Integrated Water Quality Assessment for Florida:
2006 305(b) Report and 303(d) List Update

May 2, 2006

Florida Department of Environmental Protection
Division of Water Resource Management
Bureau of Watershed Management
Tallahassee, Florida

TABLE OF CONTENTS

List of Tables

List of Figures

EXECUTIVE SUMMARY

Introduction

Purpose and Contents. This report on water quality in Florida, prepared by the Florida Department of Environmental Protection (FDEP), provides an overview of Florida's surface water and ground water quality and trends as of 2006. The report, which must be submitted to the U. S. Environmental Protection Agency (EPA) every two years, meets the reporting requirements of Sections 305(b) and 303(d) of the federal Clean Water Act (CWA). Under Section 305(b), each state must report to the EPA on the condition of its surface waters, and Section 303(d) requires each state to report on its polluted waterbodies (those not meeting water quality standards). Using the information from all the states, the EPA provides Congress with a broad-scale national inventory of water quality conditions and also develops priorities for future federal actions to protect and restore aquatic resources.

Successes in Water Quality Protection. Florida has abundant, diverse water resources, which support various habitats, plants, and animals, as well as food crops, industry, tourism, and recreation. In addition, an enormous underground aquifer system supplies potable water to 90% of the population.

Despite rapid population growth over the past 35 years, Florida has been very successful in protecting its water resources by reducing pollution from existing point and nonpoint sources. This has been accomplished by implementing new technologies, requiring better treatment of wastewater, reusing treated wastewater, eliminating many surface water discharges, and treating stormwater. The graph on the next page illustrates the success of the state's programs. It shows that after 1982, phosphorus levels decreased, because of regulations that eliminated many point sources and led to the reuse of treated domestic wastewater, and because of the implementation of stormwater treatment regulations.

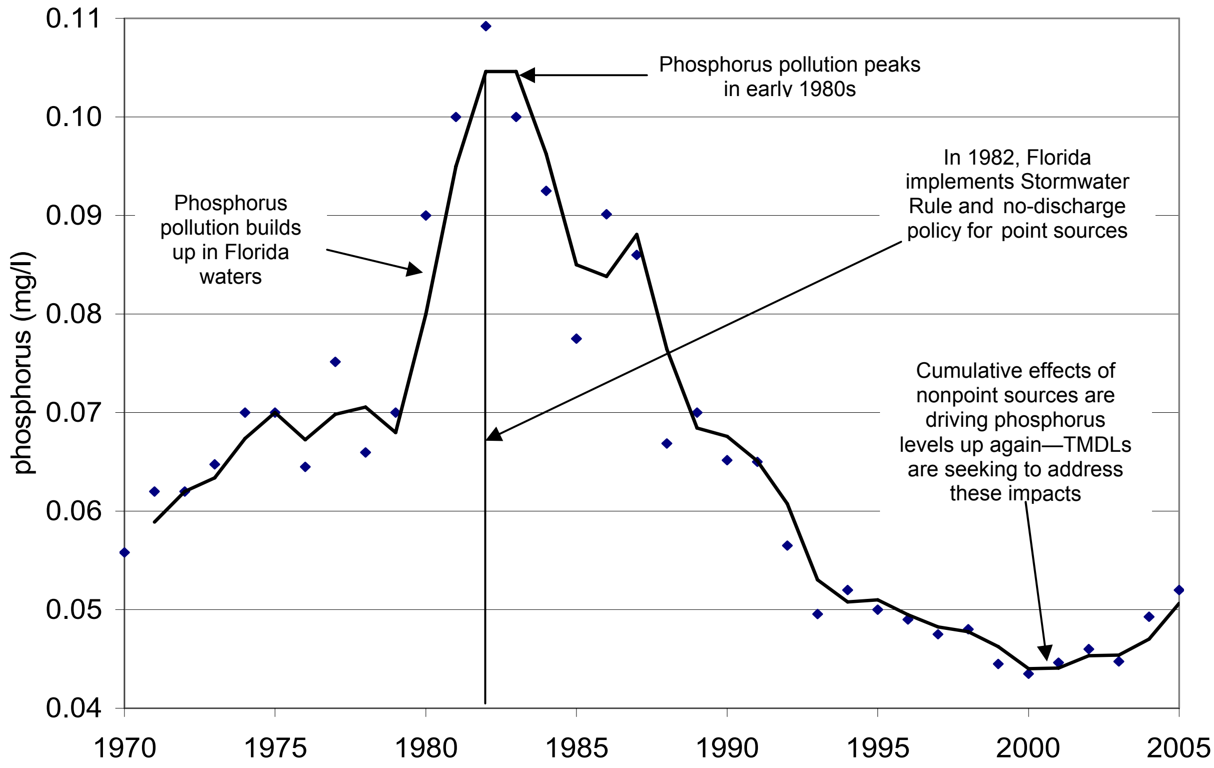
Future Challenges. The close connection between surface and ground water, in combination with the pressures of continued population growth, accompanying development, and extensive agricultural operations, present Florida with a unique set of challenges for managing both water quality and quantity in the future.

Despite Florida's successes in protecting its water resources, the graph on the next page also points to a potential problem that is emerging. After trending downward for 20 years, beginning in 2000 phosphorus levels again began moving upward, likely due to the cumulative impacts of nonpoint source pollution associated with increased population and development.

Increasing pollution from urban stormwater and agricultural activities is having other significant effects. In many springs across the state, for example, nitrate levels have increased dramatically (twofold to threefold) over the past 20 years, reflecting the close link between surface and ground water. Nitrate sources in ground water include the following:

- *Excess fertilizer from agricultural operations (particularly high levels of nitrates are found underneath intense, center-pivot agricultural operations associated with dairy farming; crops; and areas with wastewater reuse),*

- *Excess fertilizer from urban lawns and landscapes, and*
- *Excess nutrients leaching into ground water from septic tanks.*

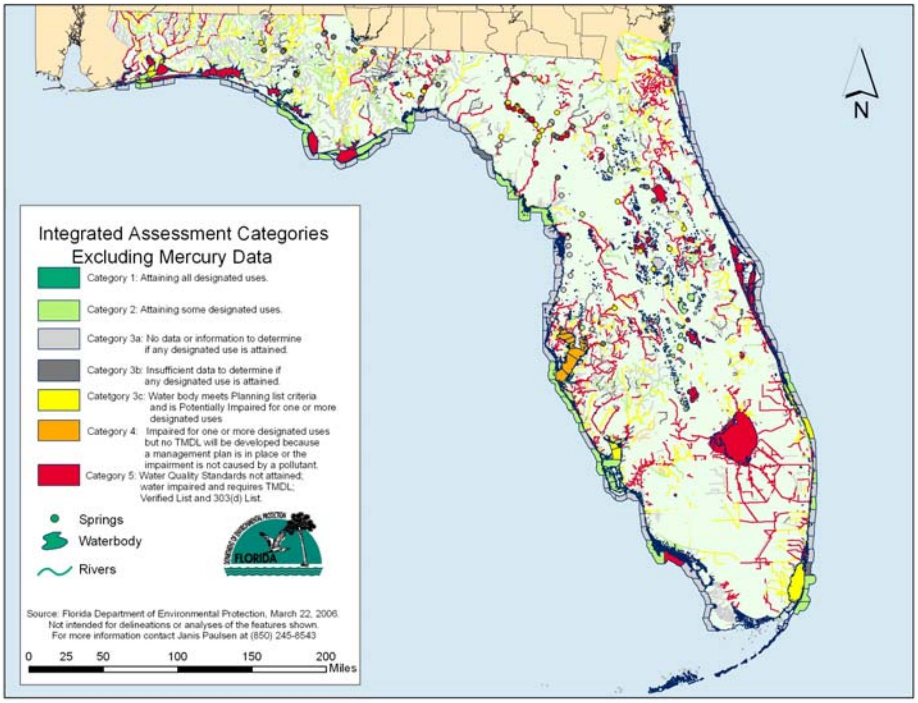


Surface Water Results

FDEP evaluated data from 5,800 waterbodies statewide against state water quality standards. There were sufficient data to evaluate (by area or length) 50% of the state's rivers and streams, 75% of its lakes, and 90% of its estuaries. Ninety different chemical and biological parameters were evaluated.

This report encompasses results from the first 4 years of a 5-year cycle that evaluates water quality for the entire state by focusing on 20% of the state each year for 5 years. The figure on the next page shows that most surface water quality problems are found in highly urbanized central and south Florida (except for mercury contamination, which is statewide). Areas with intense agricultural and industrial use are also associated with poor water quality. Water quality in the northwest and west-central sections of the state is generally better than in other areas.

Of the waterbodies that were evaluated, poor water quality was found in 50% of the river and stream miles, 60% of the lake acres (excluding Lake Okeechobee), and 60% of the square miles of estuaries. To date, with 80% of the state evaluated, approximately 1,066 TMDLs will be required for 223 Florida waters. Because TMDLs are developed for individual pollutants, a



waterbody may have multiple TMDLs. FDEP has developed or adopted over 125 TMDLs to date, and the first Basin Management Action Plans (BMAPs) are almost complete.

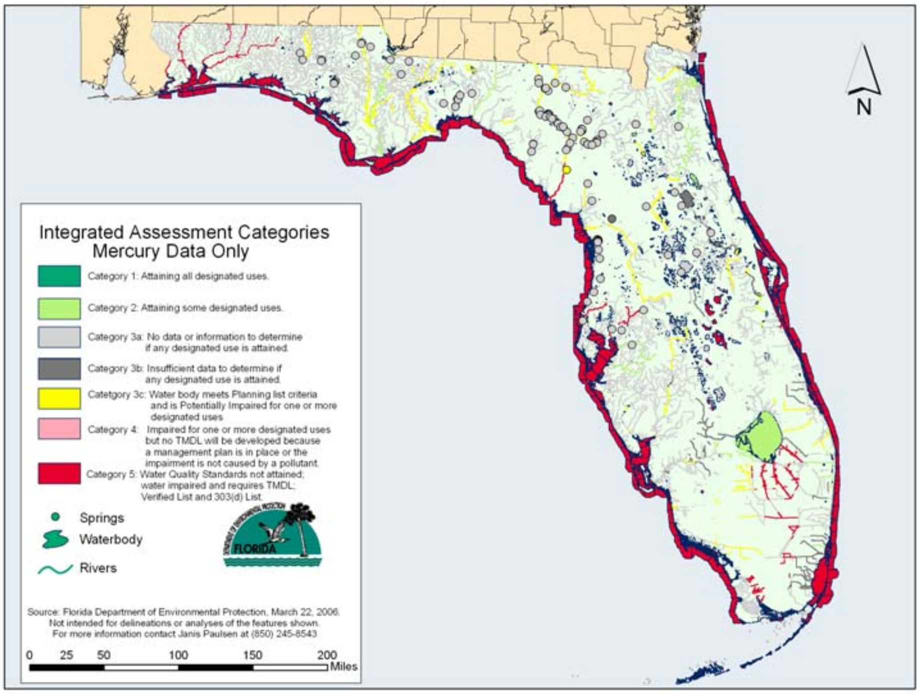
The percentage of unpolluted waterbodies for each surface water classification was as follows:

- *Class 1 waters (potable supplies), which supply about 13% of Florida's drinking water: 17% of river/stream miles and 0% of lakes.*
- *Class II waters (shellfish propagation or harvesting): 10% of river/stream miles and 12% of estuarine square miles.*
- *Class III fresh waters (recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife): 7% of river/stream miles and 10% of lake acres.*
- *Class III marine waters (recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife): 15% of estuarine square miles and 25% of coastal square miles.*

All estuaries and coastal waters have been tested for mercury, and consumption advisories have been established for a number of fish species. The figure on the next page shows the results for mercury only. The TMDLs for mercury will be developed statewide and are due in 2011.

Causes of Surface Water Impairment. Florida's major pollution problems are caused by nutrients, bacteria, and mercury in fish. Low dissolved oxygen is a problem in many waters, caused by natural conditions, hydrologic modifications, or pollution discharges.

Surface Water Quality Trends. Changes in water quality over time are an important indicator of the health of surface waters. Out of 841 rivers/streams, lakes, estuaries, and coastal waters evaluated from 1995 to 2005, about 50% were stable, about 25% were improving (in urban areas, due to improved wastewater and stormwater treatment), and about 25% are degrading (in agricultural areas, the Suwannee River Basin, and areas of urban growth).



Ground Water Results

Ground water, which provides more than 90% of Florida's drinking water, is highly vulnerable to contamination in much of the state. Generally, the overall quality of the evaluated potable aquifers was good. However, there are a number of potential ground water issues that should be monitored.

The evaluation used historical ground water data from monitoring networks, private wells, and public water systems. The results were as follows:

- ***Volatile organics—****Benzene most frequently exceeded its maximum contaminant level (MCL). Trichloroethene (TCE) was the second most frequently detected compound above its MCL in samples from public water systems and private wells, closely followed by tetrachloroethene. The most frequently repeated detections in public water systems occurred in southeast Florida, primarily for vinyl chloride and TCE.*
- ***Pesticides—****In public water system samples, the greatest number of exceedances were for lindane, toxaphene, and methoxychlor (mainly detected in the 1980s and since banned). In private wells, most exceedances were for another banned compound, ethylene dibromide (EDB), which was found in*

samples collected in the 1980s. More recent issues in private wells were identified for bromacil and alachlor.

- ***Nitrates—****Exceedances of the MCL were found in samples from 156 public water systems, with the greatest number found in or near agricultural areas. Most private well exceedances were also found in agricultural areas.*
- ***Metals—****Samples from public water systems have historically exceeded MCLs for 1 or more primary metals; however, some data, particularly for lead and cadmium, may not be valid because of the influences of metal piping and tanks used to transport and store water. In samples from private drinking water wells, exceedances were most frequent for arsenic and lead, with lead most often associated with plumbing or fixtures rather than ground water.*
- ***Radionuclides—****Most exceedances in samples from public water systems were found in the large phosphate-mining area of west-central Florida. Radioactivity is a natural characteristic of phosphate.*
- ***Sodium—****Most of the elevated sodium concentrations were found in public water systems in southeast and southwest Florida, two areas where the intrusion and upwelling of saline waters are serious concerns.*
- ***Trihalomethanes (THMs)—****Most exceedances in public water systems were found in southeastern Florida adjacent to the Everglades. THMs are byproducts of the disinfection of water containing organic matter.*
- ***Bacteria—****Bacterial contamination was an issue for monitoring well samples and is a common issue with water from private wells and water systems. Well contamination is typically from a localized source.*

Sources of Ground Water Degradation. The most significant sources were petroleum sites, drycleaners, hazardous waste sites, and nonpoint pollution.

Ground Water–Surface Water Interaction. Nutrients, dissolved oxygen, and iron were the ground water constituents most frequently identified with affected surface waters that exceed criteria. Ground water inflows account for most of the water in many Florida surface waters.

Ground Water Quality Trends. Downward statewide trends from 1991 to 2003 for water level, temperature, and pH were probably due to abnormally low rainfall from 1999 to 2002. Significant downward trends in pH are believed to be tied to declining water levels. No statewide trends were observed for sodium, nitrate, and fluoride.

Conclusion

Water quality in Florida's surface and ground water systems is being evaluated on a rotating basin approach, allowing greater monitoring and evaluation of the health of surface water and ground water. Tremendous progress has been made in addressing point and nonpoint pollution. However, as the state's rapid population growth continues, increasing nonpoint source pollution, especially from urban stormwater and agricultural activities, remains a concern that needs greater focus.

CHAPTER 1: INTRODUCTION

Purpose and Contents

This report, *Integrated Water Quality Assessment for Florida,* provides an overview of Florida's surface water and ground water quality and trends. Referred to as the Integrated Report because it fulfills the reporting requirements under Sections 305(b) and 303(d) of the federal Clean Water Act (CWA), the report must be submitted to the U. S. Environmental Protection Agency (EPA) every two years.

Chapter 1 of this report provides background information on the federal assessment and reporting requirements and how these requirements are integrated into Florida's watershed management approach. Chapter 2 contains background information on the state's population, surface water and ground water resources, climate, and hydrogeology. It also summarizes Florida's major programs and activities to protect and manage water resources, and the results of these programs. Chapter 3 describes Florida's approach to surface water monitoring, presents significant surface water quality findings, and summarizes attainment of designated uses (i.e., functional classifications such as recreation, drinking water, and aquatic life) for rivers and streams, lakes, estuaries, and coastal waters. Long-term trends in surface water quality, public health and drinking water issues, and wetlands protection efforts are discussed. Chapter 4 describes the state's ground water monitoring program, presents significant ground water quality findings, summarizes ground water contaminant sources, and characterizes ground water–surface water interactions. Evaluating ground water resources is particularly important because 90% of the state's drinking water supplies come from ground water. The Appendices provide background information and supporting data.

Federal Assessment and Reporting Requirements

Section 305(b) of the CWA requires states and other jurisdictions to submit biennial water quality reports to the EPA. These reports, referred to 305(b) reports, describe surface water and ground water quality and trends, the extent to which waters are attaining their designated uses (such as drinking water, recreation, and shellfish harvesting), and major impacts to surface water and ground water. Under Section 303(d) of the CWA, states are also required to identify waters that are not attaining their designated uses, submit to the EPA a list of these impaired waters (referred to as the 303[d] list because they are required under Section 303[d] of the CWA), and develop total maximum daily loads (TMDLs) for them. A TMDL represents the maximum amount of a given pollutant that a waterbody can assimilate and still meet its designated uses.

Water quality monitoring and data analysis are the foundation of water resource management decisions. The EPA and its state partners have worked together to develop an integrated 305(b) and 303(d) assessment approach to address water quality monitoring strategies, data quality and data quantity needs, and data interpretation methodologies. This Integrated Report continues the consolidation and alignment of the 305(b) and 303(d) assessment and reporting requirements. It also includes Section 314 reporting on the status and trends of significant publicly owned lakes.

The Integrated Report allows states to document whether water quality standards are being attained, documents the availability of data and information for each waterbody segment, identifies trends in water quality conditions, and provides information to managers in setting priorities for future actions to protect and restore the health of Florida's aquatic resources. This comprehensive approach to assessment enhances Florida's ability to track important programmatic and environmental goals of the CWA and ideally, speeds up the pace of achieving these goals.

Florida's integrated approach to monitoring and assessment consists of three tiers: probability-based, basin-specific, and site-specific. Probabilistic assessments (Tier I) are used to develop statistical estimates of water quality across the entire state, based on a representative sample, and to examine changes in water quality and flow over time statewide. The use of probability assessments can eliminate the risk of generating a biased picture of water quality conditions statewide, provide information on changes in water quality and flow over time statewide, and provide a cost-effective benchmark of the effectiveness of Florida's water quality program. The results can also provide information on whether it would be useful to target certain waters for further assessment, or if limited resources for water quality assessment can be used more effectively in other ways.

Basin-specific and stream-specific monitoring (Tier II) is used to carry out strategic monitoring to address gaps in data provided by other monitoring agencies, to address questions in specific basins and waterbody segments that are associated with determinations of waterbody impairment for the TMDL Program, and to obtain information on springs across the state. Site-specific monitoring (Tier III) includes intensive surveys for TMDLs, monitoring for the development of water quality standards and site-specific alternative criteria, and fifth-year inspections for permit renewals for facilities that discharge to surface waters.

Placing each waterbody segments into one of five reporting categories, based on available data, is an essential part of the assessment. According to the EPA, this approach allows the states to document the attainment of applicable water quality standards and develop monitoring strategies that effectively respond to the needs identified in the assessment, while ensuring that the attainment status of each water quality standard applicable to a particular waterbody segment is addressed. The five categories are as follows:

- *Category 1: All designated uses are supported; no use is threatened.*
- *Category 2: Available data and/or information indicate that some, but not all, of the designated uses are supported.*
- *Category 3: There are insufficient available data and/or information to make a use support determination.*
- *Category 4: Available data and/or information indicate that at least one designated use is not being supported or is threatened, but a TMDL is not needed.*
- *Category 5: Available data and/or information indicate that at least one designated use is not being supported or is threatened, and a TMDL is needed.*

Integrating the Federal Requirements into Florida's Watershed Management Approach

For the 2006 305(b) report, the Florida Department of Environmental Protection (FDEP) has continued to move towards a comprehensive assessment by integrating the federal assessment and reporting requirements into its watershed management approach. The 1999 Florida Watershed Restoration Act (FWRA) directed FDEP to implement a comprehensive, integrated watershed approach to evaluating and managing cumulative impacts to the state's waters. FDEP's Division of Water Resource Management initiated the watershed management approach in 2000, through the Bureau of Watershed Management.

To implement the watershed management approach, Florida's 52 basins were divided into 29 groups that are distributed among FDEP's 6 districts. There are 5 basins each in the Northwest, Central, Southwest, South, and Southeast Districts, and 4 basins in the Northeast District. One basin is assessed in each district every year. Using a rotating basin management cycle, which ensures that each basin is assessed every 5 years, FDEP and local stakeholders assess individual basins, identify impaired waters requiring the development of TMDLs, and develop Basin Management Action Plans (BMAPs) to restore water quality. The order and specific time frame for evaluating each basin are based on a number of priority factors, including watersheds that contain surface water sources of drinking water, watersheds with more severe water quality problems, and watersheds where Surface Water Improvement and Management (SWIM) plans are proposed or under way.

The assessment, consisting of multiple phases, has been completed in four-fifths of the state's basins (the Group 1–4 basins), and the scope of the 303(d) list submittal currently is limited to these basins. As part of its watershed management approach, which rotates through all of the state's basins over a five-year cycle, FDEP developed Verified Lists of impaired waters for the Group 1–4 basins in 2002, 2003, 2004, and 2005, respectively, and, as required by Subsection 403.067(4), Florida Statutes (F.S.), the lists were adopted by Secretarial Order. The resulting Verified Lists of impaired waters and waters to be delisted in those basins amend the 1998 303(d) list of impaired Florida waters maintained by the EPA. FDEP plans to submit annual amendments to its 303(d) list as part of the watershed management approach, and assessments in the remaining one-fifth of the state (the Group 5 basins) will be completed over the next year.

Florida continues to develop an integrated database of assessment information that reflects whether water quality standards are being attained. The Master List provided in the Water Quality Assessment Report for each basin provides detailed results of the assessment. The basin reports, as well as all of the Verified Lists and lists of waters to be delisted, are available at http://www.dep.state.fl.us/water/tmdl/index.htm.

CHAPTER 2: BACKGROUND INFORMATION

Overview

Florida's 65,758 square miles support abundant, diverse natural resources. Some of these—for example, the Everglades—are found nowhere else. Florida also contains the only coral reef in the continental United States. The state has 11,761 square miles of surface water (ranking third in the country in total water area) and enormous supplies of fresh water in its underground aquifers. Florida depends on water resources in many ways—for example, for its $7 billion fishing and $32 billion tourism industries.

The pressures of population growth and its accompanying development are stressing the state’s freshwater, ground water, and saltwater resources. Although the state ranks twenty-second in the country in total land area, it currently ranks fourth in population, and that population continues to grow rapidly. Florida will soon be the third largest state. Most Floridians live in coastal areas where less fresh water is available, and about three-fourths of new Florida residents choose coastal locations for their new homes. As development continues, different users vie for water resources. Major challenges include maintaining overall water quality and supplies, protecting public health, satisfying competing and rapidly increasing demands for finite quantities of fresh water, minimizing damage to future water reserves, and ensuring healthy populations of fish and wildlife.

Despite the fact that water is plentiful in many areas, water quantity and quality are critical issues. In 1950, Florida’s population of 2.8 million used about 2.9 billion gallons per day (bgd) of fresh ground water and surface water. In 1995, that number had risen to 7.2 bgd, and consumption is projected to rise to 9.3 billion gallons per day by 2020. In many areas, surface water and ground water quality has been degraded by industrial, residential, and agricultural land uses. Many point sources of pollution such as sewage treatment plant discharges have been eliminated, but contamination from widespread, diffuse nonpoint sources such as urban development and agriculture remains a problem. Nitrate in ground water discharging from springs is a widespread concern.

Along the coasts, water quality in many estuaries has deteriorated, habitat losses have affected commercial and recreational fisheries, and sediments in many urban estuaries contain heavy metals and organic contaminants. Consumption advisories have been issued because tissues in a number of freshwater and saltwater fish species in many waters contain excessive concentrations of mercury. In Florida Bay, there have been algal blooms and extensive mangrove and seagrass die offs in recent years.

This chapter provides background information about Florida’s population, water resources, climate, and physical features. It also describes Florida’s Water Resource Management Program for protecting surface water and ground water.

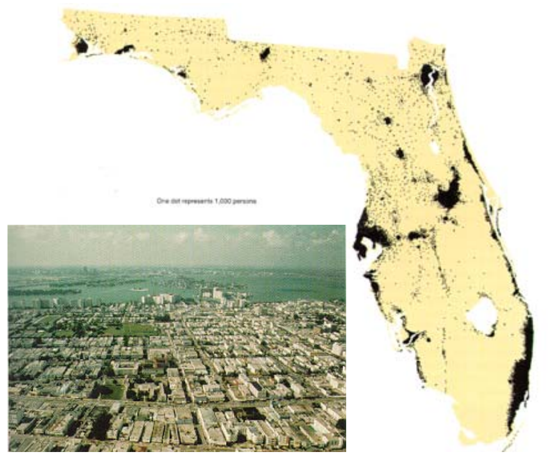
Table 1 summarizes basic information on the state and its surface water resources.

Table 1. Florida Atlas

2004 estimated population (U. S. Census Bureau)	17,397,161 people
Ranking by population among 50 states	4th largest
% change, April 1, 2000, to July 1, 2004	+ 8.8%
Surface area	**65,758 square miles**
Ranking by land area among 50 states	22nd in size
Total water area	**11,761 square miles**
Ranking by total water area among 50 states	3rd largest
Number of U. S. Geological Survey hydrologic units (i.e., watersheds with hydrologic unit codes, or HUCs)	**52**
Total number of rivers and streams	**More than 1,700**
Total number of river and stream miles	**51,858 miles**
Total river miles bordering other states	191 miles
Chattahoochee River	*26 miles*
Perdido River	*65 miles*
St. Marys River	*100 miles*
Total density of rivers/streams	0.89 miles/square mile
Longest river (entirely in Florida)	**St. Johns River (273 miles)**
Largest discharge	**Apalachicola River (average of 24,768 cubic feet per second [cfs])**
Perennial streams	**19,705 miles**
Density of perennial streams	0.39 miles/square mile
Intermittent streams	**2,956 miles**
Density of intermittent streams	0.05 miles/square mile
Ditches and canals	**25,909 miles**
Density of ditches and canals	0.44 miles/square mile
Number of lakes, reservoirs, and ponds	**7,712 (area greater than or equal to 10 acres)**
Area of lakes, reservoirs, and ponds	1,529,280 acres
Area of largest lake	**Lake Okeechobee (435,840 acres)**
Area of estuaries and bays	**4,462 square miles**
Area of coastal waters	**6,758 square miles**
Area of freshwater and tidal wetlands	**17,830 square miles**
Prominent wetlands systems	Everglades and Big Cypress Swamp, Green Swamp, Okefenokee Swamp, Big Bend coastal marshes, St. Johns River marshes
Area of islands greater than 10 acres	**1,314 square miles**
Number of known springs	**More than 700**
Combined spring outflow	8 billion gallons per day
Largest spring	Wakulla Springs (average discharge of 252 million gallons per day [mgd])
Number of first-order magnitude springs (flows greater than 64.6 mgd)	33

Population

According to the U. S. Census Bureau, Florida's population in 2004 was 17,397,161. Currently the fourth most populous state in the country, it is projected to be the third most populated in approximately 4 years.[1] Within the next two decades, the state's total population is expected to increase by 7.2 million people, the ninth largest gain in the country. Florida is also expected to gain 1.9 million people through international migration between 1995 and 2025, the third largest net gain in the country.



Florida Population, 1990
Source: *Fernald and Purdum,* 1998
Photo: Florida Department of Commerce

As the baby-boom generation (those born between 1946 and 1964) reaches retirement age, the numbers of elderly residents (65 and over) are expected to accelerate rapidly in all states. In Florida, the proportion of elderly is projected to expand from 18.6% in1995 to 26.3% in 2025. Florida had the country's highest proportion of elderly in 1995 and is also projected to have the highest proportion in 2025.

The state has a number of large, expanding population centers, including southeastern Florida (Dade, Broward, and Palm Beach Counties), Jacksonville, Tampa–St. Petersburg, southwest Florida (from Sarasota to Naples), and Orlando. In contrast, other relatively large areas of Florida area sparsely populated.

Climate

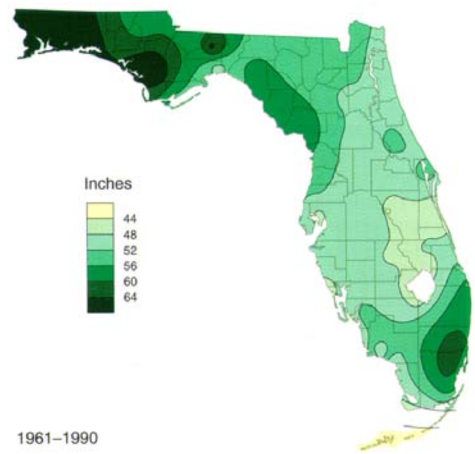
The state's climate ranges from a transitional zone between temperate and subtropical in the north and northwest, to tropical in the Keys. As a result, Florida's plants and animals are a mix of those from more temperate northern climates and those from the tropical Caribbean. Three hundred native trees and 3,500 vascular plants have been recorded. More than 425 bird species, about half the known species in the United States, can be seen in Florida.

Summers are long, with periods of very warm, humid air. Maximum temperatures average about 90° F., although temperatures of 100° F. or greater can occur in some areas. Winters are generally mild, except when cold fronts move across the state. Frosts and freezes are possible, but typically temperatures do not remain low during the day, and cold weather usually lasts no more than two or three days at a time.

Rainfall across the state varies with location and season. On average, more than 60 inches per year falls in the far northwest and southeast, while the Keys receive about 40 inches annually. This variability can create local water shortages. The heaviest rainfall occurs in northwestern Florida and in a strip 10 to 15 miles inland along the southeast coast.

[1] *Vogel*, April 2006.

Except for the northwestern part of the state, most of Florida has a rainy season and a relatively long dry season. In the peninsula, half the average annual rainfall usually falls between June and September. In northwestern Florida, a secondary rainy season occurs in late winter to early spring. The lowest rainfall for most of the state occurs in fall (October and November) and spring (April and May). The varying patterns of rainfall create differences in the timing of high and low discharges from surface waters.



Florida's Average Annual Rainfall, 1961–90
Source: Fernald and Purdum, 1998

An approximate diagonal line drawn from the mouth of the St. Johns River at the Atlantic Ocean to the boundary of Levy and Dixie Counties on the Gulf of Mexico depicts a climatic river basin divide. North and northwest of the divide, streams have high discharges in spring and late winter (March and April) and low discharges in the fall and early winter (October and November). A second low-water period occurs from May to June. South of the climatic divide, high stream discharges occur in September and October, and low discharges occur from May to June.

Surface Water and Ground Water Resources

Florida has 51,858 miles of streams and rivers (about half of which are ditches and canals). It contains more than 7,700 lakes greater than 10 acres in size, with a total surface area of 1,618,368 acres. The state also has 4,460 square miles of estuaries and a coastline ranking second in length only to Alaska. A line running from the northeast corner of the state to Key West and back up to the northwest corner along the Gulf Coast would extend 1,300 miles. If the distance around barrier islands and estuaries were included, the line would stretch 8,460 miles.

Streams and Rivers

The state has more than 1,700 streams and rivers. Differences in climate, hydrogeology, and location all affect their water quality. The longest river entirely in the state is the St. Johns, which flows north as a recognizable stream about 273 miles from the St. Johns Marsh in north St. Lucie County to its mouth at Jacksonville. The river drains a land area equal to about one-sixth of Florida's surface. The Apalachicola River, in the Florida Panhandle, has the largest discharge, averaging almost 25,000 cfs. Its basin, draining over 19,000 square miles, extends to north Georgia's southern Appalachian Mountains. Also, in the Panhandle, spring discharges give rise to ground water rivers, where the ground water base flow comprises 80% of the rivers' flow.

Florida has several types of natural river systems. In fact, most Florida rivers exhibit characteristics of more than one type of river system, either at different places along their length or at different times of the year. The links between surface water and ground water can also affect natural systems. A good example is the Suwannee River, which originates in the Okefenokee Swamp as a blackwater stream and becomes spring fed south of Ellaville. During periods of high flow, it carries sand and sediments, behaving like a true alluvial stream. During low flow, however, the river's base flow comes from underground springs. These variations in flow affect the downstream stretches of the river and the receiving estuary. Ground water has higher nitrate concentrations that can affect animals and plants downstream, while the sand and sediments carried by the river during periods of high flow have a different effect on biological life.

In north and northwest Florida, many rivers are alluvial. The Choctawhatchee, Apalachicola, and Escambia Rivers best represent this type. Common features include a well-developed floodplain, levees, terraces, oxbows, and remnant channels (sloughs) that parallel the active riverbed. Typically, because flows fluctuate more than with other types of rivers, habitats are more diverse.

There are many blackwater streams and rivers in Florida. Blackwater rivers usually have acidic, highly colored, slowly moving waters containing few sediments. These systems typically drain acidic flatwoods or swamps and are low in biological productivity. The upper Suwannee River and the north New River are good examples.

Many major river systems that originate as springs are found in central and north Florida, the Big Bend area of the Gulf Coast, and the southern portion of the Tallahassee Hills. Chemically, these rivers are clear, alkaline, and well buffered, with little temperature variation. They have relatively constant flows and little sediment. Their clear water encourages the growth of submerged plants that provide habitat for diverse animal species. Many spring-fed rivers flow directly into estuaries; the constant temperatures offer protection from temperature extremes to a number of species, including estuarine fish such as spotted seatrout and red drum, as well as manatees.

Major dams have been built on the Apalachicola, Ocklawaha, Ochlockonee, Hillsborough, and Withlacoochee (Citrus County) Rivers. The most extreme alterations were damming the Ocklawaha to create the Cross-Florida Barge Canal and channelizing the Kissimmee River. The southern third of Florida's peninsula has been so hydrologically altered that few naturally flowing streams and rivers remain. Most fresh waterbodies in South Florida are canals, which usually support plants and animals more typical of lakes than rivers.

Lakes

Florida's lakes provide important habitats for plant and animal species and are a valuable resource for human activities and enjoyment. The state has more than 7,700 lakes, which occupy close to 6% of its surface. The largest, Lake Okeechobee (covering 435,840 acres), is the ninth largest lake in surface area in the United States and the second largest freshwater lake wholly within the conterminous United States.[2] Most of the state's lakes are shallow, averaging 7 to 20 feet deep, although many sinkhole lakes and parts of other lakes can be much deeper.

[2] Fernald and Purdum, 1998.

Florida's lakes are physically, chemically, and biologically diverse. Many lakes are spring-fed; others are seepage lakes fed by ground water, and still others are depression lakes fed by surface water sources. There are two principal lake types, based on color and alkalinity. In addition, FDEP has defined 47 different lake regions as part of its Lake Bioassessment/Regionalization Initiative. These regions provide a framework for assessing lake characteristics and establishing management goals and strategies.[3] Within each lake region, the lakes have similar geology, soils, chemistry, hydrology, and biology, and lakes in one region may differ significantly from those in another region. For example, most lakes in the New Hope Ridge/Greenhead Slope lake region in northwestern Florida (in Washington, Bay, Calhoun, and Jackson Counties) tend to have lower total nitrogen, lower total phosphorus, lower chlorophyll concentrations, and higher Secchi depths compared with other Florida lakes. Lakes in the Lakeland/Bone Valley Upland lake region in central Florida (in Polk and Hillsborough Counties) tend to have higher total nitrogen, higher total phosphorus, higher chlorophyll concentrations, and lower Secchi depths when similarly compared.

Estuaries and Coastal Waters

With over 8,000 coastal miles, Florida is second only to Alaska in amount of coastline. The state's west coast alone contains almost 22% of the Gulf Coast estuarine acreage in the United States. Florida's estuaries are some of the nation's most diverse and productive. They include embayments, low- and high-energy tidal salt marshes, lagoons or sounds behind barrier islands, mangrove swamps, coral reefs, oyster bars, and tidal segments of large river mouths.

The Atlantic coast of Florida from the mouth of the St. Marys River to Biscayne Bay is a high-energy shoreline bordered by long stretches of barrier islands, behind which lie highly saline lagoons. This 350-mile stretch of coast contains only 18 river mouths and inlets. Biscayne Bay spans the transition from high- to low-energy shorelines, which are more typical of Florida's west coast.

At the southern end of the state lie Florida Bay and the Ten Thousand Islands, both of which are dominated by mangrove islands fronting expansive freshwater marshes on the mainland. Many tidal creeks and natural passes connect the islands and marshes. Historically, the area's fresh water came mainly from sheet flow across the Everglades.

Florida's west coast has low relief, and the continental shelf extends seaward for many miles. Unlike the east coast, numerous rivers, creeks, and springs contribute to estuarine habitats. Generally, the west coast's estuaries are well-mixed systems with classically broad variations in salinity. They often lie behind low-energy barrier islands or at the mouths of rivers that discharge into salt marshes or mangrove-fringed bays. The Big Bend coast from the Anclote Keys north to Apalachee Bay is low-energy marsh shoreline. While it does not conform to the classical definition of an estuary, its flora and fauna are typically estuarine. Many freshwater rivers and streams feeding the shoreline here are either spring runs or receive significant quantities of spring water. The Florida Panhandle from Apalachee Bay west to Pensacola Bay comprises high-energy barrier islands, with sand beaches fronting the Gulf of Mexico.

Major coastal and estuarine habitats vary from northern to southern Florida. Salt marshes dominate from Apalachicola Bay to Tampa Bay and from the Indian River Lagoon north to the

---

[3] Florida LakeWatch, October 1999a; EPA, 2006a. Additional information on Florida lake regions and the ecology of Florida's lakes is available from Florida LakeWatch (http://lakewatch.ifas.ufl.edu/ and the EPA (http://www.epa.gov/wed/pages/ecoregions/fl_eco.htm).

Georgia state line. The estuaries west of Apalachicola Bay have few salt marshes. Mangrove swamps dominate the southern Florida coast. There are about 6,000 coral reefs between the city of Stuart on the Atlantic Coast south and west to the Dry Tortugas, while seagrasses are most abundant from Tarpon Springs to Charlotte Harbor, and from Florida Bay to Biscayne Bay.

Wetlands

Because of its low elevation and peninsular nature, Florida has many varied types of wetlands, including estuarine *Spartina* and mangrove marshes, as well as freshwater sawgrass marshes, cypress swamps, and floodplain marshes. Wetlands comprise almost one-third of the state. The following are the largest and most important in the state:

- *The Everglades and the adjacent Big Cypress Swamp. Including the Water Conservation Areas (diked portions of the original Everglades system) and excluding the developed coastal ridge, this system extends from about 20 miles south of Lake Okeechobee to Florida Bay.*
- *The Green Swamp in the state's central plateau.*
- *The Big Bend coast from the St. Marks River to the (South) Withlacoochee River.*
- *Vast expanses of* Spartina *marsh between the Nassau and St. Mary's Rivers.*
- *The system of the St. Johns River marshes. Before alteration by humans, all but the northernmost one-fifth of the river basin was an extensive freshwater system of swamps, marshes and lakes.*[4] *Even today, half of the length of the St. Johns River is actually marsh, and in many respects it functions like a northern-flowing Everglades.*
- *The headwaters and floodplains of many rivers throughout the state, especially the Apalachicola, Suwannee, St. Johns, Ocklawaha, Kissimmee, and Peace Rivers.*

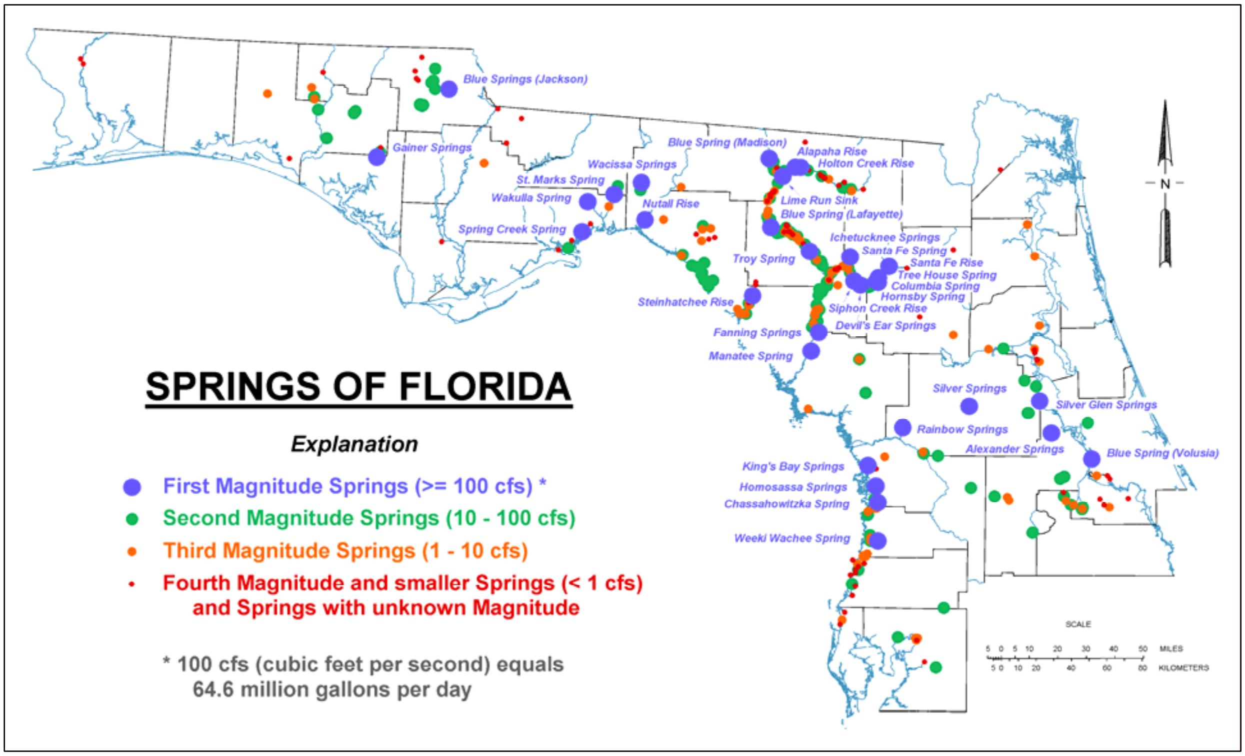
Aquifers and Springs

Florida lies atop a vast underground aquifer system that provides potable water to most of the state's population. Ground water naturally discharges into streams, lakes, wetlands, coastal waters, and springs. Florida has more than 700 known springs ***(Figure 1)***, which discharge about 8 billion gallons of water per day (bgd); the state may contain the largest concentration of freshwater springs on Earth. The largest spring by discharge is Wakulla Springs, with an average discharge of 252 million gallons per day (mgd). Florida also contains 33 of the 78 first-magnitude springs (defined as springs that discharge on average at least 64.6 mgd) in the United States. Several river systems in the state originate as spring discharges.

Archaeological evidence indicates that humans have been attracted to Florida's life-giving springs for thousands of years. Florida's 14 state parks that are named for springs attracted over 2 million visitors in 1999. Private spring attractions and parks are a multimillion-dollar tourist industry.

[4] Kushlan, 1990.

Figure 1. Springs of Florida



Hydrogeology

Surface Water

Most of Florida is relatively flat. The highest elevations are 345 feet near Lakewood, in Walton County in the Panhandle, and 312 feet at Sugarloaf Mountain in the peninsula (Lake County).[5] The longest river, the St. Johns on Florida's east coast, only falls about a tenth of a foot per mile from the headwaters to the mouth. Farther south, below Lake Okeechobee, the land relief is less than 6 feet. Surface drainage and topographic relief are greatest in the streams and rivers entering north and northwest Florida from Alabama and Georgia. Most of these streams are alluvial, or sediment carrying. As the land flattens farther south, surface drainage becomes less distinct. Rivers and streams are typically slower moving, noneroding, and nonalluvial.

Many Florida rivers have their headwaters in wetlands. In its natural setting, the Green Swamp in central Florida is the headwater for five major river systems: the (South) Withlacoochee, Ocklawaha, Peace, Kissimmee, and Hillsborough. In north Florida, the Suwannee and St. Marys Rivers originate in the Okefenokee Swamp. Throughout the state, smaller streams often disappear into wetlands and later re-emerge as channeled flows.

In the past, many wetlands were drained (for agriculture and urban development), and numerous rivers were channelized for navigation. The modifications were most intense in south

[5] http://www.americasroof.com/highest/fl.shtml.

Florida where, beginning in the 1920s, canals and levees were built to control flooding and drain wetlands. These modifications resulted in the loss of much of the original Everglades wetlands from Lake Okeechobee south and the channeling of the Kissimmee River.

Ground Water

Florida is in the Coastal Plain physiographic province, which is blanketed by surficial sands and underlain by a thick sequence of bedded limestone and dolomite. Together the surficial sands, limestone, and dolomites form an enormous ground water reservoir that provides proportionally larger quantities of ground water than in any other state.

These sources of high-quality, potable ground water underlying virtually all of Florida supported average withdrawals of more than 4,600 mgd in 1990. This remarkable resource supplies more than 90% of the drinking water for almost 18 million residents. In addition, ground water resources supply over 50% of all water needs, including agricultural, industrial, mining, and electric power generation.

Florida primarily relies on the following four aquifer systems as drinking water sources:

- *The Floridan aquifer system, one of the most productive sources of ground water in the United States, extends across all of Florida, southern Georgia, and adjoining parts of Alabama and South Carolina. Many public water systems—including Jacksonville, Orlando, Clearwater, St. Petersburg, and Tallahassee—tap into the Floridan. It is also a major supplier of water for industrial, irrigation, and rural use. This aquifer provides 60% (2,790 mgd) of Florida's potable water supplies.*
- *Unnamed surficial and intermediate aquifers, which are present over much of the state, are used when the deeper aquifers contain nonpotable water. They supply water needs for about 10% of the population, especially in rural locations. These aquifers provide 20% (948 mgd) of the state's potable water supplies.*
- *In southeast Florida, the Biscayne aquifer supplies virtually all the water needs for over 4 million residents in densely populated Dade, Broward, Palm Beach and Monroe Counties. This aquifer provides 18% (824 mgd) of Florida's potable water supplies. The EPA has designated the Biscayne Aquifer as a sole source drinking water aquifer.*
- *The sand and gravel aquifer, the major source of water supply in the western part of the Florida Panhandle, provides 2% (103 mgd) of Florida's potable water.*

Surface Water–Ground Water Interactions

Florida's low relief, coupled with its geologic history, has created unique hydrogeologic features. Large areas are characterized by karst topography, which forms when ground water dissolves limestone. Landforms in these areas include streams that disappear underground, springs and seeps where ground water rises to the surface, sinkholes, and caves. Surface water commonly drains underground and later reappears, sometimes in a completely different surface water basin from where it entered the ground. For example, drainage from a large karst area in Marion County provides water for Silver Springs, which discharges to the Ocklawaha River and then to the St. Johns River and the Atlantic Ocean. The same area also provides water for Rainbow Springs, which discharges to the Withlacoochee River and then to the Gulf of Mexico.

Florida's sandy soils, high average rainfall, shallow water table, and porous karst terrain promote close and extensive interactions between ground water and surface water. By the same mechanisms, surface waters recharge underground aquifers. The fact that Florida contains more than one-third of the first-magnitude springs in the United States is an indication of significant ground water and surface water interchange. Most lakes and streams receive some ground water, but in a significant number of watersheds, ground water inflow contributes the base flow for streams. In the Springs Coast region of western Florida, for example, ground water provides 70% to 80% of the flow in spring runs.

Hydrologic Divide
Source: *Fernald and Purdum, 1998*

A hydrologic divide interrupts the movement of Florida's ground water and surface water. The divide is represented by an approximate line extending from near Cedar Key on the Gulf Coast to New Smyrna Beach on the Atlantic Coast. Little, if any, surface water or ground water moves across this barrier. Most major rivers north of the line receive part of their discharges from outside Florida, in addition to rain. South of the divide, rain is the sole fresh water source. Hydrologically, the half of Florida lying south of the divide is an island. About 75% of the state's population lives in this area in peninsular Florida.

Water Pollution Control Programs

Florida's Water Resource Management Program

Florida's Water Resource Management Program is a comprehensive effort comprising a number of activities and programs. These include the Florida Water Plan, watershed management, water quality standards, the management of nonpoint source pollution, wastewater facilities permitting, ambient monitoring, ground water protection, educational programs, and land use management. The Water Resource Management Program also includes extensive FDEP coordination with other agencies and programs, including the SWIM Program, run by the five regional water management districts.

Florida Water Plan

In 1972, the Florida legislature, recognizing the importance of the state's water resources, passed the Water Resources Act, Chapter 373, F.S., and the Florida Air and Water Pollution Control Act, Chapter 403, F.S. Many goals and policies in the State Comprehensive Plan, Chapter 187, F.S., also address water resources and natural systems protection. Section 373.036, F.S., outlines the requirements for developing the Florida Water Plan, which is to include the following:

- *FDEP's programs and activities related to water supply, water quality, flood protection, floodplain management, and natural systems;*
- *FDEP's water quality standards for surface water and ground water;*
- *The water management plans of the water management districts; and*
- *The Water Resource Implementation Rule (Rule 62-40, Florida Administrative Code [F.A.C.]), which provides goals, objectives, and guidance for the development and review of programs, rules, and plans relating to water resources.*

Under Florida's water management system, FDEP oversees the water management districts, an approach that balances the need for consistent statewide regulations with regional flexibility. As the primary stewards of the state's water resources, FDEP and the water management districts often must address competing public demands for water supplies, flood protection, water quality, and natural systems protection. To accomplish this, they have developed comprehensive water management plans for each region.

Overview of Surface Water Protection Programs

Water Quality Standards Program

Florida's surface water quality standards system is published in Rule 62-302 (and Section 62-302.530), F.A.C. The components of this system, which are described below, include water quality classifications; water quality criteria; an antidegradation policy; moderating provisions; and the special protection of certain waters, such as Outstanding Florida Waters (OFWs), because of their natural attributes.

Water Quality Classifications. Florida's Water Quality Standards Program, the foundation of the state's program of water quality management, designates the "present and future most beneficial uses" of the waters of the state (Subsection 403.061[10], F.S.). Florida's surface water is protected for five designated use classifications, as follows:

Class I	*Potable water supplies*
Class II	*Shellfish propagation or harvesting*
Class III	*Recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife*
Class IV	*Agricultural water supplies (large agricultural lands, located mainly around Lake Okeechobee)*
Class V	*Navigation, utility, and industrial use (there are no state waters currently in this class)*

Class I waters generally have the most stringent water quality criteria and Class V the least. However, Class I, II, and III surface waters share water quality criteria established to protect recreation and the propagation and maintenance of a healthy, well-balanced population of fish and wildlife. All waters of the state are considered to be Class III, except for those specifically identified in Section 62-302.600, F.A.C. All waters of the state are required to meet the "Minimum Criteria for Surface Waters," as identified in Section 62-302.500, F.A.C.

A Designated Uses and Classification Refinement Policy Advisory Committee (PAC) was recently formed to help FDEP re-evaluate the current classifications and assess whether refinements or a new system are needed to provide more appropriate levels of protection for different surface waterbody types and the uses they support. The PAC met for the first time in February 2006.

Water Quality Criteria. Water quality criteria, expressed as numeric or narrative limits for specific parameters, describe the water quality necessary to maintain designated uses (such as fishing, swimming, and drinking water) for surface water and ground water. Chapter 3 discusses the relationship between the state and the EPA's designated use classifications.

In response to recent initiatives put forth by the EPA, Florida has been working to develop biological criteria and nutrient criteria for fresh waters and estuaries.

Antidegradation Policy. The Florida Antidegradation Policy (Sections 62-302.300 and 62-4.242, F.A.C.) recognizes that pollution that causes or contributes to new violations of water quality standards or to the continuation of existing violations is harmful to the waters of the state. Under this policy, the permitting of new or previously unpermitted existing discharges is prohibited where the discharge is expected to reduce the quality of a receiving water below the classification established for it. Any lowering of water quality caused by a new or expanded discharge to surface waters must be in the public interest (that is, the benefits of the discharge to public health, safety, and welfare must outweigh any adverse impacts on fish and wildlife or recreation). Further, the permittee must demonstrate that other disposal alternatives (for example, reuse) or pollution prevention are not economically and technologically reasonable alternatives to the surface water discharge.

Moderating Provisions. Moderating provisions (provided in Subsection 62-302.300[10] and Rules 62-4 and 62-6, F.A.C., and described in Sections 62-302.300, 62-4.244, 62-302.800, 62-4.243, F.A.C., and Sections 403.201 and 373.414, F.S.) include mixing zones, zones of discharge, site-specific alternative criteria, exemptions, and variances. These provisions are intended to moderate the applicability of water quality standards where it has been determined that, under certain special circumstances, the social, economic, and environmental costs of such applicability outweigh the benefits.

Watershed Management Approach

FDEP's statewide approach to water resource management, called the watershed management approach, is the framework for developing and implementing TMDLs as required by federal and state laws (a later section of this chapter discusses FDEP's TMDL Program).

Watershed management is a comprehensive approach to managing water resources on the basis of hydrologic units—which are natural boundaries such as river basins—rather than arbitrary political or regulatory boundaries. It does not focus on individual causes of pollution. Instead, each basin is assessed as an entire functioning system, and aquatic resources are evaluated from a basinwide perspective that considers the cumulative effects of human activities.

On a simple level, Florida's watershed management approach provides a mechanism to focus resources on specific units (river or estuary basins) rather than trying to work on all state waters at one time. An important feature is the involvement of all the stakeholders who have an interest in an individual basin (including federal, state, regional, tribal, and local governments and individual citizens), in a cooperative effort to define, prioritize, and resolve water quality problems. Existing programs are coordinated to manage basin resources without duplicated effort.

The watershed management approach is not new, nor does it compete with or replace existing programs. Rather than relying on single solutions to water resource issues, it is intended to improve the health of surface water and ground water resources by strengthening coordination among such activities as monitoring, stormwater management, wastewater treatment, wetland restoration, land acquisition, and public involvement.

FDEP's Division of Water Resource Management in the Bureau of Watershed Management is responsible for implementing and coordinating watershed management activities. The key components of this approach include the following:

- *A **basin management unit,** or geographic or spatial unit, is used to divide the state into smaller areas for assessment — generally groups of HUCs. HUCs are a nationwide cataloging system commonly used for watershed assessment and management. They provide a common framework for delineating watersheds and their boundaries at different geographic scales.*
- *A five-year **watershed management cycle** provides a set schedule that organizes work activities and helps to ensure that all waters are addressed in a timely manner. At the conclusion of the cycle, the process begins anew, allowing basin managers and stakeholders to respond to changing conditions or adjust strategies that have not performed as anticipated. The cycle was initiated in the state on July 1, 2000.*
- *A **Basin Management Action Plan** (BMAP), developed for each basin in cooperation with stakeholders and local communities, coordinates and guides management actions. Other plans that provide reasonable assurance that water quality goals will be met may also be used. The BMAP specifies how pollutant loadings from point and nonpoint sources of pollution will be allocated and reduced to meet TMDL requirements.*
- ***Forums and communication networks** help participants collect information, fill data gaps, and reach a consensus on solutions to the basin's problems.*
- *A statewide **basin rotation schedule** ensures that each of the state's river basins is assessed every five years.*

To implement the watershed management approach, Florida's 52 basins (51 HUCs plus the Florida Keys) have been divided into 29 groupings. These have been further subdivided into 5 groups within each of FDEP's 6 districts statewide. There are 5 basins each in the Northwest, Central, Southwest, South, and Southeast Districts, and 4 basins in the Northeast District. Each district assesses 1 basin each year. The order and specific time frame for evaluating each basin in each district is based on a number of priority factors, including watersheds that contain surface water sources of drinking water, watersheds with more severe water quality problem, and watersheds where SWIM plans are proposed or under way.

Total Maximum Daily Load Program

Section 303(d) of the federal CWA requires states to submit to the EPA lists of surface waters that do not meet applicable water quality standards (i.e., their designated uses or water quality criteria) and establish TMDLs for each of these waters on a schedule. Pollution limits are then allocated to each pollutant source in an individual river basin. A waterbody that does not meet its designated use is defined as *impaired*.

The 1999 FWRA (Section 403.067, Florida Statutes) clarified FDEP's statutory authority to establish TMDLs, required FDEP to develop a scientifically sound methodology for identifying impaired waters, specified that FDEP could develop TMDLs only for waters on a future state list of impaired waters developed using this new methodology, and directed FDEP to establish an Allocation Technical Advisory Committee (ATAC) to assure the equitable allocation of load reductions when implementing TMDLs. The act also declared Lake Okeechobee impaired and, as required under the TMDL Consent Decree, allowed the state to develop a TMDL for total phosphorus for the lake that was completed in 2001.

Another significant component of the FWRA was the requirement for FDEP and the Florida Department of Agriculture and Consumer Services (FDACS) to adopt, by rule, best management practices (BMPs) to reduce urban and agricultural nonpoint sources of pollution. Since Florida already has an urban stormwater regulatory program, this new authority was particularly important in strengthening Florida's agricultural nonpoint source management program. This section of the law requires FDACS to adopt, by rule, BMPs to reduce agricultural nonpoint source pollution, and for FDEP to verify the effectiveness of the BMPs in reducing pollutant loads through monitoring at representative sites. Once FDACS adopts the BMPs, landowners must submit a Notice of Intent to FDACS, specifying the BMPs that will be applied on specific land parcels and the schedule for BMP implementation. The landowners also must maintain records, such as fertilizer use, and allow FDACS staff to inspect the BMPs. By submitting a Notice of Intent, the landowners become eligible for state and federal cost-share funding to implement BMPs and receive a presumption of compliance that they are meeting water quality standards. The BMP rules and the associated BMP manuals that have been adopted are available from FDACS' Office of Agricultural Water Policy at http://www.floridaagwaterpolicy.com/.

Florida's Identification of Impaired Surface Waters Rule (IWR) (Rule 62-303, F.A.C.), provides a science-based methodology for evaluating water quality data in order to identify impaired waters, and establishes specific criteria for impairment based on chemical parameters, the interpretation of narrative nutrient criteria, biological impairment, fish consumption advisories, and ecological impairment. The IWR also establishes thresholds for data sufficiency and data quality, including the minimum sample size required and the number of exceedances of the applicable water quality standard for a given sample size that identify a waterbody as impaired. The number of exceedances is based on a statistical approach designed to provide greater confidence that the outcome of the water quality assessment is correct. Waters that are identified as impaired through the IWR are prioritized for TMDL development and implementation.

BMAPs to restore water quality are developed over 18 to 24 months following TMDL development. The strategies developed in each BMAP are implemented into National Pollutant Discharge Elimination System (NPDES) permits for wastewater facilities and municipal separate storm sewer system (MS4) permits.

The 2005 Florida legislature's amendments to the FWRA focused on the development and adoption of BMAPs as an appropriate method for implementing TMDLs. The legislature also established a long-term funding source that provides $20 million per year for urban stormwater retrofitting projects to reduce pollutant loadings to impaired waters. Additionally, the 2005 amendments provide FDEP with the ability to take enforcement action against nonpoint sources that do not implement the BMPs that they agreed to implement in the BMAP.

Surface Water Improvement and Management Program

In 1987, the Florida legislature passed the SWIM Act, Sections 373.451 through 373.4595, F.S. The act directed the state to develop management and restoration plans for preserving or restoring priority waterbodies. The legislation designated 6 SWIM waterbodies: Lake Apopka, Tampa Bay, Indian River Lagoon, Biscayne Bay, Lower St. Johns River, and Lake Okeechobee. Today, SWIM plans have been developed for 30 waterbodies statewide.

The SWIM Program addresses a waterbody's needs as a system of connected resources, rather than isolated wetlands or waterbodies. Its goals are protecting water quality and natural systems, creating governmental and other partnerships, and managing watersheds. While FDEP oversees the program, the water management districts are responsible for its implementation—including developing lists of additional high-priority waterbodies and waterbody plans (outlined under Rule 62-43, F.A.C.). The districts also provide matching funds for state revenues. In a collaborative effort, other federal and state agencies, local governments, and the private sector provide funds or in-kind services.

SWIM plans must contain the following:

- *A description of the waterbody;*
- *A list of governmental agencies with jurisdiction;*
- *A description of land uses;*
- *A list of point and nonpoint source discharges;*
- *Restoration strategies;*
- *Research or feasibility studies needed to support restoration strategies;*
- *A restoration schedule;*
- *An estimate of costs; and*
- *Plans for interagency coordination and environmental education.*

Pollutant Load Reduction Goals. A pollutant load reduction goal (PLRG) is an estimated reduction in stormwater pollutant loadings needed to preserve or restore designated uses in SWIM waterbodies that receive stormwater. Ultimately, water quality in a receiving water should meet state water quality standards, and PLRGs provide benchmarks toward which specific strategies can be directed. Interim PLRGs are best-judgment estimates of the pollution reductions from specific corrective actions. Final PLRGs are goals needed to maintain water quality standards.

The Water Resource Implementation Rule (Rule 62-40, F.A.C.) requires the water management districts to establish PLRGs for SWIM priority waters and other waterbodies, and include them as part of a SWIM plan, other watershed management plan, or districtwide or basin-specific rules.

Point Source Control Program

Florida's well-established wastewater facility permitting program was revised in 1995 when the EPA authorized FDEP to administer a partial NPDES Program, and then was expanded again in 2000 when the EPA authorized FDEP to administer the NPDES stormwater program. While the federal program only regulates discharges to surface waters, the state wastewater program issues permits for facilities that discharge to either surface water or ground water. Of about 4,100 wastewater facilities in Florida, approximately 500 are permitted to discharge to state surface waters under individual permits. While an additional 500 facilities discharge to surface water under general permit authorization (and many others discharge stormwater to surface water under the NPDES stormwater program), most wastewater facilities in Florida discharge indirectly to ground water via land application.

An important component of Florida’s wastewater management is the encouragement and promotion of reuse. In fact, the current reuse capacity (year 2004 data) represents about 56% of the total permitted domestic wastewater treatment capacity in Florida.

FDEP's district offices handle most of the permitting process, with the Tallahassee office overseeing the program, providing technical assistance, and coordinating with the EPA. The Tallahassee office also oversees the administrative relief mechanisms for applicants that are allowed under Florida law, as well as permits for steam electric–generating power plants that discharge to waters of the state. Wastewater permits, issued for up to five years, set effluent limits and monitoring requirements to provide reasonable assurance that water quality criteria will be met. A permit may allow a mixing zone when there is enough dilution to ensure that a waterbody's designated use will not be affected. In other special cases, a variance or exemption allows certain water quality standards to be exceeded. Facilities that cannot comply with new requirements may be issued or reissued a permit containing the effluent limitations to be met and an administrative order setting out the steps required to achieve compliance. This procedure applies only to facilities complying with an existing permit, and is not used in lieu of enforcement when a permittee is out of compliance with an existing permit or operating without a required permit.

All facilities must meet, at a minimum, appropriate technology-based effluent limitations. In many cases, water quality–based effluent limitations (WQBELs) may also be necessary. Two types of WQBELs are used (as defined in Rule 62-650, F.A.C.). Level I WQBELs are generally based on more simplified evaluations for streams and for permit renewals. To determine Level II WQBELs, which are typically calculated for more complicated situations, a waterbody is generally sampled intensively, and computer models are used to predict its response to a facility’s discharge.

Ground water discharge permits address an array of discharge options, including sprayfields, percolation ponds, and injection wells. Direct discharge to ground water through wells is not allowed, except through the Underground Injection Control (UIC) Program. Ground water discharges are provided a ”zone of discharge,” where ground water standards are not applied and the attenuation and dilution of contaminants occurs in the surficial aquifer. Zones of discharge are typically the lesser of 100 feet in diameter or the facility’s property boundary in areal extent, and vertically to the top of the next aquifer unit. Ground water monitoring plans are required to ensure that ground water flowing from the zone of discharge complies with ground water standards. Monitoring plans comprise upgradient background wells and downgradient compliance wells, and generally require quarterly monitoring. There are provisions for exemptions from individual ground water quality standards that allow certain standards to be exceeded. Historically, these have been primarily granted for the sodium standard in coastal areas.

Permit Compliance. The primary objective of FDEP’s Wastewater Program is to protect the quality of Florida's surface water and ground water by ensuring that permitted wastewater facilities meet the conditions of their individual permits and to quickly identify unpermitted pollution sources and those facilities that do not meet water quality standards or specific permit conditions. To provide proper oversight of the wastewater facilities in the state, FDEP’s Wastewater Compliance Evaluation Section developed a compliance inspection strategy based on its five-year permitting cycle (permits are issued for five years). For NPDES-permitted facilities, the goal is to conduct an annual inspect with at least a Compliance Evaluation Inspection (CEI) and to conduct a Performance Audit Inspection (PAI) immediately following permit renewal. When an NPDES-permitted facility is approximately one year away from submitting a permit renewal application, a much more comprehensive inspection, or Fifth Year Inspection (FYI), is scheduled. The FYI consists of an overview of the facilities operation, but also includes an in-depth sampling plan consisting of a Compliance Sampling Inspection (CSI), a Toxic Sampling Inspection (XSI, a Compliance Biomonitoring Inspection (CBI), and an Impact Bioassessment (IBI) and Water Quality Inspection (WQI). The results of these inspections help to determine if current permit limits are adequate to protect the quality of the receiving waters. Land application facilities are also inspected on an annual basis as resources allow; however, they are not subject to the same sampling intensity as the surface water dischargers.

District compliance and enforcement staff make every effort to work with a permittee to resolve minor problems before beginning a formal enforcement action. During an inspection, it is the inspector’s responsibility to determine if a facility is in compliance with its permit limits and compliance schedules. This is accomplished by verifying the accuracy of facility records and reports, plant operation and maintenance requirements, effluent quality data (Discharge Monitoring Reports, or DMRs), and the general reliability of the facility’s self-monitoring program.

Enforcement. FDEP’s Wastewater Program uses the Office of General Council’s Enforcement Manual as a guide for developing specific types of enforcement actions such as Consent Orders and Notices of Violations. However, in order to provide guidance on specific wastewater issues related directly to the Wastewater Program, the Wastewater Program Enforcement Response Guide was developed to aid inspectors in determining the correct course for corrective actions. The guide also provides consistency in addressing enforcement actions specifically related to wastewater issues.

When formal enforcement is necessary, staff attempt to negotiate a consent order—a type of administrative order in which civil penalties (such as fines) and corrective actions for noncompliance can be assessed. Consent orders also establish step-by-step schedules for complying with permit conditions and Florida law.

In 2001, the Florida legislature enacted the Environmental Litigation Reform Act (ELRA) to provide a fair, consistent, and expedient method for determining appropriate penalty amounts for violations. If a settlement cannot be reached through the consent order process, FDEP has the authority to issue a Notice of Violation (NOV) to collect penalties (up to $10,000), as specified in ELRA. The NOV can also be used when only corrective actions are needed and no penalties are being sought. When a serious violation endangers human health or welfare, or the environment, FDEP issues a complaint for injunctive relief or takes other legal action, including an immediate final order for corrective action.

Healthy Beaches Program

As part of Florida's Healthy Beaches Program, FDOH monitors the state's coastal beaches for high levels of bacteria. In August 2000, the beach water sampling program was extended to all 34 of Florida's coastal counties through state legislation (Senate Bill 1412 and House Bill 2145) and funding. With additional funding from the EPA in 2002, the program was expanded to include sampling on a weekly basis for fecal coliform and enterococci bacteria.

In a healthy environment, an array of bacteria is normally found in the soil, on plants, on and in ourselves and our pets and other animals, and in water. When concentrations of bacteria are too high, they can present problems themselves, or they can be an indicator of other organisms that can cause problems to humans. Two bacteria types that normally inhabit the intestinal tract of humans and animals are fecal coliform and enterococci.

The presence of elevated levels of these enteric bacteria in water is an indication of possible pollution that may come from stormwater runoff, pets and wildlife, or human sewage. While not necessarily pathogenic, their presence in high concentrations in recreational waters indicates that pathogens may be present. If waste pathogens are present in high quantities and are ingested while swimming, or if they enter the skin through a cut or sore, the bacteria may cause human disease, infections, or rashes. The rationale for selecting these two bacteria for analysis and the implications of the sampling results are described in more detail on FDOH's Web site at http://esetappsdoh.doh.state.fl.us/irm00beachwater/terms.htm.

If a sampling event leads to a "poor" bacterial indicator result in a single sample, then the county health department immediately collects a resample. If the resample confirms the high result, then an advisory or warning is issued, signs are posted parallel to the sample point, the results are posted on FDOH's Web site, and the news media are notified. If the county health department cannot collect a timely resample, it issues an advisory or warning with the first "poor" result obtained. Sampling events resulting in a "poor" classification normally require resampling.

In a calendar year, if FDOH posts more than 21 days of advisories for a water, that water is considered impaired for swimming, and the water is listed as impaired on the 303(d) list so that the sources of the bacteriological levels can be addressed.

The most recent results from the current Florida's Healthy Beaches Program can be reviewed at http://esetappsdoh.doh.state.fl.us/irm00beachwater/default.aspx. A sampling history of the original counties included in the program and the counties that were added, and a sampling history between 1998 and July 2000 are available at http://esetappsdoh.doh.state.fl.us/irm00beachwater/history/hisintro.htm.

Nonpoint Source Management Program

The importance of minimizing nonpoint source pollution, especially from new developments, was recognized in Florida in the late 1970s when the state's growth rate increased greatly. Over the past 25 years, Florida has implemented one of the most comprehensive and effective nonpoint source management programs in the country. The Nonpoint Source Management Program includes a mixture of regulatory, nonregulatory, land acquisition, public education, and finance assistance components, which are discussed below.

The cornerstone of Florida's nonpoint source program is the state Stormwater Rule. Florida was the first state in the country to establish a statewide Stormwater Permitting Program that requires the treatment of stormwater from all new development. The state's first Stormwater Rule was adopted in 1979, with a more comprehensive rule going into effect in February 1982. New developments, except for single-family dwellings, and modifications to existing discharges must obtain stormwater permits. Projects must include a stormwater management system that provides flood control and BMPs such as retention, detention, or wetland filtration to reduce stormwater pollutants. The Stormwater Rule, a technology-based rule, establishes design criteria for various stormwater treatment BMPs to obtain the minimum level of treatment established in the state's Water Resource Implementation Rule (Rule 62-40, F.A.C.). Specifically, these BMPs are designed to remove at least 80% of the total suspended solids (TSS) pollutant loading. For OFWs, some other sensitive waters (such as shellfish-harvesting areas), and waters that are below standards, BMPs must be designed to remove 95% of the TSS loading.

A 1989 stormwater law directed FDEP to establish statewide goals for treatment and to oversee the implementation of stormwater regulatory programs, which were also delegated to the water management districts. Delegation allows minor design adjustments for Florida's diverse landscape. In 1993, the legislature modified portions of Chapters 373 and 403, F.S., to streamline permitting. The Wetlands Resource Permit and the Management and Storage of Surface Water (MSSW) Permit were unified into a single Environmental Resource Permit to increase statewide consistency in minimizing the impacts of new land uses.

Therefore, except in the area served by the Northwest Florida Water Management District, where FDEP still issues stormwater and dredge-and-fill permits, an Environmental Resource Permit is issued that provides for flood control, stormwater treatment, and wetlands protection.

A second important nonpoint source regulatory program is the state's wetlands protection law and permitting program. This program has been instrumental in minimizing the loss of wetlands, especially isolated wetlands. Details about this program can be found in Chapter 3, in the section on wetlands protection.

As discussed earlier in this chapter (in the section on the TMDL Program), the FWRA requires FDACS' Office of Agricultural Water Policy to develop and adopt, by rule, BMPs to reduce agricultural nonpoint source pollution. FDEP is charged with monitoring the effectiveness of the BMPs. To date, FDACS has developed and/or adopted BMP manuals for Ridge citrus, Indian River citrus, leatherleaf ferns, silviculture, cow/calf operations, Peace River citrus, vegetable and agronomic crops, container-grown plants, forage grass, tri-county agriculture, south Florida nurseries, and Gulf citrus. The BMP rules and the associated BMP manuals that have been adopted are available at http://www.floridaagwaterpolicy.com/.

This nonregulatory program provides agricultural producers with incentives to implement BMPs. Participation in the program opens the door for state and federal cost-share dollars to implement BMPs, and it provides the landowner with a presumption of compliance that water quality standards are being met. To participate, landowners must submit a Notice of Intent to FDACS, specifying the lands to be covered, the BMPs to be implemented, the BMP implementation schedule, and the annual tracking requirements such as fertilizer use.

Land acquisition is one of the most important components of Florida's Nonpoint Source Management Program. The state's first environmental land acquisition program was enacted by the legislature in 1972 (the Environmentally Endangered Lands Act). In 1981, the Save our Coasts and Save our Rivers Programs were enacted to expand land acquisition. In 1989, recognizing the importance of accelerating land acquisition, given the state's rapid population growth, the Preservation 2000 program was enacted. This decade-long program provided $300 million annually for land acquisition. In 1999, Preservation 2000 was extended for another decade by the enactment of the Florida Forever Program, which continued the $300 million annual commitment for another decade. These programs have led to the acquisition of over 1 million acres of sensitive lands.

The state's growth management program, implemented by the Florida Department of Community Affairs (FDCA) and the state's local governments, is another key component of Florida's Nonpoint Source Management Program. The 1985 State Comprehensive Plan and the Local Government Comprehensive Planning and Land Development Regulation Act require local governments to establish blueprints for future growth (local comprehensive plans) and to adopt local land development regulations to minimize the adverse social, economic, and environmental impacts of growth.

Dedicated funding for nonpoint source management programs is crucial to their success. In 1986, legislation was passed that authorized local governments to implement stormwater utility fees to provide funding for stormwater treatment and infrastructure. Today, over 140 of Florida's local governments have implemented a stormwater utility fee, with the average fee for a single-family homeowner of $3.50. These dedicated local stormwater funds open the door for cost-sharing from FDEP and the water management districts for stormwater retrofitting projects. In 1994 the legislature adopted the Nitrate Bill, which imposed a small fee on nitrogen fertilizers. These funds are used to fund research to develop BMPs to reduce the leaching of nitrogen into ground water, especially from agricultural producers. In 2004, the Nitrate Bill was expanded to add a fee for phosphorus fertilizers and to also address the eutrophication of surface waters. In 1997, legislation expanded the scope of the State Revolving Load Fund to provide funding for stormwater retrofitting projects and for agricultural BMP implementation. With the passage of the FWRA in 1999, FDEP and FDACS were authorized to receive documentary stamp funding for the research and demonstration of urban and agricultural BMPs. Funding has varied from $2.8 million to $9.2 million per year. Finally, as discussed earlier, in 2005 the legislature established a new funding source that will provide FDEP with about $20 million per year for the TMDL Water Quality Restoration Grant Program, allowing FDEP to partner with local governments on urban stormwater retrofitting projects.

Public education on "pointless personal pollution" is the final component of Florida's Nonpoint Source Management Program. Over the past 20 years, a wide variety of educational materials, many of which can be customized for local areas, have been developed and distributed. Nearly all of these materials are now available electronically and can be downloaded either from FDEP's Nonpoint Source Management Section Web site (http://www.dep.state.fl.us/water/nonpoint/), or from the University of Central Florida Stormwater

Management Academy Web site (http://www.stormwater.ucf.edu/). Given the state's rapid growth rate, especially from people from out of state, these educational materials are important in teaching residents how they contribute to nonpoint source pollution and how they can be part of the solution to pointless personal pollution.

Atmospheric Deposition Reduction Strategies

Mercury. Mercury, a naturally occurring toxic trace element, has a complex cycle between the Earth's crust, atmosphere and oceans. Some mercury is released by natural processes, but the predominant emissions to the atmosphere result from human activities, principally the mining and smelting of mineral ores, fossil fuel combustion, and the use of mercury itself. Today these human activities liberate mercury from its geological sinks into the free environment at a rate five to six times higher than in the preindustrial era. Mercury released in this way can travel long distances through atmosphere, ultimately depositing from the air to watersheds and wetlands.

Mercury deposited in wetlands, lakes, and streams can be converted by natural bacteria into methylmercury, a toxic form that is accumulated and biomagnified at each link in the food chain. In some circumstances, this results in sportfish that would be toxic if eaten by humans and prey fish that may be toxic to wildlife that eat them. This effect is particularly acute in the marshes of the Florida Everglades, where largemouth bass once contained six times the level of mercury safe for human consumption, and wading birds have ingested amounts of mercury close to levels that could reduce their populations.

Substantial progress has been made in alleviating the mercury problem in south Florida. Human-caused mercury emissions from industrial sources in south Florida, principally incinerators, have come under effective control during the past decade; emissions of mercury in south Florida have declined by 90%. Subsequently, mercury in fish and wildlife of the Everglades has declined by about 75% to date. However, despite these encouraging results, mercury levels in fish and wildlife of the region remain excessive. In 2003, the EPA promulgated nationwide mercury standards for our nation's waterbodies; the Florida Everglades remains above acceptable limits.

A private–public partnership led by FDEP is investigating ways to alleviate the problem. A consortium of electric utility interests and federal and state agencies is collaborating in the South Florida Mercury Science Program (SFMSP). SFMSP managers meet regularly to apportion research responsibilities, correlate funding requests, and share scientific results on Everglades mercury issues. While the SFMSP is focused on the Everglades and south Florida, virtually all of its work has statewide and national application.

The EPA and FDEP are developing a field study in south Florida that seeks to obtain robust estimates of dry deposition of both fine and coarse particulate matter for mercury (as well as phosphorus, which is discussed in the next section). The two-year study will commence in 2006 and conclude in 2008.

FDEP's mercury Web site (http://www.dep.state.fl.us/labs/mercury/index.htm) describes SFMSP strategies, plans activities and results. It also provides links to the mercury-related Web sites of SFMSP participants and to other useful Web sites dealing with mercury.

FDOH, FDEP, and the Florida Fish and Wildlife Conservation Commission (FWCC) operate jointly to determine if environmental chemicals are present in fish from Florida waters. In most instances, the FWCC determines what fish species should be sampled and collects those samples. FDEP measures the levels of chemicals in fish tissue. FDOH determines the potential for adverse human health effects from consuming the fish and issues fish consumption advisories when needed. Information on the latest fish consumption advisories is available on FDOH's Web site at http://www.doh.state.fl.us/environment/community/fishconsumptionadvisories/index.html.

Phosphorus. The fundamental role of phosphorus in controlling primary productivity and determining the basic structure of the algal community in freshwater aquatic systems has long been recognized. For seepage lakes, which by definition receive the preponderance of their hydrologic income from rainfall directly to the lake surface, atmospheric deposition directly to the lake is the dominant source of inorganic nutrients. In Florida, the atmospheric deposition of phosphorus is particularly important, because approximately 70% of the state's lakes are seepage lakes.

Recent investigations, however, suggest that the atmospheric deposition of phosphorus is of secondary importance as a contributor to the load to the Everglades Protection Area. Still, there has been very little research done to actually measure the dry deposition of phosphorus, or for that matter, of nutrients in general. As discussed earlier, the EPA and FDEP are developing a field study in south Florida that seeks to obtain robust estimates of dry deposition of both fine and coarse particulate matter for phosphorus (as well as mercury, which is discussed in the preceding section). The two-year study will commence in 2006 and conclude in 2008.

Nitrogen. The air deposition of nitrates and ammonia (nutrients) can represent a significant pollutant load to estuaries and coastal waters (typically nitrogen-limited systems), causing or contributing to eutrophication and waterbody impairment. In Florida, Tampa Bay typifies such situations, involving a mix of fixed nitrogen loads from point and nonpoint source discharges, stormwater, and atmospheric deposition, and posing a challenge for source apportionment and abatement through TMDL analyses. There is limited scientific expertise, however, to adequately quantify nutrient deposition to the waterbody and watershed.

Current estimates suggest that atmospheric deposition comprises approximately 30% of the nitrogen budget of Tampa Bay. This estimate is based, however, on limited ambient monitoring data and simple models. In 1999, the EPA, FDEP, and the Tampa Bay Estuary Program (TBEP) and its many collaborators initiated a Bay Regional Atmospheric Chemistry Experiment (BRACE) study to provide better information on air quality in the Tampa Bay area, with specific reference to air deposition and its effects on water quality. The results of the study, which will be released in the coming year, will provide improved estimates of the effects of local and regional emissions of oxides of nitrogen (NOx) on the bay and the benefits of implementing emissions reduction strategies.

Overview of Ground Water Protection Programs

Permitting Programs

FDEP implements a comprehensive ground water quality protection program that establishes ground water quality standards, classifications, and permitting criteria. Many regulatory tools are employed, including construction and operation permit requirements, setbacks, and ground water monitoring criteria.

Many FDEP rules exist to implement the standards for ground water protection. Each rule addresses a specific type of discharge or potential discharge to ground water that, if not managed appropriately, may pose a potential threat to the resource. Each rule incorporates technical reviews of permit applications and associated data, construction and operation permits with standard and specific conditions that ensure all permit requirements are met, ground water monitoring, compliance inspections, and enforcement actions when necessary.

Underground Injection Control

Florida has obtained primacy for implementing the Underground Injection Control Program for Class I, III, IV, and V injection wells. The purpose of the program is to protect Florida's underground sources of drinking water (USDWs) from the potentially harmful effects of injection wells. A USDW is defined as an aquifer that contains a total dissolved solids concentration of less than 10,000 milligrams per liter (mg/L).

There are more than 140 active Class I wells in Florida. The majority of the Class I injection facilities in Florida dispose of nonhazardous, secondary-treated effluent from domestic wastewater treatment plants, desalinization concentrate, or a blend of these two waste streams. Injection wells are required to be constructed, maintained, and operated so that the injected fluid remains in the injection zone, and the unapproved interchange of water between aquifers is prohibited. Class I injection wells are monitored so that if the migration of injection fluids were to occur, it would be detected before reaching the USDW.

There are no Class III wells, and Class IV wells are banned in Florida. Class V wells are generally used for the storage or disposal of fluids into or above a USDW. The fluid injected must meet appropriate criteria, as determined by the classification of the receiving aquifer. Common types of Class V wells in Florida include air conditioning return flow wells, swimming pool drainage wells, stormwater drainage wells, lake level control wells, domestic waste wells, and aquifer storage and recovery (ASR) wells.

Delineation Program

In 1988, the Florida legislature directed FDEP to implement water well construction and water testing standards within areas of known ground water contamination. This was done primarily because of a widespread ground water contamination problem with the pesticide ethylene dibromide (EDB) in drinking water wells, These actions were taken to protect public health and ground water resources, and to promote the cost-effective remediation of contaminated potable water supplies (Subsection 373.309[1][e], F.S.). While areas have been delineated based on detections of solvents and gasoline, EDB, which has been detected in 38 counties statewide, has been the primary contaminant serving as the basis for the 427,897 acres delineated under Rule 62-524, F.A.C.

FDEP's primary responsibility in the implementation of Rule 62-524 has been the delineation of areas of ground water contamination and the corresponding development of maps identifying those areas. These are based on ground water quality data or knowledge of historical land uses. Where data are incomplete, a 1,000-foot protective setback is placed around the contaminated site or well to estimate the extent of the contaminated plume. The contaminated sites and associated plumes are plotted on maps, and each plume is labeled with a unique identifier that can be used to determine the contaminants that it contains. A well permitted in a delineated area must be tested for the contaminants for which the area was delineated before it can be cleared for use.

All delineation maps undergo rigorous internal review, and are adopted under rulemaking procedures (Chapter 120, F.S.) that include public meetings and approval by the Environmental Regulation Commission. The latest maps produced by FDEP were approved in 1994.

The implementation of the delineation rule has involved a cooperative effort among FDEP, FDOH, and the water management districts. After FDEP delineates areas of ground water contamination, the water management districts implement stricter well construction standards through permitting requirements. Each permit application for a new well is reviewed to determine the well's location relative to delineated areas. If the well is located in a delineated area, the water management district will either require more rigorous well construction standards or connection to a public water system. FDOH is responsible for collecting and testing water samples.

Source Water Assessment and Protection Program

Originally passed by Congress in 1974, the Safe Drinking Water Act (SDWA) was created to protect public health by regulating the nation's public drinking water supply. It establishes national standards and practices to prevent the contamination of drinking water sources and to ensure proper drinking water treatment and distribution. In 1996, the act was amended to include the Source Water Assessment and Protection Program (SWAPP). To assess and report to the public on potential contaminants of Florida's source water and threats to public water systems, SWAPP comprises the following four key steps:

- *Define the source water protection area,*
- *Identify known or potential sources of contaminants in the area,*
- *Determine the susceptibility of the water source to the contaminants, and*
- *Notify the water systems and the public and explain the significance of the contaminants identified in the source inventory.*

EPA Region 4 approved Florida's source water assessment approach on April 1, 2000. The Florida assessment, which is geographic information system (GIS) based, is designed to be repeated every five years.

In 2004, FDEP assessed all transient noncommunity, nontransient noncommunity, and community public water systems. These comprised approximately 6,300 public water systems, with close to 12,000 wells and 24 surface water intakes. The results of the assessments were sent to the public water systems and posted on the SWAPP Web site at www.dep.state.fl.us/swapp.

As of December 2005, assessments for 99.2% of public water systems in the state were completed through the posting of results on the SWAPP Web site. In 62% of the assessed public water systems, no potential sources of contamination were found. Of the 38% of systems with one or more potential sources of contamination within their assessment areas, the most prevalent potential source is petroleum storage tank facilities, followed by wastewater treatment facilities, delineated groundwater contamination areas, and dry-cleaning sites.

The 2005 EPA SWAPP reporting guidance requests that the states measure the degree of source water protection in place for community water systems. Two factors were identified to define the level of source water protection. The first factor measures initial implementation, or the number and population of community water systems with source water protection strategies under which some protection actions are occurring. The second factor measures the amount of substantial implementation of the community water system's source water protection strategy. The EPA has left it to each state to define what constitutes initial implementation and substantial implementation. Florida's SWAPP has developed the following definitions:

- ***Initial Implementation.*** *All of Florida's community water systems are covered by statewide protection measures, which include Florida's Wellhead Protection Program, the requirement for local government comprehensive plans to include protection for local wellfields, Florida's surface water and ground water standards, and specific statewide programs that cover and regulate potential contaminant sources. Under this definition, 100% of Florida's community water systems are classified as having a source water strategy in place and implemented.*
- ***Substantial Implementation.*** *Many of Florida's community water systems are further covered by system level measures. These measures include the implementation of wellhead or source water protection plans completed by the Florida Rural Water Association, wellhead or source water protection ordinances or programs implemented on a local level, and other community water system measures. Tracking the various stages of implementation and program effectiveness is a challenge, because there are no mechanisms in Florida for reporting source water protection at a local level. Based on information available to FDEP, approximately 48% of all community water systems in Florida have substantial implementation of source water protection under this definition.*

Watershed-based Monitoring and Reporting

Integrating ground water into FDEP's watershed management approach has required an expansion in the approaches for both monitoring design and data analysis to include ground water–surface water issues. Historically, the majority of ground water protection efforts emphasized land use and aquifer vulnerability, as well as investigating and remediating local point sources of contamination to protect potable water supplies. Integrating ground water into watershed protection, however, has required the additional consideration of ground water contributions to surface waterbodies (i.e., base flow). The water quality of base flow is now also considered an equally important ground water use to ensure the support of aquatic life in surface waterbodies. Identifying and quantifying ground water contributions where substances with extensive natural or anthropogenic abundances in geological deposits coexist with high percentages of base flow are also important in evaluating impaired surface waters.

FDEP has developed a methodology and screening tools to evaluate and identify ground water resource issues and potential influences of ground water on surface water quality within Florida's watershed management cycle. The findings of these evaluations are used in guiding future monitoring and assessment efforts, identifying potential private well sampling needs, and identifying more detailed evaluations to determine ground water's influence on impaired or potentially impaired surface waters.

Springs Initiative

In 1999, the Secretary of FDEP directed the formation of a multiagency Florida Springs Task Force to recommend strategies for protecting and restoring Florida's springs. In 2000, the task force published its findings and recommendations in a report, *Florida's Springs: Strategies for Protection and Restoration.*[6]

In 2001, the Florida Springs Task Force II was formed to guide the implementation of the "action steps" in the report. During the same year, the Florida legislature, with the support of the Governor and FDEP's Secretary, allocated approximately $2.5 million to begin the process of protecting and restoring Florida's springs. Funding was continued in 2002, 2003, 2004, 2005, and 2006. As of 2005, approximately $12.5 million had been spent in three broad areas: research and monitoring, landowner assistance, and educational outreach.

The Florida Springs Initiative has funded a wide variety of projects, including septic system upgrades and relocations to reduce nutrient inputs; the development of BMPs for golf courses; the removal of invasive, non-native aquatic plants; water quality and spring flow monitoring; ecological studies; dye tracing studies; the development of educational materials; and the establishment of Springs Working Groups.

The physical restoration of springs and spring runs has also been a priority, and rules to protect state sovereignty springs have been developed and enacted. Educational projects have included producing informational booklets and flyers, creating spring-specific local working groups, constructing kiosks at highly visited springs, developing and maintaining the award-winning interactive Web site, http://www.floridasprings.org, and sponsoring the PBS film, *Water's Journey—The Hidden Rivers of Florida.* A state-approved educational effort centered around the film and associated Web resources is being developed for use in the curricula of Florida public schools.

Some Springs Initiative projects that will provide data for future 305(b) assessments include the following:

- *A quarterly trend-monitoring network, designed to depict long-term trends, that includes all of Florida's clear-water first-magnitude springs (flows of 100 cfs and greater) and select second-magnitude springs (flows of 10 to 100 cfs). Although this quarterly springs network is not part of the Temporal Variability Network discussed in Chapter 3, similar analytes are collected during the same months. Quarterly sampling has been ongoing for over four years, and trend analyses are in progress.*
- *Regular biological assessments in spring runs using FDEP's Stream Condition Index (SCI).*
- *The installation and maintenance of continuous stage and flow gaging stations in most first-magnitude spring runs.*
- *The installation and maintenance of continuous flow metering in selected spring caves.*
- *The delineation of ground water basins for major spring systems ("springsheds").*

[6] A copy of the report is available at http://www.dep.state.fl.us/springs/reports/floridaspringsreport.pdf.

- *Biological baseline studies in spring systems.*
- *Spring-specific ecosystem studies (e.g., Silver Springs 50-Year Retrospective Ecosystem Study).*

Coordination with Other State, Tribal, and Local Agencies

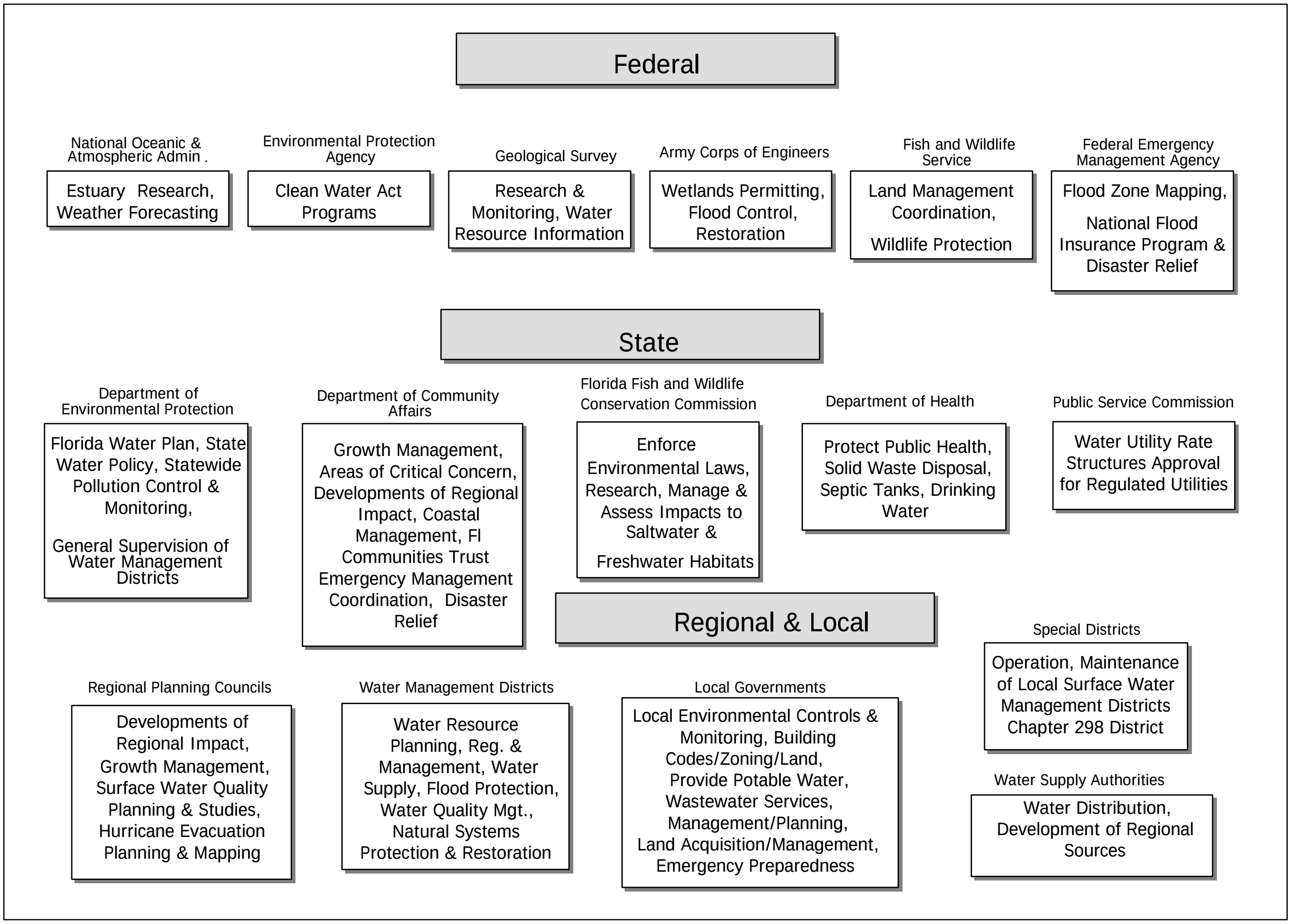
Florida's surface water protection programs all emphasize the need for interagency coordination in achieving statewide water management goals. ***Table 2*** lists the primary state, local, and regional coordination mechanisms for managing water resources. ***Figure 2*** shows the agencies responsible for water resource management and coordination in Florida, and lists their principal activities.

Table 2. Primary Coordination Mechanisms for Managing State, Regional, and Local Water Resources

Function/Entity	*Primary Mechanisms*
General supervision over water management districts (policies, plans, and programs) (Florida Department of Environmental Protection)	a. Water Resources Coordinating Commission b. Meetings of the water management districts' executive directors c. Water Resource Implementation Rule (Rule 62-40, F.A.C.) d. Florida Water Plan/District Water Management Plan (DWMP) work group e. Issue-specific work groups (policy and rule development) f. Reuse Coordinating Committee g. Memoranda of understanding (delegation of programs and authorities) h. Permit streamlining, mitigation banking i. FDEP review of water management district rules and budgets, auditing
Statewide watershed management approach (Florida Department of Environmental Protection)	a. Implementation of rotating watershed management cycle for assessing the state's river basins b. Process for verifying impaired waterbodies in each basin c. Development of total maximum daily loads (TMDLs) for verified impaired waters d. Adaptive management
State Comprehensive Plan (Governor's Office)	Overall coordination by Governor's Office
State Land Development Plan (Florida Department of Community Affairs)	Interagency Planning Committees
Florida Transportation Plan (Florida Department of Transportation)	Interagency plan review process
Strategic regional policy plans (Regional Planning Councils)	a. Florida Water Plan/DWMP work group b. Plan review process (Subsection 186.507[2], F.S., and Rule 27E-5, F.A.C.)
Agricultural interests (Florida Department of Agriculture and Consumer Services)	Agricultural Water Policy Committee

Function/Entity	***Primary Mechanisms***
Local comprehensive plans (Florida Department of Community Affairs)	Plan review process (Rule 9J-5, F.A.C.)
Water supply planning, wastewater management, stormwater management, solid waste management (Local governments)	FDEP and water management district programs for technical and financial assistance
Reuse of reclaimed water (Florida Department of Environmental Protection, water management districts, Florida Department of Community Affairs, Florida Department of Transportation, Public Service Commission)	Reuse Coordinating Committee
U. S. Army Corps of Engineers	a. Public works program b. State clearinghouse review process c. Quarterly meetings between FDEP and the Corps d. Joint FDEP/Corps permit application process (CWA, Section 404) e. Memoranda of understanding f. Potential delegation of Section 404 permitting to FDEP
U. S. Environmental Protection Agency	a. U. S. Environmental Protection Agency (EPA)/FDEP yearly work plans and grants b. EPA technical assistance and special projects c. Delegation of EPA/CWA programs to FDEP
National Oceanic and Atmospheric Administration	a. Grants b. Cooperative agreements and special projects
U. S. Geological Survey	a. Contracts for technical services and data b. Cooperative agreements
U. S. Department of Agriculture Natural Resource Conservation Service (formerly Soil Conservation Service)	Contracts for technical services and data
U. S. Forest Service	Ecosystem Management teams
U. S. Fish and Wildlife Service	a. Acquisition programs b. Ecosystem Management teams c. Special projects
National Park Service	a. Acquisition programs b. Ecosystem Management teams
Alabama and Georgia	a. Memorandum of Agreement for Apalachicola–Chattahoochee–Flint/Alabama–Coosa–Tallapoosa Rivers Comprehensive Study b. Suwannee River Coordinating Committee c. St. Marys River Management Committee d. Florida–Alabama Water Resources Coordinating Council

Figure 2. Agencies Responsible for Water Resource Coordination and Management in Florida



Results of Florida's Surface Water Protection Programs

Despite the increase in Florida's population over the past 35 years, from 6.8 million to almost 18 million, the state's surface water management programs have been very successful in preventing and minimizing pollution from new sources, especially from new nonpoint sources of pollution, and in reducing existing pollutant loadings, especially from point sources of pollution. This has been accomplished by implementing new technologies, requiring better treatment of wastes, eliminating many surface water discharges, and treating stormwater. ***Figure 3,*** which shows the history of phosphorus trends in Florida's surface waters since 1970, illustrates the success of the state's programs. The figure shows that phosphorus pollution began to increase beginning in about 1970, peaking in 1982. After 1982, levels decreased because of new regulations that eliminated many point sources, encouraged the reuse of treated domestic wastewater, and required the treatment of stormwater from all new development.

However, the graphic also points to an emerging problem. After trending downward for 20 years, beginning in 2000 phosphorus levels again began moving upward, perhaps because of the cumulative impacts of Florida's increased population and development.

Two major water quality control programs were responsible for this decreasing trend in phosphorus. The first is the state's point source regulatory/management program, which in the early 1980s recognized the low assimilative capacity of many of Florida's surface waters. This led to the implementation of a "no discharge" policy, resulting in the elimination of many point sources of pollution and the reuse of treated domestic wastewater. The second program responsible for a decline in phosphorus levels in Florida's waters is the state's stormwater treatment regulatory program. Implemented in 1979, the program was further expanded with an increased level of treatment in February 1982, with the implementation of the state's Stormwater Rule.

However, ***Figure 3*** also illustrates an emerging problem. Phosphorus levels have begun to increase in recent years, most likely a result of the cumulative effect of nonpoint sources of pollution, since the state's Stormwater Rule is based on a minimum treatment level of 80% average annual load reduction. Additionally, Florida's intensive agriculture industry, together with the increasing population and the resulting increase in home landscapes, has led to increased fertilizer usage, which undoubtedly is contributing to this upward trend in phosphorus.

Nature and Extent of Nonpoint Source Pollution

Florida's major water quality concerns are increased nitrates in ground water and increased nutrients in surface waters. FDEP's comprehensive Nonpoint Source Management Program, in collaboration with the TMDL Program (which is being implemented through the watershed management approach), provides the institutional, technical, and financial framework to address these issues.

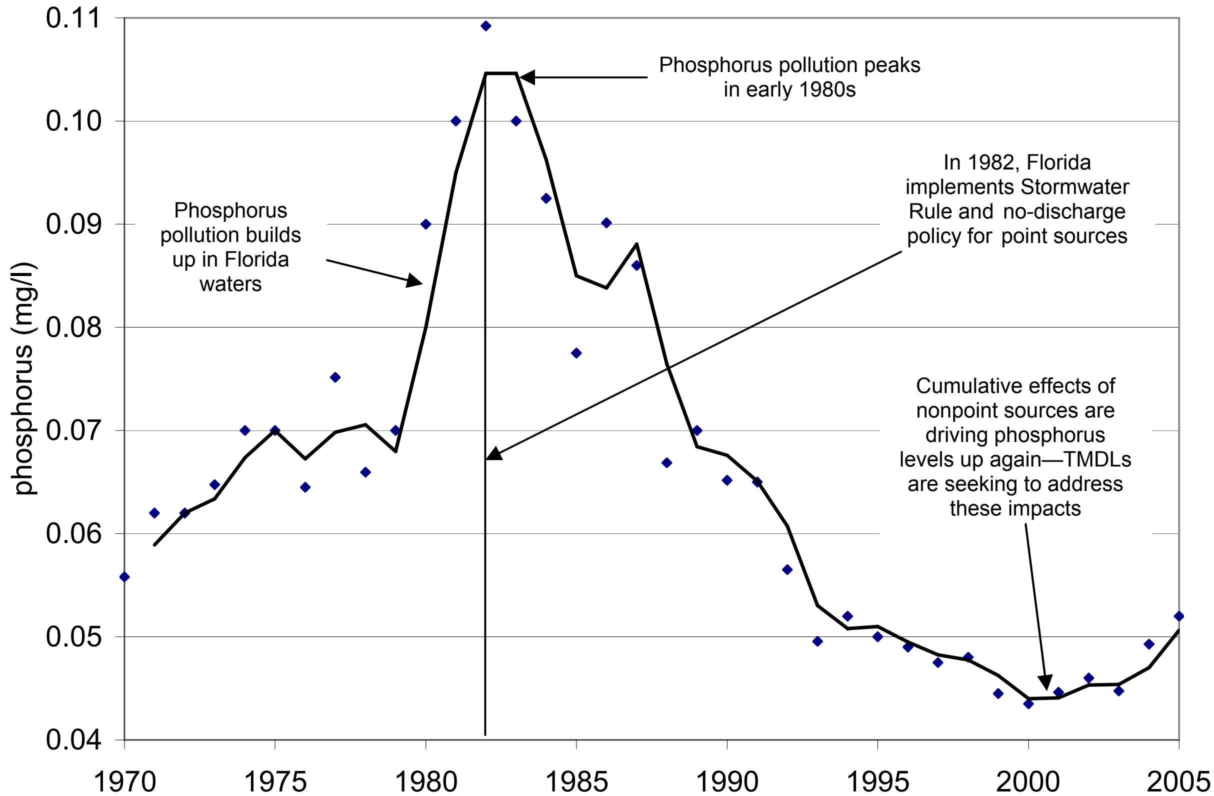
Recommended Nonpoint Source Programs

FDEP is currently evaluating the need to increase the minimum level of treatment of nutrients from stormwater discharges and is working with the development community to promote low-impact development, through approaches such as the Florida Yards and Neighborhoods Program, to further reduce nutrient impacts from nonpoint sources of pollution.

Costs and Benefits of Implementing Florida's Surface Water Protection Programs To Meet the Clean Water Act's Objectives

The EPA, in partnership with the states, conducts the Clean Watersheds Needs Survey (CWNS) to identify and document the cost of projects needed to address water quality and public health in all 50 states, the District of Columbia, and the U. S.-held territories. The CWNS includes detailed estimates of the capital costs eligible for funding under the Clean Water State Revolving Fund (CWSRF) Program established by the 1987 Amendments to the CWA—that is, CWSRF-eligible costs. The CWNS includes publicly owned municipal wastewater collection and treatment facilities; facilities for the control of combined sewer overflows (CSOs); activities designed to control stormwater runoff; activities designed to control nonpoint source pollution;

Figure 3. Phosphorus Trends in Florida Waters, 1970–2005
(based on 733,000 measurements from 3,330 waterbodies)



and activities associated with implementing approved Comprehensive Conservation and Management Plans (CCMPs) under the National Estuary Program (NEP) established by Section 320 of the CWA.

Key elements of the survey are as follows:

- *Facilities must be publicly owned and operated,*
- *Costs represent capital needs (operating and maintenance costs are not represented), and*
- *Costs must be documented.*

Historically, the costs have been interpreted as representing 20-year design needs, but more recently, since the 1996 survey, costs have been documented by planning and design documents representing horizons of 10 years or less.

The survey is conducted every four years, and the results are published in the *Clean Watersheds Needs Survey Report to Congress*. The 2004 survey is under review by the White House Office of Management and Budget and the *Report to Congress* has not been published, but ***Table 3*** provides Florida's preliminary survey results.

These needs are being addressed by several funding mechanisms, most notably the CWA State Revolving Fund (SRF) Program; direct congressional appropriations through the State and Tribal Assistance Grant (STAG) Program; state appropriations through the Community Budget Initiative Request (CBIR) Program; the Comprehensive Everglades Restoration Plan (CERP) (a joint 50/50 program funded by Florida and the EPA); Section 319 nonpoint source grants; TMDL Water Quality Restoration Grants; and local county, municipal, and water management district programs.

Table 3: Preliminary Results of the Clean Watersheds Needs Survey for Florida

Category of Need	***Needs ($000)***
Category I – Secondary Treatment	$ 33,611
Category II – Advanced Treatment	$ 4,595,918
Category III-A – Inflow/Infiltration Correction	$ 310,526
Category III-B – Major Sewer Rehabilitation	$ 960,088
Category IV-A – New Collector Sewers	$ 1,752,257
Category IV-B – New Transmission Facilities	$ 1,392,458
Category V – Combined Sewer Overflow Correction	0
Category VI – Municipal Separate Storm Sewer System (MS4) Permitted Stormwater Management	$ 2,182,750
Category VII – Nonpoint Source BMPs	$ 9,285,007
Category VIII – Confined Animals Point Source	0
Category IX – Mining Point Source	0
Category X – Recycled Reclaimed Water Distribution	$ 1,672,115
Category XI – Estuary Management	$ 63,073
Florida's Total Needs	**$22,247,803**

Clean Water Act State Revolving Fund Program

The CWA SRF Program provides low-interest loans for water pollution control activities and facilities. Water pollution sources are divided into point sources (typically domestic and industrial wastewater discharges) and nonpoint sources (generally associated with leaching or runoff associated with rainfall events from various land uses). Since the program began in 1989, FDEP has made over $2 billion in loans. The program revolves in perpetuity, using state and federal appropriations, loan repayments, investment earnings, and bond proceeds.

Projects eligible for SRF loans include wastewater management facilities, reclaimed wastewater reuse facilities, stormwater management facilities, widely accepted pollution control practices (sometimes called BMPs) associated with agricultural stormwater runoff pollution control activities, brownfields associated with the contamination of ground water or surface water, and estuary protection activities and facilities.

For the SRF Program, the funds awarded/disbursed to date are as follows:

Source	Awarded	Disbursed
Wastewater	$2,022,901,101	$1,533,473,520
Stormwater	$89,604,391	$53,314,398
Nonpoint Sources	$16,506,130	$2,817,056

Construction Grants Program

The primary purpose of federal grant assistance under the Construction Grants Program was to assist municipalities in meeting the enforceable requirements of the CWA, particularly applicable NPDES permit requirements. Prior to October 1, 1984, EPA grant assistance was limited to a maximum of 75% of the allowable costs of building the project and included an allowance for facilities planning and design. After September 30, 1984, the federal share was limited to a maximum grant of 55% of these costs, unless modified to a lower percentage rate uniform throughout the state by the Governor. Innovative and alternative technology projects may have received an additional 20% federal share. Before October 1, 1984, eligible projects included collection systems, intercepting sewers, wastewater treatment facilities, outfall sewers, infiltration/inflow (I/I) rehabilitation, and the correction of combined sewer overflows. After September 30, 1984, eligible projects included only intercepting sewers, wastewater treatment facilities, outfall sewers, and I/I rehabilitation.

For the Construction Grants Program, the funds disbursed to date from 1958 to 1988 are $1,986,134,673.

Section 319(h) Grant Funds

FDEP's Nonpoint Source Management Section administers grant money it receives from the EPA through Section 319(h) of the federal CWA. These grant funds can be used to implement projects or programs that will help to reduce nonpoint sources of pollution. Projects or programs are targeted toward the state's nonpoint source priority watersheds, which are the verified impaired waters on the 303(d) list, the state's SWIM watersheds, and NEP waters. All projects must include at least a 40% nonfederal match.

Examples of fundable projects include the demonstration and evaluation of BMPs, nonpoint pollution reduction in priority watersheds, ground water protection from nonpoint sources, and public education programs on nonpoint source management. Section 319 funding since 1988 through the fiscal year (FY) 2005 grant award (FDEP has not received the FY2006 grant award) is $86,912,743. Approximately 70% of these funds have been used to partner with local governments and water management districts on urban stormwater retrofitting projects to reduce stormwater pollutant loadings to priority waterbodies such as the Indian River Lagoon and Tampa Bay.

TMDL Water Quality Restoration Grants

With the passage of the 1999 FWRA, FDEP and FDACS also began receiving funds generated by documentary stamps to reduce nonpoint source pollution discharged to impaired waterbodies. The funding amount has varied from $2.8 to $9.2 million per year with the agencies receiving a total of $29 million in the past 6 years. Additionally, Senate Bill (SB) 444, enacted by the 2005 legislature, created a new funding program that provides $20 million annually to FDEP, with 7.5% going to FDACS, to be used to reduce pollutant loading from urban stormwater discharges or agricultural nonpoint sources. FDEP's grant funds typically require at least a 50% match from grant recipients.

Special State Concerns and Recommendations

Concerns

Major issues of concern include the following:

- *Since the 1970s, scientists have documented increasing levels of nutrients in surface water.*
- *Water quality has declined in most springs since the 1970s; in particular, levels of nitrate (a nutrient) have increased.*
- *The tripling of Florida's population between 1950 and the present, and the shift from natural landscapes to intense urban development, has caused extensive habitat loss in aquatic habitats and affected the viability of fisheries in many estuarine areas.*
- *Freshwater harmful algal blooms (HABs) are increasing in frequency, duration, and magnitude and therefore may be a significant threat to surface drinking water resources and recreational areas. Abundant populations of blue-green algae, some of them potentially toxigenic, have been found statewide in numerous lakes and rivers. In addition, measured concentrations of cyanotoxins—a few of them of above the suggested guideline levels—have been reported in finished water from some drinking water facilities.*
- *Based on beach closures and shellfish bed closures, the presence of excessive concentrations of bacteria in the water column sometimes limits primary contact and recreation use support and shellfish harvesting use support.*
- *In many coastal and inland waters, excessive concentrations of mercury in the tissue of some fish species limit the attainment of designated use.*
- *Sediments in many urban estuaries such as Tampa Bay, the St. Johns River Estuary, and Pensacola Bay contain heavy metals and organic contaminants.*

Recommendations

To address the special state concerns listed above, FDEP, in cooperation with other agencies and stakeholders, has started several initiatives to improve scientific understanding of Florida's water resources and to improve the protection, management, and restoration of surface water and ground water. These initiatives include the following:

- ***Statewide DO/Nutrient Monitoring Program.*** *To better understand the natural variability of levels of DO and nutrients in the wide variety of freshwater aquatic systems around the state, FDEP received a special legislative appropriation for a contracted monitoring program. Approximately 350 sites in 6 different waterbody types were monitored on a quarterly basis during 2005–*

06. Monitoring includes the 4-day deployment of YSI data sondes, water chemistry samples, and bioassessments. These data will be used to help the state revise its DO criterion to reflect the natural variation that occurs (the current criterion is 5 mg/L for all waters at all times). The data will also be used to develop quantitative nutrient criteria to replace the current narrative criterion.

- ***Nutrient Criteria Development.*** *In the summer of 2001, the EPA published waterbody type–specific guidance manuals for lakes and reservoirs, and streams and rivers, followed in the fall of 2001 by guidance for estuarine and coastal waters. Following a method detailed in these manuals, the EPA undertook analyses of the available pools of data to generate Ambient Water Quality Criteria Recommendations as summarized below for rivers and streams, and lakes and reservoirs for the 3 nutrient ecoregions that Florida partially or wholly encompasses. These recommendations are based on an assumption that the upper 25th percentile of a distribution of medians for a water quality parameter represents a reference condition, and are intended to be revised to more fully represent localized conditions while supporting designated uses. Recognizing the limitations of EPA's analysis and recommendations (given that Florida has identified up to 47 lake ecoregions), FDEP convened a Nutrient Technical Advisory Committee (TAC) to tailor the EPA's recommended criteria for Florida's aquatic systems. The Nutrient TAC has met 13 times since it was established and is making significant progress in addressing the multitude of issues associated with establishing scientifically sound quantitative nutrient criteria.*

- ***Pollutant Trading Policy Advisory Committee (PAC).*** *The Pollutant Trading PAC has been established to assist FDEP in developing a pollutant trading program and rule in Florida. The PAC members represent different stakeholder groups that are involved in the implementation of TMDLs to restore the health of impaired waters. A report to the Florida legislature on the viability of pollutant trading is due in November 2006.*

- ***Statewide Unified Stormwater Rule.*** *The performance standard for the minimum level of treatment for new stormwater discharges established in the state's Water Resource Implementation Rule is "80% average annual load reduction of the pollutants that cause or contribute to violations of state water quality standards." However, the existing BMP design criteria in the current stormwater treatment rules of FDEP and the water management districts were based on an 80% average annual load reduction of total suspended solids. Governor Jeb Bush has directed FDEP to investigate the feasibility of increasing the minimum level of nutrient removal in stormwater discharges from new development. Additionally, the Florida Department of Transportation (FDOT) and FDEP, in cooperation with the water management districts, are revising the state's erosion and sediment control BMPs, leading to a single statewide manual.*

- ***Urban Stormwater BMP Research Program.*** *In 2003, FDEP, in cooperation with FDOT, partnered with the University of Central Florida to establish the Stormwater Management Academy as a center of excellence on urban stormwater treatment and management. The academy has completed or is conducting research on a variety of urban stormwater BMP issues, including the effectiveness of proprietary BMPs, the health and water quality risks associated with stormwater reuse, the design and effectiveness of green roofs* *in Florida, the permeability of pervious concrete, and the effectiveness of erosion and sediment control BMPs,. Additionally, FDEP is funding research to determine fertilization and irrigation needs to establish and maintain turfgrasses, the impact of wet detention pond depth on the effectiveness of stormwater treatment, and the development of BMPs to increase nitrogen removal in stormwater. FDEP and FDACS also are working with the fertilizer industry to develop Florida-specific formulations of slow-release and low-phosphorus fertilizers.*

CHAPTER 3: SURFACE WATER MONITORING AND ASSESSMENT

Florida's Surface Water Monitoring Program

Background

FDEP's approach to comprehensive surface water monitoring is designed to meet the monitoring-related requirements of the federal CWA, as well as Florida's statutory and regulatory monitoring requirements.[7] Broadly stated, these requirements are as follows:

- *Determine water quality standards attainment and identify impaired waters,*
- *Identify the causes and sources of water quality impairments,*
- *Establish, review, and revise water quality standards,*
- *Support the implementation of water management programs,*
- *Establish special monitoring for unique resources, and*
- *Support the evaluation of program effectiveness.*

FDEP continues to carry out extensive statewide monitoring in order to meet these federal and state requirements. However, the state's surface waters are so abundant that FDEP does not have the staff or budgetary resources to monitor every waterbody in the state. Numerous other governmental entities at federal, state, regional, and local levels, as well as volunteer and private organizations, carry out much of the monitoring. The bulk of the data used in this report comes from approximately 79 data providers across the state, who do ambient monitoring of water chemistry, collect biological data, and carry out benthic sampling and sampling of sediments in estuarine waters. In most cases, the data are uploaded to STORET, the EPA's national STOrage and RETrieval database, and FDEP evaluates, analyzes, and reports on these data. Some qualifiers are placed on these data, to address issues such as systematic errors. For example, by law Florida LakeWatch data can be used only for nonregulatory

---

[7] At the federal level, Section 305(b) of the 1972 CWA (Federal Water Pollution Control Act, 33 U. S. Code 1251–1375, as amended) directs each state to (1) prepare and submit a report every two years that includes a description of water quality of all of its navigable surface waters to the EPA, and (2) analyze the extent to which navigable waters provide for the protection and propagation of a balanced population of shellfish, fish, and wildlife. Section 303(d) of the CWA requires states to submit to the EPA lists of surface waters that are impaired (i.e., that do not meet their designated uses, such as drinking water, recreation, and shellfish harvesting, as defined by applicable water quality standards). TMDLs must be developed for each of these impaired waters on a schedule. Also, Section 106 (e)(1) of the CWA directs the EPA to determine whether states meet the prerequisites for monitoring their aquatic resources.

Monitoring is required under Florida law through a series of rules that govern FDEP's regulatory activities. The 1997 Water Quality Assurance Act (Section 403.063, F.S.) directs FDEP to establish and maintain a ground water quality monitoring network designed to detect or predict contamination of the state's ground water resources. In addition, Section 62-40.540, F.A.C., Florida's Water Policy, states that FDEP ". . . shall coordinate district, state agency, and local government water quality monitoring activities in order to improve data quality and reduce costs."

proceedings and cannot be used for enforcement activities. These qualifiers are discussed in greater detail later in this chapter.

Each governmental agency and volunteer or private organization has its own monitoring objectives, strategy, design, and indicators, as well as procedures for quality assurance, data management, data analysis and assessment, and reporting. However, these are beyond the scope of this report. ***Table 4*** lists the various entities, including FDEP, that carry out water quality monitoring statewide.

Table 4. Federal, State, Regional, and Local Agencies and Organizations that Carry Out Water Quality Monitoring in Florida

Monitoring Level	*Monitoring Agency/Organization*
Federal	Apalachicola National Estuarine Research Reserve
	Avon Park Air Force Range
	Charlotte Harbor National Estuarine Program
	Eglin Air Force Base
	Guana Tolomato Matanzas National Estuarine Research Reserve
	National Oceanic and Atmospheric Administration
	Rookery Bay National Estuarine Reserve
	U. S. Army Corps of Engineers
	U. S. Environmental Protection Agency
	U. S. Geological Survey
Out of State	Georgia Department of Natural Resources
State	Charlotte Harbor Aquatic/Buffer Preserves
	Estero Bay Aquatic Preserve
	Florida Department of Agriculture and Consumer Services
	Florida Department of Health
	Florida Marine Research Institute
	FDEP's Ambient Monitoring Program
	FDEP's District offices (6)
	FDEP's Watershed Assessment Section
	Florida Fish and Wildlife Conservation Commission
Regional	Choctawhatchee Basin Alliance
	Loxahatchee River District
	Peace River Manasota Regional Water Authority (PBS&J)
	Pensacola Bay Nutrient Study (Gulf Breeze)
	Northwest Florida Water Management District
	South Florida Water Management District
	Southwest Florida Water Management District
	Southwest Florida Water Management District (Coast Project)
	St. Johns River Water Management District
	Suwannee River Water Management District
Local	Alachua County
	Bay County
	Broward County Environmental Monitoring Division
	Charlotte County Storm Water
	City of Cape Coral

Monitoring Level	Monitoring Agency/Organization
	City of Jacksonville
	City of Lakeland
	City of Lynn Haven
	City of Key West
	City of Maitland
	City of Naples
	City of Orlando
	City of Panama City Beach
	City of Port St. Joe Project (Gulf Breeze)
	City of Port St. Joe Wastewater Treatment Plant
	City of Port St. Lucie
	City of Punta Gorda Utilities
	City of Sanibel
	City of Tallahassee
	City of Tampa
	City of West Palm Beach
	Collier County Pollution Control
	Dade County Environmental Resource Management
	East County Water Control District
	Escambia County Utility Association
	Hillsborough County
	Lake County Water Resource Management
	Lee County Environmental Laboratories
	Lee County Hyacinth Control District
	Manatee County Environmental Management
	McGlynn Laboratories and Leon County
	Okaloosa County Environmental Council
	Orange County Environmental Protection Division
	Palm Beach County Environmental Resource Management
	Pinellas County Department of Environmental Management
	Polk County Natural Resources Division
	Reedy Creek Improvement District Environmental Services
	Sarasota County Environmental Services
	Seminole County Public Works Roads/Stormwater
	Seminole Improvement District
	St. Johns County
	Volusia County Environmental Health Lab
Volunteer/Private	Baskerville Donovan, Inc.
	Baywatch
	Biological Research Associates
	Bream Fisherman's Association
	Conservancy of Southwest Florida
	Environmental Research and Design, Inc
	Florida Center for Community Design + Research
	Florida LakeWatch (identification of potentially impaired waters only)
	Gulf Power Company

Monitoring Level	Monitoring Agency/Organization
	IMCA/Agrico/Phosphates
	Janicki Environmental
	The Nature Conservancy of the Florida Keys
	Palm Coast Community Service Corp.
	Sanibel Captiva Conservation Foundation
	Southeast Environmental Research Center

Florida's Integrated Water Resources Monitoring Program

As discussed earlier, water resource monitoring in Florida is conducted by FDEP, the water management districts, local governments, and other entities. Over the past decade, FDEP has worked very closely with these monitoring entities to establish an Integrated Water Resources Monitoring (IRWM) Program that integrates surface water and ground water monitoring, as well as water chemistry, biological, and sediment monitoring. Since it is fiscally and logistically prohibitive to sample every segment of river or stream, every acre of lake, or each individual monitoring well in the state annually, the IWRM also integrates three tiers of monitoring—statewide probabilistic monitoring that allows statistical inferences to be made about all waters in the state; more intensive basin monitoring; and site-specific monitoring **(Table 5).** These three tiers are composed of eight core monitoring programs in FDEP's Division of Water Resource Management.

The IWRM approach is consistent with the EPA's 2003 guidance document, *Elements of a State Water Monitoring and Assessment Program,*[8] and addresses the following 10 elements:

1. *Monitoring objectives,*
2. *Monitoring strategy,*
3. *Monitoring design,*
4. *Indicators,*
5. *Quality assurance,*
6. *Data management,*
7. *Data analysis and assessment,*
8. *Reporting,*
9. *Programmatic evaluation, and*
10. *General support and infrastructure planning.*

This section broadly discusses Elements 1 (monitoring objectives), 2 (monitoring strategy), 5 (quality assurance), 6 (data management), 9 (programmatic evaluation), and 10 (general support and infrastructure planning). The methodology and assessment sections of this chapter address Elements 3 (monitoring design), 4, (indicators), 7 (data analysis and assessment), and 8 (reporting).

[8] U. S. Environmental Protection Agency, March 2003.

Table 5. Summary of FDEP's Core Monitoring Programs

Tier	*Program*	*Summary*	*Resources Addressed*
Statewide (Tier I)	Status Network	Consists of a probabilistic monitoring design to estimate water quality across the entire state based on a representative subsample of water resource types.	Large lakes Small lakes Large rivers Small streams Confined aquifers Unconfined aquifers
	Temporal Variability Network	Comprises a fixed station design to examine changes in water quality and flow over time throughout the state.	Large rivers Small streams Confined aquifers Unconfined aquifers
Basin Specific (Tier II)	Springs Initiative	Consists of a fixed station network of freshwater springs intended to enhance the understanding of Florida's springs, stop the degradation and loss of spring flow, and restore springs to their former health.	First-magnitude springs Second-magnitude springs Subaquatic conduits River rises Coastal submarine springs
	Strategic Monitoring Program	Addresses gaps in data provided by other monitoring agencies and addresses questions in specific basins and waterbody segments that are associated with determinations of waterbody impairment for the TMDL Program.	All surface waters based on the schedule in the watershed management cycle
Site Specific (Tier III)	Intensive Surveys for TMDLs	Provides detailed, time-limited investigations of the conditions of specific surface waters that are identified as impaired.	Specific surface waters identified as impaired
	Water Quality Standards Development	Develops, evaluates, and revises new and existing surface water quality standards. Carries out monitoring to determine concentrations to protect aquatic life and human health.	Surface water Ground water
	Site-Specific Alternative Criteria	Develops moderating provisions unique to a waterbody that does not meet particular water quality criteria, due to natural background conditions or human-induced conditions that cannot be controlled or abated.	Surface waters to which particular ambient water quality criteria may not be applicable
	Fifth-Year Inspections	Achieves and maintains compliance through sound environmental monitoring and permitting practices.	Surface waters that receive point source discharges

Element 1: Monitoring Objectives

The goal of FDEP's monitoring activities is to determine the overall quality of the state's surface water and ground water, how they are changing over time, and the effectiveness of waer resource management, protection, and restoration programs. Monitoring activities collectively address the following broad objectives:

- *Identify and document the condition of Florida's water resources with a known certainty;*

- *Determine the proportion of the state's waterbodies that meet water quality thresholds and other indicators of ecosystem health;*
- *Identify water quality changes over time in the state, in individual river basins, and in specific waterbodies;*
- *Collect data on important chemical, physical, and biological parameters to characterize waterbodies that do not meet the applicable Florida water quality standards and criteria in the IWR (Rules 62-302 and 62-303, F.A.C.);*
- *Conduct monitoring that is consistent with the criteria set forth in the IWR;*
- *Identify waters that are currently on the 303(d) list as verified impaired, or identify waters that are no longer determined to be impaired;*
- *Collect data for waters that are suspected to be impaired that were originally not on the 303(d) list;*
- *Collect data on waterbodies that currently have few or no data for assessing their impaired status;*
- *Continue to collect data that will be useful in assessing changes over time in the status of impaired waters;*
- *Establish a scientific database that can be useful in determining the status of a basin's long-term overall health;*
- *Provide reliable data to help refine management decision making;*
- *Establish a water database with known data quality objectives and quality assurance that can be used to help establish water quality standards;*
- *Help provide data to evaluate the effectiveness of clean water projects and programs; and*
- *Provide technically sound information to managers, legislators, agencies, and the public.*

Element 2: Monitoring Strategy

Under FDEP's IWRM approach, there are three tiers of monitoring, ranging from the general to the specific, that are designed to fill data gaps or support specific regulatory needs. Each of FDEP's eight core monitoring programs has a detailed monitoring design, a list of core and supplemental water quality indicators, and specific procedures for quality assurance, data management, data analysis and assessment, reporting, and programmatic evaluation. FDEP relies on both chemical and biological sampling in all of its monitoring programs, and also conducts the bulk of the biological sampling that is carried out statewide. ***Table 5*** briefly describes FDEP's approach and the water resources addressed for each FDEP monitoring program.

Based on the goals and objectives of each individual core monitoring program, sample locations are selected, monitoring parameters and sampling frequencies are determined, and sample collection and analysis are coordinated among FDEP's districts; cooperating federal, state, and county agencies; and volunteer monitoring groups. This close coordination with other monitoring entities around the state is essential to prevent duplication and to maximize the number of waterbodies that are monitored on a regular basis.

Statewide monitoring (Tier I) consists of FDEP's statewide surface water and ground water Status and Trend (Temporal Variability, or TV) Networks. The Status Network uses a rotating-basin, probabilistic monitoring design to estimate water quality across the entire state, based on a representative subsample of water resource types. The TV Network uses a fixed station design to examine changes in water quality and flow over time throughout the state. The objective of these networks is to provide scientifically defensible information on the important chemical, physical, and biological characteristics of surface waters and major aquifer systems of Florida. Both networks are designed to measure condition using a variety of threshold values, including water quality standards, water quality indices, and other appropriate ecological indicators.

Basin-specific monitoring (Tier II) includes the Strategic Monitoring Program, which is designed to address data gaps in order to verify impairment in segments with waterbody identification numbers (WBIDs) for the TMDL Program, and monitoring in response to citizen concerns and environmental emergencies. The Springs Initiative encompasses all of the extensive monitoring activities begun in 1999 to address the needs of Florida's freshwater spring systems, a fragile and unique resource type that is at risk.

Site-specific monitoring (Tier III) addresses questions that are regulatory in nature. Examples include monitoring to determine whether moderating provisions such as site-specific alternative criteria (SSACs) should apply to certain waters, all monitoring tied to regulatory permits issued by FDEP (including fifth-year inspections of wastewater facilities under the NPDES Program, intensive surveys for the development of TMDLs, monitoring to evaluate the effectiveness of BMPs, and, infrequently, monitoring to establish or revise state water quality standards.

Element 5: Quality Assurance

Because water quality monitoring is carried out by many agencies and groups statewide, FDEP has a centralized quality assurance (QA) program to ensure that data are properly and consistently collected. A Quality Assurance Officer coordinates and oversees data quality activities for each program. However, QA is the responsibility of everyone associated with sampling, monitoring, and data analysis.

Training classes, which are conducted by FDEP staff, focus on program-specific sampling requirements. Any updates or changes to an individual program's monitoring protocols are communicated through project management meetings, statewide meetings, an Internet Web site, and training classes.

The accuracy of field measurements is assessed through internal FDEP programs. Staff also monitor the on-site sampling environment, sampling equipment decontamination, sample container cleaning, the suitability of sample preservatives and analyte-free water, and sample transport and storage conditions.

For each monitoring program, field staff are instructed to follow a comprehensive set of Standard Operating Procedures (SOPs) set forth in Rule 62-160, F.A.C., and specified in the FDEP document, *Standard Operating Procedures for Field Activities* (DEP-SOP-001/01, February 1, 2004).

Water quality samples are sent to FDEP's Central Laboratory for analysis for the majority of programs, and to a lesser degree to district laboratories for limited analyses, such as bacteriological tests and turbidity. FDEP labs have SOPs for handling and analyzing samples, reporting precision, accuracy and method detection limits that apply, and reporting data. Laboratory certification is maintained as required by Section 62-160.300, F.A.C. The Quality Assurance Rule (Rule 62-160, F.A.C.), which was adopted on June 8, 2004, requires all entities submitting data to FDEP be certified by the National Environmental Laboratory Accreditation Conference (NELAC) through FDOH.

Element 6: Data Management

The smooth and timely flow of water quality data from sample collectors and analytical agencies to data analysts is a high priority. FDEP's Watershed Monitoring and Watershed Data Services Sections comprise the lead IWRM organization. Assisted by cooperating federal, state, and county agencies, sample locations are selected, monitoring parameters and frequencies determined, and sample collection and analysis coordinated. This information is communicated electronically to the sampling agencies before sampling commences.

Some data collected in the field are computerized at the sampling agency, using a customized FDEP computer program that facilitates the flow of data from the field. Water quality samples are tracked from the field to the lab. Files containing analytical data are transferred to FDEP, processed and merged with corresponding field data, and linked to the corresponding site data. Computerized accuracy and completeness checks are run, in addition to a variety of other QA checks. FDEP staff manually check each data file to identify any obvious random or systematic errors.

All data collected are uploaded to STORET annually. Periodically, data are uploaded to FDEP's Oracle-based Generalized Water Information System (OGWIS), which is available to FDEP staff.

Element 9: Program Evaluation

Florida, in consultation with the EPA, reviews each monitoring program to determine how well the program serves its water quality decision needs for all state waters. EPA and FDEP QA audits are used in evaluating each program to determine how well each of the EPA's recommended elements is addressed and how to incorporate needed changes and additions into future monitoring cycles.

Element 10: General Support and Infrastructure Planning

The EPA's general support and infrastructure planning element is encompassed by a number of activities. FDEP's Central Laboratory provides laboratory support for all eight core monitoring programs. The Watershed Monitoring and Data Management (WMDM) Section provides both administrative and technical support primarily to three of the eight programs: the Status Network, Temporal Variability Network, and the TMDL Program.

Evolving Approaches to Monitoring

Florida continues to develop new approaches to monitoring. FDEP has developed a number of biological indices to characterize the condition of surface waters and has adopted these indices for use in water resource assessments at all three tiers of monitoring. The following new indicators that FDEP is currently using integrate the biological responses from land uses in a basin and can provide a measure of resource health:

- *FDEP uses a macroinvertebrate-based index, BioReconnaissance (BioRecon), as a rapid assessment tool. The BioRecon is a 6-metric index ranging from 0 to 10. If a site scores less than 6 on the index, it is recommended for a further, more intensive study using the SCI method.*
- *A composite macroinvertebrate index for use in flowing streams, the SCI is used as a definitive measure of impairment. Data generated on the species composition and abundance of organisms in a stream are used to calculate 10 biological metrics. Points are assigned for each metric, based on regionally calibrated criteria. The points from each of these 10 biological metrics are then summed to rate a site as excellent, good, fair, poor, or very poor.*
- *Similarly, the Lake Condition Index (LCI), which uses six metrics, is used to characterize noncolored lakes statewide. As macroinvertebrate-based indices have not been shown to assess colored lakes in Florida accurately, they have been excluded from bioassessments.*
- *Florida has also launched a lake condition characterization, the Lake Vegetation Index (LVI), employing plant community (macrophyte) composition. Using transects and a visual survey, the results can be compiled for a rapid assessment of lake condition.*
- *A Wetland Condition Index, using vegetation, macroinvertebrates, and algae, has been developed for some freshwater wetland systems (depression marshes and forested wetlands only). This tool is being used to refine FDEP's rapid wetland assessment methodology for permitting/mitigation and to assess the effectiveness of wetland restoration projects.*
- *Florida has also developed geochemical- and biology-based tools to measure the quality of sediments in marine and freshwater systems. Sediments will be collected from a statistical sampling of lake resources in the state as part of the Status Network. The resulting data will then be compared with a geochemical tool developed to measure naturally occurring concentrations of metals, and biology-based thresholds will be used to estimate levels of potentially toxic contaminants in sediments.*

Surface Water Assessment

Statewide Probabilistic Assessment (Tier 1)

Approach to the Assessment

While FDEP's broad-based historical approach to collecting monitoring data enlarged the overall population of waters monitored beyond what the agency alone could provide, the information was still limited to approximately 20% to 30% of the state's rivers and streams in 305(b) reports, up to and including the 2000 report.[9] As a result, prior to the establishment of the Tier I Status Monitoring Network, a majority of Florida's waters may not have been monitored or completely assessed in any 2-year cycle of reporting to the EPA.

[9] FDEP, 2000 and 2002.

In recent years, EPA's Integrated Report guidance on the requirements for water quality assessment, listing, and reporting under Sections 303(d) and 305(b) of the CWA has stated that a probabilistic monitoring design is a cost-effective approach to producing a statistical statement of known confidence to describe the aggregate condition of water resources.[10] Florida adopted this approach beginning in 2000, so that the condition of all of the state's aquatic resources could be estimated with a known statistical confidence. Data produced by the Status Network can be used to complement traditional CWA 305(b) reporting.

Two separate but complementary probabilistic designs estimate the condition of the state's surface fresh and marine waters, using key ecological indicators. FDEP is responsible for the freshwater component, and the FWCC, with the EPA, designed and implements the marine network.

The information in this report focuses on the freshwater portion of the probabilistic monitoring network. The Status Monitoring Network, maintained by FDEP, is based on the EPA's Environmental Monitoring and Assessment Program (EMAP) model. A stratified, rotating basin, multiyear approach is used to sample and report on aquatic resources from the entire state.

All stratified, random sampling networks use predefined geographic units so that the results can address questions at different scales. Florida was divided into 29 geographic reporting units, representing watershed basins ***(Figure 4).*** To carry out systematic sampling, Florida's waters were subdivided into identifiable surface waters and ground waters, and delineated as different resource types. The resulting data for these resource types were analyzed statewide for a number of key indicators.

Short-term Schedule for Next Two-Year Reporting Cycle

The Status Network's probabilistic monitoring will follow the basin rotation schedule over the next 3 years ***(Figure 4).*** The Group 3 basins will be monitored during 2006, Group 4 will be sampled in 2007, and Group 5 will be sampled in 2008. The assessment results that will be reported in the 2008 305(b) report will include the basins in Groups 1–3.

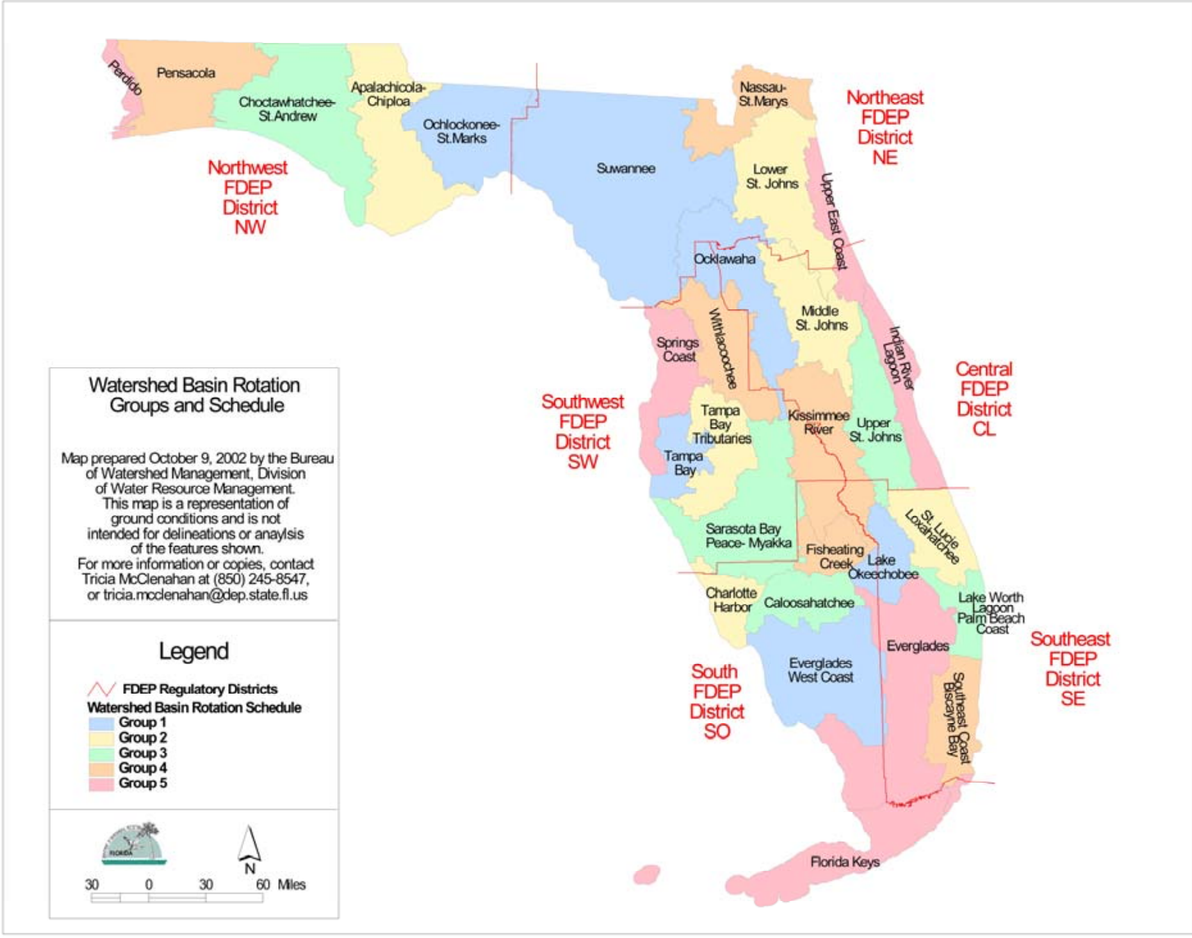
How Data Are Identified and Evaluated

Data from the Status and Trend monitoring networks are generated within the program, and therefore no additional data are used to make a determination of condition. The data are used in both statewide and basin (Tier 1) reporting, and are incorporated into STORET for segment-specific (Tier II and Tier III) analyses.

Public Participation Process. The Watershed Monitoring Section holds 2 meetings and 10 teleconferences each year to ensure open communication among all participants. The water management districts, local governments, and other agencies participate in the support and continued evolution of the IWRM Status and Trend monitoring programs.

[10] U. S. Environmental Protection Agency, July 21, 2003.

Figure 4. Five-Year Rotating Basin Cycle in FDEP's Six Districts



Quality Assurance/Quality Control Criteria Used to Evaluate Outside Data. No outside data are used for the probabilistic network. All in-house data are required to meet all SOP requirements described in Chapter 3, Element 5. A field-sampling manual is available to all samplers, and training supplied to ensure proper collection of water and biological samples for submittal to the FDEP lab. Field audits are conducted by the section Quality Assurance Officer and regional project managers, and the lab conducts audits of data quality.

How Data Are Used To Make Attainment Determinations

A methodology that uses a two-part terminology—"attaining" and "not attaining"—was developed to allow an overall summary of the quality of the resource in a sampling unit. The methodology is based on the percentage of sample sites that attain and do not attain sample results, and so it can be used to communicate the overall quality of a resource. However, "not attained" does not mean that a specific waterbody is impaired and is required to have a TMDL developed. ***Table 6*** lists the thresholds used.

Table 6. Status Network Water Quality Standards and Thresholds for Fresh Surface Waters

Analyte	*Criterion/Threshold*	*Use*
Fecal Coliform Bacteria	< 400 (single sample maximum)	Recreation
DO	≥ 5 mg/L	Aquatic Life
pH	≥ 6, ≤ 8.5 standard units (su)	
Un-ionized Ammonia (Calculated from temperature, pH, salinity, ammonia)	≤ 0.02 mg/L	
Chlorophyll *a*	≤ 20 μg/L	
TSI (Calculated from chlorophyll, Total Phosphorus, NO_2 + NO_3 +Nitrogen [TKN])	Color ≤ 40 platinum cobalt units (PCUs) then TSI ≤ 40 Color > 40 PCUs then TSI ≤ 60	

Changes in Assessment Methodology since the Last Reporting Cycle. The design of the probabilistic network has changed significantly since the last reporting cycle. These changes at the very basic level include a switch from 20 reporting basins to the 29 TMDL reporting basins ***(Figure 4).*** The surface water resource types were redefined; lakes, rivers, and streams now include only waters that are considered waters of the state. The assessment incorporates an updated Generalized Random Tessellation Stratified (GRTS) design adopted from the EPA's EMAP. The assessment remains similar in that the condition of a basin is reported using adopted standards or thresholds; however, instead of 3 categories (meets, partially meets, and does not meet threshold), a pass-fail, two-category assessment (attain/not attain) is used. **Appendix C** describes the Status Network surface water methodology.

Analytical Approaches Used to Infer Conditions. The probabilistic network is designed to randomly select samples from 4 surface water (and 2 ground water) resource types. An attempt is made to collect 30 samples of each resource; these samples represent the basin. Typically, only 1 sample is obtained from each waterbody in each of the resource types; however, large rivers and large lakes often have more than 1 sample taken. The results for each indicator from the samples are plotted using the Cumulative Distribution Function (CDF), which allows the generation of percentiles of each resource on a percentile basis (5%, 10%, 25%, 50%, etc.), or on a percentile meeting a threshold (95% of the state met a water quality standard [attaining]; 5% did not [not attaining]). These are reported in a tabular format ***(Tables 7b–e)*** for the Group 1 basins. Because the 29 basins were used as reporting units beginning in 2004, results are available only for the Group 1 basins. ***Table 7a*** contains a legend for the terms used in the tables.

In ***Tables 7b–e,*** the units are not segments; they are miles for large rivers and large streams, acres for large lakes, and numbers of small lakes. For example, in ***Table 7b,*** the estimate of stream miles found to be inaccessible was 27, those miles found to be sampleable are 116, and the target population therefore is the combination of the two, or 143 stream miles. The figures in **Appendix A** contain pie charts showing the estimate for the entire basin.

Rationales for Not Using Existing Data. All data generated by the Status Network are used. During the year, it is possible that events beyond FDEP's control (for example, drought, hurricanes, limited resources, or absence of permission) may mean that data are not collected from all 30 sites. This results in reduced confidence around the estimate of condition. ***Tables 7b–e*** cite instances when this happened.

Table 7a: Legend for Terms Used in Tables 7b–e

Term	***Explanation***
Basin	Reporting unit for which attainment results are reported
Target Population	Estimate of actual extent of resource from which attainment results were calculated. Excludes % of resource that was determined to not fit definition of resource
Sampleable	Estimate of extent of resource that staff would have been able to sample during index period
Inaccessible	Estimate of extent of resource that was inaccessible due to safety concerns and owner denials
Dry	Estimate of extent of resource that was dry during the index period and therefore could not be sampled
% Attaining	% of estimate of extent of resource that attains a specific indicator's criterion value
95% Confidence Bounds (% Attaining)	Upper and lower bounds for 95% confidence of % attaining for a specific indicator's criterion value
% Not Attaining	% of estimate of extent of resource that does not attain a specific indicator's criterion value
Assessment Period	Duration of probabilistic survey's sampling event

Table 7b. Attainment Results Calculated Using Probabilistic Monitoring Designs, Large Rivers, Group 1

Status Network   Designated Use: Recreation and Aquatic Life   Units: Miles

Basin	*Target Population*	*Sampleable*	*Dry*	*Inaccessible*	*Number of Samples*	*Indicator*	*% Attaining*	*95% Confidence Bounds (% Attaining)*	*% Not Attaining*	*Assessment Period*
NWFWMD1 Ochlockonee–St. Marks	143	116	0	27	30	Fecal Coliform	96.7	91.1 - 100.0	3.3	August–October 2004
					30	DO	76.7	65.4 - 87.9	23.3	
					30	pH 6.0 - 8.5	43.3	30.6 - 56.0		
						pH < 6.0			56.7	
						pH > 8.5				
					30	Un. Ammonia	100.0	100.0	0.0	
					30	Chlorophyll a	100.0	100.0	0.0	
SFWMD1 Everglades–West Coast	255	207	0	48	30	Fecal Coliform	100.0	100.0	0.0	May–June 2004
					30	DO	76.7	62.6 - 90.7	23.3	
					30	pH 6.0 - 8.5	100.0	100.0	0.0	
						pH < 6.0				
						pH > 8.5				
					30	Un. Ammonia	100.0	100.0	0.0	
					30	Chlorophyll a	56.7	42.6 - 70.8	43.3	
SFWMD6 Lake Okeechobee	26	14	0	12	30	Fecal Coliform	93.3	86.4 - 100.0	6.7	May–June 2004
					30	DO	60.0	47.8 - 72.2	40.0	
					30	pH 6.0 - 8.5	96.7	91.0 - 100.0		
						pH < 6.0				
						pH > 8.5			3.3	
					30	Un. Ammonia	96.7	91.0 - 100.0	3.3	
					30	Chlorophyll a	33.3	23.6 - 43.1	66.7	
SJRWMD1 Ocklawaha	62	54	0	8	28	Fecal Coliform	100.0	100.0	0.0	May–June 2004
					30	DO	60.0	47.8 - 72.2	40.0	
					30	pH 6.0 - 8.5	96.7	91.4 - 100.0		
						pH < 6.0				
						pH > 8.5			3.3	
					30	Un. Ammonia	100.0	100.0	0.0	
					30	Chlorophyll a	80.0	68.7 - 91.3	20.0	
SRWMD1 Suwannee	333	294	20	19	30	Fecal Coliform	93.3	86.0 - 100.0	6.7	August–September 2004
					30	DO	66.7	53.5 - 79.8	33.3	
					30	pH 6.0 - 8.5	66.7	55.6 - 77.8		
						pH < 6.0			33.3	
						pH > 8.5				
					30	Un. Ammonia	100.0	100.0	0.0	
					30	Chlorophyll a	100.0	100.0	0.0	

Basin	Target Population	Sampleable	Dry	Inaccessible	Number of Samples	Indicator	% Attaining	95% Confidence Bounds (% Attaining)	% Not Attaining	Assessment Period
SWFWMD1 Tampa Bay	0	0	0	0	0	No large rivers in basin				
Summary of All Group 1 Basins	819	685	20	114	148	Fecal Coliform	96.5	93.3 - 99.7	3.5	2004
					150	DO	70.8	63.6 - 78.1	29.2	
					150	pH 6.0 - 8.5	76.1	71.0 - 81.2		
						pH < 6.0			23.5	
						pH > 8.5			0.3	
					150	Un. Ammonia	99.9	99.7 - 100.0	0.1	
					150	Chlorophyll a	83.1	78.6 - 87.6	16.9	

Table 7c. Attainment Results Calculated Using Probabilistic Monitoring Designs, Small Streams, Group 1

Status Network Designated Use: Recreation and Aquatic Life Units: Miles

Basin	*Target Population*	*Sampleable*	*Dry*	*Inaccessible*	*Number of Samples*	*Indicator*	*% Attaining*	*95% Confidence Bounds (% Attaining)*	*% Not Attaining*	*Assessment Period*
NWFWMD1 Ochlockonee–St. Marks	1,267	535	482	250	30	Fecal Coliform	76.7	63.2 - 90.1	23.3	April–June 2004
					30	DO	90.0	80.3 - 99.7	10.0	
					30	pH 6.0 - 8.5	53.3	41.5 - 65.1		
						pH < 6.0			46.7	
						pH > 8.5			0.0	
					30	Un. Ammonia	100.0	100.0	0.0	
					30	Chlorophyll a	100.0	100.0	0.0	
SFWMD1 Everglades–West Coast	912	190	76	646	9	Fecal Coliform	Data not sufficient	Data not sufficient	Data not sufficient	October 2004
					9	DO				
					9	pH 6.0 - 8.5				
						pH < 6.0				
						pH > 8.5				
					9	Un. Ammonia				
					9	Chlorophyll a				
SFWMD6 Lake Okeechobee	645	484	72	89	27	Fecal Coliform	81.5	68.0 - 95.0	18.5	October 2004
					28	DO	25.0	10.8 - 39.2	75.0	
					28	pH 6.0 - 8.5	100.0	100.0	0.0	
						pH < 6.0			0.0	
						pH > 8.5			0.0	
					28	Un. Ammonia	96.4	90.2 - 100.0	3.6	
					28	Chlorophyll a	64.3	48.1 - 80.4	35.7	
SJRWMD1 Ocklawaha	320	125	35	160	27	Fecal Coliform	77.8	65.3 - 90.2	22.2	August–December 2004
					29	DO	48.3	33.2 - 63.4	51.7	
					29	pH 6.0 - 8.5	75.9	61.7 - 90.1		
						pH < 6.0			24.1	
						pH > 8.5			0.0	
					29	Un. Ammonia	100.0	100.0	0.0	
					29	Chlorophyll a	86.2	78.0 - 94.4	13.8	
SRWMD1 Suwannee	1,794	233	686	875	21	Fecal Coliform	85.7	71.9 - 99.5	14.3	April–June 2004
					19	DO	63.2	46.2 - 80.1	36.8	
					19	pH 6.0 - 8.5	94.7	85.3 - 100.0		
						pH < 6.0			5.3	
						pH > 8.5			0.0	
					19	Un. Ammonia	94.7	85.4 - 100.0	5.3	
					21	Chlorophyll a	90.5	79.5 - 100.0	9.5	

Basin	***Target Population***	***Sampleable***	***Dry***	***Inaccessible***	***Number of Samples***	***Indicator***	***% Attaining***	***95% Confidence Bounds (% Attaining)***	***% Not Attaining***	***Assessment Period***
SWFWMD1 Tampa Bay	212	115	12	85	30	Fecal Coliform	30.0	16.5 - 43.5	70.0	August–September 2004
					30	DO	43.3	27.3 - 59.4	56.7	
					30	pH 6.0 - 8.5	100.0	100.0	0.0	
						pH < 6.0			0.0	
						pH > 8.5			0.0	
					30	Un. Ammonia	100.0	100.0	0.0	
					30	Chlorophyll a	86.7	76.0 - 97.3	13.3	
Summary of All Group 1 Basins Assessed*	5,150 4,238*	1,682 1,492*	1,363 1,287*	2,105 1,459*	135	Fecal Coliform	79.0	71.5 - 86.4	21.0	2004
					136	DO	63.3	55.1 - 71.4	36.7	
						pH 6.0 - 8.5	82.0	76.6 - 87.4		
						pH < 6.0			18.0	
					136	pH > 8.5			0.0	
					136	Un. Ammonia	97.2	93.2 - 100.0	2.8	
					138	Chlorophyll a	88.8	83.5 - 94.1	11.2	

Note: Summary of All Group 1 shows total streams miles and assessed stream miles (excluding SFWMD1).

Table 7d. Attainment Results Calculated Using Probabilistic Monitoring Designs, Large Lakes (greater than 25 acres in size), Group 1

Status Network   Designated Use: Recreation and Aquatic Life   Units: Acres

Basin	*Target Population*	*Sampleable*	*Dry*	*Inaccessible*	*Number of Samples*	*Indicator*	*% Attaining*	*95% Confidence Bounds (% Attaining)*	*% Not Attaining*	*Assessment Period*
NWFWMD1 Ochlockonee–St. Marks	30,108	17,042	1,704	11,362	30	Fecal Coliform	96.7	91.0 - 100.0	3.3	June–August 2004
					30	DO	53.3	42.2 - 64.4	46.7	
					30	pH 6.0 - 8.5	43.3	31.8 - 54.9		
						pH < 6.0			46.7	
						pH > 8.5			10.0	
					30	Un. Ammonia	100.0	100.0	0.0	
					30	TSI	96.7	90.9 - 100.0	3.3	
SFWMD1 Everglades–West Coast	1,524	1,426	0	98	29	Fecal Coliform	100.0	100.0	0.0	October–December 2004
					29	DO	100.0	100.0	0.0	
					29	pH 6.0 - 8.5	17.2	4.7 - 29.8		
						pH < 6.0				
						pH > 8.5			82.8	
					29	Un. Ammonia	89.7	79.9 - 99.4	10.3	
					29	TSI	44.8	30.5 - 59.1	55.2	
SFWMD6 Lake Okeechobee	359,579	247,985	0	111,594	17	Fecal Coliform	100.0	100.0	0.0	November–December 2004
					20	DO	100.0	100.0	0.0	
					20	pH 6.0 - 8.5	95.0	86.9 - 100.0		
						pH < 6.0				
						pH > 8.5			5.0	
					17	Un. Ammonia	100.0	100.0	0.0	
					17	TSI	88.2	77.9 - 98.6	11.8	
SJRWMD1 Ocklawaha	142,924	119,103	0	23,821	29	Fecal Coliform	100.0	100.0	0.0	October–December 2004
					30	DO	90.0	81.2 - 98.8	10.0	
					30	pH 6.0 - 8.5	36.7	23.8 - 49.5		
						pH < 6.0			16.7	
						pH > 8.5			46.7	
					30	Un. Ammonia	80.0	71.4 - 88.6	20.0	
					30	TSI	60.0	48.5 - 71.5	40.0	
SRWMD1 Suwannee	24,566	14,932	4,335	5,299	31	Fecal Coliform	93.5	86.0 - 100.0	6.5	July 2004
					31	DO	87.1	78.0 - 96.2	12.9	
					31	pH 6.0 - 8.5	51.6	36.4 - 66.9		
						pH < 6.0			48.4	
						pH > 8.5				
					31	Un. Ammonia	100.0	100.0	0.0	
					31	TSI	93.5	86.1 - 100.0	6.5	

Basin	Target Population	Sampleable	Dry	Inaccessible	Number of Samples	Indicator	% Attaining	95% Confidence Bounds (% Attaining)	% Not Attaining	Assessment Period
SWFWMD1 Tampa Bay	6,191	6,191	0	0	30	Fecal Coliform	96.7	91.0 - 100.0	3.3	October–November 2004
					30	DO	86.7	78.3 - 95.0	13.3	
					30	pH 6.0 - 8.5	90.0	81.9 - 98.1		
						pH < 6.0			3.3	
						pH > 8.5			6.7	
					30	Un. Ammonia	100.0	100.0	0.0	
					30	TSI	93.3	87.7 - 98.9	6.7	
Summary of All Group 1 Basins	564,892	406,679	6,039	152,174	166	F. Coliform	99.5	99.1 -100.0	0.5	2004
					170	DO	94.3	91.9 - 96.6	5.7	
					170	pH 6.0 - 8.5	75.4	69.2 - 81.5		
						pH < 6.0			8.8	
						pH > 8.5			15.6	
					167	Un. Ammonia	94.9	92.7 - 97.1	5.1	
					167	TSI	83.1	75.8 - 90.5	16.9	

Table 7e. Attainment Results Calculated Using Probabilistic Monitoring Designs, Small Lakes (2.5 to less than 25 acres in size), Group 1

Status Network **Designated Use: Recreation and Aquatic Life** **Units: Lakes**

Basin	Target Population	Sampleable	Dry	Inaccessible	Number of Samples	Indicator	% Attaining	95% Confidence Bound (% Attaining)	% Not Attaining	Assessment Period
NWFWMD1 Ochlockonee–St. Marks	301	161	32	108	30	Fecal Coliform	96.7	91.3 - 100.0	3.3	March–April 2004
					30	DO	86.7	77.6 - 95.8	13.3	
					30	pH 6.0 - 8.5	26.7	13.7 - 39.6		
						pH < 6.0			73.3	
						pH > 8.5			0.0	
					30	Un. Ammonia	100.0	100.0	0.0	
					30	TSI	90.0	80.8 - 99.2	10.0	
SFWMD1 Everglades–West Coast	3	0	3	0		No lakes to assess				
SFWMD6 Lake Okeechobee	0	0	0	0		No lakes to assess				
SJRWMD1 Ocklawaha	552	224	75	253	30	Fecal Coliform	93.3	87.8 - 98.8	6.7	July–September 2004
					30	DO	53.3	37.1 - 69.5	46.7	
					30	pH 6.0 - 8.5	80.0	70.1 - 89.9		
						pH < 6.0			20.0	
						pH > 8.5			0.0	
					30	Un. Ammonia	100.0	100.0	0.0	
					30	TSI	93.3	85.6 - 100.0	6.7	
SRWMD1 Suwannee	994	215	382	397	26	Fecal Coliform	100.0	100.0	0.0	March–April 2004
					27	DO	88.9	78.7 - 99.1	11.1	
					27	pH 6.0 - 8.5	29.6	15.1 - 44.2		
						pH < 6.0			63.0	
						pH > 8.5			7.4	
					27	Un. Ammonia	96.3	90.3 - 100.0	3.7	
					27	TSI	88.9	78.6 - 99.2	11.1	
SWFWMD1 Tampa Bay	216	175	6	35	30	Fecal Coliform	83.3	72.7 - 93.9	16.7	July–August 2004
					30	DO	63.3	49.3 - 77.4	36.7	
					30	pH 6.0 - 8.5	73.3	60.1 - 86.5		
						pH < 6.0			16.7	
						pH > 8.5			10.0	
					30	Un. Ammonia	96.7	90.9 - 100.0	3.3	
					30	TSI	70.0	57.1 - 82.9	30.0	

Basin	***Target Population***	***Sampleable***	***Dry***	***Inaccessible***	***Number of Samples***	***Indicator***	***% Attaining***	***95% Confidence Bound (% Attaining)***	***% Not Attaining***	***Assessment Period***
Summary of All Group 1 Basins	2,066	775	498	793	116	Fecal Coliform	96.0	94.0 - 98.0	4.0	2004
					117	DO	76.4	69.5 - 83.2	23.6	
					117	pH 6.0 - 8.5	47.3	39.4 - 55.1		
						pH < 6.0			48.1	
						pH > 8.5			4.6	
					117	Un. Ammonia	97.9	94.9 - 100.0	2.1	
					117	TSI	88.3	82.6 - 94.0	11.7	

Note: No lakes to assess in SFWMD1 and SFWMD6 – No lakes meeting FDEP criteria for small lakes were found in the basins.

Probabilistic Surface Water Assessment Results for 2004

In 2004, the six Group 1 basins were sampled ***(Figure 4).*** Four surface water resources were assessed: large rivers, small streams, large lakes, and small lakes. ***Table 8*** summarizes the miles (for rivers and streams) and acres (for lakes) of the waters assessed. Approximately 30 samples were collected from each of the resources in all six Group 1 basins.

Exceptions were as follows: there were no large rivers in the Tampa Bay Basin, and no small lakes available for sampling in the Lake Okeechobee and Everglades West Coast Basins. Additionally, FDEP was able to collect only nine samples from the small stream population in the Everglades West Coast Basin. These results were not reported due to the large error estimate that would be associated with the percent attaining values. Therefore, no assessment results are reported for those resources within those basins.

Table 8. Summary of Waters Assessed by the Status Network's Probabilistic Monitoring in 2004

Waterbody Type	*Assessed*
Large Rivers	819 miles
Small Streams	4,238 miles
Large Lakes	564,892 acres
Small Lakes	2,066 lakes

Note: The estimates in the table do not include coastal or estuarine waters. These calculations are from the 1:100,000 releveled National Hydrography Dataset (rNHD).

Indicators selected for the surface water monitoring reporting include fecal coliform, DO, pH, un-ionized ammonia, chlorophyll *a* (rivers and streams), and TSI (lakes). **Appendix B** discusses the reasoning behind the use of these indicators and possible sources.

Some of the analytes sampled in the Status Network have numeric surface water quality standards to protect one or more designated uses ***(Table 6).*** The thresholds described are indicators of predominantly fresh surface water. The source of indicators includes Rule 62-302, F.A.C., which contains surface water quality standards for Florida. Additionally, this rule contains indicators used to identify impaired surface waters. Values indicate an exceedance of standards or guidance criteria.

It is important to remember that the diversity of Florida's aquatic ecosystems also means there is large natural variation in some water quality parameters. This is especially true for DO and pH. Many Florida aquatic systems naturally have DO levels less than the state's standard of 5.0 mg/L and pH levels outside the normal range. For example, surface waters that are dominated by ground water inflows or flows from wetland areas will have lower DO levels. This natural variation helps to explain the large percentage of the waters that are found to be in nonattainment in the following discussion.

Tables 7b–e summarize the results for all basins. Each table provides a summary by basin and a summary for the six basins combined. Additionally, the results for all six basins and four resource types are shown on maps in **Appendix A.** Maps were not created for the six basins' combined estimates but are summarized in each of the resource tables. ***Table A-1*** in **Appendix A** explains the terms used in the assessment and the water quality targets used to assess basin water quality. Regions and indicators falling below standards are briefly discussed below.

For **large rivers *(Table 7b),*** DO ranged between 23.3% and 40% in the nonattaining estimate, across all basins. Other indicators with high percentages of nonattainment of the indicator thresholds include pH in the Suwannee and Ochlocknee–St. Marks Basins. Blackwater rivers may contribute to lower pH values in the northern part of the state and in the Suwannee Basin. Exceedance of thresholds for the Ocklawaha, Everglades West Coast, and Lake Okeechobee Basins ranged from 20% to 66.7% for chlorophyll *a.*

Like the larger rivers, **small streams *(Table 7c)*** had DO violations in all basins; 10% to 75% of small streams reported levels below 5.0 mg/L. Fecal coliform thresholds were exceeded in all basins as well, ranging from 14.3% in the Suwannee Basin to a high of 70% in the Tampa Bay Basin.

Large lakes *(Table 7d)* had nonattaining pH values in all basins; the highest were the Ocklawaha, Everglades West Coast, Ochlocknee–St. Marks, and Suwannee Basins. Again, it is suspected that many of these values are natural, due to ambient conditions. There was 100% attainment for DO in the Everglades West Coast and Lake Okeechobee Basins. Otherwise, there were small percentages of nonattainment for DO in all other basins, except the Ochlocknee–St. Marks Basin, which had 46.7% of the basin not attaining for DO. Several basins had favorable TSI values reported for most lakes; the Everglades West Coast and Ocklawaha Basins had the highest percentage of TSI nonattainment, with values of 55.2% and 40.0%, respectively.

For **small lakes *(Table 7e),*** there were two basins where small lakes were not present, or were found to be predominantly stormwater treatment ponds, golf course ponds, or other resources not part of the parent population; therefore, no samples were collected or analyzed. Small lakes in other basins showed low pH in the Suwannee and northwestern basins of the state, again likely due to natural conditions. TSI values were good in all basins, with the highest nonattainment at 30% in the Tampa Bay Basin. Levels of un-ionized ammonia were found to be in an acceptable range in most basins, as were fecal coliform results.

Statewide Basin Assessment (Tier II)

Approach to the Comprehensive Assessment: Sections 305(b) and 303(d)

The EPA has requested that the states merge their reporting requirements under the CWA for Section 305(b) surface water quality reports and Section 303(d) lists of impaired waters into an Integrated Water Quality Monitoring and Assessment Report (Wayland, 2001). As part of its TMDL assessment, FDEP prepares Water Quality Status Reports and Assessment Reports that integrates the 303(d) list and the 305(b) report for each of the state's 29 river basins. These reports are available at http://www.dep.state.fl.us/water/basin411/default.htm. (At the bottom of the screen, select the basin group that you want to access (Groups 1–5), click on the name of an individual river basin on the map, and when that basin map appears, click above the map to access the Status and Assessment Reports.)

Following the EPA's guidance, FDEP delineated waterbodies or waterbody segments in each basin, assessed them for impairment based on individual parameters, and then placed them into one of five major assessment categories and subcategories. These categories provide information on a waterbody's status based on water quality, sufficiency of data, and the need for TMDL development ***(Table 9).***

The primary purpose of the assessments for the TMDL Program is to determine if waterbodies or waterbody segments are to be placed on the Verified List of impaired waterbodies. The listings are made in accordance with evaluation thresholds and data sufficiency and data quality requirements in the IWR (Rule 62-303, F.A.C.). The results of the assessment are used to identify waters in each basin for which TMDLs will be developed.

Determining impairment in individual waterbodies for the TMDL Program takes place in two phases. First, in each river basin FDEP evaluates the existing water quality data, using the methodology prescribed in the IWR, to determine whether waters are potentially impaired. Waters found to be potentially impaired are included on a *Planning List* for further assessment under Subsections 403.067(2) and (3), F.S. As required by Subsection 403.067(2), F.S., the Planning List is not used to administer or implement any regulatory program; it is submitted to the EPA for informational purposes only.

The second step is to assess waters on the Planning List under Subsection 403.067(3), F.S., as part of FDEP's watershed management approach (described earlier). FDEP carries out additional data gathering and strategic monitoring, focusing on these potentially impaired waters, and determines—using the methodology in the IWR—if a waterbody is, in fact, impaired and if the impairment is caused by pollutant discharges.

A Water Quality Assessment Report is produced containing the results of this updated evaluation and a *Verified List* of impaired waters. The criteria for the Verified List are more stringent than those for the Planning List. FDEP is required to develop TMDLs for waters on the Verified List under Subsection 403.067(4), F.S. A watershed management plan (called a Basin Management Action Plan, or BMAP) to reduce the amount of pollutants that cause impairments may also be produced and implemented.

The Verified List is adopted by Secretarial Order in accordance with the FWRA. Once adopted, the list is submitted to the EPA for approval as the state's Section 303(d) list of impaired waters for the basin.

To implement the watershed cycle, the state's river basins have been divided into five groups within each of FDEP's six districts statewide, and each district will assess one basin each year. ***Table 10*** shows the basin groups for implementing the cycle in FDEP's districts, and ***Figure 4*** shows these groups and the rotating cycle in the districts. ***Table 11,*** which lists the basin rotation schedule for TMDL development and implementation, shows that it will take nine years to complete one full cycle of the state.

The watershed management cycle is an iterative, or repeated, process. One of its key components is that the effectiveness of management activities (TMDL implementation) will be monitored in successive cycles. Monitoring conducted in Phase 2 of subsequent cycles will be targeted at evaluating whether water quality objectives are being met and whether individual waters are no longer impaired. FDEP also will track the implementation of scheduled restoration activities, whether required or voluntary, to ensure continued progress towards meeting the TMDLs.

Table 9. Categories for Waterbodies or Waterbody Segments in the 2006 Integrated Report

Category	***Description***	***Comments***
1	Attaining all designated uses	If use attainment is verified for a waterbody or segment that was previously listed as impaired, FDEP will propose that it be delisted.
2	Attaining some designated uses and insufficient or no information or data are present to determine if remaining uses are attained	If attainment is verified for some designated uses of a waterbody or segment, FDEP will propose partial delisting for the uses attained. Future monitoring will be recommended to determine if remaining uses are attained.
3a	No data and information are present to determine if any designated use is attained	Future monitoring will be recommended to determine if designated uses are attained.
3b	Some data and information are present but not enough to determine if any designated use is attained	Future monitoring will be recommended to gather sufficient information and data to determine if designated uses are attained.
3c	Enough data and information are present to determine that one or more designated uses may not be attained according to the Planning List methodology	A waterbody or segment is potentially impaired for one or more designated uses. These waters will be prioritized for future monitoring to verify use attainment or impaired status.
3d	Enough data and information are present to determine that one or more designated uses are not attained according to the Verified List methodology	A waterbody or segment exceeds Verified List evaluation criteria and may be listed as impaired at the end of Phase 2 of the watershed management cycle. However, the data have not yet been fully evaluated and the waters have not been formally verified as impaired. Further monitoring and analysis may be necessary. **NOTE:** This category is applicable only to the Status Report. Waters that pass the Verified List criteria at this stage of the process are placed in Category 5.
4a	Impaired for one or more designated uses but does not require TMDL development because a TMDL has already been completed	After the EPA approves a TMDL for the impaired waterbody or segment, it will be included in a Basin Management Action Plan to reduce pollutant loading toward attainment of designated use(s).
4b	Impaired for one or more designated uses but does not require TMDL development because the water will attain water quality standards due to existing or proposed measures	Pollutant control mechanisms designed to attain applicable water quality standards within a reasonable time frame are either proposed or in place.
4c	Impaired for one or more criteria or designated uses but does not require TMDL development because impairment is not caused by a pollutant	This category includes waterbodies or segments that are impaired because of naturally occurring conditions or pollution. The impairment is not caused by specific pollutants.[1]
5	One or more designated uses is not attained and a TMDL is required	Waterbodies or segments in this category are impaired for one or more designated uses by a pollutant or pollutants. Waters in this category are included on the basin-specific Verified List adopted by FDEP's Secretary as Florida's impaired waters list and submitted to the EPA as Florida's 303(d) list of impaired waters at the end of Phase 2.

Note: The descriptions in ***Table 9*** are consistent with the EPA's integrated assessment categories. In the Water Quality Status Reports for Groups 1 through 3 and in the Water Quality Assessment Reports for Groups 1 through 2 that were previously produced, Categories 4b and 4c were reversed. That is, the description of Category 4b was previously listed as Category 4c, and the description of Category 4c was listed as Category 4b.

[1] For purposes of the TMDL Program, pollutants are chemical and biological constituents, introduced by humans into a waterbody, that may result in pollution (water quality impairment). There are other causes of pollution, such as the physical alteration of a waterbody (for example, canals, dams, and ditches). However, TMDLs are established only for impairments caused by pollutants (a TMDL quantifies how much of a given pollutant a waterbody can receive and still meet its designated uses).

Waterbodies that are verified impaired due to specified pollutants, and therefore require a TMDL, are listed under Category 5 in the Integrated Assessment Report; waterbodies with water quality impairments due to other causes, or unknown causes, are listed under Category 4c. Although TMDLs are not established for Category 4c waterbodies, these waterbodies still may be addressed through a watershed management program (for example, the Kissimmee River restoration).

Table 10. Basin Groups for Implementing the Watershed Management Cycle, by FDEP District Office

District	*Group 1 Basins*	*Group 2 Basins*	*Group 3 Basins*	*Group 4 Basins*	*Group 5 Basins*
Northwest	Ochlockonee–St. Marks Rivers	Apalachicola–Chipola Rivers	Choctawhatchee River and Bay–St. Andrew Bay	Pensacola Bay	Perdido River and Bay
Northeast	Suwannee River	Lower St. Johns River	–	St. Marys–Nassau Rivers	Northeast Coast Lagoons
Central	Ocklawaha River	Middle St. Johns River	Upper St. Johns River	Kissimmee River	Indian River Lagoon
Southwest	Tampa Bay	Tampa Bay Tributaries	Sarasota Bay–Peace and Myakka Rivers	Withlacoochee River	Springs Coast
South	Everglades West Coast	Charlotte Harbor	Caloosahatchee River	Fisheating Creek	Florida Keys
Southeast	Lake Okeechobee	St.Lucie–Loxahatchee Rivers	Lake Worth Lagoon–Palm Beach Coast	Biscayne Bay–Southeast Coast	Everglades

Table 11. Basin Rotation Schedule for TMDL Development and Implementation

Year	***00 01***	***01 02***	***02 03***	***03 04***	***04 05***	***05 06***	***06 07***	***07 08***	***08 09***	***09 10***
Group 1	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5
Group 2		PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5	PHASE 1	PHASE 2	PHASE 3	PHASE 4
Group 3			PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5	PHASE 1	PHASE 2	PHASE 3
Group 4				PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5	PHASE 1	PHASE 2
Group 5					PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5	PHASE 1
	1st Five-Year Cycle – High-Priority Waters					2nd Five-Year Cycle – Medium-Priority Waters				

Note: Projected years for Phases 3, 4, and 5 may change due to accelerated local activities, length of plan development, legal challenges, etc.

Determining Attainment of Designated Use(s)

The designated uses of a given waterbody are established using the surface water quality classification system described in the section on Florida's Water Quality Standards Program in Chapter 1. Specific water quality criteria, expressed as numeric or narrative limits for specific parameters, describe the water quality necessary to maintain each of these uses for surface water and ground water.

It is important to note, however, that the EPA uses slightly different terminology in its description of designated uses. Because FDEP is required to provide use attainment status for both the state's 305(b) report and the state's 303(d) list of impaired waters, FDEP uses EPA terminology when assessing waters for use attainment. The water quality evaluations and decision processes for listing impaired waters that are defined in Florida's IWR are based on the following designated use attainment categories:

Aquatic Life Use Support-Based Attainment
Primary Contact and Recreation Attainment
Fish and Shellfish Consumption Attainment
Drinking Water Use Attainment
Protection of Human Health

Table 12 summarizes the designated uses assigned to Florida's various surface water classifications.

Table 12. Designated Use Attainment Categories for Surface Waters in Florida

Designated Use Attainment Category Used in IWR Evaluation	*Applicable Florida Surface Water Classification*
Aquatic Life Use Support-Based Attainment	Class I, II, and III
Primary Contact and Recreation Attainment	Class I, II, and III
Fish and Shellfish Consumption Attainment	Class II
Drinking Water Use Attainment	Class I
Protection of Human Health	Class I, II, and III

How Data Are Identified and Evaluated

The Impaired Surface Waters Rule. To identify impaired waters in each of the state's river basins, FDEP evaluates water quality data using the science-based methodology in the IWR (Rule 62-303, F.A.C.). The rule establishes specific criteria and thresholds for impairment, in addition to data sufficiency and data quality requirements. The methodology described in the rule is based on a statistical approach (called the binomial method) designed to provide greater confidence that the outcome of the water quality assessment is correct. The complete text of the IWR is available at http://www.dep.state.fl.us/water/tmdl/docs/AmendedIWR.pdf.

As part of the watershed management approach, for each river basin in the state FDEP follows the methodology in Section 62-303.300, F.A.C., to develop a Planning List of potentially impaired waters to be assessed under Subsections 403.067(2) and (3), F.S. The methodology for developing the Planning List includes an evaluation of aquatic life use support, primary contact and recreational use support, fish and shellfish consumption use support, drinking water use support, and protection of human health. Data older than 10 years cannot be used to evaluate water quality criteria exceedances for the Planning List. As required by Subsection 403.067(2), F.S., the Planning List will not be used to administer or implement any regulatory program, and is submitted to the EPA for informational purposes only.

After further assessment, using the methodology in Part III, Section 62-303.400, F.A.C., FDEP determines if waters on the Planning List are, in fact, impaired and if the impairment is caused by pollutant discharges. These waters are placed on a Verified List. The criteria for the Verified List are more stringent than those for the Planning List. Data older than 7.5 years are not used to verify impairment. The Verified List is adopted by Secretarial Order and forwarded to the EPA for approval as Florida's Section 303(d) list of impaired waters. FDEP develops TMDLs for these waters under Subsection 403.067(4), F.S.

Public Participation Process. FDEP works with a variety of stakeholders and holds public meetings on developing and adopting the Verified Lists of impaired waters for the state's 29 river basins. Basin-specific draft Verified Lists of waters that meet the requirements of the IWR are made available to the public. The lists are placed on FDEP's TMDL Program Web site and are also sent on request to interested parties via mail or e-mail.

Citizens are given the opportunity to comment on the draft lists in person and/or in writing. As part of the review process, public workshops are advertised and held in each basin to help explain the process for developing the Verified List, exchange information, and encourage public involvement. If additional information or data is provided prior to or during the public comment period, FDEP considers it before submitting the proposed list to the Secretary and EPA.

Sources of Data. FDEP's assessment of water quality for each basin statewide includes an analysis of quantitative data from a variety of sources, many of which are readily available to the public. These sources include the EPA's Legacy and modernized STORET databases, the U. S. Geological Survey (USGS), FDEP, FDOH, the water management districts, local governments, and volunteer monitoring groups.

Historically, FDEP carried out statewide water quality assessments using data available in the EPA's Legacy STORET Database; Legacy STORET makes up approximately 40% of the statewide data used in the IWR assessment. The Legacy STORET dataset is a repository of data collected and uploaded by numerous organizations through 1999. The Legacy STORET Database can be accessed at http://www.dep.state.fl.us/water/storet/index.htm.

In 2000, the EPA created a modernized version of STORET that included new features designed to address data quality assurance/quality control concerns (the new STORET Web siteis available at http://www.epa.gov/storet/. However, because of software difficulties associated with batch uploading of data to modernized STORET, FDEP has decided to rebuild a local version of STORET with much easier data-loading capabilities (referred to as the Water Integrated Database [WID] project). Modernized STORET currently houses only about 30% of the statewide IWR Database.

Approximately 30% of the data used in the IWR assessment is provided by individual organizations that for various reasons, such as time constraints or resource limitations, are not able to enter their data into the national database. The organizations providing the largest datasets include the South Florida, Southwest Florida, and St. Johns River Water Management Districts; the USGS; and the University of Florida LakeWatch volunteer monitoring group. Several of these databases are readily available to the public via the Internet: the South Florida Water Management District at http://www.envirobase.usgs.gov/, the USGS at http://water.usgs.gov/, and LakeWatch at http://lakewatch.ifas.ufl.edu/.

FDEP created the IWR Database in 2002 to evaluate data simultaneously in accordance with the IWR methodology for every basin in the state, based on the appropriate data "window." ***Tables 13a*** and ***13b*** show the periods of record for the Verified and Planning Lists for the five basin groups for the first and second basin rotation cycles.

Table 13a. Data Used in Developing the Planning and Verified Lists, First Basin Rotation Cycle

Basin Group	Reporting	Period of Data Record Used in IWR Evaluation
Group 1	Planning List	January 1, 1989 – December 31, 1998
	Verified List	January 1, 1995 – June 30, 2002
Group 2	Planning List	January 1, 1991 – December 31, 2000
	Verified List	January 1, 1996 – June 30, 2003
Group 3	Planning List	January 1, 1992 – December 31, 2001
	Verified List	January 1, 1997 – June 30, 2004
Group 4	Planning List	January 1, 1993 – December 31, 2002
	Verified List	January 1, 1998 – June 30, 2005
Group 5	Planning List	January 1, 1994 – December 31, 2003
	Verified List	January 1, 1999 – June 30, 2006

Note: Typically, a 10-year data record is used for the development of the Planning Lists, and a 7.5-year record is used for the Verified Lists.

Table 13b. Data Used in Developing the Planning and Verified Lists, Second Basin Rotation Cycle

Basin Group	Reporting	Period of Data Record Used in IWR Evaluation
Group 1	Planning List	January 1, 1995 – December 31, 2004
	Verified List	January 1, 2000 – June 30, 2007
Group 2	Planning List	January 1, 1996 – December 31, 2005
	Verified List	January 1, 2001 – June 30, 2008
Group 3	Planning List	January 1, 1997 – December 31, 2006
	Verified List	January 1, 2002 – June 30, 2009
Group 4	Planning List	January 1, 1998 – December 31, 2007
	Verified List	January 1, 2003 – June 30, 2010
Group 5	Planning List	January 1, 1999 – December 31, 2008
	Verified List	January 1, 2004 – June 30, 2011

Note: Typically, a 10-year data record is used for the development of the Planning Lists, and a 7.5-year record is used for the Verified Lists.

Quality Assurance/Quality Control Criteria. The IWR addresses quality assurance/quality control (QA/QC) concerns by requiring all data to meet QA rule requirements (Rule 62-160, F.A.C.), including NELAC certification and the use of established SOPs. Starting one year after the effective date of the rule, on June 8, 2004, the IWR also requires that data providers submit a list of QA/QC metadata[11] elements with their data. The metadata requirements are designed to allow FDEP to conduct a number of electronic checks on the quality of data.

[11] Metadata are defined as information about other data, including when and how the data were collected, by whom, and how they were formatted.

Criteria for Evaluating Outside Data. Occasionally, in closely evaluating data for a particular waterbody, FDEP may find systematic errors from a data provider. These errors may include the blatant shifting of decimals for a parameter such as iron (e.g., reporting 1,000 mg/L, rather than 1 mg/L). When systematic errors are found, those data are censored from the analysis, and FDEP works with the provider to correct the errors. Upon correction, the data are used in the assessment.

The Florida legislature has specifically prohibited the use of data from the volunteer monitoring group LakeWatch in any regulatory proceeding. However, LakeWatch data can be used in developing the Planning List of potentially impaired waters, evaluating pollutant loading to lakes, and modeling lake function for FDEP's TMDL Program. The data can also be used to document long-term water quality trends and provide general background information. However, they cannot be used to verify impairment, nor can they be used in support of enforcement actions.

Rationales for Not Using Existing Data. FDEP uses all water quality data that are provided through STORET, as long as it is ambient in nature (it does not use data for water coming out of a discharge pipe). It may restrict the use of an agency's data if consistent errors have been found (only the water quality parameters that have problems are restricted). FDEP also may restrict an agency's data if it has failed QA/QC inspections. Data gathered during periods that are not representative of the general health of the waterbody (e.g., during or immediately after a hurricane that can be tied to a short-term event, such as a spill) are flagged for further evaluation before being added to the IWR database.

How Data Are Used To Make Attainment Determinations

Once the data have been screened and validated, they are evaluated to determine whether individual segments with waterbody identification numbers (WBIDs) are attaining their designated uses. Different analytical approaches, such as statistical analyses, are used to infer conditions from all valid data. **Appendix D** provides a detailed description of the IWR methodology. There have been no changes in the basin assessment methodology since the last reporting cycle.

Results of Statewide Basin Assessments

For the purposes of this assessment, there are two different types of total waters: total waters in the state and total waters assessed. FDEP keeps track of total waters in the state with a waterbody identification system, which includes 6,243 waterbodies that are characterized by waterbody type (rivers/streams, lakes, estuaries, or coastal waters). These comprise hydrologically unique pieces of rivers and streams, lakes, and estuaries with homogeneous water quality. Typically, the river and stream segments are about 5 miles long (generally bounded by headwaters, river mouths, or major intersecting streams); the estuary segments are about 5 square miles in size (often bounded by bridges); and lake segments comprise approximately 60 acres each (usually entire lakes, but if a lake is very large or has distinct areas of water quality, it may be subdivided).

The assessed waters include those waters for which enough information is available to determine whether they attain their designated use (Category 2 under the EPA's integrated assessment) or do not attain their designated use (EPA Categories 3c, 3d, 4a, 4b, 4c, and 5). ***Table 14*** lists the number and size of waters assessed for each waterbody type, and ***Table 15*** lists the size of the surface waters assigned to each of the EPA reporting categories.

For the determination of use support in this report, FDEP assessed 18,902 miles of rivers and streams, 1,529,280 acres of lakes, 4,145 square miles of estuaries, and 2,967 square miles of coastal waters using the IWR methodology for the Verified List of impaired waters. It should be noted that the assessment results for lakes are highly affected by the assessment results for one impaired lake, Lake Okeechobee, which is by far the largest lake in the state. All estuaries and coastal waters have been assessed for mercury, and consumption advisories have been issued for a number of fish species because of excessive concentrations of mercury in fish tissue.

Table 14. Waters Assessed for the Statewide Basin Assessments, by Waterbody Type

Waterbody Type	*Number of Waterbody Segments*	*Assessed*
Rivers/streams	3,484	18,902 miles
Lakes	1,578	1,529,280 acres
Estuaries	458	4,145 square miles
Coastal Waters	291	2,967 square miles

Note: Scale is 1:24,000.
Source: National Hydrologic Dataset (NHD).

Table 15. Size of Surface Waters Assigned to Each EPA Integrated Report Category

Waterbody Type	*Category 2**	*Categories 3c and 3d (Planning List)**	*Category 4**	*Category 5**	*No Data*	*Insufficient Data*	*Total Waters Assessed*	*Total in State*
Rivers/streams (miles)	1,389	3,264	3	4,394	8,410	1,441	18,902	19,838
Lakes (acres)	117,888	170,880	0	864,704	248,832	126,976	1,529,280	1,557,504
Estuaries (square miles)	607	797	0	2,249	379	113	4,145	4,462
Coastal Waters (square miles)	769	84	0	1,461	588	66	2,967	4,415

Note: There are no waters in EPA Category 1 (attaining all designated uses) because FDEP does not sample for all uses. Category 2 comprises waters attaining all the uses that are sampled for.

– Not applicable.

*****The EPA's Integrated Report categories are as follows:

1—Attains all designated uses;
2—Attains some designated uses;
3a—No data and information are available to determine if any designated use is attained;
3b—Some data and information are available, but they are insufficient for determining if any designated use is attained;
3c—Meets Planning List criteria and is potentially impaired for one or more designated uses;
3d—Meets Verified List criteria and is potentially impaired for one or more designated uses;
4a—Impaired for one or more designated uses and the TMDL is complete;
4b—Impaired for one or more designated uses, but no TMDL is required because an existing or proposed pollutant control mechanism provides reasonable assurance that the water will attain standards in the future;
4c—Impaired for one or more designated uses but no TMDL is required because the impairment is not caused by a pollutant; and
5—Water quality standards are not attained and a TMDL is required.

Summaries of Designated Use Support for Rivers/Streams, Lakes, Estuaries, and Coastal Waters

Table 16 summarizes support for designated use (class) for the rivers/streams, lakes, estuaries, and coastal waters assessed in the Group 1–4 basins, as follows:

- *Class 1 waters (potable water supplies): 17% of river/stream miles assessed supported their designated use, compared with 0% of lake acres.*
- *Class II waters (shellfish propagation or harvesting): 10% of river/stream miles and 12% of estuarine square miles assessed supported their designated uses.*
- *Class III fresh waters (recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife): 7% of river/stream miles and 10% of lake acres assessed supported their designated use.*
- *Class III marine waters (recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife): 15% of estuarine square miles and 25% of coastal square miles assessed supported their designated use.*

Table 17 summarizes the size of waters impaired by various causes for each waterbody type in the Group 1–4 basins; the principal causes of impairment are as follows:

- *Out of 813 river/stream segments assessed: DO, fecal coliform, chlorophyll, fish advisories for mercury, and total coliform.*
- *Out of 283 lake segments assessed: TSI, fish advisories for mercury, DO, historical TSI, and total coliform.*
- *Out of 352 estuarine segments assessed: fish advisories for mercury, chlorophyll, DO, and fecal coliform.*
- *Out of 111 coastal segments assessed: fish advisories for mercury and dioxin.*

Table 16. Individual Designated Use Support Summary, Group 1–4 Basins

Designated Use (Class)[1, 2]	Waterbody Type	Total in State	Total Assessed	Supports Designated Use (Category 2)	% Supporting Designated Use	Insufficient Data (Categories 3a, 3b, and 3c)	Does Not Support Designated Use (Categories 4 and 5)	% Not Supporting Designated Use
I	Rivers/streams (miles)	335	335	58	17%	119	158	47%
	Lakes (acres)	420,288	420,288	0	0%	9,664	419,648	97%
II	Rivers/streams (miles)	416	327	34	10%	182	111	34%
	Estuaries (square miles)	1,815	1,647	214	12%	144	1,289	78%
IIIF	Rivers/streams (miles)	19,087	18,240	1,297	7%	12,815	4,128	22%
IIIF	Lakes (acres)	1,137,216	1,108,992	117,888	10%	537,024	445,056	40%
IIIM	Estuaries (square miles)	2,647	2,499	393	15%	1,145	1,461	38%
IIIM	Coastal waters (square miles)	4,415	2,967	769	25%	738	961	49%

[1] Class I Potable water supplies
Class II Shellfish propagation or harvesting
Class III Recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife
Class IV Agricultural water supplies (large agricultural lands, located mainly around Lake Okeechobee)
Class V Navigation, utility, and industrial use (there are no state waters currently in this class)

[2] F = Fresh water
M = Marine

[3] Lake Okeechobee, a Class 1 waterbody, was designated as impaired by the Florida legislature in 1999, and FDEP completed and adopted by rule a TMDL for total phosphorus for the lake in 2001. The entire TMDL (140 metric tons/year) is allocated to nonpoint sources. This is based on an in-lake target restoration goal of 40 parts per billion (ppb). Lake Okeechobee has subsequently been verified as impaired for coliform bacteria, DO, and un-ionized ammonia.

303(d) List of Verified Impaired Waters

The 1998 303(d) list and the adopted 303(d) lists (Verified Lists) for 2002, 2003, 2004, and 2005 (Basin Groups 1–4, respectively) are available on FDEP's TMDL Program Web site at http://www.dep.state.fl.us/water/tmdl/index.htm. The EPA has approved only the Group 1 Verified List, with approval pending for Groups 2, 3, and 4. For the Group 5 basins, the waters identified as impaired on the 1998 303(d) list were carried forward.

The Web site also contains information on the adopted lists of waters to be delisted (i.e., removed) from the 1998 303(d) list for the Group 1 basins, the adopted lists of waters proposed for delisting for the Groups 2 and 3 basins, and a draft list of waters proposed for delisting for the Group 4 basins. A draft list of waters to be delisted will be developed for the Group 5 basins in 2006. If use attainment is verified for a waterbody or segment that was previously listed as impaired, FDEP will propose that it be delisted. If attainment is verified for some designated uses of a waterbody or segment, FDEP will propose partial delisting for the uses attained. Future monitoring will be recommended to determine if remaining uses are attained.

Table 17. Size of Waters Impaired by Causes, Group 1–4 Basins (Rivers/Streams, Lakes, Estuaries, and Coastal Waters)

Rivers/Streams

Parameter	*Number of Waterbodies*	*Miles Impaired*
DO	258	2,288
Fecal Coliform	153	1,132
Chlorophyll	105	1,073
Mercury–Fish	46	708
Total Coliform	78	673
Historical Chlorophyll	28	503
Iron	30	387
pH	24	311
Turbidity	16	212
Biology	9	211
Alkalinity	9	130
Lead	15	97
Total Suspended Solids	10	96
Conductance	9	93
Copper	8	50
Dioxin-Fish	1	48
Un-ionized Ammonia	8	40
Dissolved Solids	3	38
BOD 5Day	2	32
Cadmium	1	15

Lakes

Parameter	*Number of Waterbodies*	*Acres Impaired*
TSI	169	729,216
DO	31	119,296
Mercury–Fish	25	92,352
Historical TSI	7	30,592
Chlorophyll	7	29,696
Iron	5	26,752
Total Coliform	5	24,768
Uniionized Ammonia	11	22,976
Silver	1	13,760
Lead	9	10,048
Cadmium	1	5,248
Fecal Coliform	5	4,416
Historical Chlorophyll	5	1,856
Turbidity	2	704

Estuaries

Parameter	*Number of Waterbodies*	*Square Miles Impaired*
Mercury–Fish	40	772
Dioxin-Fish	20	678
Chlorophyll	74	647
Fecal Coliform	54	641
Dissolved Oxygen	64	461
Historical Chlorophyll	23	191
Iron	15	168
Lead	9	137
Total Coliform	22	110
Copper	15	109
Silver	2	67
Cadmium	2	67
Selenium	2	67
Thallium	2	67
Biology	2	57
Nickel	3	29
pH	3	5

Coastal Waters

Parameter	*Number of Waterbodies*	*Square Miles Impaired*
Mercury–Fish	97	1,170
Dioxin-Fish	7	162
Dissolved Oxygen	2	1
Fecal Coliform	5	1

Waters may also be delisted for other reasons, such as sufficient data to assess potential impairment, flaws in the original analysis, or impairment due to natural causes (such as low DO). The Comments column in each table explains the reason for proposing a segment for delisting.

Any waters that do not have sufficient data to be analyzed in accordance with the requirements of the IWR will remain on the 1998 303(d) list of impaired waters maintained by the EPA. These waters are not delisted, and they will be sampled during the next phases of the watershed management cycle so that their impairment status can be verified.

Status of Total Maximum Daily Load Development

Table 18 lists the verified impaired waters in the Group 1–4 basins for which TMDLs are required, the pollutants causing impairment, the status of TMDL development, and the projected TMDL submittal date. Currently, with 80% of the state evaluated, approximately 1,066 TMDLs will be required for 223 Florida waters. Because TMDLs are developed for individual pollutants, a waterbody may have multiple TMDLs.

Table 18. TMDL Development Status, Group 1–4 Basins

Basin/Pollutant	*WBID*	*TMDL Status*	*Projected TMDL Submittal Date*
Apalachicola–Chipola/ DO	1286	To be developed	2008
Apalachicola–Chipola/ Bacteria (shellfish)	1266, 1274, 1274A, 1274B, 1288, 1256	To be developed	2008
Apalachicola–Chipola/ Fecal Coliform	1274, 1274A, 1286, 376, 51E, 52	To be developed (WBIDs 1274 and 1286 proposed)	2008, 2003 (1274, 1286)
Apalachicola–Chipola/ Total Coliform	376, 52	To be developed	2008
Apalachicola–Chipola/ Mercury (in fish tissue)	926A1	To be developed	2011
Caloosahatchee/ Copper	3240A, 3240I, 3235K	To be developed	2009
Caloosahatchee/ Fecal Coliform	3240A, 3240B, 3240C, 3240E, 3240E 1, 3240F, 3240G, 3240H, 3240I, 3240J, 3240L, 3240M, 3240N, 3240Q	To be developed	2009
Caloosahatchee/ Conductance	3240G	To be developed	2009
Caloosahatchee/ DO	3237B, 3240A, 3240B, 3240C, 3240E 1, 3240L, 3240Q	To be developed	2009
Caloosahatchee/ Total Coliform	3237C, 3240I	To be developed	2009
Caloosahatchee/ Fecal Coliform	3237D	Proposed	2004

Basin/Pollutant	***WBID***	***TMDL Status***	***Projected TMDL Submittal Date***
Caloosahatchee/ Iron	3235A, 3237A, 3246	To be developed	2009
Caloosahatchee/ Lead	3235A, 3235K, 3237C, 3237D, 3240I	To be developed	2009
Caloosahatchee/ Nutrients (chlorophyll *a*)	3235D, 3237B, 3240A, 3240B, 3240C, 3240E 1, 3240L, 3240M, 3240Q	To be developed	2009
Charlotte Harbor/ Nutrients (chlorophyll *a*)	1983A, 2078B	To be developed	2008
Charlotte Harbor/ Bacteria (shellfish)	1983A, 1983B, 2065C, 2065E, 2065F, 2092E	To be developed	2008
Charlotte Harbor/ Fecal Coliform	2030	To be developed	2008
Charlotte Harbor/ DO	2030, 2052, 2063, 2067, 2068	To be developed	2008
Charlotte Harbor/ Iron	2065A	To be developed	2008
Charlotte Harbor/ Mercury (in fish tissue)	2065A, 2065B, 2065C, 2065D, 8999	To be developed	2011
Charlotte Harbor/ Nutrients (TSI)	2092F	To be developed	2008
Choctawhatchee–St Andrew/ Bacteria (shellfish)	778A, 778B, 778C, 1061F	To be developed	2009
Choctawhatchee–St Andrew/ Fecal Coliform	49F, 1265, 1061BB	To be developed (WBID 49F adopted)	2009
Choctawhatchee–St Andrew/ Total Coliform	49F	Adopted	2009
Choctawhatchee–St Andrew/ Nutrients (historical chlorophyll *a*)	986, 1009, 1061A	To be developed	2009
Choctawhatchee–St Andrew/ Mercury (in fish tissue)	722B, 778A, 778AB, 778AC, 778B, 778C, 778D, 843B, 1061BB, 1061CB, 1061EB, 1061FB, 1267A, 1267B, 1267C, 8008, 8008A, 8008B, 8008C, 8008D, 8008E, 8009, 8009A, 8010, 8010A, 8010B, 8010C, 8011, 8011A, 8011B, 8012, 8012A, 8012B, 8012C, 8013, 8013A, 8013B, 8013C, 8013D, 8014, 8015, 8015A, 8015B, 8015C, 8015D, 8015E, 8016, 8017, 49, 49A, 49B, 49C, 49D, 49E, 49F	To be developed	2011
Choctawhatchee–St Andrew/ Beach Advisory (bacteria)	692, 754, 778AC, 722B, 778CA, 843B, 1061BB, 1061CB, 1061EB, 1061FB, 1267C, 8012B, 8012C, 8013A, 8013B, 8015A	To be developed	2009

Basin/Pollutant	***WBID***	***TMDL Status***	***Projected TMDL Submittal Date***
Everglades West Coast/ DO	3258B, 3258B1, 3258C, 3258D1, 3258E, 3258H1, 3259A, 3259B, 3259D, 3259E, 3259L	To be developed	2007
Everglades West Coast/ Nutrients (chlorophyll *a*)	3258B, 3258B1, 3258C, 3258D1, 3258E, 3258H1	To be developed	2007
Everglades West Coast/ Fecal Coliform	3258B1	To be developed	2007
Everglades West Coast/ Copper	3258D1, 3258E1, 3258H1	To be developed	2007
Everglades West Coast/ Iron	3259B	To be developed	2007
Everglades West Coast/ Nutrients (TSI)	3259W	To be developed	2007
Everglades West Coast/ Bacteria (shellfish)	8065	To be developed	2007
Everglades West Coast/ Mercury (in fish tissue)	8999	To be developed	2011
Fisheating Creek/ DO	3201A	To be developed	2011
Fisheating Creek/ Iron	3201A	To be developed	2011
Fisheating Creek/ Nutrients (chlorophyll *a*)	3201A	To be developed	2011
Fisheating Creek/ Nutrients (Historical chlorophyll *a*)	3201A	To be developed	2011
Fisheating Creek/ DO	3204	To be developed	2010
Fisheating Creek/ Nutrients (chlorophyll *a*)	3204	To be developed	2010
Fisheating Creek/ Nutrients (chlorophyll *a*)	3206	To be developed	2005
Fisheating Creek/ DO	3206	To be developed	2005
Kissimmee/ Copper	3171C	To be developed	2011
Kissimmee/ Fecal Coliform	1761D, 3170K	To be developed	2011
Kissimmee/ Lead	3171A	To be developed	2011
Kissimmee/ Mercury	3171C, 1761D, 3170K, 3171A, 1706, 1730B, 1842, 1685A, 1860B, 1938A, 1938C, 3171, 3172, 3176, 1472B,	To be developed	2011

Basin/Pollutant	WBID	TMDL Status	Projected TMDL Submittal Date
	3170B, 3170Q, 3171A, 3173A, 3177A, 3183B		
Kissimmee/ DO	1761, 1685B, 1869A, 3207, 3186C, 3173, 1436A, 3169P, 3183G	To be developed	2007
Kissimmee/ Nutrients	1761, 1860A, 3186C, 3170Q, 1893, 1856B, 1860B, 1938E, 3184, 3168G, 3168H, 3168I, 3168M, 3168N, 3169G, 3169H, 3169I, 3169J, 3169P, 3169G, 3180A, 3183B, 3183G	To be developed	2007
Kissimmee/ DO	3188, 3170C	To be developed	2005
Kissimmee/ Fecal Coliform	1436	To be developed	2005
Kissimmee/ Nutrients	3192C	To be developed	2005
Lake Okeechobee/ Chloride	3212A	Proposed	2002
Lake Okeechobee/ DO	3199B, 3203A, 3203B, 3212C, 3212D, 3212F, 3213A, 3213B, 3213C, 3213D, 3205, 3205D	Proposed	2002
Lake Okeechobee/ Fecal Coliform	3212B, 3203A, 3203B, 3213B, 3213D	Proposed	2002
Lake Okeechobee/ Iron	3212D, 3212E, 3212G	Proposed	2002
Lake Okeechobee/ Nitrogen Ammonia as N (mg/L)	3212D, 3212G	Proposed	2002
Lake Okeechobee/ Nutrients	3199B, 3203A, 3203B, 3213A, 3213B, 3213C, 3213D, 3205, 3205D	Proposed	2002
Lake Okeechobee/ Total Coliform	3212B, 3203A, 3203B, 3213B, 3213D	Proposed	2002
Lake Okeechobee/ Turbidity	3199B, 3205	Proposed	2002
Lake Worth Lagoon–Palm Beach Coast/ Biology	3233	To be developed	2005
Lake Worth Lagoon–Palm Beach Coast/ BOD 5-Day	3256B, 3242	To be developed	2010
Lake Worth Lagoon–Palm Beach Coast/ Copper	3226F, 3226F2	To be developed	2010
Lake Worth Lagoon–Palm Beach Coast/ DO	3242, 3242A, 3245, 3262D, 3264D, 3233	To be developed	2005
Lake Worth Lagoon–Palm Beach Coast/	3242, 3262D, 3264D	To be developed	2010

Basin/Pollutant	*WBID*	*TMDL Status*	*Projected TMDL Submittal Date*
Fecal Coliform			
Lake Worth Lagoon– Palm Beach Coast/ Mercury (in fish tissue)	8998	To be developed	2011
Lake Worth Lagoon– Palm Beach Coast/ Nutrients	3226E1, 3242A, 3245, 3264D	To be developed	2010
Lake Worth Lagoon– Palm Beach Coast/ Historical Nutrients	3264, 8096B	To be developed	2010
Lake Worth Lagoon– Palm Beach Coast/ TSI	3245B, 3262A	To be developed	2010
Lake Worth Lagoon– Palm Beach Coast/ Total Coliform	3242, 3256A	To be developed	2010
Lake Worth Lagoon– Palm Beach Coast/ Turbidity	3233	To be developed	2005
Lower St. Johns/ Nutrients	2213A, 2213B, 2213C, 2213E, 2213F, 2213I, 2213K, 2213L, 2213M, 2213N	Adopted	2003
Lower St. Johns/ Nutrients	2549, 2592, 2622A	Established by EPA	2004
Lower St. Johns/ Nutrients	2228, 2322, 2365	Proposed by EPA	2005
Lower St. Johns/ Nutrients	2213P, 2265A, 2410, 2460, 2538, 2589, 2606A, 2389, 2543F, 2606B, 2630I, 2660A	To be developed	2008
Lower St. Johns/ Fecal Coliforms	2365, 2326, 2252, 2304, 2322, 2316, 2282, 2228, 2224	Proposed	2006
Lower St. Johns/ Fecal Coliforms	2592	Established by EPA	2004
Lower St. Johns/ Fecal Coliforms	2181, 2191, 2203, 2203A, 2204, 2207, 2210, 2213P, 2220, 2227, 2232, 2233, 2235, 2238, 2239, 2240, 2244, 2246, 2248, 2249A, 2249B, 2254, 2256, 2257, 2265B, 2266, 2270, 2278, 2280, 2284, 2287, 2297, 2299, 2304, 2306, 2308, 2321, 2324, 2356, 2361, 2370, 2381, 2382, 2385	To be developed	2008
Lower St. Johns/ Total Coliforms	2262, 2316, 2282, 2228	Proposed	2006
Lower St. Johns/ Total Coliforms	2191, 2207, 2232, 2239, 2249A, 2254, 2265, 2270, 2278, 2284, 2361	To be developed	2008
Lower St. Johns/ Cadmium	2213G	To be developed	2008

Basin/Pollutant	*WBID*	*TMDL Status*	*Projected TMDL Submittal Date*
Lower St. Johns/ Copper	2213A, 2213B, 2213C, 2213D, 2213E	To be developed	2008
Lower St. Johns/ Copper	2228	Proposed by EPA	2005
Lower St. Johns/ DO	2540, 2549, 2569, 2592, 2622A	Established by EPA	2004
Lower St. Johns/ DO	2262, 2322, 2324	Proposed by EPA	2005
Lower St. Johns/ DO	2191, 2203, 2204, 2213P, 2220, 2224, 2227, 2256, 2273, 2287, 2297, 2326, 2382, 2415A, 2423, 2424, 2460, 2561, 2571, 2578,2583, 2589, 2606A, 2630C	To be developed	2008
Lower St. Johns/ Iron	2622A	Established by EPA	2004
Lower St. Johns/ Iron	2228	Proposed by EPA	2005
Lower St. Johns/ Iron	2213A, 2213B, 2213C, 2213D, 2213E, 2423, 2606B, 2630B	To be developed	2008
Lower St. Johns/ Lead	2213B, 2213P, 2228, 2423, 2424	To be developed	2008
Lower St. Johns/ Mercury (in fish)	2575Q, 2630B, 8998	To be developed	2011
Lower St. Johns/ Nickel	2213B, 2213C, 2213D, 2213E	To be developed	2008
Lower St. Johns/ Selenium	2630B	To be developed	2008
Lower St. Johns/ Silver	2213I	To be developed	2008
Middle St. Johns/ Mercury (in fish tissue)	2892, 2905C, 2916B, 2934A, 2964A, 3011C	To be developed	2011
Middle St. Johns/ Biology	3014	To be developed	2008
Middle St. Johns/ Cadmium	2925	To be developed	2008
Middle St. Johns/ DO	2893A2, 2893D, 2893E, 2893F, 2962, 2964A, 2973, 2985, 2990, 2992, 3024A, 3004	To be developed	2008
Middle St. Johns/ Fecal Coliform	2962, 2987, 2991, 2997A, 3001, 3004, 3023A, 3024A	To be developed	2008
Middle St. Johns/ Iron	2925, 2962, 2985, 2990	To be developed	2008

Basin/Pollutant	*WBID*	*TMDL Status*	*Projected TMDL Submittal Date*
Middle St. Johns/ Lead	2925, 2931	To be developed	2008
Middle St. Johns/ Nutrients	22130, 2893A1, 2893A2, 2893C, 2893E, 2985, 2990, 3004, 3023A, 2893F, 2893A, 2893D, 2893U, 2951, 2964A, 2973F, 2986D, 2986E, 2987A, 2994D, 2994Y, 2997B, 2997D, 2997L, 2997P, 2997R, 2997S, 2998A, 2998C, 2998E, 3002D, 3002E, 3002G, 3002N, 3004C, 3004D, 3004G, 3009	To be developed	2008
Middle St. Johns/ Total Coliform	2987, 2997A, 3023A, 3024A	To be developed	2008
Middle St. Johns/ DO	3014, 3030	Proposed	2004
Middle St. Johns/ Fecal Coliform	3014, 3023, 3030	Proposed	2004
Middle St. Johns/ Iron	3030	Proposed	2004
Middle St. Johns/ Nutrients	2981A, 2981	Proposed	2004
Middle St. Johns/ Total Coliform	3014, 3023, 3030	Proposed	2004
Middle St. Johns/ Un-ionized Ammonia	2981	Proposed	2004
Nassau–St. Marys/ DO	2156	To be developed	2010
Nassau–St. Marys/ Fecal Coliform	2156	To be developed	2005
Nassau–St. Marys/ Iron	2148B, 2211	To be developed	2010
Nassau–St. Marys/ Mercury (fish tissue)	2097D, 2097E, 2097F, 2097G, 2097H, 2097I, 2097J, 2339	To be developed	2011
Nassau–St. Marys/ Coliforms (shellfish)	2140, 2140A, 2149, 2174, 2174A, 2198, 2198A, 8127	To be developed	2010
Nassau–St. Marys/ Total Coliform	2153, 2156, 2157	To be developed	2005/2010
Ocklawaha/ DO	2695, 2698	To be developed	2007
Ocklawaha/ Iron	2740D	To be developed	2007
Ocklawaha/ Nutrients	2718C, 2717C, 2839, 2990, 2807, 2705, 2713B, 2782C, 2790A, 2807A, 2829A, 2832A, 2834C	To be developed (WBIDs 2807, 2807A, 2834C, 2839 adopted)	2007

Basin/Pollutant	*WBID*	*TMDL Status*	*Projected TMDL Submittal Date*
Ocklawaha/ Pesticides (in fish tissue)	2835D	To be developed	2007
Ocklawaha/ Nutrients	2814A, 2831B	Adopted	2003
Ocklawaha/ Un-ionized Ammonia	2814A, 2831B	Adopted	2003
Ocklawaha/ DO	2754, 2740C, 2740D, 2740F	Proposed	2002
Ocklawaha/ DO	2817A, 2831A, 2835A, 2839	Adopted	2002
Ocklawaha/ Fecal Coliform	2718A, 2698, 2711	Adopted	2002
Ocklawaha/ Nutrients	2754, 2740C	Proposed	2002
Ocklawaha/ Nutrients	2832, 2740D, 2817A, 2831A, 2835A, 2835C, 2738A, 2741, 2749, 2837B, 2705B, 2720A, 2817B, 2819A, 2835D, 2838A, 2838B	Adopted (WBID 2738A to be developed; WBID 2720A proposed)	2002
Ocklawaha/ Total Coliform	2688, 2718A, 2740D	Adopted	2002
Ocklawaha/ Un-ionized Ammonia	2817B	Adopted	2002
Pensacola/ Bacteria (shellfish)	915	To be developed	2012
Pensacola/ Fecal Coliform	176, 548FB, 738AB, 846CB, 848DA, 35	To be developed	2012
Pensacola/ Total Coliform	176, 548H	To be developed	2012
Pensacola/ Nutrients (chlorophyll *a*)	548AB, 846CB	To be developed	2012
Pensacola/ Nutrients (historical chlorophyll *a*)	548H	To be developed	2012
Pensacola/ Mercury (in fish tissue)	24, 24B, 24C, 10A, 10B, 10G	To be developed	2012
Pensacola/ Beach Advisory (bacteria)	548BB, 548FB, 738AB, 846CB, 848DA, 915A, 915B, 915C, 915D	To be developed	2012
Sarasota Bay–Peace–Myakka (Myakka River)/ Fecal Coliform	1869B, 1877A, 1933, 1955, 1958, 1991B	To be developed	2009
Sarasota Bay–Peace–Myakka (Myakka River)/ Total Coliform	1877A, 1958	To be developed	2009
Sarasota Bay–Peace–Myakka (Myakka River)/ DO	1981B, 1991C, 2045	To be developed	2009

Basin/Pollutant	***WBID***	***TMDL Status***	***Projected TMDL Submittal Date***
Sarasota Bay–Peace–Myakka (Myakka River)/ Nutrients	1981B, 1991A, 1991C, 2055	To be developed	2009
Sarasota Bay–Peace–Myakka (Myakka River)/ Iron	1981B	To be developed	2009
Sarasota Bay–Peace–Myakka (Peace River)/ Fecal Coliform	1501A, 1613, 1623K, 1539, 1623J, 1580, 1871	Proposed	2005
Sarasota Bay–Peace–Myakka (Peace River)/ Total Coliform	1580	Proposed	2005
Sarasota Bay–Peace–Myakka (Peace River)/ DO	1549B, 1549A, 1623L, 1623K, 1501A, 1613, 1580, 1497, 1626, 1539, 1521, 1623J, 1921, 1871, 1623L	Proposed	2005
Sarasota Bay–Peace–Myakka (Peace River)/ Nutrients	1549B, 1549A, 1497E, 1623L, 1501, 1497B, 1623K, 1521K, 1521H, 1521G, 1521F, 1521E, 1521D, 1521B, 1521, 1488C, 1488A, 1501A, 1613, 1623K, 1580, 1539, 1617, 1521, 1623J, 1921, 1871, 1954B, 1549A, 1488A, 1501, 1488C	Proposed	2005
Sarasota Bay–Peace–Myakka (Peace River)/ Turbidity and TSS	1623K	Proposed	2005
Sarasota Bay–Peace–Myakka (Peace River)/ BOD	1539, 1623J	Proposed	2005
Sarasota Bay–Peace–Myakka (Sarasota Bay)/ Fecal Coliform	1975A, 1975	Proposed	2005
Sarasota Bay–Peace–Myakka (Sarasota Bay)/ Total Coliform	1975A, 1975, 1896, 1937	Proposed (WBIDs 1896, 1937 to be developed)	2005 (WBID 1937 in 2008; WBID 1896 in 2009)
Sarasota Bay–Peace–Myakka (Sarasota Bay)/ Nutrients	2009A, 1984A, 1982A, 1975, 1984, 1971, 1968D, 2049, 2039, 2042, 2030	Proposed (WBIDs 1883, 1896, 1968F, 1975AA to be developed)	2005
Sarasota Bay–Peace–Myakka (Sarasota Bay)/ DO	1975, 2049	Proposed	2005
Southeast Coast–Biscayne Bay/ BOD 5-Day	3277B	To be developed	2006
Southeast Coast–Biscayne Bay/ Cadmium	3304	To be developed	2011
Southeast Coast–Biscayne Bay/ Copper	3288, 3304	To be developed	2011
Southeast Coast–Biscayne Bay/ Dioxin	3288A	To be developed	2011

Basin/Pollutant	*WBID*	*TMDL Status*	*Projected TMDL Submittal Date*
Southeast Coast–Biscayne Bay/ DO	3270, 3271, 3273, 3274, 3276, 3276A, 3277, 3277A, 3277B, 3279, 3281, 3284, 3285, 3286B, 3287, 3288, 3288A, 3303, 3303A	To be developed	2006
Southeast Coast–Biscayne Bay/ Fecal Coliform	3226G4, 3226H, 3226M2, 3270, 3273, 3274, 3276, 3276A, 3277, 3277A, 3277B, 3279, 3281, 3283, 3285, 3287, 3288, 3288A, 3288B, 3290, 3292,	To be developed	2006
Southeast Coast–Biscayne Bay/ Lead	3304	To be developed	2011
Southeast Coast–Biscayne Bay/ Mercury (based on fish consumption)	3284, 3303	To be developed	2011
Southeast Coast–Biscayne Bay/ Mercury (in fish tissue)	8998	To be developed	2011
Southeast Coast–Biscayne Bay/ Nitrogen	6001	To be developed	2011
Southeast Coast–Biscayne Bay/ Nutrients	3271, 3273, 3276A, 3277, 3277A, 3277B, 3279, 3281, 3282, 3284, 3285, 3286B, 3287, 3288A, 3303A	To be developed	2006
Southeast Coast–Biscayne Bay/ Historical Nutrients	3271, 3273, 3274, 3277, 3277A, 3277B, 3279, 3281, 3282, 3283, 3284, 3285, 3286B, 3287, 3288A, 3303, 3303A	To be developed	2006
Southeast Coast–Biscayne Bay/ Total Coliform	3226M2, 3270, 3273, 3276, 3276A, 3277, 3277A, 3277B, 3279, 3281, 3285, 3287, 3288, 3288A, 3288B, 3292	To be developed	2006
Southeast Coast–Biscayne Bay/ TSS	3277B	To be developed	2006
St. Lucie–Loxahatchee/ Bacteria (in Shellfish)	3190, 3193A, 3224, 3226A, 3226C, 3226D, 5003A, 8102, 8103, 8104	To be developed	2008
St. Lucie–Loxahatchee/ BOD 5-Day	3194A, 3224B	To be developed	2010
St. Lucie–Loxahatchee/ Conductance	3163, 3197, 3210B	To be developed	2005
St. Lucie–Loxahatchee/ Copper	3194, 3194B, 3208, 3210	To be developed	2008
St. Lucie–Loxahatchee/ DO	3160, 3163, 3189, 3194, 3194A, 3194B, 3197, 3200, 3210A, 3210B, 3211, 3218, 3224B, 3234	To be developed	2005
St. Lucie–Loxahatchee/ Fecal Coliform	3189, 3194, 3194A, 3210B, 3211, 3226C	To be developed	2005
St. Lucie–Loxahatchee/ Iron	3197, 3200	To be developed	2005

Basin/Pollutant	*WBID*	*TMDL Status*	*Projected TMDL Submittal Date*
St. Lucie–Loxahatchee/ Mercury	3234	To be developed	2010
St. Lucie–Loxahatchee/ Mercury (in fish tissue)	8998	To be developed	2011
St. Lucie–Loxahatchee/ Nutrients	3160, 3163, 3163B, 3189, 3190, 3193, 3194B, 3197, 3200, 3208, 3210, 3210A, 3210B, 3211, 3224A, 3224B, 3226A	To be developed	2005
St. Lucie–Loxahatchee/ Historical Nutrients	3194	To be developed	2005
St. Lucie–Loxahatchee/ Total Coliform	3189, 3194, 3194A, 3210B, 3234	To be developed	2005
St. Lucie–Loxahatchee/ TSS	3210B	To be developed	2010
St Marks-Ochlockonee/ DO	582B, 628, 647, 756, 756A, 756B, 756C, 807C, 807D, 971B	To be developed	2007, 2002 (756A)
St Marks-Ochlockonee/ Bacteria (shellfish)	8026	To be developed	2007
St Marks-Ochlockonee/ Fecal Coliform	1300, 756	To be developed (WBID 756 proposed)	2007, 2002 (756)
St Marks-Ochlockonee Basins/ Total Coliform	1297F, 1300, 424, 756, 791L	To be developed (WBID 756 proposed)	2007, 2002 (756)
St Marks-Ochlockonee Basins/ Nutrients (TSI)	540A, 582B, 756A, 756B, 756C, 807C	To be developed (WBID 756 A proposed)	2007, 2002 (756A)
St Marks-Ochlockonee Basins/ Mercury (in fish tissue)	889, 8999	To be developed	2011
St Marks-Ochlockonee Basins/ Biology	1006	To be developed	2007
St Marks-Ochlockonee Basins/ Beach Advisory (bacteria)	8025B, 8026B	To be developed	2007
Suwannee/ Historical Chlorophyll	3605A	To be developed	2007
Suwannee/ BOD	3473A, 3473B	Proposed	2002
Suwannee/ Coliforms (beach advisory)	8032A, 8032B, 8032C	To be developed	2007
Suwannee/ Coliforms (shellfish)	8037, 8038, 3422D	To be developed	2007
Suwannee/ Conductivity	3473B	To be developed	2007
Suwannee/ Dioxin	3473A	Proposed	2002

Basin/Pollutant	WBID	TMDL Status	Projected TMDL Submittal Date
Suwannee/ DO	3473A, 3473B, 3605C	Proposed, to be developed	2002/2007
Suwannee/ Fecal Coliforms	3520, 3626	To be developed	2007
Suwannee/ Mercury (fish tissue)	8999, 3422A, 3422B	To be developed	2011
Suwannee/ Nutrients	3729, 3516	To be developed	2007
Suwannee/ Total Coliforms	3473A, 3699	Proposed, to be developed	2002
Suwannee/ Unionized Ammonia	3473B	Proposed	2002
Tampa Bay/ Fecal Coliform	1605, 1624, 1627, 1507, 1474	Adopted (WBID 1507 proposed)	2005
Tampa Bay/ Total Coliform	1605, 1624, 1627	Adopted	2005
Tampa Bay/ DO	1605, 1627, 1507, 1507A, 1474, 1584B	Proposed	2004
Tampa Bay/ Nutrients	1605, 1584A, 1507, 1507A, 1584B	Proposed (WBID 1605 adopted in 2005)	2004
Tampa Bay Tributaries (Hillsborough River)/ DO	1443B, 1443D, 1522A, 1442, 1482, 1402, 1495B, 1561, 1534	Proposed	2004
Tampa Bay Tributaries (Hillsborough River)/ Total Coliform	1443D, 1522A, 1442, 1522C, 1482, 1402, 1443E, 1561	Adopted	2005
Tampa Bay Tributaries (Hillsborough River)/ Fecal Coliform	1522A, 1442, 1522C, 1482, 1443E, 1561	Adopted	2005
Tampa Bay Tributaries (Hillsborough River)/ Nutrients	1522A, 1543, 1522C, 1443E, 1561	Proposed (WBIDs 1543, 1522C, 1561 adopted)	2004
Tampa Bay Tributaries (Hillsborough River)/ BOD	1482, 1495	Adopted	2005
Tampa Bay Tributaries (Hillsborough River)/ Un-ionized Ammonia	1522B	Adopted	2005
Tampa Bay Tributaries (Hillsborough River)/ Lead	1522B	Adopted	2005
Tampa Bay Tributaries (Manatee River)/ Fecal Coliform	1899, 1819, 1848C, 1901	Proposed	2004
Tampa Bay Tributaries (Manatee River)/ Total Coliform	1819, 1848C, 1901	Proposed	2004

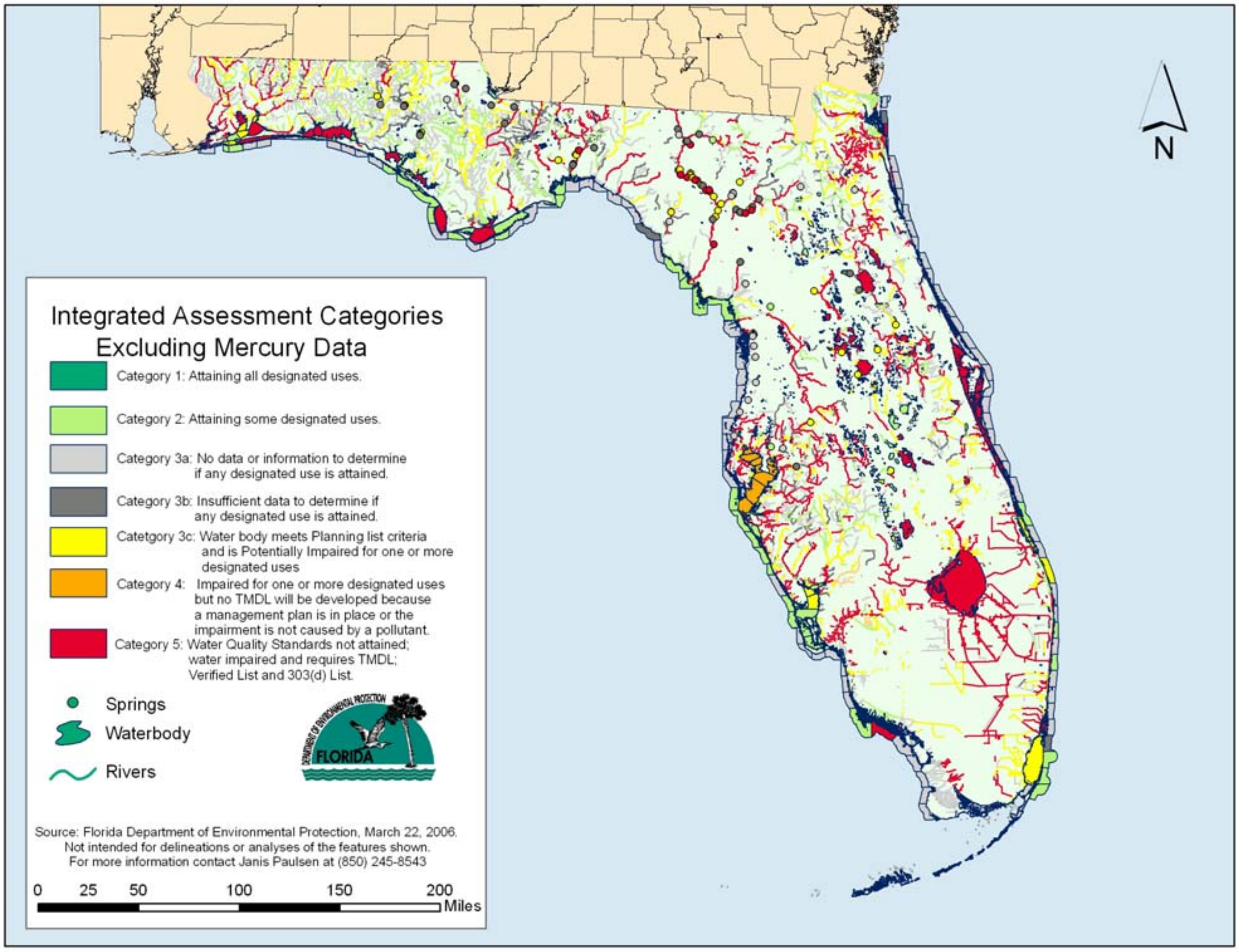
Basin/Pollutant	*WBID*	*TMDL Status*	*Projected TMDL Submittal Date*
Upper St. Johns/ Mercury (in fish tissue)	28931	To be developed	2011
Upper St. Johns/ Copper	3073	To be developed	2009
Upper St. Johns/ DO	28931, 3108C, 28935	To be developed	2009
Upper St. Johns/ Nutrients	2893K	To be developed	2009
Upper St. Johns/ DO	2893K, 2893I	To be developed	2008
Upper St. Johns/ Fecal Coliform	3073	To be developed	2008
Upper St. Johns/ Nutrients	3073, 2893I	To be developed	2008
Upper St. Johns/ Total Coliform	3073	To be developed	2008
Upper St. Johns/ DO	2893L, 2893Q, 2893X	Proposed	2004
Upper St. Johns/ Nutrients	2893L, 2893Q	Proposed	2004
Withlacoochee (Upper)/ Nutrients	1467	To be developed	2011
Withlacoochee (Lake Panasoffkee)/ DO	1531B	To be developed	2011
Withlacoochee (Lake Panasoffkee)/ Nutrients	1531B	To be developed	2011

Note: The TMDLs for mercury will be developed statewide and are due in 2011 (see Chapter 2 for a summary of mercury reduction strategies).

Figure 5 illustrates the statewide assessment results for all parameters, excluding mercury. The figure illustrates the fact that most surface water quality problems are found in highly urbanized central and south Florida. Problems are evident around the densely populated, major urban centers, including Jacksonville, Orlando, Tampa, Pensacola, Cape Kennedy, and the southeastern Florida coast. Basins with intense agricultural and industrial use are also associated with poor water quality. Water quality in the northwest and west-central sections of the state is generally better than in other areas.

Figure 6 summarizes the assessment results for mercury. As noted earlier, in many Florida waters consumption advisories have been issued for a number of fish species. The TMDLs for waters impaired for mercury, which will be developed statewide, are due in 2011.

Figure 5. Results of Florida's Surface Water Quality Assessment for all Parameters (Excluding Mercury)



Biology. The IWR relies heavily on stream biological data for impairment status. Since 1992, FDEP has taken about 1,000 BioReconnaissance (BioRecon) and about 2,500 SCI measurements. Over this period, BioRecons statewide showed a 32% stream failure rate, and 23% of the SCIs failed. ***Table 19*** shows the numbers of measurements and impairment status for the BioRecon and SCI from 1992 to 2005.

Figure 6. Results of Florida's Surface Water Quality Assessment for Mercury

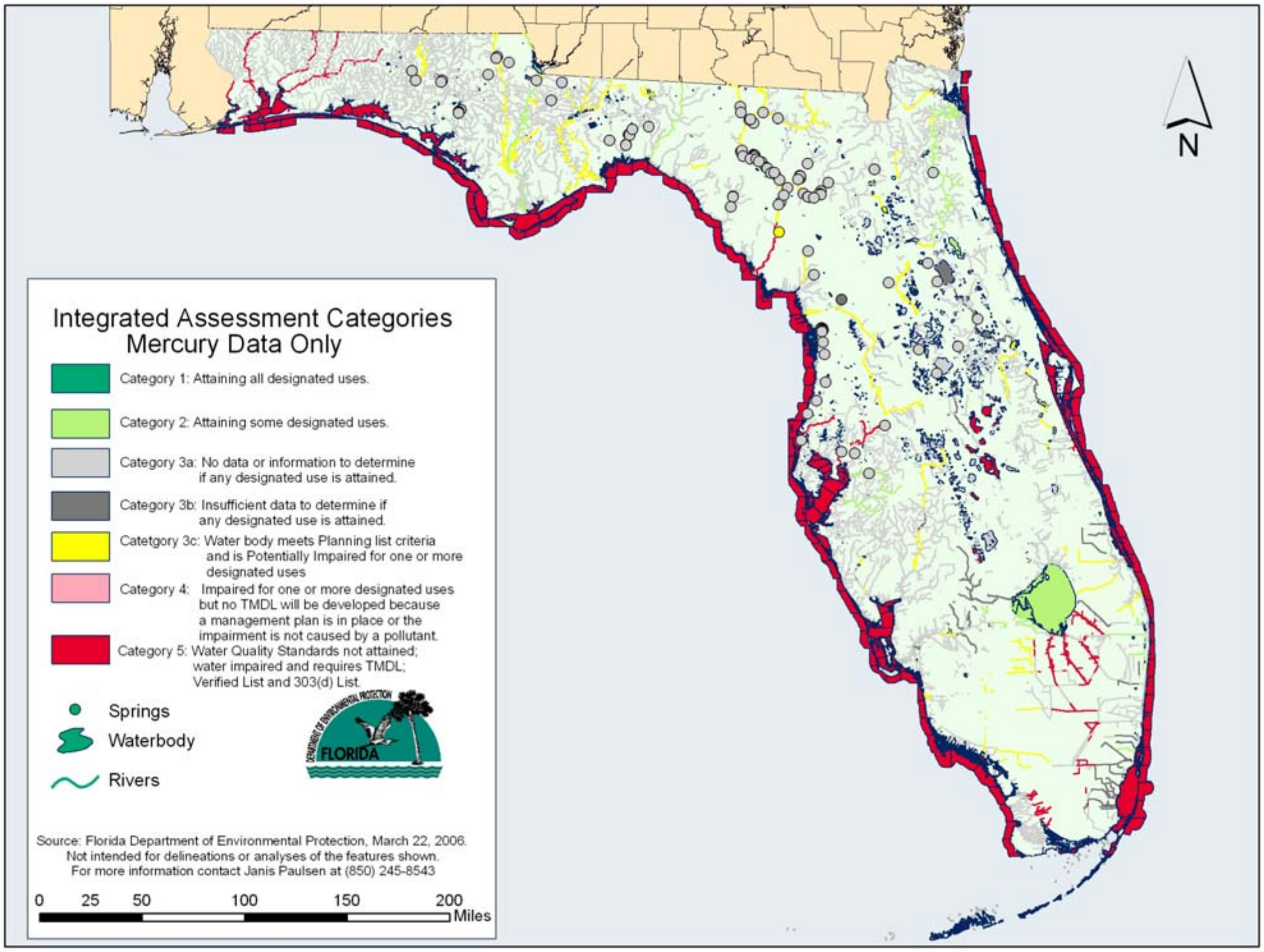


Table 19. Numbers of Measurements and Impairment Status for the BioRecon and SCI, 1992–2005

Biological Test	*Call*	*Impairment*	*Number of Measurements*
BioRecon	Healthy	Not impaired	342
BioRecon	Pass	Not impaired	16
BioRecon	Suspect	Not impaired	322
BioRecon	Impaired	Impaired	288
BioRecon	Fail	Impaired	25
SCI	Excellent	Not impaired	1,270
SCI	Fair	Not impaired	96
SCI	Good	Not impaired	521
SCI	Poor	Impaired	411
SCI	Very Poor	Impaired	150

Trend Analysis for Rivers/Streams, Lakes, Estuaries, and Coastal Waters

Changes in water quality over time are an important indicator of the health of surface waters. **Table 20** shows trends in water quality for chlorophyll *a*, nitrogen, and phosphorus in rivers/streams, lakes, estuaries, and coastal waters from 1995 to 2005. Enough data were available to evaluate long-term trends in water quality for 841 rivers/streams, lakes, estuaries, and coastal waters. Overall, most (about 54%) showed no significant trends, while 22% improved and 24% worsened.

Table 20. Trends in Water Quality for Rivers/Streams, Lakes, Estuaries, and Coastal Waters, 1995–2005

Description	*Number of Waterbodies*	*Assessed*
Rivers/Streams Assessed for Trends (miles)		
Improving	46	440
Stable	230	2,625
Degrading	75	979
Fluctuating	0	0
Trend Unknown	3,133	14,858
Lakes Assessed for Trends (acres)		
Improving	93	138,432
Stable	147	289,792
Degrading	118	368,832
Fluctuating	0	0
Trend Unknown	1,220	732,224
Estuaries Assessed for Trends (square miles)		
Improving	42	892
Stable	73	807
Degrading	9	61
Fluctuating	0	0
Trend Unknown	334	2,385
Coastal Waters Assessed for Trends (square miles)		
Improving	3	33
Stable	5	104
Degrading	0	0
Fluctuating	0	0
Trend Unknown	388	2,830

Special Focus: Lake Issues

Lakes are a particular focus of the EPA's 2006 Integrated Report guidance. This section provides information on lake trends, lake trophic status, approaches to controlling lake pollution and lake water quality, approaches to mitigating high acidity in lakes, and publicly owned lakes with impaired uses. ***Table 17*** summarizes support for designated use (class) for lakes, and ***Table 18*** provides information on the acres of lakes impaired by various causes.

Lake Trends. Trends in Florida lakes between 1994 and 2003 were analyzed, and there were sufficient data for trend analysis for 358 lakes. Of these 358 lakes, 93 were improving, 147 were stable, and 118 were degrading ***(Table 20).*** For 1,274 lakes, trends were unknown.

Trend analysis was accomplished using quarterly waterbody medians of nitrogen, phosphorus and chlorophyll for the 1995–2005 period. Only waterbodies with at least 10 or 11 years of data were used in the Spearman rank-order nonparametric correlation (correlations had to be significant at the 95% confidence level).

Lake Trophic Status. ***Table 21*** lists the trophic status of significant publicly owned lakes in the state. The table shows that of almost 1,280,128 acres of lakes assessed (or about 84% of the lake acres in Florida), 83.7% are eutrophic and another 2.6% are hypereutrophic.

Table 21. Trophic Status of Significant Publicly Owned Lakes

Description	*Number of Lakes*	*Acres of Lakes*
Total in State	1,578	1,529,280
Assessed	1,036	1,280,128
Eutrophic	691	1,067,264
Hypereutrophic	17	33,856
Mesotrophic	300	163,392
Oligotrophic	28	15,616
Dystrophic	0	0
Unknown	542	249,152

Note: Results are based on the TSI.
TSI values for lakes are as follows:
Oligotrophic – < 20
Mesotrophic – 20 to < 40
Eutrophic – 40 to < 80
Hypereutrophic – ≥ 80

Approaches to Controlling Lake Pollution and Lake Water Quality. The TMDL assessment process described earlier in this chapter provides an approach to controlling the point and nonpoint source pollution entering Florida's lakes and restoring lake water quality. In particular, the Basin Management Action Plans (BMAPs) developed for impaired waterbodies contain specific management activities and BMPs for reducing pollution. Each BMAP also provides interim and final targets for evaluating water quality improvements, a mechanism for tracking the implementation of management actions, procedures for monitoring and reporting on progress, data management and QA/QC procedures, a description of methods used to evaluate progress towards goals, a strategy and schedule for periodically reporting results to the public, and procedures to determine whether additional corrective actions are needed and whether plan components need to be revised.

Approaches to Mitigating High Acidity in Lakes. High acidity in lakes is not generally considered to be a problem in Florida, because of naturally low pH due to swamp drainage and the low buffering capacity of swampy rainwater.

Publicly Owned Lakes with Impaired Uses. Florida has a number of publicly owned lakes that are known to be impaired. These include lakes that do not meet applicable WQSs or that require the implementation of control programs to maintain compliance with applicable standards. **Appendix E** lists alphabetically the impaired lakes in the state, the parameter causing impairment, the basin group, and the river basin within which each lake is located.

Drinking Water

Surface waters supply only about 13% of Florida's drinking water. Of 7,200 public drinking water systems statewide, 19 obtain their water from surface water. An additional 26 systems wholly or partially purchase water from these 19 systems. Because it is expensive to operate a surface water system (given that filtration and advanced disinfection are costly), most are large.

While earlier sections of this chapter discussed impaired waters by waterbody type, this section provides assessment results specifically for drinking water use attainment. To determine attainment for drinking water use, the data for all Class I rivers/streams and lakes in the state were assessed. Class I waters must also protect general human health, aquatic life, and allow for the protection of fish and wildlife, as well as recreational uses.

Table 22 lists the total miles of rivers/streams and acres of lakes/reservoirs designated for drinking water use in Florida (657 miles and 214,500 acres, respectively). For waters designated for drinking water use, ***Table 23*** lists the miles of rivers/streams and acres of lakes/reservoirs designated for drinking water use that are assigned to each of the EPA's five reporting categories. ***Table 17,*** which summarizes the causes and acreages of waterbodies not attaining drinking water use for rivers/streams and lakes (i.e., Class I waters), shows that 28.6% of rivers and streams, and 96.9% of lakes, supported drinking water use.

Table 22. Total Miles of Rivers/Streams and Acres of Lakes/Reservoirs Designated for Drinking Water Use

Waterbody Type	*Number*	*Total in State*
Streams	18	657 miles
Lakes	43	214,500 acres

Table 23. Miles of Rivers/Streams and Acres of Lakes/Reservoirs Designated for Drinking Water Use that Are Assigned to Each of the EPA's Five Reporting Categories

Waterbody Type	*Number of Waterbodies*	*Stream Miles and Lake Acres*	*EPA Category**	*Assessment Status*
Rivers/Streams	6	58	2	Meets use
Rivers/Streams	15	69	3a	Insufficient data
Rivers/Streams	9	50	3c	Planning List
Rivers/Streams	13	158	5	Verified List
Lake	0	0	2	Meets use
Lake	3	192	3a	Insufficient data
Lake	2	3,648	3c	Planning List
Lake	13	416,448	5	Verified List

*****The EPA's Integrated Report categories are as follows:
1—Attains all designated uses;
2—Attains some designated uses;
3a—No data and information are available to determine if any designated use is attained;
3b—Some data and information are available, but they are insufficient for determining if any designated use is attained;
3c—Meets Planning List criteria and is potentially impaired for one or more designated uses;
3d—Meets Verified List criteria and is potentially impaired for one or more designated uses;
4a—Impaired for one or more designated uses and the TMDL is complete;
4b—Impaired for one or more designated uses, but no TMDL is required because an existing or proposed pollutant control mechanism provides reasonable assurance that the water will attain standards in the future;
4c—Impaired for one or more designated uses but no TMDL is required because the impairment is not caused by a pollutant; and
5—Water quality standards are not attained and a TMDL is required.

Overlap of Source Water Areas and Impaired Surface Waters. Verified Lists of impaired surface waters have been adopted for the Group 1, 2, 3, and 4 basins. Several waters were listed based on parameter concentrations that may pose a public health concern to public water systems, and in several instances these coincide with source water assessment and protection areas for community water system surface water intakes. Source water areas were modeled based on a 3-day travel time to the intake within surface waters and their 100-year floodplains. Streams were added to the source water coverage from USGS quadrangles, with a 3-meter buffer around each one. The overlap of impaired surface waters and these source water areas were determined using the source water coverage, the lists of impaired surface waters, the areas of Florida's lakes and reservoirs, and the 1:24,000-scale NHD for streams.

Table 24 summarizes the findings. The table shows the aggregate miles of rivers/streams and acres of lakes/reservoirs representing an overlap between source water areas and surface waters that are listed for primary drinking water parameters. This summary includes segments of 16 waterbodies that were listed for total and/or fecal coliform. It is mandatory for public water systems in Florida to perform chlorination treatment to address bacteria.

Table 24. Summary of Impaired River/Stream Miles and Lake/Reservoir Areas Overlapping Source Water Areas of Community Water Systems

Surface Water Type	*Length or Area of Impaired Surface Waters Overlapping Source Water Areas in Groups 1-4*	*Percent of Total Length or Area in Groups 1-4*
Streams and Rivers	658 miles	1.3%
Lakes/Reservoirs	1,566 acres	0.10%

Note: The analysis is based on adopted lists of impaired surface waters for the Group 1, 2, 3, and 4 basins. Parameters of interest were total coliform and fecal coliform.

Freshwater, Estuarine, and Marine Sediment Contamination

Freshwater Sediments. In healthy aquatic environments, sediments provide critical habitat for many organisms. However, sediments can also accumulate contaminants. Knowledge of existing sediment quality is important for environmental managers, especially in restoration and dredging projects, but periodic water quality monitoring cannot fully assess aquatic ecosystems, as it is not usually designed to assess the cumulative impact of contaminants.

Unlike water, there are no sediment standards. Tools have been designed to evaluate sediment quality. In 2002, FDEP released a Web-assisted statistical tool that evaluates metals enrichment in freshwater sediments. The tool estimates anthropogenic impacts by comparing sediment metal contaminants with both aluminum and iron in the sediment. Furthermore, in 2003, FDEP released the document, *Development and Evaluation of Numerical Sediment Quality Assessment Guidelines for Florida Inland Waters*, which provides guidance in the interpretation of freshwater sediment contaminant data as it relates to biological impacts at a site. The report contains freshwater sediment guidelines that are based on the same weight-of-evidence statistical approach used to develop the 1994 coastal sediment quality guidelines (discussed in the following estuarine assessment section). Each metal and organic contaminant has two guidelines, a lower guideline that informs managers that contaminant-induced harm may occur, and a higher guideline that informs managers that biological harm will most likely occur due to elevated contaminant concentrations. These interpretive documents are available at http://www.dep.state.fl.us/water/monitoring/index.htm#seds.

In 2004, FDEP, in conjunction with two water management districts (North Florida and St. Johns River), conducted a survey of sediments from both large and small lakes in the 6 Group 1 basins. A total of 284 lake sediment samples was collected after the collection of the water samples. FDEP's Central Laboratory analyzed these samples for metals, nutrients, and organic contaminants. Metals analyzed included arsenic, cadmium, chromium, copper, lead, nickel, mercury, silver, and zinc; organic contaminants included polynuclear hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and organochlorine pesticides (for example, DDT and its breakdown products). FDEP's Monitoring Section then applied the sediment quality assessment tools to the resulting dataset.

Using the two guidelines in the 2003 guidelines document, it is apparent that the metals copper, lead, and zinc produce the most exceedances of both the lower and higher guidelines. Arsenic, cadmium, chromium, and mercury rarely exceed the higher guideline, but do commonly exceed the lower guideline. Not surprisingly, sediment metals were highest in lakes in urbanized areas, with the highest number of samples that show elevated metals collected in the Tampa Bay region.

In the 284 samples, there were 41 detections of an organic contaminant; however, some sediment samples had detections of more than 1 individual organic contaminant. No PCB compounds were detected, and only 7 samples had detectable amounts of PAHs. However, the persistent organochlorine pesticides DDT (along with its breakdown products, DDD and DDE) and chlordane were detected at 20 stations. The two Group 1 basins with the most exceedances of the higher organic contaminant guideline were the Ocklawaha River Basin, which is heavily agricultural, and the urban Tampa Bay Basin. Chlordane, a now-banned but formerly widely used termiticide, was detected in 7 lake sediment samples, all in the Tampa Bay Basin.

Estuarine and Marine Sediments. Florida's unique geologic and hydrologic features make its surface water and ground water relatively vulnerable to contamination. Sediment and soil contamination is particularly important to water quality, because surface and subsurface sediments, ground water, and surface water interact extensively. Sediment contamination is also crucial because of the state's extensive estuaries and their use as commercial and recreational fisheries.

Although Florida currently has no criteria for heavy metals or toxic organics in sediments, FDEP studied estuarine sediments to assess current conditions, develop tools to identify contaminated areas, and provide background information to develop future sediment criteria.

The initial study collected and interpreted data on natural background concentrations of selected metals, including arsenic, cadmium, chromium, copper, mercury, lead, zinc, cadmium, barium, iron, lithium, manganese, silver, titanium, and vanadium.[12] The study was later expanded to include five classes of organic contaminants: chlorinated hydrocarbons (pesticides), polycyclic aromatic hydrocarbons, polychlorinated biphenyls, phenolic hydrocarbons, and aliphatic hydrocarbons.[13]

The sediment database contains information collected from 700 sites by FDEP, 42 sites by the National Oceanic and Atmospheric Administration's National Status and Trends Program, and 33 sites in the St. Johns River by Mote Marine Laboratory (a private marine research facility in Sarasota). The data came from 3 different surveys. From 1983 to 1984, sediments were collected as part of the Deepwater Ports Project from sites near dense population centers and close to commercial channels and ship berths. A second survey, from 1985 to 1991, assessed sites where contamination was expected because of flows from tributaries and local land use practices. The third survey examined sites in relatively remote or unimpacted areas.

Once the data were collected, the group developed tools using metal-to-aluminum ratios to identify estuarine and marine sites contaminated with cadmium, lead, arsenic, zinc, lead, nickel, chromium, and copper. Ratios greater than 1 indicate potential contamination. Mercury was evaluated against a maximum concentration associated with uncontaminated estuarine sediments. Metal contamination above background levels was most often seen for cadmium, mercury, lead, and zinc. Polycyclic aromatic hydrocarbons were found in about 70% of the

12 This effort culminated in the release of the document, *A Guide to Interpretation of Metal Concentrations in Estuarine Sediments* (FDEP, April 1988).
13 The expanded database is summarized in *Florida Coastal Sediment Contaminants Atlas* (FDEP, 1994).

samples tested for organic chemicals. Of this group, fluoranthene and pyrene were found in more than 50% of the samples. Not surprisingly, more contaminants were found in urban watersheds than in rural or undeveloped watersheds.

While contaminant levels in estuarine and marine sediments can be measured, the effects of specific concentrations of metals or organic chemicals on aquatic life are not completely understood. Because of the difficulty of interpreting the data, FDEP developed guidelines for assessing sediment quality rather than sediment criteria. The guidelines provide ranges of concentrations that could cause a specific level or intensity of biological effects.

Using data from 20 different areas of Florida, FDEP developed preliminary guidelines for 34 priority contaminants in coastal and marine sediments.[14] Data from acute toxicity tests were used mainly because little information exists on chronic effects. Three ranges of effects were defined for each contaminant: probable, possible, and minimal. These are interpreted, respectively, as concentrations that always have an effect, frequently have an effect, and rarely or never have an effect. The guidelines for 28 substances have a high or moderate degree of reliability. The guidelines for all 34 substances, used collectively, predict the potential effects of contaminated marine and estuarine sediments on biological communities.[15]

Although the guidelines are a valuable tool, it is recommended that they be used with other tools and assessment procedures. Direct cause and effect should not be inferred. They also do not replace dredging disposal criteria or formal procedures, nor are they meant to be sediment quality criteria or numeric attainment levels for cleaning up Superfund sites.

Public Health Concerns and Programs

Drinking Water

FDEP has the primary role of regulating public water systems in Florida, under Chapter 403, Part IV, F. S., and by delegation of the federal program from the EPA. To this end, FDEP has promulgated a number of rules in the Florida Administrative Code. The section entitled Overview of Ground Water Protection Programs in Chapter 2 describes FDEP's ongoing efforts to protect drinking water supplies.

A public water system is one that provides water to 25 or more people for at least 60 days each year or serves 15 or more service connections. These public water systems may be publicly or privately owned and operated. Additional information is available at FDEP's Drinking Water Program Web site at http://www.dep.state.fl.us/water/drinkingwater/index.htm.

FDOH and the county health departments regulate very small water systems that provide water for public consumption, but that do not fall under the definition of public water systems. Additional information is available on FDOH's Web site at http://www.doh.state.fl.us/environment/water/index.html. The water management districts regulate the digging of water wells, both public and private, and the quantities of water that may be extracted.

14 This approach was adapted from recommendations by Long and Morgan, 1990.
15 For a complete discussion of methodology, see MacDonald, 1994.

Bacterial and Mercury Contamination

Assessment results indicate that several human health-related designated uses are not always maintained in Florida's surface waters. Specifically, primary contact and recreation use support and shellfish harvesting use support are sometimes limited by the presence of bacteria in the water column, and for a number of species in many waters across the state, fish consumption use support is commonly limited by the presence of mercury in fish tissue.

It is important to note, however, that these impairments are not based on documented impacts on public health. Florida has extensive monitoring programs that issue beach advisories, shellfish bed closures, and fish consumption advisories when ambient samples reach predetermined thresholds. These thresholds are conservatively designed to protect public health against the potential effects of exposure to bacteria (in water and shellfish) and mercury (in fish tissue).

FDEP's mercury Web site at http://www.dep.state.fl.us/labs/mercury/index.htm provides information on the mercury issue and links to other useful Web sites dealing with mercury. Information on the latest fish consumption advisories is available on FDOH's Web site at http://www.doh.state.fl.us/environment/community/fishconsumptionadvisories/index.html. Information on beach closures is available on FDOH's Web site at http://esetappsdoh.doh.state.fl.us/irm00beachwater/default.aspx. Information on shellfish bed closures is available on FDACS Web site at http://www.floridaaquaculture.com/SEAS/SEAS_intro.htm.

Harmful Algal Blooms

Over the last several years, concern has grown in Florida about the potential public health threat from harmful algal blooms (HABs). In general, researchers believe that freshwater algal blooms are increasing in frequency, duration, and magnitude and therefore may be a significant threat to surface drinking water resources and recreational sites (Williams, April 14, 2004). Typically caused by excess nutrients, these blooms may produce toxins that can harm humans through exposure to contaminated fish, dermal contact, and even the inhalation of aerosols.

Blue-green Algae

A relatively new issue of concern in Florida is the presence of the toxigenic blue-green algae called cyanobacteria and their production of cyanotoxins. Blooms of cyanobacteria are due, in most part, to high nutrient loads; slow-moving waters; and hot, humid, and stagnant conditions. Cyanotoxins are naturally produced chemicals that can cause liver, brain, and skin toxicity. Several cyanotoxins, namely microcystins and the lyngbyiatoxins, have been implicated as tumor promoters (Williams, April 14, 2004). Cyanobacteria were on the EPA's1998 Contaminant Candidate List (CCL), which is used to prioritize research and make regulatory determinations. Since the CCL was developed, the EPA has placed a number of the microcystin toxins on its "Unregulated Contaminant Monitoring Rule – List 3" for a more detailed investigation into these toxins' occurrence and health impacts. Although no formal decision has been made to date, this nationwide monitoring would take place after 2005.

Potentially toxigenic cyanobacteria have been found statewide, including river and stream systems such as the St. Johns, Caloosahatchee, Peace, and Kissimmee Rivers. The Cyanobacteria Survey Project (1999–2001), managed by the Harmful Algal Bloom Task Force at FMRI, indicated that the species of *Microcystis, Anabaena,* and *Cylindrospermopsis* were dominant, while *Aphanizomenon, Planktothrix, Oscillatoria,* and *Lyngbya* were also observed statewide but not as frequently. Cyanotoxins (microcystins, cylindrospermopsin, and anatoxin-a) were also found statewide. A quota of 25 samples was collected in each water management district.

A number of waterbodies in Florida are known to have extremely abundant populations of blue-green algae. These include Lakes Seminole and Tarpon in Pinellas County, Lakes Beauclair and Dora in Lake County, Newnans Lake in Alachua County, Lake Jesup in Seminole County, Lake Okeechobee in Okeechobee, Palm Beach, Hendry, and Glades Counties, and numerous others (Williams, April 14, 2004). The first demonstrated case in Florida of human dermatitis related to a freshwater cyanobacteria species, *C. raciborskii,* occurred in Winter Haven on Lake Cannon during the 1990s (J. King, FDEP, April 14, 2004, personal communication).

Frequently, measured concentrations of cyanotoxins have been reported in some post-processed finished water of drinking water facilities in Florida. A few of these concentrations were above the suggested guideline levels. The Cyanobacteria Survey Project of 2000 focused on water treatment plants that produced drinking water from surface waters. Samples (raw and finished water) were collected once a month for approximately 9 months. On 6 occasions, microcystin levels (hepatotoxins) in finished water samples were reported above the 1 microgram per liter (μg/L) World Health Organization (WHO) guideline level (a range of 1 to 10 micrograms per liter [μg/L]). However, these guideline levels have a 1000x safety factor and are based on a lifetime exposure. Further, the sample deviation at these low concentrations raised the issue of quality assurance, particularly considering the use of new analytical procedures and lack of lab certification.

There are no WHO guidelines for cylindrospermopsin (which is classified as a hepatotoxin but is a more general tissue toxin) or anatoxin-a (a neurotoxin). However, Australia determined that 1 μg/L for cylindrospermopsin was appropriate due to its genotoxic capabilities. The Cyanobacteria Survey Project found 9 samples of finished water that contained cylindrospermopsin levels between 8 and 97 μg/L. As for anatoxin-a, 2 samples contained levels from 2 to 8 μg/l, and 4 samples contained detectable levels but below an arbitrary level of 1 μg/L (C. Williams, GreenWater Laboratories/CyanoLab, April 14, 2004, personal communication). Again quality assurance issues cause the results to be questionable.

Since that study, FDOH has established a testing laboratory and certification program for these chemicals and is participating in additional studies of recreational and drinking waters. Several Drinking Water facilities are either monitoring for these substances or are participating in a larger study to evaluate the effectiveness of treatment methodologies to eliminate the toxins. Reports from WHO and other research around the world indicate that conventional treatment processes are effective at eliminating the algae and the toxin, when present. The taste, odor, and color associated with the bloom provide a clear indication of its presence and initiate the use of additional treatment. While these treatment techniques are being used to control the taste, odor, and color of the water, they are also being shown to very effective at removing or degrading the toxins.

Consistent/persistent low levels of microcystins (0.1 to 1.0 μg/L) have been found in the Harris Chain of Lakes in central Florida and in Lake Okeechobee. Eutrophic waterbodies with high blue-green populations are likely to have consistent levels of toxins present, especially during the spring and summer months. Reports indicate that the greatest toxin production (microcystins) is almost always during the late fall and early winter (Williams, April 14, 2004, personal communication).

Pfiesteria

Citizens near the Lower St. Johns River and St. Lucie River Estuary have expressed particular concern about potential blooms of *Pfiesteria piscicida,* which has been documented to cause ulcers in fish and respiratory irritation, skin rashes, and possible neurocognitive disorders in humans in the mid-Atlantic region. *P. piscida* has never been positively identified in the Lower St. Johns, but *Pfiesteria*-like organisms have been found. No *Pfiesteria* or *Pfiesteria*-like events have been documented in Florida. FMRI has also evaluated coastal waters for *Pfiesteria*, and no samples to date have contained this species.

Red Tide

The Florida Marine Research Institute (FMRI) in St. Petersburg monitors HABs as part of its ECOHAB (Ecology and Oceanography of Harmful Algal Blooms in Florida) program. This monitoring primarily focuses on red tide, a brevetoxin that has been linked to numerous marine mammal deaths (in manatees and dolphins) and can cause severe respiratory distress in people who are exposed to a strong red tide event. Additional information on red tide is available at FDACS' Web site at http://www.floridaaquaculture.com/RedTide/RedTideInfo.htm.

Wetlands Program

Wetlands Inventory and Wetlands Protection

Florida does not assess attainment of designated use for wetlands as it does for rivers and streams, lakes, estuaries, and coastal waters, because water quality in wetlands is not routinely monitored. However, wetlands are often associated with rivers and lakes, which are routinely sampled.

Although some background data are collected for issuing permits (particularly for wastewater discharged to wetlands) and restoration programs may require water quality data, Florida does not have a comprehensive wetlands monitoring network. This section provides an inventory of major wetlands and historical coverage of wetlands in the state, the development of wetlands water quality standards, and wetlands management and protection efforts.

Major Wetland Systems

Wetlands comprise almost one-third of the state. Because of its low elevation and peninsular nature, Florida has many varied types of wetlands, including estuarine and freshwater marshes, mangrove forests, cypress swamps, and riverine floodplain. The following are the largest and most important in the state:

- *The Everglades and the adjacent Big Cypress Swamp. Including the Water Conservation Areas (diked portions of the original Everglades system) and excluding the developed coastal ridge, this system extends approximately from Lake Okeechobee to Florida Bay.*

- *The Green Swamp in the state's central plateau.*
- *The Big Bend coast from the St. Marks River to the (South) Withlacoochee River.*
- *Vast expanses of* Spartina *marsh between the Nassau and St. Mary's Rivers.*
- *The system of the St. Johns River marshes. Before alteration by humans, all but the northernmost one-fifth of the river basin was an extensive freshwater system of swamps, marshes and lakes.*[16] *Even today, half of the length of the St. Johns River is actually marsh, and in many respects it functions like a northern-flowing Everglades.*
- *The headwaters and floodplains of many rivers throughout the state, especially the Apalachicola, Suwannee, St. Johns, Ocklawaha, Kissimmee, and Peace Rivers.*

Historical Wetlands Coverage in Florida

Although information on the historical extent of Florida's wetlands is limited, one researcher estimates that the state lost as many as 46% of its original wetlands between the 1780s and the 1980s. ***Table 25*** contains estimates of Florida's historical wetlands at a number of different points in time.

Table 25. Historical Estimates of Wetlands in Florida, 1780–1980

Period	*Wetlands Acreage*	*Source*
circa 1780	20,325,013	*Dahl, 1990*
mid-1950s	12,779,000	*Hefner, 1986*
mid-1970s	11,334,000	*Hefner, 1986*
mid-1970s	11,298,600	*Frayer and Hefner, September 1991*
1979–80	11,854,822	*U. S. Fish and Wildlife Service, January 1984*
circa 1980	11,038,300	*Dahl, 1990*

What is notable about the table above is that the rate of wetland loss appears to have significantly slowed since the mid-1970s, corresponding to when federal and state dredge-and-fill regulatory programs were enacted. Another point to keep in mind is that there is no single, current, comprehensive way to estimate the wetland acreage in Florida. The state uses its own wetland delineation methodology, which has been adopted as Rule 62-340, F.A.C. This methodology, used by all state and local agencies throughout the state, requires field-based, site-specific determinations on a case-by-case basis—including an assessment of on-site soils, hydrology, and vegetation (as such, wetland estimates cannot be determined based on aerial surveys or mapping). The methodology is similar, but not identical, to the 1987 Manual methodology used by the U. S. Army Corps of Engineers. Further, many of the estimates in the table are based on the rather crude National Wetlands Inventory, which has not been ground-truthed and does not directly correspond to either the state or the Corps' methodology.

[16] Kushlan, 1990.

Development of Wetlands Water Quality Standards

Since most wetlands are considered waters of the state,[17] they are regulated under the same standards as other surface waters, and the same five functional classifications described earlier also apply. The state's antidegradation rules are set out in Sections 62-302.300 and 62-4.242, F.A.C. Statutory authority for regulating impacts to wetlands and other surface waters is set forth in Part IV, Chapter 373, F.S. Rules regulating impacts to wetlands and other surface waters have been adopted under that authority by FDEP and the state's five water management districts. These include Rule 62-312, F.A.C., which covers the Florida Panhandle, and Rules 62-330, 62-341, 62-343, 40A-4, 40B-4, 40B-400, 40C-4, 40C-40, 40C-41, 40C-400, 40D-4, 40D-40, 40D-400, 40E-4, 40E-40, 40E-41, and 40E-400, F.A.C. A requirement for issuance of a permit is that the activity must not be contrary to the public interest, or, if located in OFWs, the activity must be clearly in the public interest. Finally, an extremely rigorous nondegradation policy covers Outstanding National Resource Waters.[18]

Florida's rules already contain qualitative and quantitative biological criteria—for example, substances shall not be present in concentrations that will result in a dominance of nuisance species, and there is a maximum allowable degradation of biological integrity. The state has developed procedures for assessing biological communities in streams and lakes, defining relevant ecoregions, and identifying relatively pristine reference sites. Florida has also developed and implemented the toughest standards for phosphate loading in the country, at 10 ppb.

Integrity of Wetlands Resources

Table 26 summarizes the acreage of affected wetlands regulated by FDEP (since 2003) and the water management districts (since 2000).

Wetlands Management and Protection

Florida implements an independent permitting program that operates *in addition to* the federal dredge-and-fill permitting program. The state's regulatory permit program is implemented differently, depending on the location of the activity. As described below, this includes a statewide regulatory environmental resource and wetland resource permit under Part IV, Chapter 373, F.S, and a mangrove trimming and alteration program under Chapter 403, F.S., as follows:

- *In peninsular Florida (encompassing the geographic territory of four water management districts, beginning south and east of mid-Jefferson County):*

  —An Environmental Resource Permit (ERP) Program regulates virtually all alterations to the landscape, including all tidal and freshwater wetlands and other surface waters (including isolated wetlands) and uplands. The ERP addresses dredging and filling in wetlands and

[17] Wetlands owned entirely by one person other than the state are not considered waters of the state; this would include isolated wetlands owned entirely by one permit (Section 403.031[13], F.S.).
[18] Although this last designation, created in 1989, applies to Everglades and Biscayne National Parks, it has not been confirmed by the Florida legislature.

Table 26. Acreage of Affected Wetlands Regulated by FDEP (since 2003) and the Water Management Districts (since 2000)

Agency	*Wetlands Acreage*			
	Acreage Permanently Lost[3]	*Acreage Preserved*[4]	*Acreage Created*[5]	*Acreage Improved*[6]
FDEP[1]	323.9	570.9	62.8	892.1
Water Management Districts				
Northwest Florida	124.0	5,205.7	117.2	573.9
Southwest Florida	1,487.3	8,648.2	2,233.7	3,209.6
St. Johns River	6,394.7	57,381.5	1,339.4	9,033.4
South Florida	16,538.5	38,847.9	10,875.4	19,723.9
Suwannee River	24,594.4	110,621.3	14,635.8	34,133.9
Totals[2]	**49,462.8**	**221,275.4**	**29,264.3**	**67,567.0**

[1] FDEP data coverage is from February 2003 to the present. This marks the creation of the ERPce Database for tracking wetlands impacts. Previous data reported have proven to be unreliable.
[2] Data do not represent impacts from nonregulated or unpermitted activities.
[3] Wetlands that have been destroyed.
[4] Wetlands created where none existed (i.e., in uplands).
[5] Wetlands having additional protective devices placed on them (i.e., conservation easements)
[6] Poor or lesser quality jurisdictional wetlands that have been enhanced through various activities (i.e., improved hydrology; removal of exotics, re-establishment of native flora).

other surface waters, as well as stormwater runoff quality (i.e., stormwater treatment) and quantity (i.e., stormwater attenuation and flooding of other properties), including that resulting from alterations of uplands. The program regulates everything from the construction of single-family residences in wetlands, convenience stores in uplands, to dredging and filling for any purpose in wetlands and other surface waters (including maintenance dredging), to the construction of roads located in uplands and wetlands, to agricultural alterations that impede or divert the flow of surface waters. Issuance of the ERP also constitutes a water quality certification or waiver under Section 401 of the CWA, 33 U.S.C. 1341. In addition, the issuance of an ERP in coastal counties constitutes a finding of consistency under the Florida Coastal Zone Management Program under Section 307 (Coastal Zone Management Act). The ERP Program is implemented jointly by FDEP and four water management districts, in accordance with an operating agreement that identifies the respective division of responsibilities.

- *In the panhandle (encompassing the geographic territory of the Northwest Florida Water Management District, west of and including mid-Jefferson County):*

—A Wetland Resource Permit Program under Rule 62-312, F.A.C, regulates dredging and filling in all tidal and freshwater wetlands and other surface waters that are connected (by one or more natural or artificial waters) to other bays, bayous, streams, rivers, lakes, estuaries, or the Gulf of Mexico. It does not regulate dredging or filling in isolated wetlands. The issuance of a Wetland Resource Permit also constitutes a water quality certification or waiver under

Section 401 of the CWA, 33 U.S.C. 1341, and a finding of consistency under the Florida Coastal Zone Management Program under Section 307 (Coastal Zone Management Act). This program is implemented solely by FDEP.

—A separate stormwater permit program under Rule 62-25, F.A.C., regulates construction and land alterations (typically in uplands) that collect, convey, channel, hold, inhibit, or divert the movement of stormwater and that discharge into surface waters. The program only addresses the quality of water discharged from stormwater systems, not the quantity of water (i.e., it does not address flooding issues, as does the ERP Program in the rest of the state.) This program is implemented solely by FDEP, except that the city of Tallahassee has received a delegation to review and take agency action on stormwater general permits within its geographic limits (see below).

—An agricultural and dam safety program implemented by the Northwest Florida Water Management District under Rule 40A-4, F.A.C. This includes regulating the management, storage, and drainage of surface waters associated with agricultural and forestry projects. The program has jurisdiction over impacts to isolated wetlands in agricultural lands, and issuance of this permit constitutes water quality certification under Section 401 of the CWA, 33 U.S.C. 1341. The dam safety program regulates the construction, alteration, or abandonment of dams or levees utilized in nonagricultural settings.

In addition to the *regulatory* permit programs described above, activities that are located on submerged lands that are owned by the state (otherwise called sovereign submerged lands) also require a *proprietary* authorization for such use under Chapter 253, F.S. Such lands generally extend waterward from the mean high water line (of tidal waters) or the ordinary high water line (of fresh waters) both inland and out to the state's territorial limit (approximately 3 miles into the Atlantic Ocean, and 10 miles into the Gulf of Mexico). If such lands are located within certain designated Aquatic Preserves, the authorization also must meet the requirements of Chapter 25, F.S. Such authorization considers issues such as riparian rights, impacts to submerged land resources, and the preemption of other uses of the water by the public. Authorizations typically are in the form of consents of use, easements, and leases. This program is implemented jointly by FDEP and four of the state's five water management districts, in accordance with the same operating agreement that governs the ERP Program. The program is structured so that applicants who do not qualify at the time of the permit application for both the regulatory permit and the proprietary authorization cannot receive either a permit or authorization.

Although each FDEP and water management district office has its own enforcement officers, the public reports many violations. Public education occurs through several state pamphlets and documents, technical and regulatory workshops, and newspaper coverage. The press has done a good job of reporting on wetlands issues.

As discussed above, Florida uses its own methodology (Rule 62-340, F.A.C.), rather than the federal methodology, to define the boundaries of wetlands and other surface waters. This approach, designed specifically for Florida wetlands communities, determines the landward extent of wetlands and other surface waters. It applies to both isolated and contiguous wetlands, with some exceptions in northwest Florida, and must be used by all local, state, and regional governments.

Numerous programs are working to restore both freshwater and estuarine wetlands—most notably the Everglades system. Over 60,000 acres of filtration marshes, known as stormwater treatment areas, are being built to reduce the phosphorus in agricultural runoff entering the Everglades.

Comprehensive mapping is essential to assessing the extent of Florida's wetlands and how human activities affect them. Both the U. S. Fish and Wildlife Service and the FWCC have mapped wetlands in Tampa Bay, and Sarasota Bay. In addition, FDEP continues to develop its GIS capabilities to track the wetlands management program.

Land acquisition is crucial to wetlands preservation. The state has bought wetlands and other environmentally sensitive lands since 1963, mainly through the Florida Forever and Conservation and Recreation Lands (CARL) Programs, administered by FDEP, and the Save Our Rivers (SOR) Program, administered by the water management districts. Both are funded primarily by the documentary stamp tax on the transfer of property. Additional funding comes from the Preservation 2000 (P-2000) Trust Fund. In addition to outright land purchases, the state and water management districts can enter into agreements where the owner retains use of the property with certain restrictions such as conservation easements, the purchase of development rights, leasebacks, and sale with reserved life estates.

Florida's five water management districts regulate agriculture and silviculture under Chapter 373, F.S. Permit applicants must show that they will not harm wetlands (including isolated wetlands) of five acres or larger. FDACS also has developed and advises the districts on agricultural and silvicultural BMPs in hardwood forested wetlands. In addition, the districts administer permits for surface water and ground water withdrawals (consumptive use permitting) under Part II, Chapter 373, F.S.

Mitigation, which is often used to offset otherwise unpermittable wetlands impacts, may include the restoration, enhancement, creation, or preservation of wetlands, other surface waters, or uplands. Prior to 2004, the recommended ranges of ratios for offsetting wetland impacts through mitigation generally ranged from 1.5:1 to 4:1 for created or restored marshes, 2:1 to 5:1 for created or restored swamps, 4:1 to 20:1 for wetlands enhancement, 10:1 to 60:1 for wetlands preservation, and 3:1 to 20:1 for uplands preservation.

In 2004, FDEP, in consultation with the water management districts, adopted a statewide Uniform Mitigation Assessment Method (UMAM) in Rule 62-345, F.A.C. All state, regional, and local agencies in the state use UMAM to determine the amount of mitigation required to offset impacts to wetlands and other surface waters. As of August 2005, the U. S. Army Corps of Engineers, Jacksonville District, also began using this method. It is used to determine the amount of functional loss caused by a proposed project, and the amount of "lift" need to offset that loss of function.

FDEP and the water management districts adopted rules governing mitigation banks in 1994 (Rule 62-342, F.A.C.). A mitigation bank is a large area set aside for enhancement, restoration, and preservation. Mitigation credits are the increase in ecological value from restoring, creating, enhancing, or preserving wetlands. Permit applicants can use mitigation credits to offset damage to wetlands functions. ***Table 27*** lists all mitigation banks in the state and the agency administering each of them.

Table 27. Mitigation Banks in Florida

Bank Name	***Administrative Agency****	***Acres***	***Potential Credits***	***Credits Released***	***Credits Used***
Bear Point	FDEP	317.00	49.80	20.00	0.10
Breakfast Point	FDEP	4,637.00	1,051.66		
Corkscrew	FDEP	635.00	351.80		
Devils Swamp	FDEP	3,049.20	526.80		
FMB	FDEP	1,582.00	847.50	847.50	646.60
FPL/EMB I	FDEP	4,124.67	424.50	382.00	219.22
FPL/EMB II	FDEP	9,026.00	1,769.53	194.60	27.90
Garcon	FDEP	337.00	172.39	77.40	2.90
Graham	FDEP	65.90	32.50	29.25	5.50
Lox	FDEP	1,264.00	641.60	299.40	194.90
LPI	FDEP	1,264.00	807.00	279.40	119.60
San Pedro	FDEP	6,748.00	1,083.00	48.80	0.00
Sand Hill Lakes	FDEP	2,155.00	298.40		
Wekiva River	FDEP	1,643.00	390.12	48.80	4.10
Big Cypress	SFWMD	1,280.00	1,001.78	593.50	197.00
Bluefield	SFWMD	2,675.00	1,240.00	558.14	109.80
Panther	SFWMD	2,788.15	934.64	653.06	404.40
Platt's Creek	SFWMD	82.40	69.51		
Reedy Creek	SFWMD	2,992.98	908.90	407.00	274.88
RG Reserve	SFWMD	638.00	32.48	2.55	0.58
Treasure Coast	SFWMD	2,545.14	1,033.43		
Barberville	SJRWMD	365.82	84.30	54.20	30.00
CGW	SJRWMD	150.00	63.10	50.50	39.35
Colbert	SJRWMD	2,604.00	718.80	268.70	201.80
East Central	SJRWMD	1,061.00	286.30	286.30	157.89
Farmton	SJRWMD	23,992.00	4,585.00	555.74	247.86
Lake Louisa	SJRWMD	1,007.00	297.90	256.30	192.89
Lake Monroe	SJRWMD	603.00	199.90	130.00	110.50
Loblolly	SJRWMD	6,246.92	2,034.30	508.58	115.26
Longleaf	SJRWMD	3,020.70	813.80	105.54	15.60
Mary A	SJRWMD	2,068.50	1,252.80	302.90	85.74
NE Florida	SJRWMD	779.00	407.30	400.00	376.95
Port Orange	SJRWMD	5,719.00	1,176.30	237.90	48.70
Sundew	SJRWMD	2,107.10	698.30	81.80	70.63
TM-Econ	SJRWMD	5,198.90	1,568.60	350.46	66.20
Toso	SJRWMD	1,312.00	185.00	153.10	151.70
Tupelo	SJRWMD	1,524.80	459.70	132.20	127.73

Bank Name	***Administrative Agency****	***Acres***	***Potential Credits***	***Credits Released***	***Credits Used***
Boran	SWFWMD	236.76	108.59	70.24	32.10
Clear Springs	SWFWMD	1,168.00	438.00		
Myakka	SWFWMD	380.00	224.60		
Tampa Bay	SWFWMD	161.23	111.55		
The following banks have released all available credits and are closed:					
Wetlandsbank	SFWMD	420.00	370.00	367.37	367.37
Split Oak	SFWMD	1,049.00	206.50	88.80	88.80

* SFWMD – South Florida Water Management District.
SJRWMD – St. Johns River Water Management District.
SWFWMD – Southwest Florida Water Management District.

CHAPTER 4: GROUND WATER MONITORING AND ASSESSMENT

Summary of Ground Water Monitoring Programs

The quality of ground water is of foremost concern in Florida, because ground water is so heavily used as a potable water source and because ground water inputs into surface water systems are so important. Over the years, ground water quality monitoring has been incorporated into several programs. The programs pertinent to this report are discussed below and summarized in ***Table 28.***

Table 28. Summary of Ground Water Monitoring Programs and Data Sources

Monitoring Network or Program	*Period*	*Description*
FDEP-maintained Monitoring Networks		
Status Network	1999–ongoing	Statewide probabilistic sampling network of over 1,100 water wells per cycle. Probabilistic sampling occurs over the 5-year basin rotation schedule. Sample locations are randomly selected from a list frame of wells with samples collected from 30 wells from unconfined and 30 confined aquifers in a given basin. Data to characterize water quality on a basinwide scale, and parameters monitored correspond with those targeted in surface water evaluations.
Background Network and Temporal Variability (TV) Subnetwork	1985–99	Statewide network of 1,600 water wells and monitoring wells to spatially monitor general background water quality of local aquifers (surficial, intermediate, and Floridan). On average, each well was sampled once every 3 years for an extensive list of analytes. TV network well sampled monthly to quarterly.
Ground Water Temporal Variability (GWTV) Subnetwork	1999–ongoing	Current temporal network consists of 46 wells statewide. Designed to help correlate Status Network results with seasonal hydrological variations, estimate temporal variance of analytes.
Very Intense Study Area (VISA) Network	1989–99	Network monitored the effects of land uses on ground water quality in 23 selected areas of the state. Individual VISAs consisted of approximately 20 wells sampled 3 times over an 11-year period. Sampled for a targeted list of analytes..
Programs That Include Potable Ground Water Sampling		
Public Water System (PWS) Monitoring	1975–Ongoing	Per Rule 62-550, F.A.C., all public water systems are required to monitor and report water quality at regular intervals within their Compliance Cycle. Ground water is the primary source of potable water in the state.
FDOH/FDEP Water Supply Restoration Program (WSRP)–Private Well Sampling Program	Ongoing	Private well data collected in investigations of potential ground water contamination, maintained in an FDEP WSRP database. Parameter list is variable, depending on contaminants of concern.
Monitoring of discharges to ground water	Ongoing	Per Rule 62-522, F.A.C., facilities discharging to ground water are required to implement a ground water monitoring plan and report those results to FDEP.

FDEP-maintained Ground Water and Springs Monitoring Programs

FDEP established a ground water quality monitoring network in 1984, under the authority and direction of the 1983 Water Quality Assurance Act. From 1984 to1999, the Background Network was maintained to establish the background and baseline ground water quality of major aquifer systems in Florida. In 1999, FDEP initiated a probabilistic sampling Status Network to assess ground water and surface water quality on a basinwide scale. This sampling has been integrated into the agency's watershed management approach. Thus the ground water assessment has been conducted using the 29 surface water basins discussed in Chapter 2. The first round of sampling was initiated in 2000, and over 1,100 wells are evaluated in each basin management cycle.

Monitoring results for the Ground Water Temporal Variability Network, which also began in 1999, are used to assess seasonal and long-term variability in ground water quality. Other, historical monitoring efforts include the Background Network, the Very Intense Study Area (VISA) Network, and FDOH's Private Water Well Quality Survey.

This report used the Status, Background, and VISA monitoring data to evaluate overall ground water quality, potential contaminants of concern, and ground water parameters of particular concern that may influence receiving surface waters.

FDEP established a springs monitoring network as part of the Florida Springs Initiative. Beginning in 2000, this initially included quarterly monitoring at each of the state's first-magnitude springs but has since expanded to include important second-magnitude springs as well. In this report, Springs Initiative monitoring data are evaluated to identify spring water quality trends and issues of concern.

Potable Water Monitoring by FDOH/FDEP Water Supply Restoration Program

Contaminated drinking water wells are identified through the sampling efforts of the local county public health units, supported by FDEP funding. To optimize resources, wells are sampled in areas of known or suspected contamination, such as agricultural areas, areas of known offsite contamination near regulated facilities, landfills, or near underground storage tanks.

The State Underground Petroleum Environmental Response (SUPER) Act program at FDOH concentrates its efforts in areas suspected to have petroleum-related contamination and targets drinking water wells near known storage tanks for sampling.

fertilizers, and contamination from solvents and metals. The program is a cooperative effort between FDOH, the county public health units, and FDEP. FDEP funds the program through a contract with FDOH, and FDOH directs the sampling effort by the local public health units.
In this report, the WSRP database maintained by FDEP was used in the evaluation of the ground water contaminants of concern identified in private drinking water wells. The database currently has water quality records for approximately 44,000 private wells. A caveat to their use in this evaluation is that these wells are not evenly distributed because they were sampled in areas of known or suspected contamination. Thus, the number of detections in a particular basin can be misleading because results may depend on well density and distribution in relationship relative to a given problem area.

Public Water System (PWS) Monitoring

Approximately 5,000 public water systems in Florida rely on ground water. These are served by nearly 11,000 wells. Rule 62-550, F.A.C., sets the drinking water standards, monitoring requirements, and treatment techniques to be met by public water systems and the testing protocol required for certified laboratories. The ultimate concern of the public water system supervision program is the quality of water for human consumption when the water reaches consumers, and so public water system monitoring involves the direct sampling of wells in some instances; however, water quality results also include samples from various entry points into the water system, may include treated water, and for some parameters may include composite samples.

The monitoring framework for public water systems is a nine-year compliance cycle containing specific monitoring requirements for individual parameter groups and specific actions based on the detection of parameters above action limits or maximum contaminant levels (MCLs). Water quality data in the PWS database are reported by system (PWS ID#). While individual sample results collected for this report may exceed an action level or MCL, that exceedance does not necessarily translate directly into a violation of water delivered to the consumer (1) because of the compositing or blending of water mentioned above, or (2) because averaging with subsequent samples was below the action level or MCL.

Water quality data in the PWS dataset were used in the evaluation of regional and statewide contaminants of concern, with the data reported by PWS ID#. To do so, water systems were associated with basins using the locations of their supply wells. Since a given PWS can have from one to tens of wells, it was assigned to the basin that contained most of its wells. Water quality data in the PWS database are not easily associated with individual wells, since the data may be representative of one well or multiple wells, depending on the parameter and sampling schedule (as outlined in Rule 62-550, F.A.C.). An additional consideration in interpreting data from this database is that the higher numbers of wells per water system occur in the most densely populated areas of the state. In less populated areas, each water system may rely on only one well. Regardless of well number, MCL exceedances are counted by system, and those with more of fewer wells were not weighted differently in the analysis of contaminants of concern.

Monitoring of Discharges to Ground Water

FDEP implements a comprehensive ground water quality protection program that regulates discharges to ground water. The program establishes ground water quality standards and classifications and permitting criteria. Within several FDEP rules there are construction and operation requirements, minimum setbacks, and ground water monitoring criteria.

Most permitted discharges to ground water are required to submit and implement a ground water monitoring plan showing the location of the proposed upgradient and downgradient monitoring wells, construction details, and a ground water sampling and analysis protocol. At a minimum, these plans require three monitoring wells: a background well, an intermediate well, and a compliance well. These wells are generally sampled quarterly, and the analysis is submitted to FDEP to ensure compliance with Florida's ground water standards.

Summary of Ground Water Quality

Overall Ground Water Quality

FDEP has been monitoring ambient ground water quality since 1986 as part of the Status, Background, and VISA monitoring networks. A subset of these data, representing aquifers that are most commonly used for potable supply, was compiled for this statewide assessment of the overall quality of ground water based on primary ground water MCLs. The data were sorted into analyte groups, and an "indicator" analyte was selected to determine ground water quality for wells in each of the basins. The groups (coliforms, nitrates, primary metals, organics [all categories], and radioisotopes) represent the most common threats to drinking water noted by the EPA in national surveys. **Appendix B** describes the ground water indicators used.

The wells used in this statewide evaluation of overall ground water quality are of all types, including private, public, monitoring, and, less commonly, agricultural irrigation wells, that represent the basin's most predominant aquifers used for potable supply. These data indicate general basin-scale or statewide conditions and do not represent local conditions. They generally represent ambient ground water quality, although a small number of upgradient facility wells are included. While there may be data sufficiency issues for some basins and analytes, it is assumed for the purposes of this analysis that the water quality in these wells provides a reasonable representation of overall ground water conditions.

Calculations were made to determine the portion of each basin's area that had suitable coverage by wells. The total basin area sampled for ground water conditions was estimated by assuming that each well represented one square mile of the aquifer's ground water. These data were then added to estimate the areal extent (by percent) of the state's aquifers that are typically used for potable supply ***(Table 29).*** **Appendix G** provides details of the summary that include counts for each basin, plus the MCLs for the analytes of interest.

Table 29. Indicator Analytes and Overall Ground Water Quality in Florida's Aquifers

Indicator Analyte	***STATEWIDE POTABLE AQUIFERS (SAMPLED 1986–2005)***	***GROUP 1 BASINS ALL AQUIFERS (SAMPLED 2004)***
	ALL NETWORKS AND ALL BASINS	***GROUP 1 BASINS ONLY***
	Ground Water Meeting Designated Use for Potable Supply in Primary Use Aquifer (%); Normalized for Basin Area	***Ground Water Meeting Designated Use in Confined (C) and Unconfined (U) Aquifer***
Metals, Highest % MCL	74.0% as lead[1]	94.9%(C); 96.9%(U)
Metals, Arsenic	96.1%	97.7%(C); 93.4%(U)
Total Coliform	77.2%	88.5%(C); 79.0%(U)
Organics	92.5% (combined)	Not assessed
Nitrates	99.3%	100%(C); 99.7%(U)
Gross Alpha, Total	94.1%	Not assessed
Saline Water	90.8% as sodium	75.1%(C); 92.7%(U)

Notes:
– The estimates in ***Table 29*** may change as more ground water data become available.
– Maximum value per well was used to produce a conservative assessment with equal representation from wells.
– Detection limits for some of the historical data may have been higher than current laboratory method detection limits.
– All values below the detection limit were consistently used at half the laboratory method detection limit. In some cases, this may slightly affect the number of MCL exceedances.
– There are many metals and organic compounds that have ground water standards. When all metals or organics were assessed, the value used represents the metal or organic compound with the highest number of samples exceeding its MCL. When there were no MCL exceedances, the metal or organic compound that was sampled most was used for calculations.

[1] For metals, the greatest number of MCL exceedances was for lead. However, older lead data are suspect due to well/plumbing materials and quality assurance issues with sampling.

In ***Table 29,*** the results from the statewide assessment are compared with the Group 1 probabilistic network's results***.*** The Status Network is the current ground water monitoring program that uses a rotating-basin, probabilistic monitoring design to estimate water quality across the entire state, based on a representative subsample of water resource types. Currently only the Group 1 basins (Everglades West Coast, Ocklawaha, Ochlockonee–St. Marks, Okeechobee, Suwannee, and Tampa Bay) have available ground water data. The probabilistic monitoring design includes data from 30 wells from confined aquifers and 30 wells from unconfined aquifers for each of these basins (the primary use aquifers in the statewide results may be either confined or unconfined, depending on location). ***Tables 31*** and ***32*** present the probabilistic network data for these six basins. ***Table 30*** contains a legend for the terms used in the tables.

Table 30: Legend for Terms Used in Tables 30 and 31

Term	***Explanation***
Basin	Reporting unit for which attainment results are reported
Target Population	Estimate of actual extent of resource from which attainment results were calculated. Excludes % of resource that was determined to not fit definition of resource
Sampleable	Estimate of extent of resource that staff would have been able to sample during index period
Inaccessible	Estimate of extent of resource that was inaccessible due to safety concerns and owner denials
Dry	Estimate of extent of resource that was dry during the index period and therefore could not be sampled
% Attaining	% of estimate of extent of resource that attains a specific indicator's criterion value
95% Confidence Bounds (% Attaining)	Upper and lower bounds for 95% confidence of % attaining for a specific indicator's criterion value
% Not Attaining	% of estimate of extent of resource that does not attain a specific indicator's criterion value
Assessment Period	Duration of probabilistic survey's sampling event

Table 31. Attainment Results Calculated Using Probabilistic Monitoring Designs, Confined Aquifers, Group 1

Status Network, measured by number of wells in list frame
Designated Use: Primary Drinking Water Standards

Basin	Target Population	Sampleable	Inaccessible	Number of Samples	Indicator	% Attaining	95% Confidence Bounds (% Attaining)	% Not Attaining	Assessment Period
NWFWMD1 Ochlockonee–St. Marks	1,600	1,024	576	30	Arsenic	92.9	84.5 - 100.0	7.1	January–March 2004
				30	Cadmium	100.0	100.0	0.0	
				30	Chromium	100.0	100.0	0.0	
				30	Lead	100.0	100.0	0.0	
				30	Nitrate-Nitrite	100.0	100.0	0.0	
				30	Sodium	97.9	94.3 - 100.0	2.1	
				30	Fluoride	100.0	100.0	0.0	
				30	Total Coliform	87.4	72.2 - 100.0	12.6	
SFWMD1 Everglades–West Coast	80	63	17	30	Arsenic	96.5	90.7 - 100.0	3.5	January–March 2004
				30	Cadmium	100.0	100.0	0	
				30	Chromium	100.0	100.0	0	
				30	Lead	74.5	61.8 - 87.1	25.5	
				30	Nitrate-Nitrite	100.0	100.0	0	
				30	Sodium	59.5	43.0 - 76.0	40.5	
				30	Fluoride	100.0	100.0	0	
				30	Total Coliform	73.6	58.9 - 88.2	26.4	
SFWMD6 Lake Okeechobee	8	4	4	4	Arsenic	100.0	100.0	0	January–March 2004
				4	Cadmium	100.0	100.0	0	
				4	Chromium	100.0	100.0	0	
				4	Lead	100.0	100.0	0	
				4	Nitrate-Nitrite	100.0	100.0	0	
				4	Sodium	23.3	0.0 - 62.1	76.7	
				4	Fluoride	100.0	100.0	0	
				4	Total Coliform	100.0	100.0	0	
SJRWMD1 Ocklawaha	167	116	51	30	Arsenic	100.0	100.0	0	January–March 2004
				30	Cadmium	100.0	100.0	0	
				30	Chromium	100.0	100.0	0	
				30	Lead	100.0	100.0	0	
				30	Nitrate-Nitrite	100.0	100.0	0	
				30	Sodium	96.9	91.7 - 100.0	3.1	
				30	Fluoride	100.0	100.0	0	
				30	Total Coliform	83.2	71.9 - 94.5	16.8	

Basin	Target Population	Sampleable	Inaccessible	Number of Samples	Indicator	% Attaining	95% Confidence Bounds (% Attaining)	% Not Attaining	Assessment Period
SRWMD1 Suwannee	376	260	116	30	Arsenic	100.0	100.0	0	January–March 2004
				30	Cadmium	100.0	100.0	0	
				30	Chromium	100.0	100.0	0	
				30	Lead	95.1	86.7 - 100.0	4.9	
				30	Nitrate-Nitrite	100.0	100.0	0	
				30	Sodium	100.0	100.0	0	
				30	Fluoride	100.0	100.0	0	
				30	Total Coliform	100.0	100.0	0	
SWFWMD1 Tampa Bay	113	72	41	30	Arsenic	96.9	91.8 - 100.0	3.1	January–March 2004
				30	Cadmium	100.0	100.0	0	
				30	Chromium	100.0	100.0	0	
				30	Lead	100.0	100.0	0	
				30	Nitrate-Nitrite	100.0	100.0	0	
				30	Sodium	72.8	59.4 - 86.3	27.2	
				30	Fluoride	97.6	93.6 - 100.0	2.4	
				30	Total Coliform	86.6	75.1 - 98.0	13.4	
Summary of All Group 1 Basins	2,344	1,539	805	154	Arsenic	94.9	89.1 - 100.0	5.1	2004
				154	Cadmium	100.0	100.0	0.0	
				154	Chromium	100.0	100.0	0.0	
				154	Lead	98.3	96.9 - 99.8	1.7	
				154	Nitrate-Nitrite	100.0	100.0	0.0	
				154	Sodium	95.4	92.7 - 98.0	4.6	
				154	Fluoride	99.9	99.7 - 100.0	0.1	
				154	Total Coliform	88.7	78.2 - 99.1	11.3	

Table 32. Attainment Results Calculated Using Probabilistic Monitoring Designs, Unconfined Aquifers, Group 1

Status Network, measured by number of wells in list frame

Designated Use: Primary Drinking Water Standards

Basin	*Target Population*	*Sampleable*	*Inaccessible*	*Number of Samples*	*Indicator*	*% Attaining*	*95% Confidence Bounds (% Attaining)*	*% Not Attaining*	*Assessment Period*
NWFWMD1 Ochlockonee–St. Marks	542	303	239	30	Arsenic	100.0	100.0	0	June–July 2004
				30	Cadmium	100.0	100.0	0	
				30	Chromium	100.0	100.0	0	
				30	Lead	100.0	100.0	0	
				30	Nitrate-Nitrite	100.0	100.0	0	
				30	Sodium	100.0	100.0	0	
				30	Fluoride	100.0	100.0	0	
				30	Total Coliform	55.1	28.2 - 82.0	44.9	
SFWMD1 Everglades–West Coast	240	133	107	30	Arsenic	82.8	65.2 - 100.0	17.2	April–May 2004
				30	Cadmium	100.0	100.0	0	
				30	Chromium	100.0	100.0	0	
				30	Lead	100.0	100.0	0	
				30	Nitrate-Nitrite	100.0	100.0	0	
				30	Sodium	80.2	61.8 - 98.6	19.8	
				30	Fluoride	100.0	100.0	0	
				30	Total Coliform	89.8	82.4 - 97.1	10.2	
SFWMD6 Lake Okeechobee	103	74	29	30	Arsenic	100.0	100.0	0	April–May 2004
				30	Cadmium	100.0	100.0	0	
				30	Chromium	100.0	100.0	0	
				30	Lead	97.4	92.9 - 100.0	2.6	
				30	Nitrate-Nitrite	100.0	100.0	0	
				30	Sodium	84.7	72.8 - 96.6	15.3	
				30	Fluoride	100.0	100.0	0	
				30	Total Coliform	94.7	88.4 - 100.0	5.3	
SJRWMD1 Ocklawaha	273	115	158	30	Arsenic	92.1	82.8 - 100.0	7.9	April–May 2004
				30	Cadmium	100.0	100.0	0	
				30	Chromium	100.0	100.0	0	
				30	Lead	90.0	77.7 - 100.0	10.0	
				30	Nitrate-Nitrite	100.0	100.0	0	
				30	Sodium	100.0	100.0	0	
				30	Fluoride	100.0	100.0	0	
				30	Total Coliform	68.9	52.0 - 85.9	31.1	

Basin	Target Population	Sampleable	Inaccessible	Number of Samples	Indicator	% Attaining	95% Confidence Bounds (% Attaining)	% Not Attaining	Assessment Period
SRWMD1 Suwannee	560	198	362	29	Arsenic	93.3	86.2 - 100.0	6.7	June–July 2004
				29	Cadmium	100.0	100.0	0	
				29	Chromium	100.0	100.0	0	
				29	Lead	100.0	100.0	0	
				30	Nitrate-Nitrite	98.4	95.7 - 100.0	1.6	
				30	Sodium	94.6	88.9 - 100.0	5.4	
				30	Fluoride	100.0	100.0	0	
				28	Total Coliform	82.1	66.2 - 98.1	17.9	
SWFWMD1 Tampa Bay	125	92	33	30	Arsenic	92.2	83.5 - 100.0	7.8	April–May 2004
				30	Cadmium	100.0	100.0	0	
				30	Chromium	100.0	100.0	0	
				30	Lead	94.0	86.4 - 100.0	6.0	
				30	Nitrate-Nitrite	100.0	100.0	0	
				30	Sodium	96.9	91.9 - 100.0	3.1	
				30	Fluoride	97.6	93.6 - 100.0	2.4	
				30	Total Coliform	83.3	71.7 - 94.9	16.7	
Summary of All Group 1 Basins	1,843	915	928	179	Arsenic	94.0	90.5 - 97.5	6.0	2004
				179	Cadmium	100.0	100.0	0.0	
				179	Chromium	100.0	100.0	0.0	
				179	Lead	98.0	96.1 - 99.9	2.0	
				180	Nitrate-Nitrite	99.5	98.7 - 100.0	0.5	
				180	Sodium	94.7	91.7 - 97.7	5.3	
				180	Fluoride	99.8	99.6 - 100.0	0.2	
				177	Total Coliform	74.0	64.4 - 83.6	26.0	

In the statewide dataset, the analyte group with the fewest wells that meet their designated use is metals, with lead being the metal with the highest frequency of MCL exceedances. ***Table G-1*** in **Appendix G** provides the ground water MCLs. Water quality results for lead can be biased by a number of conditions, such as well casing materials; sampling contamination; the use of lead weights in monitoring wells; and in-place plumbing, piping, and fixtures. The probabilistic network's data (a much more recent dataset) for the Group 1 basins show a much lower frequency of lead exceedances, which may relate to the "clean metals" sampling technique that the monitoring program instituted in recent years and the more careful selection of wells that would eliminate those with water level recorders or casing issues. Arsenic was also selected to represent the metals group because it is not typically influenced by casing materials or sampling equipment/ technique. Both sets of arsenic data are similar, with the statewide results showing that approximately 4% of the area represented by wells has MCL exceedances for arsenic.

Coliforms can commonly reflect conditions in the well rather than the aquifer when associated with well construction or inadequate maintenance issues, and so these results should also be scrutinized. They are discussed in greater detail in the discussion that follows on contaminants of concern. The statewide assessment shows that wells in approximately 23% of the state exceeded the MCL for total coliform. This is considerably lower than the Group 1 confined-aquifer median and slightly lower than the Group 1 unconfined-aquifer median.

The category of organics includes volatile organics, extractable organic compounds, and a suite of common organic-based pesticides. The detection of these compounds depends heavily on the existence of point sources or land use areas that include practices that discharge any of these contaminants over a broad area. One or more organic compound exceeded MCL(s) in about 7.5% of the state. Organics were not included in the probabilistic sampling.

Nitrate is a conservative contaminant, and detected concentrations are not typically biased by well materials or sampling technique. Elevated nitrate detections reflect the presence of nutrient sources such as fertilizers, animal waste, or domestic wastewater. According to both the statewide and Group 1 assessments, nitrates above MCLs would be a concern in less than 1% of the assessed area.

Gross Alpha data should always be qualified by noting that this laboratory method can produce false positives and negatives but is commonly used as an indicator due to the low analytical cost. According to the statewide assessment, this radionuclide is a concern in about 6% of the state. Radionuclides were not a part of the probabilistic monitoring suite for the Group 1 basins.

Sodium can be used as an indicator for saline ground water when freshwater aquifers are threatened by saltwater intrusion. The issues with salt water can be related to increased ground water usage that creates lthe upconing of mineralized ground water from deeper aquifers or seawater intrusion if wells are located in coastal areas. Saline water (as sodium) may be a concern in approximately 9% of the state, based on statewide statistics. According to the Group 1 assessment, approximately 75% of the confined-aquifer wells exceeded the MCL for sodium; however, some of these aquifers are naturally saline (particularly those in the southern part of the state).

This generalized analysis shows that overall ground water quality in the state is good, when considering these parameters. Both the statewide and Group 1–scale assessments suggest that over 90% of the aquifers assessed meet their designated use of providing potable water.

However, problems were also identified in the analysis. The following section describes the contaminants of concern in Florida and their observed occurrence in potable ground waters.

Ground Water Quality Issues and Contaminants of Concern, Including Public Health Issues

As discussed in the analysis of ambient data, the overall quality of ground water in Florida is good. However, there are ground water quality issues in specific areas. Monitoring networks, private well sampling data, and water quality data from public water systems that are served by ground water were used to develop a summary of the categories of parameters that were most frequently found at levels exceeding MCLs in potable water aquifers. These detections help shape some of the issues that pose the most significant concern to potable ground water resources. ***Figure 7*** provides a statewide summary of findings by contaminant category. ***Table 33*** provides summary information on contaminant categories in each of the state's 29 major basins. These categories include volatile organic compounds (VOCs), pesticides/synthetic organic chemicals (SOCs), nitrates (measured as total nitrate, dissolved nitrate, or nitrite+nitrate), primary metals, salinity (as measured by sodium concentrations), and radionuclides. The specific contaminants included in this evaluation have potable ground water MCLs. Although not included in the summary table, trihalomethanes and bacteria are significant contaminants affecting water supplies, and they will also be discussed in this section.

Volatile Organic Compounds

Volatile organics can be highly mobile and persistent in ground water, and incidences of ground water contamination by VOCs are widespread. ***Table 33*** summarizes the numbers of water systems or wells with above-MCL detections of VOCs that have primary drinking water MCLs in aquifers used for potable supply. The greatest numbers of public water systems with above-MCL VOC detections were in the Ocklawaha (18 systems), Middle St. Johns (16 systems), and St. Lucie–Loxahatchee (14 systems) Basins. The largest numbers of MCL exceedances in private wells were in the Tampa Bay Tributaries (338 wells), Southeast Coast-Biscayne Bay (174 wells), and Middle St. Johns (100 wells) Basins. The greatest number of state monitoring wells with above-MCL VOC detections (primarily from the VISA Network) occurred in the Pensacola (46 wells) Basin.

Benzene was the compound that most frequently exceeded MCLs in each of the three sets of water quality data. Trichloroethene (TCE) was the second most frequently detected compound above MCLs in the PWS and WSRP datasets, closely followed by tetrachloroethene (PCE, which was second most frequently detected in the state monitoring networks). Other compounds with primary MCLs that were detected included vinyl chloride, dichloromethane, 1,1-dichloroethene, 1,2-dichloroethane, and carbon tetrachloride (in PWS systems only). The most frequently repeated detections in public water systems occurred in the basins of southeastern Florida, with the primary compounds being vinyl chloride and TCE.

Figure 7. Statewide Summary of Contaminants of Concern in Potable Ground Water Sources

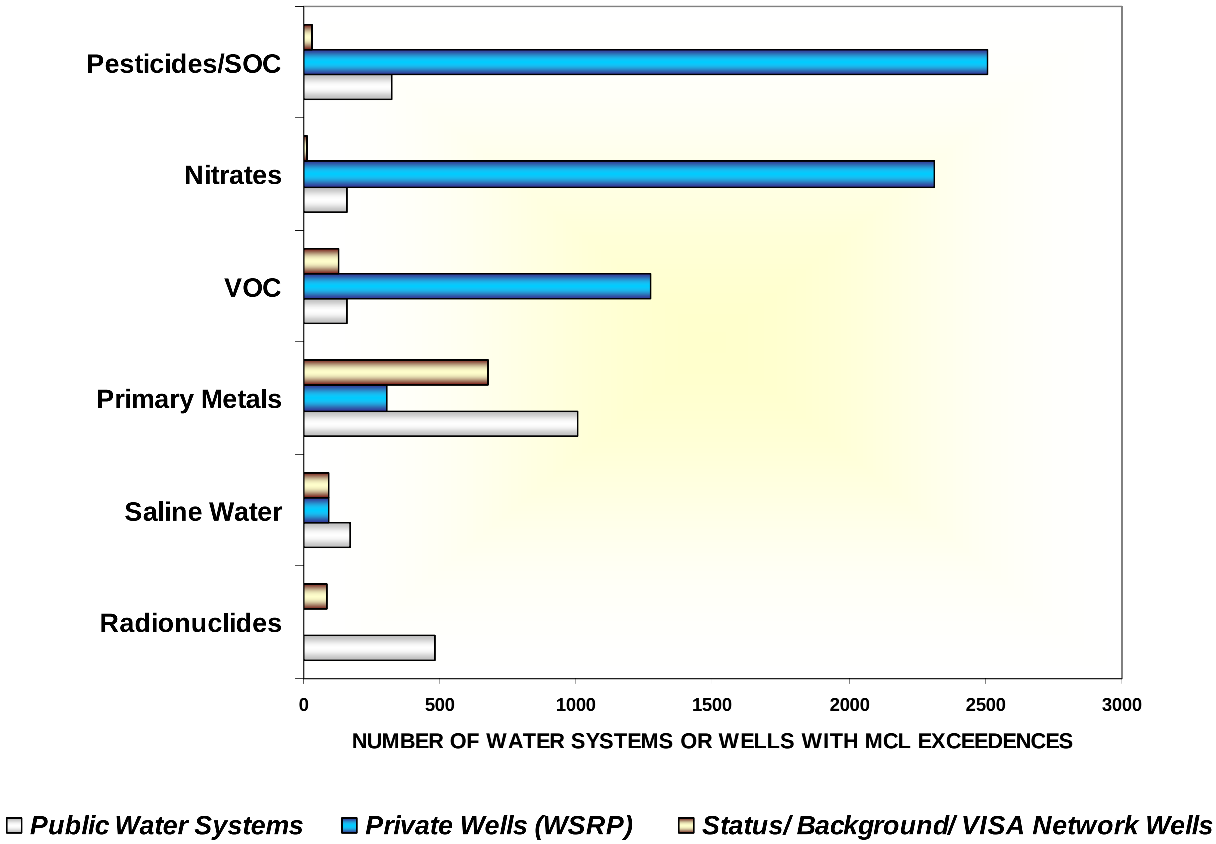


Table 33. Summary of Contaminants of Concern for Aquifers Used as Potable Water Sources

Basin—Aquifer	Contaminant Categories and Number of Wells or Water Systems with Samples that Have Exceeded Primary Standards								
	VOCs[1]			Pesticides/SOCs[2]			Nitrates[3]		
	Public Water Systems[7]	Private Wells (WSRP)[8]	Status/ Background/ VISA Network Wells	Public Water Systems[7]	Private Wells (WSRP)[8]	Status/ Background/ VISA Network Wells	Public Water Systems[7]	Private Wells (WSRP)[8]	Status/ Background/ VISA Network Wells
Apalachicola–Chipola—Floridan Aquifer	2	4		4	658			31	
Caloosahatchee—Surficial Aquifer	7	3	1	9	6		1		
Charlotte Harbor—Floridan Aquifer (SW)	1	25	3	4					
Choctawhatchee–St. Andrew—Floridan Aquifer	6	30	1	5	19			2	1
Everglades—Surficial Aquifer (SW)									
Everglades West Coast—Surficial Aquifer			2	9					
Fisheating Creek—Surficial Aquifer		2		1	2		2	5	
Florida Keys—None		1							
Indian River Lagoon—Floridan and Surficial Aquifers		7		7			3		
Kissimmee River—Floridan, Intermediate, and Surficial Aquifers	7	21	10	22	776	1	8	1,081	6
Lake Okeechobee—Surficial Aquifer (SW)	2	2					1		
Lake Worth Lagoon–Palm Beach Coast—Surficial Aquifer	10	42	8	5	4	10			
Lower St. Johns—Floridan Aquifer	7	89	1	4	17	5	5	29	
Middle St. Johns—Floridan Aquifer	16	100		21	119	4	16	36	1
Nassau–St. Marys—Floridan Aquifer	1	12	1				1	1	
Ochlockonee–St. Marks—Floridan Aquifer	2	22	2	2	1		1	10	
Ocklawaha—Floridan Aquifer	17	90		52	471		14	428	
Pensacola—Sand-and-Gravel Aquifer	8	11	46	1	2		2	2	3
Perdido—Sand-and-Gravel Aquifer	2	2	7					1	
Sarasota Bay–Peace–Myakka—Floridan and Surficial Aquifers	6	45	5	37	247		12	376	2
Southeast Coast–Biscayne Bay---Biscayne Aquifer	6	174	7	7	4	7	8	7	
Springs Coast—Floridan Aquifer	11	17	4	8	9		9	11	
St. Lucie–Loxahatchee—Surficial Aquifer	13	98		22	0		2	2	
Suwannee—Floridan Aquifer	7	43		2	59		6	126	
Tampa Bay—Floridan Aquifer	5	64		8	31		3	15	
Tampa Bay Tributaries—Floridan Aquifer	8	338	6	16	20		43	101	
Upper East Coast—Floridan Aquifer and Surficial Aquifer	1	2		3			5		
Upper St. Johns—Floridan Aquifer and Surficial Aquifer	2	4	3	2					
Withlacoochee—Floridan Aquifer	8	26	1	32	69		7	54	
STATEWIDE SUMMARY—All results	**155**	**1,274**	**108**	**283**	**2,514**	**27**	**149**	**2,318**	**13**

Notes:

1 Systems or wells with samples that exceeded MCLs for volatile organic compounds, excluding trihalomethanes and ethylene dibromide.

2 Systems or wells with samples that exceeded MCLs for pesticides (also known as synthetic organic chemicals, or SOCs).

3 Systems or wells with samples that exceeded MCLs for nitrate or nitrate+nitrite.

4 Systems or wells with samples that exceeded MCLs for primary metals.

5 Systems or wells with samples that exceeded MCL for sodium, an indicator of salinity.

6 Systems or wells with samples that exceeded MCL for radionuclides; measured as radon 226, radon 228, gross Alpha, and/or gross Beta.

7 PWS data not restricted to wells only. Some parameter results may be for other entry points into a system, composite samples, or treated water. Data are from systems that that operate their own wells. While individual sample results collected for this report may exceed an action level or MCL, that exceedance does not necessarily translate directly into a violation of water delivered to the consumer (1) because of the compositing or blending of water mentioned above, or (2) because averaging with subsequent samples was below the action level or MCL.

8 Private well sampling under the WSRP is targeted sampling conducted in areas of suspected contamination, and the parameters analyzed are specific to contaminants of concern.

Table 33 (continued). Ground Water Contaminants of Concern in Aquifers Used as Potable Water Sources

Basin—Aquifer	*Contaminant Categories and Number of Wells or Water Systems with Samples that Have Exceeded Primary Standards*								
	Primary Metals[4]			*Saline Water[5]*			*Radionuclides[6]*		
	Public Water Systems[7]	*Private Wells (WSRP)[8]*	*Status/ Background/ VISA Network Wells*	*Public Water Systems[7]*	*Private Wells (WSRP)[8]*	*Status/ Background/ VISA Network Wells*	*Public Water Systems[7]*	*Private Wells (WSRP)[8]*	*Status/ Background/ VISA Network Wells*
Apalachicola–Chipola—Floridan Aquifer	26	39	9	2			5		
Caloosahatchee—Surficial Aquifer	11		13	13		3	15		3
Charlotte Harbor—Floridan Aquifer	12		1	7	2	5	12		4
Choctawhatchee–St. Andrew—Floridan Aquifer	35		6	5			7		
Everglades—Surficial Aquifer	3		2	6					
Everglades West Coast—Surficial Aquifer	10		27	12		7	8		3
Fisheating Creek—Surficial Aquifer	1		2			2	2		
Florida Keys—None			2	1			1		
Indian River Lagoon—Floridan and Surficial Aquifers	26	3	8	18	9	2	10		1
Kissimmee River—Floridan, Intermediate, and Surficial Aquifers	52	2	41	4		4	29		4
Lake Okeechobee—Surficial Aquifer	6		1			1	5		
Lake Worth Lagoon–Palm Beach Coast—Surficial Aquifer	40	1	17	16	1		9		
Lower St. Johns—Floridan Aquifer	79	51	23	10	9	5	8		3
Middle St. Johns—Floridan Aquifer	53	1	44	5	15	8	14		3
Nassau–St. Marys—Floridan Aquifer	17	1	3	1			1		
Ochlockonee–St. Marks—Floridan Aquifer	19	3	18			1	11		1
Ocklawaha—Floridan Aquifer	122	51	31	4		1	7		3
Pensacola—Sand-and-Gravel Aquifer	29	1	57	3			21		17
Perdido—Sand-and-Gravel Aquifer	1	1	12	1					6
Sarasota Bay–Peace–Myakka—Floridan and Surficial Aquifers	79	4	54	18	11	3	108		
Southeast Coast–Biscayne Bay–Biscayne Aquifer	33	24	98	5	2	7	7		2
Springs Coast—Floridan Aquifer	46	22	20	6	7	6	8		
St. Lucie–Loxahatchee—Surficial Aquifer	44	1	16	21	2	3	6		1
Suwannee—Floridan Aquifer	32	25	2	2	2		9		
Tampa Bay—Floridan Aquifer	39	12	12	7	14	10	19		
Tampa Bay Tributaries—Floridan Aquifer	111	50	21	5	7		53	14	
Upper East Coast—Floridan Aquifer and Surficial Aquifer	12	2	24	6	8	7	5		1
Upper St. Johns—Floridan Aquifer and Surficial Aquifer	8		18	5		5	2		
Withlacoochee—Floridan Aquifer	87	10	19	1	1		11		
STATEWIDE SUMMARY—All results	**1,033**	**304**	**601**	**184**	**90**	**80**	**393**	**14**	**52**

Notes:

1 Systems or wells with samples that exceeded MCLs for volatile organic compounds, excluding trihalomethanes and ethylene dibromide.

2 Systems or wells with samples that exceeded MCLs for pesticides (also known as synthetic organic chemicals).

3 Systems or wells with samples that exceeded MCLs for nitrate or nitrate+nitrite.

4 Systems or wells with samples that exceeded MCLs for primary metals.

5 Systems or wells with samples that exceeded MCL for sodium, an indicator of salinity.

6 Systems or wells with samples that exceeded MCL for radionuclides; measured as radon 226, radon 228, gross Alpha, and/or gross Beta.

7 PWS data not restricted to wells only. Some parameter results may be for other entry points into a system, composite samples, or treated water. Data are from systems that that operate their own wells. While individual sample results collected for this report may exceed an action level or MCL, that exceedance does not necessarily translate directly into a violation of water delivered to the consumer (1) because of the compositing or blending of water mentioned above, or (2) because averaging with subsequent samples was below the action level or MCL.

8 Private well sampling under the WSRP is targeted sampling conducted in areas of suspected contamination, and the parameters analyzed are specific to contaminants of concern.

Synthetic Organic Chemicals/Pesticides

For SOCs used as pesticides, the largest number of MCL exceedances in public water systems occurred in the Ocklawaha (52 systems) and Withlacoochee (36 systems) Basins. In private wells, the largest number occurred in the Kissimmee (776 wells), Apalachicola (658 wells), and Ocklawaha (471 wells) Basins. The detections of agrichemicals in private wells can provide meaningful presence/absence information and give an indication of the aquifer's vulnerability to pesticide use. The number of private well exceedances can sometimes be related to the density of homesteads (unregulated rural growth versus dense rural residential developments) and their proximity to agricultural land uses or lawn/turf care practices. ***Table 33*** shows the distribution of MCL exceedances.

The pesticides that occurred in public water systems at above-MCL concentrations were mainly detected in the mid- to late-1980s and have since been banned from use. Lindane, toxaphene, and methoxychlor were the pesticides most commonly detected at above-MCL concentrations in the 1980s, but have not appeared in the PWS database at above-MCL levels since the early 1990s. These compounds, plus heptachlor, endothal, and malathion, were mainly detected in the basins where agricultural land uses are or were prevalent. Dieldrin, another older compound, was also detected in private drinking water wells.

EDB, a nematocide used heavily in the 1980s on citrus and other croplands, was found to be highly mobile and a threat to potable ground water supplies. In response to FDEP's identification of this as an issue, FDOH conducted a comprehensive EDB sampling program in areas where it was suspected to have been applied. In 16 of the basins, this revealed numerous private drinking water wells that were contaminated by the compound, which prompted the formal delineation of ground water contamination areas. EDB was also detected in public water systems throughout the state. In the late 1980s, the use of EDB was banned. New detections of EDB seldom occur; however, some private drinking water wells continue to yield samples with detectable concentrations of EDB decades after its use was discontinued. The most recent PWS system detections of EDB above its MCL (in the late 1990s) were reported in the Tampa Bay Tributaries Basin of southwest Florida, which includes a significant agricultural area.

More recently, applied pesticides such as bromacil and alachlor were detected at levels exceeding their health advisory limits in private drinking water wells. Bromacil has a ground water guidance concentration, and alachlor has a primary MCL. Elevated detections of bromacil were found (mainly in the 1990s) in the citrus-growing area of central Florida, which includes parts of the Kissimmee, Tampa Bay Tributaries, Middle St. Johns, and Ocklawaha Basins. In the 1990s, both compounds were found (along with dieldrin) at elevated levels at numerous wells in an agricultural area of Jackson County in the Apalachicola–Chipola Basin. FDACS has since required modifications to the application of bromacil to prohibit its application from citrus areas with vulnerable soils and high leaching potential. Alachlor is now listed as a restricted use pesticide.

Nitrates

Nitrates above the MCL of 10 mg/L were detected in 156 public water systems, with the Tampa Bay Tributaries Basin having by far the greatest number (45 systems). The largest number of private wells with nitrates above the MCL were found in the Kissimmee Basin (1,081 wells), followed by the Ocklawaha (428 wells) and Sarasota Bay–Peace–Myakka (376 wells) Basins.

Several status/background/VISA wells also had nitrate above MCLs, with the largest number in the Kissimmee Basin. These are all summarized in ***Table 33***.

The basins with the highest number of above-MCL detections in water systems and wells include large citrus-growing areas or areas where citrus was previously grown on top of vulnerable aquifers. The area of the Kissimmee Basin that has the highest number of above-MCL concentrations of nitrate in private wells is the Ridge citrus area along the basin's western edge. In the early 1990s, FDACS implemented a BMP program for growers in the Ridge citrus area to use fertilizers more efficiently and reduce nitrate concentrations in ground water.

Primary Metals

Metals with primary drinking water MCLs include arsenic, barium, beryllium, cadmium, chromium, lead, mercury, nickel, and selenium. ***Table 33*** summarizes the detections of primary metals above their MCLs.

Approximately 1,000 public water systems reported one or more primary metals exceeding an MCL, which may be misleading since elevated metals in public water systems are often due to the materials containing and conveying the water and are not usually related to actual concentrations in the ground water. Metal well casings, piping, storage tanks, and plumbing fixtures, in addition to sampling techniques, often cause bias in the analysis of ground water samples for metals. Lead and cadmium are the most frequently detected metals at above-MCL concentrations in public water systems, and both metals are very frequently associated with impurities in water distribution and storage systems. Galvanized coatings on metal surfaces, paint, and lead solder are documented sources of metals contamination in water systems. The Ocklawaha (120 systems) and Tampa Bay Tributaries (107 systems) Basins have the greatest number of water systems with above-MCL detections, primarily for lead and cadmium. Results from resampling usually show that the ground water is actually not affected by these metals.

In private drinking water wells, the metals most frequently exceeding MCLs are arsenic and lead. The basins with the greatest number of exceedances are the Ocklawaha (51 wells), Lower St. Johns (51 wells) and Tampa Bay Tributaries (50 wells) Basins. Lead, again, may be an artifact of well materials, piping, or plumbing fixtures, but arsenic is not typically associated with any of these. The resampling of private water wells usually reveals that there is no actual ground water problem with lead. Samples from over 200 wells in FDEP's status/background/VISA networks exceed the MCL for lead, followed by approximately 30 wells exceeding the MCL for arsenic, and a smaller number exceeding the MCL for cadmium. Reported concentrations for metals in FDEP's networks are qualified due to the potential influence of well materials, lead water level recorder weights, and/or sampling problems.

Future monitoring will help FDEP determine the extent to which elevated metals detections actually represent ground water quality. However, for public water systems and private wells, the materials composing the water storage and distribution systems, piping, and fixtures will continue to pose a challenge to the interpretation of data for metals. Differentiating natural sources from contaminating influences is another issue. Arsenic, in particular, can on occasion exceed its MCL of 10 μg/L due to natural conditions.

Radionuclides

In Florida, most elevated radionuclide levels are due to natural conditions, but these conditions may still pose a significant health concern. Radionuclides occur naturally as trace elements in rocks and soils as a consequence of the radioactive decay of uranium-238 (U-238) and thorium-232 (Th-232). Elevated radionuclide levels occur most commonly from phosphate that is prevalent in Miocene-age clay deposits present throughout much of the state. Radionuclides measured in ground water include gross Alpha, gross Beta, radium 226, and radium 228. Gross Alpha is the most commonly measured parameter. ***Table 33*** summarizes radionuclide detections in public water systems and wells.

Public water systems in the west-central area of the state have the greatest incidence of MCL exceedances for radionuclides. The Sarasota Bay–Peace–Myakka (107 systems) Basin, followed by the Tampa Bay Tributaries (54 systems), and the Kissimmee River (30 systems) Basins lie within one of the three largest phosphate-mining areas in the world that includes large areas of Manatee, Sarasota, Polk, and Hillsborough Counties.

The Pensacola Basin also contains a number of public water systems (20) with samples that have exceeded MCLs. In addition, the basin includes a VISA monitoring area with 17 wells that exceed the MCL for gross Alpha. It also contains the Agrico Chemical Superfund site, the long-time former location of an agrichemical plant that derived phosphoric acid as well as other products. An extensive plume of ground water contamination, consisting of fluoride, nitrates, and other constituents, also has associated high radionuclide counts. In addition, other areas of the basin have elevated gross Alpha counts that could be naturally occurring or related to unknown sources.

Saline Water

The intrusion of saline water is a well-documented concern in coastal areas of the state where the wedge of salt water migrates laterally inshore as discharge from supply wells increases. In some of these coastal areas, as well as other areas that lie more inland, the upconing of brackish water from deeper zones can also be an issue. In this assessment, an exceedance of the MCL for sodium was used as an indicator of possible saline water intrusion or upwelling. ***Table 33*** summarizes these results.

Elevated sodium concentrations were noted in samples from public water systems in the St. Lucie (21 systems), Indian River Lagoon (17 systems), Sarasota Bay–Peace–Myakka (17 systems), and Lake Worth Lagoon–Palm Beach Coast (16 systems) Basins. Public drinking water supplies in the three basins on the Atlantic Coast (St. Lucie, Indian River Lagoon, and Lake Worth Lagoon) depend on the surficial aquifer system as their primary source, although the Floridan aquifer system is also used to a lesser extent in parts of the St. Lucie and Indian River Lagoon Basins. The lateral migration of sea water via the surficial aquifer system and pumpage-induced upconing from lower zones in the Floridan aquifer system can both be a concern in these two areas. In the Sarasota Bay–Peace–Myakka Basin, deeper water is highly mineralized and upcoming caused by withdrawals, particularly for irrigation water, has created concern. With the increase in population in many of these areas creating stress on potable ground water supplies, many public water utilities have looked for alternative supplies or additional treatment measures to continue providing potable water to their customers.

Trihalomethanes

Chlorination is a disinfection treatment practiced by many public water systems to remove potentially harmful bacteria. Unlike a number of states, Florida requires disinfection. Trihalomethanes (THMs) are an unfortunate byproduct of chlorinating source water that contains organic matter. Chloroform, dibromochloromethane, bromodichloromethane, and bromoform are the most common THMs found in treated water. According to the PWS database, the basins with the most significant number of THM exceedances in public water systems are located in southeastern Florida adjacent to the Everglades, a source of organic matter in shallow ground water. The surficial and Biscayne aquifers in this area are typically higher in organics than aquifers in other parts of the state. Basins with the most apparent influence by THMs include Lake Worth Lagoon–Palm Beach Coast (56 systems), St. Lucie–Loxahatchee (29 systems), and Southeast Coast–Biscayne Bay (28 systems). Many public water systems are using alternative disinfection methods (such as the use of chloramine) to reduce or eliminate the creation of THMs.

Bacteria (Coliform)

Bacteria are not typically a concern to public water systems, because the water is disinfected before distribution. However, the bacterial contamination of private wells is an ongoing issue that is addressed by FDOH. Of all water quality issues evaluated, bacterial contamination, as indicated by elevated total and/or fecal coliform counts, is the most prevalent issue in ground water samples collected from the Status Network monitoring wells. Over one-third of the basins had significant exceedances of MCLs or health advisory levels for total and/or fecal coliform, indicating potential public health issues in some of these cases. However, the significance of these findings must still be determined. High bacterial counts may be caused by improper well construction, poor hygiene at the wellhead, animal waste or septic tank issues and/or flooding, and the surface water infiltration of a water system. These considerations highlight the fact that individual well assessments are necessary, and that in many cases, bacterial contamination is localized and may not be an issue outside of the individual wells themselves.

Summary of Ground Water Contaminant Sources

The EPA's *2004 Florida Source Water Assessment* identified the top five potential sources of contamination in Florida. These are (1) underground storage tanks (not leaking); (2) gasoline service stations (including historical gas stations); (3) municipal sanitary waste treatment and disposal (commercial, domestic, and industrial waste); (4) known contamination sites/plumes (equivalent to FDEP's delineated areas); and (5) drycleaning facilities. Several of these have commonly been the focus of waste cleanup and monitoring activities in Florida. However, there are also instances where ground water has been degraded as the result of nonpoint activities. This section discusses the most significant ground water degradation sources, based on waste cleanup, monitoring, and restoration actions taken by FDEP and other agencies concerned with ground water quality.

Petroleum Facilities

FDEP's Storage Tank Contamination Monitoring (STCM) database contains information on all storage tank facilities registered with FDEP and tracked for active storage tanks, storage tank history, or petroleum cleanup activity. Currently, the STCM database lists approximately 60,000 petroleum storage facilities. Of those, almost 14,000 have documented ground water contamination by petroleum constituents. Petroleum sites and petroleum problems are concentrated in the most populated areas of the state, as well as along major transportation corridors. The main petroleum constituents found in ground water are benzene, toluene, ethylbenzene, xylenes, and methyl tert-butyl ether. Contaminants at older petroleum sites may also contain lead and EDB.

Florida has a program in place for the cleanup of petroleum-contaminated sites. The Petroleum Cleanup Program encompasses the technical oversight, management, and administrative activities necessary to prioritize, assess, and clean up sites contaminated by the discharges of petroleum and petroleum products from stationary petroleum storage systems. These sites include those determined to be eligible for state-funded cleanup using preapproval contractors designated by the property owner or responsible party and state lead contractors under direct contract with FDEP, as well as nonprogram or voluntary cleanup sites funded by responsible parties.

Drycleaning Solvent Facilities

Approximately 1,400 drycleaning facilities (mainly retail) have signed up for eligibility for contaminant cleanup under FDEP's Drycleaning Solvent Cleanup Program (DSCP) due to evidence of contamination. Of those, 200 are actively being assessed and may be under remedial action. Drycleaning solvent constituents (PCE, TCE, dichloroethenes, and vinyl chloride) are among the most mobile and persistent contaminants in the environment.

The Florida legislature has established a state-funded program, administered by FDEP, to clean up properties that are contaminated as a result of the operations of a drycleaning facility or wholesale supply facility (Chapter 376, F.S.). The statute was sponsored by the drycleaning industry to address environmental, economic, and liability issues resulting from drycleaning solvent contamination. The program limits the liability of the owner, operator, and real property owner of drycleaning or wholesale supply facilities for cleaning up drycleaning solvent contamination, if the parties meet the eligibility conditions stated in the law.

Federal and State Waste Cleanup and Monitoring Sites

The Federal Superfund Program (authorized under the Comprehensive Environmental Response Compensation and Liability Act [CERCLA]) and Florida's Hazardous Waste Site Cleanup Program were developed to provide mechanisms for addressing contamination on uncontrolled or abandoned hazardous waste sites. In the state, there are currently 68 Superfund sites on the National Priorities List (NPL) and 91 sites on Florida's Hazardous Waste Cleanup Program list. According to the EPA, 43 of the NPL sites have documented ground water contamination.

Nonpoint Sources

Degraded ground water quality is sometimes not associated with a single contaminant source, but instead may be related to multiple sources or land use practices in an area. In many cases, it is the cumulative effect of human activities through leaching from nonpoint sources of pollution such as septic tanks or fertilizer applications that creates the ground water quality problems. In many urban areas of the state, ground water (including sinkholes and permitted injection wells) receives untreated stormwater runoff from urban areas and roadways. Ground water is particularly vulnerable in areas of karst, where these discharges have a direct, unfiltered pathway to the drinking water resource. In other areas, wastewater applications, septic tank leachate, right-of-way maintenance, and residential landscaping fertilization activities can degrade ground water quality and cause potential problems in karst areas where springs discharge. Additionally, the leaching of fertilizers and pesticides from agricultural lands has had a significant impact on ground water quality. Unfortunately, the potable ground water resource in some areas dominated by agricultural activities is often susceptible to direct impacts by fertilizer and agrichemical use. The Ridge citrus area in central Florida provides an example of an area with known nitrate impacts to ground water. The citrus growers in this area are now addressing nonpoint impacts through the Agricultural Nonpoint Source Program, using voluntary fertilizer management practices as a primary BMP. This work is serving as a model for the implementation of BMPs for ground water protection from the use of fertilizers and pesticides on urban lands. These more-refined BMP programs should reduce the nutrient contamination of ground water.

Ground Water–Surface Water Interaction

Setting and Pathways

The free exchange between ground water and surface water in Florida cannot be overemphasized. As mentioned previously, spring-fed stream systems can depend almost entirely on ground water discharge. Canals can also contain mostly ground water. Other streams and lakes may receive as much as 30% to 50% of their total inflows via ground water seepage, and natural estuaries rely on ground water seepage as a significant source of fresh water. In areas where the Floridan aquifer system is near the surface, and in southern parts of the state where porous limestone exists near the surface, conduit systems in the limestone material efficiently deliver ground water to streams and canals at high rates. In other areas of the state, ground water discharge occurs as seepage from the surficial aquifer system.

Ground Water Parameters of Concern for Impaired Surface Waters

Nutrients, DO, and iron are the parameters of greatest concern identified in basin-scale evaluations of ground water influence on impaired or potentially impaired surface waters. ***Table 34*** summarizes the median concentrations of these parameters in unconfined aquifers of the state's 29 major basins. The table also compares these ground water medians with the statewide medians for surface water types.

Relatively low concentrations of nitrate and phosphorus can create nutrient imbalances in surface water and contribute to impairments. Nitrate in ground water is associated with anthropogenic sources such as atmospheric deposition, fertilizers, animal waste, and human wastewater. Elevated nitrogen concentrations are of particular concern to fragile surface water systems such as spring runs. As discussed previously, phosphorus occurs naturally throughout the state, and its natural occurrence in ground water is attributed to ground water contact with mineral phosphate in the aquifer material. It can also be derived from organic material such as peat or from phosphatic shell beds. The more common anthropogenic sources of phosphorus include fertilizers, animal waste, and domestic wastewater/residuals.

Table 34. Median Concentrations of Ground Water–Surface Water Constituents in Unconfined Aquifers

Basin	*Median Concentrations in Unconfined Aquifers[1]*			
	Nitrite+Nitrate (NO_2+NO_3- dissolved, in mg/L)	*Phosphorus (dissolved, in mg/L)*	*DO (mg/L)*	*Iron (total, in µg/L)*
Apalachicola–Chipola	0.69	0.019	6.95	180
Caloosahatchee	0.028	0.065	0.51	5,280
Charlotte Harbor	0.024	0.067	0.34	2,235
Choctawhatchee–St. Andrew Bay	0.05	0.01	2.38	1,300
Everglades	0.013	0.021	0.36	630
Everglades West Coast	0.023	0.03	0.36	2,120
Fisheating Creek	0.03	0.04	0.55	630
Florida Keys	0.017	0.03	0.2	133
Indian River Lagoon	0.125	0.43	2.91	909
Kissimmee River	0.069	0.06	0.52	648
Lake Okeechobee	0.01	0.15	0.3	620
Lake Worth Lagoon–Palm Beach Coast	0.06	0.12	0.64	877
Lower St. Johns	0.06	0.08	1.73	3,000
Middle St. Johns	0.056	0.078	1.08	4,860
Nassau–St. Marys	0.01	0.048	0.76	1,550
Ochlockonee–St. Marks	0.082	0.03	2.9	597
Ocklawaha	0.6	0.083	2.93	462
Pensacola	1.09	0.02	7.2	820
Perdido	0.245	0.03	5.6	1,150
Sarasota Bay–Peace–Myakka	0.055	0.12	0.7	3,300
Southeast Coast–Biscayne Bay	0.067	0.04	0.5	1,470
Springs Coast	0.185	0.048	1.07	2,320
St. Lucie–Loxahatchee	0.0305	0.086	0.77	1,895
Suwannee	0.14	0.06	1.6	505
Tampa Bay	0.11	0.041	0.57	1,055
Tampa Bay Tributaries	0.0655	0.036	1.44	1,600
Upper East Coast	0.037	0.1	0.49	5,905
Upper St. Johns	0.029	0.074	0.64	1,023
Withlacoochee	0.15	0.06	0.88	1,550
Statewide Median	**0.06**	**0.06**	**0.76**	**1,150**
Statewide Medians for Surface Water[2]				
Lake	**0.02**	**0.03**	**7.66**	**158**
Stream	**0.07**	**0.08**	**5.53**	**200**
Estuary	**0.01**	**0.02**	**7.2**	**NA**

Notes:
NA – Not available.

[1] Values highlighted in gray exceed medians for at least one waterbody type; values highlighted in yellow exceed medians for all surface water types.
[2] Obtained from *Typical Water Quality Values for Florida's Lakes, Streams, and Estuaries (Draft)*, May 2004. Phosphorus values for surface waters are total rather than dissolved concentrations.

Low DO is a normal characteristic of ground water. Depressed DO in springs, spring runs, spring-fed rivers, and many drainage canals is primarily or entirely attributable to ground water inflows. In instances where ground water contributions to surface waterbodies are high, low DO is a typical consequence.

Iron is another ground water constituent that occurs naturally due to the leaching of ferric iron from iron-rich clay soils and sediment. Iron in the environment also has an affinity for organic materials. Streams that are high in iron concentration typically have a high to moderate ground water component, low DO, and high dissolved organic carbon content.

Springs and Spring-related Issues

Elevated nitrates are a common and growing problem in Florida springs, with steady rises in nitrate levels observed in many Florida springs over the past 30 years (Florida Springs Task Force, 2000). Nitrate was once a very minor constituent of Florida spring water. Typical nitrate concentrations were less than 0.2 mg/L. Today many Florida springs discharge water that has more than 1.0 mg/L of nitrate nitrogen. It is believed that nitrate nitrogen levels as low as 1 mg/L or less can cause a significant shift in the balance of spring ecological communities, leading to the degradation of biological systems.

There are two main FDEP sources of data for this evaluation of Florida's springs. The majority of springs data is provided by the Springs Initiative (2001 to the present) and the Ambient Monitoring Program collected a small amount of historical data (1986 to 2000). ***Table 35*** lists these reference springs, along with median values for nitrate.

Table 35. Reference Springs and Statewide Medians for Nitrate Nitrogen

Spring	Basin	County	Spring Magnitude[1]	Total Nitrate-N Median (mg/L)
Gainer Springs Group	Choctawhatchee–St. Andrew	Bay	Combined Median	0.2
Silver Glen Springs	Middle St. Johns	Marion	1	0.05
Cypress Spring	Choctawhatchee–St. Andrew	Washington	2	0.027
Juniper Springs	Middle St. Johns	Marion	2	0.084
Washington Blue Spring (Econfina)	Choctawhatchee–St. Andrew	Washington	2	0.14
Williford Spring	Choctawhatchee–St. Andrew	Washington	2	0.075
Alexander Springs	Middle St. Johns	Lake	1	0.0505
Reference Springs	**Overall Median**			**0.08**
Statewide Springs	**Overall Median**			**0.62**
First-magnitude Springs	**Overall Median**			**0.55**

Notes:
[1] Spring magnitude based on discharge. First-magnitude (1) springs have an average discharge greater than100 cfs; second-magnitude (2) springs have an average discharge of 10 to 100 cfs.

The statewide spring data were combined and compared with the reference springs for nutrients. The period of record for statewide nitrate nitrogen data is 1985 to 2005; however, most springs only have data from 2000 to 2005. The statewide median nitrate value was over 8 times higher than the median value for reference springs; and the statewide median phosphorus value was over 1.5 times higher than reference springs. The first-magnitude springs were also compared with the reference springs and have a similar result.

The trends in water quality for springs are best analyzed by looking at the data for individual springs or groups of springs that are in close proximity and comparing them with reference springs ***(Figure 8).*** Some springs were organized by clusters or groups to increase the number of sampling events. For the empirical trend analysis in this report, only the data from the 2000 to 2005 period of monitoring implemented by the Springs Initiative were used. There could be several contributing factors to observable trends, but the overall increases in nitrate are associated with anthropogenic sources. Essentially no nitrate trends were identified in the reference springs, where the primary source of nitrate is assumed to be atmospheric deposition. Nitrate trends for most other springs, especially those springs with the highest nitrate concentrations in the state, show measurable increases.

Nitrate concentrations in spring clusters or springs that had at least 10 observations over at least 4 years were plotted over time to observe trends. The spring clusters or springs were categorized by the magnitude of the nitrate impact into 5 groups. Nitrates in Homosassa, Blue Hole (Columbia), Ichetucknee Head, and Wakulla are elevated, but there seem to be no distinct trends over the 4-year period. Nitrates were found to be trending downward only at Wacissa, St. Marks River Rise, and Spring Creek Rise. All other springs had increasing nitrate nitrogen concentrations, with Manatee, Fanning, and Jackson Blue at the highest levels.

A group of 36 springs was used to compare historical, 30-year-old nitrate data with recent quarterly sampling data. Median values were calculated for the comparison. Thirty years ago, nitrates were already a concern in Florida's springs, with nitrate concentrations in at least 44% and 61% of the springs over the thresholds of 0.45 mg/L and 0.20 mg/L, respectively.

Figure 8. Comparison of Spring Nitrate Trends

SPRING NITRATE IMPACTS (2000-2005) BY CLUSTERS

LOW (0-0.2 mg/L)	SLIGHT (>0.20-0.50 mg/L) Increasing	MODERATE (>0.50 - 1 mg/L) Increasing	VERY HIGH (>1.0 - 3.0 mg/L) Increasing	EXTREME (>3.0 - 10.0 mg/L) Increasing
ALEXANDER (REF) SILVER GLENN (REF) TARPON HOLE BIG SPRING (JEFFERSON)	HUNTER GAINER GROUP (REF)	CHASSAHOWITZKA WEEKI WACHEE VOLUSIA BLUE HOMOSASSA* BLUE HOLE (COLUMBIA)* ICHETUCKNEE HEAD* WAKULLA*	BUBBLING MADISON BLUE VOLUSIA BLUE TROY ROCK WEKIWA (ORANGE) BLUE GROTTO LAFAYETTE BLUE RECEPTION HALL DEVIL'S EAR SILVER SPRING RAINBOW	MANATEE FANNING JACKSON BLUE*

* Elevated but not increasing or decreasing

The 0.45 mg/L reflects a potential adverse impact limit based on chlorophyll growth that FDEP's Ground Water Protection Section uses in basinwide assessments of potential ground water–surface water impacts. The 0.20 mg/L threshold is considered to be a background concentration. Today the data for the same springs show about a 19% increase in the number of springs that now exceed the safe nitrate threshold and background level. At least 63% and 80.5% of the springs are now over the thresholds of 0.45 and 0.20 mg/L, respectively. Also, during this 30-year period, the combined median value for nitrate has more than doubled for these springs. ***Figures 9a*** and 9***b*** show the historical and recent median nitrate levels in Florida springs, respectively.

Figure 9a. Historical Median Nitrate Values for Florida Springs

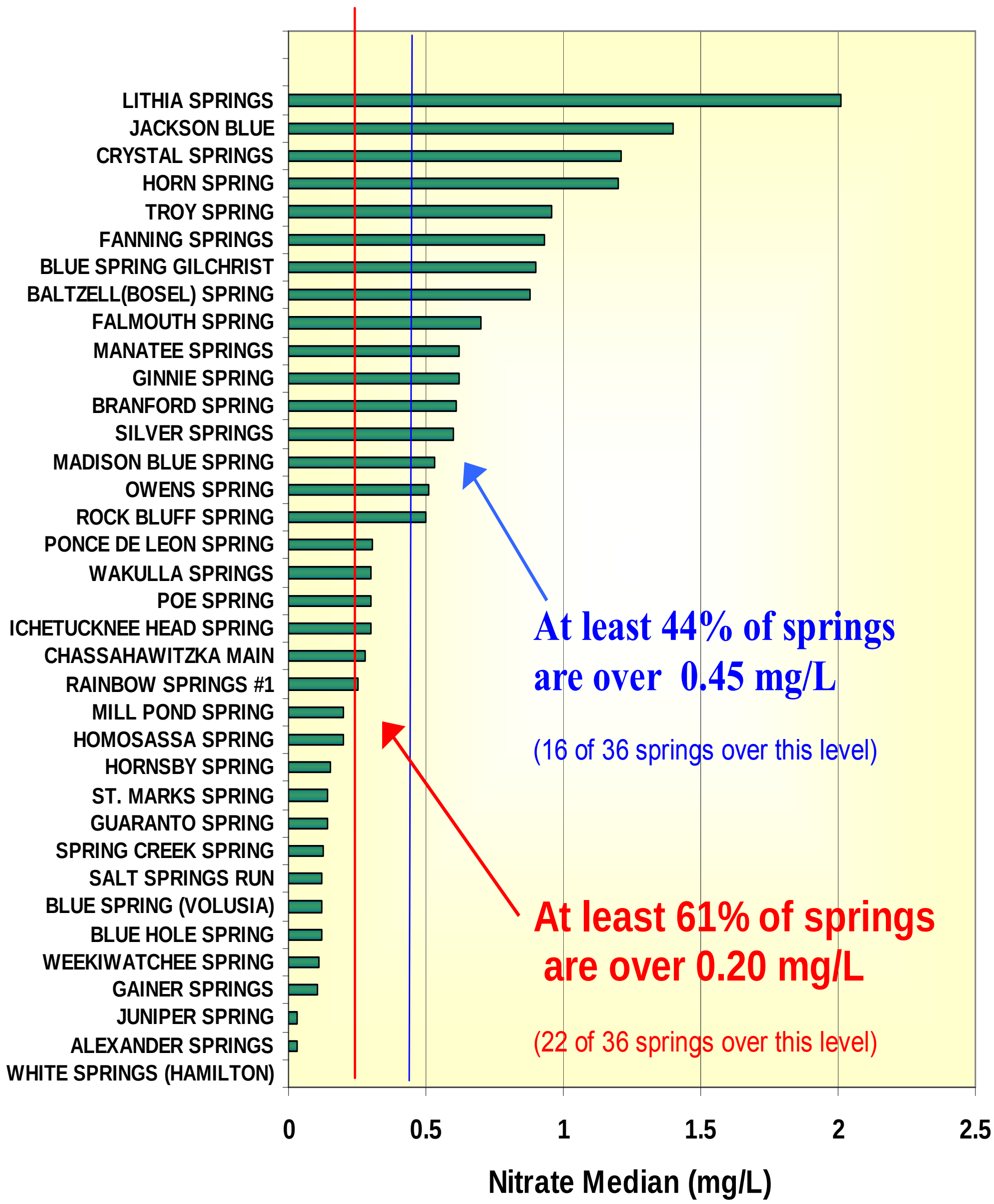


Figure 9b. Recent Median Nitrate Values for Florida Springs

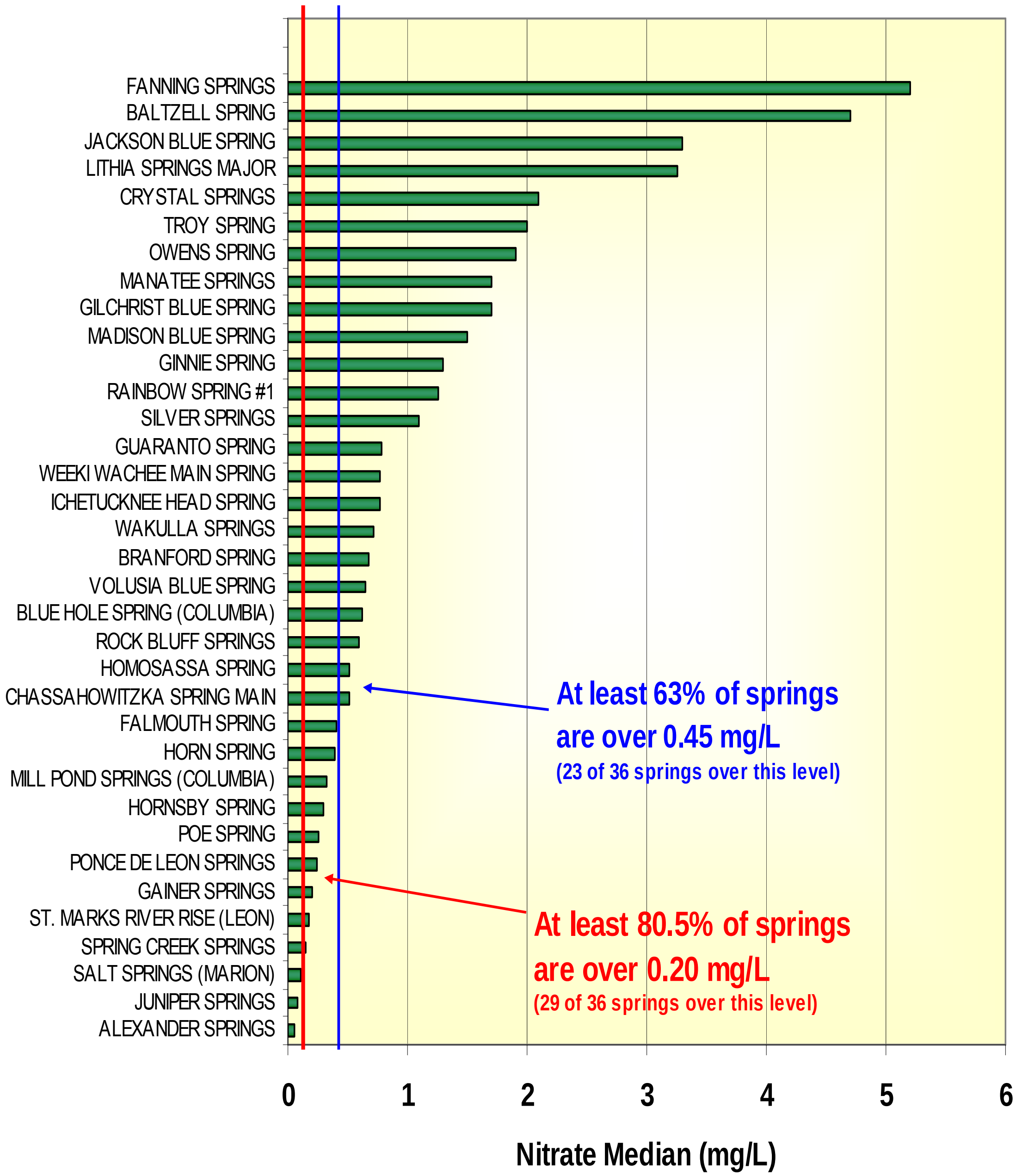
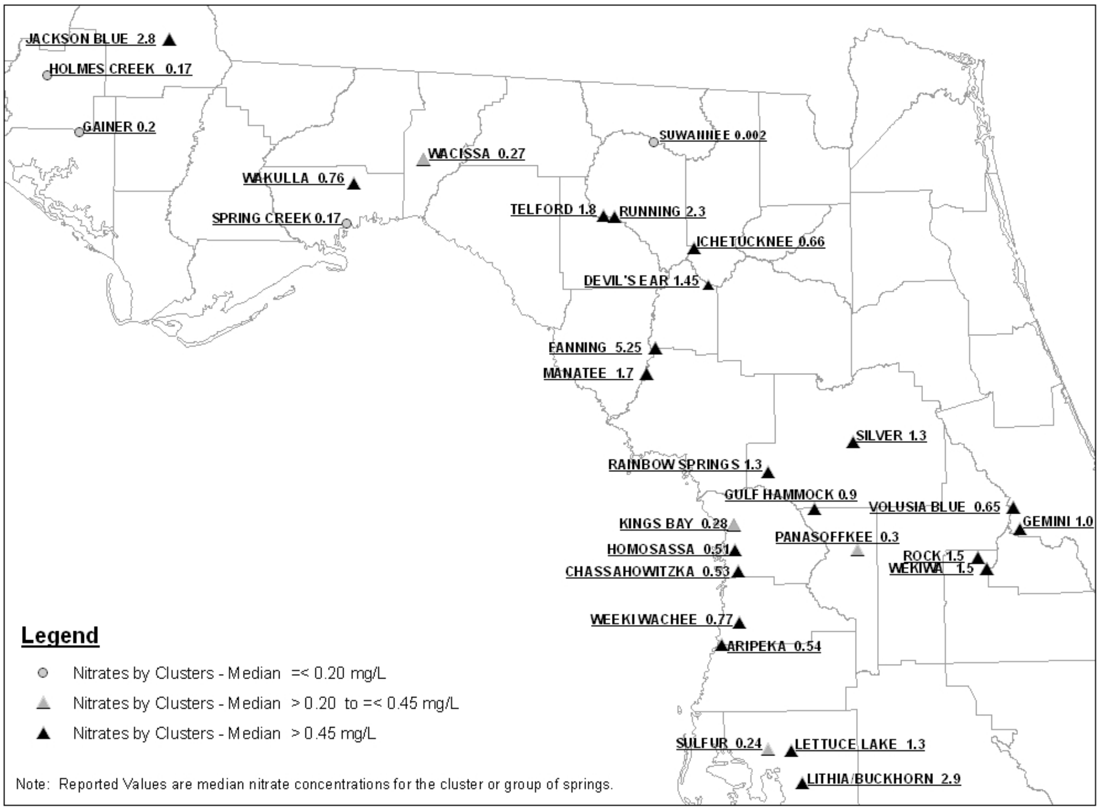


Figure 10 shows the distribution of nitrate concentrations in individual springs and spring clusters. The water quality evidence indicates that elevated nitrate concentrations are often associated with relatively near-field sources that lie within spring recharge areas (or *springsheds*). Typical sources include chemical fertilizers associated with agriculture, lawns, and turfgrass, and organic sources such as domestic wastewater and animal waste.

Figure 10. Distribution of Nitrate Concentrations in Springs Clusters



Summary of Ground Water Quality Trends

During the early 1990s, FDEP established a network of wells to determine the natural ground water quality of Florida. A subset of those wells became known as the Temporal Variability (TV) Network. Its goal was to establish and report on the variability over time of Florida's ground water quality. The 46 wells in the network tap both confined and unconfined ground water from each aquifer system of the state and are aerially scattered evenly across the state. Depending on the well, they are sampled monthly or quarterly.

Currently there is sufficient data to check for trends for over 20 analytes. Recently, a study was completed for these analytes for the period 1991–2003. Three analytes demonstrated statewide trends for this period. These analytes, shown in the following figures, are field analytes: water level **(*Figure 11)*,** temperature ***(Figure 12*)**, and pH (***Figure 13*)**. Another set of analytes of particular interest are the analytes with primary drinking water standards. For ground water, these analytes are sodium **(*Figure 14*),** nitrate (NO3 +NO2 as N) **(*Figure 15*),** fluoride **(*Figure 16*),** and total coliform bacteria. Although there are sufficient data for sodium, nitrate, and fluoride, none of these analytes demonstrated statewide trends. There is insufficient data for the trend analysis for total or fecal coliform bacteria. ***Table 36*** lists the results for significant trends.

An example of an analyte of interest is chloride, which is used to track saline intrusion. It was observed that chloride concentrations in wells in south Florida ***(Figure 17)*** decreased slightly, although not significantly. Since chloride is a saline indicator, as is sodium, this suggests that there may have been a slight surplus of recharge to ground water in Florida during the late 1990s and early 2000s.

Table 36. Trends in Well Water Quality, 1991–2003

NW	***SR***	***SJ***	***SW***	***SF***
WL ↓	**WL ↓**	WL 0	WL 0	WL 0
Tmp ↑	Tmp 0	Tmp ↑	Tmp ↑	Tmp 0
pH ↓	**pH ↓**	**pH ↓**	pH ↓	pH ↓
Na ↑	NA 0	NA 0	NA 0	NA 0

Notes:
↑ – 50% or more of water management district wells demonstrate upward trend.
0 – Less than 50% of water management district wells demonstrate upward or downward trend.
↓ – 50% or more of water management district wells demonstrate downward trend.

Bold – Statistically significant districtwide trend.

The following abbreviations refer to the region within the associated water management district boundary:
NW – Northwest
SR – Suwannee River
SJ – St. Johns River
SW – Southwest
SF – South Florida

The following abbreviations are listed in the table above:
WL – water level
Tmp – temperature
pH – pH
Na – sodium
Cl – chloride
↑ – increasing trend
↓ – decreasing trend
0 – no trend

Figure 11. Well Trends, Depth to Water (DtoH2O), 1991–2003

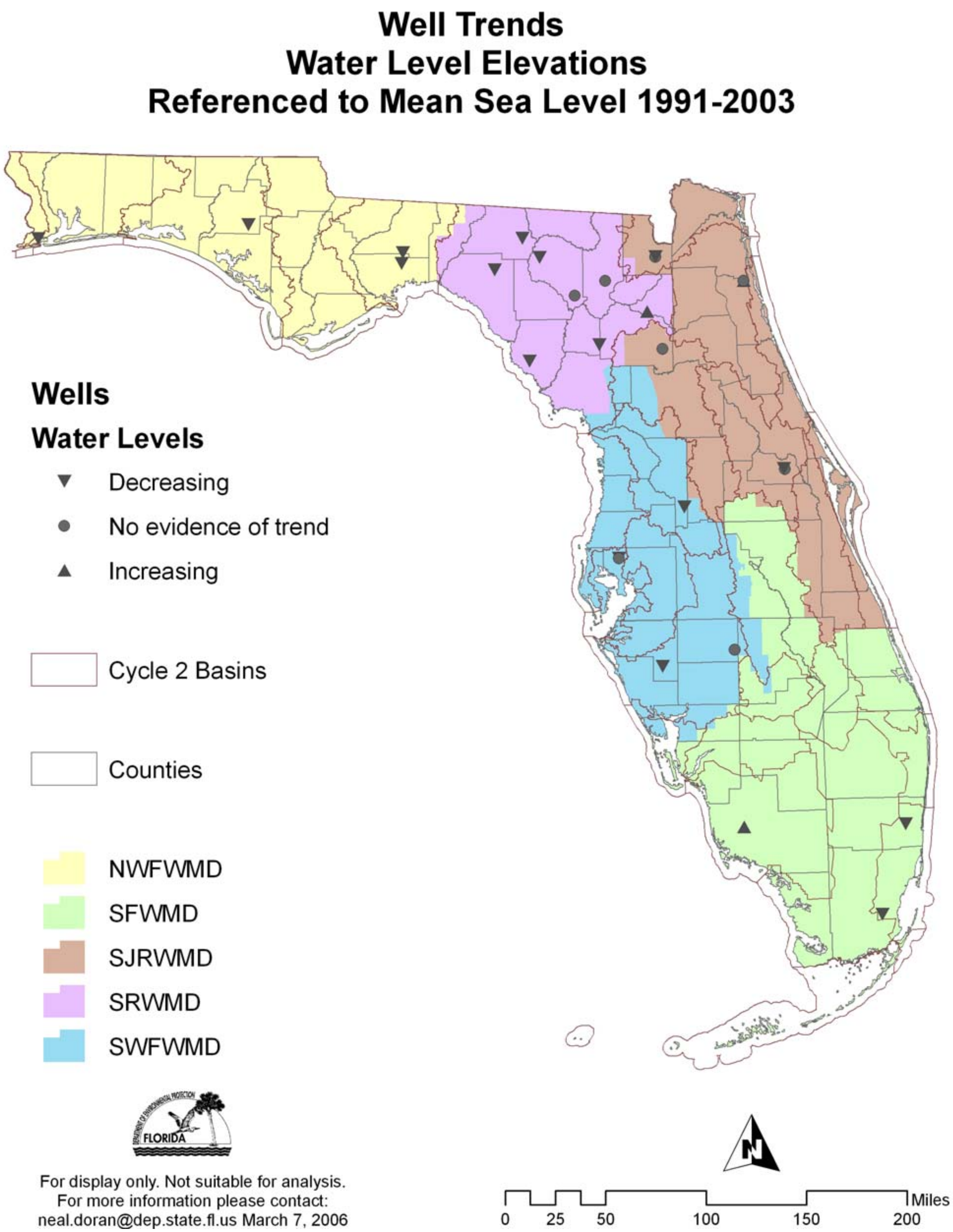


Figure 12. Well Trends for Temperature, 1991–2003

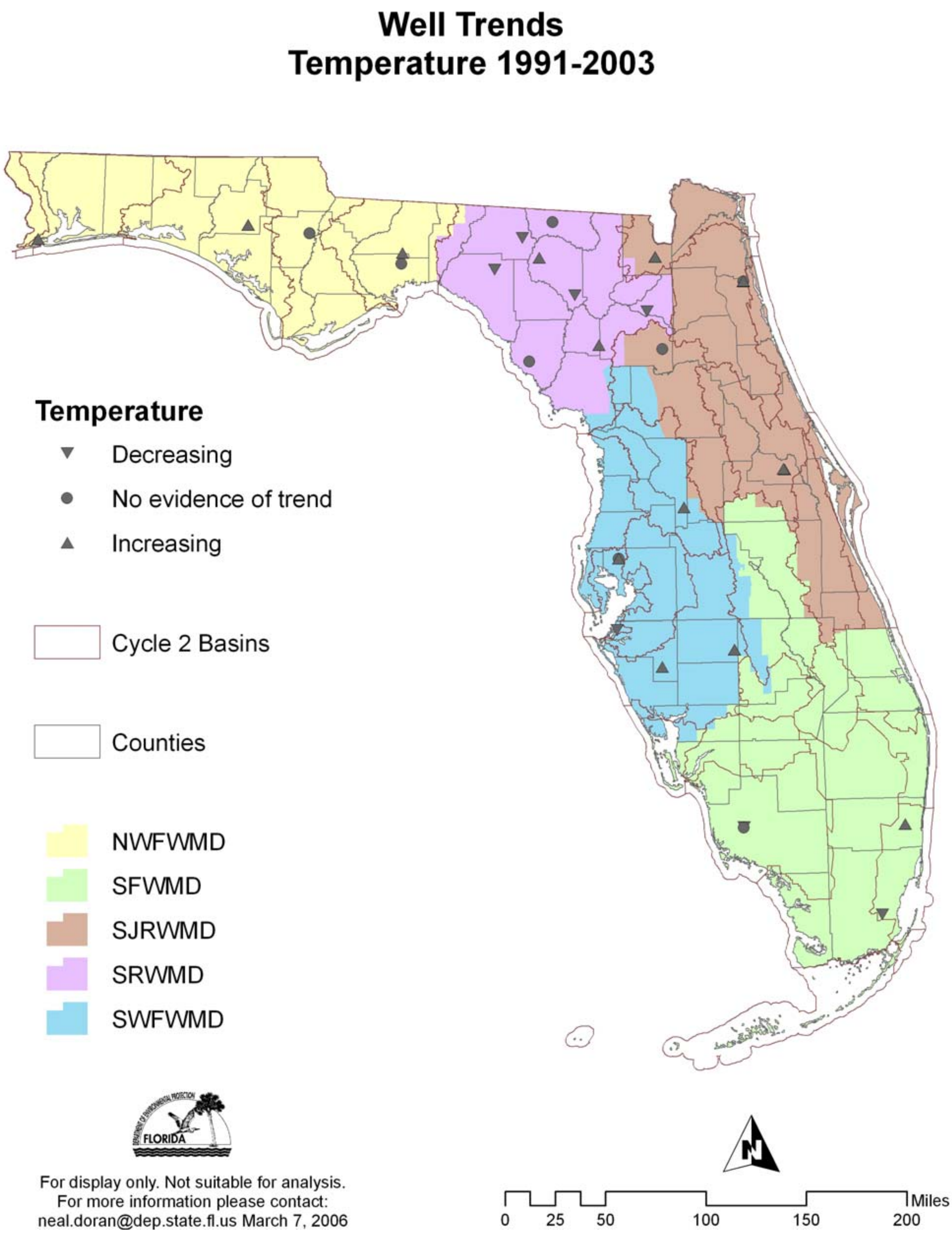


Figure 13. Well Trends for pH, 1991–2003

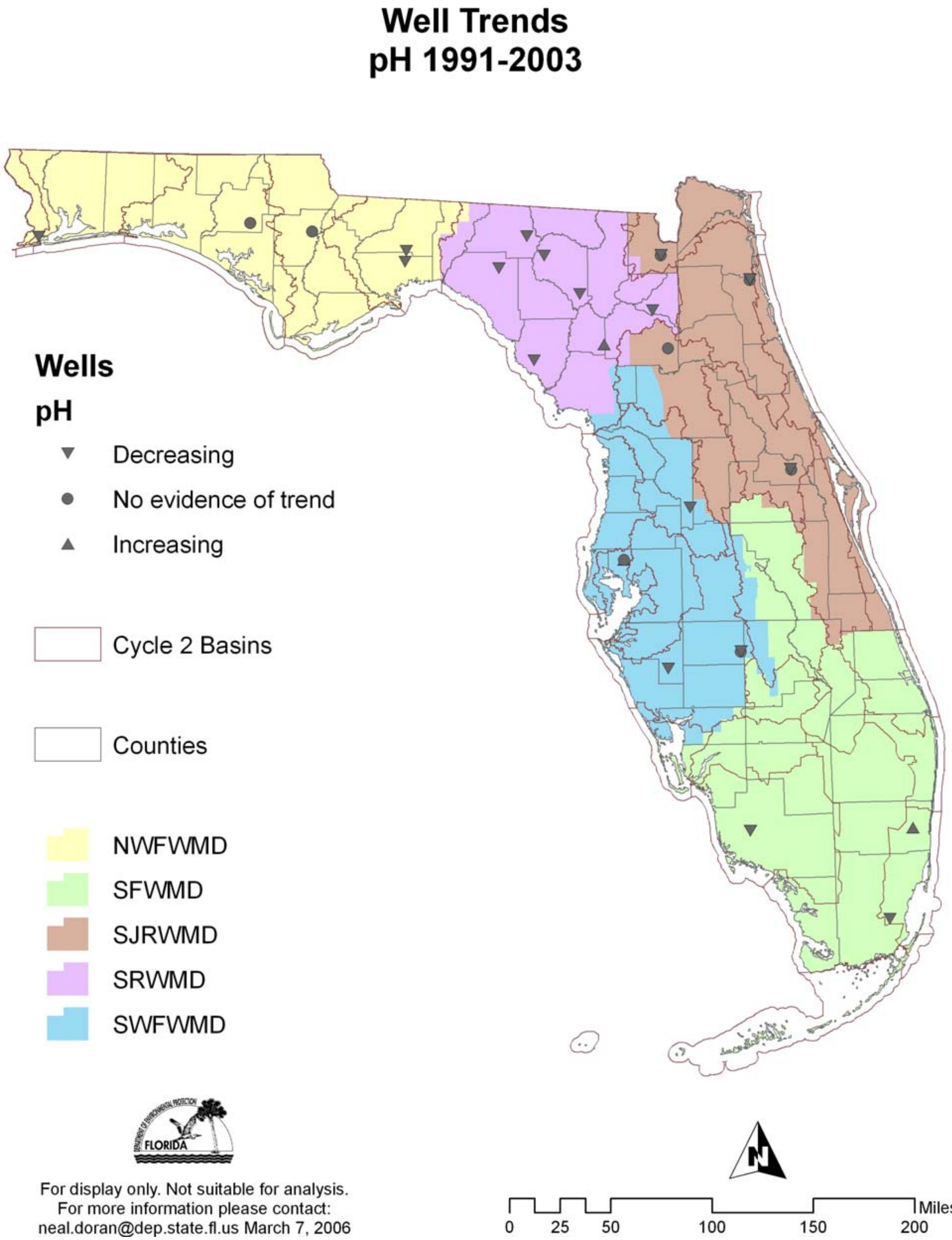


Figure 14. Well Trends for Sodium (Na) Dissolved, 1991–2003

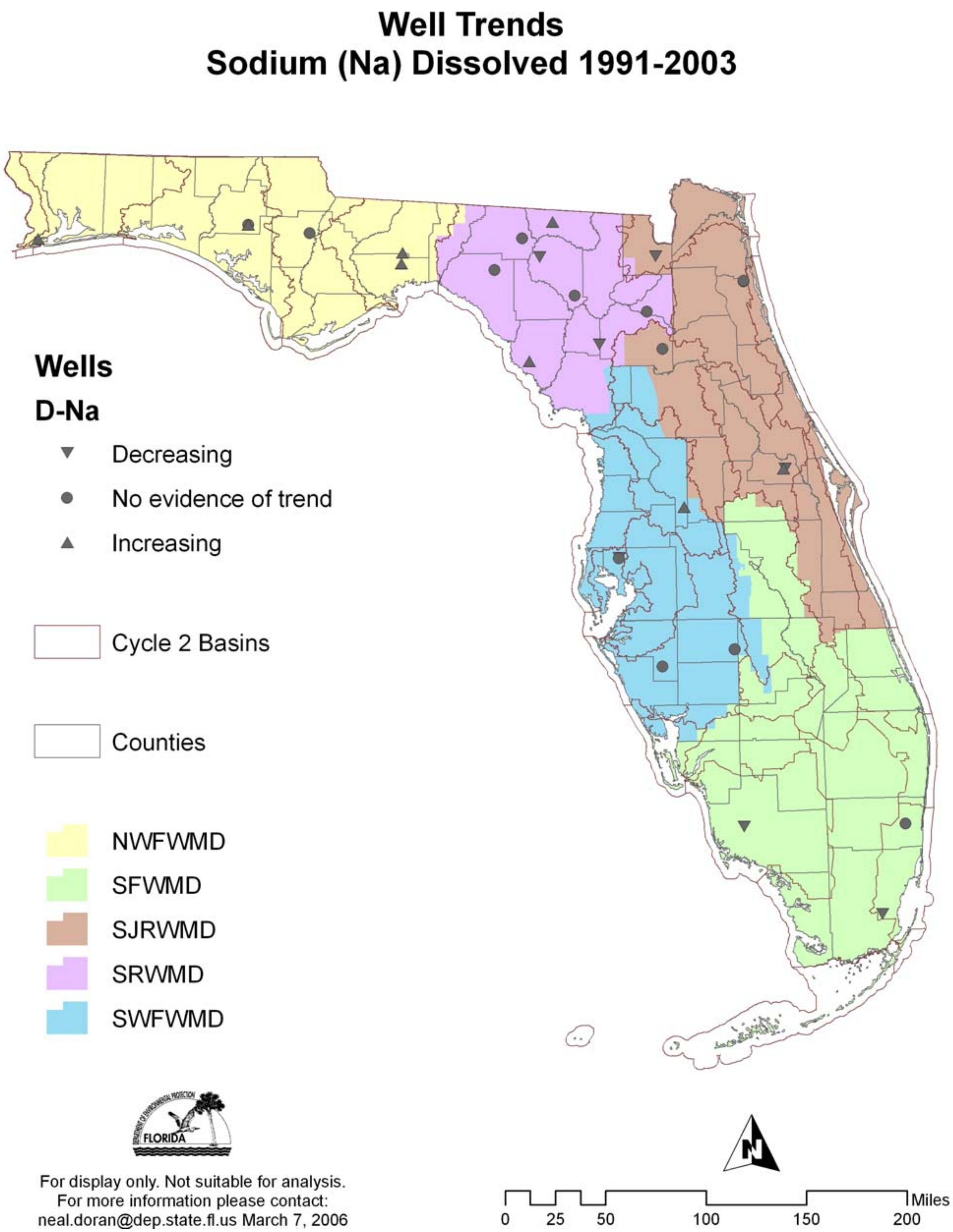


Figure 15. Well Trends for Nitrate-Nitrite (NO3NO2) Dissolved, 1991–2003

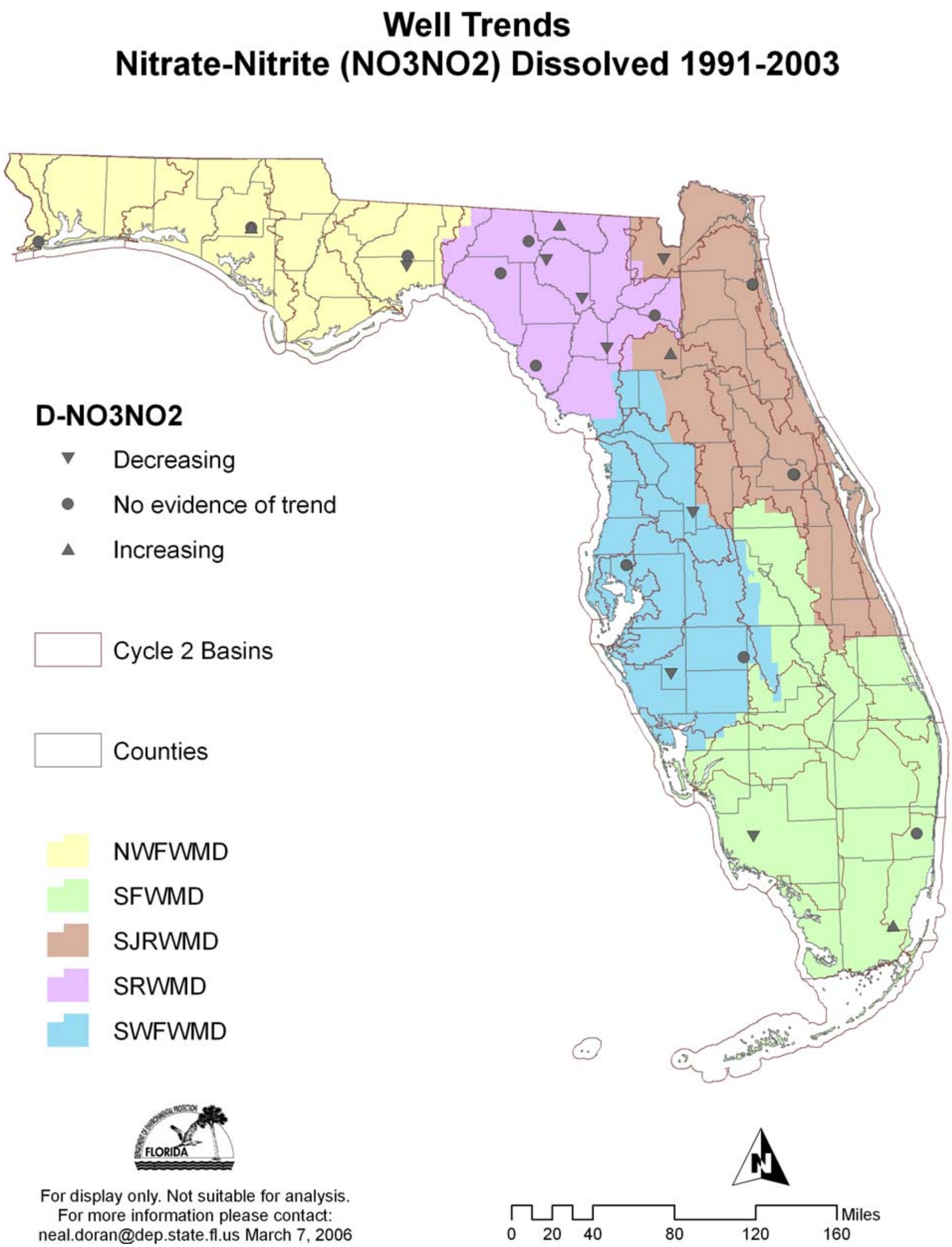
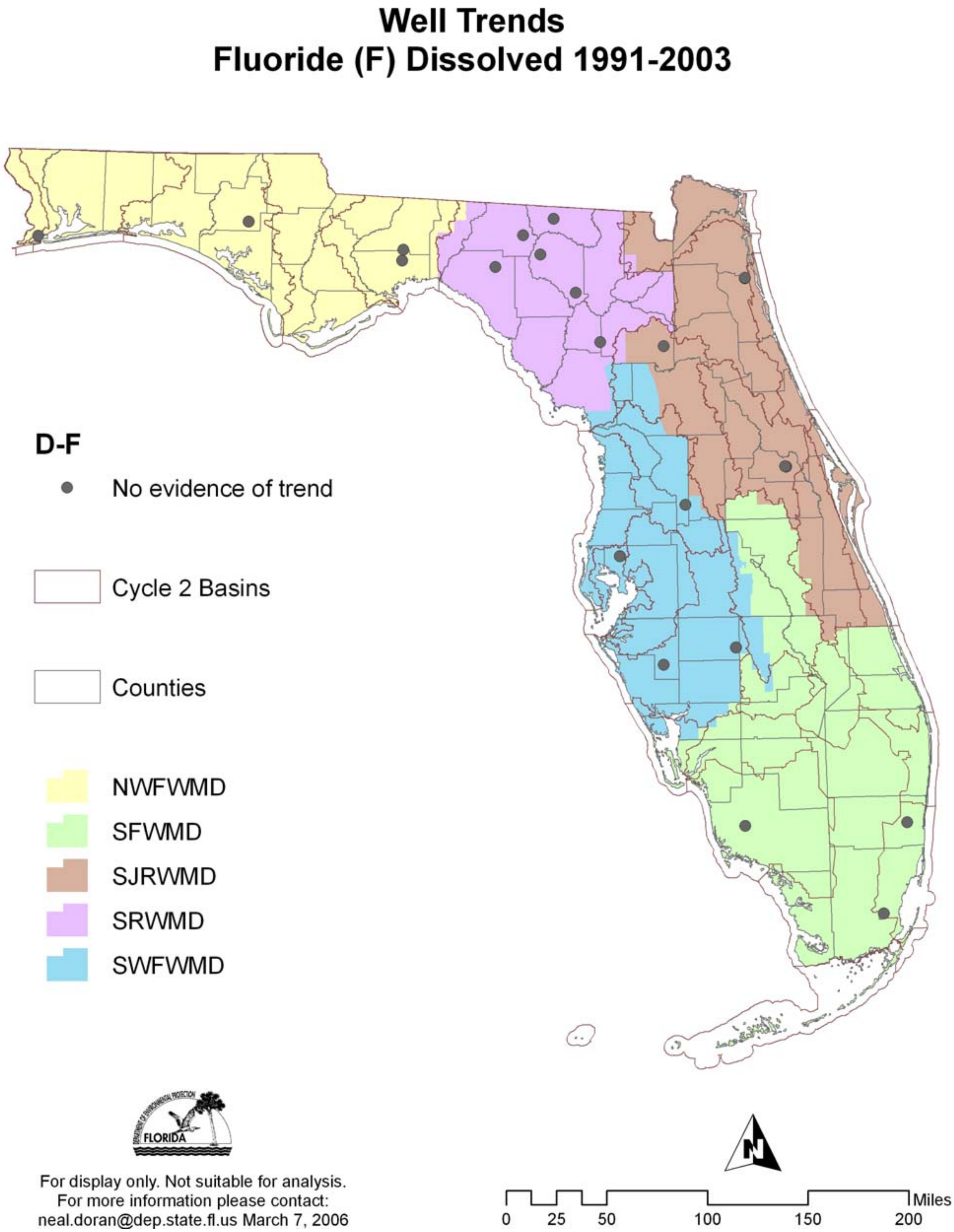


Figure 16. Well Trends for Fluoride (F) Dissolved, 1991–2003



Field Analytes with Statewide Trends

Figures 11, 12, and ***13*** depict the geographic locations of each of the TV wells and also demonstrate which wells had upward trends, downward trends, and no trends for water levels, temperature, and pH respectively. The trends were determined by a statistical test known as a Mann-Kendall test for trend (Gilbert, 1987) set at a confidence level of 0.95. However, for the determination of a statewide trend, a sign test was conducted (Conover, 1999). For a given analyte, the sign test compares the number of upward trends with the downward trends from each of the 46 wells, ignoring all wells with no trend. If the number of wells with upward trends greatly exceeds those with downward trends, or vice versa, it is concluded that there is a significant trend for the entire group of wells. Since the wells are spread throughout the state, a significant test result infers that the trend is statewide. ***Table 36*** presents summary results.

In order to fully understand the trend results for the field analytes, it is important to understand the rainfall patterns in Florida for this period. Although the early to mid-1990s had normal precipitation, beginning in about 1999 and lasting until about 2002, Florida experienced an abnormally low period of rainfall. The “drought” was more severe in the Panhandle than in the peninsula of the state. As a consequence, water levels in aquifers dropped significantly ***(Figure 11).*** In order to assist in reading the figure, it should be noted that the state is divided into five geographic regions corresponding with Florida’s five water management districts. In the figure, the water management districts are labeled as follows: NW–Northwest Florida Water Management District, SR–Suwannee River Water Management District, SJ–St. Johns River Water Management District, SW–Southwest Florida Water Management District, and SF–South Florida Water Management District.

Significant downward trends in pH were observed statewide and are believed to be tied to declining water levels. It is known that rainfall naturally has a lower pH than most of Florida’s ground water. After rain falls, some of the rain percolates downward through the soil column to the water table. This younger, freshly recharged ground water has a lower pH than older ground water. During periods of low rainfall (e.g., droughts), the water table will be lowered.

It should be noted that when a water sample is collected from a TV well, water is pumped from the well. Replacement water comes directly from the aquifer through a well screen or open hole of the well, which is located at a fixed position below the land surface. During a drought, when the water table is lowered, the top of the table comes closer and closer to the top of the well screen or open hole. Since the uppermost layer of ground water has a lower pH than older ground water, during a drought a greater and greater proportion of water being pumped into the well from the aquifer has a lower pH, relative to normal periods of rainfall. Thus, during the late 1990s and continuing through the early 2000s, Florida’s ground water experienced a downward trend in pH. It is believed to be directly related to the downward trends in ground water levels.

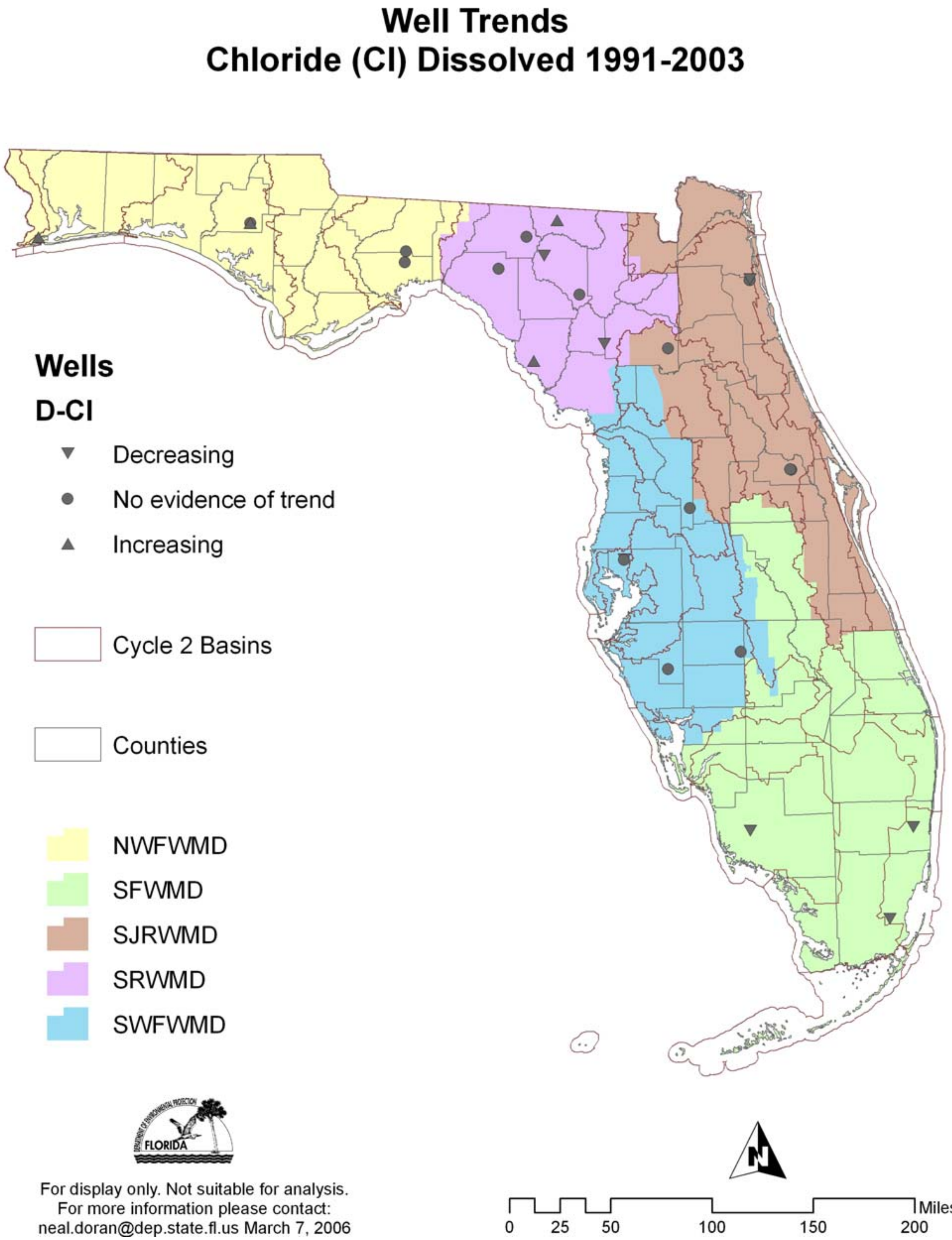
During the 1991 through 2003 period, ground water temperatures tended to rise ***(Figure 12).*** The reason for the rise is not completely understood at this time. It could be related to increases in air temperature. However, it should be noted that the air temperature varied across the state very slightly, and on a preliminary basis, no significant air temperature trends have been observed. When this report was compiled, FDEP had not completed its investigation regarding increasing air temperature trends. Thus, no conclusions can be made at this time.

Analytes with Primary Drinking Water Standards

Although trend analyses were conducted for sodium, nitrate, and fluoride, no statewide trends were observed. On a regional basis, there is evidence (not statistically significant) that sodium had a slight upward trend in northwest Florida **(*Figure 14*).** This could be directly related to the lowering of ground water levels and consequently followed by a slight intrusion of older, more saline water from the deeper portions of the underlying aquifers.

It was also observed that rainfall conditions in the St. Johns River Water Management District were not as severe as in northwest Florida during the drought period. In the district, ground water levels demonstrated no significant declines ***(Figure 11).***

Figure 17. Well Trends for Dissolved Chloride (Cl), 1991–2003



CHAPTER 5: PUBLIC PARTICIPATION

Public Participation Process

The success of Florida's water resource management program, especially its watershed management approach/TMDL Program, depends heavily on input from local watershed stakeholders. This process is highly collaborative, and FDEP staff closely coordinate and communicate with watershed stakeholders in all phases of the five-year, rotating basin cycle.

During Phase 1, a kickoff meeting is held within each basin to provide an overview of FDEP's watershed management program and cycle, and to solicit data and other relevant information needed to complete the initial evaluation of waterbody health. Those attending these meetings are asked to provide their email addresses and other contact information, so that they can be placed on a basin-specific list to be notified of future meetings and deliverables such as the Status Report or the Assessment Report. Also during Phase 1, FDEP staff work closely with local monitoring staff to determine when and where additional monitoring is needed. This culminates in the preparation of a Strategic Monitoring Plan that is implemented the following year, during Phase 2 of the cycle.

The key product of Phase 2 is the Verified List of impaired waters. As discussed in Chapter 3, FDEP works with a variety of stakeholders and holds public meetings on developing and adopting the Verified Lists for the state's 29 river basins. Basin-specific draft Verified Lists of impaired waters that meet the requirements of the IWR are made available to the public via the Internet and by email. The lists are placed on FDEP's TMDL Program Web site and are also sent on request to interested parties via mail or email. Stakeholders are given the opportunity to comment on the draft lists in person and/or in writing. As part of the review process, public workshops are advertised and held in each basin to help explain the process for developing the Verified Lists, exchange information, and encourage public involvement. If additional information or data is provided during the public comment period or before, FDEP typically creates a revised draft Verified List for further review and comment before submitting the final proposed list to the Secretary for adoption and then to the EPA.

During Phase 3 of the cycle, watershed and waterbody modeling are carried out to develop the TMDL and the preliminary allocations to point and nonpoint sources. Typically, a basin working group, formalized during this phase, begins the process of developing the Basin Management Action Plan (BMAP). FDEP works closely with the basin working group and other watershed stakeholders to ensure that they understand and support the approaches being undertaken to develop the TMDL.

During Phase 4 of the cycle, the basin working group and other stakeholders—especially representatives of local governments, including local elected officials—develop the BMAP. This process typically takes about two years and culminates in the adoption of the BMAP by FDEP's Secretary.

Like the BMAP, the Verified List of impaired waters is adopted by the Secretary, while all TMDLs are adopted by rule. Like all official agency actions, these adoptions are subject to state administrative procedures set forth in Chapter 120, F. S. Once a BMAP, Verified List, or TMDL is adopted, a notice is published in the Florida Administrative Weekly allowing any affected party to request an administrative hearing to challenge the adoption.

Responsiveness Summary

As noted, public input is received via email, letters, or oral comments. All public meetings are recorded, and specific comments are noted in written meeting summaries. These and any other comments received are on permanent file at FDEP. Significant comments typically receive a written response. All of FDEP's responses are also kept in a permanent file maintained by FDEP.

All written comments and FDEP's responses are included in an Appendix to each Water Quality Assessment Report; the reports are available at http://www.dep.state.fl.us/water/tmdl/stat_rep.htm.

REFERENCES

American Public Health Association. 1995. *Standard methods for the examination of water and wastewater resources.* 19th Edition. Maryland: United Book Press.

Conover, W. J. 1999. *Practical nonparametric statistics.* New York: Wiley.

Fernald, E. A., and E. D. Purdum, Eds. 1998. *Water resources atlas of Florida.* Tallahassee, Florida: Florida State University, Institute of Science and Public Affairs.

Florida Department of Agriculture and Consumer Services. 2006. *Shellfish bed closures.* Available: http://www.floridaaquaculture.com/SEAS/SEAS_intro.htm.

———. 2006. *Red tide.* Available: http://www.floridaaquaculture.com/RedTide/RedTideInfo.htm).

Florida Department of Environmental Protection. 2000. *Florida's water quality assessment 2000 305(b) report.* Tallahassee, Florida.

———. May 1, 2001. *Impaired Surface Waters Rule (Draft–Adopted version).* Available: http://www.dep.state.fl.us/water/tmdl/docs/AmendedIWR.pdf.

———. 2004. *Florida's water quality assessment 2004 305(b) report.* Tallahassee, Florida. Available: http://www.dep.state.fl.us/water/docs/2004_Integrated_Report.pdf.

———. 2000–06. *Water quality status reports and water quality assessment reports.* Available: http://www.dep.state.fl.us/water/tmdl/stat_rep.htm.

———. *Interpretative tool for the assessment of metal enrichment in Florida freshwater sediment.* January 2003. Available: http://www.dep.state.fl.us/water/monitoring/fwseds.htm.

———. *February 1, 2004. Standard operating procedures for field activities.* DEP-SOP-001/01. Available at http://www.dep.state.fl.us/labs/qa/qadocument.htm.

———. *Elements of Florida's Water Monitoring and Assessment Program.* December 22, 2004 (revised March 30, 2005). Tallahassee, Florida: Division of Water Resource Management, Bureau of Watershed Management

———. 2006. *Discussion of ground water indicators.* Available: http://www.dep.state.fl.us.

———. 2006. *STORET Program.* Available: http://www.dep.state.fl.us/water/storet/index.htm.

———. 2006. *Criteria for surface water quality classifications.* Available: http://www.dep.state.fl.us/water/wqssp/classes.htm.

———. 2006. *Allocation Technical Advisory Committee (ATAC) Report.* Available: http://www.dep.state.fl.us/water/tmdl/docs/Allocation.pdf.

———. 2006. *Florida's springs: Protecting native gems*. Available: www.floridasprings.org.

———. 2006. *South Florida Mercury Science Program.* Available: http://www.dep.state.fl.us/labs/mercury/index.htm.

———. 2006. *Drinking Water Program.* Available: http://www.dep.state.fl.us/water/drinkingwater/index.htm.

Florida Department of Health. 2006. *Bacterial contamination and sampling.* Available: http://esetappsdoh.doh.state.fl.us/irm00beachwater/terms.htm.

———. 2006. *Healthy Beaches Program. Beach water sampling results.* Available: http://esetappsdoh.doh.state.fl.us/irm00beachwater/default.aspx. History. Available: http://esetappsdoh.doh.state.fl.us/irm00beachwater/history/hisintro.htm.

———. 2006. *Fish consumption advisories.* Available: http://www.doh.state.fl.us/environment/community/fishconsumptionadvisories/index.html.

———. 2006. *Small water systems.* Available: http://www.doh.state.fl.us/environment/water/index.html.

———. 2006. *Beach closures.* Available: http://esetappsdoh.doh.state.fl.us/irm00beachwater/default.aspx.

Florida LakeWatch. October 1999a. *A beginner's guide to water management: The ABCs.* Gainesville, Florida: University of Florida, Department of Fisheries and Aquatic Sciences, Institute of Food and Agricultural Sciences. Available: http://lakewatch.ifas.ufl.edu/circpdffolder/ABCsInt.pdf.

———. October 1999b. November 2000. *Florida's springs: Strategies for protection and restoration.* Florida Springs Task Force. Available: http://www.dep.state.fl.us/springs/reports/floridaspringsreport.pdf.

———. 2006. Available: http://lakewatch.ifas.ufl.edu/.

Gilbert, R. O. 1987. *Statistical methods for environmental pollution monitoring*. New York, Van Nostrand.

Kushlan, J. A. 1990. "Freshwater Marshes." In: Myers, R. L., and J. J. Ewel (Eds.). *Ecosystems of Florida.* Orlando, Florida: University of Central Florida Press.

Long, E. R., and L. G. Morgan. 1990. *The potential for biological effects of sediment-sorbed contaminants tested in the National Status and Trends Program.* NOAA Technical Memorandum NOS OMA 52. Seattle, Washington: National Oceanic and Atmospheric Administration.

MacDonald, D. D. 1994. *Approach to the assessment of sediment quality in Florida coastal waters.* McDonald Environmental Sciences Ltd.

South Florida Water Management District. 2006. Available: http://www.envirobase.usgs.gov/.

U. S. Census Bureau Web site. 2006. Available: http://quickfacts.census.gov/qfd/states/12000.html.

U. S. Environmental Protection Agency. March 2003. *Elements of a state water monitoring and assessment program*. Washington, D. C.: Office of Wetlands, Oceans and Watersheds. EPA 841-B-03-003. Available: http://www.epa.gov/owow/monitoring/elements/.

———. July 29, 2005. *Guidance for 2004 assessment, listing, and reporting requirements under Sections 303(d) and 305 (b) of the Clean Water Act.* Watershed Branch, Office of Wetlands, Oceans and Watersheds.

———. 2006a. *Ecoregions of Florida.* Available: http://www.epa.gov/wed/pages/ecoregions/fl_eco.htm.

———. 2006b. *Region 4: Total Maximum Daily Loads in Florida.* Available: http://www.epa.gov/region4/water/tmdl/florida/.

———. 2006c. *National STORET Program.* http://www.epa.gov/storet/.

U. S. Geological Survey. 2006. Available: http://water.usgs.gov/.

Vogel, M. April 2006. Economic yearbook 2006: Good migrations. *Florida Trend.* Available: http://www.floridatrend.com/article.asp?id=5795.

Water Quality Association. 2006. *Water quality glossary: pH.* Available: http://www.wqa.org/glossary.cfm?gl=1146.

APPENDICES

Appendix A. Maps Showing 2004 Probabilistic Surface Water Assessment Results for Group 1 Large Rivers, Small Streams, Large Lakes, and Small Lakes

Table A-1. Legend for Surface Water Terms and Indicators Used in Figures A-1 through A-20

Term	*Explanation*
Resource	The Status Network design focuses on the following four surface water resource types: • Large Rivers are major rivers of the state. • Small Streams are the remaining streams. • Small Lakes are 2.5 to less than 25 acres in size. • Large Lakes are 25 acres or greater.
Indicators	Indicators include the following: • Large Rivers and Small Streams: Fecal Coliform, DO, pH, Un-ionized Ammonia (Calculated), Chlorophyll *a*. • Large Lakes and Small Lakes: Fecal Coliform, DO, pH, Un-ionized Ammonia (Calculated), and TSI.
Meeting Threshold (Green portion of each individual pie chart per basin in each of the figures)	Threshold criteria: Fecal coliform: less than or equal to 400 counts per 100 mL. DO: 5.0 mg/L or above. pH: greater than or equal to 6.0 and less than or equal to 8.5 su. Un-ionized Ammonia: less than 0.02 mg/L. Chlorophyll *a*: less than or equal to 20 µg/L. TSI: For samples with color less than or equal to 40 PCUs, threshold is less than or equal to 40. For samples with color greater than 40 PCUs, threshold is less than or equal to 60.

Note: Appendix B provides additional information on whether the thresholds listed in the table are water quality standards or screening levels.

Figure A-1. Summary of Chlorophyll a Assessment for Large Rivers, Group 1 Basins

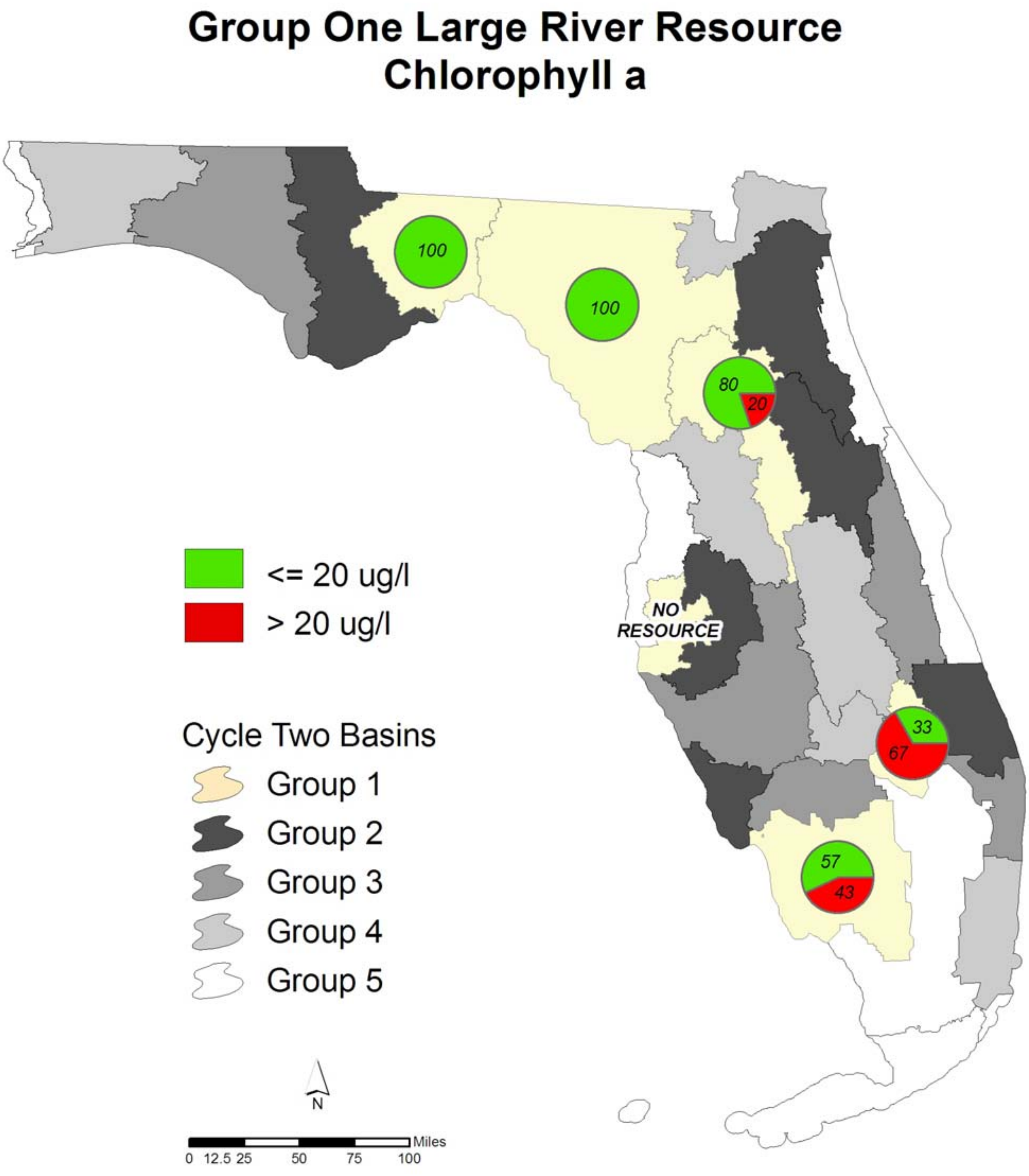


Figure A-2. Summary of Fecal Coliform Assessment for Large Rivers, Group 1 Basins

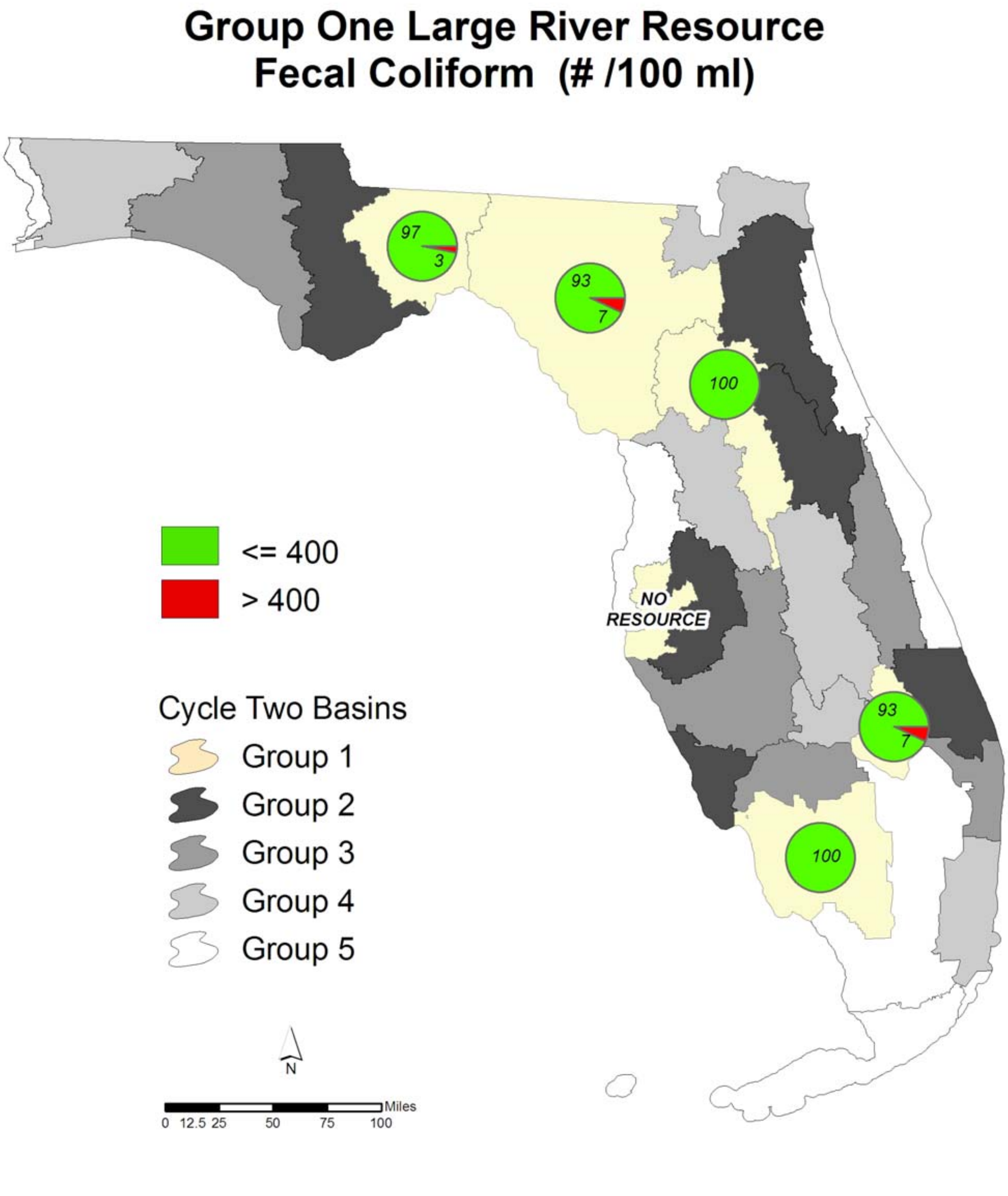


Figure A-3. Summary of DO Assessment for Large Rivers, Group 1 Basins

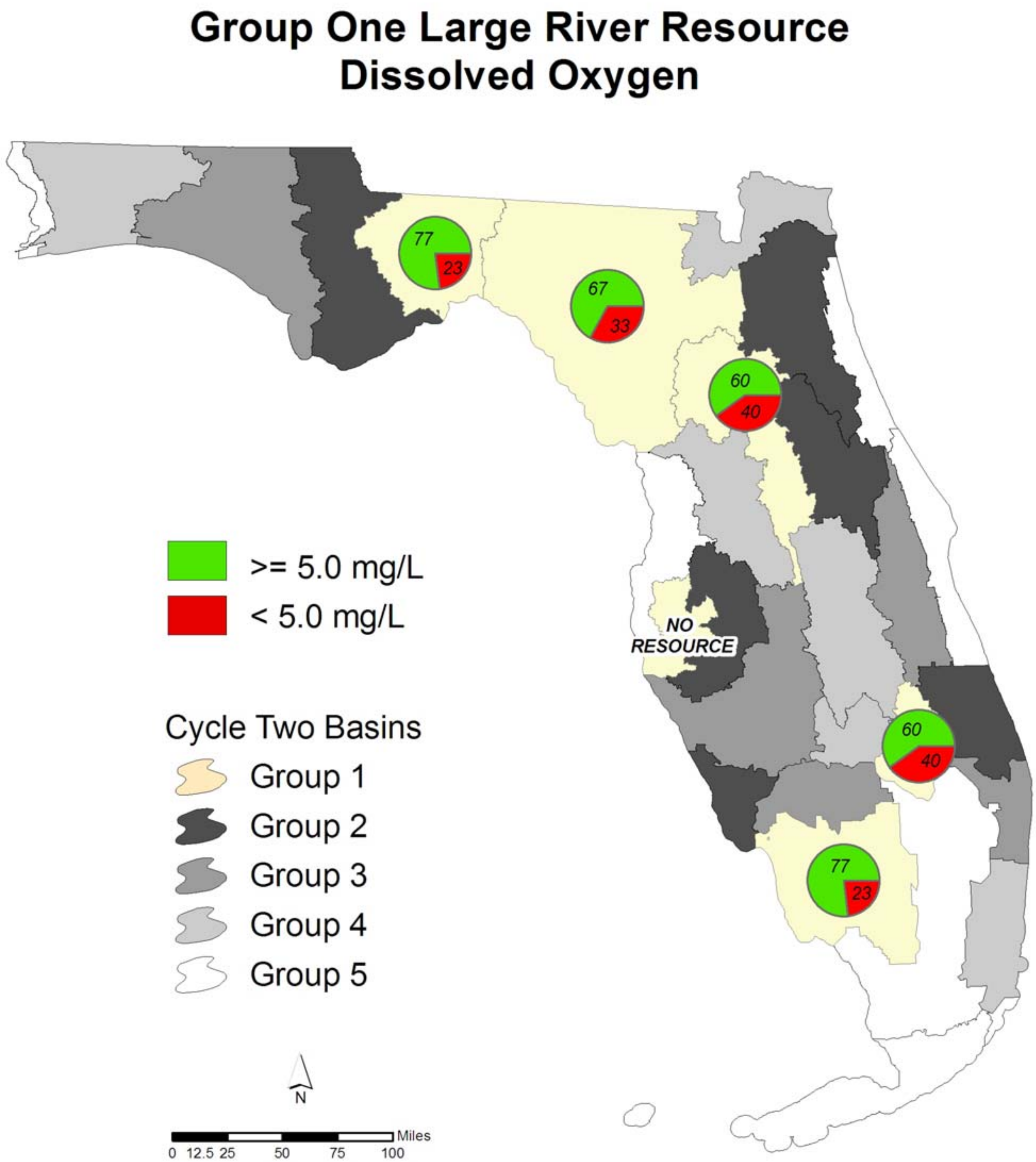


Figure A-4. Summary of pH Assessment for Large Rivers, Group 1 Basins

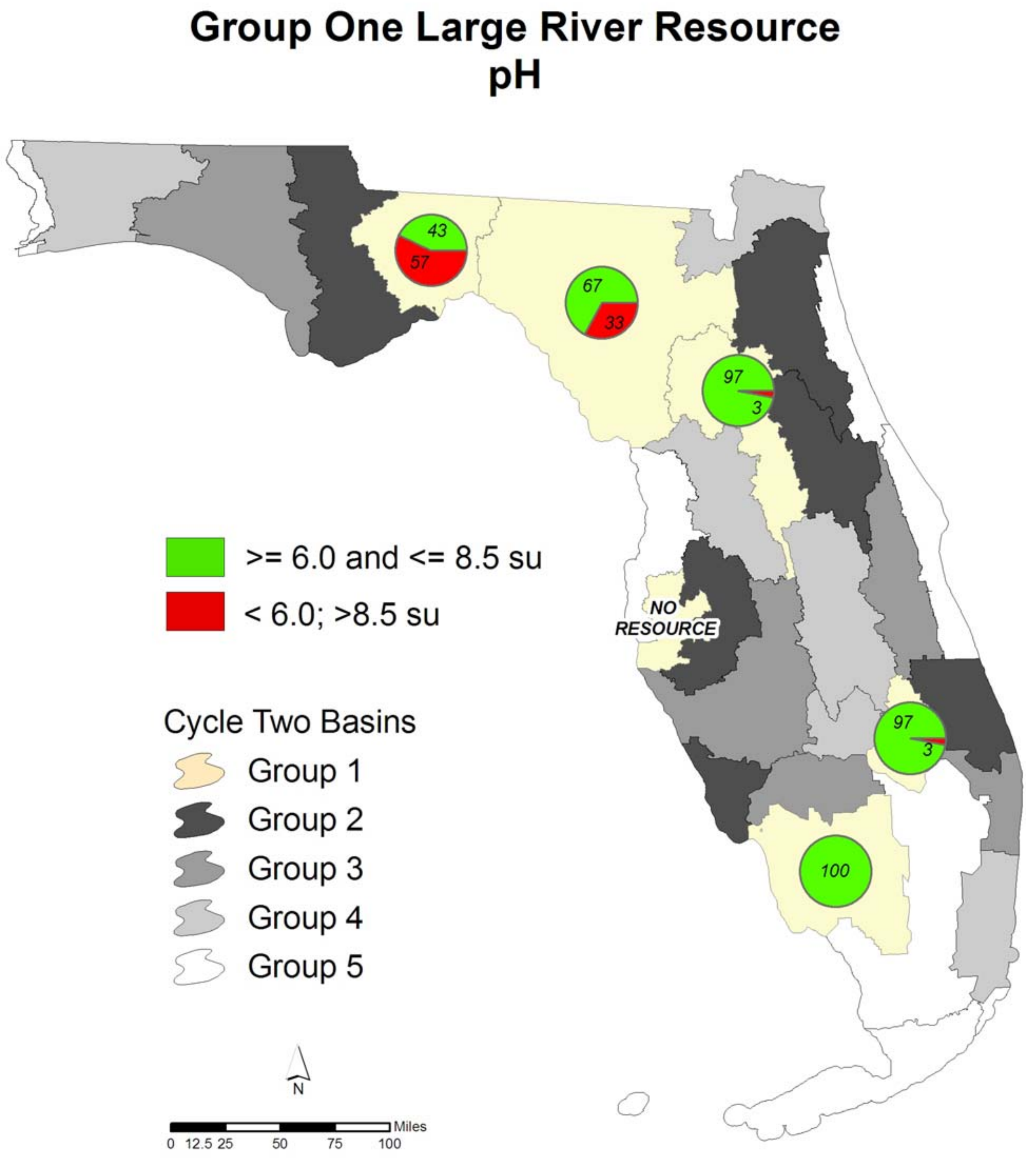


Figure A-5. Summary of Un-ionized Ammonia Assessment for Large Rivers, Group 1 Basins

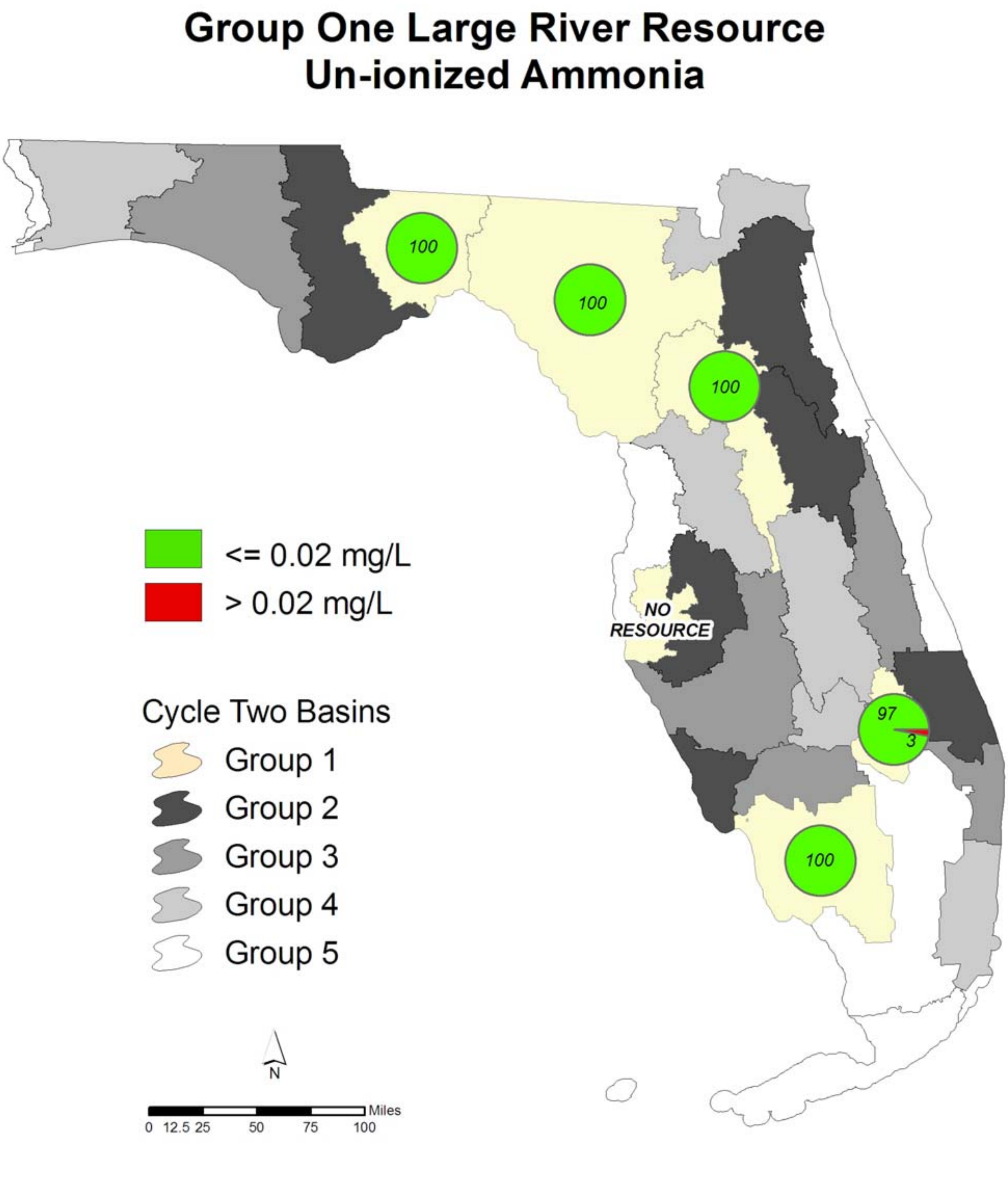


Figure A-6. Summary of Chlorophyll a Assessment for Small Streams, Group 1 Basins

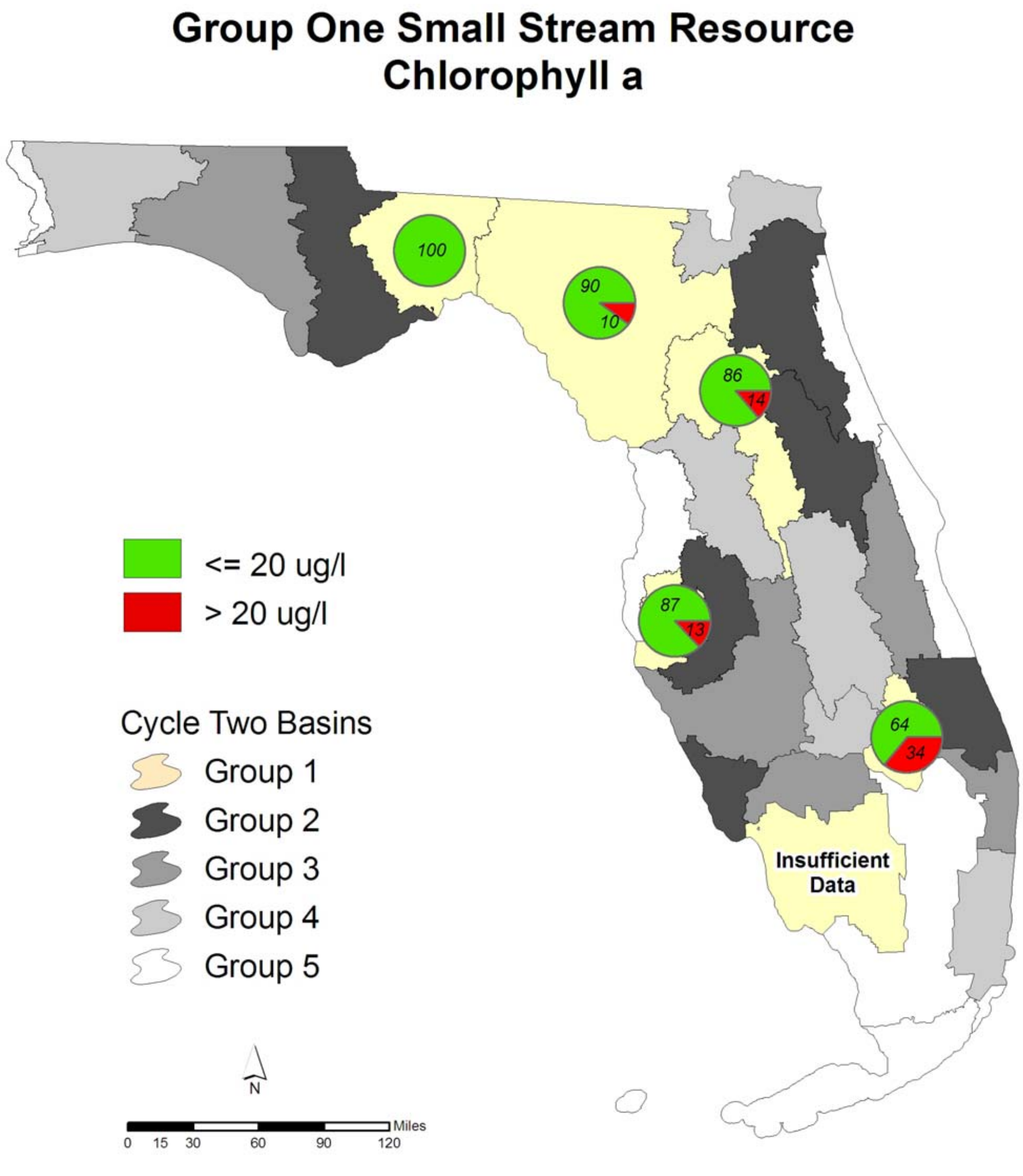


Figure A-7. Summary of DO Assessment for Small Streams, Group 1 Basins

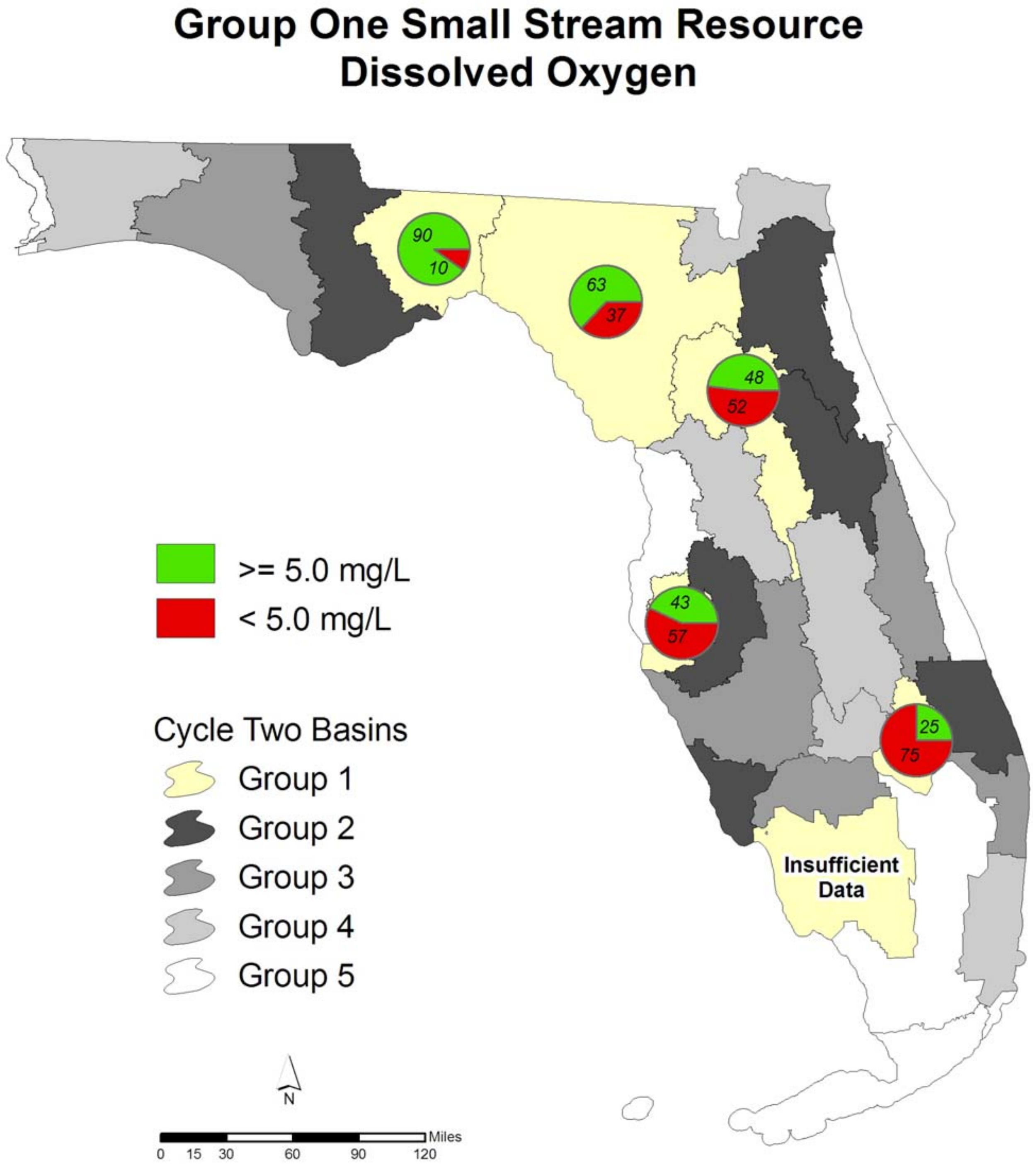


Figure A-8. Summary of Fecal Coliform Assessment for Small Streams, Group 1 Basins

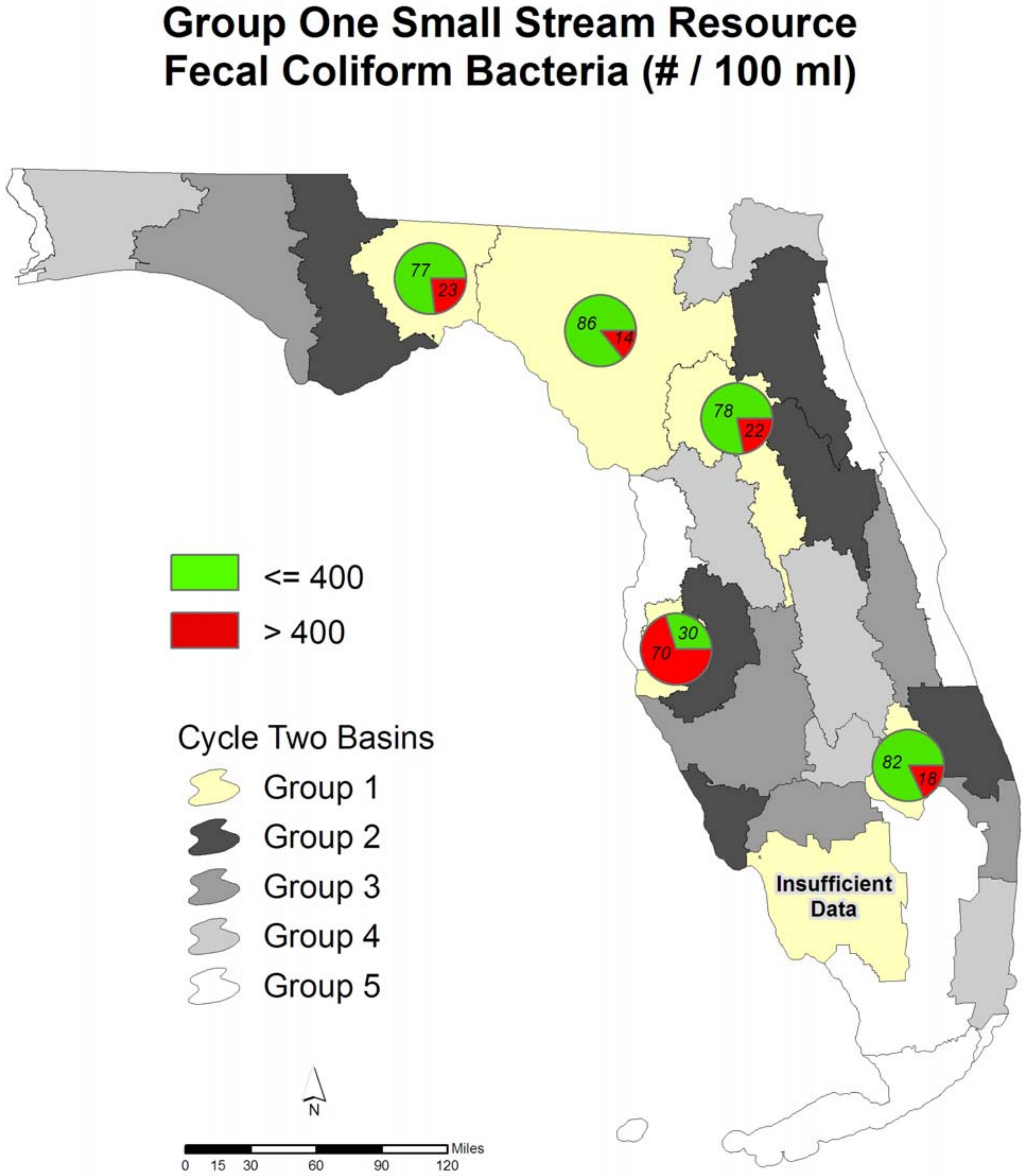


Figure A-9. Summary of pH Assessment for Small Streams, Group 1 Basins

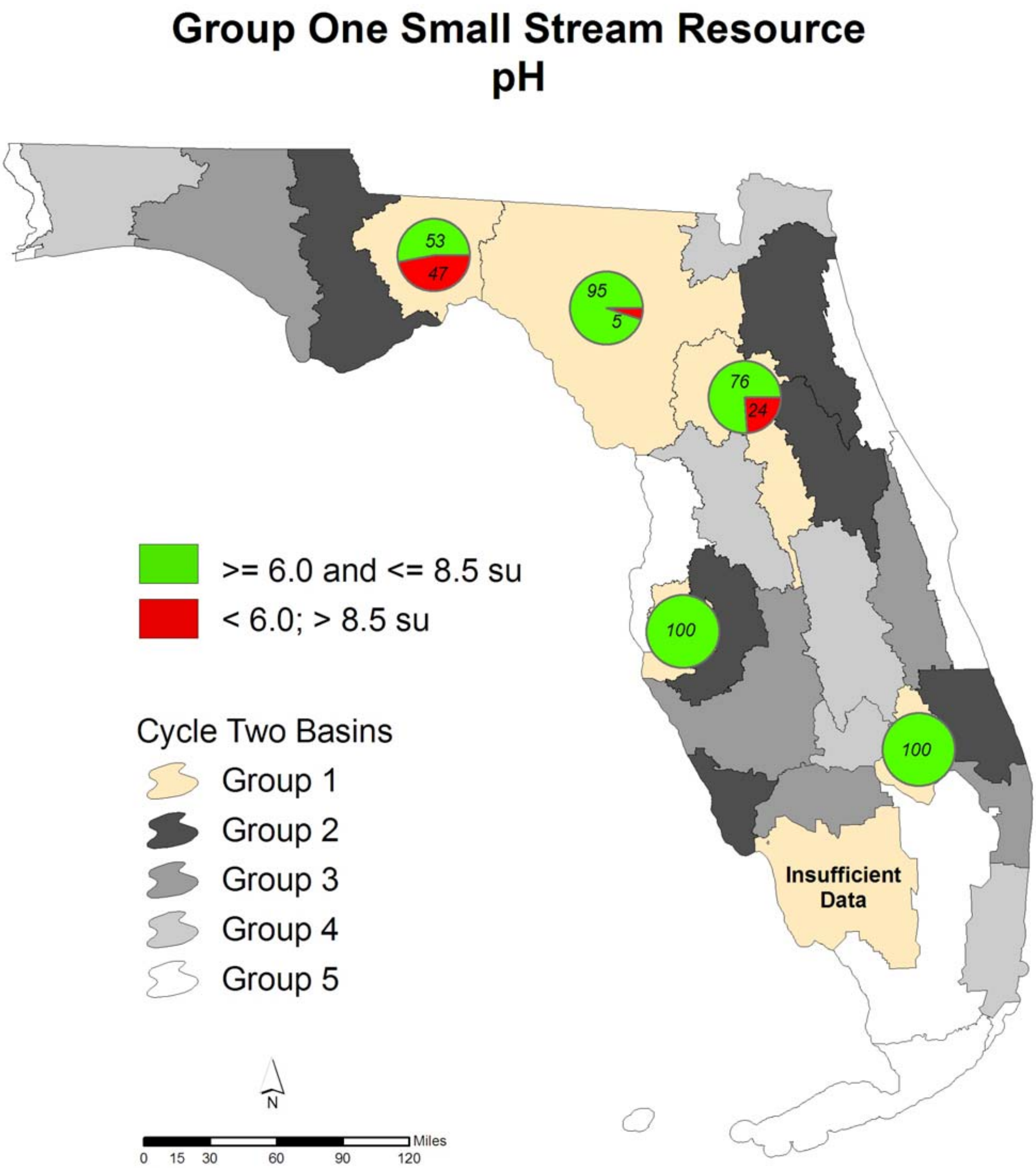


Figure A-10. Summary of Un-ionized Ammonia Assessment for Small Streams, Group 1 Basins

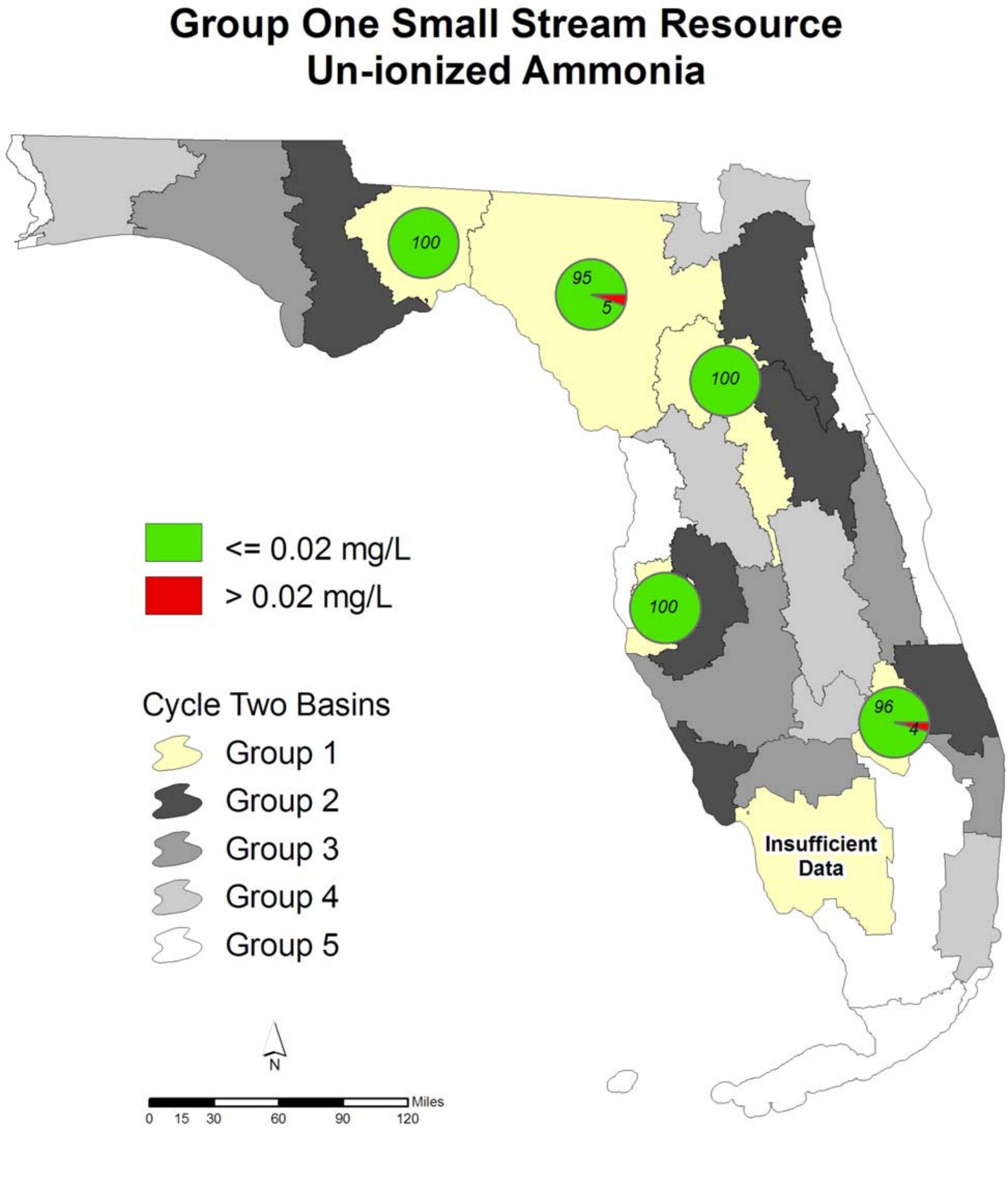


Figure A-11. Summary of Fecal Coliform Assessment for Large Lakes, Group 1 Basins

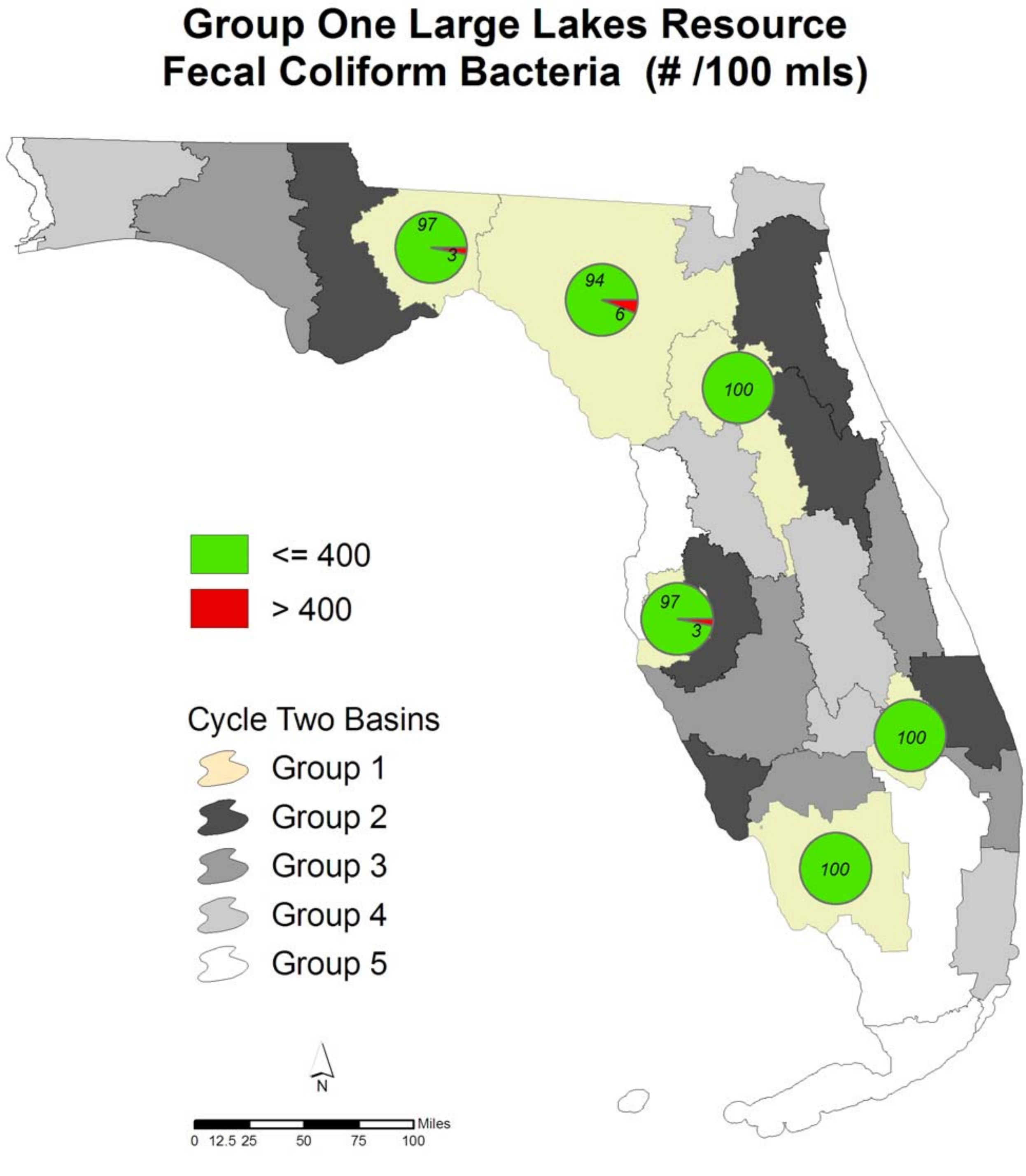


Figure A-12. Summary of pH Assessment for Large Lakes, Group 1 Basins

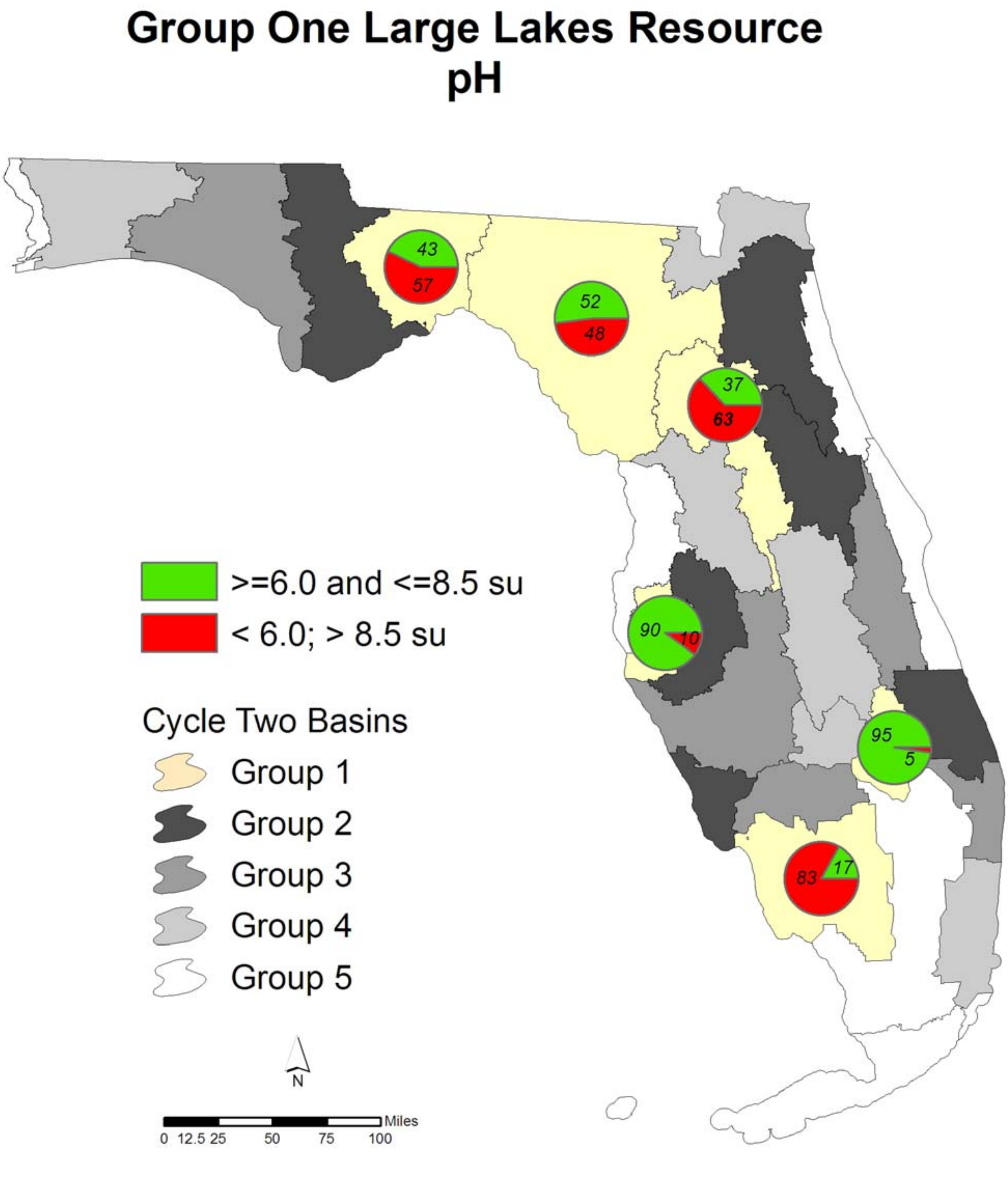


Figure A-13. Summary of TSI Assessment for Large Lakes, Group 1 Basins

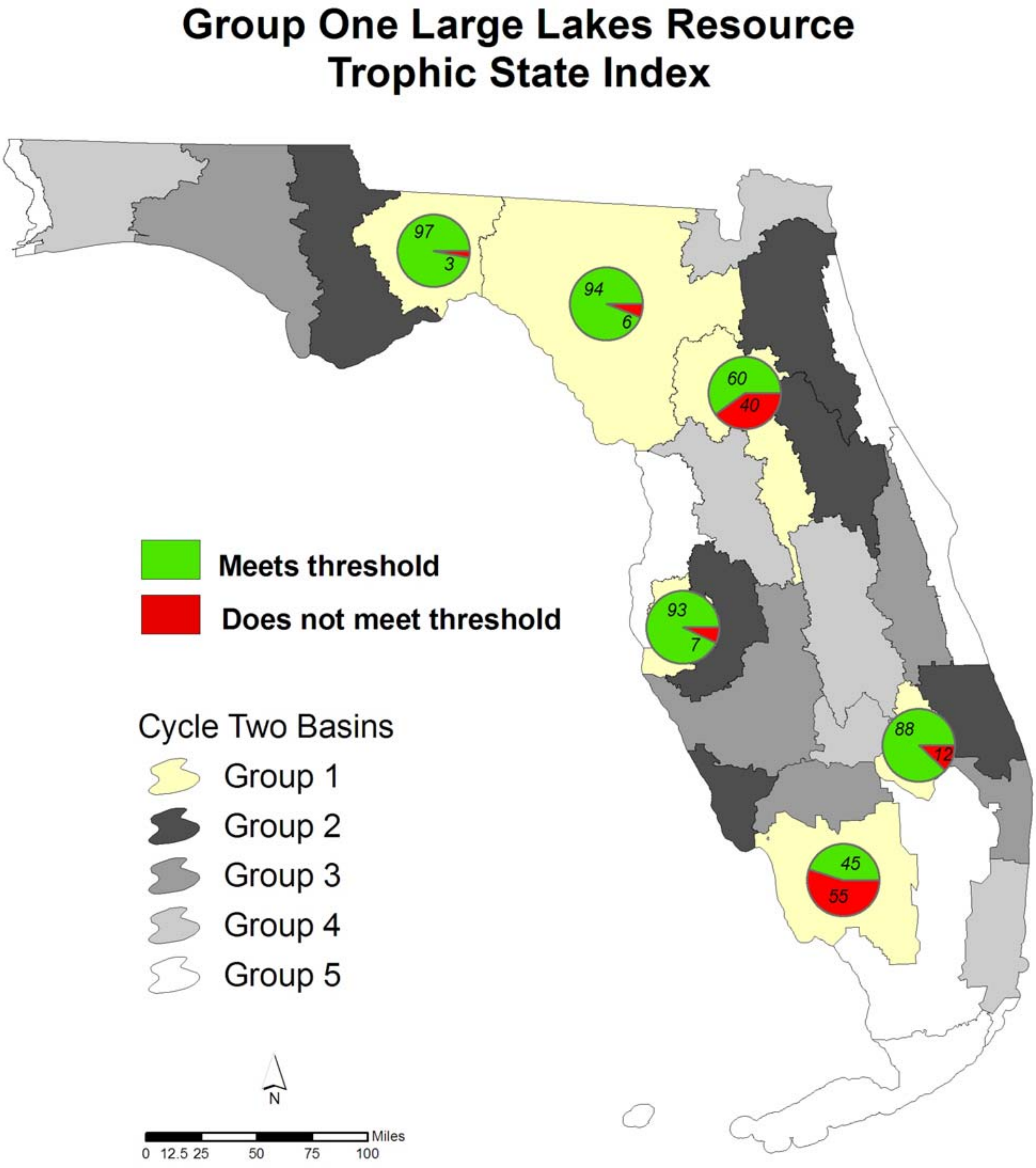


Figure A-14. Summary of Un-ionized Ammonia Assessment for Large Lakes, Group 1 Basins

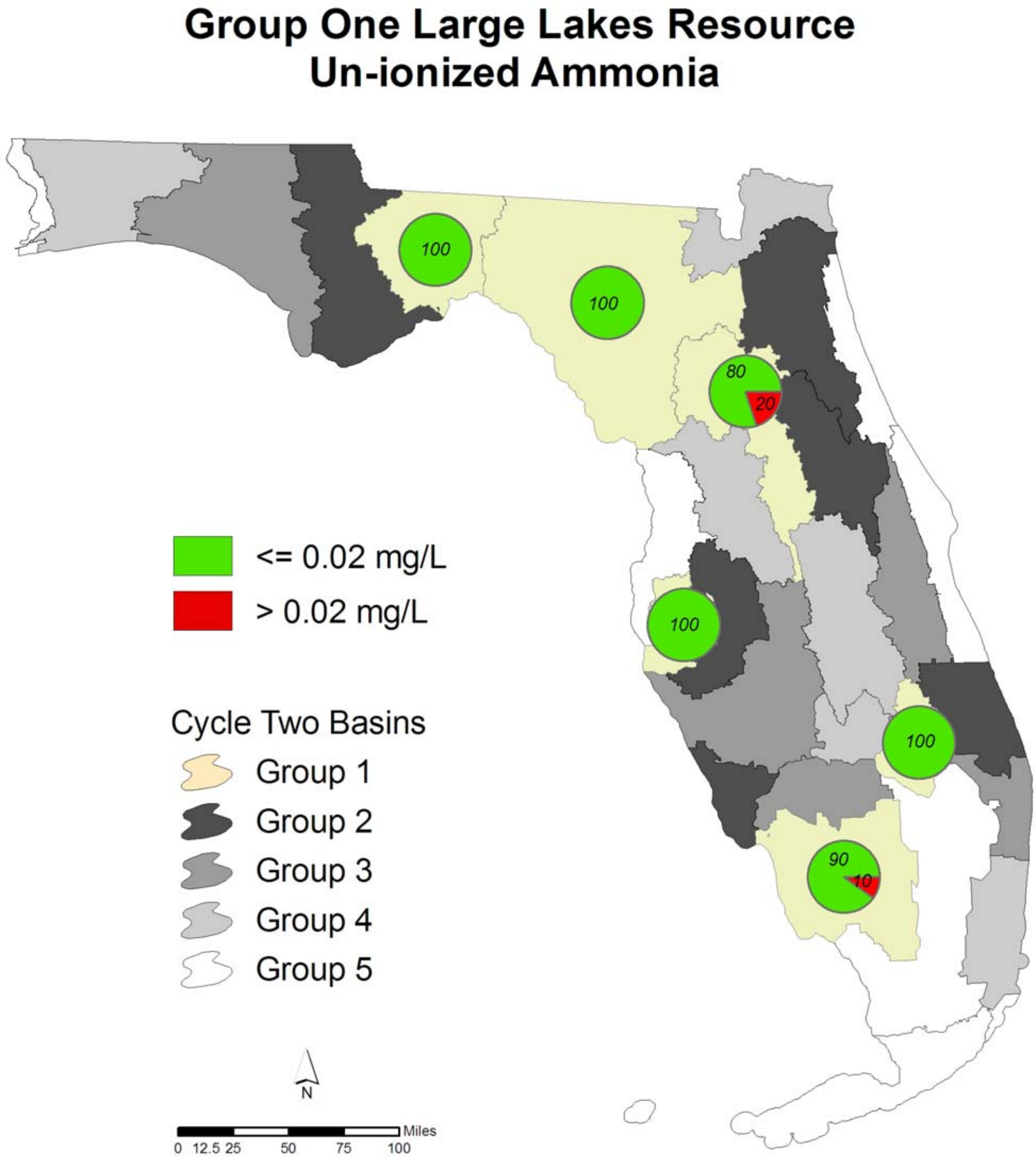


Figure A-15. Summary of DO Assessment for Large Lakes, Group 1 Basins

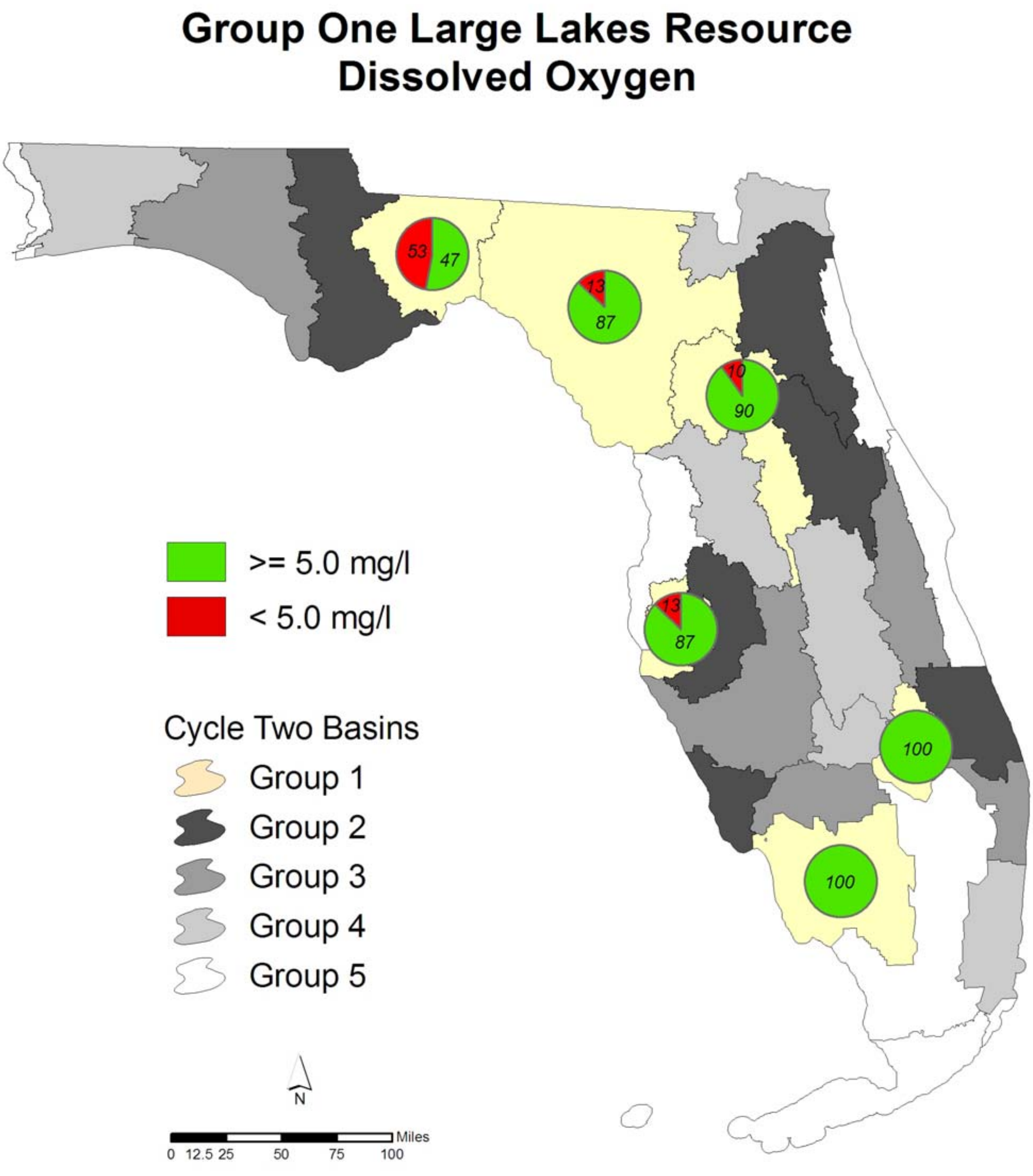


Figure A-16. Summary of DO Assessment for Small Lakes, Group 1 Basins

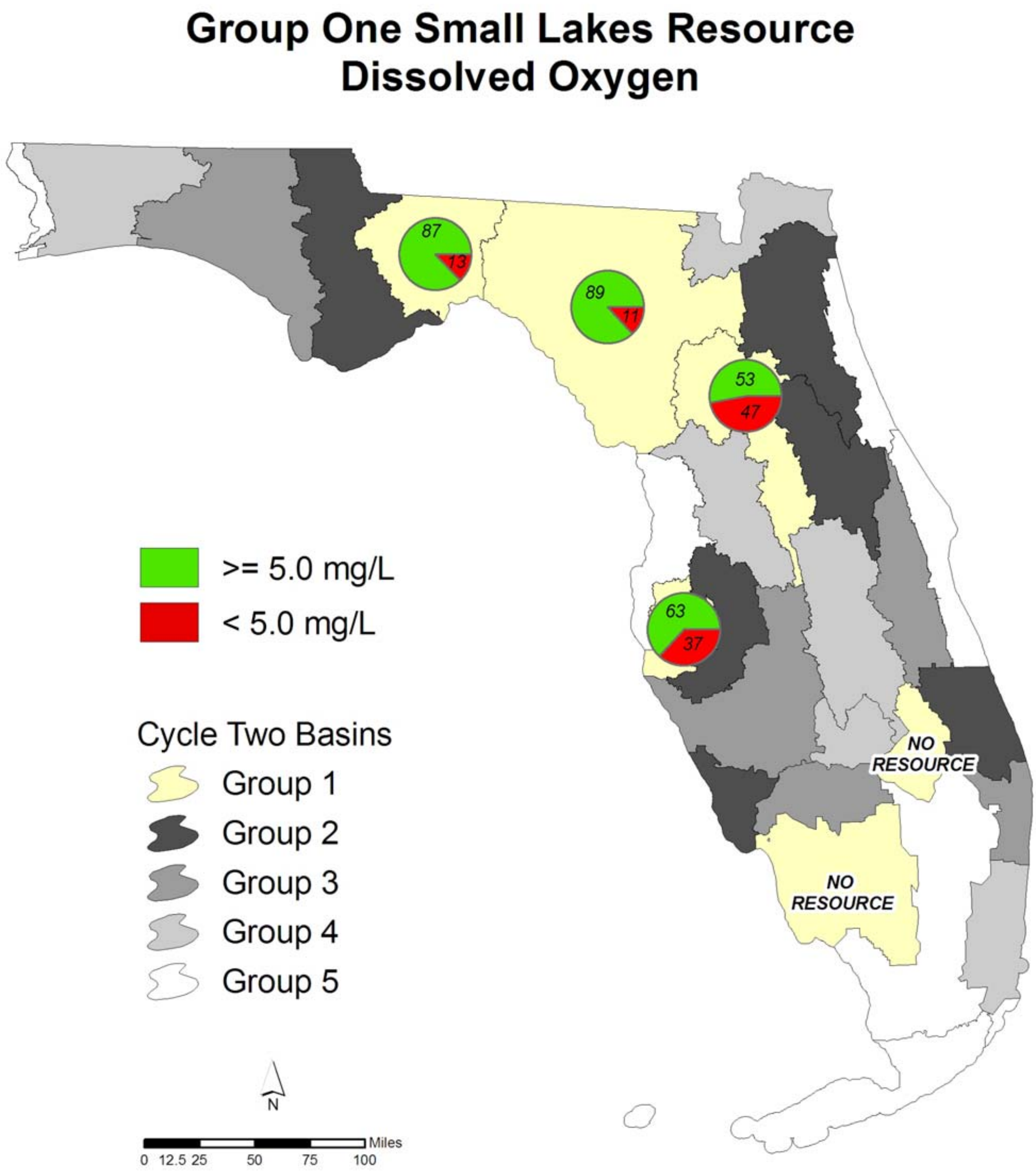


Figure A-17. Summary of Fecal Coliform Assessment for Small Lakes, Group 1 Basins

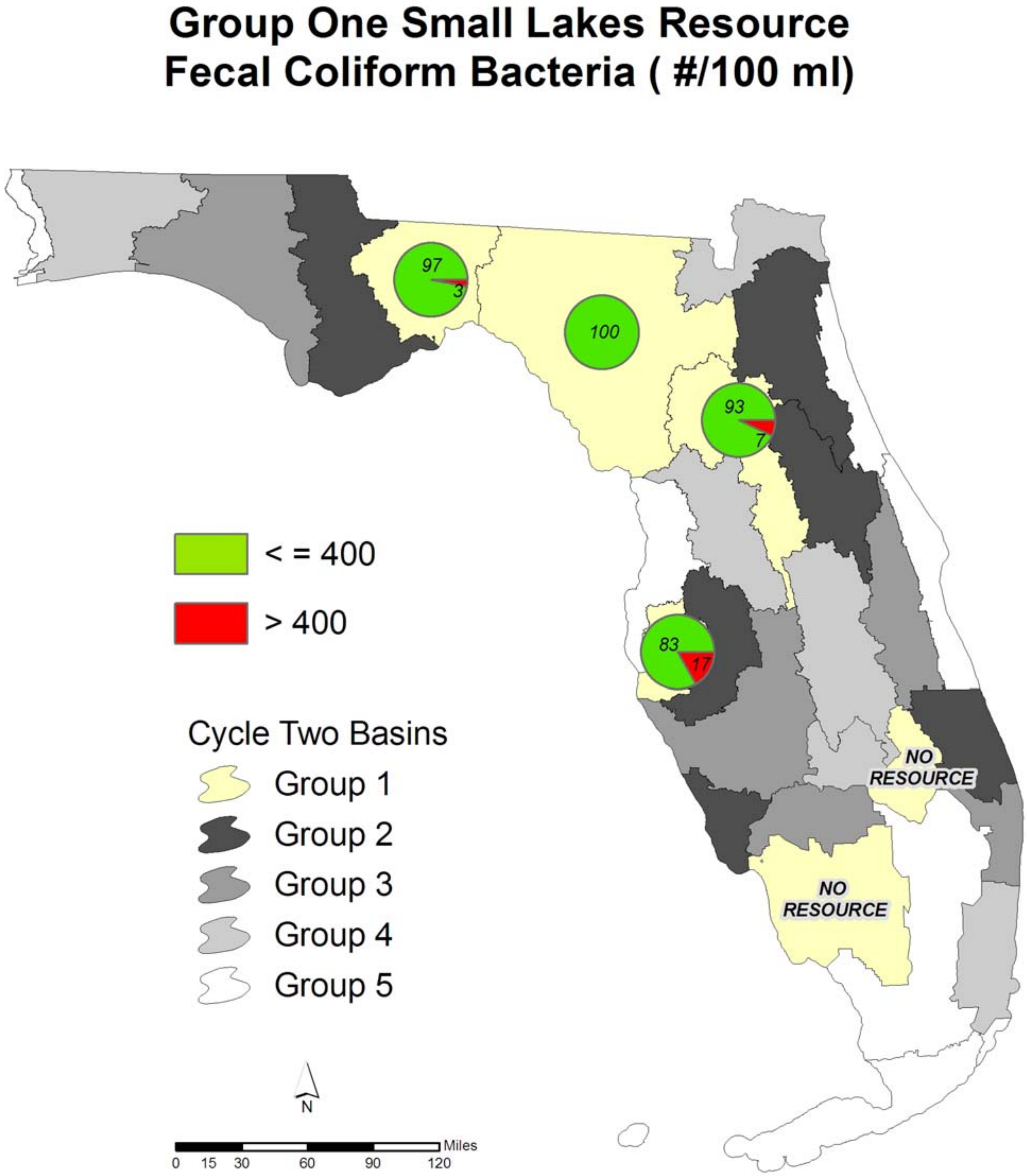


Figure A-18. Summary of pH Assessment for Small Lakes, Group 1 Basins

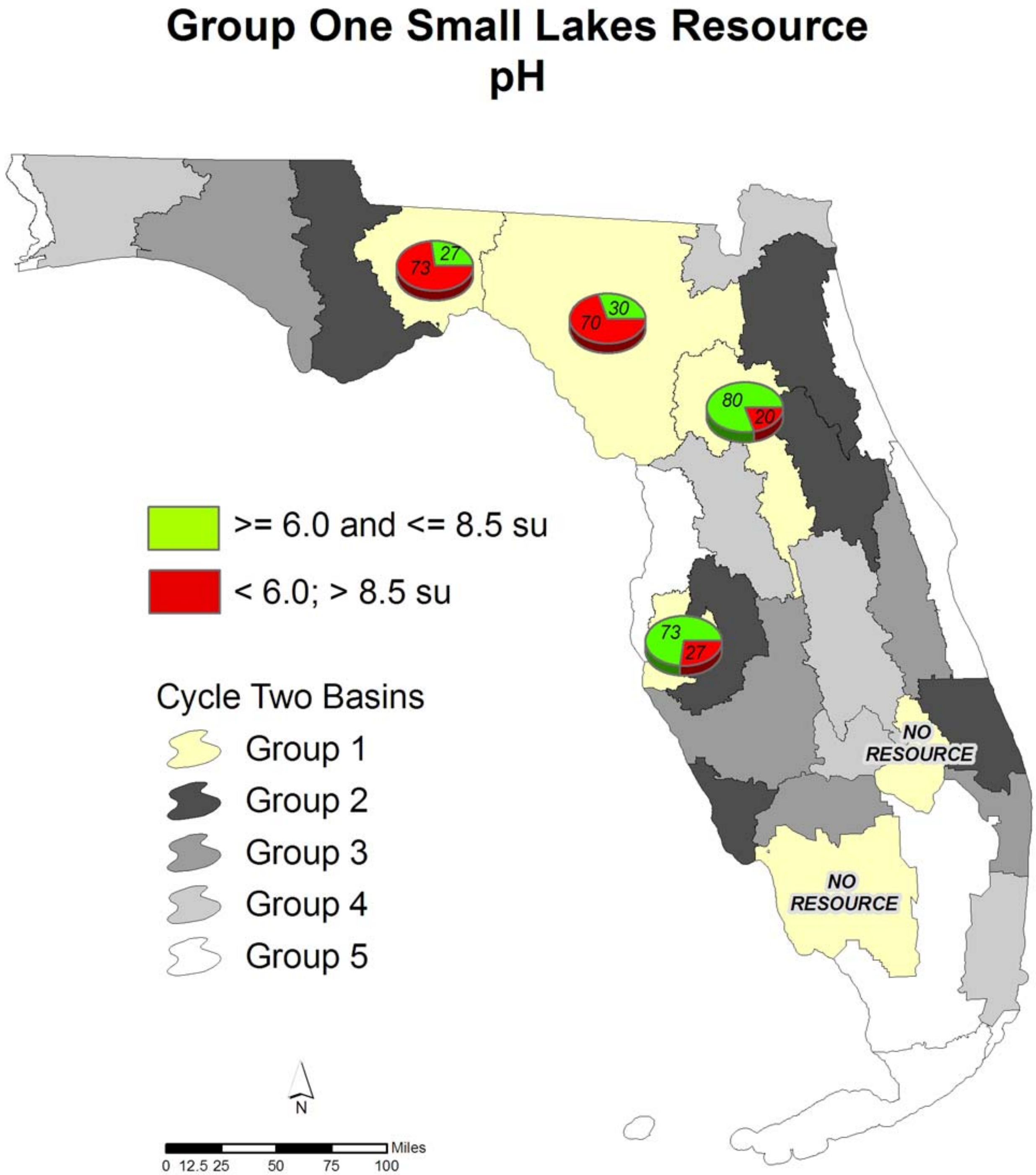


Figure A-19. Summary of TSI Assessment for Small Lakes, Group 1 Basins

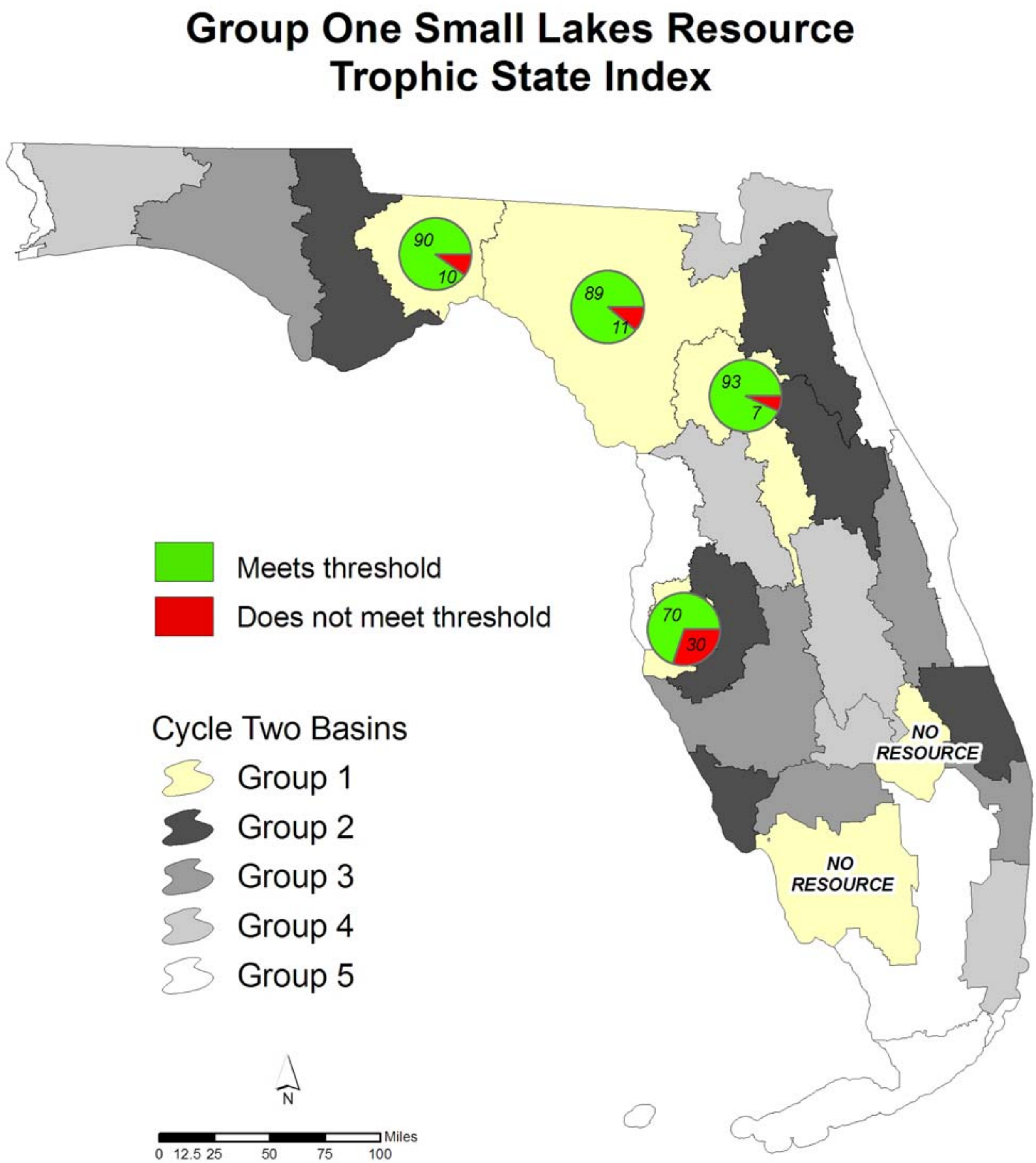
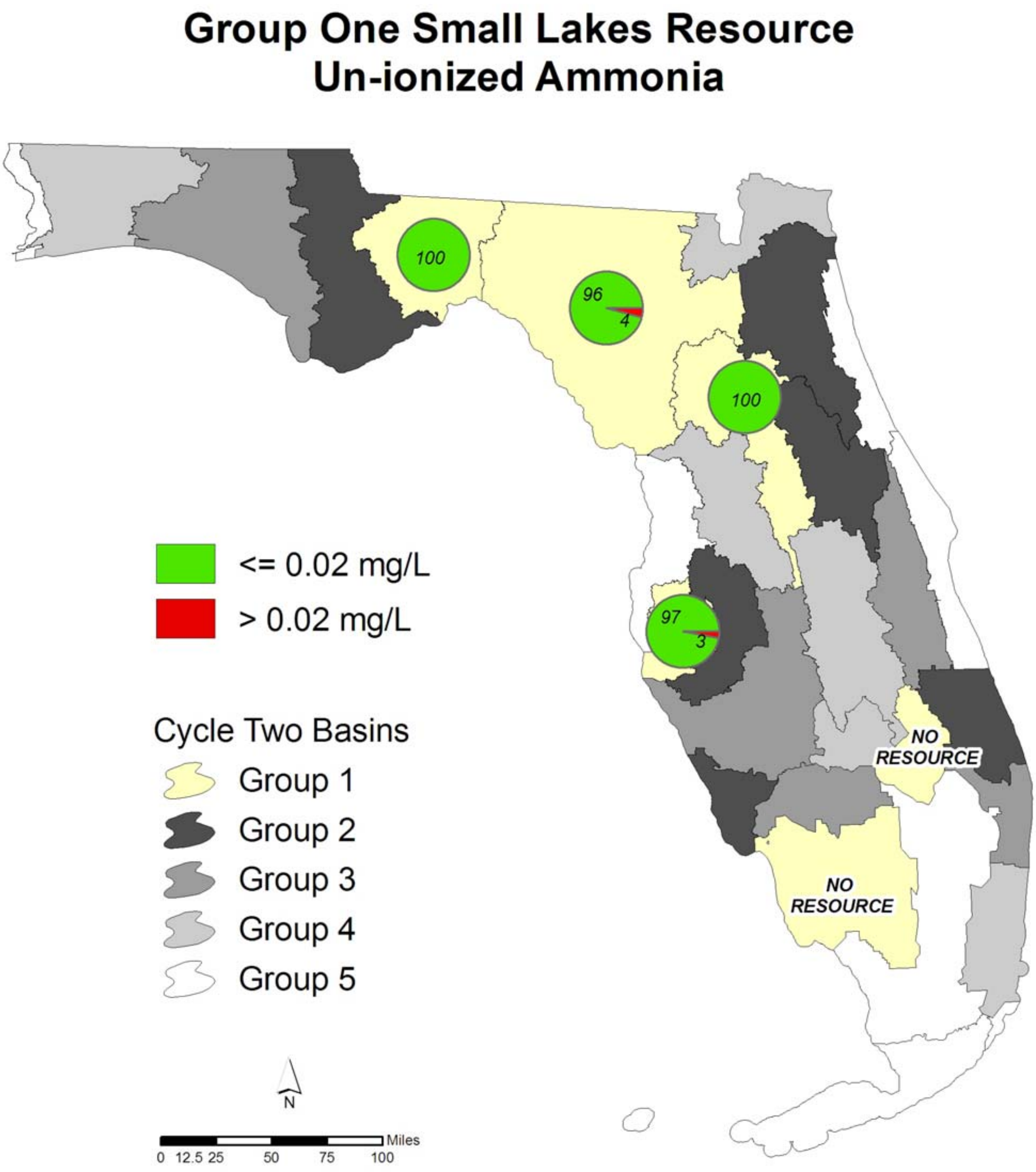


Figure A-20. Summary of Un-ionized Ammonia Assessment for Small Lakes, Group 1 Basins



Appendix B. Discussion of Status Network Surface Water Indicators for Rivers and Lakes, and Ground Water Indicators

Surface Water Indicators for Rivers and Lakes

Fecal Coliform Bacteria

The threshold for fecal coliform bacteria is 400 colonies per 100 milliliters (mL) of water. Additionally, twice that number (800) is cited in Rule 62-302, F.A.C., as indicating a highly contaminated result used for regulatory purposes. The presence of these bacteria can indicate the contamination of a waterway or well and the possible presence of other pathogenic organisms.

Fecal coliform bacteria can enter water through the discharge of waste from mammals and birds, from agricultural and stormwater runoff, and from untreated human sewage. Septic tanks for individual homes can become overloaded during the rainy season and allow untreated human wastes to flow into drainage ditches and nearby waters. Agricultural practices such as allowing animal wastes to wash into nearby streams during the rainy season, spreading manure and fertilizer on fields during rainy periods, and allowing livestock watering in streams can all contribute fecal coliform contamination.

Dissolved Oxygen

The state criterion for DO is greater than or equal to 5 mg/L. DO is a measure of water quality indicating free oxygen dissolved in water. Oxygen is measured in its dissolved form. If more oxygen is consumed than is produced, DO levels decline and some sensitive aquatic animals may move away, weaken, or die. Levels vary with water temperature; therefore, cold water holds more oxygen than warm water.

Surface water gains oxygen from the atmosphere and plants as a result of photosynthesis. Running water contains more oxygen than still water because of its flow. Respiration by aquatic animals, decomposition, and various chemical reactions consume oxygen.

Wastewater from sewage treatment plants often contains organic materials that are decomposed by microorganisms, which use oxygen in the process. Other sources of oxygen-consuming waste include stormwater runoff from farmland or urban streets, feedlots, and failing septic systems. Ground water is naturally low in DO. Surface water contact with ground water seepage or upwelling can cause a natural lowering of DO levels.

pH

The surface water criterion for pH is ≥ 6, ≤ 8.5 su. pH is a measure of the degree of acidity or alkalinity of a solution, as measured on a pH scale of 0 to 14. The midpoint of 7.0 on the pH scale represents neutrality—that is, a neutral solution is neither acid nor alkaline. Numbers below 7.0 indicate acidity; numbers above 7.0 indicate alkalinity.

pH is the negative of the logarithm of the hydrogen ion concentration of a solution. The hydrogen ion concentration is the weight of hydrogen ions, in grams, per liter of solution. In neutral water, for example, the hydrogen ion concentration is 10^7 grams per liter; the pH is therefore 7.

Hydrogen is responsible for acidity and alkalinity; therefore, the abbreviation "pH" stands for the "potential of hydrogen." The neutral point of 7.0 actually indicates the presence of equal concentrations of free hydrogen and hydroxide ions.

Acidity increases as pH gets lower. pH affects many chemical and biological processes in water. For example, different organisms flourish within different ranges of pH. When pH levels are outside this range, aquatic animal diversity is harmed because it stresses the physiological systems of most organisms and can reduce reproduction. Low pH can also allow toxic elements and compounds to become mobile and "available" for uptake by aquatic plants and animals. This can produce conditions that are toxic to aquatic life, particularly to sensitive species. Changes in acidity can be caused by atmospheric deposition (acid rain), surrounding rock, and certain wastewater discharges.

Un-ionized Ammonia

The threshold for un-ionized ammonia is ≤0.02 mg/L as ammonia and is calculated using temperature, salinity, ammonia, and pH. This criterion applies to predominantly fresh waters in Florida. In water, ammonia occurs in two forms, which together are called total ammonia nitrogen, or TAN. Chemically, these two forms are represented as NH_4^+ and NH_3. NH_4^+ is called ionized ammonia because it has a positive electrical charge, and NH_3 is called un-ionized ammonia since it has no charge. Un-ionized ammonia (abbreviated as UIA), is the form that is toxic to fish and invertebrates. Water temperature and pH affect which form of ammonia is predominant at any given time in an aquatic system.

Chlorophyll *a*

The threshold for chlorophyll is ≤ 20 μg/L. This threshold is applied to the rivers and streams resources in the Status Monitoring Network. This is not a criterion under Rule 62-302, F.A.C.; rather, it is listed as a measure to identify impairment in surface waters in Section 62-303.351, F.A.C., describing the assessment of nutrients in streams. Chlorophyll is the pigment that allows plants—including algae—to convert sunlight into organic compounds during the process of photosynthesis. Chlorophyll *a* is the predominant type found in algae and cyanobacteria (blue-green algae), and its abundance is a good indicator of the amount of algae present in a surface waterbody.

Excessive quantities of chlorophyll *a* can indicate the presence of algal blooms. These usually consist of a single species of algae, typically a species undesirable for fish and other predators to consume. Unconsumed algae sink to the bottom and decay, using up the oxygen required by other plants and benthic organisms to survive. The presence of too many nutrients, such as nitrogen and phosphorus, can stimulate algal blooms and result in reduced water clarity.

Chlorophyll *a* also plays a direct role in reducing the amount of light available to plants in shallow-water habitats. Like their terrestrial cousins, these plants need sunlight to grow. As chlorophyll *a* levels increase, the amount of sunlight reaching underwater plants declines.

Trophic State Index

Lakes are potentially impaired for nutrients if (1) in lakes with a mean color greater than 40 CUs), the annual mean TSI for the lake exceeds 60, or (2) in lakes with a mean color less than or equal to 40 PCUs, the annual mean TSI for the lake exceeds 40. TSI was used as a threshold for both large and small lakes in the Status Monitoring Network.

The TSI classifies lakes based on chlorophyll levels and nitrogen and phosphorus concentrations. It is based on a classification scheme that relies on 3 indicators—Secchi depth, chlorophyll, and total phosphorus—to describe a lake's trophic state. A 10-unit change in the index represents a doubling or halving of algal biomass.

The Florida TSI is based on the same rationale, but total nitrogen replaces total Secchi depth as the third indicator. Attempts in previous 305(b) reports to include Secchi depth have been unsuccessful in dark-water lakes and estuaries, where dark waters rather than algae diminish transparency.

Note: Both TSI and chlorophyll *a* are not standards, but thresholds used to estimate the condition of state waters. These thresholds are used in the analysis of Status Network data based on single samples within a basin during a predetermined index period. The analysis and representation of these data are not intended to infer the verification of impairment as defined in Rule 62-303, F.A.C., in these waters.

Ground Water Indicators

Analytes with primary drinking water standards have been added to measure the condition of Florida's aquifers. ***Table B-1*** contains the list of analytes with the associated criterion for each analyte. Primary standards mean that the criterion for an analyte is based on human health effects.

Key indicator contaminants for ground water (e.g., chloride, nitrate, metals, and bacteria) serve to assess the general suitability for drinking water purposes. In Cycle 1 of the Status Network, aquifer samples were filtered to mitigate well construction factors, and the analytes were measured as dissolved constituents. This was changed in Cycle 2 to total constituents in order to reflect more closely the water directly from the aquifer. Additionally, standards are measured using unfiltered water, and so unfiltered samples allow consistency with standards.

Total Coliform Bacteria

The EPA has determined that the presence of total coliforms is a possible health concern. Total coliforms are common in the environment and are generally not harmful themselves. The presence of these bacteria in drinking water, however, generally is a result of a problem with water treatment or the pipes that distribute the water, and indicates that the water may be contaminated with organisms that can cause disease.

The EPA and the state have set an enforceable drinking water standard for total coliforms of 4 counts per 100 mL to reduce the risk of adverse health effects. Drinking water that meets this standard is usually not associated with a health risk from disease-causing bacteria and should be considered safe.

Table B-1. Status Network Water Quality Standards for Ground Water

Analyte	*Criterion/Threshold*	*Use*
Total Coliform Bacteria (# /100 mL)	≤ 4 (sample maximum)	Potable water
Arsenic Cadmium Chromium Fluoride Lead Sodium	≤ 10 μg/L ≤ 5 μg/L ≤ 100 μg/L ≤ 4 mg/L ≤ 15 μg/L ≤ 160 mg/L	Potable water
Nitrate + Nitrite	≤ 10 mg/L	Potable water

Arsenic

Arsenic, a naturally occurring element, is widely distributed in the earth's crust. Two main categories are found, inorganic and organic arsenic. Inorganic arsenic compounds are mainly used to preserve wood. Arsenic in animals and plants combines with carbon and hydrogen to form organic arsenic compounds. Organic arsenic compounds are used as pesticides, primarily on cotton plants.

Many arsenic compounds can dissolve in water, and can be transported into ground water. Arsenic can affect human health. Several studies have shown that inorganic arsenic can increase the risk of lung, skin, bladder, liver, kidney, and prostate cancers. The World Health Organization (WHO), the U. S. Department of Health and Human Services (DHHS), and the EPA have determined that inorganic arsenic is a human carcinogen.

Organic arsenic compounds are less toxic than inorganic arsenic compounds. Exposure to high levels of some organic arsenic compounds may cause similar effects to those of inorganic arsenic.

Cadmium

The EPA and FDEP set the drinking water standard for cadmium at 5 ppb to protect against the risk of adverse health effects. Cadmium, a naturally occurring heavy metal whose chemical properties are similar to those of zinc, does not occur uncombined in nature. A byproduct of smelting and refining ores of zinc and lead, it is used for its anticorrosive properties in the electroplating of steel, in its sulfide form in the manufacture of paint pigments, and in the manufacture of batteries and other electrical components. Cadmium also occurs as a byproduct in many chemical fertilizers that are produced from phosphate ores. Cadmium enters the ambient air primarily from local smelting operations, it enters soil from local mining operations and from chemical fertilizers, and it enters water from fertilizer runoff and/or industrial wastewater.

This inorganic metal is a contaminant in the metals used to galvanize pipe. It generally gets into water by corrosion of galvanized pipes or by improper waste disposal. The EPA has set the drinking water standard for cadmium at 0.005 parts per million (ppm) to protect against the risk of adverse health effects. Drinking water that meets the EPA standard is associated with little to none of this risk and is considered safe with respect to cadmium.

Chromium

This inorganic metal, which occurs naturally in the ground, is often used in the electroplating of metals. It generally enters water from runoff from old mining operations and improper waste disposal from plating operations. Some humans exposed to high levels of chromium suffered liver and kidney damage, dermatitis and respiratory problems. The EPA has set the drinking water standard for chromium at 0.1 ppm to protect against the risk of adverse health effects. Drinking water that meets the EPA standard is associated with little to none of this risk and is considered safe with respect to chromium.

Fluoride

EPA regulations require that fluoride, which occurs naturally in some water supplies, not exceed a concentration of 4.0 mg/L in drinking water. Exposure to drinking water levels above 4.0 mg/L for many years may result in crippling skeletal fluorosis, a serious bone disorder.

State regulations require a water system to notify the public when monitoring indicates that the fluoride in drinking water exceeds 2.0 mg/L. This is intended to alert families about dental problems that might affect children under nine years of age.

Fluoride in children's drinking water at levels of approximately 1 mg/L reduces the number of dental cavities. However, some children exposed to levels of fluoride greater than about 2.0 mg/L may develop dental fluorosis. Dental fluorosis, in its moderate and severe forms, is a brown staining and/or pitting of the permanent teeth.

Because dental fluorosis occurs only when developing teeth (before they erupt from the gums) are exposed to elevated fluoride levels, households without children are not expected to be affected by this level of fluoride. Families with children under the age of nine are encouraged to seek other sources of drinking water for their children to avoid the possibility of staining and pitting.

Lead

Materials that contain lead have frequently been used in the construction of water supply distribution systems, and in plumbing systems in private homes and other buildings. The most commonly found materials include service lines, pipes, brass and bronze fixtures, and solders and fluxes. Lead in these materials can contaminate drinking water as a result of the corrosion that takes place when water comes into contact with those materials. The EPA's national primary drinking water regulation requires all public water systems to optimize corrosion control to minimize lead contamination resulting from the corrosion of plumbing materials.

Nitrate-Nitrite

Nitrate is used in fertilizer and is found in sewage and wastes from human and/or farm animals; it generally enters drinking water from these activities. Excessive levels of nitrate in drinking water have caused serious illness and sometimes death in infants less than 6 months of age. The EPA has set the drinking water standard at 10 ppm for nitrate to protect against the risk of adverse effects.

The EPA has also set a drinking water standard for nitrite at 1 ppm. In addition, to allow for the fact that the toxicity of nitrate and nitrite are additive, the EPA has established a standard for the sum of nitrate and nitrite at 10 ppm. Drinking water that meets the EPA standard is associated with little to none of this risk and is considered safe with respect to nitrate.

Sodium

EPA has set the drinking water standard for sodium (salt) at 160.0 ppm to protect individuals who are susceptible to sodium-sensitive hypertension or diseases that cause difficulty in regulating body fluid volume. Sodium is monitored so that individuals who have been placed on sodium-restricted diets may take the sodium in their water into account. Sodium naturally occurs in food and drinking water. Food is the common source of sodium. Drinking water contributes only a small fraction (less than 10%) of an individual's overall sodium intake. Sodium levels in drinking water can be increased by ion-exchange softeners at water treatment facilities or some point-of-use treatment devices.

Appendix C. Status Network Surface Water Methodology

Florida launched the sampling portion of the Status Network beginning in January 2004 for the current reporting cycle. This monitoring network is designed to assess both surface water and ground water throughout the state. The design provides an estimate of condition, or status, of the state's numerous and diverse water resources. The implementation of the Status Network monitoring enables FDEP to estimate the condition of 100% of accessible aquatic resources in the state with a known statistical confidence. Data produced by the Status Network are used to complement traditional CWA 305(b) reporting.

The Status Network design for probabilistic monitoring is based on the EPA's EMAP model. The design incorporates a stratified, rotating-basin, multiyear approach to sampling and reporting on water resources from the entire state. ***Figure 4*** in **Chapter 3** shows the basins used as a foundation for Florida's watershed programs, especially for 303(d) and 305(b) reporting. FDEP will be able to answer questions of statewide concern—for example, "what are the concentrations of nutrients in Florida's surface waters?" and "are these concentrations changing over time?"

Monitoring Design

A stratified random design to address statewide as well as regional resources was selected, using the Generalized Random Tessellation Stratified (GRTS) probabilistic sampling design supported by the EPA's EMAP Program. All stratified random sampling networks use predefined geographic subunits (basins) that together comprise the whole state, so that the resulting data can address questions at statewide and specific basin scales. As seen in ***Figure 4*** (Chapter 3), and summarized in ***Table C-1,*** the state is divided into 29 basins as the foundation for the basin assessments. During the 5-year cycle of the Status Network (January 2004 through December 2008), all basins will be sampled in a predetermined sequence, using the same 5-year rotation as the TMDL Program. At the end of the 5-year cycle, the entire state will be sampled.

Table C-1: Basin Groups for Implementing the Watershed Management Cycle, by FDEP District Office

	Group 1 Basins	Group 2 Basins	Group 3 Basins	Group 4 Basins	Group 5 Basins
Northwest	Ochlockonee–St. Marks Rivers	Apalachicola–Chipola Rivers	Choctawhatchee River and Bay and St. Andrew Bay	Pensacola Bay	Perdido River and Bay
Northeast	Suwannee River	Lower St. Johns River	—	St. Marys–Nassau Rivers	Northeast Coast Lagoons
Central	Ocklawaha River	Middle St. Johns River	Upper St. Johns River	Kissimmee River	Indian River Lagoon
Southwest	Tampa Bay	Tampa Bay Tributaries	Sarasota Bay and Peace–Myakka Rivers	Withlacoochee River	Springs Coast
South	Everglades West Coast	Charlotte Harbor	Caloosahatchee River	Fisheating Creek	Florida Keys
Southeast	Lake Okeechobee	St. Lucie–Loxahatchee Rivers	Lake Worth Lagoon/Palm Beach Coast	Southeast Urban Coast	Everglades

Sampling in the Status Network occurs 1 to 2 years ahead of the TMDL rotation. This schedule provides both recently collected data from the region of interest and an estimate of condition for 4 surface water and 2 ground water resources from each of the 29 basins. Results are provided annually to FDEP's Watershed Assessment Section to complement the information gathered to prepare basin reports. Every 2 years, the results of the Tier I sampling of basins are submitted to the EPA through the 305(b) reporting process.

Some limitations are inherent in the GRTS sample design, due to the state's geography. Not all resources can be sampled in all basins, depending on how the basins are delineated and whether specific resources are actually present. Portions of Florida do not support all the "typical" waters used in the sampling design. For example, there are few, if any, true small lakes in the southern portions of the state. Or watersheds may split the tributaries to an estuary from the upland contributing portion, leaving no stream miles on the estuarine side of the two watersheds. Therefore, the ideal number of samples would not be collected.

As in any monitoring program, the placement of sites and the total number of sites are based on the assessment questions. Since many of the Tier I monitoring questions require assessments for "all" of Florida's fresh waters, then an element of the sampling design must be extractable and thus probabilistic in nature. The use of the term "probabilistic" infers that the sites are representative and not biased. Therefore, the use of random selections is adopted from a list (list frame) of resources available to sample from each population. The specific protocol for the selection of sample sites for each resource type (e.g., small lakes, small streams) is somewhat different. Some resources are selected as points, while others are line features, and still others are based on area. The base for the state map showing water resources is the rNHD. The following section discusses the selection of the sites.

Geographic Design

Location information for point-feature sites (e.g., wells, small lakes) and electronic representations of all other water resources are sent in a GIS file with associated metadata to the EPA in Corvallis, Oregon. Thirty random primary selections and a 5-time oversample, for a total of 180 possible selections, are chosen from each resource in each basin. The oversample is required because of the high probability of possible sampling problems, such as landowner denials of permission, dry resources, possible GIS errors, and other sampling challenges that are routinely associated with random versus fixed station sampling designs.

The 180 potential sample sites are placed into a database and accessed by samplers in an Internet-based application called OGWIS. These sites must be sampled in the same order in which they were generated from the EPA program. The application allows samplers to review selected sites using an Arc Interactive Mapping System (ArcIMS). Initial reconnaissance can then be conducted to determine whether the site represents the correct resource, whether additional information is needed from the field to determine if the site meets the definition of the population being sampled, or even to help determine the easiest access for collecting samples at the site.

Water Resource Types

In order to sample many different occurrences of water systematically across the state, Florida's waters have been subdivided into "resources." Each resource constitutes a readily identifiable occurrence of a water of interest for management purposes. In addition, the scale of a waterbody has an effect on sampling strategy and, in many cases, on the management of resources, and so the resources have been subdivided to facilitate sampling and resource evaluation. The following surface water resources are monitored as part of the Status Network:

- *Lakes (2.5 to 25 acres and over 25 acres), and*
- *Large rivers and small streams (including canals).*

Lakes

Lakes are subdivided into two groups: (1) small lakes between 2.5 and 25 acres and (2) large lakes over 25 acres. This differentiation on the basis of size is intended to accommodate different sampling strategies and methods and allow better representation of the resource. The number and size of large lakes would have skewed selection and caused small lakes to be under-represented in the sample design, had all lakes been in one category.

The protocol for site selection for small lakes (between 2.5 and 25 acres) was based on the rNHD 1:100,000 scale. All lakes less than 25 acres in size are associated with latitude-longitude coordinates for the center of the lake. A list frame was developed for each basin, and 180 random selections were chosen in each basin.

The selections of large lakes (over 25 acres) were also based on available coverage from the rNHD 1:1000:000 scale. Random point locations were generated based on area; several stations may exist in one lake.

Rivers, Streams, and Canals

Streams and rivers are abundant in Florida, which has approximately 52,000 miles of waters including canals and ditches (see the section on Surface Water and Ground Water Resources in Chapter 2). Using the 1:100,000 coverage and not counting the estuarine portions of these waterbodies, the statewide estimate of waters in the Status Network listframe is approximately 48,000 miles.

The resource was divided into “large rivers” and “small streams” based on the 1:100,000 GIS coverage. This division was predetermined by review by water management district and FDEP project managers. Large rivers were selected as waters of greatest interest or significance within the different watersheds. Once the “large rivers” coverage was determined, the remaining rivers and streams on the 1:100,000 scale were deemed “small streams.” This also allows adequate representation of the large river resource when making sample site selections, as the miles of small streams far exceed the large river miles.

Each year approximately 30 random samples are collected from each of the resources in 5 to 6 basins around the state. Approximately 120 samples are collected for the combined surface water resources in addition to quality assurance samples. The indicator list, which consists of both chemical and biological parameters, is discussed in **Appendix B.** The same sampling and analytical methodologies are used for all of the basins.

Proposed indicators may exhibit large intra-annual (seasonal) variability. Generally, monitoring programs do not have the monetary resources to characterize this variability, or to assess ambient conditions in all seasons for "all" resources (i.e., all of Florida’s fresh waters). Therefore, sampling is often limited to a confined portion of the year (index period). Annual sampling for the Status Network occurs during different index periods of 4 to 12 weeks for each resource type **(*Table C-2*).**

A study is under way to answer the question of whether there are significant changes in individual measures of condition as a result of the seasonality in the study design. Duplicate stations are collected from the same lakes, but will be sampled in different seasons. The results will be compared to determine whether the proportional estimate of condition of selected indicators is significantly different.

Table C-2. Status Network Primary Index Periods

Resource North Florida	***Jan***	***Feb***	***Mar***	***Apr***	***May***	***Jun***	***Jul***	***Aug***	***Sep***	***Oct***	***Nov***	***Dec***
Confined Aquifers	■	■	■									
Unconfined Aquifers						■	■					
Small Streams				■	■							
Large Rivers							■	■				
Small Lakes			■	■								
Large Lakes						■	■					

Resource Peninsular Florida	***Jan***	***Feb***	***Mar***	***Apr***	***May***	***Jun***	***Jul***	***Aug***	***Sep***	***Oct***	***Nov***	***Dec***
Confined Aquifers	■	■	■									
Unconfined Aquifers				■	■							
Small Streams								■	■			
Large Rivers					■	■						
Small Lakes							■	■				
Large Lakes										■	■	

Appendix D. Impaired Surface Waters Rule Methodology for Evaluating Impairment for the Basin Assessments

To determine the status of surface water quality in individual WBIDs in Florida, three categories of data—chemistry data, biological data, and fish consumption advisories—are evaluated using the IWR methodology to determine potential impairments for four designated use attainment categories: aquatic life, primary contact and recreation, fish and shellfish consumption, drinking water use, and protection of human health.

Aquatic Life Based Attainment

The IWR follows the principle of independent applicability. A waterbody is listed for potential impairment of aquatic life use support based on exceedances of any one of four types of water quality indicators (numeric water quality criteria, nutrient thresholds, biological thresholds, and toxicity data).

Exceedances of Numeric Water Quality Criteria

The water quality data from STORET used in evaluating impairment were also used in making attainment determinations. The assessment of impairment included only ambient surface water quality stations. Water quality information from point sources or wells was excluded. Data that were determined to be of insufficient quality for TMDL data quality objectives were also excluded from the Verified List assessment. Monitoring stations were classified as one of five waterbody types—spring, stream, lake, estuary, or blackwater—based on specific criteria. The assessments included the following parameters:

Metals	*Arsenic, aluminum, cadmium, chromium VI, chromium III, copper, iron, lead, mercury, nickel, selenium, silver, thallium, and zinc*
Nutrients	*Chlorophyll a for streams and estuaries, and TSI (chlorophyll a, total nitrogen, and total phosphorus) for lakes*
Conventionals	*DO, fecal coliform, total coliform, pH, un-ionized ammonia*

The requirements for placing waters on the Planning List of potentially impaired waters included a minimum of 10 temporally independent samples from the 10-year period of record shown in ***Tables 13a*** and ***13b*** (in **Chapter 3**), unless there were 3 exceedances of water quality or 1 exceedance of an acute toxicity criterion in a 3-year period. The screening methodology for the Verified List of impaired waters requires at least 20 samples from the last 7.5 years preceding the Planning List assessment. An exceedance, meaning that water quality criteria or standards are not met, is recorded any time the criterion is exceeded by any amount. An exceedance for

DO, however, means that a waterbody does not meet the DO criterion, rather than an actual exceedance of the criterion.

To determine if a water should be placed on the Planning List for each parameter, the chemical data were analyzed using a computer program written to assess the data, based on criteria established in the IWR, with two exceptions. First, un-onized ammonia data were not analyzed by the program, but rather with an Excel spreadsheet. Second, because the full complexity of the pH criterion could not be programmed, the incomplete listings for pH were not included, but were further examined while additional data were collected during Phase 2 of the watershed management cycle. Data analysis and statistical summaries of waterbody identification numbers (WBIDs), waterbody types, and parameters obtained from the STORET Database were conducted using Access, SAS statistical software, and ArcView GIS applications

The data for metals and conventional parameters were compared with the state surface water quality criteria in Section 62-302.530, F.A.C. (IWR). The rule contains a table of sample numbers versus exceedances. A waterbody was placed on the Planning List if there was at least 80% confidence that the actual criteria exceedance rate was greater than or equal to 10%. To be placed on the Verified List, at least a 90% confidence rate was required.

Exceedances of Nutrient Thresholds

The state currently has a narrative nutrient criterion instead of a numeric value for nutrient thresholds. The narrative criterion states, “In no case shall nutrient concentrations of a body of water be altered so as to cause an imbalance in natural populations of aquatic flora or fauna.” The IWR provides an interpretation of the narrative nutrient criterion. In general, the TSI and the annual mean chlorophyll *a* values are the primary means for assessing whether a waterbody should be assessed further for nutrient impairment.

The rule also considers other information that might indicate an imbalance in flora or fauna due to nutrient enrichment, such as algal blooms, excessive macrophyte growth, a decrease in the distribution (either in density or aerial coverage) of seagrasses or other submerged aquatic vegetation, changes in algal species richness, and excessive diel oxygen swings.

Potential nutrient impairment was evaluated by calculating annual mean chlorophyll a values for estuaries and streams and the TSI for lakes. For lakes, the TSI was calculated using chlorophyll *a*, total phosphorus, and total nitrogen measurements. Direct evidence of imbalances of flora and fauna in waterbodies was also considered in the evaluation of nutrient impairments.

In estuarine areas, a waterbody was considered nutrient enriched if the annual mean chlorophyll a values were greater than 11 μg/L, or if annual mean chlorophyll a values increased by more than 50% over historical values for at least 2 consecutive years. For streams, a waterbody was considered nutrient enriched if the annual mean chlorophyll *a* values were greater than 20 μg/L, or if the annual mean increased by more than 50% over historical values for at least 2 consecutive years.

A lake with a mean color greater than 40 PCUs was considered nutrient enriched if the annual mean TSI exceeded 60. A lake with a mean color less than or equal to 40 PCUs was considered nutrient enriched if the annual mean TSI exceeded 40. In addition, a lake was considered nutrient enriched if there was a statistically significant increase in TSI over the last 5-year period, or if TSI measurements were 10 units higher than historical values.

Exceedances of Biological Thresholds

Bioassessments were carried out for streams, lakes, canals, and rivers using the IWR as guidance and following FDEP's standard operating procedures, which provide definitions and specific methods for the generation and analysis of bioassessment data. These are referenced in the individual bioassessment data tables contained in the Water Quality Status Reports (available at http://www.dep.state.fl.us/water/basin411/default.htm). The purpose behind using a bioassessment methodology in surface water characterizations is that biological components of the environment manifest long-term water quality conditions and thus provide a better indication of a waterbody's true health than discrete chemical or physical measurements alone. Biological communities also respond to factors other than water quality, such as habitat disruption and hydrologic disturbances. Therefore, to use bioassessment data to list a waterbody, FDEP must reasonably demonstrate the pollutant responsible for the observed degradation. Recent recalibrations of the SCI and the BioRecon method involved the use of the Human Disturbance Gradient (HDG). The HDG ranked sites based on independent assessments of habitat quality, the degree of hydrologic disturbance, water quality, and human land use intensity. Biological measures (metrics) associated with minimally affected waters in a given region were used to set ecoregional expectations.

A metric is a precise measure of biological community structure or function that responds in a predictable manner to human disturbance. Metrics (e.g., number of long-lived taxa, number of sensitive taxa, % filter feeders, % clingers) were calculated and aggregated into a dimensionless, multimetric index. Indices have advantages over individual metrics in that they can integrate several nonredundant metrics into a single score that reflects a wider range of biological variables. In Florida, multimetric bioassessment indices have been developed for vascular plants (aquatic trees, shrubs, and herbaceous macrophytes) and benthic macroinvertebrates (animals without a backbone, such as aquatic insects, crayfish, snails, and mussels). Efforts to create multimetric indices for periphyton (attached algae) and phytoplankton (drifting algae) are currently under way.

Only macroinvertebrate data from ambient sites in state surface waters were used in the bioassessments analyzed for the Planning and Verified Lists. The data included sites designated as test and background sites for NPDES fifth-year inspections, but excluded data from effluent outfalls from discharging facilities, or data from monitoring sites not clearly established to collect ambient water quality data. Because site-specific habitat and physicochemical assessment information (e.g., % suitable macroinvertebrate habitat, water velocities, extent of sand or silt smothering, and riparian [or streamside] buffer zone widths) was not available at the time of reporting, it was not included. However, this information is important for identifying the stressors responsible for a failed bioassessment and will be included in future reporting. Waterbodies that are adversely affected only by pollution (e.g., a lack of habitat or hydrologic disruption) but not a pollutant (a water quality exceedance) are not placed on the Verified List.

The data used to develop the Planning and Verified Lists were obtained from FDEP's Biological Database (SBIO) and the EPA's STORET Water Quality Database, where it could be substantiated that the data were generated in compliance with the bioassessment standard operating procedures referenced in the IWR (Section 62-303.330, F.A.C.). The data from these databases were used without regard to the randomness of sample site selection. For the purposes of the Status Reports, the seasons were defined as follows: winter (1/1–3/31), spring (4/1–6/30), summer (7/1–9/30), and fall (10/1–12/31). The wet season for northern Florida generally includes November through March, while the wet season in south Florida is usually from June to September, although conditions can vary in the state as a whole.

Lake Condition Index

The scoring of the individual metrics of the Lake Condition Index (LCI), except % Diptera, was performed according to the following formula:

100(B/A) where A = the 95 percentile of the reference population and B = observed value.

For % Diptera, the following formula was used:

100 (100-B)/(100-A) where A = the 95 percentile of the reference population and B = observed value.

An average LCI score was calculated by averaging the scores of the 6 metrics in the method: total number of taxa; total number of taxa belonging to the orders Ephemeroptera, Odonata, and Trichoptera (EOT taxa); % EOT taxa; Shannon-Wiener Diversity Index score; Hulbert Index score; and % Dipteran individuals. LCI calculations were only provided for noncolored lakes (≤ 20 PCUs). As macroinvertebrate-based indices have not been shown to assess colored lakes in Florida accurately (> 20 PCUs), they have been excluded from bioassessments. A poor or very poor rating based on the average score constituted a failed bioassessment, based on the IWR.

Stream Condition Index

A total SCI score was calculated by averaging the scores of the 10 metrics in the method: total number of taxa; total number of taxa belonging to the order Ephemeroptera, total taxa of the order Trichoptera, % filter feeders, % long-lived taxa, clinger taxa, % dominant taxa, % taxa in the Tanytarsini, % sensitive taxa, and % very tolerant taxa (see the table below for calculations). A poor or very poor rating based on the total score constituted a failed bioassessment, based on the IWR. The Water Quality Status Reports contain definitions and specific methods for the generation and analysis of bioassessment data.

SCI Metric	***Northeast***	***Panhandle***	***Peninsula***
Total taxa	10 * (X–16)/26	10 * (X–16)/33	10 * (X–16)/25
Ephemeroptera taxa	10 * X /3.5	10 * X /6	10 * X /5
Trichoptera taxa	10 * X /6.5	10 * X /7	10 * X /7
% filterer	10 * (X–1)/41	10 * (X–1)/44	10 * (X–1)/39
Long-lived taxa	10 * X /3	10 * X /5	10 * X /4
Clinger taxa	10 * X /9	10 * X /15.5	10 * X /8
% dominance	10 – (10 * [(X–10)/44])	10 – (10 * [(X–10)/33])	10 – (10 * [(X–10)/44])
% Tanytarsini	10 * [ln(X + 1) /3.3]	10 * [ln(X + 1) /3.3]	10 * [ln(X + 1) /3.3]
Sensitive taxa	10 * X /11	10 * X /19	10 * X /9
% Very tolerant	10 – (10 * [ln(X + 1)/4.4])	10 – (10 * [ln(X + 1)/3.6])	10 – (10 * [ln(X + 1)/4.1])

BioReconnaissance

To establish an impairment rating based on BioRecon data, the six metrics as calculated in the table below were used.

BioRecon Metric	***Northeast***	***Panhandle***	***Peninsula***
Total taxa	(X–14)/23	(X–16)/33	(X–11)/25
Ephemeroptera taxa	X /3.5	X /12	X /5
Trichoptera taxa	X /6.5	X /7	X /7
Long–lived taxa	X /6	X /10	X /7
Clinger taxa	X /7	X /15.5	X /8
Sensitive taxa	X /11	X /19	X /9

A poor score, based on two BioRecon failures, warrants inclusion on the Verified List.

BioRecon	***Index Range***
1 sample	
Pass	(6–10)
Fail	(0–6)
2 samples	
Good	(7–10)
Fair	(4–7)
Poor	(0–4)

Biological Integrity Standard

Quantitative data, generated through the use of Hester-Dendy artificial substrate samplers, were used to calculate Shannon-Wiener Diversity Index scores for paired background and test sites, as specified in the Biological Integrity Standard of Subsection 62-302.530(11), F.A.C. One failure of the standard meant that a waterbody segment was listed as potentially impaired.

Evaluation of Toxicity Data

Although the IWR describes the use of toxicity data for the assessment of aquatic life-based attainment, no ambient toxicity data were available for assessment and this metric was not used.

Primary Contact and Recreation Attainment

For Class I, II, or III waters, a waterbody was potentially impaired if the following criteria were met:

- *The waterbody segment did not meet the applicable water quality criteria for bacteriological quality,*
- *The waterbody segment included a bathing area that was closed by a local health department or county government for more than 1 week or more than once during a calendar year based on bacteriological data,*
- *The waterbody segment included a bathing area for which a local health department or county government issued closures, advisories, or warnings totaling 21 days or more during a calendar year based on bacteriological data, or*
- *The waterbody segment included a bathing area that was closed or had advisories or warnings for more than 12 weeks during a calendar year based on previous bacteriological data or on derived relationships between bacteria levels and rainfall or flow.*

Fish and Shellfish Consumption Attainment

For Class I, II, or III waters, a waterbody was potentially impaired if it did not meet the applicable Class II water quality criteria for bacteriological quality, or if a fish consumption advisory had been issued. Fish consumption advisories were based on FDOH's "limited consumption" or "no consumption" advisories for surface waters because of high levels of mercury in fish tissue. In addition, for Class II waters, waterbody segments that had been approved for shellfish harvesting but were downgraded to a more restrictive classification were listed as potentially impaired.

Drinking Water Attainment and Protection of Human Health

For Class I waters, a waterbody was potentially impaired if it did not meet the applicable Class I water quality criteria.

Appendix E: Impaired Lakes in Florida, Group 1–4 Basins

Lake	*WBID*	*Parameter Causing Impairment*	*Basin Group*	*Basin Name*
Alachua Sink	2720A	TSI	Group 1	Ocklawaha
Alford Arm	647	DO	Group 1	Ochlockonee–St. Marks
Alligator Lake	3176	Fish–Mercury	Group 4	Kissimmee River
Alligator Lake Outlet	3516	DO	Group 1	Suwannee
Alligator Lake Outlet	3516	TSI	Group 1	Suwannee
Banana Lake	1549B	DO	Group 3	Sarasota Bay–Peace–Myakka
Banana Lake	1549B	TSI	Group 3	Sarasota Bay–Peace–Myakka
Bay Lake	3004G	TSI	Group 2	Middle St. Johns
Bear Gulley Lake	3009	TSI	Group 2	Middle St. Johns
Beckett Lake–Open Water	1603C	TSI	Group 1	Tampa Bay
Bevens Arm Outlet	2718	TSI	Group 1	Ocklawaha
Blue Cypress Lake	2893V	Iron	Group 3	Upper St. Johns
Brant Lake	1494B	TSI	Group 1	Tampa Bay
Brick Lake	3177A	Fish–Mercury	Group 4	Kissimmee River
Buck Lake Outlet	1493	TSI	Group 1	Tampa Bay
Calm Lake	1473Y	Historical TSI	Group 1	Tampa Bay
Calm Lake	1473Y	TSI	Group 1	Tampa Bay
Cane Lake	3169J	TSI	Group 4	Kissimmee River
Cedar Lake (East) Open Water	1523C	TSI	Group 2	Tampa Bay Tributaries
Chapman Lake	1502C	TSI	Group 1	Tampa Bay
Chilton Lake–Open Water	1776A	TSI	Group 3	Sarasota Bay–Peace–Myakka
Christie Lake	3169S	Lead	Group 4	Kissimmee River
Clark Lake	1971	TSI	Group 3	Sarasota Bay–Peace–Myakka
Clear Lake	3169G	TSI	Group 4	Kissimmee River
Crescent	1474V	TSI	Group 1	Tampa Bay
CrescentLake	2606B	Iron	Group 2	Lower St. Johns
Crescent Lake	2606B	TSI	Group 2	Lower St. Johns
Doctors Lake	2389	TSI	Group 2	Lower St. Johns
Eagle Lake	1623M	TSI	Group 3	Sarasota Bay–Peace–Myakka
East Lake Tohopekaliga	3172	Fish–Mercury	Group 4	Kissimmee River
Fruitwood Lake	2994Y	TSI	Group 2	Middle St. Johns
Hillsborough Reservoir	1443E1	DO	Group 2	Tampa Bay Tributaries
Hillsborough Reservoir	1443E1	Fish–Mercury	Group 2	Tampa Bay Tributaries
Hillsborough Reservoir	1443E1	Historical Chlorophyll	Group 2	Tampa Bay Tributaries
Hollingsworth Lake	1549X	Copper	Group 3	Sarasota Bay–Peace–Myakka

Lake	*WBID*	*Parameter Causing Impairment*	*Basin Group*	*Basin Name*
Hollingsworth Lake	1549X	Fecal Coliform	Group 3	Sarasota Bay–Peace–Myakka
Hollingsworth Lake	1549X	Lead	Group 3	Sarasota Bay–Peace–Myakka
Hollingsworth Lake	1549X	TSI	Group 3	Sarasota Bay–Peace–Myakka
Hollingsworth Lake	1549X	Un-ionized Ammonia	Group 3	Sarasota Bay–Peace–Myakka
Howell Lake	2997B	TSI	Group 2	Middle St. Johns
Huckleberry Lake	1893	TSI	Group 4	Kissimmee River
Island Lake	2994D	TSI	Group 2	Middle St. Johns
Keene Lake	1451B	TSI	Group 2	Tampa Bay Tributaries
Lake Adair	2997R	TSI	Group 2	Middle St. Johns
Lake Alma	2986D	TSI	Group 2	Middle St. Johns
Lake Arbuckle	1685A	Fish–Mercury	Group 4	Kissimmee River
Lake Barber	3036A1	Historical chlorophyll	Group 2	Middle St. Johns
Lake Barton	3023B	TSI	Group 2	Middle St. Johns
Lake Beauclair	2834C	TSI	Group 1	Ocklawaha
Lake Beauclair Outlet	2834B	TSI	Group 1	Ocklawaha
Lake Bentley	1549C	TSI	Group 3	Sarasota Bay–Peace–Myakka
Lake Beresford	2893U	TSI	Group 2	Middle St. Johns
Lake Bonny	1497E	Lead	Group 3	Sarasota Bay–Peace–Myakka
Lake Bonny	1497E	TSI	Group 3	Sarasota Bay–Peace–Myakka
Lake Bryant Outlet	2782	TSI	Group 1	Ocklawaha
Lake Buckeye	1488S	TSI	Group 3	Sarasota Bay–Peace–Myakka
Lake Burkett	3009C	TSI	Group 2	Middle St. Johns
Lake Burkett	3009C	Un-ionized Ammonia	Group 2	Middle St. Johns
Lake Butler	3170Q	Fish–Mercury	Group 4	Kissimmee River
Lake Butler	3170Q	Historical TSI	Group 4	Kissimmee River
Lake Butler	3566	TSI	Group 1	Suwannee
Lake Cannon	1521H	TSI	Group 3	Sarasota Bay–Peace–Myakka
Lake Cargo	1497D1	TSI	Group 3	Sarasota Bay–Peace–Myakka
Lake Carlton Outlet	2837	TSI	Group 1	Ocklawaha
Lake Carroll	1516A	TSI	Group 1	Tampa Bay
Lake Catherine	3169P	DO	Group 4	Kissimmee River
Lake Catherine	3169P	TSI	Group 4	Kissimmee River
Lake Clarke	3245B	DO	Group 3	Lake Worth Lagoon–Palm Beach Coast
Lake Clarke	3245B	Iron	Group 3	Lake Worth Lagoon–Palm Beach Coast
Lake Clinch	1706	Fish–Mercury	Group 4	Kissimmee River
Lake Concord	2997P	TSI	Group 2	Middle St. Johns
Lake Conine	1488U	TSI	Group 3	Sarasota Bay–Peace–Myakka
Lake Copeland	3168M	TSI	Group 4	Kissimmee River
Lake Cypress	3180A	Fish–Mercury	Group 4	Kissimmee River

Lake	*WBID*	*Parameter Causing Impairment*	*Basin Group*	*Basin Name*
Lake Cypress	3180A	TSI	Group 4	Kissimmee River
Lake Davenport–Open Water	1436A	DO	Group 4	Kissimmee River
Lake Denham	2832A	TSI	Group 1	Ocklawaha
Lake Denham	2832A	Turbidity	Group 1	Ocklawaha
Lake Disston	2630B	Iron	Group 2	Lower St. Johns
Lake Disston	2630B	Fish–Mercury	Group 2	Lower St. Johns
Lake Dora	2831B	TSI	Group 1	Ocklawaha
Lake Dora	2831B	Un-ionized Ammonia	Group 1	Ocklawaha
Lake DoraOutlet	2831	TSI	Group 1	Ocklawaha
Lake DoraOutlet	2831	Un-ionized Ammonia	Group 1	Ocklawaha
Lake Dot	2997Q	TSI	Group 2	Middle St. Johns
Lake Eckles–Open Water	1523D	TSI	Group 2	Tampa Bay Tributaries
Lake Ellen–Open Water	1516E	TSI	Group 1	Tampa Bay
Lake Eloise	1521B	TSI	Group 3	Sarasota Bay–Peace–Myakka
Lake Estes	1502A	TSI	Group 1	Tampa Bay
Lake Eustis	2817B	TSI	Group 1	Ocklawaha
Lake Eustis	2817B	Un-ionized Ammonia	Group 1	Ocklawaha
Lake Fairview Lake	3004N	TSI	Group 2	Middle St. Johns
Lake Fannie	14882	TSI	Group 3	Sarasota Bay–Peace–Myakka
Lake Formosa	2997M	TSI	Group 2	Middle St. Johns
Lake Garfield	1622	TSI	Group 3	Sarasota Bay–Peace–Myakka
Lake George	2893A	TSI	Group 2	Middle St. Johns
Lake Gibson	1497D	Lead	Group 3	Sarasota Bay–Peace–Myakka
Lake Gibson	1497D	TSI	Group 3	Sarasota Bay–Peace–Myakka
Lake Griffin	2814A	Chlorophyll	Group 1	Ocklawaha
Lake Griffin	2814A	Un-ionized Ammonia	Group 1	Ocklawaha
Lake Haines	1488C	TSI	Group 3	Sarasota Bay–Peace–Myakka
Lake Hancock	1623L	DO	Group 3	Sarasota Bay–Peace–Myakka
Lake Hancock	1623L	TSI	Group 3	Sarasota Bay–Peace–Myakka
Lake Hanna	1451T	TSI	Group 2	Tampa Bay Tributaries
Lake Harney	2964A	DO	Group 2	Middle St. Johns
Lake Harney	2964A	TSI	Group 2	Middle St. Johns
Lake Harris	2838A	TSI	Group 1	Ocklawaha
Lake Hart	3171	Fish–Mercury	Group 4	Kissimmee River
Lake Hartridge	1521I	TSI	Group 3	Sarasota Bay–Peace–Myakka
Lake Hatchineha	1472B	Fish–Mercury	Group 4	Kissimmee River
Lake Helen Blazes	2893Q	DO	Group 3	Upper St. Johns
Lake Helen Blazes	2893Q	Iron	Group 3	Upper St. Johns
Lake Helen Blazes	2893Q	TSI	Group 3	Upper St. Johns

Lake	*WBID*	*Parameter Causing Impairment*	*Basin Group*	*Basin Name*
Lake Hicpochee	3237C	Lead	Group 3	Caloosahatchee
Lake Hicpochee	3237C	Total Coliform	Group 3	Caloosahatchee
Lake Holden	3168H	TSI	Group 4	Kissimmee River
Lake Howard	1521F	TSI	Group 3	Sarasota Bay–Peace–Myakka
Lake Hunter	1543	Lead	Group 2	Tampa Bay Tributaries
Lake Hunter	1543	TSI	Group 2	Tampa Bay Tributaries
Lake Hunter	1543	Turbidity	Group 2	Tampa Bay Tributaries
Lake Iamonia Outlet	442	DO	Group 1	Ochlockonee–St. Marks
Lake Idylwild	1521J	TSI	Group 3	Sarasota Bay–Peace–Myakka
Lake in the Woods	29977	TSI	Group 2	Middle St. Johns
Lake Istokpoga	1856B	Historical TSI	Group 4	Kissimmee River
Lake Istokpoga	1856B	TSI	Group 4	Kissimmee River
Lake Ivanhoe	2997F	DO	Group 2	Middle St. Johns
Lake Ivanhoe	2997F	TSI	Group 2	Middle St. Johns
Lake Jackson	582	DO	Group 1	Ochlockonee–St. Marks
Lake Jackson–Osceola County	3183G	DO	Group 4	Kissimmee River
Lake Jackson–Osceola County	3183G	TSI	Group 4	Kissimmee River
Lake Jessie	1521K	TSI	Group 3	Sarasota Bay–Peace–Myakka
Lake Jessup	2981	TSI	Group 2	Middle St. Johns
Lake Jessup	2981	Un-ionized Ammonia	Group 2	Middle St. Johns
Lake Jessup Near St. Johns Ri	2981A	TSI	Group 2	Middle St. Johns
Lake Josphine	1860B	Fish–Mercury	Group 4	Kissimmee River
Lake Josphine	1860B	TSI	Group 4	Kissimmee River
Lake Juanita	1473W	Historical TSI	Group 1	Tampa Bay
Lake June in Winter	1938A	Fish–Mercury	Group 4	Kissimmee River
Lake Killarney	2997X	TSI	Group 2	Middle St. Johns
Lake Kissimmee (Middle)	3183B	Fish–Mercury	Group 4	Kissimmee River
Lake Kissimmee (Middle)	3183B	TSI	Group 4	Kissimmee River
Lake Lafayette Drain	756	DO	Group 1	Ochlockonee–St. Marks
Lake Lafayette Drain	756	Fecal Coliform	Group 1	Ochlockonee–St. Marks
Lake Lafayette Drain	756	Total Coliform	Group 1	Ochlockonee–St. Marks
Lake Lawne	3004C	TSI	Group 2	Middle St. Johns
Lake Lawne	3004C	Un-ionized Ammonia	Group 2	Middle St. Johns
Lake Lena	1501	TSI	Group 3	Sarasota Bay–Peace–Myakka
Lake Lorna Doone	3169H	TSI	Group 4	Kissimmee River
Lake Lorraine Outlet	2829	TSI	Group 1	Ocklawaha
Lake Lotta	3002G	TSI	Group 2	Middle St. Johns
Lake Lulu	1521	TSI	Group 3	Sarasota Bay–Peace–Myakka
Lake Lulu	1521	Un-ionized Ammonia	Group 3	Sarasota Bay–Peace–Myakka
Lake Madelene	1516B	TSI	Group 1	Tampa Bay

Lake	*WBID*	*Parameter Causing Impairment*	*Basin Group*	*Basin Name*
Lake Manatee Reservoir	1807B	DO	Group 2	Tampa Bay Tributaries
Lake Manatee Reservoir	1807B	Total Coliform	Group 2	Tampa Bay Tributaries
Lake Mann	3169I	TSI	Group 4	Kissimmee River
Lake Marian	3184	TSI	Group 4	Kissimmee River
Lake Marie	2951	TSI	Group 2	Middle St. Johns
Lake Mary Jane	3171A	Fish–Mercury	Group 4	Kissimmee River
Lake Mary Jane	3171A	Lead	Group 4	Kissimmee River
Lake Maude	1488Q	TSI	Group 3	Sarasota Bay–Peace–Myakka
Lake May	1521E	TSI	Group 3	Sarasota Bay–Peace–Myakka
Lake Miccosukee Outlet	791L	DO	Group 1	Ochlockonee–St. Marks
Lake Miccosukee Outlet	791L	Total Coliform	Group 1	Ochlockonee–St. Marks
Lake Minnehaha	2997D	TSI	Group 2	Middle St. Johns
Lake Mirror	1521G	TSI	Group 3	Sarasota Bay–Peace–Myakka
Lake Molly	2680A	TSI	Group 2	Lower St. Johns
Lake Monroe	2893D	DO	Group 2	Middle St. Johns
Lake Monroe	2893D	TSI	Group 2	Middle St. Johns
Lake Munson	807C	DO	Group 1	Ochlockonee–St. Marks
Lake Munson	807C	TSI	Group 1	Ochlockonee–St. Marks
Lake Mystic	926A1	Fish–Mercury	Group 2	Apalachicola–Chipola
Lake Okeechobee	3212A	DO	Group 1	Lake Okeechobee
Lake Okeechobee	3212C	DO	Group 1	Lake Okeechobee
Lake Okeechobee	3212A	TSI	Group 1	Lake Okeechobee
Lake Okeechobee	3212B	TSI	Group 1	Lake Okeechobee
Lake Okeechobee	3212C	TSI	Group 1	Lake Okeechobee
Lake Okeechobee	3212D	TSI	Group 1	Lake Okeechobee
Lake Okeechobee	3212E	TSI	Group 1	Lake Okeechobee
Lake Okeechobee	3212F	TSI	Group 1	Lake Okeechobee
Lake Okeechobee	3212G	TSI	Group 1	Lake Okeechobee
Lake Okeechobee	3212H	TSI	Group 1	Lake Okeechobee
Lake Okeechobee	3212I	TSI	Group 1	Lake Okeechobee
Lake Olive	3168N	TSI	Group 4	Kissimmee River
Lake Orienta	2998C	TSI	Group 2	Middle St. Johns
Lake Osborne	3256A	DO	Group 3	Lake Worth Lagoon–Palm Beach Coast
Lake Panasoffkee	1351B	DO	Group 4	Withlacoochee
Lake Panasoffkee	1351B	Historical TSI	Group 4	Withlacoochee
Lake Panasoffkee	1351B	TSI	Group 4	Withlacoochee
Lake Pansy	1488Y	TSI	Group 3	Sarasota Bay–Peace–Myakka
Lake Park	2997U	TSI	Group 2	Middle St. Johns
Lake Parker	1497B	TSI	Group 3	Sarasota Bay–Peace–Myakka
Lake Pickett	3003	Historical Chlorophyll	Group 2	Middle St. Johns

Lake	*WBID*	*Parameter Causing Impairment*	*Basin Group*	*Basin Name*
Lake Piney Z	756B	DO	Group 1	Ochlockonee–St. Marks
Lake Piney Z	756B	TSI	Group 1	Ochlockonee–St. Marks
Lake Placid	1938C	Fish–Mercury	Group 4	Kissimmee River
Lake Poinsett	2893K	DO	Group 3	Upper St. Johns
Lake Poinsett	2893K	TSI	Group 3	Upper St. Johns
Lake Price	3012A	Historical TSI	Group 2	Middle St. Johns
Lake Primavista	3002E	TSI	Group 2	Middle St. Johns
Lake Reinheimer–Open Water	1478H	TSI	Group 1	Tampa Bay
Lake Rochelle	1488B	TSI	Group 3	Sarasota Bay–Peace–Myakka
Lake Rose	3004I	TSI	Group 2	Middle St. Johns
Lake Ross	2543F	TSI	Group 2	Lower St. Johns
Lake Rousseau	1329B	DO	Group 4	Withlacoochee
Lake Rowena	2997J	TSI	Group 2	Middle St. Johns
Lake Russell	3170B	Fish–Mercury	Group 4	Kissimmee River
Lake Searcy	2986E	TSI	Group 2	Middle St. Johns
Lake Sebring	1842	Fish–Mercury	Group 4	Kissimmee River
Lake Seminole	1618	Chlorophyll	Group 5	Springs Coast
Lake Seminole	1618	Fecal Coliform	Group 5	Springs Coast
Lake Shipp	1521D	TSI	Group 3	Sarasota Bay–Peace–Myakka
Lake Silver	1553A	TSI	Group 2	Tampa Bay Tributaries
Lake Smart	1488A	TSI	Group 3	Sarasota Bay–Peace–Myakka
Lake Spring	2997S	TSI	Group 2	Middle St. Johns
Lake Suzy	2033Z	TSI	Group 3	Sarasota Bay–Peace–Myakka
Lake Thonotosassa	1522B	Fecal Coliform	Group 2	Tampa Bay Tributaries
Lake Thonotosassa	1522B	Historical Chlorophyll	Group 2	Tampa Bay Tributaries
Lake Thonotosassa	1522B	Lead	Group 2	Tampa Bay Tributaries
Lake Thonotosassa	1522B	TSI	Group 2	Tampa Bay Tributaries
Lake Thonotosassa	1522B	Un-ionized Ammonia	Group 2	Tampa Bay Tributaries
Lake Tohopekaliga	3173A	Fish–Mercury	Group 4	Kissimmee River
Lake Trafford	3259W	Fish–Mercury	Group 1	Everglades West Coast
Lake Trafford	3259W	TSI	Group 1	Everglades West Coast
Lake Underhill	3168G	TSI	Group 4	Kissimmee River
Lake Valrico	1547A	TSI	Group 2	Tampa Bay Tributaries
Lake Weeks–Open Water	1547C	TSI	Group 2	Tampa Bay Tributaries
Lake Weir	2790A	TSI	Group 1	Ocklawaha
Lake Weir Outlet	2790	TSI	Group 1	Ocklawaha
Lake Winterset	1521A	TSI	Group 3	Sarasota Bay–Peace–Myakka
Lake Winyah	2997L	TSI	Group 2	Middle St. Johns
Lake Yale	2807A	Chlorophyll	Group 1	Ocklawaha
Lake Yale Canal	2807	Chlorophyll	Group 1	Ocklawaha

Lake	*WBID*	*Parameter Causing Impairment*	*Basin Group*	*Basin Name*
Little Lake Fairview	3004H	TSI	Group 2	Middle St. Johns
Little Lake Harris	2838B	TSI	Group 1	Ocklawaha
Livingston Lake	1730B	Fish–Mercury	Group 4	Kissimmee River
Lake Winnemissett	2931	Lead	Group 2	Middle St. Johns
Lochloosa Lake Outlet	2738	Chlorophyll	Group 1	Ocklawaha
Lower Lake Lafayette	756C	DO	Group 1	Ochlockonee–St. Marks
Lower Lake Lafayette	756C	TSI	Group 1	Ochlockonee–St. Marks
Mason Lake	2575Q	Fish–Mercury	Group 2	Lower St. Johns
Moore Lake Drain	889	Fish–Mercury	Group 1	Ochlockonee–St. Marks
Mound Lake	1473X	Historical TSI	Group 1	Tampa Bay
Mud Lake	1467	TSI	Group 4	Withlacoochee
Newnans Lake	2705B	TSI	Group 1	Ocklawaha
Newnans Lake Outlet	2705	TSI	Group 1	Ocklawaha
Ocean Pond	2339	Fish–Mercury	Group 4	Nassau–St. Marys
Orange Lake Reach	2749	Chlorophyll	Group 1	Ocklawaha
Palatlakaha Lake	2839G	Alkalinity	Group 1	Ocklawaha
Persimmon Lake	1938E	TSI	Group 4	Kissimmee River
Lake Pineloch	3168I	TSI	Group 4	Kissimmee River
Prairie Lake	3002N	TSI	Group 2	Middle St. Johns
Rattlesnake Slough	1923	DO	Group 2	Tampa Bay Tributaries
Rattlesnake Slough	1923	Fecal Coliform	Group 2	Tampa Bay Tributaries
Rattlesnake Slough	1923	Historical Chlorophyll	Group 2	Tampa Bay Tributaries
Rattlesnake Slough	1923	Total Coliform	Group 2	Tampa Bay Tributaries
Rattlesnake Slough	1923	TSI	Group 2	Tampa Bay Tributaries
Reclaimed Mine Cut Lake	1623X	TSI	Group 3	Sarasota Bay–Peace–Myakka
Red Lake	3171C	CU	Group 4	Kissimmee River
Redwater Lake	2713B	TSI	Group 1	Ocklawaha
Rock Lake	3169Q	TSI	Group 4	Kissimmee River
Sanibel Island	2092F	TSI	Group 2	Charlotte Harbor
Sawgrass Lake	28931	DO	Group 3	Upper St. Johns
Shell Creek Reservoir (Hamilton Reservoir)	2041B	DO	Group 3	Sarasota Bay–Peace–Myakka
Silver Lake	3004D	TSI	Group 2	Middle St. Johns
Silver Lake	3004D	Un-ionized Ammonia	Group 2	Middle St. Johns
South Lake Talmadge	2630I	TSI	Group 2	Lower St. Johns
Spirit Lake	1501V	TSI	Group 3	Sarasota Bay–Peace–Myakka
Spring Lake	2987A	TSI	Group 2	Middle St. Johns
Starke Lake	3002D	TSI	Group 2	Middle St. Johns
St. Johns River above Black Creek	2213I	Silver	Group 2	Lower St. Johns

Lake	*WBID*	*Parameter Causing Impairment*	*Basin Group*	*Basin Name*
St. Johns River above Black Creek	2213I	TSI	Group 2	Lower St. Johns
St. Johns River above Doctor Lake	2213G	Cadmium	Group 2	Lower St. Johns
St. Johns River above Federal Point	2213L	TSI	Group 2	Lower St. Johns
St. Johns River above Palmo Creek	2213J	TSI	Group 2	Lower St. Johns
St. Johns River above Tocio	2213K	TSI	Group 2	Lower St. Johns
Tallavanna Lake	540A	TSI	Group 1	Ochlockonee–St. Marks
Trout Lake	2819A	TSI	Group 1	Ocklawaha
Trout Lake Outlet	2819	TSI	Group 1	Ocklawaha
Twin Lake–Open Water	1440D	TSI	Group 2	Tampa Bay Tributaries
Upper Lake Lafayette	756A	DO	Group 1	Ochlockonee–St. Marks
Upper Lake Lafayette	756A	TSI	Group 1	Ochlockonee–St. Marks
Walberg Lake Outlet	2741	TSI	Group 1	Ocklawaha
Ward Lake	1914A	TSI	Group 2	Tampa Bay Tributaries
Waunatta Lake	3009A	TSI	Group 2	Middle St. Johns

Appendix F. Maps Showing 2004 Probabilistic Ground Water Assessment Results for Group 1 Confined and Unconfined Aquifers

Figure F-1. Summary of Arsenic Assessment for Confined Aquifers, Group 1 Basins

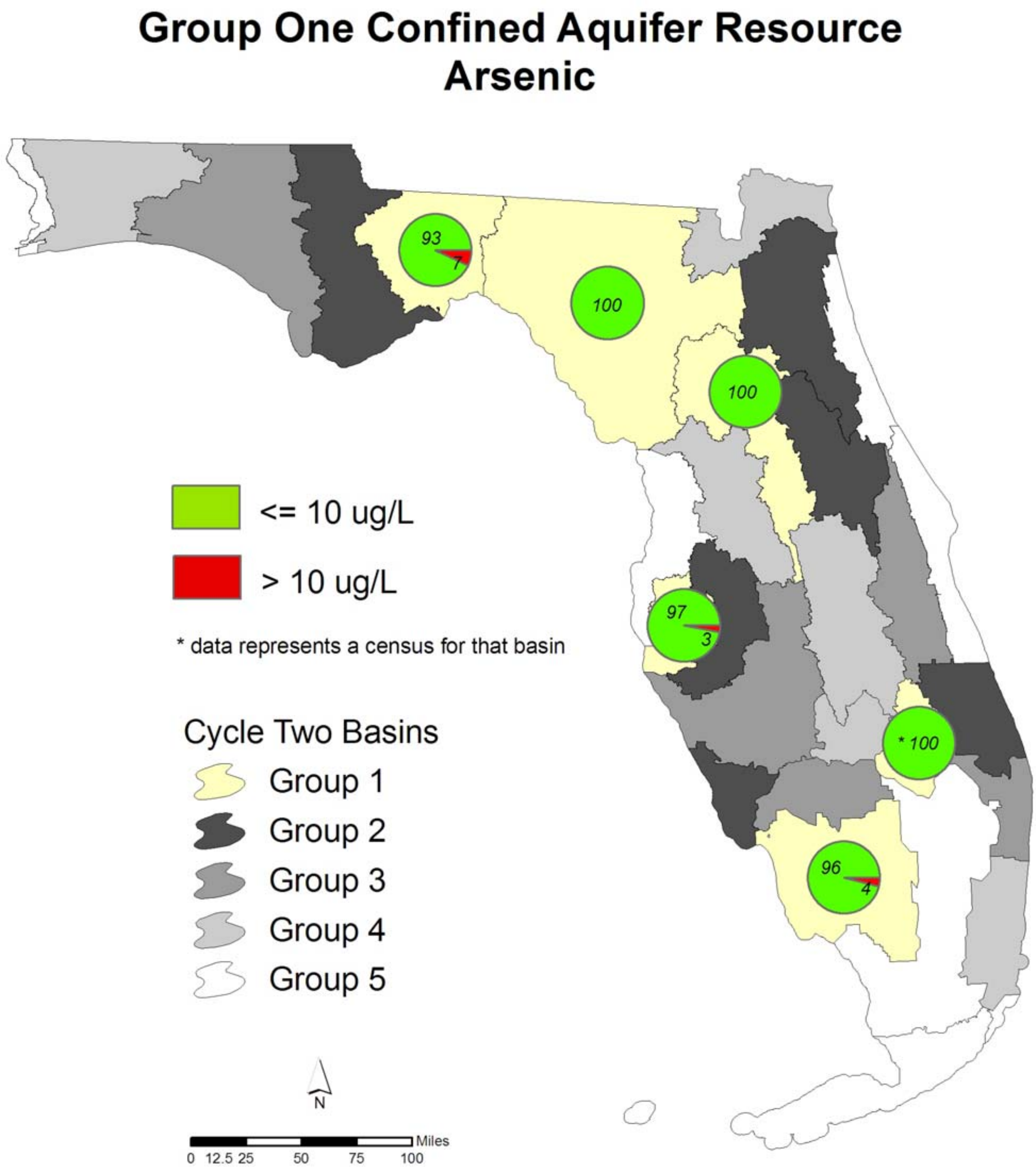


Figure F-2. Summary of Cadmium Assessment for Confined Aquifers, Group 1 Basins

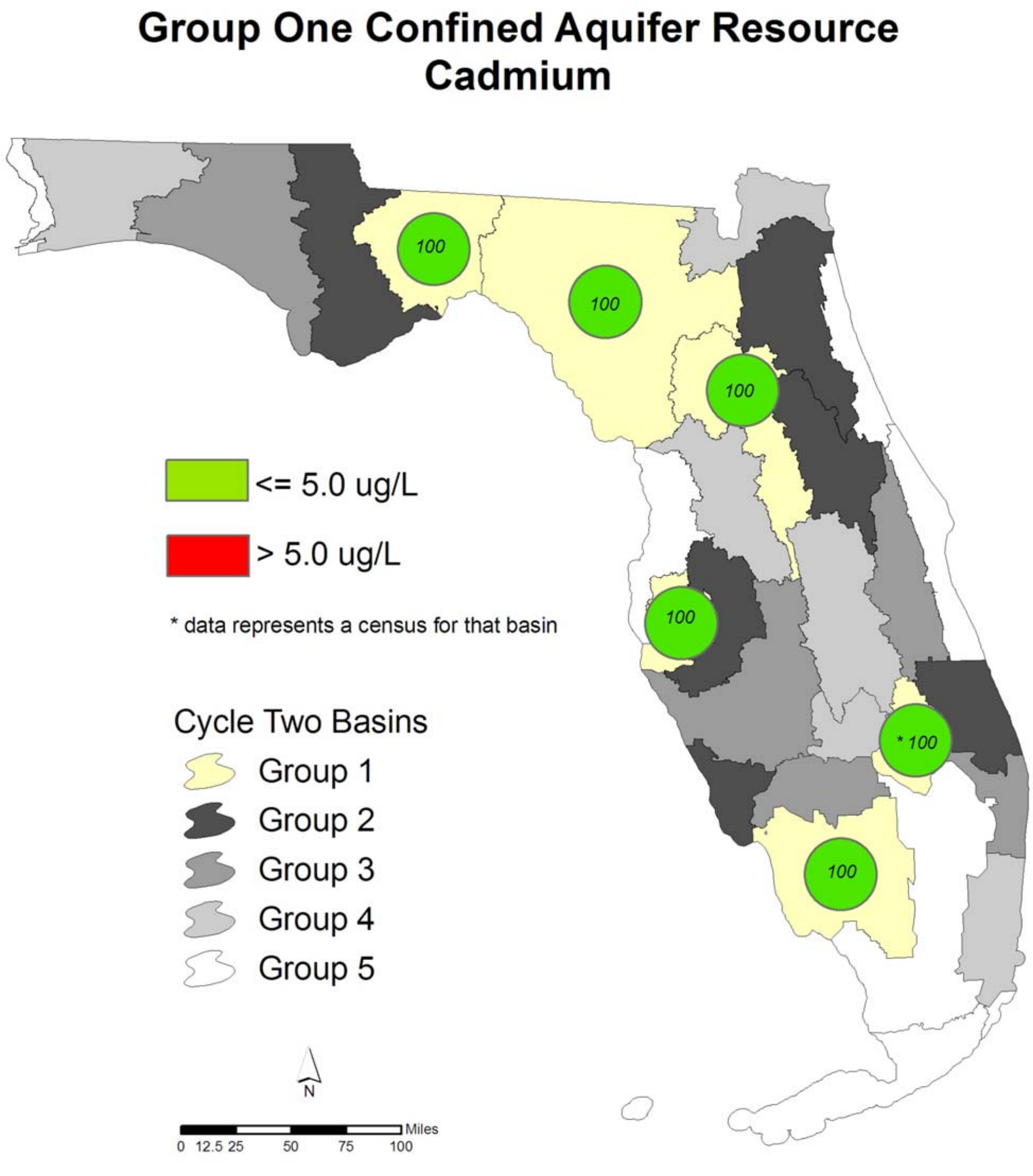


Figure F-3. Summary of Chromium Assessment for Confined Aquifers, Group 1 Basins

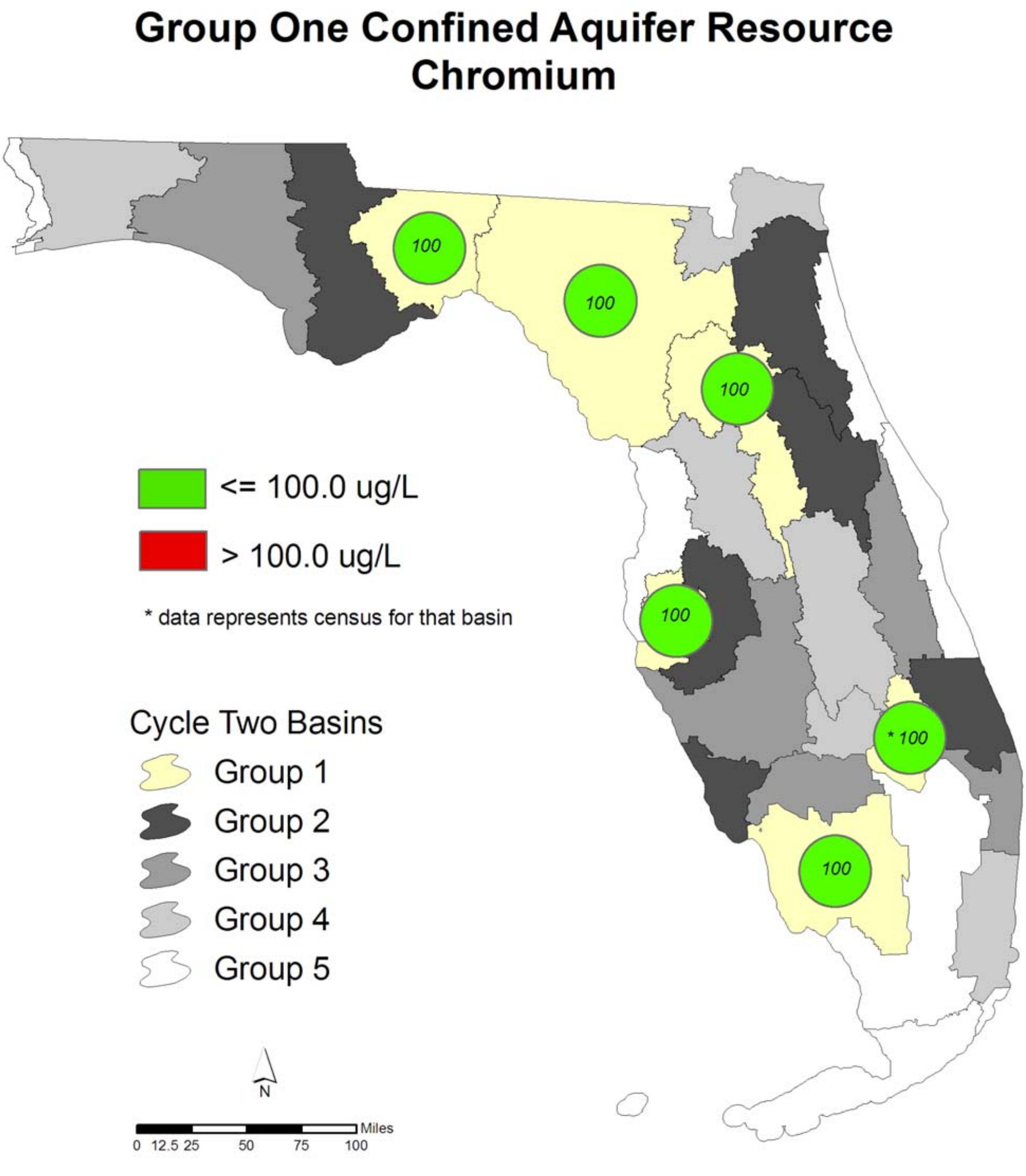


Figure F-4. Summary of Fluoride Assessment for Confined Aquifers, Group 1 Basins

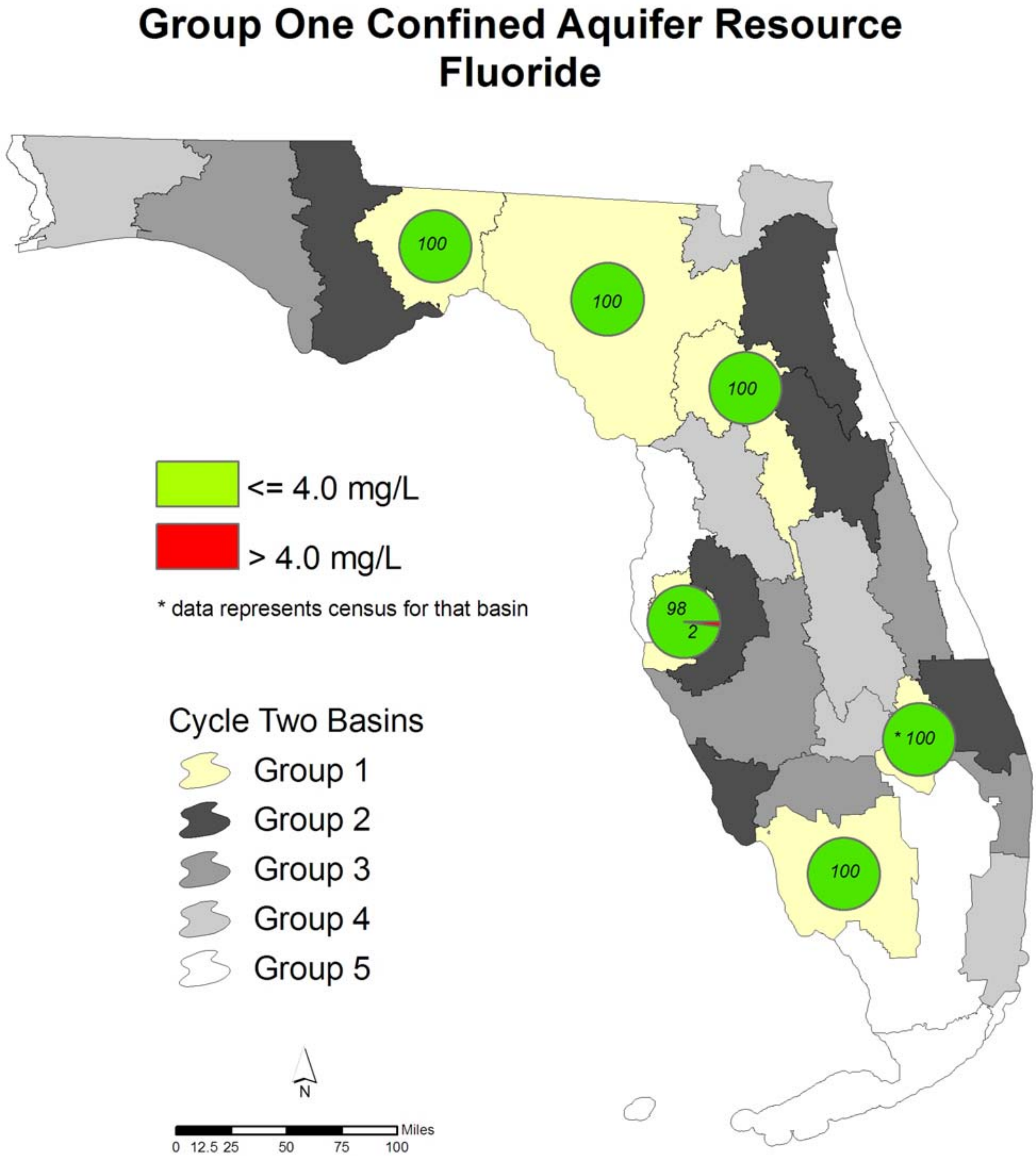


Figure F-5. Summary of Lead Assessment for Confined Aquifers, Group 1 Basins

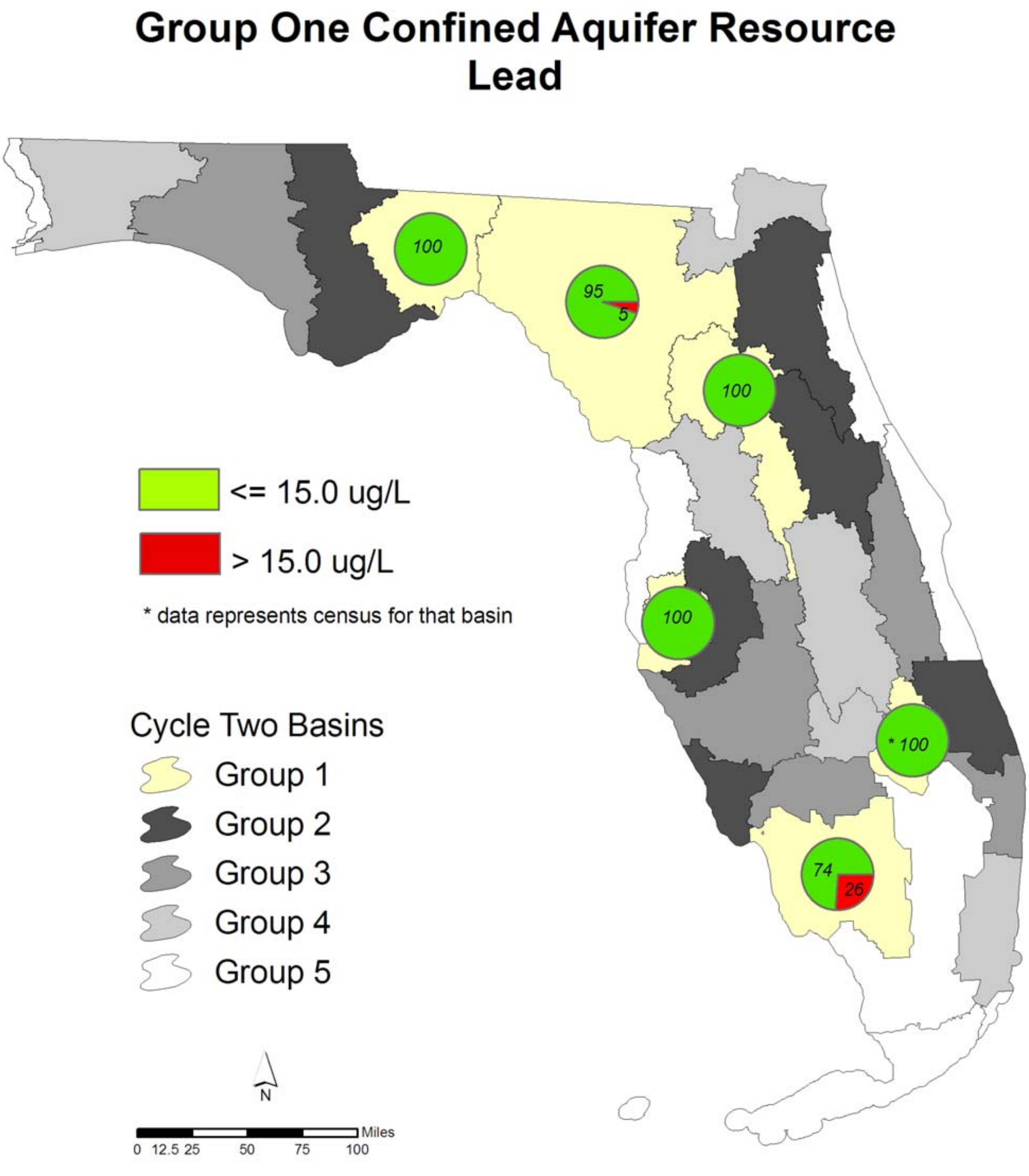


Figure F-6. Summary of Nitrate + Nitrite Assessment for Confined Aquifers, Group 1 Basins

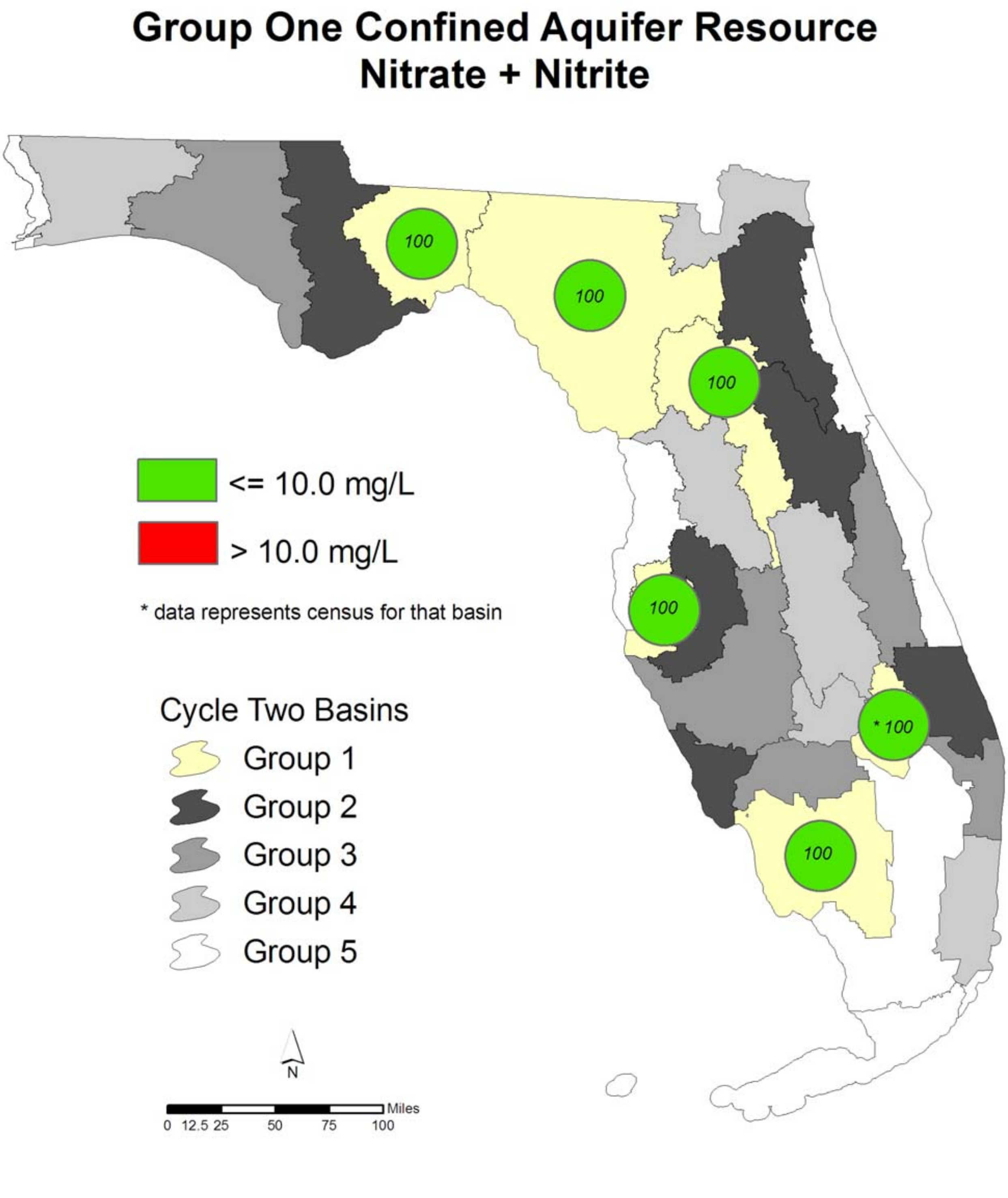


Figure F-7. Summary of Sodium Assessment for Confined Aquifers, Group 1 Basins

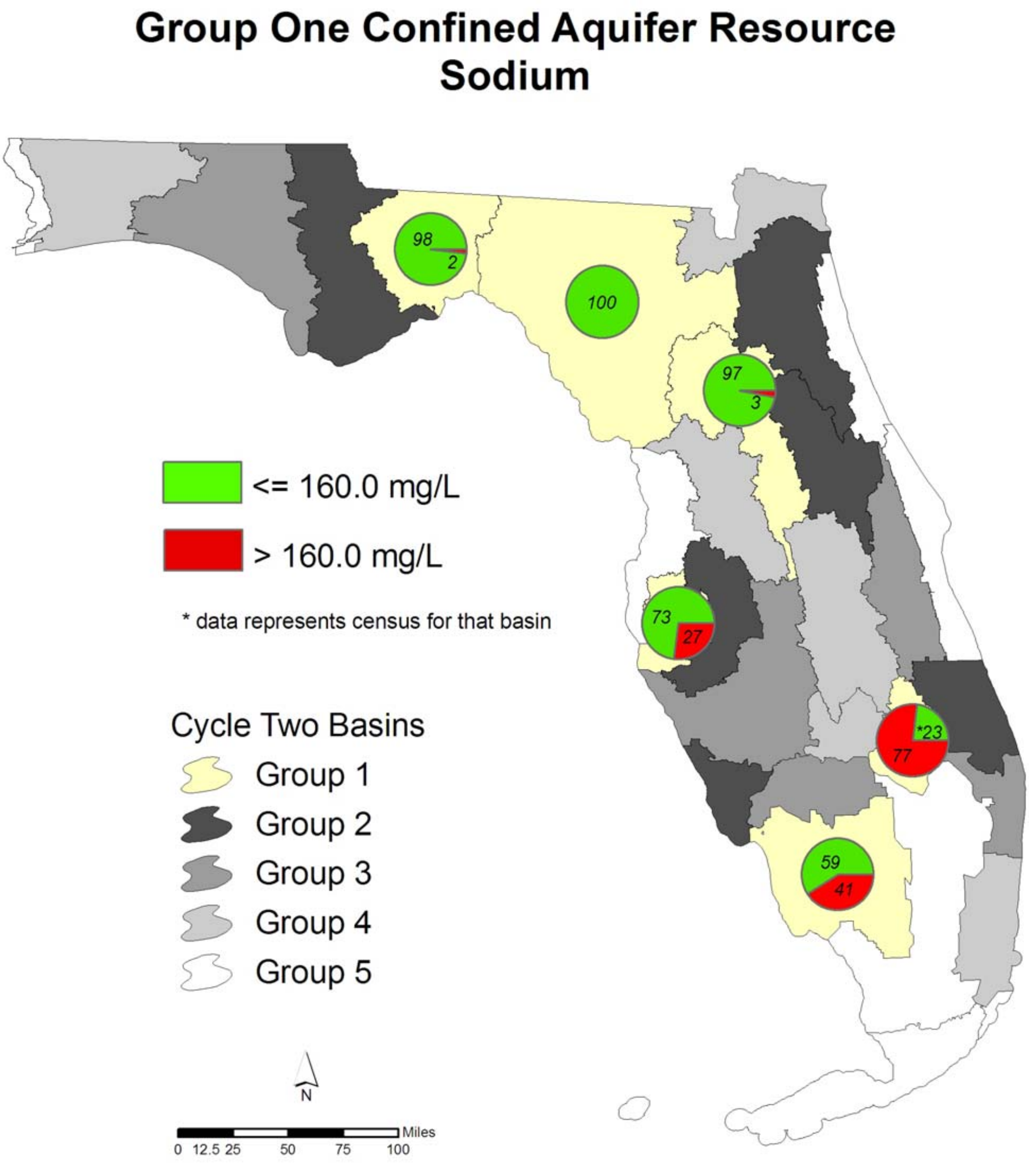


Figure F-8. Summary of Total Coliform Assessment for Confined Aquifers, Group 1 Basins

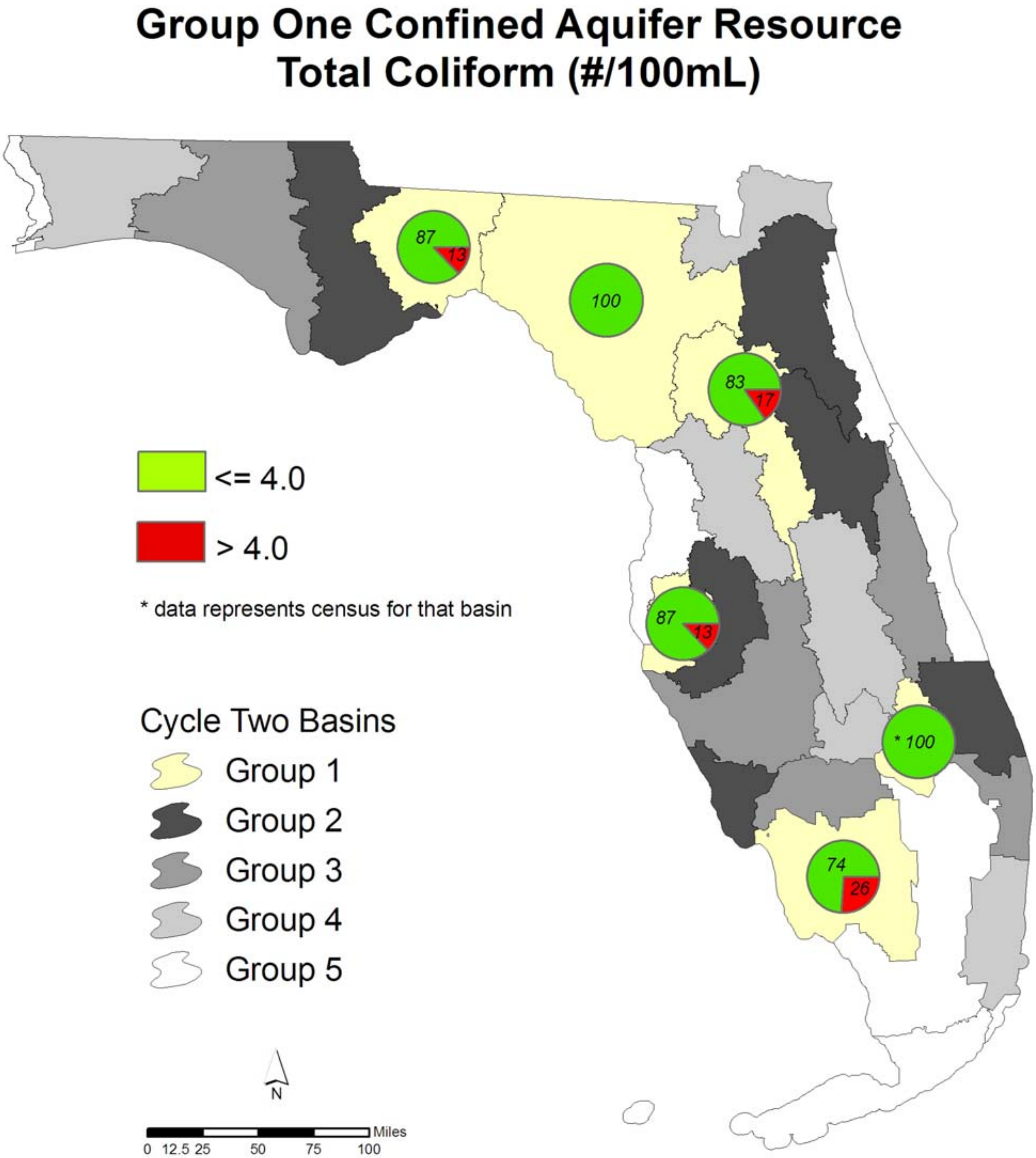


Figure F-9. Summary of Arsenic Assessment for Unconfined Aquifers, Group 1 Basins

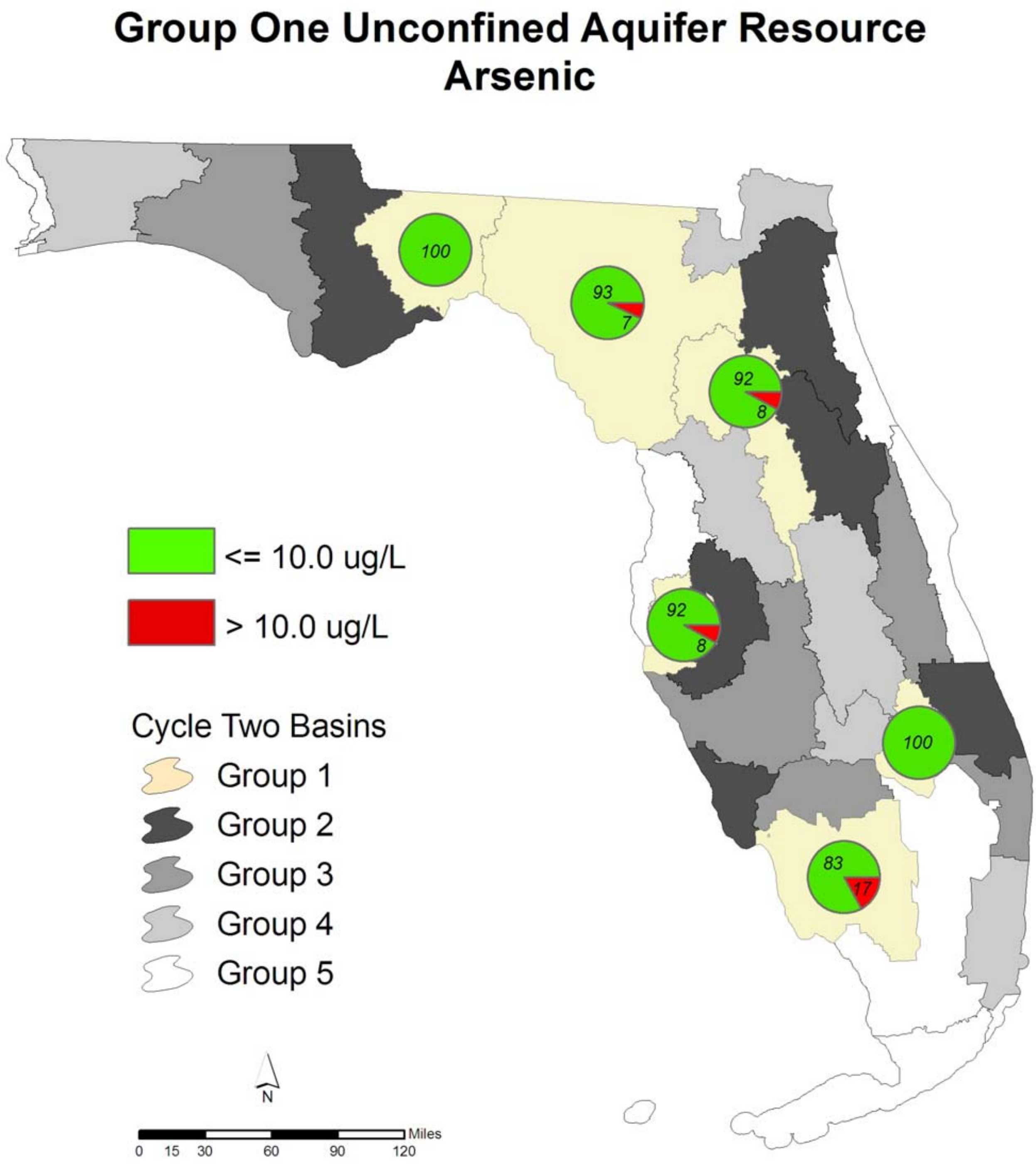


Figure F-10. Summary of Cadmium Assessment for Unconfined Aquifers, Group 1 Basins

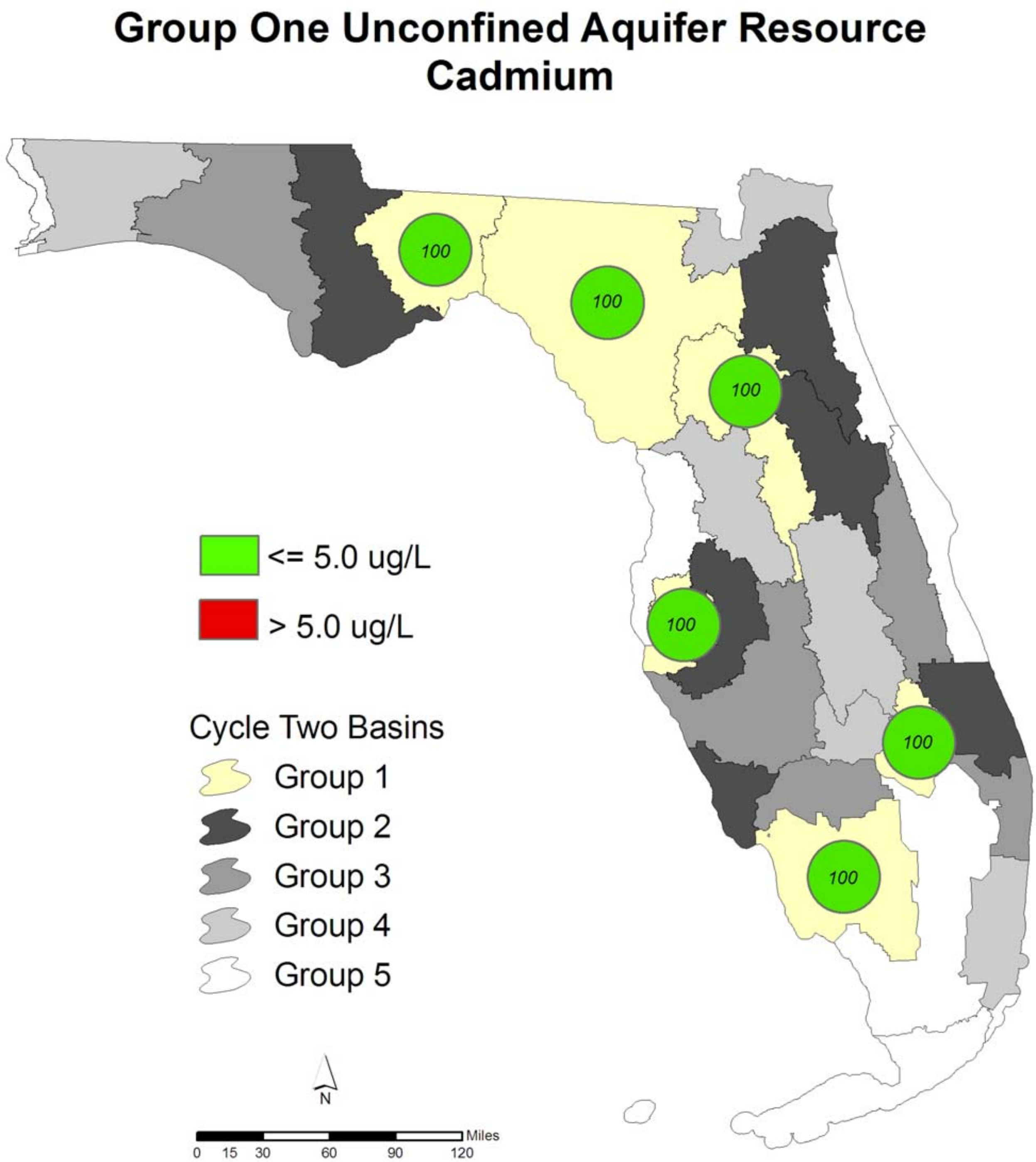


Figure F-11. Summary of Chromium Assessment for Unconfined Aquifers, Group 1 Basins

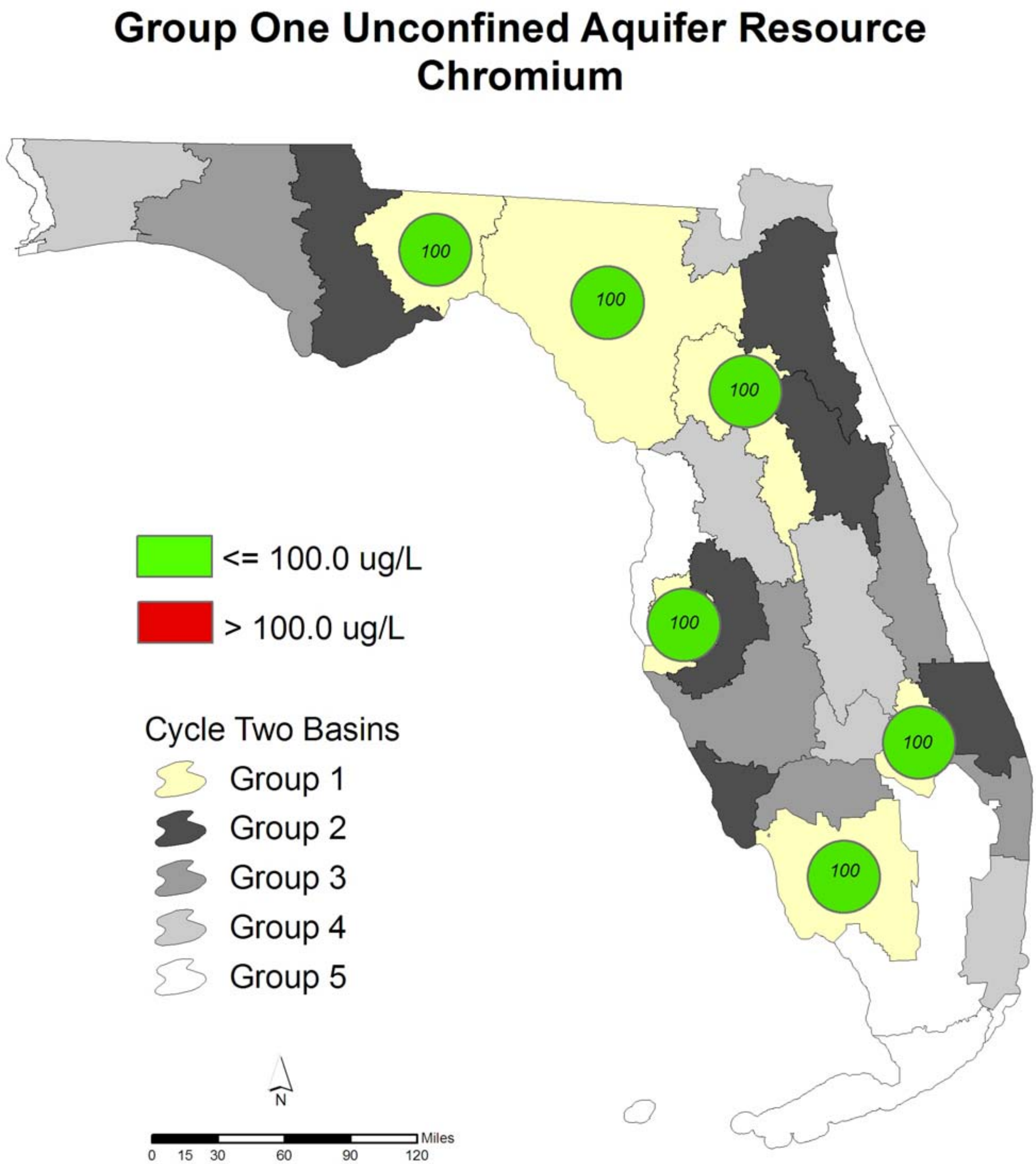


Figure F-12. Summary of Fluoride Assessment for Unconfined Aquifers, Group 1 Basins

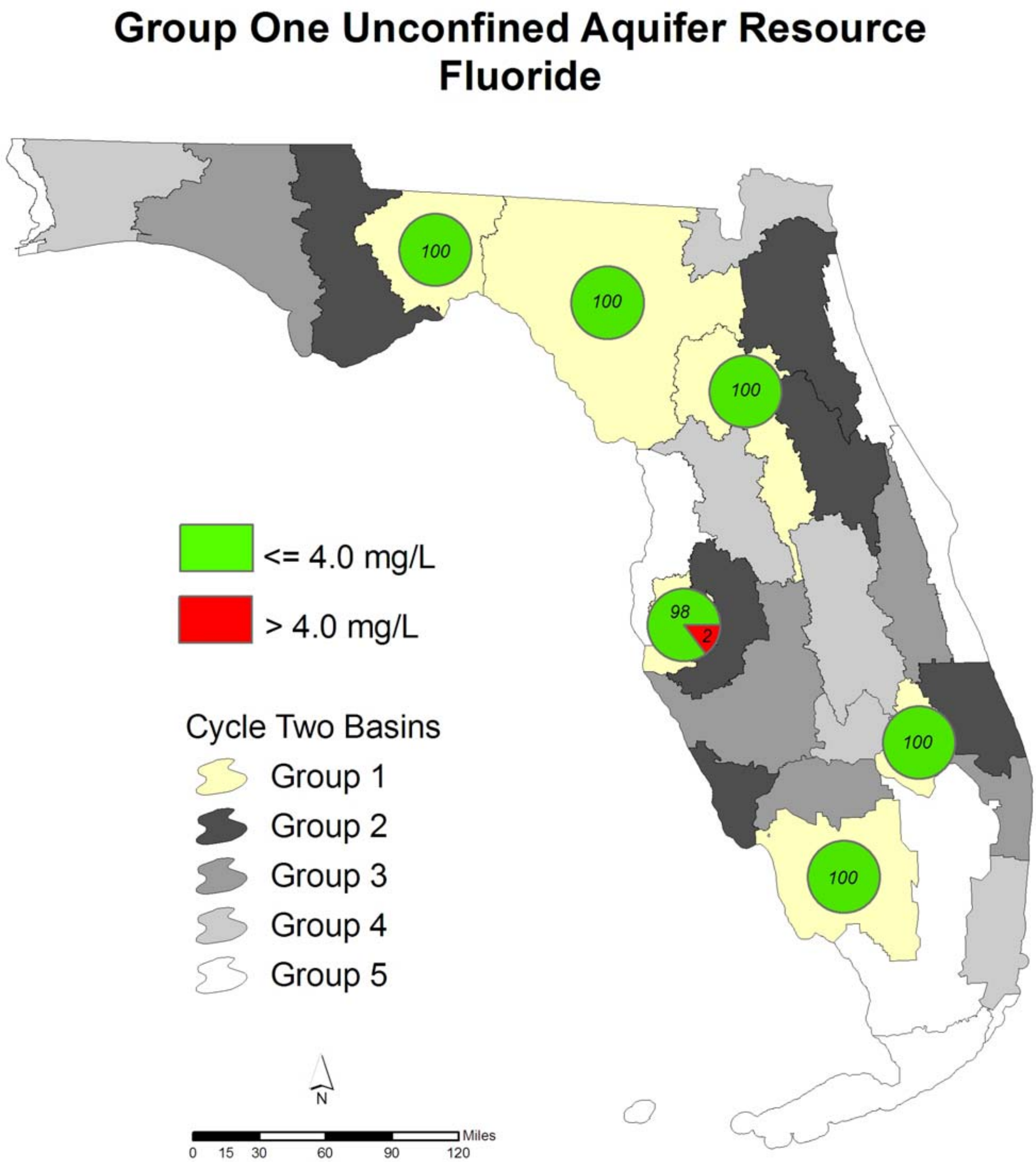


Figure F-13. Summary of Lead Assessment for Unconfined Aquifers, Group 1 Basins

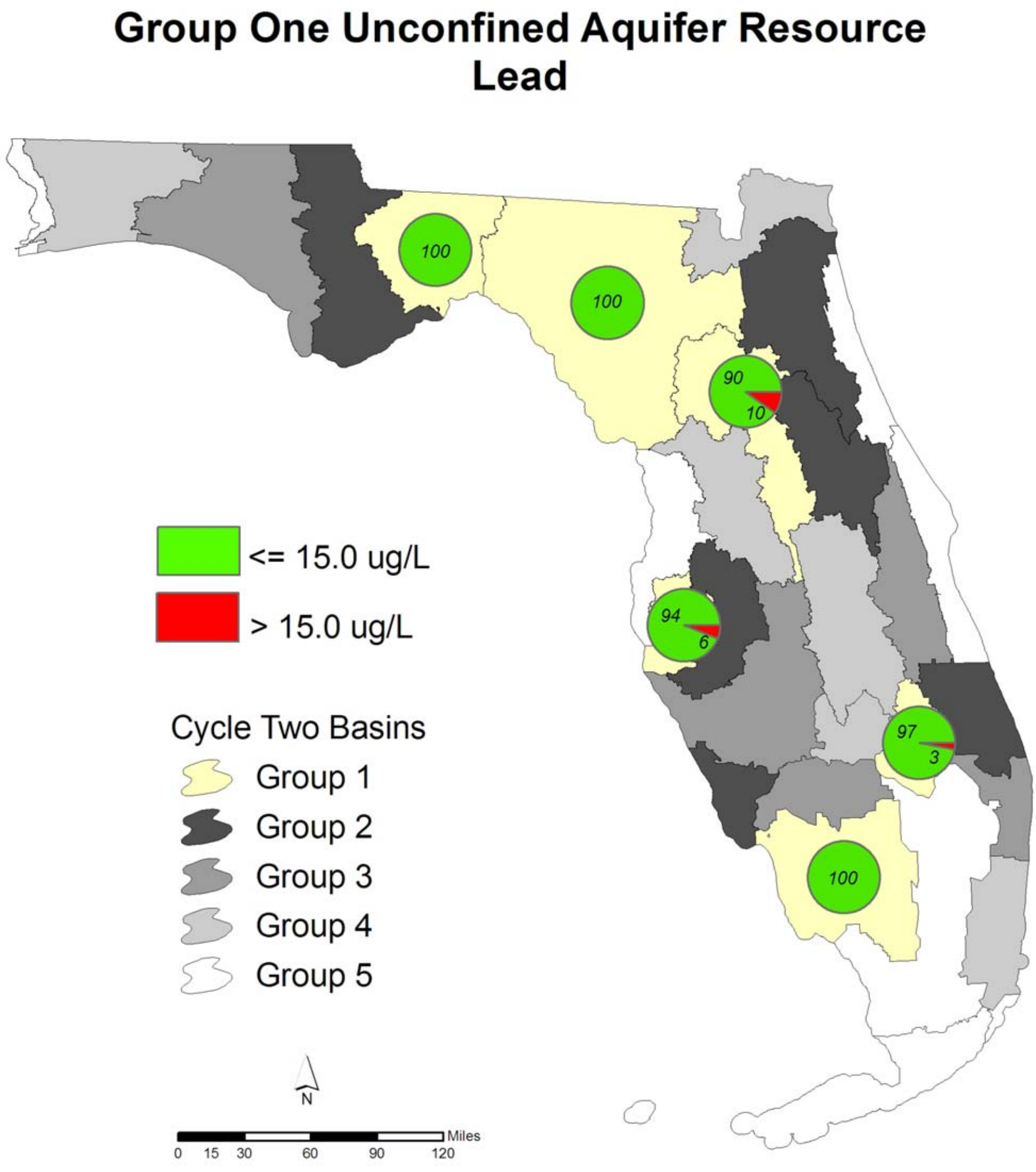


Figure F-14. Summary of Nitrate + Nitrite Assessment for Unconfined Aquifers, Group 1 Basins

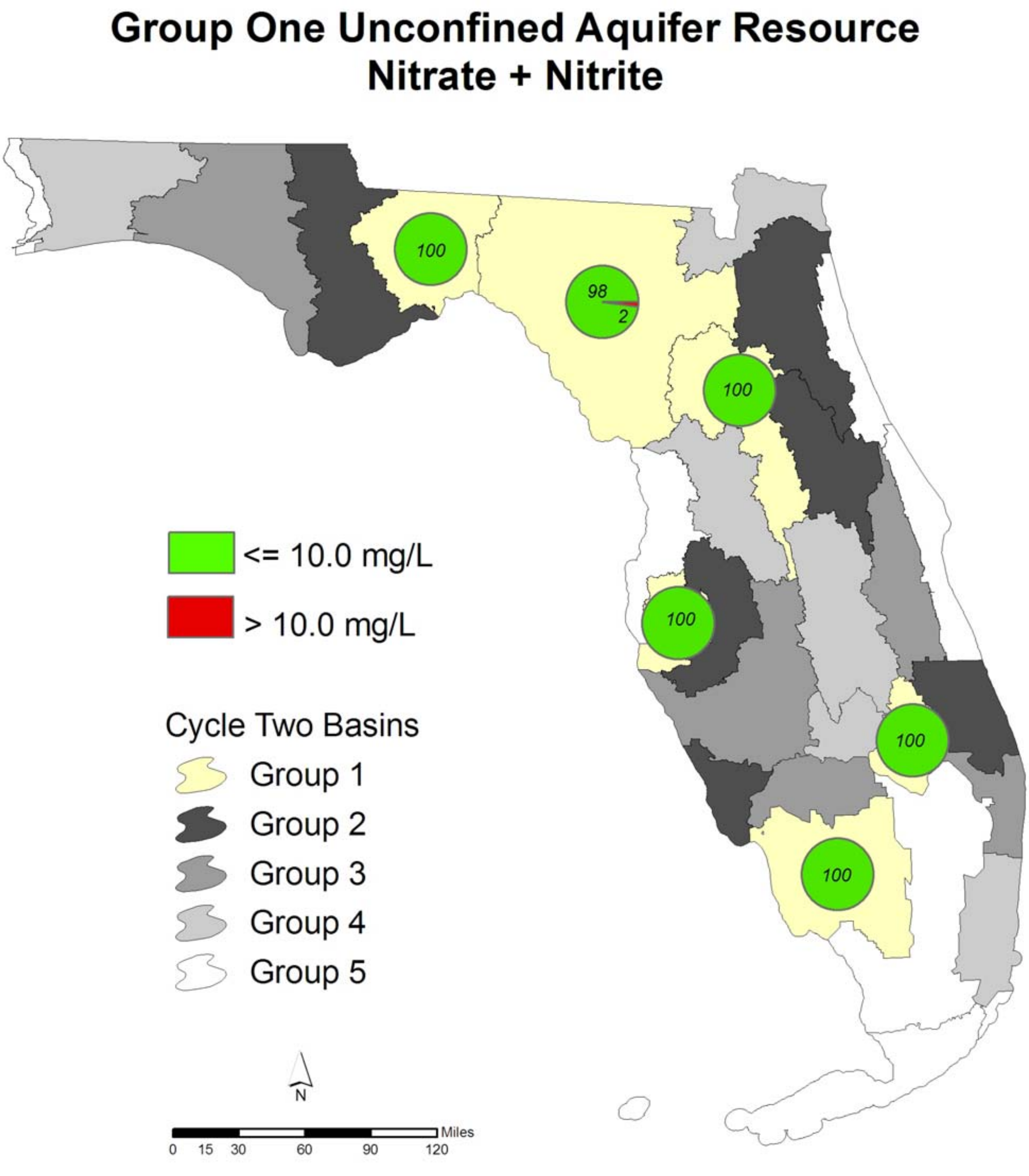


Figure F-15. Summary of Sodium Assessment for Unconfined Aquifers, Group 1 Basins

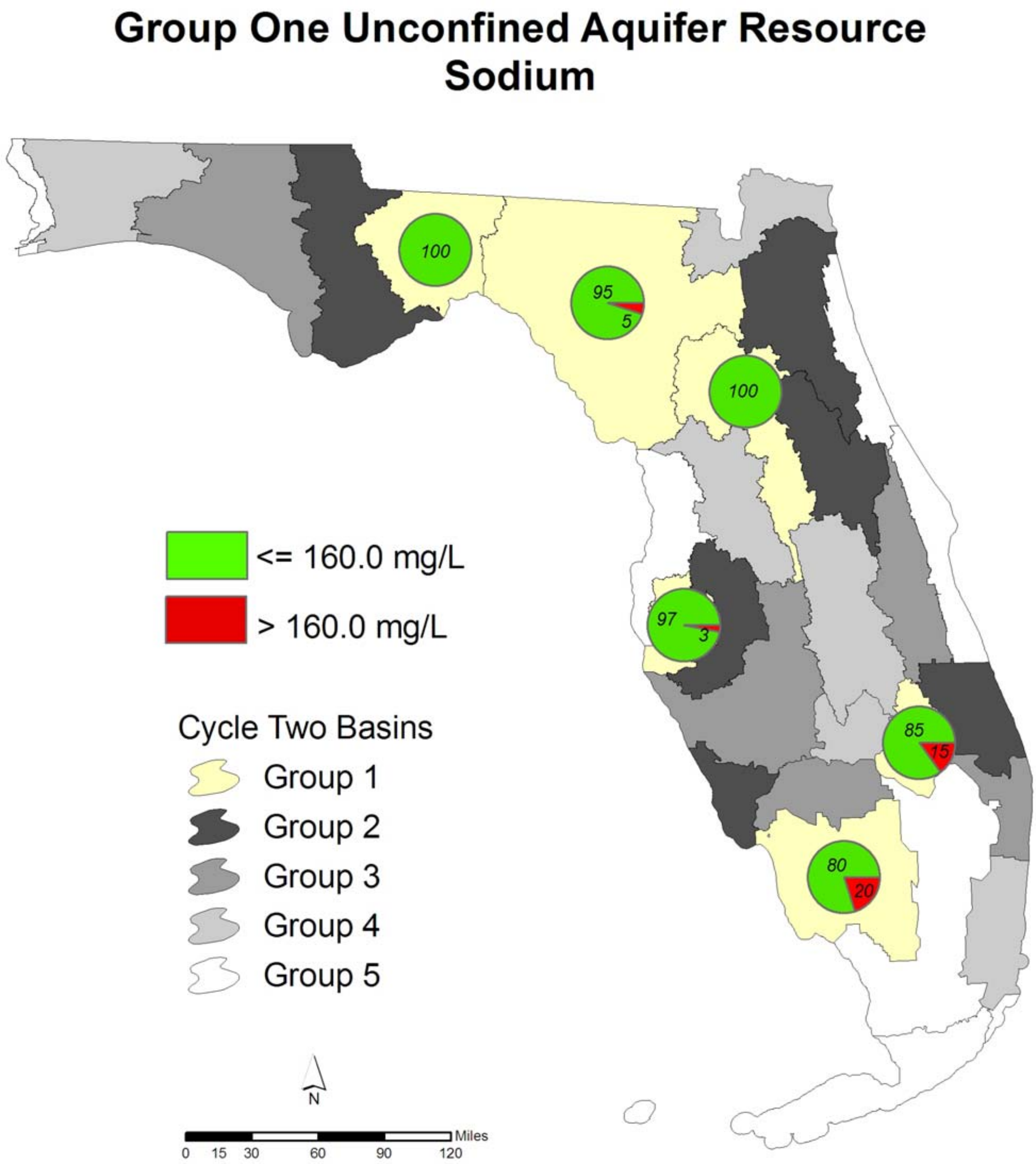
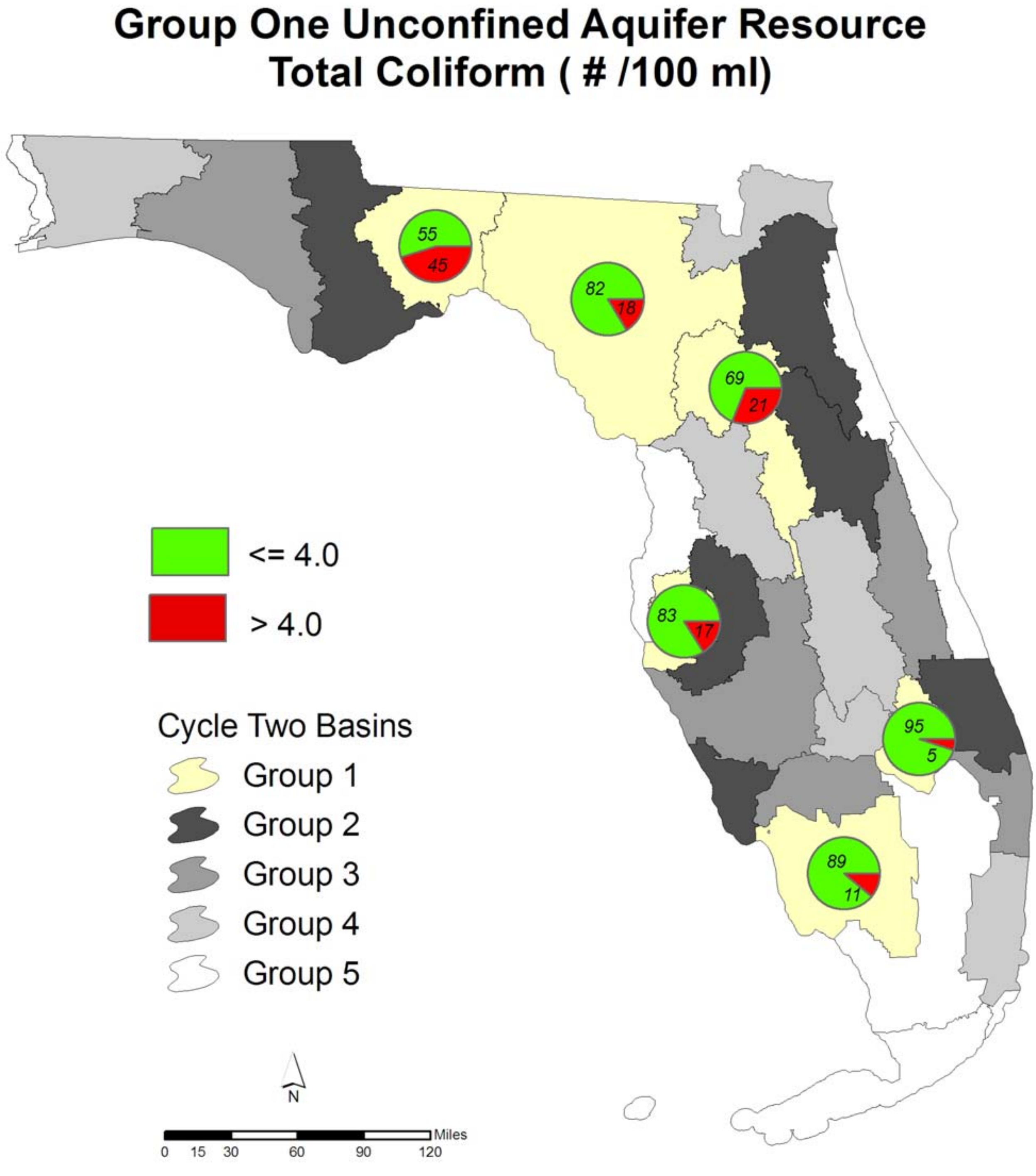


Figure F-16. Summary of Total Coliform Assessment for Unconfined Aquifers, Group 1 Basins



Appendix G. Summary of Overall Ground Water Quality, by Basin

Table G-1. Primary Ground Water Standards

PRIMARY GROUND WATER STANDARDS

CAS #	PARAMETER	MCL	Units	Parameter Code	Type
A					
15972608	Alachlor	2	ug/L	77825	Primary Standard
7440360	Antimony, Total	6	ug/L	1097	Primary Standard
7440382	Arsenic, Total /1	10	ug/L	1002	Primary Standard
1912249	Atrazine	3	ug/L	39033	Primary Standard
B					
7440393	Barium, Total	2000	ug/L	1007	Primary Standard
71432	Benzene	1	ug/L	78124	Primary Standard
50328	Benzo[a]pyrene	0.2	ug/L	34247	Primary Standard
7440417	Beryllium, Total	4	ug/L	1012	Primary Standard
58899	BHC, Gamma-hexachlorocyclohexane (Lindane)	0.2	ug/L	39340	Primary Standard
103231	Bis(2-ethylhexyl)adipate, or Di(2-ethylhexyl) adipate	400	ug/L	77903	Primary Standard
117817	Bis(2-ethylhexyl)phthalate, Di(2-ethylhexyl) phthalate	6	ug/L	39100	Primary Standard
C					
7440439	Cadmium, Total	5	ug/L	1027	Primary Standard
1563662	Carbofuran	40	ug/L	81405	Primary Standard
56235	Carbon tetrachloride (Tetrachloromethane)	3	ug/L	32102	Primary Standard
57749	Chlordane	2	ug/L	39350	Primary Standard
108907	Chlorobenzene (Monochlorobenzene)	100	ug/L	34301	Primary Standard
16065831	Chromium, Total	100	ug/L	1034	Primary Standard
	Coliform, Total (MF) (MPN)	4	#/100ml	31501, 31507	Primary Standard
57125	Cyanide, Total	200	mg/L	720	Primary Standard
D					
75990	Dalapon (2,2-Dichloropropionic acid)	200	ug/L	38432	Primary Standard
96128	1,2-Dibromo-3-chloropropane (DBCP)	0.2	ug/L	38760	Primary Standard
106934	1,2-Dibromoethane (EDB)	0.02	ug/L	77651	Primary Standard
95501	1,2-Dichlorobenzene (o-Dichlorobenzene)	600	ug/L	34536	Primary Standard
106467	1,4-Dichlorobenzene (p-Dichlorobenzene)	75	ug/L	34571	Primary Standard
107062	1,2-Dichloroethane (Ethylene Dichloride)	3	ug/L	34531	Primary Standard
540590	1,2-Dichloroethene	70	ug/L	45617	Primary Standard
156592	1,2-Dichloroethene (cis)	70	ug/L	81686	Primary Standard
156605	1,2-Dichloroethene (trans)	100	ug/L	34546	Primary Standard
75354	1,1-Dichloroethene (Vinylidene chloride)	7	ug/L	34501	Primary Standard
94757	2,4-D (2,4-Dichlorophenoxyacetic acid)	70	ug/L	39730	Primary Standard
78875	1,2-Dichloropropane	5	ug/L	34541	Primary Standard
11746016	Dioxin (2,3,7,8-tetrachlorodibenzo-p-dioxin) (TCDD)	$3x10^{-8}$	mg/L		Primary Standard
88857	Dinoseb	7	ug/L	30191	Primary Standard
85007	Diquat (Reglone)	20	ug/L	78885	Primary Standard
E					
145733	Endothall	100	ug/L		Primary Standard
72208	Endrin	2	ug/L	39390	Primary Standard
100414	Ethylbenzene	700	ug/L	34371	Primary Standard
F					
7782414	Fluoride, Total	4	mg/L	951	Primary Standard
G					
1071836	Glyphosphate (Roundup)	700	ug/L	79743	Primary Standard
14127629	Gross Alpha, Total /2	15	pCi/L	1501	Primary Standard
H					
76448	Heptachlor	0.4	ug/L	39410	Primary Standard
1024573	Heptachlor epoxide	0.2	ug/L	39420	Primary Standard
118741	Hexachlorobenzene (HCB)	1	ug/L	39700	Primary Standard
77474	Hexachlorocyclypentadiene	50	ug/L	34386	Primary Standard
L					
7439921	Lead, Total	15	ug/L	1051	Primary Standard

CAS #	PARAMETER	MCL	Units	Parameter Code	Type
M					
7439976	Mercury, Total	2	ug/L	71900	Primary Standard
72435	Methoxychlor	40	ug/L	39480	Primary Standard
75092	Methylene chloride (Dichloromethane)	5	ug/L	34423	Primary Standard
N					
7440020	Nickel, Total	100	ug/L	1067	Primary Standard
14797558	Nitrate, Total (as N)	10	mg/L	620	Primary Standard
	Nitrate+Nitrite, Total (as N)	10	mg/L	630	Primary Standard
14797650	Nitrite, Total (as N)	1	mg/L	615	Primary Standard
O					
23135220	Oxamyl	200	ug/L	38865	Primary Standard
P					
87865	Pentachlorophenol	1	ug/L	39032	Primary Standard
127184	Perchlorethylene (Tetrachloroethene)	3	ug/L	34475	Primary Standard
1918021	Picloram	500	ug/L	39720	Primary Standard
1336363	Polychlorinated biphenyl, Total (PCBs)	0.5	ug/L	39516	Primary Standard
R					
13982633	Radium-226, Total [/3]	5	pCi/L	9501	Primary Standard
15262201	Radium-228, Total [/3]	5	pCi/L	11501	Primary Standard
S					
7782492	Selenium, Total	50	ug/L	1147	Primary Standard
122349	Simazine	4	ug/L	39055	Primary Standard
93721	Silvex (2,4,5-TP)	50	ug/L	39760	Primary Standard
7440235	Sodium, Total	160	mg/L	929	Primary Standard
100425	Styrene (Vinyl benzene)	100	ug/L	77128	Primary Standard
T					
11746016	2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) (Dioxin)	$3x10^{-8}$	mg/L		Primary Standard
127184	Tetrachloroethene (Perchlorethylene)	3	ug/L	34475	Primary Standard
7440280	Thallium, Total	2	ug/L	1059	Primary Standard
108883	Toluene	1000	ug/L	78131	Primary Standard
	Total Trihalomethanes [/4]	80	ug/L	82080	Primary Standard
8001352	Toxaphene	3	ug/L	39400	Primary Standard
93721	2,4,5-TP (Silvex)	50	ug/L	39760	Primary Standard
120821	1,2,4-Trichlorobenzene	70	ug/L	34551	Primary Standard
79005	1,1,2-Trichloroethane	5	ug/L	34511	Primary Standard
71556	1,1,1-Trichloroethane	200	ug/L	34506	Primary Standard
79016	Trichloroethene (Trichloroethylene, TCE)	3	ug/L	39180	Primary Standard
U					
	Uranium	30	ug/L		Primary Standard
V					
75014	Vinyl Chloride (Chloroethylene)	1	ug/L	39175	Primary Standard
X					
1330207	Xylenes	10000	ug/L	81551	Primary Standard

NOTES:

Fluoride, **ethylbenzene**, **toluene**, and **xylenes** have both primary and secondary standards.

[/1] **Arsenic** Standard changed after 1/1/2005

[/2] **Gross alpha** particle activity including radium-226 but excluding radon and uranium.

[/3] **Radium-226 and radium-228** has a combined MCL of 5 picocurries per Liter.
Radionuclide MCL is the average annual concentration of beta particles and photon radioactivity from man-made radionuclides

[/4] **Total Trihalomethanes** equals the sum of the concentrations of bromodichloromethane, dibromochloromethane, tribromomethane (bromoform) and trichloromethane (chloroform).

Table G-2. Water Quality in Aquifers Used for Potable Supply

WATER QUALITY IN AQUIFERS USED FOR POTABLE SUPPLY
Nitrates

BASIN NAME	BASIN AREA (sq. miles)	BASIN AREA (% sq. miles)	PREDOMINANT AQUIFER	NITRATES, TOTAL		AREA SAMPLED	ESTIMATED POTABLE GW		
				TOTAL WELLS	% WELLS OVER MCL	BASIN AREA SAMPLED (% sq.miles)	WELLS THAT MEET DESIGNATED USE (1 well = 1 sq. mile)	ESTIMATED AREA MEETS DESIGNATED USE (sq. miles)	ESTIMATED PERCENT MEETS DESIGNATED USE (% sq. miles)
Apalachicola - Chipola	3322	4.69%	FLORIDAN	33	0.00%	0.99%	33	3322	100%
Caloosahatchee	1341	1.90%	INTERMEDIATE	14	0.00%	1.04%	14	1341	100%
Caloosahatchee	1341	1.90%	SURFICIAL	17	0.00%	1.27%	17	1341	100%
Charlotte Harbor	857	1.21%	INTERMEDIATE	7	0.00%	0.82%	7	857	100%
Choctawhatchee - St.Andrew	3951	5.58%	FLORIDAN	32	3.10%	0.81%	31	3829	97%
Everglades	4571	6.46%	SURFICIAL	3	0.00%	0.07%	3	4571	100%
Everglades	4571	6.46%	BISCAYNE	22	0.00%	0.48%	22	4571	100%
Everglades West Coast	3211	4.91%	SURFICIAL	52	0.00%	1.62%	52	3211	100%
Everglades West Coast	3211	4.91%	INTERMEDIATE	44	0.00%	1.37%	44	3211	100%
Fisheating Creek	850	1.20%	SURFICIAL	6	0.00%	0.71%	6	850	100%
Fisheating Creek	850	1.20%	INTERMEDIATE	1	0.00%	0.12%	1	850	100%
Indian River Lagoon	1410	1.99%	FLORIDAN	5	0.00%	0.35%	5	1410	100%
Indian River Lagoon	1410	1.99%	SURFICIAL	6	0.00%	0.43%	6	1410	100%
Kissimmee River	2933	4.14%	FLORIDAN	24	4.20%	0.82%	23	2809	96%
Kissimmee River	2933	4.14%	INTERMEDIATE	1	0.00%	0.03%	1	2933	100%
Lake Okeechobee	1023	1.45%	SURFICIAL	18	5.60%	1.76%	17	966	94%
Lake Okeechobee	1023	1.45%	INTERMEDIATE	0	0.00%	0.00%	0	1023	100%
Lake Worth Lagoon - Palm Beach Coast	869	1.23%	BISCAYNE	9	0.00%	1.04%	9	869	100%
Lake Worth Lagoon - Palm Beach Coast	869	1.23%	SURFICIAL	31	0.00%	3.57%	31	869	100%
Lower St. Johns	2822	3.99%	FLORIDAN	13	0.00%	0.46%	13	2822	100%
Middle St. Johns	2037	2.88%	FLORIDAN	44	2.30%	2.16%	43	1990	98%
Nassau - St. Marys	1511	2.13%	FLORIDAN	2	0.00%	0.13%	2	1511	100%
Ochlockonee - St.Marks	2531	3.58%	FLORIDAN	47	0.00%	1.86%	47	2531	100%
Ocklawaha	2780	3.93%	FLORIDAN	46	0.00%	1.65%	46	2780	100%
Pensacola	2691	3.80%	SAND AND GRAVEL	45	6.70%	1.67%	42	2511	93%
Perdido	400	0.56%	SAND AND GRAVEL	29	6.90%	7.26%	27	372	93%
Sarasota Bay - Peace - Myakka	3386	4.79%	INTERMEDIATE	42	0.00%	1.24%	42	3386	100%
Sarasota Bay - Peace - Myakka	3386	4.79%	FLORIDAN	31	0.00%	0.92%	31	3386	100%
Southeast Coast - Biscayne Bay	1506	2.13%	BISCAYNE	101	2.00%	6.71%	99	1476	98%
Springs Coast	1623	2.29%	FLORIDAN	27	0.00%	1.66%	27	1623	100%
St.Lucie - Loxahatchee	1527	2.16%	SURFICIAL	18	0.00%	1.18%	18	1527	100%
Suwannee	8303	11.73%	FLORIDAN	5	0.00%	0.06%	5	8303	100%
Tampa Bay	926	1.31%	FLORIDAN	33	0.00%	3.56%	33	926	100%
Tampa Bay Tributaries	1680	2.37%	FLORIDAN	30	0.00%	1.79%	30	1680	100%
Upper East Coast	982	1.39%	FLORIDAN	17	0.00%	1.73%	17	982	100%
Upper St. Johns	1888	2.67%	FLORIDAN	7	0.00%	0.37%	7	1888	100%
Upper St. Johns	1888	2.67%	SURFICIAL	12	0.00%	0.64%	12	1888	100%
Withlacoochee	2109	2.98%	FLORIDAN	33	0.00%	1.56%	33	2109	100%

Total Area for All Aquifers Combined (square miles) 84518

SUM OF BASIN AREAS THAT MEET DESIGNATED USE: 83930

ESTIMATED PERCENT OF ALL GROUND WATER IN STATE THAT MEETS DESIGNATED USE AS POTABLE WATER PERIOD OF RECORD (1986-2005): **99.30%** *

* NOTE: BASED ON DATA REPRESENTING LESS THAN 10% OF BASIN AREAS SAMPLED

WATER QUALITY IN AQUIFERS USED FOR POTABLE SUPPLY

Nitrates

BASIN NAME	BASIN AREA (sq. miles)	BASIN AREA (% sq. miles)	PREDOMINANT AQUIFER	NITRATES, TOTAL: TOTAL WELLS	NITRATES, TOTAL: % WELLS OVER MCL	AREA SAMPLED: BASIN AREA SAMPLED (% sq.miles)	ESTIMATED POTABLE GW: WELLS THAT MEET DESIGNATED USE (1 well = 1 sq. mile)	ESTIMATED POTABLE GW: ESTIMATED AREA MEETS DESIGNATED USE (sq. miles)	ESTIMATED POTABLE GW: ESTIMATED PERCENT MEETS DESIGNATED USE (% sq. miles)
Apalachicola - Chipola	3322	4.69%	FLORIDAN	33	0.00%	0.99%	33	3322	100%
Caloosahatchee	1341	1.90%	INTERMEDIATE	14	0.00%	1.04%	14	1341	100%
Caloosahatchee	1341	1.90%	SURFICIAL	17	0.00%	1.27%	17	1341	100%
Charlotte Harbor	857	1.21%	INTERMEDIATE	7	0.00%	0.82%	7	857	100%
Choctawhatchee - St.Andrew	3951	5.58%	FLORIDAN	32	3.10%	0.81%	31	3829	97%
Everglades	4571	6.46%	SURFICIAL	3	0.00%	0.07%	3	4571	100%
Everglades	4571	6.46%	BISCAYNE	22	0.00%	0.48%	22	4571	100%
Everglades West Coast	3211	4.91%	SURFICIAL	52	0.00%	1.62%	52	3211	100%
Everglades West Coast	3211	4.91%	INTERMEDIATE	44	0.00%	1.37%	44	3211	100%
Fisheating Creek	850	1.20%	SURFICIAL	6	0.00%	0.71%	6	850	100%
Fisheating Creek	850	1.20%	INTERMEDIATE	1	0.00%	0.12%	1	850	100%
Indian River Lagoon	1410	1.99%	FLORIDAN	5	0.00%	0.35%	5	1410	100%
Indian River Lagoon	1410	1.99%	SURFICIAL	6	0.00%	0.43%	6	1410	100%
Kissimmee River	2933	4.14%	FLORIDAN	24	4.20%	0.82%	23	2809	96%
Kissimmee River	2933	4.14%	INTERMEDIATE	1	0.00%	0.03%	1	2933	100%
Lake Okeechobee	1023	1.45%	SURFICIAL	18	5.60%	1.76%	17	966	94%
Lake Okeechobee	1023	1.45%	INTERMEDIATE	0	0.00%	0.00%	0	1023	100%
Lake Worth Lagoon - Palm Beach Coast	869	1.23%	BISCAYNE	9	0.00%	1.04%	9	869	100%
Lake Worth Lagoon - Palm Beach Coast	869	1.23%	SURFICIAL	31	0.00%	3.57%	31	869	100%
Lower St. Johns	2822	3.99%	FLORIDAN	13	0.00%	0.46%	13	2822	100%
Middle St. Johns	2037	2.88%	FLORIDAN	44	2.30%	2.16%	43	1990	98%
Nassau - St. Marys	1511	2.13%	FLORIDAN	2	0.00%	0.13%	2	1511	100%
Ochlockonee - St.Marks	2531	3.58%	FLORIDAN	47	0.00%	1.86%	47	2531	100%
Ocklawaha	2780	3.93%	FLORIDAN	46	0.00%	1.65%	46	2780	100%
Pensacola	2691	3.80%	SAND AND GRAVEL	45	6.70%	1.67%	42	2511	93%
Perdido	400	0.56%	SAND AND GRAVEL	29	6.90%	7.26%	27	372	93%
Sarasota Bay - Peace - Myakka	3386	4.79%	INTERMEDIATE	42	0.00%	1.24%	42	3386	100%
Sarasota Bay - Peace - Myakka	3386	4.79%	FLORIDAN	31	0.00%	0.92%	31	3386	100%
Southeast Coast - Biscayne Bay	1506	2.13%	BISCAYNE	101	2.00%	6.71%	99	1476	98%
Springs Coast	1623	2.29%	FLORIDAN	27	0.00%	1.66%	27	1623	100%
St.Lucie - Loxahatchee	1527	2.16%	SURFICIAL	18	0.00%	1.18%	18	1527	100%
Suwannee	8303	11.73%	FLORIDAN	5	0.00%	0.06%	5	8303	100%
Tampa Bay	926	1.31%	FLORIDAN	33	0.00%	3.56%	33	926	100%
Tampa Bay Tributaries	1680	2.37%	FLORIDAN	30	0.00%	1.79%	30	1680	100%
Upper East Coast	982	1.39%	FLORIDAN	17	0.00%	1.73%	17	982	100%
Upper St. Johns	1888	2.67%	FLORIDAN	7	0.00%	0.37%	7	1888	100%
Upper St. Johns	1888	2.67%	SURFICIAL	12	0.00%	0.64%	12	1888	100%
Withlacoochee	2109	2.98%	FLORIDAN	33	0.00%	1.56%	33	2109	100%

Total Area for All Aquifers Combined (square miles): 84518

SUM OF BASIN AREAS THAT MEET DESIGNATED USE: 83930

ESTIMATED PERCENT OF ALL GROUND WATER IN STATE THAT MEETS DESIGNATED USE AS POTABLE WATER PERIOD OF RECORD (1986-2005): **99.30%** *

* NOTE: BASED ON DATA REPRESENTING LESS THAN 10% OF BASIN AREAS SAMPLED

WATER QUALITY IN AQUIFERS USED FOR POTABLE SUPPLY

Organics

BASIN NAME	BASIN AREA (sq. miles)	BASIN AREA (% sq. miles)	PREDOMINANT AQUIFER	ORGANICS, TOTAL		AREA SAMPLED	ESTIMATED POTABLE GW		
				TOTAL WELLS	% WELLS OVER MCL	BASIN AREA SAMPLED (% sq.miles)	WELLS THAT MEET DESIGNATED USE (1 well = 1 sq. mile)	ESTIMATED AREA MEETS DESIGNATED USE (sq. miles)	ESTIMATED PERCENT MEETS DESIGNATED USE (% sq. miles)
Apalachicola - Chipola	3322	4.69%	FLORIDAN	56	0.00%	1.69%	56	3322	100%
Caloosahatchee	1341	1.90%	INTERMEDIATE	15	0.00%	1.12%	15	1341	100%
Caloosahatchee	1341	1.90%	SURFICIAL	17	5.90%	1.27%	16	1262	94%
Charlotte Harbor	857	1.21%	INTERMEDIATE	10	0.00%	1.17%	10	857	100%
Choctawhatchee - St.Andrew	3951	5.58%	FLORIDAN	34	2.90%	0.86%	33	3837	97%
Everglades	4571	6.46%	SURFICIAL	21	0.00%	0.46%	21	4571	100%
Everglades	4571	6.46%	BISCAYNE	12	8.30%	0.26%	11	4191	92%
Everglades West Coast	3211	4.91%	SURFICIAL	43	2.30%	1.34%	42	3137	98%
Everglades West Coast	3211	4.91%	INTERMEDIATE	19	5.30%	0.59%	18	3041	95%
Fisheating Creek	850	1.20%	SURFICIAL	9	0.00%	1.06%	9	850	100%
Fisheating Creek	850	1.20%	INTERMEDIATE	1	0.00%	0.12%	1	850	100%
Indian River Lagoon	1410	1.99%	FLORIDAN	6	0.00%	0.43%	6	1410	100%
Indian River Lagoon	1410	1.99%	SURFICIAL	34	0.00%	2.41%	34	1410	100%
Kissimmee River	2933	4.14%	FLORIDAN	25	4.00%	0.85%	24	2815	96%
Kissimmee River	2933	4.14%	INTERMEDIATE	1	0.00%	0.03%	1	2933	100%
Lake Okeechobee	1023	1.45%	SURFICIAL	4	0.00%	0.39%	4	1023	100%
Lake Okeechobee	1023	1.45%	INTERMEDIATE						
Lake Worth Lagoon - Palm Beach Coast	869	1.23%	BISCAYNE	13	0.00%	1.50%	13	869	100%
Lake Worth Lagoon - Palm Beach Coast	869	1.23%	SURFICIAL	32	31.30%	3.68%	22	597	69%
Lower St. Johns	2822	3.99%	FLORIDAN	37	0.00%	1.31%	37	2822	100%
Middle St. Johns	2037	2.88%	FLORIDAN	60	0.00%	2.95%	60	2037	100%
Nassau - St. Marys	1511	2.13%	FLORIDAN	9	11.10%	0.60%	8	1343	89%
Ochlockonee - St.Marks	2531	3.58%	FLORIDAN	80	1.30%	3.16%	79	2498	99%
Ocklawaha	2780	3.93%	FLORIDAN	58	0.00%	2.09%	58	2780	100%
Pensacola	2691	3.80%	SAND AND GRAVEL	57	29.80%	2.12%	40	1889	70%
Perdido	400	0.56%	SAND AND GRAVEL	3	66.70%	0.75%	1	133	33%
Sarasota Bay - Peace - Myakka	3386	4.79%	INTERMEDIATE	4	25.00%	0.12%	3	2539	75%
Sarasota Bay - Peace - Myakka	3386	4.79%	FLORIDAN	48	10.40%	1.42%	43	3034	90%
Southeast Coast - Biscayne Bay	1506	2.13%	BISCAYNE	21	33.30%	1.39%	14	1004	67%
Springs Coast	1623	2.29%	FLORIDAN	11	9.10%	0.68%	10	1475	91%
St.Lucie - Loxahatchee	1527	2.16%	SURFICIAL	43	0.00%	2.82%	43	1527	100%
Suwannee	8303	11.73%	FLORIDAN	8	0.00%	0.10%	8	8303	100%
Tampa Bay	926	1.31%	FLORIDAN	41	0.00%	4.43%	41	926	100%
Tampa Bay Tributaries	1680	2.37%	FLORIDAN	2	50.00%	0.12%	1	840	50%
Upper East Coast	982	1.39%	FLORIDAN	18	0.00%	1.83%	18	982	100%
Upper St. Johns	1888	2.67%	FLORIDAN	7	0.00%	0.37%	7	1888	100%
Upper St. Johns	1888	2.67%	SURFICIAL	18	5.60%	0.95%	17	1782	94%
Withlacoochee	2109	2.98%	FLORIDAN	43	2.30%	2.04%	42	2060	98%

Total Area for All Aquifers Combined (square miles) 84518

SUM OF BASIN AREAS THAT MEET DESIGNATED USE 78178

ESTIMATED PERCENT OF ALL GROUND WATER IN STATE THAT MEETS DESIGNATED USE AS POTABLE WATER PERIOD OF RECORD (1986-2005) **92.50%** *

* NOTE: BASED ON DATA REPRESENTING LESS THAN 10% OF BASIN AREAS SAMPLED

WATER QUALITY IN AQUIFERS USED FOR POTABLE SUPPLY
Total Coliforms

				TOTAL COLIFORMS, TOTAL		AREA SAMPLED	ESTIMATED POTABLE GW		
BASIN NAME	BASIN AREA (sq. miles)	BASIN AREA (% sq. miles)	PREDOMINANT AQUIFER	TOTAL WELLS	% WELLS OVER MCL	BASIN AREA SAMPLED (% sq.miles)	WELLS THAT MEET DESIGNATED USE (1 well = 1 sq. mile)	ESTIMATED AREA MEETS DESIGNATED USE (sq. miles)	ESTIMATED PERCENT MEETS DESIGNATED USE (% sq. miles)
Apalachicola - Chipola	3322	4.69%	FLORIDAN	33	15.20%	0.99%	28	2817	85%
Caloosahatchee	1341	1.90%	INTERMEDIATE	21	14.30%	1.57%	18	1149	86%
Caloosahatchee	1341	1.90%	SURFICIAL	15	20.00%	1.12%	12	1073	80%
Charlotte Harbor	857	1.21%	INTERMEDIATE	5	0.00%	0.58%	5	857	100%
Choctawhatchee - St.Andrew	3951	5.58%	FLORIDAN	32	15.60%	0.81%	27	3335	84%
Everglades	4571	6.46%	SURFICIAL	0	0.00%	0.00%	0	4571	100%
Everglades	4571	6.46%	BISCAYNE	7	14.30%	0.15%	6	3917	86%
Everglades West Coast	3211	4.91%	SURFICIAL	26	19.20%	0.81%	21	2594	81%
Everglades West Coast	3211	4.91%	INTERMEDIATE	32	25.00%	1.00%	24	2408	75%
Fisheating Creek	850	1.20%	SURFICIAL	6	33.30%	0.71%	4	567	67%
Fisheating Creek	850	1.20%	INTERMEDIATE	0	0.00%	0.00%	0	850	100%
Indian River Lagoon	1410	1.99%	FLORIDAN	5	0.00%	0.35%	5	1410	100%
Indian River Lagoon	1410	1.99%	SURFICIAL	6	16.70%	0.43%	5	1175	83%
Kissimmee River	2933	4.14%	FLORIDAN	11	9.10%	0.38%	10	2666	91%
Kissimmee River	2933	4.14%	INTERMEDIATE	3	0.00%	0.10%	3	2933	100%
Lake Okeechobee	1023	1.45%	SURFICIAL	23	0.00%	2.25%	23	1023	100%
Lake Okeechobee	1023	1.45%	INTERMEDIATE	0	0.00%	0.00%	0	1023	100%
Lake Worth Lagoon - Palm Beach Coast	869	1.23%	BISCAYNE	0	0.00%	0.00%	0	869	100%
Lake Worth Lagoon - Palm Beach Coast	869	1.23%	SURFICIAL	6	0.00%	0.69%	6	869	100%
Lower St. Johns	2822	3.99%	FLORIDAN	25	20.00%	0.89%	20	2258	80%
Middle St. Johns	2037	2.88%	FLORIDAN	44	13.60%	2.16%	38	1760	86%
Nassau - St. Marys	1511	2.13%	FLORIDAN	9	0.00%	0.60%	9	1511	100%
Ochlockonee - St.Marks	2531	3.58%	FLORIDAN	80	27.50%	3.16%	58	1835	73%
Ocklawaha	2780	3.93%	FLORIDAN	56	41.00%	2.01%	33	1640	59%
Pensacola	2691	3.80%	SAND AND GRAVEL	45	40.00%	1.67%	27	1615	60%
Perdido	400	0.56%	SAND AND GRAVEL	29	17.20%	7.26%	24	331	83%
Sarasota Bay - Peace - Myakka	3386	4.79%	INTERMEDIATE	17	29.40%	0.50%	12	2390	71%
Sarasota Bay - Peace - Myakka	3386	4.79%	FLORIDAN	9	44.40%	0.27%	5	1883	56%
Southeast Coast - Biscayne Bay	1506	2.13%	BISCAYNE	83	36.10%	5.51%	53	962	64%
Springs Coast	1623	2.29%	FLORIDAN	0	0.00%	0.00%	0	1623	100%
St.Lucie - Loxahatchee	1527	2.16%	SURFICIAL	13	7.70%	0.85%	12	1409	92%
Suwannee	8303	11.73%	FLORIDAN	4	75.00%	0.05%	1	2076	25%
Tampa Bay	926	1.31%	FLORIDAN	26	26.90%	2.81%	19	677	73%
Tampa Bay Tributaries	1680	2.37%	FLORIDAN	16	12.50%	0.95%	14	1470	88%
Upper East Coast	982	1.39%	FLORIDAN	17	11.80%	1.73%	15	866	88%
Upper St. Johns	1888	2.67%	FLORIDAN	6	0.00%	0.32%	6	1888	100%
Upper St. Johns	1888	2.67%	SURFICIAL	7	0.00%	0.37%	7	1888	100%
Withlacoochee	2109	2.98%	FLORIDAN	6	50.00%	0.28%	3	1054	50%

Total Area for All Aquifers Combined (square miles) 84518

SUM OF BASIN AREAS THAT MEET DESIGNATED USE 65239.7081

ESTIMATED PERCENT OF ALL GROUND WATER IN STATE THAT MEETS DESIGNATED USE AS POTABLE WATER PERIOD OF RECORD (1986-2005) **77.19%** *

* NOTE: BASED ON DATA REPRESENTING LESS THAN 10% OF BASIN AREAS SAMPLED

WATER QUALITY IN AQUIFERS USED FOR POTABLE SUPPLY

Arsenic

				ARSENIC, TOTAL		AREA SAMPLED	ESTIMATED POTABLE GW		
BASIN NAME	BASIN AREA (sq. miles)	BASIN AREA (% sq. miles)	PREDOMINANT AQUIFER	TOTAL WELLS	% WELLS OVER MCL	BASIN AREA SAMPLED (% sq.miles)	WELLS THAT MEET DESIGNATED USE (1 well = 1 sq. mile)	ESTIMATED AREA MEETS DESIGNATED USE (sq. miles)	ESTIMATED PERCENT MEETS DESIGNATED USE (% sq. miles)
Apalachicola - Chipola	3322	4.69%	FLORIDAN	56	0.00%	1.69%	56	3322	100%
Caloosahatchee	1341	1.90%	INTERMEDIATE	15	0.00%	1.12%	15	1341	100%
Caloosahatchee	1341	1.90%	SURFICIAL	20	25.00%	1.49%	15	1006	75%
Charlotte Harbor	857	1.21%	INTERMEDIATE	10	0.00%	1.17%	10	857	100%
Choctawhatchee - St.Andrew	3951	5.58%	FLORIDAN	34	0.00%	0.86%	34	3951	100%
Everglades	4571	6.46%	SURFICIAL	22	9.10%	0.48%	20	4155	91%
Everglades	4571	6.46%	BISCAYNE	21	0.00%	0.46%	21	4571	100%
Everglades West Coast	3211	4.91%	SURFICIAL	65	12.30%	2.02%	57	2816	88%
Everglades West Coast	3211	4.91%	INTERMEDIATE	46	2.20%	1.43%	45	3140	98%
Fisheating Creek	850	1.20%	SURFICIAL	7	0.00%	0.82%	7	850	100%
Fisheating Creek	850	1.20%	INTERMEDIATE	1	0.00%	0.12%	1	850	100%
Indian River Lagoon	1410	1.99%	FLORIDAN	6	0.00%	0.43%	6	1410	100%
Indian River Lagoon	1410	1.99%	SURFICIAL	35	0.00%	2.48%	35	1410	100%
Kissimmee River	2933	4.14%	FLORIDAN	30	0.00%	1.02%	30	2933	100%
Kissimmee River	2933	4.14%	INTERMEDIATE	2	0.00%	0.07%	2	2933	100%
Lake Okeechobee	1023	1.45%	SURFICIAL	23	0.00%	2.25%	23	1023	100%
Lake Okeechobee	1023	1.45%	INTERMEDIATE						
Lake Worth Lagoon - Palm Beach Coast	869	1.23%	BISCAYNE	13	7.70%	1.50%	12	802	92%
Lake Worth Lagoon - Palm Beach Coast	869	1.23%	SURFICIAL	63	6.30%	7.25%	59	814	94%
Lower St. Johns	2822	3.99%	FLORIDAN	35	0.00%	1.24%	35	2822	100%
Middle St. Johns	2037	2.88%	FLORIDAN	62	1.60%	3.04%	61	2005	98%
Nassau - St. Marys	1511	2.13%	FLORIDAN	9	0.00%	0.60%	9	1511	100%
Ochlockonee - St.Marks	2531	3.58%	FLORIDAN	163	5.50%	6.44%	154	2392	95%
Ocklawaha	2780	3.93%	FLORIDAN	72	2.80%	2.59%	70	2702	97%
Pensacola	2691	3.80%	SAND AND GRAVEL	102	2.80%	3.79%	99	2616	97%
Perdido	400	0.56%	SAND AND GRAVEL	31	6.50%	7.76%	29	374	94%
Sarasota Bay - Peace - Myakka	3386	4.79%	INTERMEDIATE	60	5.00%	1.77%	57	3217	95%
Sarasota Bay - Peace - Myakka	3386	4.79%	FLORIDAN	49	0.00%	1.45%	49	3386	100%
Southeast Coast - Biscayne Bay	1506	2.13%	BISCAYNE	147	2.70%	9.76%	143	1465	97%
Springs Coast	1623	2.29%	FLORIDAN	42	7.10%	2.59%	39	1507	93%
St.Lucie - Loxahatchee	1527	2.16%	SURFICIAL	44	4.50%	2.88%	42	1458	96%
Suwannee	8303	11.73%	FLORIDAN	9	0.00%	0.11%	9	8303	100%
Tampa Bay	926	1.31%	FLORIDAN	47	2.10%	5.07%	46	907	98%
Tampa Bay Tributaries	1680	2.37%	FLORIDAN	40	0.00%	2.38%	40	1680	100%
Upper East Coast	982	1.39%	FLORIDAN	15	6.70%	1.53%	14	916	93%
Upper St. Johns	1888	2.67%	FLORIDAN	10	0.00%	0.53%	10	1888	100%
Upper St. Johns	1888	2.67%	SURFICIAL	22	4.50%	1.17%	21	1803	96%
Withlacoochee	2109	2.98%	FLORIDAN	46	2.20%	2.18%	45	2062	98%

Total Area for All Aquifers Combined (square miles) 84518

SUM OF BASIN AREAS THAT MEET DESIGNATED USE 81195.2375

ESTIMATED PERCENT OF ALL GROUND WATER IN STATE THAT MEETS DESIGNATED USE AS POTABLE WATER PERIOD OF RECORD (1986-2005) **96.07%** *

* NOTE: BASED ON DATA REPRESENTING LESS THAN 10% OF BASIN AREAS SAMPLED

WATER QUALITY IN AQUIFERS USED FOR POTABLE SUPPLY

Metals

BASIN NAME	BASIN AREA (sq. miles)	BASIN AREA (% sq. miles)	PREDOMINANT AQUIFER	METALS, TOTAL: TOTAL WELLS	METALS, TOTAL: % WELLS OVER MCL	AREA SAMPLED: BASIN AREA SAMPLED (% sq.miles)	ESTIMATED POTABLE GW: WELLS THAT MEET DESIGNATED USE (1 well = 1 sq. mile)	ESTIMATED POTABLE GW: ESTIMATED AREA MEETS DESIGNATED USE (sq. miles)	ESTIMATED POTABLE GW: ESTIMATED PERCENT MEETS DESIGNATED USE (% sq. miles)
Apalachicola - Chipola	3322	4.69%	FLORIDAN	56	14.30%	1.69%	48	2847	86%
Caloosahatchee	1341	1.90%	INTERMEDIATE	15	26.70%	1.12%	11	983	73%
Caloosahatchee	1341	1.90%	SURFICIAL	20	40.00%	1.49%	12	805	60%
Charlotte Harbor	857	1.21%	INTERMEDIATE	10	30.00%	1.17%	7	600	70%
Choctawhatchee - St.Andrew	3951	5.58%	FLORIDAN	34	8.80%	0.86%	31	3603	91%
Everglades	4571	6.46%	SURFICIAL	22	9.10%	0.48%	20	4155	91%
Everglades	4571	6.46%	BISCAYNE	21	19.00%	0.46%	17	3702	81%
Everglades West Coast	3211	4.91%	SURFICIAL	65	24.60%	2.02%	49	2421	75%
Everglades West Coast	3211	4.91%	INTERMEDIATE	46	26.10%	1.43%	34	2373	74%
Fisheating Creek	850	1.20%	SURFICIAL	7	14.30%	0.82%	6	728	86%
Fisheating Creek	850	1.20%	INTERMEDIATE	1	100.00%	0.12%	0	0	0%
Indian River Lagoon	1410	1.99%	FLORIDAN	6	16.70%	0.43%	5	1175	83%
Indian River Lagoon	1410	1.99%	SURFICIAL	35	14.30%	2.48%	30	1208	86%
Kissimmee River	2933	4.14%	FLORIDAN	30	23.30%	1.02%	23	2249	77%
Kissimmee River	2933	4.14%	INTERMEDIATE	2	0.00%	0.07%	2	2933	100%
Lake Okeechobee	1023	1.45%	SURFICIAL	23	4.30%	2.25%	22	979	96%
Lake Okeechobee	1023	1.45%	INTERMEDIATE						
Lake Worth Lagoon - Palm Beach Coast	869	1.23%	BISCAYNE	13	23.10%	1.50%	10	668	77%
Lake Worth Lagoon - Palm Beach Coast	869	1.23%	SURFICIAL	63	14.30%	7.25%	54	745	86%
Lower St. Johns	2822	3.99%	FLORIDAN	38	50.00%	1.35%	19	1411	50%
Middle St. Johns	2037	2.88%	FLORIDAN	66	56.10%	3.24%	29	894	44%
Nassau - St. Marys	1511	2.13%	FLORIDAN	9	0.00%	0.60%	9	1511	100%
Ochlockonee - St.Marks	2531	3.58%	FLORIDAN	163	5.50%	6.44%	154	2392	95%
Ocklawaha	2780	3.93%	FLORIDAN	72	33.30%	2.59%	48	1854	67%
Pensacola	2691	3.80%	SAND AND GRAVEL	102	19.60%	3.79%	82	2164	80%
Perdido	400	0.56%	SAND AND GRAVEL	31	16.10%	7.76%	26	335	84%
Sarasota Bay - Peace - Myakka	3386	4.79%	INTERMEDIATE	60	40.00%	1.77%	36	2032	60%
Sarasota Bay - Peace - Myakka	3386	4.79%	FLORIDAN	49	30.60%	1.45%	34	2350	69%
Southeast Coast - Biscayne Bay	1506	2.13%	BISCAYNE	177	46.90%	11.75%	94	800	53%
Springs Coast	1623	2.29%	FLORIDAN	42	38.10%	2.59%	26	1004	62%
St.Lucie - Loxahatchee	1527	2.16%	SURFICIAL	44	29.50%	2.88%	31	1077	71%
Suwannee	8303	11.73%	FLORIDAN	9	22.20%	0.11%	7	6460	78%
Tampa Bay	926	1.31%	FLORIDAN	47	23.40%	5.07%	36	709	77%
Tampa Bay Tributaries	1680	2.37%	FLORIDAN	40	47.50%	2.38%	21	882	53%
Upper East Coast	982	1.39%	FLORIDAN	18	44.40%	1.83%	10	546	56%
Upper St. Johns	1888	2.67%	FLORIDAN	10	20.00%	0.53%	8	1510	80%
Upper St. Johns	1888	2.67%	SURFICIAL	22	40.90%	1.17%	13	1116	59%
Withlacoochee	2109	2.98%	FLORIDAN	46	39.10%	2.18%	28	1284	61%

Total Area for All Aquifers Combined (square miles) 84518

SUM OF BASIN AREAS THAT MEET DESIGNATED USE 62503.7350

ESTIMATED PERCENT OF ALL GROUND WATER IN STATE THAT MEETS DESIGNATED USE AS POTABLE WATER PERIOD OF RECORD (1986-2005) **73.95%** *

* NOTE: BASED ON DATA REPRESENTING LESS THAN 10% OF BASIN AREAS SAMPLED

WATER QUALITY IN AQUIFERS USED FOR POTABLE SUPPLY

Gross Alpha

				GROSS ALPHA, TOTAL		AREA SAMPLED	ESTIMATED POTABLE GW		
BASIN NAME	***BASIN AREA (sq. miles)***	***BASIN AREA (% sq. miles)***	**PREDOMINANT AQUIFER**	***TOTAL WELLS***	***% WELLS OVER MCL***	***BASIN AREA SAMPLED (% sq.miles)***	***WELLS THAT MEET DESIGNATED USE (1 well = 1 sq. mile)***	***ESTIMATED AREA MEETS DESIGNATED USE (sq. miles)***	***ESTIMATED PERCENT MEETS DESIGNATED USE (% sq. miles)***
Apalachicola - Chipola	3322	4.69%	FLORIDAN	33	0.00%	0.99%	33	3322	100%
Caloosahatchee	1341	1.90%	INTERMEDIATE	14	14.30%	1.04%	12	1149	86%
Caloosahatchee	1341	1.90%	SURFICIAL	15	20.00%	1.12%	12	1073	80%
Charlotte Harbor	857	1.21%	INTERMEDIATE	3	66.70%	0.35%	1	285	33%
Choctawhatchee - St.Andrew	3951	5.58%	FLORIDAN	32	0.00%	0.81%	32	3951	100%
Everglades	4571	6.46%	SURFICIAL	2	0.00%	0.04%	2	4571	100%
Everglades	4571	6.46%	BISCAYNE	7	0.00%	0.15%	7	4571	100%
Everglades West Coast	3211	4.91%	SURFICIAL	26	11.50%	0.81%	23	2842	89%
Everglades West Coast	3211	4.91%	INTERMEDIATE	17	0.00%	0.53%	17	3211	100%
Fisheating Creek	850	1.20%	SURFICIAL	6	0.00%	0.71%	6	850	100%
Fisheating Creek	850	1.20%	INTERMEDIATE						
Indian River Lagoon	1410	1.99%	FLORIDAN	4	0.00%	0.28%	4	1410	100%
Indian River Lagoon	1410	1.99%	SURFICIAL	6	16.70%	0.43%	5	1175	83%
Kissimmee River	2933	4.14%	FLORIDAN	13	7.70%	0.44%	12	2707	92%
Kissimmee River	2933	4.14%	SURFICIAL	10	30.00%	0.34%	7	2053	70%
Kissimmee River	2933	4.14%	INTERMEDIATE						
Lake Okeechobee	1023	1.45%	SURFICIAL						
Lake Okeechobee	1023	1.45%	INTERMEDIATE						
Lake Worth Lagoon - Palm Beach Coast	869	1.23%	BISCAYNE						
Lake Worth Lagoon - Palm Beach Coast	869	1.23%	SURFICIAL	6	0.00%	0.69%	6	869	100%
Lower St. Johns	2822	3.99%	FLORIDAN	25	12.00%	0.89%	22	2483	88%
Middle St. Johns	2037	2.88%	FLORIDAN	44	6.80%	2.16%	41	1899	93%
Nassau - St. Marys	1511	2.13%	FLORIDAN	2	0.00%	0.13%	2	1511	100%
Ochlockonee - St.Marks	2531	3.58%	FLORIDAN	30	3.30%	1.19%	29	2448	97%
Ocklawaha	2780	3.93%	INTERMEDIATE	4	0.00%	0.14%	4	2780	100%
Ocklawaha	2780	3.93%	FLORIDAN	22	13.60%	0.79%	19	2402	86%
Pensacola	2691	3.80%	SAND AND GRAVEL	45	37.80%	1.67%	28	1674	62%
Perdido	400	0.56%	SAND AND GRAVEL	29	20.70%	7.26%	23	317	79%
Sarasota Bay - Peace - Myakka	3386	4.79%	INTERMEDIATE	4	0.00%	0.12%	4	3386	100%
Sarasota Bay - Peace - Myakka	3386	4.79%	FLORIDAN	3	0.00%	0.09%	3	3386	100%
Southeast Coast - Biscayne Bay	1506	2.13%	BISCAYNE	74	2.70%	4.91%	72	1465	97%
Springs Coast	1623	2.29%	FLORIDAN	3	0.00%	0.18%	3	1623	100%
St.Lucie - Loxahatchee	1527	2.16%	SURFICIAL	13	7.70%	0.85%	12	1409	92%
Suwannee	8303	11.73%	FLORIDAN	3	0.00%	0.04%	3	8303	100%
Tampa Bay	926	1.31%	FLORIDAN	3	0.00%	0.32%	3	926	100%
Tampa Bay Tributaries	1680	2.37%	FLORIDAN	4	0.00%	0.24%	4	1680	100%
Upper East Coast	982	1.39%	FLORIDAN	17	0.00%	1.73%	17	982	100%
Upper St. Johns	1888	2.67%	FLORIDAN	7	0.00%	0.37%	7	1888	100%
Upper St. Johns	1888	2.67%	SURFICIAL	9	0.00%	0.48%	9	1888	100%
Withlacoochee	2109	2.98%	FLORIDAN	8	0.00%	0.38%	8	2109	100%

Total Area for All Aquifers Combined (square miles) 84518

SUM OF BASIN AREAS THAT MEET DESIGNATED USE 78594.2094

ESTIMATED PERCENT OF ALL GROUND WATER IN STATE THAT MEETS DESIGNATED USE AS POTABLE WATER PERIOD OF RECORD (1986-2005) **94.09%** *

* NOTE: BASED ON DATA REPRESENTING LESS THAN 10% OF BASIN AREAS SAMPLED

WATER QUALITY IN AQUIFERS USED FOR POTABLE SUPPLY

Sodium

BASIN NAME	BASIN AREA (sq. miles)	BASIN AREA (% sq. miles)	PREDOMINANT AQUIFER	SODIUM, TOTAL		AREA SAMPLED	ESTIMATED POTABLE GW		
				TOTAL WELLS	% WELLS OVER MCL	BASIN AREA SAMPLED (% sq.miles)	WELLS THAT MEET DESIGNATED USE (1 well = 1 sq. mile)	ESTIMATED AREA MEETS DESIGNATED USE (sq. miles)	ESTIMATED PERCENT MEETS DESIGNATED USE (% sq. miles)
Apalachicola - Chipola	3322	4.69%	FLORIDAN	40	0.00%	0.96%	40	3322	100%
Caloosahatchee	1341	1.90%	INTERMEDIATE	14	42.86%	0.42%	8	766	57%
Caloosahatchee	1341	1.90%	SURFICIAL	17	17.65%	0.51%	14	1104	82%
Charlotte Harbor	857	1.21%	INTERMEDIATE	7	42.86%	0.21%	4	490	57%
Choctawhatchee - St.Andrew	3951	5.58%	FLORIDAN	32	0.00%	0.96%	32	3951	100%
Everglades	4571	6.46%	SURFICIAL	3	0.00%	0.09%	3	4571	100%
Everglades	4571	6.46%	BISCAYNE	20	0.00%	0.60%	20	4571	100%
Everglades West Coast	3211	4.91%	SURFICIAL	52	13.46%	1.57%	45	2779	87%
Everglades West Coast	3211	4.91%	INTERMEDIATE	44	36.36%	1.32%	28	2043	64%
Fisheating Creek	850	1.20%	SURFICIAL	6	33.33%	0.18%	4	566	67%
Fisheating Creek	850	1.20%	INTERMEDIATE	0		0.00%	0	850	100%
Indian River Lagoon	1410	1.99%	FLORIDAN	5	40.00%	0.15%	3	846	60%
Indian River Lagoon	1410	1.99%	SURFICIAL	6	0.00%	0.18%	6	1410	100%
Kissimmee River	2933	4.14%	FLORIDAN	23	17.39%	0.69%	19	2423	83%
Kissimmee River	2933	4.14%	INTERMEDIATE	1	0.00%	0.03%	1	2933	100%
Lake Okeechobee	1023	1.45%	SURFICIAL	18	5.56%	0.54%	17	966	94%
Lake Okeechobee	1023	1.45%	INTERMEDIATE	0		0.00%	0	1023	100%
Lake Worth Lagoon - Palm Beach Coast	869	1.23%	BISCAYNE	9	0.00%	0.27%	9	869	100%
Lake Worth Lagoon - Palm Beach Coast	869	1.23%	SURFICIAL	32	0.00%	0.96%	32	869	100%
Lower St. Johns	2822	3.99%	FLORIDAN	29	17.24%	0.87%	24	2335	83%
Middle St. Johns	2037	2.88%	FLORIDAN	44	18.18%	1.32%	36	1667	82%
Nassau - St. Marys	1511	2.13%	FLORIDAN	3	0.00%	0.09%	3	1511	100%
Ochlockonee - St.Marks	2531	3.58%	FLORIDAN	81	1.23%	2.44%	80	2500	99%
Ocklawaha	2780	3.93%	FLORIDAN	46	2.17%	1.38%	45	2719	98%
Pensacola	2691	3.80%	SAND AND GRAVEL	45	0.00%	1.35%	45	2691	100%
Perdido	400	0.56%	SAND AND GRAVEL	29	0.00%	0.87%	29	400	100%
Sarasota Bay - Peace - Myakka	3386	4.79%	INTERMEDIATE	43	9.30%	1.29%	39	3071	91%
Sarasota Bay - Peace - Myakka	3386	4.79%	FLORIDAN	32	3.13%	0.96%	31	3280	97%
Southeast Coast - Biscayne Bay	1506	2.13%	BISCAYNE	117	5.98%	3.52%	110	1416	94%
Springs Coast	1623	2.29%	FLORIDAN	29	20.69%	0.87%	23	1287	79%
St.Lucie - Loxahatchee	1527	2.16%	SURFICIAL	18	16.67%	0.54%	15	1273	83%
Suwannee	8303	11.73%	FLORIDAN	8	0.00%	0.24%	8	8303	100%
Tampa Bay	926	1.31%	FLORIDAN	33	30.30%	0.99%	23	645	70%
Tampa Bay Tributaries	1680	2.37%	FLORIDAN	30	0.00%	0.90%	30	1680	100%
Upper East Coast	982	1.39%	FLORIDAN	17	23.53%	0.51%	13	751	76%
Upper St. Johns	1888	2.67%	FLORIDAN	7	28.57%	0.21%	5	1348	71%
Upper St. Johns	1888	2.67%	SURFICIAL	12	25.00%	0.36%	9	1416	75%
Withlacoochee	2109	2.98%	FLORIDAN	34	0.00%	1.02%	34	2109	100%

Total Area for All Aquifers Combined (square miles) 84518

SUM OF BASIN AREAS THAT MEET DESIGNATED USE 76752.5223

ESTIMATED PERCENT OF ALL GROUND WATER IN STATE THAT MEETS DESIGNATED USE AS POTABLE WATER PERIOD OF RECORD (1986-2005) **90.81%** *

* NOTE: BASED ON DATA REPRESENTING LESS THAN 10% OF BASIN AREAS SAMPLED