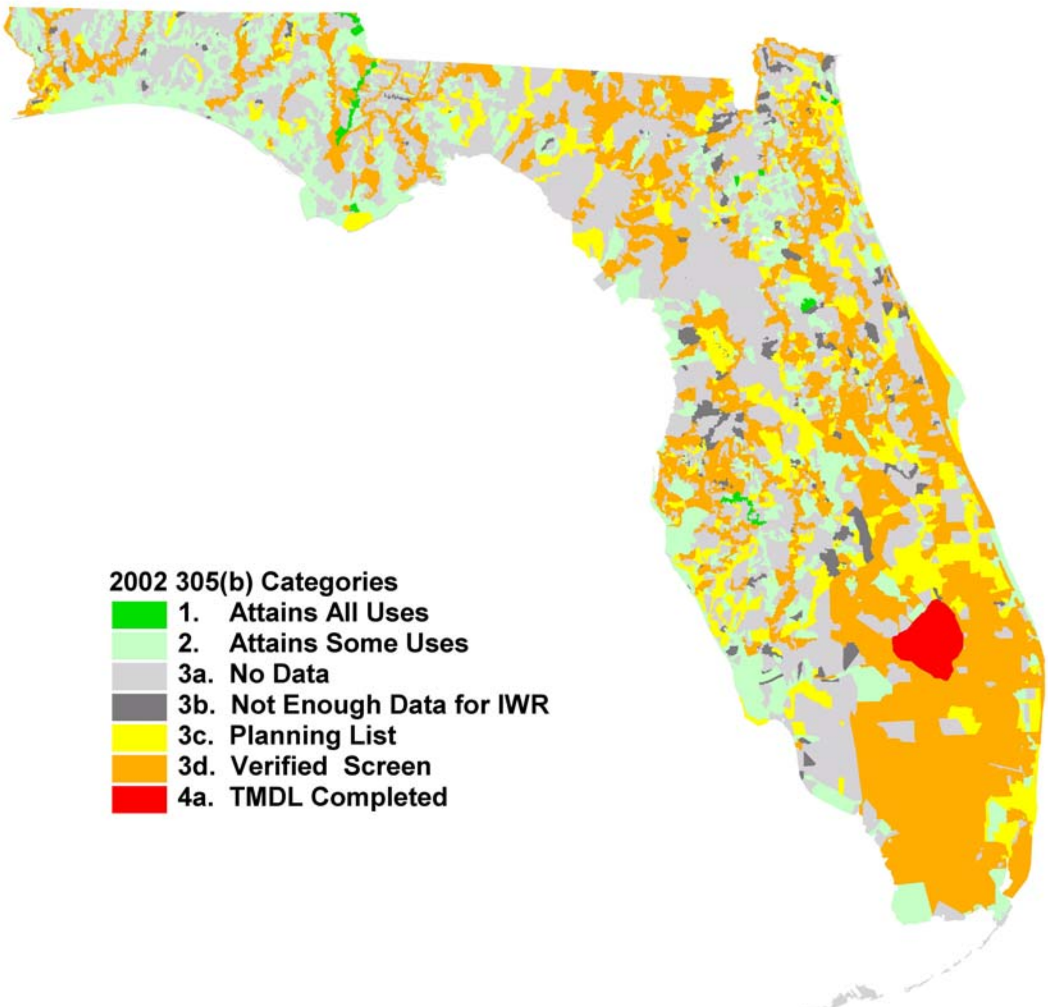
Florida's Water Quality Assessment
2002 305(b) Report



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Executive Summary/Overview

Water is Florida's most precious resource. We depend on a clean, reliable supply not only when we turn on the faucet, but as the foundation of our economy. The state has approximately 50,000 miles of streams, 3,000 square miles of lakes, and 4,000 square miles of estuaries that support diverse habitats, plants, and animals as well as food crops, industry, and recreation.

Currently the fourth most populated state in the United States, Florida continues to grow rapidly, and the pressures of population growth and development are serious threats to our water resources. Although issues of water quality and quantity are usually considered separately, they are inextricably linked, and maintaining both is critical to our future.

Recognizing the value of our water resources, Florida has acted to protect them. Chapters 403 and 373, Florida Statutes (F.S.), define the authority for preventing pollution and managing water resources. The Water Quality Assurance Act, the Surface Water Improvement and Management (SWIM) Act, and the Florida Watershed Restoration Act address water resource planning and preservation, as well as restoration of degraded waters. Funding for surface water restoration also has been provided through the Florida Forever Program and through special legislative appropriations. In addition, the Legislature annually has authorized Water Management Districts to use portions of their Water Management Lands Trust Fund appropriations for carrying out SWIM and other water restoration activities. Legislation in the mid-1980s required domestic wastewater discharges from Tampa Bay to Sarasota Bay to receive advanced treatment. In 1990, legislation also mandated the removal of all surface discharges of wastewater from the Indian River Lagoon, effective April 1, 1996.

The Florida Watershed Restoration Act (FWRA) of 1999 directed the Department to implement a watershed management program to better evaluate and manage the cumulative impacts to a watershed in a comprehensive, integrated way. The Division of Water Resource Management initiated a Watershed Approach on July 1, 2000 through the Bureau of Watershed Management. Using a five-year basin management cycle, the Department and local stakeholders in each basin statewide will assess their individual basin, reach a consensus on its most important water quality problems, and cooperate in finding and implementing management solutions.

This report provides an overview of Florida's surface and ground water quality, trends, and protection efforts. This report reflects a transition from a historic generalized assessment based on water quality indicators to a consolidated integrated report to address water quality monitoring strategies, data quality and data quantity needs, and data interpretation methodologies. It discusses the federal water quality reporting requirements (the 305(b) report), its relationship to the 303(d) Federal requirements to identify impaired waters, presents significant water quality findings, and summarizes attainment of designated use. Water quality trends are also summarized. Current monitoring efforts are briefly discussed. Wetlands protection is summarized and finally, ground water quality is summarized.

Assessing Florida's Surface Water Quality

Section 305(b) of the Clean Water Act (CWA) requires states and other jurisdictions to submit biennial water quality reports to the U.S. Environmental Protection Agency (EPA). These state reports, commonly referred to as the 305(b) report, describe the extent to which waters are attaining their designated uses. Under Section 303(d) of the CWA, states are also required to identify waters that are not attaining their designated uses, submit a list to EPA of those impaired waters, and develop Total Maximum Daily Loads (TMDLs) for them.

Water quality monitoring and data analysis are the foundation of these water resource management decisions. EPA and its partners have worked together to develop a consolidated 305(b)/303(d) assessment approach to address water quality monitoring strategies, data quality and data quantity needs, and data interpretation methodologies.

This 305(b) report, the *2002 Water Quality Assessment for Florida,* attempts to initiate the consolidation and alignment of the 305(b) assessment methodology with the requirements of 303(d) assessment and reporting. For this report, 5,215 water bodies (assessment polygons) were evaluated. Of that number, sufficient data were available to assess 2,023. The methodology used for the 2002 305(b) assessment is based on the recently adopted "Identification of Impaired Surface Waters" Rule (IWR) (Chapter 62-303). While the IWR has yet to become effective (because it was challenged and the administrative hearing process has not been completed), the rule provides an improved assessment approach that can be used for 305(b) reporting purposes without formal rulemaking. The methodology evaluates available quantitative biological data, exceedances of state criteria for conventional pollutants and toxics, and fish consumption advisory information to determine if applicable designated uses (aquatic life use, shellfish propagation, recreational use and drinking water use) are being met. Until such time as an assessment methodology is successfully implemented by rule, the FWRA precludes FDEP from formally designating any waters (other than Lake Okeechobee) as "impaired."

The 2002 Report summarizes the quality of the state's water resources, impacts to surface water and ground water, and water quality trends. For each 305(b) reporting cycle since 1976, FDEP has refined and improved its ability to assess Florida's surface water quality. The 2002 report moves further toward a comprehensive assessment.

Significant Findings

The map on this report's cover graphically displays an important conclusion on Florida's surface water quality; most problems are found in highly urbanized Central and South Florida.

Water quality in the Northwest and West-Central sections of the state is better than in other areas. Problems are evident around the densely populated, major urban centers, including Jacksonville, Orlando, Tampa, Pensacola, Cape Kennedy, and the southeastern Florida coast. Poor water quality not associated with a large population is also found in basins with intense agricultural and industrial use.

Ground water quality is also of generally high quality, most contamination being restricted to very site-specific areas. Regional ground water quality is generally affected most by saline or mineralized water caused by saltwater intrusion or upwelling.

While ground water standards are being met, some basins are experiencing significant increases in nitrate concentrations that pose a threat to contiguous surface waters. Portions of the Suwannee and Ocklawaha River basins have nitrate levels greater than 20 times that typical of the region.

Attainment of Designated Use

The process of determining attainment of designated use continually evolves. Designated use is the functional classification given to each Florida water body, 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*
Class V	*Navigation, utility, and industrial use*

For this report, water quality was summarized by determining the degree of attainment for designated use for the state's different water body types. FDEP assessed 9,016 miles of rivers and streams, 1,302,976 acres of lakes, and 3,658 square miles of estuaries. Of the assessed miles, 29 percent of total river miles, 20 percent of total lake areas, and 69 percent of total estuarine areas clearly attain their designated use (Figure 1). The percentage of waters potentially not meeting their designated use is very high, but that does not mean that similarly large percentages of the state's water do not meet their designated uses. The IWR methodology was specifically designed to conservatively identify potentially impaired waters. These potentially impaired waters will be assessed in more detail as part of the Department's Watershed Management cycle to determine if they are in fact impaired.

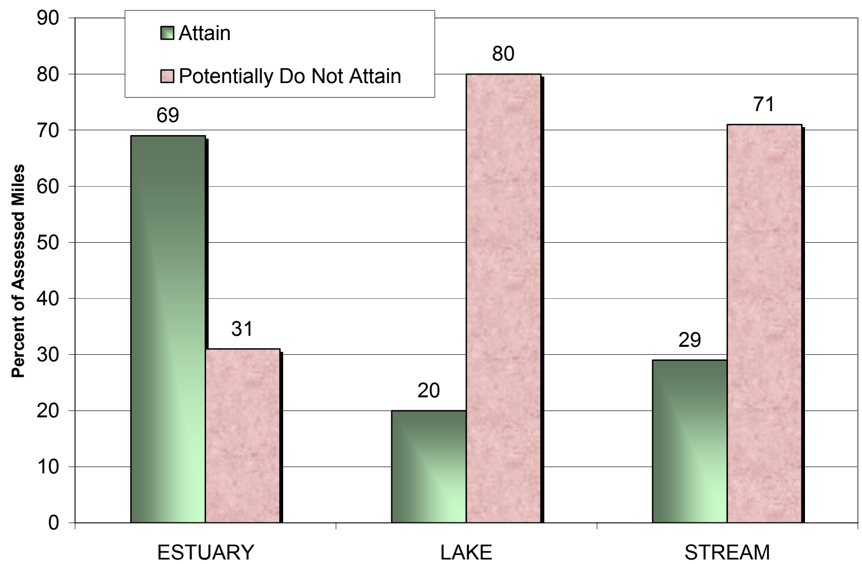


Figure 1: Percent of Florida Waters which Attain or Potentially Do Not Attain their Designated Uses

Pollution Problems

Pollution problems in Florida vary. In the past, most water quality problems resulted from domestic and industrial point sources. These are specific, identifiable sources of pollution discharged to surface waters. By implementing new technologies, treating wastes better, reusing treated wastewater, and eliminating many surface water discharges, point source pollution has diminished. While the state does not have extensive industrialization, localized concentrations of heavy industry that contribute point source pollution are centered mostly in urban areas.

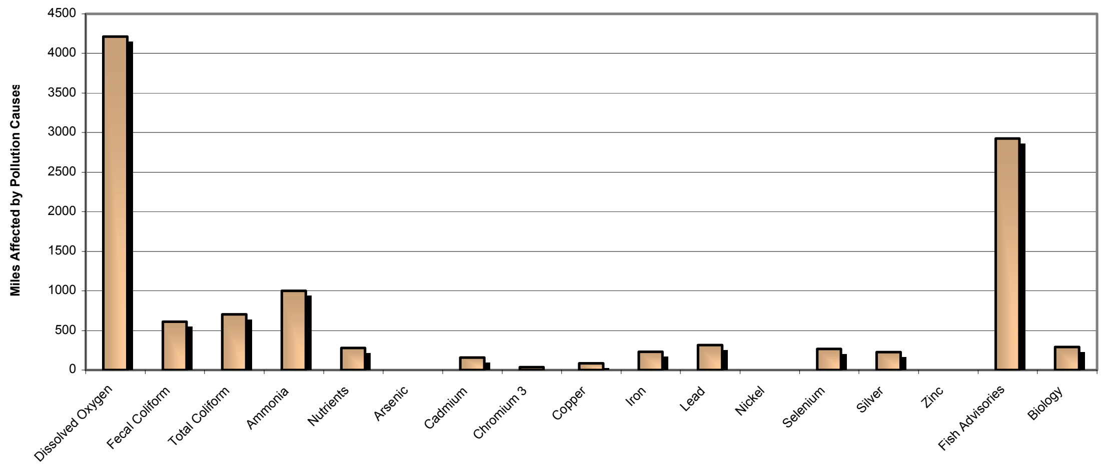
Nonpoint sources now account for most water quality problems. Nonpoint pollution is caused when rain washes pollutants off the landscape via stormwater or causes pollutants to leach into the ground water. Nonpoint source discharges can have many different kinds of contaminants (including nutrients, pesticides, and oil and grease) from multiple sources. Because Florida is so populous and has grown so rapidly — especially over the last two decades — much nonpoint pollution in urban areas is caused by runoff from urban development or septic tanks. In addition, silviculture, agriculture, and various kinds of animal farming, all of which are a large part of the state's current and historical economy, also generate significant nonpoint pollution.

Causes

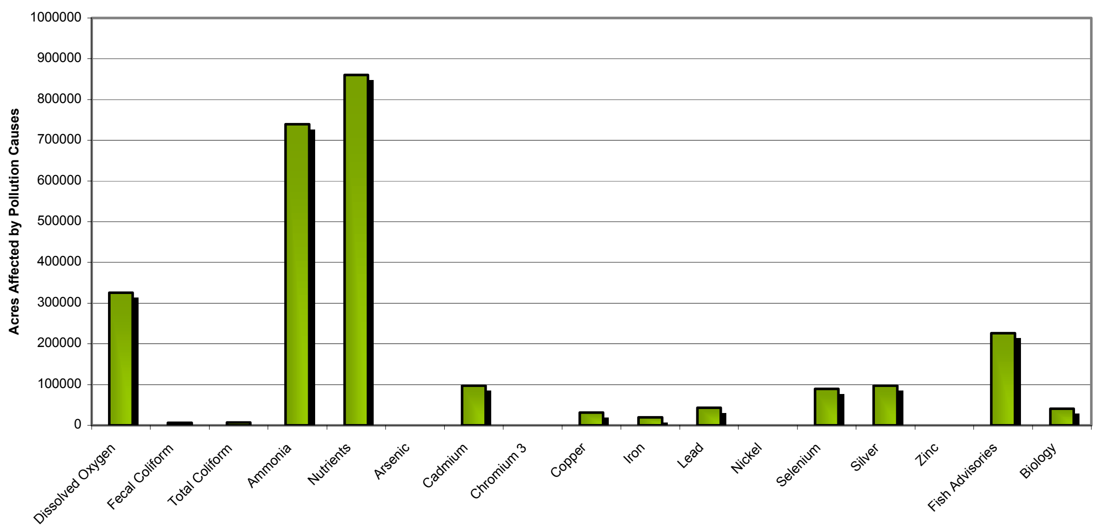
The main causes of water bodies not attaining their designated use have not been definitively determined at the present time (See Chapter 3, Methodology). In general, a preliminary assessment of lakes and estuaries indicate nutrients and subsequent eutrophication may be the major causes of impairment. For rivers, significant causes may include high organic matter levels or mercury contamination (Figure 2). Dissolved oxygen levels often do not meet the water quality criterion, but many systems in Florida have dissolved oxygen concentrations that naturally fall below the Class III criterion of 5 mg/L and still meet their designated use for aquatic life support.

Figure 2: Miles of River, Lakes and Estuaries within the State Affected by Various forms of Pollution - Causes (Based on Potentially Impaired Waters; See Chapter 3 Methodology)

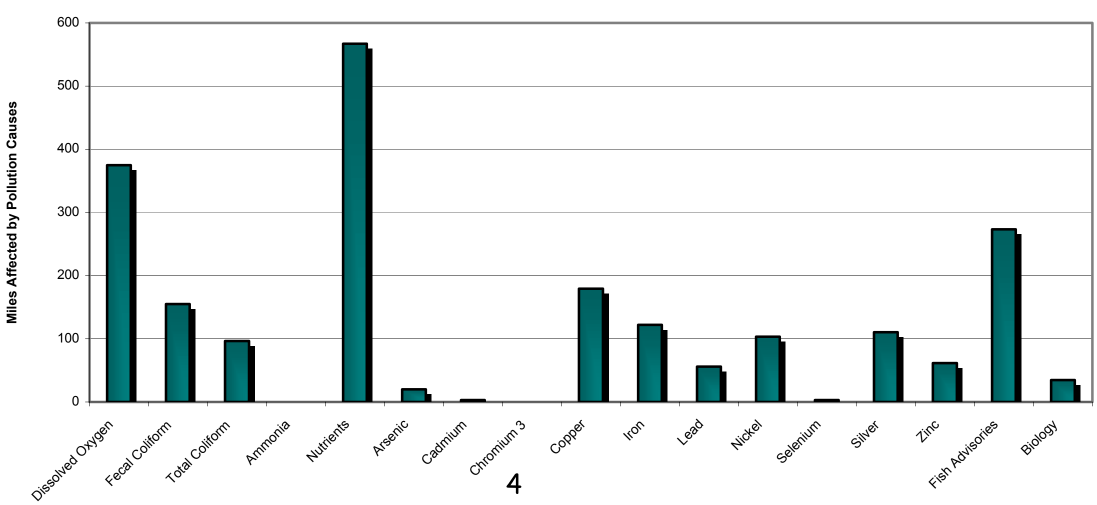
STREAMS



LAKES



ESTUARIES

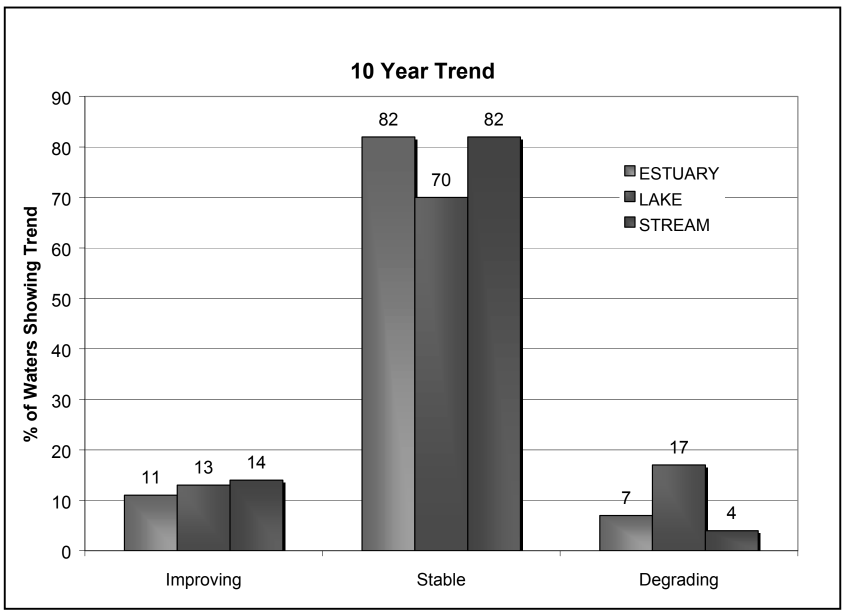


Water Quality Trends

Changes in water quality are an important indicator of the health of surface waters. Enough data were available to evaluate long-term trends (ten years) in water quality for 1165 water bodies. Overall, most (about 78 percent) showed no significant trends, while 13 percent improved and 9 percent worsened (Figure 3). The improvements generally resulted from wastewater treatment plant upgrades or new regional wastewater plants and nonpoint source controls in Tampa, Orlando, and several other cities. One hundred-two waterbodies showed worsening trends caused by both point and nonpoint sources. Possible causes include silviculture and increased land development.

Of 424 lakes assessed, 13 percent showed an improving trend, 17 percent showed a declining trend, and 70 percent remained the same. Water quality declines were generally attributed to nonpoint source pollution. Water quality improved when wastewater discharges were removed.

Figure 3: Assessment of Long-term Trends (10 years)



Monitoring

FDEP has been working to revise and expand its Ambient Monitoring Program, including the development of its bioassessment program and the integration of its surface and ground water monitoring activities. Florida's tiered Integrated Water Resources Monitoring (IWRM) Network, which includes sampling of both surface and ground waters, will be used to assess state waters. Tier 1 is a probability-based approach that will allow FDEP to statistically assess 100 percent of the waters of the state over a five-year period, to be detected with an 80 percent statistical confidence level. The five-year cycle will allow the results to be incorporated into future 305(b) reports. Tier II addresses basin specific or water body-specific questions. Tier III includes monitoring associated with regulatory permits and evaluations of TMDLs and Best Management Practices (BMPs).

The temporal variability network, which to date includes seventy nine surface water and forty-six ground water stations, is a collaborative effort with the Water Management Districts (WMDs) and local programs. Ten years of work have culminated in the development of final protocols (procedures) for biological assessments of streams and lakes, and the implementation of a new biological-monitoring program. Bioassessment focuses primarily on assessing the cumulative impacts of nonpoint sources. This type of monitoring should not only increase Florida's ability to monitor more water bodies but will also allow more comprehensive assessments.

Public Health Concerns

In the Miami River, chronic and acute bacterial contamination in the water and toxins in sediments threaten Biscayne Bay. The bacteria come from illegal sewer connections to the stormwater system, leaking or broken sewer lines, and direct discharges of raw sewage when pumping stations exceed capacity. When sewage is directly discharged, coliform bacteria counts in the Miami River and the adjoining waters of Biscayne Bay are hundreds of times higher than state criteria, periodically closing bathing beaches along the bay and Atlantic Ocean.

Sediments in many urban estuaries such as Tampa Bay, the St. Johns River Estuary, and Pensacola Bay contain heavy metals and organic contaminants. Continued habitat losses from dredging and filling and construction also threaten the viability of the fisheries in these areas.

In Florida Bay, algal blooms and extensive mangrove and seagrass dieoffs are important concerns. They likely stem from extensive channeling and hydrologic modifications in the watershed that have reduced freshwater flows to the bay. The problems have been exacerbated in recent years by a lack of flushing from hurricanes, high water temperatures, and high salinity.

Wetlands Protection

Urban and agricultural growth threatens Florida's eleven million acres of wetlands. However, Florida's wetland protection laws and rules have greatly diminished the loss and degradation of wetlands. The Environmental Resource Permitting program implemented in October 1995, merged with and replaced FDEP's dredge-and-fill Wetland Resource Permits and the WMDs' Management and Storage of Surface Water (MSSW) permits. This permitting program integrates the evaluation of wetland impacts with the stormwater quantity and quality changes associated with new land use activities. FDEP shares responsibility for the program with four of the state's five WMDs. In Northwest Florida, the district continues to operate a limited MSSW permitting process for agriculture and silviculture, and FDEP administers a Wetland Resource Permit program.

Regulating Pollutant Discharges

Florida's well-established point source permitting process was modified in May 1995 with the delegation of the National Pollutant Discharge Elimination System (NPDES) Program to Florida. All facilities that discharge wastewater into waters of the state or are reasonably expected to be a source of water pollution are regulated under FDEP's Wastewater Permitting Program. Permits containing effluent limitations must be obtained to build, operate, or modify domestic and industrial wastewater facilities. While the NPDES program only regulates discharges to surface waters, the state wastewater program issues permits for facilities that discharge to either surface or ground water. The state permit for surface water dischargers also serves as the NPDES permit. Florida permits about 4,794 ground water and surface water discharge facilities. Of these, only 641 are permitted to discharge to surface waters, and an additional 255 discharge to surface waters under general permits. The state also encourages the reuse of treated wastewater (primarily for irrigation) and the use of constructed and natural wetlands for wastewater treatment as alternatives to direct discharge. Currently, eighteen wetlands treatment systems are operating in the state.

The state has a comprehensive Nonpoint Source Program. At the core of this program is FDEP's Stormwater Rule and supporting stormwater legislation enacted in 1989. The regulations require all new developments to use appropriate best management practices (BMPs) to mitigate the stormwater quantity increases that occur and to treat the runoff to remove 80 to 95 percent of the total suspended solids loading before they enter surface waters. The program is also integrated with the state's SWIM Act and the Comprehensive Planning Act. The program actively supports, via 319 Program grants, the implementation of BMPs to control nonpoint source pollution. Current contracts focus on the implementation of BMPs to reduce nonpoint source pollution from older urban areas, agricultural lands, septic tanks, landfills, mining, and hydrologic modifications.

There have also been a variety of locally led efforts to reduce the impacts of wastewater discharges. Examples include:

- Regulatory actions in the 1980s and recent efforts through the National Estuary Program and Florida's SWIM Act have improved water quality in Tampa Bay. The Grizzle-Figg legislation of the mid-1980s required that all discharges of domestic wastewater to the Tampa Bay estuary and its tributaries be given advanced treatment. With improved water quality, seagrass acreages have increased. Nitrogen contributions to the bay are about half what they were in the 1970s. Nitrogen is the critical nutrient fueling algal blooms in the estuary.

- Similar regulatory actions have also helped to improve water quality in northern and central Sarasota Bay. The City of Sarasota has reduced its nitrogen contribution to the bay by 80 to 90 percent with advanced wastewater treatment, amounting to a 14 percent baywide reduction. Manatee County has removed wastewater discharges by switching to deep well injection. The county also reduced stormwater runoff into the bay by diverting reclaimed water to a gladiolus farm.

Restoration and Protection Programs

Florida has very active programs to restore and protect surface waters. The state has been buying environmentally sensitive lands since 1963, and at least eleven different programs actively purchase land. The two primary programs are the Conservation and Recreation Lands Program, administered by FDEP, and the Save Our Rivers Program, administered by the WMDs. These programs were authorized by the Preservation 2000 law in 1989 and the Florida Forever Act in 1999.

Florida has established several programs focused on the restoration or preservation of state waters. Among these, the SWIM program, established in 1987, authorizes water management districts to develop management and restoration plans for preserving or restoring priority water bodies. The Water Resource Implementation Rule (Chapter 62-40, F.A.C) requires the setting of Pollutant Load Reduction Goals (PLRGs) for those water bodies. PLRGs are estimated reductions in stormwater pollutant loading needed to preserve or restore the waterbody's designated uses. In 1999, the Florida legislature enacted the Florida Watershed Restoration Act, which provides a process for restoring waters through the establishment and implementation of Total Maximum Daily Loads (TMDLs) for pollutants causing impairment. TMDLs establish the maximum amount of a given pollutant that a particular basin can assimilate.

Most current restoration work is aimed at correcting problems caused by excess nutrients. Restoration projects under way in the Everglades, Upper St. Johns River, Lake Griffin, and Lake Apopka include the construction of large marsh flow-ways to filter nutrients and other pollutants.

Early results from Lake Apopka indicate that the marshes improve water clarity by removing suspended particles, and they may remove as much as thirty-three tons of phosphorus a year.

Ground Water Quality

Because ground water supplies about 87 percent of Florida's drinking water, Florida is a national leader in ground water protection programs. Under the 1983 Water Quality Assurance Act, the state began monitoring ambient ground water quality. Data from over 2,900 monitoring wells and 1,300 private water supply wells that monitor all the state’s aquifer systems are collected and stored in a database.

Ground water quality across the state is remarkably good considering the state’s high population and vulnerable geology. Water quality is especially good in the Floridan Aquifer, which is the major source of drinking water for all but the westernmost and southernmost parts of the state.

The majority of contamination sources are very site-specific and generally have origins from spills, or from historical activities prior to the implementation of current protection programs. This type of contamination encompasses leaking underground storage tanks, historical landfills, and industrial facilities.

Agriculture uses large quantities of pesticides and fertilizers that can contaminate ground water supplies. Several chemicals — including aldicarb, alachlor, bromacil, simazine, and ethylene dibromide (EDB) — have caused local problems. With EDB, the contamination is regional. Ground water is also showing regional to local impacts from nitrate contamination associated with fertilizer use. While levels of nitrate greater than the ground water standard are generally local problems, elevated concentrations appear on a regional level as a threat to surface water quality.

As part of the Watershed Approach, Florida has implemented a probabilistic monitoring approach to assess regional ground water quality. This report addresses the results of the first round of ground water sampling that occurred in 2000. Future 305(b) reports will provide additional information as the assessment process expands.

Florida Springs Initiative

Hydrogeologists estimate that there are nearly 600 springs in the state of Florida, representing what may be the largest concentration of freshwater springs on Earth. Between 1950 and 1990, Florida’s human population more than quadrupled, and our population continues to increase.

With growth has come an unavoidable rise in water use, as well as extensive land use changes. During the twentieth century, flow discharge reductions have been noted in many of Florida’s springs. Since the 1970s, scientists have documented a decline in water quality in most Florida springs, particularly in regard to increasing levels of nutrients, such as nitrate.

In 1999, David Struhs, Secretary of the Florida Department of Environmental Protection, directed the formation of a multi-agency *Florida Springs Task Force* to recommend strategies for the protection and restoration of Florida’s springs, which generated a report of these recommendations (“Action Steps”). In 2001, the *Florida Springs Task Force II* was formed to guide implementation of the “Action Steps” in the report. During the same year, the Florida Legislature, with the support of the DEP Secretary and Governor, allocated approximately $2.5 million to begin the process of protecting and restoring Florida’s springs.

Chapter 1: Background

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 emergent coral reef in the continental United States.

Ranking twenty-second in the country in total land area, Florida is rapidly growing and developing and ranks fourth in the country by population. Even though water is plentiful in many parts of the state, with 11,761 square miles of water (ranking 3rd in the country in total water area), water is still the state's most critical resource. 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 present serious problems. Maintaining overall good water quality and an adequate, reliable water supply; protecting public health; and ensuring healthy populations of fish and wildlife are important challenges for the state and FDEP.

Of these challenges, water quality and quantity have emerged as the most critical issues for the next century. In 1950, the state's population of 2.8 million used about 2.9 billion gallons per day. By contrast, in 1995, 7.2 billion gallons/day were used, and in 2020 it is estimated that 9.3 billion gallons per day will be needed to support the population of Florida, of which ground water will provide about two-thirds. Although the state has extensive water resources, most Floridians live in coastal areas where less fresh water is available. As population grows along with development, different users vie for water resources. The challenge is to satisfy competing and rapidly increasing demands for finite quantities of fresh water and minimize damage to future reserves.

This chapter provides background information about Florida's population, climate, and physical features. The state's total waters are summarized in terms of river and stream miles and lake and estuary areas.

Atlas

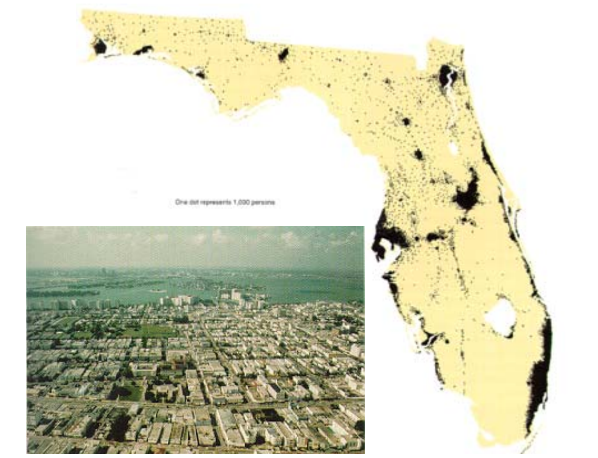
This section provides an overview of the state's population, water resources, climate, and hydrogeology *(see Table 1 for a summary of basic information on the state and its surface waters).*

Table 1: 2002 Atlas of Florida

2002 estimated population	15,982,378
Ranking by population among 50 states	4th largest
Ranking by land area among 50 states	22nd in size
Surface area	65,758 square miles
Ranking by Total Water area	3rd largest
Total Water Area	11,761 square miles
Number of U.S. Geological Survey (USGS) hydrologic units (HUC)	51
Total number of river/stream miles	51,858 miles
*Border river miles – total	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
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/ponds	7,712 (area > than or equal to ten acres)
Area of lakes/reservoirs/ponds	2,555 square miles
Area of estuaries/bays	4,385 square miles
Coastal miles	8,460 miles
Freshwater and tidal wetlands	17,830 square miles
Area of islands greater than ten acres	1,314 square miles
Number of first-order magnitude springs	27
Largest lake	Lake Okeechobee
Longest river (entirely in Florida)	St. Johns River
Prominent wetlands systems	Everglades and Big Cypress Swamp, Green Swamp, Okefenokee Swamp, Big Bend coastal marshes, St. Johns River Marshes

Population

Florida's population according to the 2000 Census was 15,982,378. Currently the fourth most populous state in the country, by 2025 it is projected to be the third most populated in the nation. Within the next three decades, the state's total population is expected to increase by 6.5 million people — the third largest net gain in the United States. This rate of population change, at 46.2 percent, ranks as the ninth largest 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.



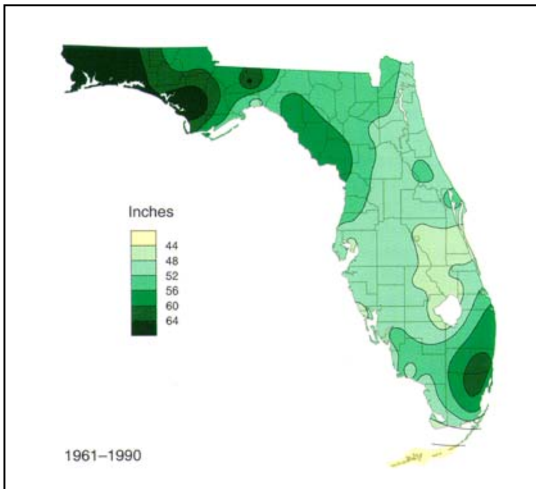
Florida Population, 1990
Source: *Water Resources Atlas of Florida,* 1998
Photo: Florida Department of Commerce

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 percent in1995 to 26.3 percent 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 several 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 are sparsely populated.

Water Resources

Florida has 51,858 miles of streams and rivers (about half of which are ditches and canals). However, only 19,705 of these miles are included in FDEP's waterbody database. Florida contains more than 7,700 lakes (greater than ten acres in area) with a total surface area of 2,555 square miles and 4,385 square miles of estuaries. The state also has an extensive coastline ranking second 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.



Average Annual Rainfall, 1961-1990
Source: *Water Resources Atlas of Florida,* 1998

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 310 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 greatest discharge. Its basin, draining over 19,000 square miles, extends to North Georgia's southern Appalachian Mountains.

Lakes occupy close to 6 percent of Florida's surface. The largest, Lake Okeechobee, is the ninth largest lake in surface area in the United States and is the 2nd largest freshwater lake wholly within the conterminous United States[1]. Most of the state's lakes are shallow, averaging seven to twenty feet deep, although many sinkhole lakes and parts of other lakes can be much deeper.

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 sixty inches per year can fall in the far northwest and southeast, while the Keys receive about forty inches annually. This variability because of location can create local water shortages. The heaviest rainfall occurs in Northwest Florida and in a strip ten to fifteen miles inland along the southeast coast.

Except for the northwestern part of the state, the year contains 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.

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.

Hydrogeology

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 water source. Hydrologically, the half of Florida south of the divide is an island. About 75 percent of the state's population live in this area in peninsular Florida.

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[1] *Fernald and Purdum 1998, Water Resources Atlas of Florida*

Most of Florida is relatively flat. The highest elevation, 345 feet, is near Lakewood, in Walton County in the Panhandle and Sugarloaf Mountain at 312 feet in the peninsula (Lake County)[2]. 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, land relief is less than six 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 classified as 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.

Hydrologic Divide
Source: *Water Resources Atlas of Florida,* 1998

Many 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.

Many wetlands have been drained in the past (for agriculture and urban development purposes) and numerous rivers historically channelized for navigation. The modifications were most intense in South 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.

Low relief coupled with Florida's geological history has created unique hydrogeological 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, sinkholes, and caves.

The state has over 600 springs, whose combined discharges are estimated at over eight billion gallons a day. The largest springs by discharge are the Spring Creek Springs in Wakulla County and the Crystal River Springs group in Citrus County. The United States has only seventy-eight first-order magnitude springs, which discharge on average at least 64.6 million gallons per day. Florida has thirty-three such springs.

Because of Florida's porous karst terrain, ground water and surface water often interact closely. Most lakes and streams receive at least some water from base flows, springs, or seeps. By the same mechanisms, surface waters can recharge underground aquifers.

Surface water commonly drains through sinks and caverns into ground water and can later reappear as springs and seeps, 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.

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

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.

Total Waters

For the purposes of this assessment, there are two different types of total waters: total waters in the state and total waters assessed. The estimates of Florida's total river and stream miles in the Florida atlas (*Table 1)* are based on the U.S. Environmental Protection Agency's (EPA's) River REACH File 3 (RF3) maps. These are derived from U.S. Geological Survey (USGS) hydrologic maps on a 1:100,000 scale. However, RF3 maps of lake and estuary areas were not available from the EPA. Areas of lakes and estuaries in the table are based on REACH File 2 (RF2) estimates. Florida has also estimated lake and estuarine areas with a new water body delineation approach that uses the EPA's RF3 files and geographic information system (GIS) techniques.

Table 2 identifies the number of Florida waters assessed. The total assessed areas for lakes and estuaries represent state rather than EPA estimates. As mentioned above, Florida and the EPA estimate the total areas of Florida lakes and estuaries using different approaches, with Florida using the higher resolution RF3 files. All estimates of lake and estuary areas that support or potentially may not support designated use are based on Florida's calculations.

Table 2: Miles and Square Miles of Waters Assessed

Water body type	*Assessed 1991 - 2000 STORET data) (Categories 1,2,3c,3d, 5)*	*Total in FDEP's Waterbody System*
Perennial Rivers (miles)	9016	19,705
Lakes (square miles)	2036	2,555
Estuaries (square miles)	3658	4,385

[*] From Table 1

Florida's Water Pollution Control Program

Florida's comprehensive Water Pollution Control Program, discussed in this section, is a multi-pronged effort that comprises a number of activities and programs. These include the Florida Water Plan, FDEP's Watershed Management Program, the Water Quality Standards Program, Wastewater Facilities Permitting Program, Nonpoint Source Program, Ambient Monitoring Program, education programs, land use management programs, and extensive interagency cooperation and coordination. The Water Pollution Control Program also includes extensive FDEP coordination with other agencies, including the WMDs' SWIM Program.

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 outlines the requirements for developing a Comprehensive State Water Use Plan. Section 373.039 stipulates that the water use plan, together with state water quality standards, constitutes the Florida Water Plan.

Under Florida's water management system, FDEP oversees five regional WMDs, 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 districts often must address competing public demands for water supplies, flood protection, water quality, and the protection of natural systems. To accomplish this, they have developed comprehensive water management plans for each region.

The Florida Water Plan builds on these regional plans to manage water resources. Its overall goal is to assure the long-term sustainability of Florida's water resources to benefit the state's economy, natural systems, and quality of life. The most recent version of the plan identifies sixteen issues as priorities, discusses strategies to address those issues, and sets specific goals. The issues are categorized into general issues, water supply, flood protection, water quality, natural systems protection, and intergovernmental coordination.

Two fundamental principles guide the plan. First, water resources must be managed to meet people's water needs while maintaining, protecting, and improving natural systems. Second, these resources can be effectively managed only if all those affected collaborate and cooperate.

The plan emphasizes the need for interagency coordination in achieving statewide water management goals. The Florida Water Plan supports the State Comprehensive Plan and is intended to coordinate and be mutually compatible with the Florida Transportation Plan and the Florida Land Development Plan. *Table 3* lists the primary state, local, and regional coordination mechanisms for managing water resources, and *Figure 4* shows the agencies responsible for water resources coordination and management.

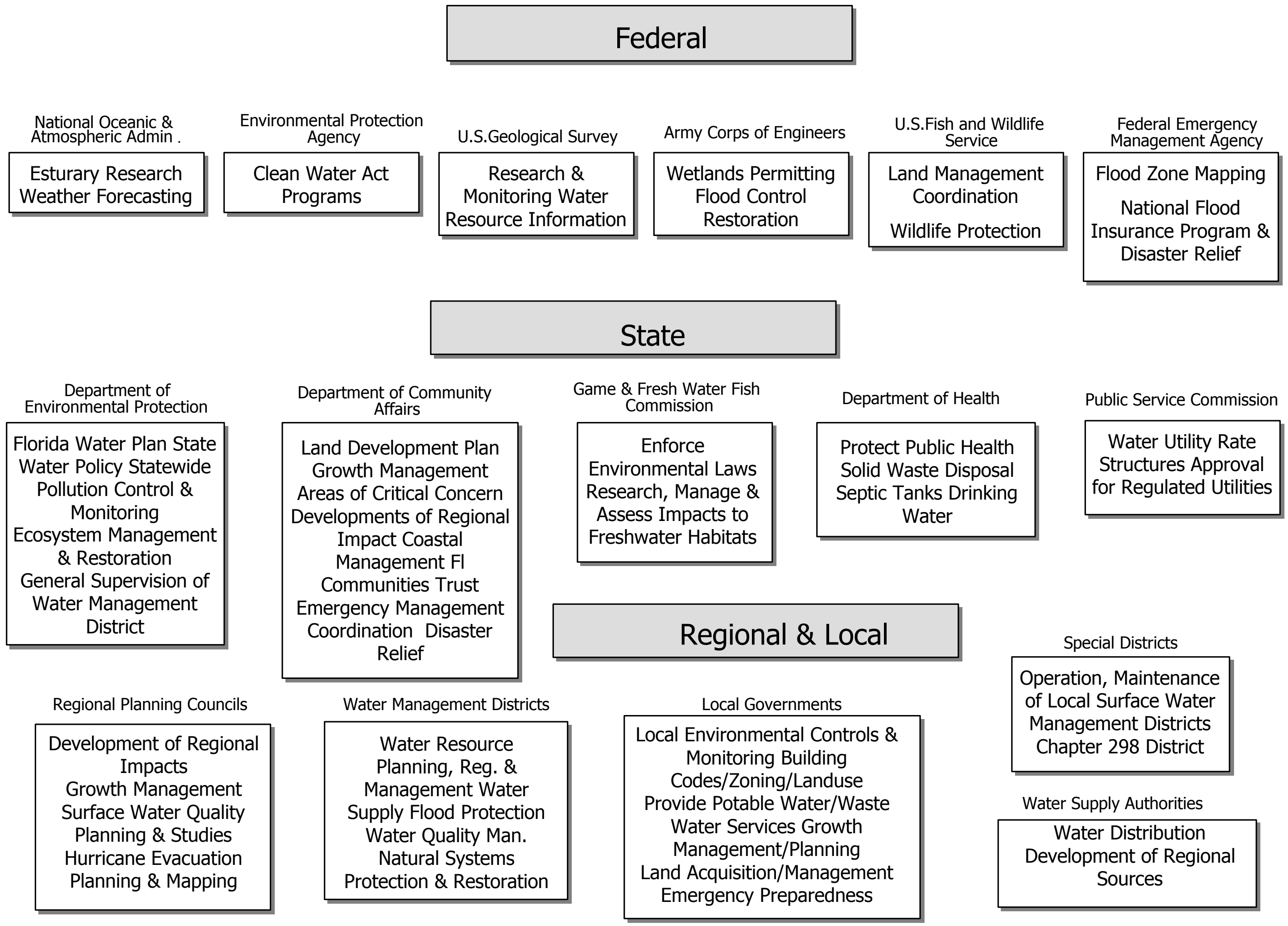
The Florida Water Plan is not self-executing. Its provisions guide FDEP and the WMDs' future actions, but are not binding unless adopted by rule.

Table 3: Primary Coordination Mechanisms for Managing Water Resources: State, Regional, and Local

Function/entity	Primary mechanisms
FDEP's general supervision over WMDs (policies, plans, and programs)	a. Water Resources Coordinating Commission b. Meetings of the WMDs' executive directors c. State Water Policy (Chapter 62-40, Florida Administrative Code [F.A.C.]) d. FDEP liaisons to the WMDs e. Florida Water Plan/District Water Management Plan (DWMP) work group f. Issue-specific work groups (policy and rule development) g. Reuse Coordinating Committee h. Memoranda of understanding (delegation of programs and authorities) i. Permit streamlining, mitigation banking j. FDEP review of WMD rules and budgets, auditing
Statewide Watershed Management initiative (FDEP)	a. Watershed Management Areas b. Adaptive management
State Comprehensive Plan (Governor's Office)	Overall coordination by Governor's Office
State Land Development Plan (Florida Department	Interagency Planning Committees

of Consumer Affairs)	
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 (Chapter 186.507[2], F.S., and Chapter 27E-5, F.A.C.)
Agricultural interests (Florida Department of Agriculture and Consumer Services)	Agricultural Water Policy Committee
Local comprehensive plans	Plan review process (Chapter 9J-5, F.A.C)
Local government water supply planning, wastewater management, stormwater management, solid waste management	FDEP and WMD programs for technical and financial assistance
Reuse of reclaimed water	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 (Clean Water Act, Section 404) e. Memoranda of understanding f. Potential delegation of Section 404 permitting to FDEP
U.S. Environmental Protection Agency	a. EPA/FDEP yearly work plans and grants b. EPA technical assistance and special projects c. Delegation of EPA/Clean Water Act 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. 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 4: Agencies Responsible for Water Resource Coordination and Management



Watershed Management

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. On a simple level, watershed management 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 the basin in a cooperative effort to define, prioritize, and resolve the basin's water quality problems. Existing programs are coordinated to manage basin resources without duplicated effort.

The Florida Department of Environmental Protection's Division of Water Resource Management, Bureau of Watershed Management is responsible for implementing and coordinating the watershed management program. The key components of this program include the following:

- The **basin management unit,** or geographic or spatial unit used to divide the state into smaller areas for assessment — generally groups of Hydrologic Unit Codes (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 **basin management cycle** began on July 1, 2000. The cycle provides a set schedule that both 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 the basin managers and stakeholders to respond to changing conditions or adjust strategies that have not performed as anticipated.

- A **Management Action Plan,** developed for each basin in cooperation with stakeholders and local communities, to coordinate and guide management actions. The Plan actually consists of several reports that are generated over the course of the cycle (Status, Assessment and Watershed Management Reports). The plan will specify among other issues how pollutant loadings from point and nonpoint sources of pollution will be allocated and reduced, in order to meet TMDL requirements.

- **Forums and communication networks** that help participants collect information, fill data gaps, and reach a consensus on solutions to the basin's problems.

- A statewide **basin management schedule** to ensure that each of the state's fifty-one basins will be assessed every five years.

To implement watershed management, Florida's 51 basins have been divided into 30 groups, five in each of the six FDEP districts. The order and specific time frame for evaluating each basin within each district is based on a number of priority factors, including watersheds that contain surface water sources of drinking water, watersheds requiring TMDL development, and watersheds where SWIM plans are proposed or under way.

Water Quality Standards Program

Florida's water quality standards and criteria are intended to maintain the designated uses of waters of the state. All surface waters of the state have been classified according to their designated use, 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*
Class V:	*Navigation, utility, and industrial use*

Classification of a water body according to a particular designated use or uses does not preclude use of the water for other purposes. The specific water quality criteria corresponding to each surface water classification are listed in Rules 62-302.500 and 62-302.530, F.A.C. Water quality classifications are arranged in order of the degree of protection required, with Class I water having generally 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 as being otherwise in Rule 62-302.600, F.A.C. All waters of the state are required to meet the "Minimum Criteria for Surface Waters," as identified in rule 62-302.500, F.A.C.

Table 4 lists the extent of Florida waters that must meet federal Clean Water Act goals for fishable and swimmable waters. These numbers should not be interpreted, however, as miles or areas of water bodies that actually attain designated use.

Table 4: Waters Classified for Uses Consistent with Clean Water Act Goals

Type of water	*Fishable*	*Swimmable*
Estuaries (square miles)	4,385	4,385
Lakes (square miles)	2,555	2,555
Rivers (miles)	19,705	19,705

Note: The table includes only waters assigned a Florida waterbody number. They do not include about 25,909 miles of ditches and canals to which numbers could not be assigned.

A water body with exceptional recreational or ecological significance may also be designated an Outstanding Florida Water (OFW). OFWs include waters in state and national parks, preserves, and sanctuaries, rivers designated as wild and scenic at federal or state levels, and "special" waters that have been designated OFW based on their exceptional environmental or recreational significance. OFWs are listed in Section 62-302.700, F.A.C. *Table 5* lists the water bodies designated since January 1, 1996.

Table 5: OFWs Designated from 1996 – 2002

Hillsborough River
Wiggins Pass and Cocohatchee River
Lake Disston

Ground water quality standards protect the designated use of aquifers and are used as a reference to determine when contamination occurs (Rule 62-520, F.A.C.). Primary numeric standards are established to protect public health, natural systems, and drinking water sources. Secondary numeric standards are established to protect the aesthetic nature of ground water, e.g. taste and odor considerations. The standards also include narrative 'minimum criteria' that provide guidance in preventing contamination from substances not listed in the numeric criteria. Florida maintains a list of Guidance Concentration Levels (GCLs) that are used as screening tools for interpreting the narrative minimum criteria. Florida's ground water is categorized into five designated use classes.

- **Class F-I** - Potable water use, ground water in a single source aquifer that has a total dissolved solids content of less than 3,000 mg/l and was specifically reclassified as Class F-I by the Environmental Regulation Commission.

- **Class G-I** - Potable water use, ground water in single source aquifers with a total dissolved solids content of less than 3,000 mg/l.

- **Class G-II** - Potable water use, ground water in aquifers with a total dissolved solids content of less than 10,000 mg/l.

- **Class G-III** - Non-potable water use, ground water in unconfined aquifers with a total dissolved solids content of 10,000 mg/l or greater; or with a total dissolved solids content of 3,000 - 10,000 mg/l and either has been reclassified as having no reasonable potential as a future source of drinking water, or has been designated as an exempted aquifer.

- **Class G-IV** - Non-potable water use, ground water in confined aquifers with a total dissolved solids content of 10,000 mg/l or greater.

The ground water quality standards and classifications are the framework that guide the ground water programs toward achieving their protection goals.

Point Source Permitting

Facility permitting. Florida's well-established wastewater facility permitting program was revised in 1995 when the EPA authorized FDEP to administer a partial National Pollutant Discharge Elimination System (NPDES) Program, and then expanded again in 2000 when 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 4,773 wastewater facilities in Florida, only 539 are permitted to discharge to state surface waters via individual permits. While an additional 343 discharge to surface water under general permit authorization (and many others discharge storm water to surface waters under the NPDES Stormwater Program), clearly the vast majority of wastewater facilities in Florida discharge to ground waters. An important component of Florida's wastewater management is the encouragement and promotion of reuse. In fact, the current reuse capacity (year 2000 data) represents about 51 percent 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 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 water body'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, though, 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 studies are generally more simplified evaluations for streams and for permit renewals. In Level II studies, which apply to more complicated situations, a water body is generally sampled intensively and computer models are used to predict its response to the facility's discharge.

Ground water discharge permits address an array of discharge options, including sprayfields and percolation ponds. Direct discharge to ground water through wells is not allowed, except through the Underground Injection Control program. Ground water discharges are provided a 'Zone of Discharge' where ground water standards are not applied and attenuation and dilution of contaminants occurs within the surficial aquifer. Zones of Discharge are typically the lesser of 100' 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 are comprised of upgradient background wells and downgradient compliance wells and generally require quarterly monitoring. There are provisions for exemptions from 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. FDEP's objective in permit compliance is to protect the quality of Florida's surface water and ground water by identifying pollution sources that do not meet water quality standards or specific permit conditions. To manage the state's wastewater facilities safely and adequately, the agency's compliance evaluation strategy, established as part of the annual state program plan, is based on its wastewater facilities compliance strategy *(see Table 6).* Staff in the Division of Water Resource Management schedule the plan based on each facility's permit expiration date (permits are issued for five years).

While the type and frequency of inspections are based on the staff available in each district office, all major facilities (as defined by the EPA) are inspected each year with at least a Compliance Evaluation Inspection. In the final year of the permit, in preparation for permit renewal, a facility is subject to a rigorous Fifth-Year inspection regime that includes five inspection types as noted in Table 6.

Table 6: Wastewater Facilities Compliance Strategy

Permit year	Inspection type
1	Performance Audit Inspection (PAI)
2	Compliance Evaluation Inspection (CEI)
3	Compliance Evaluation Inspection (CEI)
4	Compliance Evaluation Inspection (CEI)
5	Compliance Sampling Inspection (CSI)
5	Toxic Sampling Inspection (XSI)
5	Compliance Biomonitoring Inspection (CBI)
5	Impact Bioassessment Inspection (IBI)
5	Water Quality Inspection (WQI)

District compliance and enforcement staff make every effort to work with a permittee to resolve minor problems before beginning formal enforcement action. During inspections, it is the District staff's role to determine the facility's compliance with, or violations of, compliance schedules and permit conditions. Staff also verify the accuracy of facility records and reports, plant operation and maintenance requirements, effluent quality data, and the general reliability of the self-monitoring program under the permit.

Enforcement. FDEP enforces Florida's surface water quality standards under a formal Memorandum of Agreement with the EPA. The state follows the EPA's Enforcement Management System and the guidelines set out in the EPA document, *Technical Review Criteria and Enforcement Response Guide****.*** Using this structure, FDEP district staff investigate and document all violations, issue noncompliance and warning letters, conduct informal conferences, prepare case reports, and testify at administrative and judicial hearings.

When formal enforcement is necessary, staff attempts to negotiate a consent order — a type of administrative order in which civil penalties (such as fines) 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), which is intended to provide a fair, consistent and expedient method for determining appropriate penalty amounts for violations. If a settlement can not be reached through the consent order process, the Department 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.

Nonpoint Source Program

Florida established its first stormwater rules in 1979 and its first stormwater permitting program in 1982 (Chapter 17- 25, F.A.C.). FDEP, which administers the stormwater rule, delegated permitting authority to the WMDs. 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. These BMPs are designed to remove at least 80 percent of the 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 percent of the TSS loading.

A 1989 stormwater law directed FDEP to establish statewide goals for treatment and to oversee the implementation of regulatory programs, which were also delegated to the WMDs. 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

Coordination with Other Agencies

Carrying out Florida's Water Pollution Control Program to protect water resources requires coordination between governments and agencies across state lines and in Florida. Section 403.60, F.S., authorizes the governor to enter into interstate environmental agreements or compacts.

Interstate Coordination*.* The following coordinated efforts are currently under way:

1. *In 1997, Florida, Alabama, Georgia and the Federal Government signed the Apalachicola-Chattahoochee-Flint (ACF) Basin Compact, a formal agreement to develop and maintain an equitable allocation of water within the ACF basin.*

2. *In 1993, Nassau and Baker counties in Florida and Charlton and Camden counties in Georgia formed the St. Mary's River Management Committee to identify water quality issues and protect the long-term environmental and economic resources of the St. Mary's River.*

3. *Several years ago, the Florida and Alabama legislatures created the Florida–Alabama Water Resources Coordinating Council to collaborate in managing a shared resource, the Perdido River. FDEP and the Alabama Department of Environmental Management cochair the council.*

4. *The Suwannee Basin Interagency Alliance coordinates interstate natural resource management in that basin. Florida and Georgia co-chair the alliance, and a variety of federal, state, and regional agencies participate.*

***Interagency Coordination**.* FDEP, in cooperation with the WMDs, is generally responsible for protecting the state's water resources. Sections 373.016 and 373.026, F.S., give FDEP authority to oversee the WMDs, while the districts have authority over managing water quantity for flood control and protecting natural resources. In many cases FDEP has formally delegated pollution control and prevention to other agencies. The following describes some of the agencies and major coordinated activities:

1. *Many FDEP regulatory programs share responsibilities with the WMDs and local governments or have delegated responsibilities to them under Chapters 253, 373, 376, and 403, F.S., and Chapter 62, F.A.C. Local governments include counties and municipalities. Chapter 62-101 and Section 62-113.100, F.A.C, describe the delegations. FDEP coordinates and delegates pollution-control programs to the WMDs and local governments.*

2. *The Florida Fish and Wildlife Conservation Commission conducts research into freshwater and anadromous fish, endangered species, and game and nongame animals. It also manages the state's freshwater fisheries and identifies regionally significant freshwater habitats. FDEP delegates enforcement of Chapter 403, F.S., Florida's Air and Water Pollution Control Act, to the commission. FDEP may in turn report violations of Chapter 372, which authorizes wildlife management and regulation, to the commission.*

3. *The Florida Department of Community Affairs is responsible for developing the State Land Development Plan, which must be consistent with the State Comprehensive Plan and compatible with the Florida Water Plan. The agency also reviews and certifies local government comprehensive plans for conformity with state planning requirements.*

4. *The Florida Department of Health manages statewide programs to protect public health. FDEP has delegated authority to the department to issue permits for individual domestic wastewater disposal facilities up to 10,000 gallons and without a discharge to surface waters, and to authorize the application of pesticides to waters of the state for insect control. FDEP also delegates authority for drinking water distribution systems to some county public health units.*

5. *The Florida Department of Transportation prepares the Florida Transportation Plan, which has significant implications for protecting water resources and must be compatible with the Florida Water Plan.*

6. *FDEP delegates permitting and enforcement of open burning rules, as well as the testing and certification of gasoline tank trucks and storage tanks, to the Florida Department of Agriculture and Consumer Services.*

7. *The Florida Department of Agriculture and Consumer Services is the state lead agency for pesticides. FDEP participates in the monthly review of pesticide registrations, coordinates other pesticide issues through the interagency Pesticide Management Review Group, and has a representative on the statewide Pesticide Review Council that serves as a public forum for pesticide issues.*

8. *The FDEP developed minimum construction standards for water wells and the WMDs implement the permitting and enforcement provisions under a delegation agreement.*

Surface Water Improvement and Management (SWIM) Program

In 1987, the Florida legislature passed the SWIM Act, Sections 373.451-373.4595, F.S. The act directed the state to develop management and restoration plans for preserving or restoring priority water bodies. The legislation designated a number of SWIM water bodies, including Lake Apopka, Tampa Bay, Indian River Lagoon, Biscayne Bay, St. Johns River, Lake Okeechobee, and the Everglades.

The SWIM program's goals are protecting water quality and natural systems, creating governmental and other partnerships, and managing watersheds. While FDEP oversees the program, the five WMDs are responsible for its implementation — including developing lists of additional high-priority water bodies and water body plans (outlined under Chapter 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:

1. *A description of the water body.*
2. *A list of governmental agencies with jurisdiction.*
3. *A description of land uses.*
4. *A list of point and non-point source discharges.*
5. *Restoration strategies.*
6. *Research or feasibility studies needed to support restoration strategies.*
7. *A restoration schedule.*
8. *An estimate of costs.*
9. *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 receiving waters. Ultimately, water quality in 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.

A joint work group from FDEP and the WMDs produced recommendations, guidelines, and a schedule to develop regional water management plans that included PLRGs. The recommendations were incorporated into the revised Water Resource Implementation Rule (Chapter 62-40, F.A.C.) effective July 1995. This rule requires that PLRGs be established for SWIM priority water bodies.

Recommendations

The following recommendations describe Florida's strategies for improving the effectiveness of its water resource management programs:

A. Continue to Implement Watershed Management

The 1993 state Environmental Reorganization Act required FDEP to develop and implement measures to "protect the functions of entire ecological systems through enhanced coordination of public land acquisition, regulatory, and planning programs." In response, FDEP implemented Ecosystem Management, a holistic, integrated, flexible approach to Florida's environment that protects and manages resources based on watersheds. Ecosystem Management consciously redirects FDEP away from reacting to environmental crises toward exploring ways to prevent them, using tools such as planning, land acquisition, environmental education, regulation, and pollution prevention. In 1999, in response to the Florida Watershed Restoration Act, the Department of Environmental Protection initiated its watershed management program.

B. Implement Pollution Prevention

Environmental integrity is best protected when pollution is not allowed to occur in the first place. In the past, FDEP controlled pollution by permitting, compliance monitoring, and enforcement. A broader strategy includes market incentives and source controls that minimize the generation of pollutants. Source controls, for example, can minimize impervious surface areas to reduce stormwater runoff, encourage reuse rather than discharge of pollutants through more efficient industrial operations, encourage wastewater reuse, and lower fertilizer and pesticide use through integrated pest management and BMPs.

Florida has made a tremendous effort to eliminate point source pollution. Threats to surface water and ground water still exist, however, from septic tanks, waste materials discharged from boats, and domestic package plants.

C. Manage Water Quality and Water Quantity

Although programs to control water quality have emphasized controlling or eliminating discharges, many problems stem from water withdrawals or altered hydrology. Water quality and water quantity can no longer be viewed independently. On occasion, regulations to protect water quality may actually impede the management of water quantity. Programs to protect water quality and manage water resources need to be better coordinated and linked.

By taking a watershed approach, the Florida Water Plan and State Water Policy provide a mechanism to link quantity and quality. The state needs improved, more comprehensives long-range planning for water resources, and existing regulatory programs need to be applied to water resource planning.

D. Obtain Good Water Quality Data

Assessing surface waters and supporting the Watershed Approach cannot be accomplished without good, comprehensive water quality information. The 1983 Water Quality Assurance Act and the Florida Water Plan appointed FDEP the lead agency for water quality issues and the central data repository. Data are stored in the EPA's STORET database.

Traditional water chemistry, assessments of biological communities and habitats, and analyses of contaminants in tissues and sediments form the backbone of a strong, interdisciplinary approach to assessing environmental integrity. FDEP has identified a network of stations to monitor water chemistry trends, the bioassessment program has developed procedures to assess ecological integrity, and techniques to analyze trends are being developed. By linking different types of information on particular surface water, the use of geographical information system (GIS) technology is key to developing the IWRM.

FDEP's Strategic Plan and the Florida Water Plan identify several strategies to collect and integrate data for decision-making. The agency needs to support monitoring and assessment to the fullest extent possible, which includes adequate staffing and funding. Because the State Water Policy report identifies the 305(b) report as the first source of information for a water body, continued support for this report is also essential. Many other federal, state, and local governments and WMDs have active monitoring programs. By continuing its collaboration with these programs, FDEP can expand its data assessment capabilities for more complete coverage of the state. Greater coordination with the EPA on monitoring and assessment is needed to transfer information to the state and provide mutual benefits.

Chapter 2: The Watershed Management Approach, TMDLs, and the Florida Watershed Restoration Act

Under the Department's watershed management approach, water resources are managed on the basis of natural boundaries, such as river basins, rather than political or regulatory boundaries. Instead of focusing only on individual sources of pollution, water resources are assessed from a basin wide perspective that considers the cumulative effects of human activities. The approach is not new, nor does it compete with or replace existing programs. Rather than relying on single solutions to address aquatic resource issues, it is intended to improve the health of surface water and ground water resources by strengthening coordination among such activities as monitoring, nonpoint source management, wastewater treatment, wetland restoration, land acquisition, and public involvement.

The watershed management approach is the framework by which the Department will identify impaired waters, and develop and implement TMDLs as required by Section 303(d) of the federal Clean Water Act and the Florida Watershed Restoration Act. TMDLs must be developed for all waters that do not meet applicable water quality standards and are thus defined as "impaired waters."

SUMMARY OF CLEAN WATER ACT REQUIREMENTS RELATED TO THE TMDL PROGRAM

Congress enacted the Clean Water Act in 1972 with the goal of restoring and maintaining the "chemical, physical, and biological integrity of the nation's waters."—33 U.S.C. § 1251(a). The TMDL program is an important step towards cleaning up our rivers. The Clean Water Act sets out the federal requirements that Florida must follow in implementing its TMDL program under the Florida Watershed Restoration Act. The Clean Water Act and the federal TMDL program include the following provisions:

Requires states to establish water quality standards that will protect the public health and welfare—33 U.S.C. § 1313(c)(2).

Requires states to identify waters that do not meet applicable water quality standards (Water Quality Limited Segments, or WQLSs) and identify the pollutants causing the water quality threats—33 U.S.C. § 1313(d)(1)(A-B).

Requires the state to establish for each WQLS the TMDL for each pollutant that can be introduced into that waterbody without violating water quality standards—33 U.S.C. § 1313(d)(1)(C).

Requires that each TMDL be established "at a level necessary to implement the applicable water quality standards with seasonal variations and a margin of safety that takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality"—33 U.S.C. § 1313(d)(1)(C).

Requires states to update their 303(d) list of impaired waters (WQLSs) every two years or else the U.S. Environmental Protection Agency (EPA) will be required to develop a complete WQLS list and/or TMDLs for the impaired waters on behalf of the state—33 U.S.C. § 1313(d)(2).

Requires EPA approval or disapproval within 30 days, once the WQLS list and TMDLs are submitted. If approved, the list and TMDLs are to be incorporated into the state's water quality management plan—33 U.S.C. § 1313(d)(2).

THE FLORIDA WATERSHED RESTORATION ACT

In recognition of the important role that TMDLs play in restoring state waters, the 1999 Florida Legislature enacted the Florida Watershed Restoration Act. In addition to clarifying the Department's statutory authority to establish TMDLs, the act established a process for identifying and listing impaired waters and for developing TMDLs and the associated watershed management plans needed to allocate and achieve the needed pollutant load reductions. The legislation contains the following provisions:

Establishes that the 303(d) list submitted to the EPA in 1998 is for planning purposes only.

Requires the Department to adopt 303(d) listing criteria (that is, the methodology used to define impaired waters) by rule.

Requires the Department to verify impairment and then establish basin-specific verified lists. The Department must also evaluate whether proposed pollution control programs are sufficient to meet water quality standards, list the specific pollutant(s) and concentration(s) causing impairment, and adopt the basin-specific 303(d) list by Secretarial Order.

Requires the Department's Secretary to adopt TMDL allocations by rule. The legislation requires the Department to establish "reasonable and equitable" allocations of TMDLs, but does not mandate how allocations will be made among individual sources.

Requires that TMDL allocations consider existing treatment levels and management practices; the differing impacts that pollutant sources may have; the availability of treatment technologies, best management practices (BMPs), or other pollutant reduction measures; the feasibility, costs, and benefits of achieving the allocation; reasonable time frames for implementation; the potential applicability of moderating provisions; and the extent that nonattainment is caused by pollution from outside Florida, discharges that have ceased, or alteration to a waterbody.

Requires a report to the legislature by February 2001 addressing the allocation process.

Authorizes the Department to develop basin plans to implement TMDLs, coordinating with the water management districts, the Florida Department of Agriculture and Consumer Services, the Soil and Water Conservation Districts, regulated parties, and environmental groups in assessing waterbodies for impairment, collecting data for TMDLs, developing TMDLs, and conducting at least one public meeting in the watershed. Implementation is voluntary if not covered by regulatory programs.

Authorizes the Department and the Florida Department of Agriculture and Consumer Services to develop interim measures and BMPs to address nonpoint sources. While BMPs would be adopted by rule, they will be voluntary if not covered by regulatory programs. If they are adopted by rule and the Department verifies their effectiveness, then implementation will provide a presumption of compliance with water quality standards.

Directs the Department to document the effectiveness of the combined regulatory/voluntary approach and report to the legislature by January 1, 2005. The report will include participation rates and recommendations for statutory changes.

As part of the Department's watershed management approach, TMDLs will be developed, and the corresponding load reductions allocated, as part of a watershed management cycle, which rotates through the state's 52 basins (51 HUCs plus the Florida Keys) over a five-year cycle. Extensive public participation will be crucial throughout the cycle's five phases, as follows:

Phase 1: Watershed Evaluation. The Department will conduct preliminary evaluations of the status of the quality of surface water and ground water. This information will be used to generate a planning list of potentially impaired waters for which TMDLs may be needed. At the end of Phase 1, a basin status report and a strategic monitoring plan will be developed.

Phase 2: Strategic Monitoring. Monitoring will be conducted to help verify whether waters are, in fact, impaired and to collect the data needed to calibrate and verify models for TMDL development. Monitoring also will be conducted to determine whether waters on the 1998 303(d) list are impaired or not. At the end of the second phase, an Assessment Report will be produced. This report will contain an updated and more thorough assessment of water quality, associated biological resources, and current restoration plans and projects. Waters that are verified as being impaired will be placed on a basin-specific list of impaired waters that will be adopted by the Department through a Secretarial Order. This verified list will be submitted to the U.S. Environmental Protection Agency as the state's Section 303(d) list of impaired waters for the basin.

Phase 3: Developing and Adopting TMDLs. TMDLs for priority-impaired waters in the watershed will be developed and adopted by rule. Because TMDLs cannot be developed for all listed waters during a single watershed management cycle, due to fiscal and technical limitations, waterbodies will be prioritized using the criteria in the Identification of Impaired Surface Waters Rule, Section 62-303, Florida Administrative Code.

Phase 4: Developing Watershed Management Plans. A watershed management plan will be developed specifying how pollutant loadings from point and nonpoint sources of pollution will be allocated and reduced, in order to meet TMDL requirements. The plans will include regulatory and nonregulatory (i.e., voluntary), structural and nonstructural improvements. The involvement and support of affected stakeholders in this phase will be especially critical.

Phase 5: Implementing Watershed Management Plans. Implementation of the activities specified in the watershed management plan will begin.

The watershed management approach is an iterative 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. The Department also will track the implementation of scheduled restoration activities, whether required or voluntary, to ensure continued progress towards meeting the TMDLs.

This approach is intended to protect and enhance the ecological structure, function, and integrity of Florida's watersheds by promoting the management of entire natural systems and addressing the cumulative effects of human activities on a watershed basis. The approach provides a framework for setting priorities and focusing the Department's resources on protecting and restoring water quality, and aims to increase cooperation among state, regional, local, and federal interests. By emphasizing public involvement, the approach encourages stewardship by all Floridians to preserve water resources for future generations.

The watershed approach is intended to speed up projects by focusing funding and other resources on priority water quality problems, strengthening public support, establishing agreements, and funding multiagency projects. It avoids duplication by building on existing assessments and restoration activities and promotes cooperative monitoring programs. It encourages accountability for achieving water quality improvements through improved monitoring and the establishment of TMDLs.

Chapter 3: Surface Water Assessment

This chapter describes the plan for and status of Florida's current efforts to achieve comprehensive assessments, FDEP's monitoring program, the methodology used to assess Florida's surface waters, and a comprehensive assessment by water body type for the state's surface waters.

Monitoring and Comprehensive Assessment: Plans and Status

Monitoring Program

The watershed approach will be complemented by FDEP's umbrella monitoring plan, the Integrated Water Resource Monitoring (IWRM) program. This probability-based sampling approach will allow FDEP to statistically assess all of the lakes and rivers of the state. Florida's integrated approach for monitoring both surface and ground water is described below.

The Status Water Monitoring Network

Background

In mid-1996, the Florida Department of Environmental Protection's (FDEP) Division of Water Resource Management restructured its ambient water monitoring programs, with the goal of integrating statewide surface and ground water monitoring efforts. This effort brought together elements of the former Surface Water Ambient Monitoring Program (SWAMP) along with the former Ambient Ground Water Quality Monitoring Network.

An Integrated Water Resource Monitoring (IWRM) Committee was formed to develop a Departmental model for the integration of regional ambient surface and ground water monitoring data with other sub-regional to site-specific monitoring efforts within FDEP. The primary goal of IWRM is to provide scientifically defensible, statewide information on the important chemical, physical and biological characteristics of major surface water bodies and aquifer systems. A parallel cooperative effort is currently underway by the Florida Marine Research Institute (FMRI). Their Inshore Marine Monitoring and Assessment (IMAP) Program, developed in cooperation with the U.S. Environmental Protection Agency (USEPA), uses a grid-based probabilistic sampling design to assess near-coastal and estuarine systems. Comparable indicator analytes to those used in the Status Network are collected. Sampling of these nearshore IMAP areas is temporally and geographically coordinated with adjacent inshore Status Network sites. Information generated by IWRM will be used to characterize the environmental quality of Florida's water resources.

The IWRM plan re-classifies water monitoring in Florida into three "tiers" *(Figure 5). Tier 1* represents regional characterization of water resources, and is represented by the *Status Network*. The Status Network is the only FDEP monitoring effort designed to assess 100% of each monitored resource statewide. *Tier 2* includes smaller sub-regional basin assessments and stream and aquifer segment monitoring, for such efforts as the *Total Maximum Daily Load (TMDL) Program*. *Tier 3* encompasses site-specific monitoring, such as that required for compliance with regulatory permits or the evaluation of Best Management Practices (BMPs). Overlying all three "tiers" is the *Temporal Variability Monitoring Network,* a series of fixed surface and ground water trend stations monitored at regular intervals for selected indicator analytes.

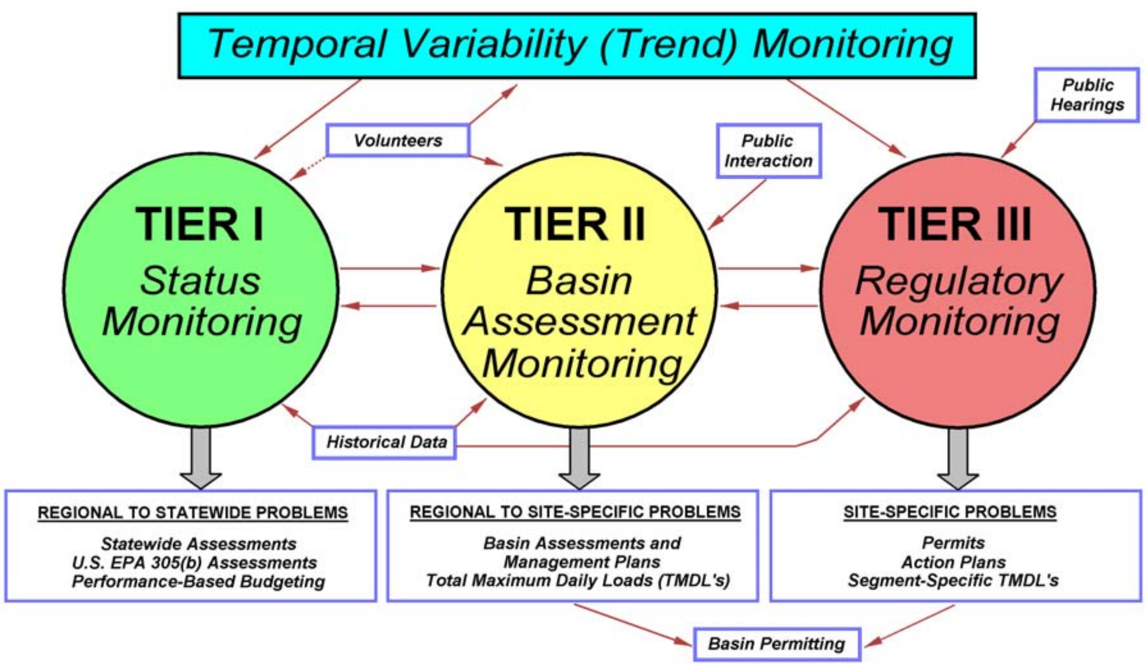
The *Status Network* employs a probabilistic (stratified random) design intended to characterize regional surface and ground water conditions. It is a cooperative undertaking between FDEP, Florida's water management districts (WMDs), and some counties.

Geographically, the Status Network divides the state into 20 monitoring or *reporting units (Figure 6).* Each reporting unit is made up of one or more major river basins, based on U.S. Geological Survey Hydrologic Units. By design, there are four reporting units within each of Florida's five WMDs. One randomly selected reporting unit is sampled each year within each of Florida's five WMDs. Thus, the entire state is sampled using a rotating basin approach every four years.

Within each reporting unit, six water resources are sampled as part of the *Status Network*. These resources include:

1) unconfined aquifers,
2) confined aquifers,
3) small lakes (between 1 and 10 hectares in area),[3]
4) large lakes (larger than 10 hectares in area),
5) small streams, and
6) large streams and rivers.

Figure 5: Integrated Water Resource Monitoring (IWRM) Schematic



[3] *One hectare equals approximately 2.5 acres.*

At least 30 water quality samples are collected per resource per reporting unit, in order to statistically analyze the results within a marginally acceptable error range (plus or minus 10%). Sampling locations are randomly selected within each reporting unit. In order to assist in this effort, a *list frame* containing potential sampling sites for each resource was created. For aquifers, the list frame consists of wells and springs from WMD, county and FDEP databases. For streams, the list frame consists of one meter stream segments taken from the USEPA River Reach 3 (RF3) map files, which are derived from U.S. Geological Survey 1:100,000 map coverages. The list frame for lakes is also derived from the RF3 coverage.

Aquifers are sampled by selecting 30 random locations within each reporting unit. Using a computer program, the closest 10 wells and springs in the list frame to each random location are selected in order of geographic proximity, with the closest at the top of the list. If the closest well/spring cannot be sampled, then the next closest site is chosen.

Streams and rivers are sampled by randomly selecting 100 one-meter stream segments each from large and small streams within each reporting unit. These sites are then field reconnoitered in the (random) order selected to determine access and sampleability. The first 30 suitable sites out of the list of 100 are then sampled.

Large lake areas are gridded so that there are approximately 30 grid cells per reporting unit. Primary and alternate random sampling locations are selected from within each grid cell. If the primary random site within a grid cell is unsampleable, then the alternate site is sampled. Up to 100 small lakes are randomly selected from within each reporting unit, and are field reconnoitered in the (random) order selected to determine access and sampleability. The first 30 suitable sites out of the list of 100 are then sampled.

Samples are collected during the same time interval each year for each resource. These sampling *Index Periods (Table 7)* were established to allow year-to-year comparison of results without having to account for intra-annual (seasonal) variability. Intra-annual variability is addressed by the *Temporal Variability Monitoring Network.* The selected Index Periods represent, for each resource and portion of the state, the time of year coincident with the greatest potential response to human-induced and/or climatic stresses. Each Index Period lasts from 8-12 weeks.

Samples collected from all resources are analyzed for a number of chemical, physical and biological analytes *(Table 8).* Proposed changes for the Network during the second sampling cycle (beginning in January, 2004) include emphasizing biology in streams using FDEP's *Stream Condition Index* assessment methodology, and realignment of the *Status Network* reporting units to match TMDL Program basins.

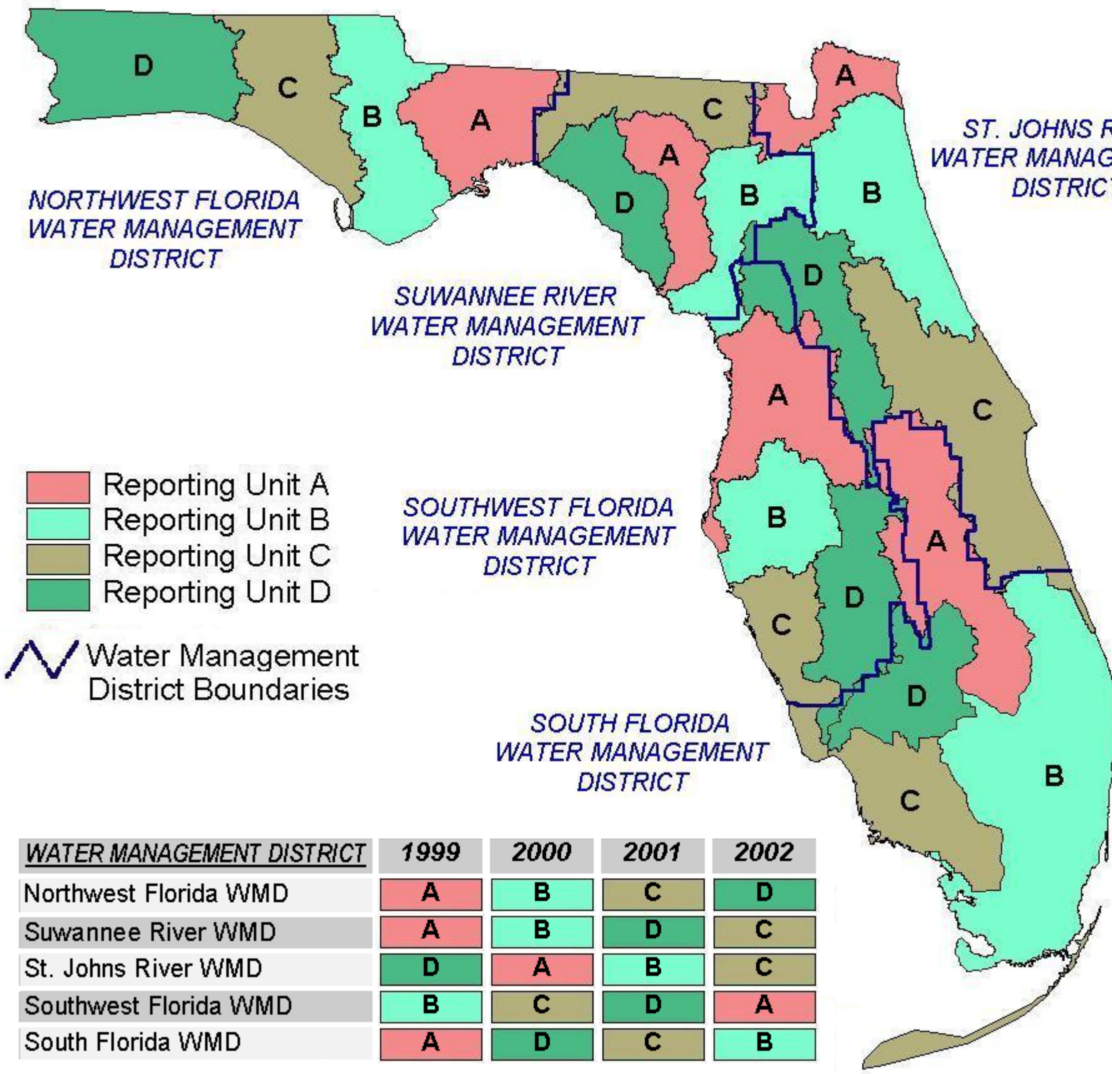
Quality Assurance

All sampling teams are trained by DEP to collect water quality samples using the same field procedures. Annual refresher and training courses, followed up with a regimen of regular field audits, assure continued compliance with procedures. A sampling manual has been written as a reference document for field staff.

At least 10% of all samples collected include blinds and blanks. Quality assurance procedures are in place to qualify data collected when blanks indicate contamination or other problems. Blind samples with known analyte concentrations are also sent out to each sampling agency for checking the measurement accuracy of field instruments.

All chemical and biological samples collected by the Program are currently analyzed by one laboratory, thus minimizing the potential variability introduced when multiple analytical labs are used.

Figure 6: Status Network Reporting Units



WATER MANAGEMENT DISTRICT	1999	2000	2001	2002
Northwest Florida WMD	A	B	C	D
Suwannee River WMD	A	B	D	C
St. Johns River WMD	D	A	B	C
Southwest Florida WMD	B	C	D	A
South Florida WMD	A	D	C	B

Table 7: Status Network Sampling Index Periods

Month	Confined Aquifer		Unconfined Aquifer		Low Order Streams		High Order Streams		Small Lakes		Large Lakes		Total Number of *Samples* *
		P	N	P	N	P	N	P	N	P	N	P	
January	20	30											50
February	20	30											50
March	20	30							30				80
April				45	30				30				105
May				45	30			45					120
June			30					45			30		105
July			30				30			45	30		135
August						45	30			45			120
September						45							45
October												45	45
November												45	45
December													0

N = North Florida (NWFWMD, SRWMD); **P** = Peninsular Florida (SJRWMD, SWFWMD, SFWMD

Primary Index Period

Overflow Index Period

* Total does not include QA samples

Table 8: Status & Temporal Variability Network Analyte List

INDICATOR	*LAKES*	*STREAMS*	*AQUIFERS*
Calcium	T	T	D
Magnesium	T	T	D
Sodium	T	T	D
Potassium	T	T	D
Chloride	T	T	D
Sulfate	T	T	D
Fluoride	T	T	D
Alkalinity	T	T	D
Nitrate + Nitrite	T	T	D
Ammonia	T	T	D
Kjeldahl Nitrogen	T	T	D
Phosphorus	T	T	D
ortho-Phosphate	D	D	D
Organic Carbon	T	T	T
Dissolved Solids	T	T	T
Suspended Solids	T	T	T
Turbidity	T	T	T
Color	T	T	T
Total Coliform	T	T	T
Fecal Coliform	T	T	T
E. coli	T	T	T
Enterococci	T	T	T
Chlorophyll-A	T	T	
Algal Growth Potential	T		
Phytoplankton	T		
Water Temperature	X	X	X
pH	X	X	X
Specific Conductance/Salinity	X	X	X
Dissolved Oxygen	X	X	X
Secchi Depth	X	X	
Total Depth	X	X	
Sample Depth	X	X	
Depth to Water (from LSE)			X
Land Surface Elevation (LSE)			X
Microlanduse			X

T = total sample
D = dissolved sample
X = other sample or measurement

Temporal Variability (TV) Monitoring

In order to assist in addressing temporal variability and trend monitoring issues, FDEP established a Temporal Variability (TV) Network. The TV Network can be subdivided into a surface water (SWTV) and a ground water (GWTV) network. As of October 1999, the SWTV consists of 79 fixed location sites that are sampled on a monthly basis (Figure 7). The sites are located at the lower end of, or receiving waters of, the basin and are placed at or close to a flow gaging station. These sites enable FDEP to obtain chemistry, discharge, and loading data at the point that integrates the land use activities of the watershed. In addition, some of the SWTV sites are located at or near the Florida State boundary with Alabama and Georgia. These stations are used to obtain chemistry and loading data for major streams entering Florida. Finally, some of the sites are located in major lakes. Data from the lakes, as well as all of the other SWTV sites, are used to assist in evaluating temporal variability in Florida's surface water resources.

The GWTV consists of 46 fixed location sites (Figure 8). The sites are used to obtain chemistry and field analyte data in confined and unconfined aquifers. These data are used to quantify temporal variability in our ground water resources and to assist in determining whether the Status Network samples are collected during wet or dry periods. As with the SWTV Network, GWTV sites are sampled by personnel at FDEP, four of the five WMDs and selected counties with the samples analyzed in the DEP Central Laboratory. It is already known that the temporal variance of water chemistry in confined aquifers is much less than that of unconfined aquifers. For this reason, the confined sites are sampled quarterly and unconfined ground water resources are sampled monthly. The analytes to be measured are listed in Table 31. Field analytes (pH, dissolved oxygen, specific conductance, and temperature) are collected on all site visits. Additionally, laboratory analytes are collected from wells located within actively sampled Status Network Reporting Units.

Achieving Comprehensive Assessments: Plan and Status

As discussed in Chapter 2, Florida is working towards the implementation of the watershed approach, which provides a structure that allows entire systems to be managed comprehensively, rather than on the basis of their separate parts and by watershed boundaries, rather than by political or regulatory boundaries.

This approach will allow FDEP to address more effectively the nonpoint source issues and adverse environmental impacts resulting from population growth and development, while continuing to address its historical responsibilities via a more efficient use of resources. FDEP anticipates that the implementation of the watershed approach will lead to a watershed-based permitting process. The environmental health of individual basins in the state will improve because activities are more likely to be coordinated and less likely to create cumulative impacts. In addition, this focusing of resources will allow Florida's water resource issues to be addressed more efficiently.

The watershed approach is designed to complement and integrate other watershed management programs in the state, including the Surface Water Improvement and Management (SWIM) Program of the WMDs and the four National Estuary Programs. The framework it provides can eventually serve as a basis for achieving broader, ecosystem-level objectives and will establish mechanisms to define priorities, improve coordination, integrate program goals, and allocate finite resources within these geographic areas.

Figure 7: Surface Water TV Network

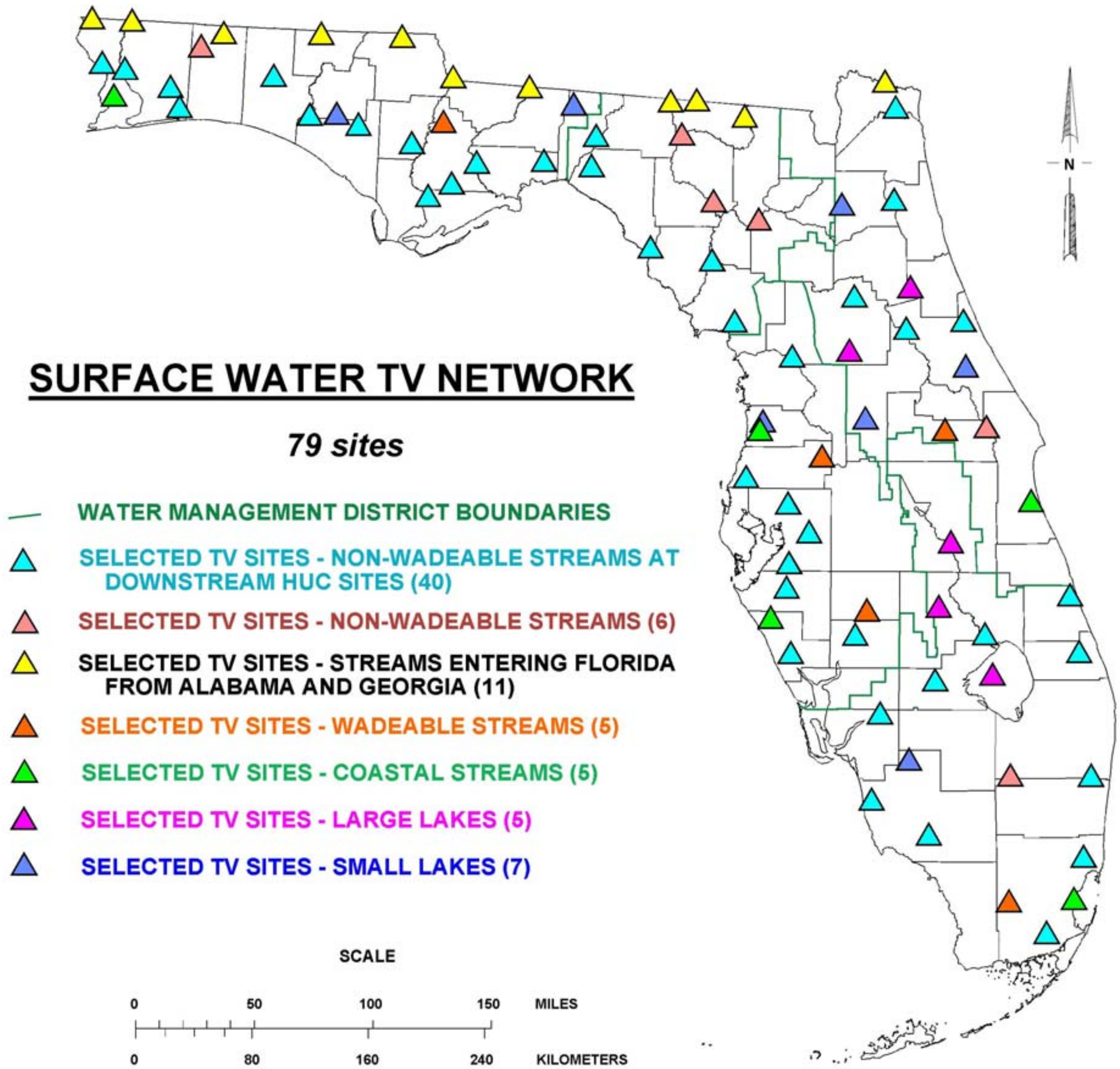
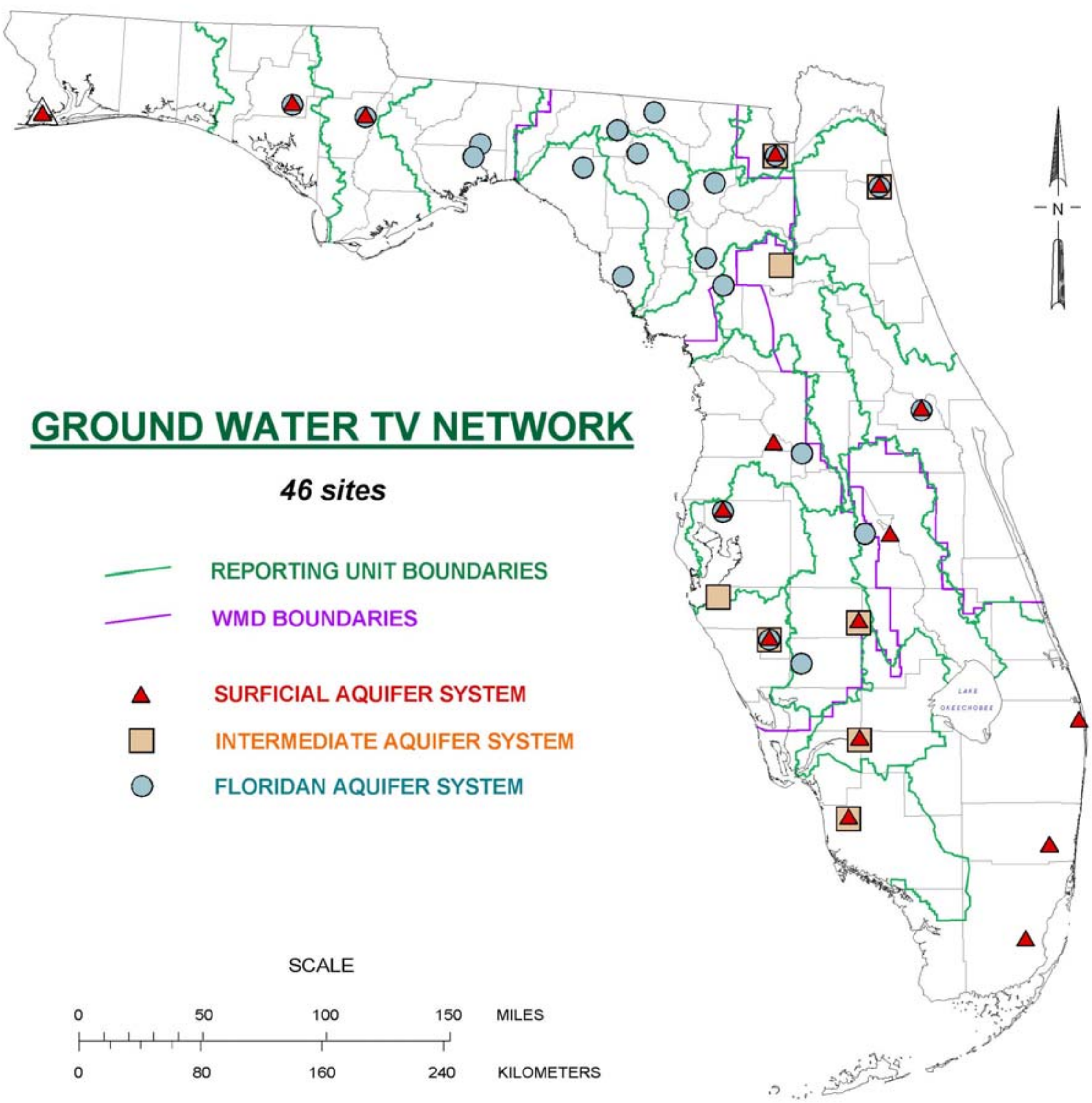


Figure 8: Ground Water TV Network



Methodology

This section summarizes the methodology used in preparing the 2002 305(b) report.

Consolidated Assessment and Listing Methodology

Historically the 305(b) report and 303(d) list have been managed and reported as separate documents. However, EPA recognized that water quality monitoring and data analysis (under 305(b)) are the foundation of water resource management decisions (using 303(d)). Thus, EPA and its partners are developing a consolidated 305(b)/303(d) assessment approach that addresses water quality monitoring strategies, data quality and data quantity needs, and data interpretation methodologies. This effort, "Consolidated Assessment and Listing Methodology" (CALM) aims to help states improve the accuracy and completeness of 303(d) lists and 305(b) report.

The CALM is developing based on input from the long-standing 305(b) consistency workgroup (which develops reporting guidelines and methods for making attainment decisions); findings of the Intergovernmental Task Force on Monitoring Water Quality; and guidance on the elements of an adequate state watershed monitoring and assessment program, which was prepared for EPA and the Standards and Monitoring Task Force of the Association of State and Interstate Water Pollution Control Administrators.

The overall goal of CALM is to both strengthen and streamline the water quality monitoring, assessment and listing process for purposes of both sections 305(b) and 303(d) of the Clean Water Act. CALM provides guidance on the monitoring data and assessment methods needed to support decision making, and on communicating water quality conditions to the public. The benefits of CALM include increasing monitoring on all waters, improved decision making on water quality standards attainment and listing impaired waters, and provides clearer communication to the public on water quality issues in each state and across the nation.

2002 Integrated Report Guidance

Recognizing that CALM documentation would not be finalized by the time that the 2002 305(b) Report and the 2002 303(d) Lists were due, EPA developed new guidance recommendations for States to use to prepare a 2002 Integrated Water Quality Monitoring and Assessment Report (Integrated Report), which will satisfy CWA requirements for both Section 305(b) water quality reports and Section 303(d) lists.[4] In order to implement these changes, EPA has recognized the need for additional time and has provided the States with the following options:

- Provide the 2002 305(b) Report on April 1, 2002 using the 1997 305(b) guidance, or
- Provide an Integrated Report on October 1, 2002 using the 2002 Integrated Water Quality Monitoring and Assessment guidance, or
- Apply a hybrid approach, serving as a transitional report and list, with both components due no later than October 1, 2002.

Recognizing the need to align the 305(b) reporting methodology with the 303(d) method, the State of Florida has chosen to initiate the change to the integrated report structure for the 2002 305(b) Report. The 2002 305(b) report (this document) uses a methodology that has been proposed in the "Identification of Impaired Surface Waters" (Rule 62-303 and also referred to as the IWR) to assess waters and the water quality standards attainment status categories outlined in the guidance. Florida has chosen to

[4] *2002 Integrated Water Quality Monitoring and Assessment Report Guidance, October 5, 2001 Final Draft.*

submit this transitional 305(b) Report in May, 2002 and then produce an Integrated Report for the 2002 303(d) List in October, 2002.

As outlined in the 2002 Integrated Water Quality Monitoring and Assessment Report Guidance, the following assessment categories *with modifications* were used for the 2002 305b Report. They are:

1. **Category 1 - Attaining all designated uses**. Water bodies are listed in this category if there are data and information that meet the requirements of the state's assessment and listing methodology for all applicable designated uses and support a determination that the water quality standard is attained.

2. **Category 2 - Attaining some of the designated uses.** Water bodies are listed in this category if there are data and information, which meet the requirements of the state's assessment and listing methodology, to support a determination that some, but not all, uses are attained. Attainment status of the remaining uses is unknown because there is insufficient or no data or information.

3. **Category 3a - No data and information to determine if any designated use is attained**. Water bodies are listed in this category where the data or information to support an attainment determination for any use is not available, consistent with the requirements of the state's assessment and listing methodology.

4. **Category 3b - Some data and information but not enough to determine if any designated use is attained**. Water bodies are listed in this category where the data or information to support an attainment determination for any use is limited, consistent with the requirements of the state's assessment and listing methodology.

5. **Category 3c - Enough data and information to determine if any designated use is attained pursuant to the Planning List methodology.** Water bodies are listed in this category where the data or information to support an attainment determination for any use meets the thresholds for Florida's IWR-based Planning List. (See p. 41 for description of the IWR methodology.)

- **Category 3d - Enough data and information to determine if any designated use is attained pursuant to the Verified Screening List methodology**. Water bodies are listed in this category where the data or information to support an attainment determination for any use meets the thresholds for Florida's IWR-based Verified List. However, the data have not yet been evaluated and the waters have not been verified as being impaired.

6. Category 4 - Impaired for one or more designated uses but does not require the development of a TMDL.
   a. TMDL has been completed. Water bodies will be listed in this subcategory once all TMDL(s) have been developed and approved by EPA that, when implemented, are expected to result in full attainment of the standard.
   b. Impairment is not caused by a pollutant. Water bodies will be listed in this subcategory if the impairment is caused by pollution, rather than a pollutant.
   c. Pollution Control Measure. A proposed pollution control measure provides reasonable assurance the water will attain standards in the future.

7. **Category 5 - The water quality standard is not attained.** The water body is impaired for one or more designated uses by a pollutant(s), and requires a TMDL. This category constitutes the basin specific verified list of impaired waters that will be adopted by the DEP Secretary as Florida's Impaired Waters List and submitted as to EPA as Florida's 303(d) list of impaired waters impaired. A water body will be listed in this category if it is determined, in accordance with the IWR, that a pollutant has caused the verified impairment.

Assessment Unit

Dividing the state into water body assessment polygons - For the 1994 report, the State was subdivided into 4,400 water body assessment polygons based on the Environmental Protection Agency's River Reach File 3 (RF3) and U.S. Geological Survey watershed delineations. The Department contracted with the USGS to identify smaller water body assessment polygons (about five square miles each) using the drainage basin boundaries on USGS topological maps and ARC/INFO geographic information system (GIS) techniques. At contract end, the U.S. Geological Survey completed 75 percent of the state, but did not delineate South Florida (Sub-region 0309). South Florida's delineations were adapted from a much coarser delineation developed by the South Florida Water Management District. As a result, these water body assessment polygons are each about 50 square miles, ten times larger than those in the rest of the state. For the 1996 report, the USGS (water body assessment polygons also called "Foose polygons") were subdivided into smaller units (4,534 water body assessment polygons also called "Joe polygons") based on the locations of the sample sites and the homogeneity of the data. Although the units may not be topologically accurate, they are a more reasonable size for assessment. In 1998, the State was subdivided into 4,934 water body assessment polygons, in 2000 into 5,126 polygons, and in 2002, 5,215 polygons are delineated.

A water body assessment polygon is defined as a water body. It is the analytic unit for assessing surface water quality and each water body assessment polygon is named for the major water body located within it. Data from all water quality-monitoring stations that are located within a given polygon and are named similar to the assessment polygon are used to assess the named water body.

Identifying the type of water body - The major water body is identified within each water body polygon—which usually encompass one major or one minor named water body—in each polygon. Each water body is identified as a stream, black water stream, lake, estuary, or spring. *Table 9* shows the types of Florida water bodies and their characteristics.

Table 9: Water Body Characterization

Water body Type	Number of Waterbodies	Characteristics
Stream	3,575	
Lake	1,155	
Estuary	485	Conductivity >5000 uhmos/cm, chloride >1500 ppm

Knowing the length of each stream and the area of each lake, spring, and estuary were essential in reporting the results to EPA. Stream lengths were determined by GIS measurements of RF3 (or assigned a length of five miles if no RF3 delineation was available). We determined lake and estuary areas using rough GIS aerial measurement techniques (if estuaries had no RF3 delineation, their areas were set at five square miles, while we assigned lakes whose areas were unknown an area of 0.1 square mile).

The water quality is assumed to be homogeneous in each water body. If visual inspection of the data proves this wrong, or if GIS mapping shows more than one water body located within an assessment polygon, the polygon is subdivided. GIS techniques were used to assign STORET sites to their respective assessment polygon.

Water Body's Designated Use(s)/ Florida's Water Classification System

Identifying each water body's designated use - Functional classifications (Class I through V) have been applied to all Florida surface waters. Standards and water quality criteria have been established for each class of water body under Chapter 62-302 of the Florida Administrative Code (Table 10).

Table 10: Florida Water Body Classifications

Class	Designation	Number of Assessment polygons	Water Body Type	Characteristics
I	Drinking Water	48	Usually lakes or reservoirs	
II	Shellfish harvesting	124	Estuarine	
III – Freshwater	Wildlife and recreation	4,641		
III – Marine	Wildlife and recreation	400		Chloride >1500 ppm
IV	Agriculture*	2		
V	Industrial**	0		

** Everglades area; ** No waters in this category*

Impaired Waters Rule Methodology

For the 2002 305(b) Report, all water body assessment polygons were assessed pursuant to proposed Chapter 62-303, Florida Administrative Code, "Identification of Impaired Surface Waters (IWR)." The IWR was adopted by the Environmental Regulation Commission in April 2001, but has not yet gone into effect because it was challenged and the administrative hearing is not yet complete. However, the Department strongly believes it is important to move forward with the assessments needed for both this report and for basin status reports rather than wait for the administrative process to be completed. The Department elected to use the IWR methodology for the 2002 305(b) Report because the IWR represents a significant improvement over the previous 305(b) methodology and because there is no requirement to adopt the methodology for the 305(b) Report as a rule.

It should be noted that the IWR establishes a two-step process for identifying impaired waters. Surface waters of the state that meet rule thresholds indicating they are potentially impaired are listed on a Planning List. Waters on the Planning List are then monitored and evaluated in more detail to verify whether they are impaired. When the appropriate data are gathered and assessed as defined in the IWR, then the waters are placed on the state's Verified List of impaired waters if they meet rule thresholds for the verified list. The Verified List, which is the list of waters for which TMDLs will be developed, will then be adopted by Secretarial Order, and once adopted, the list will be submitted to EPA as the State's 303(d) List. However, the Department will not be able to adopt any waters on the Verified List until after the IWR, or its successor, goes into effect.

To help stakeholders identify those waters that may be listed on planning and verified lists in the future, this report includes subcategories of waters (3c and 3d) that meet the data sufficiency thresholds for the planning and verified lists. However, these waters are still only potentially impaired. They waters have not been verified as being impaired and cannot be until the IWR becomes effective.

Data Sources

The U.S. Environmental Protection Agency's Storage and Retrieval (STORET) database is the primary source of data used for determining water quality criteria exceedances. As required by rule 62-40.540(3), F.A.C., the Department, other state agencies, the Water Management Districts, and local governments collecting surface water quality data in Florida must enter the data into STORET within one year of collection.

Data present in both the Legacy STORET database, Modernized STORET, and some additional datasets (St. Johns River Water Management District) were inventoried for 16,393 STORET stations (stations for which some data exist). For the 2002 305(b) report, the parameters listed in Table 11 were inventoried. The following parameters were used in the 2002 305(b) assessment:

Metals	Arsenic, aluminum, cadmium, chromium VI, chromium III, copper, iron, lead, mercury, nickel, selenium, silver, thallium, and zinc
Nutrients	Chlorophyll a, Trophic State Index (chlorophyll a, total nitrogen, and total phosphorus), nitrate, unionized ammonia, total nitrogen, and total phosphorus
Conventionals	Dissolved Oxygen, specific conductance (to differentiate marine from fresh waters), color (used to define lake types), fecal coliforms, total coliforms, alkalinity, temperature, and pH (to calculate unionized ammonia values)

Table 11:STORET Water Quality Assessment Parameters and Codes

Parameter Name	STORET Parameter Code	Parameter Group	Units	Priority
Chloride total	940	Conventionals	mg/L	Primary
Color	80	Conventionals	PCU	Primary
Color apparent	81	Conventionals	PCU	Primary alternate
Conductivity at 25C	95	Conventionals	µomhos/cm	Primary alternate
Conductivity field	94	Conventionals	µomhos/cm	Primary
DO	300	Conventionals	mg/L	Primary alternate
DO probe	299	Conventionals	mg/L	Primary
Fecal coliform m-fcagad	31625	Conventionals	#/100ml	Secondary alternate
Fecal coliform mfm-fcbr	31616	Conventionals	#/100ml	Primary alternate
Fecal coliform mpnecmed	31615	Conventionals	#/100ml	Primary
pH	400	Conventionals	SU	Primary
pH lab	403	Conventionals	SU	Primary alternate
Total alkalinity CaCO3	410	Conventionals	mg/L as $CaCO_3$	Primary
Total coliform mfimendo	31501	Conventionals	#/100ml	Primary
Total coliform mpn conf	31505	Conventionals	#/100ml	Primary alternate
Total hard CaCO3	900	Conventionals	mg/L	Primary
Water temp	10	Conventionals	deg Celsius	Primary
Aluminum	1105	Metals	mg/L	Primary
Arsenic	1002	Metals	µg/L	Primary
Arsenic	978	Metals	µg/L	Primary alternate
Cadmium	1113	Metals	µg/L	Primary alternate
Cadmium	1027	Metals	µg/L	Primary
Chromium	1034	Metals	µg/L	Primary
Chromium	1118	Metals	µg/L	Primary alternate
Chromium	1032	Metals	µg/L	Primary
Copper	1042	Metals	µg/L	Primary
Copper	1119	Metals	µg/L	Primary alternate
Iron	1045	Metals	mg/L	Primary
Iron	980	Metals	µg/L	Primary alternate
Lead	1051	Metals	µg/L	Primary
Lead	1114	Metals	µg/L	Primary alternate
Mercury	71900	Metals	µg/L	Primary
Mercury	71901	Metals	µg/L	Primary alternate
Nickel	1067	Metals	µg/L	Primary
Selenium	1147	Metals	µg/L	Primary
Selenium	981	Metals	µg/L	Primary alternate
Silver	1077	Metals	µg/L	Primary
Thallium	1059	Metals	µg/L	Primary
Thallium	982	Metals	µg/L	Primary alternate
Zinc	1092	Metals	µg/L	Primary
Ammonia-NH4, diss	71846	Nutrients	mg/L	Secondary alternate
Ammonia-NH4, total	71845	Nutrients	mg/L	Tertiary alternative
Ammonia, unionized	619	Nutrients	mg/L as NH3	Primary (computed)
Chlorophyll a	32210	Nutrients	µg/L	Primary

Chlorophyll a	32230	Nutrients	mg/L	Tertiary alternative
Chlorophyll a corrected	32211	Nutrients	µg/L	Primary alternate
Chlorophyll total	32216	Nutrients	µg/L	Secondary alternate
Kjeldahl-N, total	625	Nutrients	mg/L as N	Primary
Kjeldahl N diss	623	Nutrients	mg/L N	Primary alternate
NH3+NH4- N diss	608	Nutrients	mg/L N	Primary alternate
NH3+NH4- N total	610	Nutrients	mg/L NO3	Primary
Nitrate dissolved	71851	Nutrients	mg/L NO3	Secondary alternate
Nitrate nitrogen, total	71850	Nutrients	mg/L as NO3	Primary alternate
Nitrogen, organic	605	Nutrients	mg/L N	Primary
Nitrogen, organic dissolved	607	Nutrients	mg/L N	Primary alternate
Nitrogen, total	71887	Nutrients	mg/L NO3	Primary alternate
Nitrogen, total	600	Nutrients	mg/L N	Primary
NO2&NO3 N-diss	631	Nutrients	mg/L	Primary
NO2&NO3 total	630	Nutrients	mg/L	Primary
NO3, total	620	Nutrients	mg/L N	Primary alternate
NO3-N dissolved	618	Nutrients	mg/L	Primary alternate
Phosphate, total	650	Nutrients	mg/L P	Primary
Phosphorus, total	665	Nutrients	mg/L PO4	Primary alternate
Phosphorus, total	71886	Nutrients	mg/L PO4	Secondary alternate
Phosphorus-dissolved	666	Nutrients	mg/L P	Tertiary alternative

Data from the State Biological Database (see biological criteria), and fish consumption advisory data (based on the Florida's Department of Health's "limited consumption" or "no consumption" advisories for areas high in mercury) were also used in the assessment. Information on beach closures and downgrades of shellfish harvesting areas are being evaluated and will be included in the next Integrated Report.

Data Quality

The IWR method requires that data older than ten years not be used to evaluate water quality criteria exceedances for the planning list. For the purposes of the 2002 305(b), data from January 1991 – December 31, 2000 were used in the assessment. Likewise the method requires that data older than 5 years should not be used to verify impairment. As such, only data from January 1996 – December 31, 2000 were used to decide whether to place waters in subcategory 3d.

To evaluate the quality of data and to determine which data can be used for the assessment, sample remark codes for each sample were also retrieved. Remark codes are assigned by the analyzing laboratory and indicate how confident the lab is in reporting the value (See Table 12 for a partial list of lab remark codes). If the codes are missing, the sample is still used in the assessment.

Table 12: Remark Code Definitions

Remark Code	Definition
K	The actual value is known to be less than the value given.
L	The actual value is known to be greater than the value given.
U	Indicates that the compound was analyzed for but not detected. The reported value shall be the method detection limit.
I	The reported value is between laboratory method detection limit and the laboratory practical quantitation limit.

In accordance with the IWR and rule 62-4.246, F.A.C., those samples with remark codes K, L, U, and I were handled in the following manner:

If code = K and value >criteria, then delete
If code = K and value < criteria, then the sample is used and is not an exceedance
If code = L and value > criteria, then the sample is used and considered an exceedance
If code = L and value < criteria, then delete
If code = U and the criterion equals or exceeds the MDL, then ½ MDL value is used and not considered an exceedance
If code = U and the criterion is less than the MDL, then the value is set to ½ the criterion and not considered an exceedance
If code = I and MDL value > criteria, then value is set to the MDL, the sample is used, and considered an exceedance
If code = I and MDL value < criteria, then value is set to the MDL, the sample is used, but is not an exceedance

For the assessment of metals with hardness specific criteria, the corresponding hardness value is needed to whether the measured value exceeds applicable criteria. If the ambient hardness value is less than 25 mg/L as $CaCO_3$, then a hardness value of 25 is used to calculate the criteria. Likewise, if the hardness value is greater than 400 mg/L, then a hardness value of 400 is used to calculate the criteria.

If the hardness value is not present for the metals data, a value of 400 mg/L is assumed to determine whether the sample could exceed the criterion at any hardness. If the sample result does not exceed the calculated criterion with an assumed hardness of 400 mg/l, then it is used as a valid sample. However, if the sample exceeds the calculated criteria using the assumed hardness, then the sample is not used in the overall assessment because it is not known whether the measured value actual exceeded the criterion. For the October Integrated Report, the Department's computer code will be modified to also check metals values without measured hardness against an assumed hardness value of 25 mg/L to identify samples that would exceed the criterion at any hardness.

Data Sufficiency

The Planning List methodology requires that the number of exceedances of an applicable water quality criterion due to pollutant discharges must be greater than or equal to the number listed in Table 13 for the given sample size. This table provides the number of exceedances that indicate a minimum of a 10% exceedance frequency with a minimum of an 80% confidence level using a binomial distribution.

To be assessed for water quality criteria exceedances using Table 13, a water body assessment polygon must have:

- a minimum of ten, temporally independent samples for the assessment period (January 1991 – December 2000; a ten-year period).
- samples from a given station must be at least one week apart. Samples collected at the same location less than seven days apart will be considered as one sample, with the median value used to represent the sampling period. For the October Integrated Report, the worst case value will be used rather than the median if any of the samples exceed levels that would be expected to cause acute toxicity.

Data from different stations within a water segment will be treated as separate samples even if collected at the same time. However, there must be at least five independent sampling events during the assessment period, with at least one sampling event conducted in three of the four seasons of the calendar year. The four seasons were January 1 through March 31, April 1 through June 30, July 1 through September 30, and October 1 through December 31.

If there are less than ten samples for the segment, but there are three or more temporally independent exceedances of an applicable water quality criterion, then the water is placed in Category 3b. Waterbodies shall also be placed in Category 3b if the is more than one exceedance of an acute toxicity-based water quality criterion in any three year period.

The verified screening list methodology requires at least 20 samples from the last 5 years preceding the planning list assessment. To evaluate the number of exceedances of an applicable water quality criterion, the number of exceedances must be greater than or equal to the number listed in Table 14 for the given sample size. This table provides the number of exceedances that indicate a minimum of a 10% exceedance frequency with a minimum of a 90% confidence level using a binomial distribution.

Table 13: Category 3c

Minimum number of measured exceedances needed to put a water in Category 3c with at least 80% confidence that the actual exceedance rate is greater than or equal to ten percent.

From: # of Samples	To: # of Samples	Waters are included if they have at least this # of exceedances
10	15	3
16	23	4
24	31	5
32	39	6
40	47	7
48	56	8
57	65	9
66	73	10
74	82	11
83	91	12
92	100	13
101	109	14
110	118	15
119	126	16
127	136	17
137	145	18
146	154	19
155	163	20
164	172	21
173	181	22
182	190	23
191	199	24
200	208	25
209	218	26
219	227	27
228	236	28
237	245	29
500	500	57

From: # of Samples	To: # of Samples	Waters are included if they have at least this # of exceedances
246	255	30
256	264	31
265	273	32
274	282	33
283	292	34
293	301	35
302	310	36
311	320	37
321	329	38
330	338	39
339	348	40
349	357	41
358	367	42
368	376	43
377	385	44
386	395	45
396	404	46
405	414	47
415	423	48
424	432	49
433	442	50
443	451	51
452	461	52
462	470	53
471	480	54
481	489	55
490	499	56

Table 14: Category 3d

Minimum number of measured exceedances needed to put a water in Category 3d with at least 90% confidence that the actual exceedance rate is greater than or equal to ten percent.

From: # of Samples	To: # of Samples	Waters are included if they have at least this # of exceedances
20	25	5
26	32	6
33	40	7
41	47	8
48	55	9
56	63	10
64	71	11
72	79	12
80	88	13
89	96	14
97	104	15
105	113	16
114	121	17
122	130	18
131	138	19
139	147	20
148	156	21
157	164	22
165	173	23
174	182	24
183	191	25
192	199	26
200	208	27
209	217	28
218	226	29
227	235	30
236	244	31
245	253	32

From: # of Samples	To: # of Samples	Waters are included if they have at least this # of exceedances
254	262	33
263	270	34
271	279	35
280	288	36
289	297	37
298	306	38
307	315	39
316	324	40
325	333	41
334	343	42
344	352	43
353	361	44
362	370	45
371	379	46
380	388	47
389	397	48
398	406	49
407	415	50
416	424	51
425	434	52
435	443	53
444	452	54
453	461	55
462	470	56
471	479	57
480	489	58
490	498	59
499	500	60

Attainment of Designated Use(s)

All surface waters of the State have been classified according to their designated use. These are 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
CLASS V	Navigation, Utility and Industrial Use

Following EPA guidance, the IWR uses a different nomenclature when evaluating attainment of designated uses, as follows:

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

These water quality indicators have been aligned with the state's designated uses as outlined in Table 15. A summary of thresholds for each indicator is provided in Table 16, as the criteria or data applies to the States water classification system. A detailed description of the criteria follows.

Table 15: Water Quality Indicators as related to the Florida's Water Classification (Designated Use) System

	Aquatic Life Attainment**				Primary Contact and Recreational Criteria	Fish or Shellfish Consumption Attainment	Drinking Water Attainment and Protection of Human Health
	Numeric Water Quality Criteria	Biological Data	Toxicity Data	Nutrient Thresholds			
Class I	1	**X**	**X**	**X**	Class 1 – Bacteria Criteria		**X**
Class II	2	**X**	**X**	**X**	Class 2 – Bacteria Criteria	X	
Class III – Fresh	3 (Fresh)	**X**	**X**	**X**	Class 3 – Fresh Bacteria Criteria	**X**	
Class III – Marine	3 (Marine)	**X**	**X**	**X**	Class 3 – Marine Bacteria Criteria	**X**	
Class IV	4	**X**	**X**	**X**			
Class V	5	**X**	**X**	**X**			

***NOTE: Assume only one parameter is needed within any sub-group to attain/not attain Aquatic Life Support*

Table 16: Summary of Criteria for each Water Quality Indicator as it relates to the Florida Classification System

	Aquatic Life Based Attainment**				Primary Contact and Re-creation	Fish and Shellfish Consumption Attainment	Drinking Water Attainment and Protection of Human Health
	Numeric Water Quality Criteria	Biological Thresholds	Toxicity Criteria	Nutrient Thresholds			
Class I	exceedances of Class I water quality criterion >/= to the number listed in Table 11 (Category 3c) / Table 12 (Category 3dc) for the given sample size	Cat 3c -Failed 1 SCI or BioRecon; Cat 3d – Failed 2 bioassessment	Not used in assessment	Streams -annual mean chlorophyll a concentration > 20 ug/l Lakes - mean color > 40 PCU and annual mean TSI > 60, or mean color </= 40 PCU and annual mean TSI >40	Class I – Bacteria Criteria	There is either a limited or no consumption fish consumption advisory	does not meet the applicable Class I water quality criteria
Class II	Exceedances of Class II water quality criterion >/= to the number listed in Table 11 (Category 3c) / Table 12 (Category 3d) for the given sample size	Cat 3c -Failed 1 SCI or BioRecon; Cat 3d – Failed 2 bioassessment	Not used in assessment	Streams -annual mean chlorophyll a concentration > 20 ug/l Lakes - mean color > 40 PCU and annual mean TSI > 60, or mean color </= 40 PCU and annual mean TSI >40	Class II – Bacteria Criteria	There is either a limited or no consumption fish consumption advisory*	
Class III – Fresh	Exceedances of Class III (fresh) water quality criterion >/= to the number listed in Table 11 (Category 3c) / Table 12 (Category 3d) for the given sample size	Cat 3c-Failed 1 SCI or BioRecon; Cat 3d – Failed 2 bioassessment	Not used in assessment	Streams -annual mean chlorophyll a concentration > 20 ug/l Lakes - mean color > 40 PCU and annual mean TSI > 60, or mean color </= 40 PCU and annual mean TSI >40	Class III – Fresh Bacteria Criteria or beach closures	There is either a limited or no consumption fish consumption advisory	
Class III – Marine	Exceedances of Class III water quality criterion for estuarine water body types >/= to the number listed in Table 11 (Category 3c) / Table 12 (Category 3d) for the given sample size	Cat 3c -Failed 1 SCI or BioRecon; Cat 3d – Failed 2 bioassessment		Streams -annual mean chlorophyll a concentration > 11 ug/l	Class III – Marine Bacteria Criteria or beach closures	There is either a limited or no consumption fish consumption advisory	
Class IV	Exceedances of Class IV water quality criterion >/= to the number listed in Table 11 (Category 3c) / Table 12 (Category 3d) for the given sample size	Cat 3c -Failed 1 SCI or BioRecon; Cat 3d – Failed 2 bioassessment	Not used in assessment	Streams -annual mean chlorophyll a concentration > 20 ug/l Lakes - mean color > 40 PCU and annual mean TSI > 60, or mean color </= 40 PCU and annual mean TSI >40			
Class V	Exceedances of Class V water quality criterion >/= to the number listed in Table 11 (Category 3c) / Table 12 (Category 3d) for the given sample size	Cat 3c-Failed 1 SCI or BioRecon; Cat 3d – Failed 2 bioassessment	Not used in assessment	Streams -annual mean chlorophyll a concentration > 20 ug/l Lakes - mean color > 40 PCU and annual mean TSI > 60, or mean color </= 40 PCU and annual mean TSI >40			

**Note: In the next Integrated Report, waters will be listed if they had been approved for shellfish harvesting, but have subsequently been downgraded to a more restrictive classification.*

***Note: Assume only one parameter is needed within any sub-group to attain/not attain Aquatic Life Support.*

Aquatic Life Based Attainment

Waters were assessed for aquatic-life use support by evaluating several types of water quality data (exceedances of water quality criteria, bioassessment data, toxicity data, and nutrient thresholds). The IWR follows the principle of independent applicability such that failure of any one of the four indicators results in listing the water in category 3c or 3d for potential impairment of aquatic life use support.

Exceedance of Numeric Water Quality Criteria

The chemistry data from STORET were inventoried and data from stations that were determined to be ambient surface water quality stations were selected. Water quality information from point sources or wells were purposely excluded.

To determine if a water should be placed in Category 3b or 3c for each parameter, the chemical data were analyzed using a computer program written to assess the data based on thresholds established in the impaired surface waters rule, with one exception. Because the full complexity of the pH criterion could not be programmed, the listings for pH were not included. pH will be further examined when additional data are collected during Phase 2 of the watershed management cycle.

Exceedances of Biological Thresholds

Bioassessments were used to assess streams and lakes. These included BioRecons, Stream Condition Indices (SCIs), and the benthic macroinvertebrate component of the Lake Condition Index (LCI).

Water bodies are considered potentially impaired if the water body has at least one failed bioassessment or one failure of the biological integrity standard, Rule 62-302.530(11). In streams, the bioassessment can be an SCI or a BioRecon. Failure of a bioassessment for streams consists of a “poor” or “very poor” rating on the Stream Condition Index, or not meeting the minimum thresholds established for all three metrics (taxa richness, Ephemeroptera/Plecoptera/Tricoptera Index, and Florida Index) on the BioRecon. Failure for lakes consists of a “poor” or “very poor” rating on the Lake Condition Index.

The biology data were assessed using these criteria as guidance. 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 water body’s true health than discrete chemical or physical measurements alone. Bioassessment methods involve the identification of a biological reference condition, based on data from unimpaired or least-impacted waters in a given region. For the Basin Status Reports, the reference condition data were used to establish expected scores, ranging from best to worst, for various measures of community structure and function, such as numbers or percentages of particular species or feeding groups. Data on community structure and function from waters of unknown quality in the same region as reference waters were compared with the expected scores of metrics to evaluate their biological integrity.

Metrics (e.g., number of taxa, percent Diptera, percent filter feeders) were used independently and as an aggregated group called an index. Indices have advantages over individual metrics in that they can integrate several related metrics into one score that reflects a wider range of biological variables. A number of bioassessment metrics and indices exist for assessing populations of plant and animal life, including fish, diatoms (e.g., microscopic algae and unicellular plankton), and macroinvertebrates (e.g., insects, crayfish, snails, and mussels).

Only macroinvertebrate data from ambient sites in state surface waters were used in the bioassessments analyzed for the basin reports. The data included sites designated as test and background sites for National Pollutant Discharge Elimination System (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., percent suitable macroinvertebrate habitat, water velocities, extent of sand or silt smothering, and riparian buffer zone widths) was not available at the time of reporting, they were not included. However, habitat and physicochemical assessment information is instrumental in pinpointing the causes for failed bioassessment metrics and will be included in future reporting.

The data used were obtained from the Department's Biological Database (SBIO) and the U.S. Environmental Protection Agency's STORET Water Quality Database, where it could be substantiated that the data were generated in compliance with the bioassessment standard operating procedures in Section 62-303.330, Florida Administrative Code.

The data from these databases were used without regard to the randomness of sample site selection. The general period of record for data used in the analysis of lotic (moving) waters was January 1, 1991, through December 31, 2000. The period of record for data used in the analysis of lentic (still) waters was June 21, 1995, through December 31, 2000. The seasons are defined as follows: winter (1/1–3/31), spring (4/1–6/30), summer (7/1–9/30) and fall (10/1–12/31). Wet seasons are generally spring and summer and dry seasons are fall and winter, although conditions can vary in the state as a whole.

Lake Condition Index

Bioassessments were provided for streams, lakes, canals, and rivers. The scoring of the individual metrics of the Lake Condition Index (LCI), except percent 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 percent 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 six metrics in the method: total number of taxa; total number of taxa belonging to the orders Ephemeroptera, Odonata, and Trichoptera (EOT taxa); percent EOT taxa; Shannon-Wiener Index score; Hulbert Index score; and percent Dipteran individuals. LCI calculations are only provided for clear lakes ($\leq$ 20 platinum cobalt units). Since macroinvertebrate-based indices have not been shown to assess colored lakes in Florida accurately (> 20 platinum cobalt units), they have been excluded from bioassessments.

Stream Condition Index

The Stream Condition Index (SCI) score is calculated by adding the scores of the seven metrics in the method, i.e., total number of taxa; total number of taxa belonging to the orders Ephemeroptera, Plecoptera, and Trichoptera (EPT taxa); percent Chironomid taxa; percent dominant taxa; percent Diptera; percent filter feeders; and Florida Index.

Evaluation of Toxicity Data

The IWR methodology describes the use of toxicity data for the assessment of aquatic life-based attainment. However, no ambient toxicity data are available for assessment and this metric was not used in the assessment of the 2002 305(b) Report.

Exceedance of Nutrient Thresholds

The State currently has adopted only a narrative nutrient criterion instead of a numerical value. The narrative criteria 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 criteria. In general, the Trophic State Index (TSIs) and the annual mean chlorophyll a values are the primary means for assessing whether a water body should be assessed further for nutrient impairment. While the IWR does consider other information that indicate an imbalance in flora or fauna due to nutrient enrichment such as algal blooms, excessive macrophyte growth, decrease in the distribution (either in density or aerial coverage) of sea grasses or other submerged aquatic vegetation, changes in algal species richness, and excessive diel oxygen swings, these were not considered for the purposes of the 2002 305(b) Report and will instead be evaluated as part of the Basin Assessment Reports.

Data that was inventoried in STORET for the assessment of nutrients included the following parameters:

Nutrients	Chlorophyll *a* for streams and estuaries, and Trophic State Index (TSI) (chlorophyll *a,* total nitrogen, and total phosphorus) for lakes

To assess a water body for nutrient enrichment, at least one sample from each season is required in any given year to calculate a Trophic State Index (TSI) or an annual mean chlorophyll a value for that calendar year, and there must be a annual means from at least four years.

Nutrients in Streams - If the annual mean chlorophyll a concentration is greater than 20 ug/l or if data indicate the annual mean chlorophyll a values have increased by more than 50% over historical values, the water body is potentially impaired. When comparing changes in chlorophyll a values to historical levels, historical levels are based on the lowest five-year average for the period of record. To calculate a five-year average, there must be annual means from at least three years of the five-year period.

Nutrients in Lakes - For the purposes of evaluating nutrient enrichment in lakes the TSI is calculated based on the procedures outlined above. Lakes are potentially impaired for nutrients if:

- Lakes with a mean color greater than 40 platinum cobalt units, the annual mean TSI for the lake exceeds 60, or
- Lakes with a mean color less than or equal to 40 platinum cobalt units, the annual mean TSI for the lake exceeds 40, or
- Data indicate that annual mean TSIs have increased over the 1989 to 1998 assessment period, as indicated by a positive slope in the means plotted versus time, or the annual mean TSI has increased by more than 10 units over historical values. The slope of mean TSIs over time is determined by the Spearman's Ranked Correlation with a 90% confidence level.

Nutrients in Estuaries – Estuaries were potentially impaired if their annual mean chlorophyll a for any year is greater than 11 ug/l or if their annual mean chlorophyll a values have increased by more than 50% over historical values.

Calculating the Trophic State Index for lakes and estuaries.

The Trophic State Index effectively classifies lakes based on their chlorophyll levels and nitrogen and phosphorus concentrations. The TSI is based on a classification scheme developed in 1977 by R.E. Carlson, which relied on three indicators—Secchi depth, chlorophyll, and total phosphorus—to describe a lake's trophic state. A ten-unit change in the index represents a doubling or halving of algal biomass.

The Florida Trophic State Index is based on the same rationale, but total nitrogen replaces 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.

Lake thresholds were based on a regression analysis of data on 313 Florida lakes. The desirable upper limit for the index is 20 micrograms per liter of chlorophyll, which corresponds to an index of 60.

The Nutrient Trophic State Index is based on phosphorus and nitrogen concentrations and the limiting nutrient concept. The latter identifies a lake as phosphorus limited if the nitrogen-to-phosphorus concentration ratio is greater than 30, nitrogen limited if the ratio is less than 10, and balanced (depending on both nitrogen and phosphorus) if the ratio is between10 and 30. The nutrient index is thus based solely on phosphorus if the ratio is greater than 30, solely on nitrogen if less than 10, or on both nitrogen and phosphorus if between 10 and 30.

We calculated an overall Trophic State Index based on the average of the chlorophyll and nutrient indices. Calculating an overall index value requires both nitrogen and phosphorus measurements.

Primary Contact and Recreation Attainment

For Class I, II, or III waters, a water body is potentially impaired for Primary Contact and Recreation attainment if:

* the water segment does not meet the applicable water quality criteria for bacteriological quality based on the methodology previously described, or
* the water segment includes a bathing area that was closed by a local health Department or county government for more than one week or more than once during a calendar year based on bacteriological data, or
* the water segment includes a bathing area for which a local health Department or county government has issued closures, advisories, or warnings totaling 21 days or more during a calendar year based on bacteriological data, or
* the water segment includes 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.

For the 2002 305(b) Report, only bacterial data was used to determine attainment of use for primary contact and recreation. In the future, bathing area closures will also be considered.

Fish and Shellfish Consumption Attainment

For Class I, II, or III waters, a water body is potentially impaired if the water body does not meet the applicable Class II water quality criteria for bacteriological quality or there is either a limited or no consumption fish consumption advisory, issued by the Department of Health, in effect for the water body. In addition, for Class II waters, water segments that have been approved for shellfish harvesting by the Shellfish Evaluation and Assessment Program, but which have been downgraded from their initial harvesting classification to a more restrictive classification, shall be placed in Category 3b or 3c.

Drinking Water Attainment and Protection of Human Health

For Class I waters, a water body is potentially impaired if the water segment does not meet the applicable Class I water quality criteria.

Chapter 4: Watershed Assessment Status Report

River and Stream Assessment

Florida has over 50,000 miles of rivers *(see Table 1)*, half of which are canals. Slightly less than 20,000 of these miles currently have analytical data associated with them, making them available for evaluation using Florida's Waterbody System database (*see Table 17*).

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 freshwater bodies in South Florida are canals, which usually support plants and animals more typical of lakes than rivers.

Still, Florida does have 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 black water 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 river downstream 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 best represent this type of river. 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.

Black water 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 few sediments. 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 several species, including estuarine fish such as spotted sea trout and red drum, as well as manatees.

Attainment of Designated Use

The determination of whether each water body attains its designated use was made by evaluating many different kinds of information, including biological data, standards violations, and posted fish consumption advisories. The methodology described in Chapter 3 describes in detail how this determination was made.

Table 15 summarizes overall attainment of designated uses of Florida's rivers and streams. It should be noted that relatively few river miles are listed in Category 1 (attaining all designated uses). This is to be expected because relatively few waters are monitored to evaluate **all** applicable designated uses. In contrast, Categories 3c and 3d are much larger, but again this is not surprising because the IWR was specifically designed to conservatively identify waters that may be potentially impaired. While categories 3a and 3b (waters with insufficient data) are the largest category, it is important to recognize that data are available for the major rivers in Florida. This category includes many smaller tributaries and portions of river systems between and upstream of monitoring locations. Finally, it should be noted that the impaired category includes zero stream miles because the IWR has not yet gone into effect and waters cannot be verified as impaired at this time.

Table 17: Summary of the Level of Attainment for Rivers and Streams (Miles)

Category	*Miles in Category*
Attaining all designated uses (1)	164
Attaining some designated uses (2)	2461
Potentially Impaired (3c, 3d)	6391
Impaired (4 & 5)	0
No or insufficient data to determine if any designated use is attained (3a, 3b)	10518

Table 18 lists river miles that attain or fail to attain specific uses such as aquatic life, primary contact (swimming and recreation), fish consumption, and drinking water. Florida's criteria do not distinguish between protecting aquatic life, the protection of fish and wildlife populations, and recreational activities; these are all included in Class III water quality standards. Class I waters must also protect general human health, aquatic life, and allow for the protection of fish and wildlife, and recreational uses.

Table 18: Individual Attainment in Rivers (miles)

Category	Aquatic life	Primary Contact	Fish	Drinking Water
Attaining all or some designated uses (1,2)	3637	5225	1004	See Table 24
Potentially Impaired (3c, 3d)	4708	854	2924	“
Impaired (4 & 5)	0	0	0	“
No or sufficient data to determine if any designated use is attained (3a, 3b)	11189	13455	15607	“

Trends in Stream Water Quality

Trends in Florida streams between 1991 and 2000 were analyzed. 533 streams had sufficient data for trend analysis. Of these 533 streams, 79 were improving, 19 were declining, and 435 showed no trend *(see Table 19).*

Table 19: Trends in Streams

	Number	Miles
Surveyed	533	5,719
Improving	79	729
Stable	435	4,726
Degrading	19	264

Causes and Sources of Non-Attainment of Designated Use

For each water body that has been identified as impaired (non-attainment of its designated use), both causes (such as nutrients and oxygen demanding substances) and sources (such as industrial and municipal point sources and agricultural runoff) of the problem are identified.

Assessing Causes.
No rivers or streams have been determined to be impaired (Category 4 or5).

Lake Assessment

Florida has 7,712 public lakes with a surface area greater than or equal to ten acres. Of these, 601 had water-monitoring data, representing a total of 1,302,976 acres *(Table 20)*.

Attainment of Designated Use

Florida lakes are functionally designated as either Class I (public drinking water supply) or Class III (wildlife and/or recreational use). Although this report assesses a relatively small number of lakes, they represent close to 80 percent of the state's lake surface area. In deciding whether individual lakes attain their designated use, the methodology previous described was used.

Table 20: Total Lake Waters (acres)

Total lake acres	1,632,512
Significant public acres	1,632,512
Number of lakes greater than ten acres	7,712
Surveyed acres	1,302,976

Note: It was assumed that all lakes are public access, by definition.

Table 21 summarizes attainment of designated use of Florida's lakes. The impaired category included lakes that are verified impaired and will require the development of a TMDL as previously defined. Although this category includes one quarter of the total lake area, the information should not be interpreted to mean that a large number of lakes are impaired. Only Lake Okeechobee, designated as impaired by the legislature in the FWRA, is currently listed as impaired. It is a very large lake and comprises all of the area show below. Other lakes will be added to this category once the IWR is available for use.

Table 21: Summary of Attainment for Lakes (acres)

Category	Assessed
Attaining all designated uses (1)	6,016
Attaining some designated uses (2)	254,464
Potentially Impaired (3c, 3d)	635,008
Impaired (4 & 5)	407,488
No or insufficient data to determine if any designated use is attained (3a, 3b)	329,536

Impaired = verified as not attaining its designated use

Table 22 lists the total lake areas that attain or fail to attain specific uses such as aquatic life, primary contact (swimming and recreation), fish consumption, and drinking water. Florida's standards and criteria do not distinguish between protecting aquatic life, the protection of fish and wildlife populations, and recreational activities; these are all included in Class III water quality standards. Class I waters must also protect aquatic life, allow for the protection of fish and wildlife, and recreational uses.

Table 22: Individual Attainment in Lakes (acres)

Category	**Aquatic life**	**Primary Contact**	**Fish**	**Drinking Water**
Attaining all or some designated uses (1)	253,504	489,664	654,400	See Table 25
Potentially Impaired (3c, 3d)	574,592	9,728	226,176	"
Impaired (4 & 5)	407,488	0	0	"
No or insufficient data to determine if any designated use is attained (3a, 3b)	396,928	1,133,120	751,936	"

Causes and Sources of Non-Attainment of Designated Use

Lake Okeechobee, a Class 1 waterbody, is the only lake that has been designated as impaired. The TMDL for the lake was completed and approved by EPA on December 21, 2001. The cause of the impairment for many of the segments of the lake is phosphorus. The entire TMDL (140 metric tons/year) is allocated to nonpoint sources. This is based on an in-lake target restoration goal of 40 ppb. Lake Okeechobee is also on the 1998 303(d) list for coliforms, dissolved oxygen, iron, and un-ionized ammonia.

Lake Protection, Management, and Restoration in Florida

Many different levels of government address lake water quality, restoration and rehabilitation, and management. The EPA's Clean Lakes Program, Florida's SWIM Program, the Florida Game and Fresh Water Fish Commission's lake restoration program, FDEP's Aquatic Plant Management Program, the WMDs, local governments, and volunteers are all important participants. Work often proceeds as a partnership of local, federal, and state governments, with the costs shared by all.

Trends in Lake Water Quality

Trends in Florida lakes between 1991 and 2000 were analyzed. Of 601 lakes, only 424 had sufficient data for trend analysis. Of these 424 lakes, 57 were improving, 71 were declining, and 296 showed no trend *(see Table 23).*

Table 23: Trends in Significant Publicly Owned Lakes

	Number	Acreage
Surveyed	424	1,110,080
Improving	57	66,432
Stable	296	728,256
Degrading	71	315,392

Water quality improved in most lakes after new regulations removed the majority of point source discharges — mainly wastewater effluent — in the 1970s and 1980s. The change was most obvious in the Orlando area when effluent was eliminated from the headwaters of Lakes Howell, Jesup, and Harney, which had serious water quality problems.

Estuary and Coastal Assessment

With over 8,000 coastal miles on three sides, Florida is second only to Alaska in amount of coastline. The state's west coast alone contains almost 22 percent of the Gulf Coast estuarine acreage in the United States. *Table 24* shows the state's total estuarine and ocean shore waters.

Table 24: Total Estuarine and Ocean Shore Waters

Total estuarine square miles	4,437
Surveyed square miles	4,038
Coastal shoreline miles	8,460
Surveyed shoreline miles	0

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, vast mangrove swamps, coral reefs, oyster bars, and tidal segments of large river mouths.

The Atlantic coast of Florida from the mouth of the St. Mary's 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 eighteen 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, 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 flows across the Everglades.

Florida's west coast has low relief, since 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 lay behind low-energy barrier islands or at the mouths of rivers that discharge into salt marshes or mangrove-fringed bays.

The Big Bend from the Anclote Keys north to Apalachee Bay is low-energy marsh shoreline. It does not conform to the classical definition of an estuary, although 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 Georgia state line. West of Apalachicola Bay, estuaries 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 sea grasses are most abundant from Tarpon Springs to Charlotte Harbor, and from Florida Bay to Biscayne Bay.

Unfortunately, human activities have affected many estuaries, even though they are an important ecological and economic resource. Population growth and associated development pressures have contributed to their deterioration, since about three-fourths of new Florida residents choose coastal locations for their new homes.

Attainment of Designated Use

Florida's estuarine and coastal areas are either Class II waters (shellfish harvesting or propagation) or Class III waters (recreational and wildlife use). *Table 25* lists the total areas and attainment of designated use of estuaries.

Table 25: Summary of Attainment of Designated Uses for Estuaries (square miles)

Category	Assessed
Attaining all designated uses (1)	6
Attaining some designated uses (2)	2,500
Potentially Impaired (3c, 3d)	1,150
Impaired (4 & 5)	0
No or insufficient data to determine if any designated use is attained (3a, 3b)	724

Decisions on whether individual estuaries attain their designated use are based on the methodology previously described (Chapter 3).

Almost 70% of the state's estuaries attain their designated use. *Table 26* identifies the total estuarine areas that attain different levels of designated use specified by the EPA.

Table 26: Individual Assessment of Attainment in Estuaries (square miles)

Category	Aquatic life (Class III)	Primary Contact	Fish/Shellfish (Class II)
Attaining all or some designated uses (1,2)	2,636	2,325	90
Potentially Impaired (3c, 3d)	990	165	273
Impaired (4 & 5)	0	0	0
No or insufficient data to determine if any designated use is attained (3a, 3b)	757	1,893	4,020

Impaired = verified not attaining its designated use

Florida's standards and criteria do not distinguish between protecting aquatic life, protection of fish and wildlife populations, and recreational uses, all of which are included in Class III standards.

Table 24 was generated by identifying the square miles of attainment or non-attainment of designated use for each of Florida's water quality standards. The areas for aquatic life, swimming, and secondary contact were obtained for Class III waters. The same total area was used for each of these categories. The square miles listed for shellfishing are different because Class II areas were combined to identify the shellfish-harvesting areas.

Trends in Estuary Water Quality

Trends in Florida estuaries between 1991 and 2000 were analyzed. For the estuaries, 166 had sufficient data for trend analysis. Of these 166 estuaries, 19 were improving, 11 were declining, and 136 showed no trend *(see Table 27).*

Table 27: Trends in Estuaries

	Number	Acreage
Surveyed	166	2,334
Improving	19	114
Stable	136	1,911
Degrading	11	310

Causes and Sources of Non-Attainment of Designated Use

As noted previously, the IWR has not yet gone into effect and, as such, no estuarine waters can be assessed as impaired (Category 4 or 5) at this time.

Sediment Contamination

Florida's unique geologic and hydrologic features make 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 fisheries.

Although Florida currently has no criteria for heavy metals or toxic organics in sediments, FDEP's Coastal Zone Management Section 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.[5] 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.[6]

A 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 three 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 one 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 percent of the samples tested for organic chemicals. Of this group, fluoranthene and pyrene were found in more than 50 percent 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. They provide ranges of concentrations that could cause a specific level or intensity of biological effects.

Using data from twenty different areas of Florida, FDEP developed preliminary guidelines for thirty-four priority contaminants in coastal and marine sediments.[7] 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 twenty-eight substances have a high or moderate degree of reliability. The guidelines for all thirty-four

5 This effort culminated in the release of the document A Guide to Interpretation of Metal Concentrations in Estuarine Sediments, Florida Department of Environmental Regulation, Coastal Zone Management Section, April 1988.
6 The expanded database is summarized in Florida Coastal Sediment Contaminants Atlas, FDEP, 1994.
7 This approach was adapted from recommendations by Long and Morgan, National Oceanic and Atmospheric Administration National Status and Trends Approach, 1990.

substances, used collectively, predict the potential effects of contaminated marine and estuarine sediments on biological communities.[8]

Although the guidelines are a valuable tool, it is recommended that they be used with other tools and 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 numerical attainment levels for cleaning up Superfund sites.

In 2002, the Department released an Excel-based statistical tool which guides a user in answering questions about metals enrichment in freshwater sediments. It utilizes the technique of normalization of sediment metal concentrations to both aluminum and iron in the sediment to estimate anthropogenic impacts. Additionally, in late 2002, the Department will release a document that provides guidance in the interpretation of freshwater sediment chemistry data as it relates to biological impact at a site from sediment contaminants. These freshwater sediment guidelines were developed with the same weight-of-evidence statistical approach used to develop the 1994 Coastal sediment quality guidelines mentioned above.

Public Health Concerns

Public Health: Drinking Water

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

Attainment for Drinking Water Use

To determine attainment for drinking water use, the data for all Class I rivers and lakes in the state were examined as previously described.

8 For a complete discussion of methodology, see the report, Approach to the Assessment of Sediment Quality in Florida Coastal Waters, D.D. MacDonald, McDonald Environmental Sciences Ltd., 1994.

Summary of Attainment of Designated Use as Drinking Water

Rivers, Streams, and Reservoirs

Tables 28 and 29 summarize the causes and acreages of water bodies not attaining its drinking water use.

Table 28:Summary of Attainment of Drinking Water Use: Rivers and Streams

Total miles assessed for drinking water use — 308.3 Major causes				
Attaining all or some designated uses (1,2)	308.3	Percent Attaining all or some designated uses (1,2)	100%	
Miles potentially impaired (3c, 3d)	0	Percent potentially impaired (3c, 3d)	0%	
Miles impaired (4,5)	0	Percent impaired	0%	
Total miles assessed for drinking water use	308.3	Percent assessed	100%	

Table 29: Summary of Attainment of Drinking Water Use: Lakes and Reservoirs

Total area assessed for drinking water use — 419,008 acres Major causes				
Acres attaining all or some designated uses (1,2)	408,064	Percent attaining all or some designated uses (1,2)	97%	
Acres potentially impaired (3c, 3d)	10,944	Percent potentially impaired (3c, 3d)	3%	
Acres impaired (4,5)		Percent impaired	0%	
Total acres assessed for drinking water use	419,008	Percent assessed	100%	

Status Reports as Supportive Data

The development of a Status Report is part of the first phase of the statewide, watershed management approach of the Florida Department of Environmental Protection for each assessed basin. Each report provides a preliminary evaluation of the status of water quality and associated biological resources in the identified basin. These reports are addressed to a broad audience of potential stakeholders, including decision-makers from federal, state, regional, tribal, and local governments; public and private interests; and individual citizens. The status report is the first of several steps to be taken in the basin to implement Total Maximum Daily Load (TMDL) Program requirements for waters that are impaired, using a watershed management approach to restoring and protecting water quality. Status Reports have been developed for the following basins:

Group 1

- St. Marks / Ochlockonee River
- Tampa Bay
- Suwannee River
- Ocklawaha River
- Everglades West Coast
- Lake Okeechobee

Group 2

- Apalachicola River
- Lower St. Johns River
- Upper St. Johns River
- Tampa Bay Tributaries
- Charlotte Harbor
- St. Lucie Estuary

A subsequent Basin Assessment Report, to be completed in approximately eighteen months following the Status Report, will include additional data, a more complete evaluation of surface water and ground water quality and ecological resources, and a list of water bodies that will be included on the verified list of impaired waters to be adopted by the Department. These two reports will serve as the Technical documents for the 305b Report.

Wetlands Assessment

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:

1. *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 twenty miles south of Lake Okeechobee to Florida Bay.*

2. *The Green Swamp in the state's central plateau.*

3. *The Big Bend coast from the St. Marks River to the (South) Withlacoochee River.*

4. *Vast expanses of spartina marsh between the Nassau and St. Marys rivers*

5. *The system of the St. Johns River Marshes. Before alteration by humans, all but the northernmost 100 km of the 480 km of river basin was an extensive freshwater system of swamps, marshes and lakes[9]. Even today, 1/2 the length of the St. Johns River is actually marsh, and in many respects functions like a northern flowing Everglades.*

6. *The headwaters and floodplains of many rivers throughout the state, especially the Apalachicola, Suwannee, St. Johns, Ocklawaha, Kissimmee, and Peace rivers.*

Although information on the historical extent of Florida's wetlands is limited, one researcher estimates that the state lost as many as 46 percent of its original wetlands between the 1780s and the 1980s *(see Table 30 for estimates of Florida's historical wetlands).*

Table 30: Historical Estimates of Wetlands in Florida

Period	Wetlands acreage	Source
circa 1780	20,325,013	*Dahl*
mid-1950s	12,779,000	*Hefner*
mid-1970s	11,334,000	*Hefner*
mid-1970s	11,298,600	*Frayer and Hefner*
1979 - 1980	11,854,822	*National Wetlands Inventory*
circa 1980	11,038,300	*Dahl*

Sources:
Dahl, Thomas E., *Wetland Losses in the United States, 1780s to 1980s* (U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C., 1990).
Frayer, W.E. and J.M. Hefner, *Florida Wetlands Status and Trends, 1970s to 1980s* (U.S. Department of the Interior, Fish and Wildlife Service, Atlanta, September 1991).
Hefner, John M., *Wetlands of Florida, 1950s to 1970s* (in *Managing Cumulative Effects in Florida Wetlands* [Conference Proceedings, October 17-19, 1985], New College, Sarasota, 1986).
National Wetlands Inventory, Florida Wetland Acreage (U.S. Fish and Wildlife Service, St. Petersburg, January 1984).

Wetlands Management and Protection

While no formal, statewide wetlands conservation plan exists, the state's wetlands protection programs are well established in Florida's statutes, regulations, and policies. The 1984 Warren S. Henderson Wetlands Protection Act formally recognized the value of the state's wetlands in protecting water quality and biological resources. The act regulated permitting and required the tracking of affected wetlands and the creation of a wetlands inventory.[10] Wetlands protection was amended in 1993 to provide a unified statewide approach to defining wetlands and to streamline permitting into a single Environmental Resource Permitting Program for regulating point and nonpoint pollution as well as water quantity.

Enforcing the Environmental Resource Permit relies heavily on public awareness. Although each district 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.

Instead of using the federal methodology for defining wetlands, FDEP's rules address the extent of its wetlands jurisdiction (Chapter 62-340, F.A.C.). 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.

[9] *Kushlan 1990, Ecosystems of Florida*
[10] *Because of a variety of funding and contract problems, the inventory has not yet been created.*

Under the rule, the landward extent of a wetland is defined by the dominance of plants, soils, and other evidence of regular or periodic inundation or saturation with water. Florida's approach compares with the federal in scope but differs in its use of soils and the vegetative index. As part of the process of expanding the Army Corps of Engineers' state programmatic general permit, field-testing is under way to refine the differences between the state and federal approaches.

Numerous programs are working to restore both freshwater and estuarine wetlands — most notably, the Everglades system. Over 40,000 acres of filtration marshes known as Stormwater Treatment Areas are being built to reduce the phosphorus in agricultural runoff entering the Everglades. Filtration marshes are also being used in the Ocklawaha River and Upper St. Johns River basins.

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 Florida Game and Fresh Water Fish Commission have mapped wetlands. Local governments have also carried out mapping to comply with local comprehensive land-use plans. Several programs to map estuarine sea grasses have begun under the National Estuary Program and the state SWIM Program in the Indian River Lagoon, 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 Conservation and Recreation Lands Program, administered by FDEP, and the Save Our Rivers Program, administered by the WMDs. Both are funded primarily by the documentary stamp tax on the transfer of property. Additional funding comes from the Preservation 2000 Trust Fund. In addition to outright land purchases, the state and WMDs 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.

Integrity of Wetlands Resources

Table 31 summarizes the acreage of affected wetlands (regulated by FDEP and the WMDs) from 1985 to 1993. Implementing the Environmental Resource Permit Program, adopting a unified approach to defining wetlands, and sharing information between FDEP and the WMDs will substantially reduce problems in future reports. In comparing the numbers, the following should be considered:

1. *The numbers reflected only wetlands permits and did not measure overall trends. Wetlands lost to nonpermitted or exempt activities were not tracked.*

2. *Some minimal overlap occurred where FDEP and the WMDs both issued permits.*

3. *The WMDs used different measurements to determine jurisdictional wetlands during this period.*

4. *Not all figures were verified by field inspections or remote-sensing techniques.*

Table 31: Wetlands Acreage Affected by Permitted Activities, 1985 – 1993

Agency	Wetlands acreage			
	Lost	Created	Preserved	Improved
FDEP	7,827	39,272	20,900	123,843
WMDs				
Northwest Florida	187	170	1,986	0
Suwannee River	188	45	7,343	0
St. Johns River	4,351	8,719	65,256	14,028
Southwest Florida	4,293	3,409	30,549	1,254
South Florida	13,658	11,532	73,135	20,893
Totals	30,504	63,147	199,169	160,018

Lost — Wetlands destroyed.
Created — Wetlands created from uplands or nonjurisdictional wetlands connected to jurisdictional wetlands.
Preserved — Jurisdictional wetlands legally entered into some type of conservation easement.
Improved — Poor-quality jurisdictional wetlands enhanced by activities such as improved flow and the removal of exotic species.

Florida does not assess support for designated use for wetlands as it does for other surface waters. Although some background data are collected for issuing permits (particularly for wastewater discharged to wetlands) and restoration programs may require water quality data, no comprehensive wetlands-monitoring network exists.

Development of Wetlands Water Quality Standards

The state's policy for preventing wetlands degradation is set out in Section 403.918, F.S., and in Section 62-302.300 and 62-4.242, F.A.C. Proposed permits that may degrade wetlands must be clearly in the public interest. More stringent tests apply to activities that may degrade wetlands in OFWs. Finally, an extremely rigorous nondegradation policy covers Outstanding National Resource Waters.[11]

Since wetlands are considered waters of the state, they are regulated under the same standards as other surface waters *(Table 32 summarizes the development of wetlands and surface water standards),* and the same five functional classifications described earlier also apply.

Florida's rules already contain qualitative and quantitative biological criteria such as dominance of nuisance species and biological integrity. The state has spent the past ten years developing procedures for assessing biological communities in streams and lakes, defining relevant ecoregions, and identifying relatively pristine reference sites. Similar work and procedures for wetlands are under early development.

Table 32: Development of State Wetlands Water Quality Standards

	In place	Under development	Proposed
Use classification	X		
Narrative (qualitative) biocriteria	X	X	X
Numeric (quantitative) biocriteria	X	X	X
Antidegradation	X		
Implementation method	X		

[11] *Although this last designation, created in 1989, applies to Everglades and Biscayne national parks, it has not been confirmed by the Florida legislature.*

Additional Wetlands Protection

Florida's five WMDs 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. A state committee advises the districts on silvicultural BMPs in hardwood forested wetlands. The districts also administer permits for surface water and ground water withdrawals (consumptive use permitting) under Part II, Chapter 373, F.S.

Mitigation is often used to offset otherwise unpermittable wetlands impacts. Accepted by rule since 1984 under Part III, Chapter 62-312, F.A.C., mitigation includes the restoration, enhancement, creation, or preservation of wetlands, other surface waters, or uplands. The amount of land to be mitigated, called the mitigation ratio (mitigation ratio = land mitigated/land affected) is based on the quality of the area affected, its function, and the ability of mitigation to replace those functions. Ratios generally range 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.

FDEP adopted rules governing mitigation banks in February 1994 under Chapter 62-342, F.A.C. A mitigation bank is a large area set aside for preservation or restoration. Permit applicants can, for a fee, withdraw mitigation credits to offset damage to wetlands functions. Mitigation credits are the increase in ecological value from restoring, creating, enhancing, or preserving wetlands.

Chapter 5: Ground Water Assessment

Ground Water Assessment Status Report

Ground Water Indices

A Ground Water Quality Criteria Index (GWQCI) and a Basin Resource Index (BRI) have been developed to analyze status network data and assess water quality on a well-specific and regional basis respectively[12]. Separate indices are calculated for confined ground water and unconfined ground water. Additionally, each index is subcategorized for public health concerns (e.g. $BRI_{(H)}$) and aesthetic quality (e.g. $BRI_{(A)}$).

Ground Water Quality Criteria Indices are a very simple concept, describing water quality for an individual ground water sample and concomitant individual well or spring.

1. ***$GWQCI_{(H)}$*** is a measure of potential human ***health*** impacts. If one or more analytes in an individual ground water sample is found to exceed a primary ground water maximum contaminant level or health based guidance concentration level, the sample is considered an unacceptable risk as drinking water.
2. ***$GWQCI_{(A)}$*** is a measure of ***aesthetic*** ground water conditions. If one or more analytes in an individual ground water sample is found to exceed a secondary maximum contaminant level or aesthetic based guidance concentration level, the sample is considered a concern for drinking water quality.

Table 33: Florida Ground Water Quality Monitoring Program Analyte List*

[12] Upchurch S.B. and Copeland R.E., 2001, Florida's Ground Water Quality Criteria, and Basin Resources Indices, Florida Department of Environmental Protection, Ground Water Protection Section, Technical Document, 2001-02.

STANDARD ANALYTE LIST			
Water level	Dissolved sodium	Dissolved iron	Nitrate + nitrite
Specific conductance	Dissolved potassium	Dissolved manganese	Ammonia
Temperature	Dissolved calcium	Dissolved strontium	Turbidity
Dissolved oxygen	Dissolved magnesium	Dissolved aluminum	Dissolved sulfate
Dissolved fluoride	Dissolved chloride	Sulfide	Orthophosphorus
pH (relative acidity or alkalinity)	Total Kjeldahl nitrogen	Dissolved alkalinity	
Eh (oxidation reduction or redox potential)			

TRACE METAL ANALYTE LIST			
Total iron	Dissolved barium	Dissolved organic carbon	Total carbon
Total manganese	Dissolved silver	Total organic carbon	Total arsenic
Total strontium	Dissolved chromium	Dissolved copper	Total copper
Total aluminum	Dissolved nickel	Total barium	Total cadmium
Total mercury	Dissolved zinc	Dissolved lead	Total lead
Total selenium	Total nickel		

VOC/BNA ANALYTE LIST	
VOCs — Volatile organic chemicals	BNAs — Base neutral acid extractables

PESTICIDE ANALYTE LIST				
Carbamates	Chlorinated pesticides	Nitrogen/phosphorus pesticides	Herbicides	Urea

TEMPORAL VARIABILITY ANALYTE LIST					
Water level	Temperature	pH	Eh	Dissolved oxygen	Specific conductance

**The Temporal Variability Network is only sampled for the Temporal Variability Analyte List, while the Background Network and the VISA Network are sampled for all these measures*

GWQCI results are categorized as shown in Table 34

Table 34: Ground Water Quality Criteria Indices

INDEX	ANALYTE EXCEEDS		CATEGORY
GWQCI (H)	Primary MCL or Health Based GCL	YES	***A - Action Recommended***
		NO	***N - No Basis for Action nor Concern***
GWQCI (A)	Secondary MCL or Aesthetic Based GCL	YES	***C - Concern***
		NO	***N - No Basis for Action nor Concern***

Appropriate actions recommended for '**A**' and '**C**' classified wells (or basins, see BRI) will be situation dependent. Actions could range from filtering contamination from individual wells, to large-scale sub-regional monitoring and sampling projects. Regulatory actions may include the delineation of contaminated areas where stricter well construction standards are required, or the development and implementation of BMPs (e.g. perhaps to address septic tank influences).

The indices are analyte dependent and an index cannot be changed until the well or spring has been resampled. Since all possible analytes are not sampled, an ***N*** label does not mean that the sample provides no risk, but that there does not exist enough evidence to suggest the Department should be concerned about the ground water in the well. GWQCI results should be carefully evaluated and only statements concerning ground water quality based on the measured analytes should be made. Comparative analysis of wells can only be attempted when GWQCIs are based on a standard analyte list.

Basin Resource Indices indicate overall ground water quality on a regional scale. Each BRI is determined by the percentage of randomly sampled wells categorized as being either ***A***, or ***C*** based on the corresponding GWQCIs. If greater than **ten percent** of the randomly sampled wells in a region are classified as ***A***, or ***C*** then the entire region is categorized for Action or Concern, as demonstrated in Table 35. BRIs are not calculated in basins with less than 20 samples.

Table 35: Basin Resource Indices

INDEX	***WELLS EXCEED 10%***		***REGIONAL CATEGORY***
BRI(H)	> 10% of wells in region categorized as A	YES	***A - Action Recommended***
		NO	***N - No Basis for Action nor Concern***
BRI(A)	> 10% of wells in region categorized as C	YES	***C - Concern***
		NO	***N - No Basis for Action nor Concern***

Note: the Status Network collects Color and pH data and both have aesthetic MCLs. However, color was found to exceed the secondary MCL in all 20 Reporting Units of the state for both confined and unconfined ground water in greater than 10% of the samples. If used, the BRIs of all Reporting Units would fall into the C category. Since color lacks discriminatory power, it is not included in determining GWQCIs and BRIs. Similarly, pH exceeds its secondary MCL in greater than 10% of the samples in all **sand aquifers** of the state. As with color, pH lacks discriminatory power in sand aquifers. Thus pH is also not used in determining GWQCIs and BRIs.

Elevated Analyte Concentrations and Potential Impacts of Ground Water on Surface Water

The ground water indices focus on ground water's designated use as drinking water; however they do not address ground water's significant influence on surface water. Precipitation is abundant in Florida and ground water levels are typically near or at land surface during the majority of the year. Thus, for most of the year, ground water flows from the ground water realm to surface water. This baseflow can account for more than 40% of a surface water's volume. This creates the potential for ground water quality to adversely influence the environmental conditions of surface water bodies. For example, ground water with a nitrate (NO_3^- as N) concentration of 9.0 mg/L meets the ground water standard of 10 mg/L, but can cause significant adverse effects when it interacts with surface water having a natural nitrate background of 0.5 mg/L.

Status Network 2000 Data Assessment – Ground Water Indices

Figure 6 identifies the Status Network Reporting Units that were sampled during the year 2000; the latest data that has been evaluated. These Reporting Units are generally equivalent to the following Group One basins that are part of Florida's rotating basin sequence.

Reporting Unit	Basin
NWFWMD(A)	Ochlockonee / St. Marks
SRWMD(A)	Middle and Lower Suwannee River
SJRWMD(D)	Ocklawaha River
SWFWMD(B)	Tampa Bay
SFWMD(A)	Lake Okeechobee

As described previously, thirty samples were collected from the confined and unconfined aquifer in each basin. Table 36 lists the Ground Water Quality Criteria Indices results for each basin. The # of Wells identifies how many wells, of the 30 sampled, had concentrations exceeding the ground water criteria. The Contaminants column lists the specific analytes that exceeded the criteria. Each of these wells are categorized as **A** – action recommended for the health based GWQCI, or **C** – cause for concern for the aesthetics based GWQCI. Basins not listed, or with blank categories had no wells with exceedances of ground water criteria, e.g. the Unconfined Ocklawaha Basin.

Table 36: Ground Water Quality Criteria Indices

Unconfined Ground Water				
	$GWQCI_{(H)}$		$GWQCI_{(A)}$	
Basin	**# of Wells**	**Contaminants**	**# of Wells**	**Contaminants**
Lake Okeechobee	3	NO_3^-	4	TDS
	2	Na	2	Cl^-
	1	Fecal Coliform	1	SO_4^{2-}
Ocklawaha River	1	NO_3^-		
	1	Fecal Coliform		
St. Marks / Ocklochonee River	3	Fecal Coliform		
Middle and Lower Suwannee River	3	Fecal Coliform		
Tampa Bay	6	Fecal Coliform	1	TDS
	2	Na	2	Cl^-
	1	NO_3^-		

Confined Ground Water				
	$GWQCI_{(H)}$		$GWQCI_{(A)}$	
Basin	**# of Wells**	**Contaminants**	**# of Wells**	**Contaminants**
Lake Okeechobee	4	Fecal Coliform	5	TDS
			4	Cl^-
			2	SO_4^{2-}
Ocklawaha River	1	Fecal Coliform	1	TDS
			1	Cl^-
St. Marks / Ocklochonee River	2	Fecal Coliform		
Tampa Bay	1	Fecal Coliform	5	SO_4^{2-}
			6	TDS
			1	Cl^-

Basin Resource Indices results are listed in Table 37. No BRIs were calculated for confined ground water in the Middle and Lower Suwannee River Basin because there are too few wells to make a statistically viable result.

Table 37: Basin Resource Indices

Unconfined Ground Water					
BRI$_{(H)}$					
Basin	**Total Wells N**	**% of N Wells**	**Total Wells A**	**% of A Wells**	**BRI(H)**
Lake Okeechobee	24	80	6	20	**A**
Ocklawaha River	28	93.3	2	6.7	**N**
St. Marks / Ocklochonee River	27	90	3	10	**N**
Middle and Lower Suwannee River	27	90	3	10	**N**
Tampa Bay	21	71	9	29	**A**
BRI$_{(A)}$					
Basin	**Total Wells N**	**% of N Wells**	**Total Wells A**	**% of A Wells**	**BRI(A)**
Lake Okeechobee	26	86.7	4	13.3	**C**
Ocklawaha River	30	100	0	0	**N**
St. Marks / Ocklochonee River	30	100	0	0	**N**
Middle and Lower Suwannee River	30	100	0	0	**N**
Tampa Bay	28	93.3	2	6.4	**N**

Confined Ground Water					
BRI$_{(H)}$					
Basin	**Total Wells N**	**% of N Wells**	**Total Wells A**	**% of A Wells**	**BRI(H)**
Lake Okeechobee	26	86.7	4	13.3	**A**
Ocklawaha River	29	96.7	1	3.3	**N**
St. Marks / Ocklochonee River	28	93.3	2	6.7	**N**
Tampa Bay	29	96.7	1	3.3	**N**
BRI$_{(A)}$					
Basin	**Total Wells N**	**% of N Wells**	**Total Wells A**	**% of A Wells**	**BRI(A)**
Lake Okeechobee	25	83.3	5	16.7	**C**
Ocklawaha River	28	93.3	2	6.7	**N**
St. Marks / Ocklochonee River	30	100	0	0	**N**
Tampa Bay	24	80	6	20	**C**

Lake Okeechobee has regional water quality problems in both the unconfined and confined aquifers, and for both health and aesthetic reasons. This water quality is probably related to the upwelling of saline waters in the confined aquifers that is exacerbated by agricultural pumping. As these more mineralized waters are used for irrigation purposes, the unconfined aquifer experiences a concomitant increase in saline analytes. The wells displaying these results are all located on sandy ridge features where citrus production is prevalent. There are few water wells in the area that could be impacted.

Tampa Bay has regional water quality problems in the unconfined aquifer based on health reasons, and regional aesthetic concerns in the confined aquifer. The aesthetic concerns are related to saline water intrusion along the coast. The unconfined aquifer is being affected by fecal coliforms and nitrates. The origin of fecal coliforms is believed to be warm-blooded animals. Thus, its presence in ground water suggests a near surface origin. Its presence could be an indication that contaminated surface water is migrating downward through the annular space of the wells, or it could mean that a source of fecal coliforms exist in the local ground water. It should be understood that the behavior of fecal coliforms in ground water is not very well understood at this time and further studies addressing this issue are warranted. The source of nitrate is probably a result of intense nonpoint, agriculturally related land use activities within the basin or due to the abundance of septic tanks in the basin.

No other basins had BRIs indicating regional water quality problems.

Status Network 2000 Data Assessment – Elevated Analyte Concentrations

This assessment compares Status Network data from one Reporting Unit and historical Background Network data (described below) from the other Reporting Units within a water management district. This process evaluates the potential impacts of ground water on surface water and illustrates differences between ground water in different regions of a WMD. Background Network data were limited to that collected during the 1996-1999 time period. The analysis was performed separately for Confined and Unconfined ground water. A Mann-Whitney statistical test[13] is used to compare the distributions of two populations by comparing their corresponding median values.

Regional comparisons were made to determine if some analytes exist in specific basins at levels significantly greater than background levels within the entire water management district. Table 38 shows these results.

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[13] *Mendenhall, W., Scheaffer, R.L, and Wackerly, D.D., 1981, Mathematical Statistics with Applications, Second Edition, Duxbury Press, Boston, MA.*

Table 38: Mann-Whitney Statistical Tests Comparing Basin Results to Entire WMD

Unconfined Ground Water				
Basin	**Analyte**	**Median Concentration Basin**	**Median Concentration WMD**	**Basin/WMD Ratio**
Lake Okeechobee	P	0.086	0.04	2.18
Ocklawaha River	Temp	23.4	22.7	1.03
	DO	3.56	0.6	5.93
	F^-	0.18	0.1	1.8
	NO_3^-	0.56	0.02	28
Middle and Lower Suwannee River	Temp	22.6	21.9	1.03
	DO	1.62	0.28	5.79
	pH	7.16	6.9	1.04
	NO_3^-	0.53	0.02	26.5
St. Marks / Ocklockonee River	SC	87	39.5	2.2
	Ca	4.2	1.24	3.39
	Mg	0.64	0.05	12.31
	Alkalinity	5.19	1	5.19
	Color	100	15	6.67
	Na	3.1	2.2	1.41
	Cl^-	5.3	3.4	1.56
	P	0.02	0.01	2.2
	o-PO4	0.013	0.01	1.3

Confined Ground Water				
Basin	**Analyte**	**Median Concentration Basin**	**Median Concentration WMD**	**Basin/WMD Ratio**
Middle and Lower Suwannee River	Color	20	5	4
	P	0.13	0.06	2.17
	Ca	62.4	42.9	1.45
	Alkalinity	185	151	1.23
St. Marks / Ocklochonee	Na	3.85	2.85	1.35
Tampa Bay	SO_4^{2-}	29	7	4.14

All units are in mg/L.
Significance Level = 0.05 for each test.
Only analytes displaying statistically significant elevated concentrations are listed.

Lake Okeechobee has phosphorus levels in the unconfined aquifer at levels significantly greater than across the entire SFWMD. This increase has several possible sources, including natural phosphatic portions of the aquifer, the heavy use of fertilizers in the region, or from an abundance of septic tanks.

Ocklawaha River shows an increase in the median value of temperature; that is related to the season of the year that sampling took place. The Status Network was sampled in the summer, however the historical Background Network was sampled in the spring and winter. Increases in DO are probably indicative that Status Network wells tap shallower portions of the aquifer than wells of the Background Network. Shallower wells have more naturally occurring DO than deeper ones. Increases in fluoride concentrations are suggestive that the Status Network wells tap portions of the aquifer that naturally have greater fluoride concentrations relative to the Background Network.

Finally, nitrate has a median concentration of 0.56 mg/l in the Ocklawaha River Basin, relative to 0.02 in the remainder of the SJRWMD. The median concentration ratio is 28.00. The 28-fold increase in the median concentration indicates that nitrate is a significant problem in the Ocklawaha River basin. It is very probably a result of intense nonpoint, agriculturally related land use activities within the basin. Septic tanks may also contribute to this increase.

It should be noted that the $BRI_{(H)}$ for the basin did not indicate a problem for nitrate. Nevertheless, the Mann-Whitney test indicates a significant one. The reason for the discrepancy is that the BRI is based on a drinking water designated use. The $BRI_{(H)}$ does not recognize increased nitrate concentrations unless the concentrations exceed the MCL. Apparently the proportion of exceedances is low, even though the actual concentrations are high.

Middle and Lower Suwannee River has several analytes with a significant elevation in the MLSR basin, relative to the remainder of the SRWMD. In the confined aquifer, color, phosphorous, calcium, and alkalinity display a significant increase in median concentration for the MLSR basin. The table indicates that the median ratios range from 1.23 for alkalinity to 4.00 for color. The increases in calcium and alkalinity impose no environmental or health concerns. Wells tapping different zones within the carbonate Floridan aquifer may account for this discrepancy. Color may reflect that the Status Network wells tap different zones within the carbonate aquifer. The increase in phosphorus could simply reveal that Status Network wells tap more phosphatic zones of the aquifer. This is not unusual in north central Florida[14]. The increase in phosphorus could also indicate that nutrient concentrations, caused by land use activities, are on the increase.

The unconfined aquifer has elevated levels of temperature, dissolved oxygen, pH, and nitrate. The basin ratios range from 1.03 for temperature to over 26 for nitrate. The increases in pH and DO are not completely understood. The increase in temperature probably reflects a different sampling period for the Background Network wells (summer), relative to the Status Network (winter).

Nitrate is extremely problematic. Again, the basin ratio is over 26. Conservatively, there is over a 20-fold increase in the median concentration of nitrate in the MLSR basin in unconfined ground water, relative to the other regions of the SRWMD. The SRWMD has established monitoring of both surface water and ground water to assist in tracking changes in nitrate concentrations within the District.

St. Marks / Ochlockonee River has elevated levels of sodium in the confined aquifer. The exact cause is unknown, but may indicate an increase in saline water, or that a higher proportion of confined wells tap zones in the aquifer of increased sodium.

The unconfined aquifer has elevated concentrations of specific conductance, calcium, magnesium, and alkalinity that suggest a significantly greater number of wells tap the unconfined portion of the Floridan aquifer (limestone/dolomite) in the Status Network than for the historical Background Network. In the southern part of the basin, much of the unconfined aquifer is also the Floridan aquifer (e.g., in the Woodville Karst Plain). Many of the Background Network wells tapped the surficial aquifer system, which is composed predominantly of sands and clays. At the current time there is insufficient data to clearly indicate the reason for increased color.

Sodium and chloride are also elevated, however this could also be reflective of a significant number of wells tapping the Floridan aquifer. These wells are typically deeper than surficial aquifer wells.

[14] *Maddox, G.L., Lloyd, J.M., Scott, T.M., Upchurch, S.B, and Copeland, R.E. eds., 1992, Florida Ground Water Quality Monitoring Program – Volume 2, Background Hydrogeochemistry, Florida Geological Survey, Special Publication No. 34.*

The nutrients phosphorus and orthophosphate display significantly elevated concentrations. These analytes may reflect natural conditions that exist in different zones of the aquifer that are composed of phosphatic bearing rock.[15] They could also be indicative of changes in land use activities.

Tampa Bay has increased concentrations of sulfate in the basin relative to the remainder of the SWFWMD for confined ground water. The source is mineralized ground water existing along the coast and at depth in the region.[15]

Historical Ground Water Quality Monitoring Networks

The Florida Ground Water Quality Monitoring Network, comprising more than 2,900 wells statewide, contained two sub-networks: the Background Network and the Very Intense Study Area (VISA) Network. Each has unique monitoring priorities. The Florida Department of Health also operated a third network, the Private Well Survey, between 1986 and 1997. It analyzed ground water quality from fifty private drinking water wells in each county. Although sampling was completed in thirty-four counties, the project was not finished because of budget cuts and altered priorities. It is no longer part of the active monitoring network.

The Background Network, first sampled in 1984, consists of a statewide grid of over 2,000 wells that tap into the state's three major aquifer systems *(Figures 9 and 10 show Background Network wells by location and type)*. Background water quality is defined as existing water quality where land uses are unlikely to have widespread effects. (In this sense, background water quality differs from pristine water, that is, water unaffected by human activity.)[16] A third of the background wells are sampled annually, so that all wells are sampled every three years. Both the procedures for collecting data and the data themselves are checked for accuracy.

The VISA Network, consisting of about 400 wells, began operating in 1990 *(Figure 12).* Monitored the effects of various land uses on ground water quality in specific aquifers in selected areas. The major land uses are intensive agriculture, mixed urban/suburban, industrial, and low impact. The VISAs are chosen based on their relative susceptibility to contamination. Florida has complete data sets for twenty-three VISAs.

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[15] Maddox, G.L., Lloyd, J.M., Scott, T.M., Upchurch, S.B, and Copeland, R.E. eds., 1992, Florida Ground Water Quality Monitoring Program – Volume 2, Background Hydrogeochemistry, Florida Geological Survey, Special Publication No. 34.

[16]For further discussion of background water quality in Florida aquifers, see Maddox, G.L., et al. (editors), Florida Ground Water Quality Monitoring Program — Volume 2, Background Hydrogeochemistry, Florida Geological Survey, Special Publication No. 34, 1992.

Figure 9: Location of Background Network Monitoring Wells

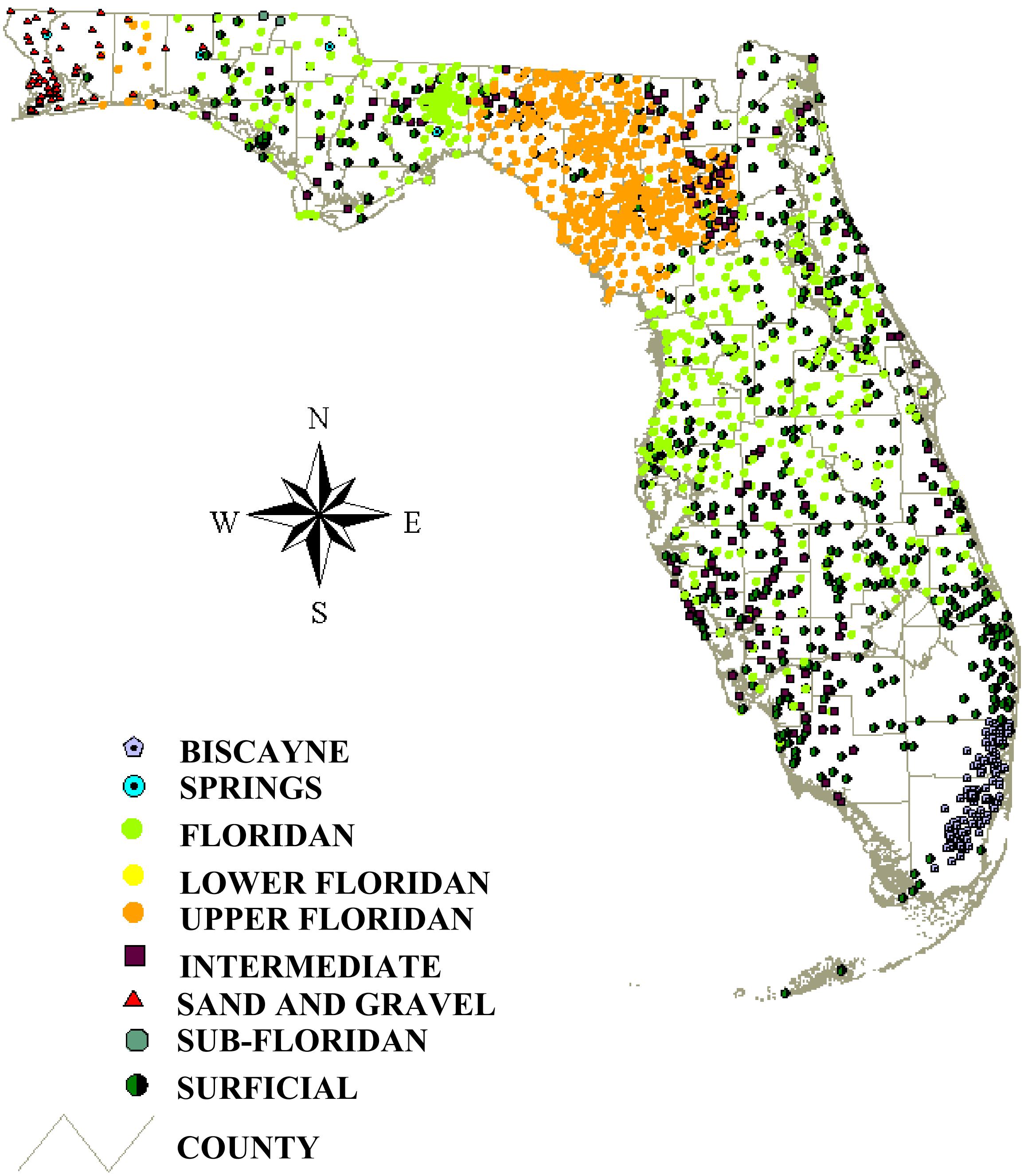

Figure 10: Location of Background Network Wells by Type

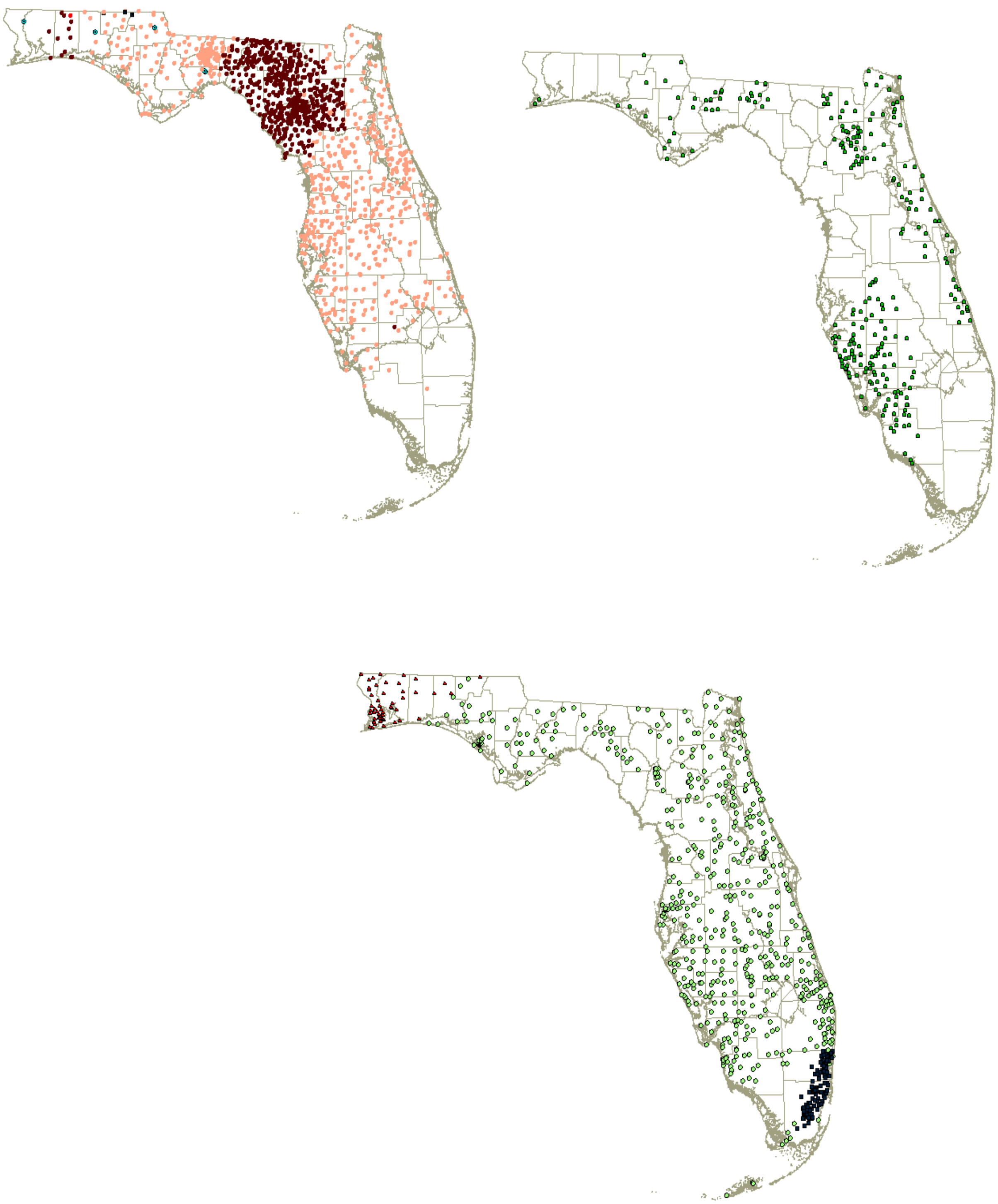

Figure 11: Location of VISA Network Monitoring Wells

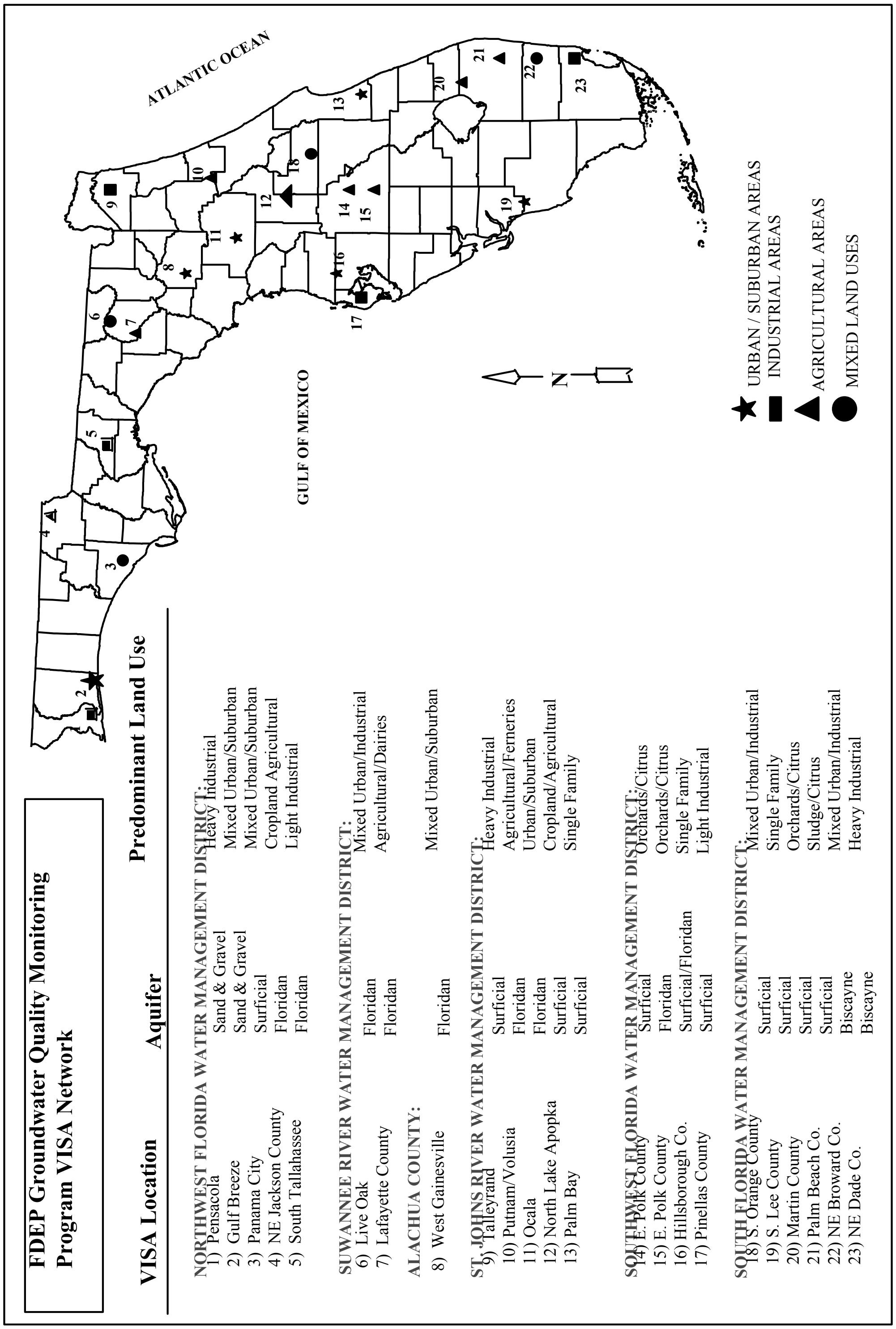

Figure 2. Location of Very Intense Study Area well networks

Wells in the VISA and Background Networks are sampled in the same year. *Table 33* lists the various water chemistry indicators and groups of pollutants monitored in both networks. Because of budget constraints, complete statewide testing for trace metals, pesticides, volatile organic chemicals, and synthetic organic chemicals (base neutral acid extractables) was reduced to once every nine years.

During the first VISA and background sampling, all wells were tested for the standard analytes and trace metals. During the second sweep, they were sampled for the standard list and pesticides, but not metals. For the final sweep, all wells were sampled for the standard list and volatile organic chemicals and base neutral acid extractables, but not metals or pesticides.

The Temporal Variability Network, a subset of about fifty wells across the state, is also monitored monthly to assess how ground water quality varies over time in the three aquifer systems *(Figure 10).*

By comparing VISA and background results in the same aquifer system, FDEP can develop lists of pollutants commonly found in different kinds of land uses. This process helps the state plan for and regulate those land uses. It is essential, however, to understand local geology and hydrology as well as the limits of monitoring to interpret the study results correctly.[17]

Statewide Ground Water Contamination

Thin soils, a high water table, porous limestone formations, high levels of rainfall, and a high potential for saltwater intrusion leave Florida's ground water vulnerable to pollution. Surficial aquifers are especially at risk because they are the first ground water layer where pollutants enter from land and air.

Table 39 lists the most common sources and causes of ground water contamination. Sources were identified as highest priority if specific programs, staff, and resources have been appointed to address those sources of contamination. The table, however, does not imply specific priorities. Two additional sources are noted with asterisks: cattle dip vats, which are unique to Florida, and pesticide applications. While these are issues of concern, there are no specific programs to address them. Agricultural activities rate particularly high.

[17] *To date, aquifer sizes and natural ground water conditions such as elevated levels of iron and manganese have been characterized in two publications of FDEP's Ground Water Quality Monitoring Program:* Hydrogeologic Framework *in Scott, T.M.,* The Lithostratigraphy of the Hawthorn Group (Miocene) of Florida, *Florida Department of Natural Resources, Florida Geological Survey Bulletin No. 59, 1988; and* Background Hydrogeochemistry *(Maddox* et al.*, 1992).*

Table 39: Major Sources of Ground Water Contamination

Contaminant source	Highest priority sources (✓)	Factors considered in selecting a contaminant source	Contaminants
Agricultural activities			
Agricultural chemical facilities	✓	C,D,E	H,M(SO_4),F,I
Animal feedlots	✓	A,C,E,F	E,J,K,L
Drainage wells			
Agricultural mix/load sites	✓	F	A,B,D,E
Fertilizer applications*	✓	A,C,D,E,B,F	E
Pesticide applications	X	A,B,C	A,B,H
Cattle dip vats*	X	E	Arsenic, D
Storage and treatment activities			
Land application			
Material stockpiles			
Storage tanks (above ground)			
Storage tanks (underground)	✓	B,D,A	D
Surface impoundments			
Waste piles			
Waste tailings			
Disposal activities			
Deep injection wells			
Landfills	✓	C,A,D,B,E	C,E,H,D,A,B,F,J
Septic systems	✓	D,C,B,A	E,L,K
Shallow injection wells			
Other			
Hazardous waste generators			
Hazardous waste sites	✓	A,D,C,E	C,A,B,H,D, phenols, PCBs
Industrial facilities	✓	A,D	C,H,D
Material transfer operations			
Mining and mine drainage			
Pipelines and sewer lines			
Saltwater intrusion	✓	C,E,B	M(SO_4,Cl,Na)
Spills			
Transportation of materials			
Urban runoff	✓	A,B,C	D,H,J,K,L
Other sources—drycleaning facilities	✓	A,B,C,D,E,F	C

Notes to Table 39:
* Includes irrigation practices.
X Indicates contaminant source of concern to state, but a specific program with funding and staff has not been allocated to address that source.

In Column 3: Factors used in selecting a contaminant source:

A. Human health and/or environmental risk (toxicity)
B. Size of population at risk
C. Location of the sources relative to drinking water sources
D. Number and/or size of contaminant sources
E. Hydrologic sensitivity
F. State findings, other findings
G. Documented from mandatory reporting
H. Geographic distribution/occurrence
I. Other factors (described in text)

In Column 4: Contaminants associated with each contaminant source:

A. Inorganic pesticides
B. Organic pesticides
C. Halogenated solvents
D. Petroleum compounds
E. Nitrate
F. Fluoride
G. Salinity/brine
H. Metals
I. Radionuclides
J. Bacteria
K. Protozoa
L. Viruses
M. Other contaminants (described in text)

Florida's Ground Water Protection Programs

Florida's goal is to protect all its ground water, in shallow, intermediate, and deep aquifers. Twenty-six programs — either established or under development — are in place to protect, manage, or assess ground water. *Table 40* lists the state's ground water programs or protection activities and their status in early 1999. The Wellhead Protection Program and the Core Comprehensive State Ground Water Protection Program will be developed after the EPA approves plans.

Florida is developing its Source Water Assessment and Protection (SWAP) Program. Created under the 1996 amendments to the Safe Drinking Water Act, which provides funding and focuses resources for the protection of drinking water sources, SWAP requires the states to identify public drinking water supplies, delineate assessment areas, identify potential sources of contamination, determine the susceptibility of drinking water supplies to the sources of contamination, and provide the assessments to the public.

A susceptibility determination will be made to assess the threat that the identified sources pose to drinking water systems which use ground water or surface water supplies. This determination will assess the threat posed from potential contamination sources in the delineated source water protection area. Florida has few surface water sources of drinking water, so to a large extent SWAP plans will address the protection of wellheads. To date, no plans have been prepared.

FDEP is preparing GIS databases for the different programs. The ability to assess data on compliance and to analyze specific sites will improve the quality of future reports.

The Florida Springs Initiative

Hydrogeologists estimate that there are nearly 600 springs in the state of Florida, representing what may be the largest concentration of freshwater springs on Earth. Archaeological evidence indicates that humans have been attracted to Florida's life-giving springs for thousands of years. Florida springs continue to draw awed and grateful visitors today – our twelve state parks that are named for springs attracted over two million visitors in 1999. Private spring attractions and parks are a multi-million dollar tourist industry.

Between 1950 and 1990, Florida's human population more than quadrupled, and our population continues to increase. With growth has come an unavoidable rise in water use, as well as extensive land use changes. During the twentieth century, flow discharge reductions have been noted in many of Florida's springs. Since the 1970s, scientists have documented a decline in water quality in most Florida springs, particularly in regard to nutrients such as nitrate. Other threats to Florida Springs include excessive recreational use causing erosion and loss of aquatic plants. This damage can be overcome by more diligent resource management. Contaminants that reach the groundwater and flow to springs include nutrients from fertilizers, septic tanks, wastewater sprayfields and farm animal wastes. Bacteria may originate from septic tanks, animal wastes and stormwater and pesticides from lawns, golf courses, croplands and commercial forests.

David Struhs, Secretary of the Florida Department of Environmental Protection, directed the formation of a multi-agency *Florida Springs Task Force* to recommend strategies for the protection and restoration of Florida's springs. The Task Force, a group of sixteen scientists, planners, and other citizens, met monthly from September 1999 to September 2000. They discussed the environmental, social, and economic interests that exist in all of Florida's spring basins.

Table 40: Summary of State Ground Water Protection Programs

Programs or activities	Check	Implementation status	Responsible state agency
Active SARA Title III Program	✓	Established	FDEP*/DCA
Ambient ground water monitoring system	✓	Established	FDEP*/WMD
Aquifer vulnerability assessment	✓	Continuing effort	FDEP*/WMD
Aquifer mapping	✓	Under development	WMD/FGS
Aquifer characterization	✓	Under development	FGS*/WMD
Comprehensive data management system	✓	Evolving	FDEP
EPA-endorsed Core Comprehensive State Ground Water Protection Program (CSGWPP)		Not endorsed	FDEP
Ground water discharge permits	✓	Established	FDEP
Ground water BMPs	✓	Established	FDEP*/WMD/DACS
Ground water legislation	✓	Established	FDEP*/WMD
Ground water classification	✓	Established	FDEP
Ground water quality standards	✓	Established	FDEP
Interagency coordination for ground water protection initiatives	✓	Established	FDEP*/WMD
Nonpoint source controls	✓	Established	FDEP*/WMD
Pesticide State Management Plan		Not endorsed	DACS*/FDEP
Pollution Prevention Program	✓	Established	FDEP
Resource Conservation and Recovery Act (RCRA) Primacy	✓	Established	FDEP
Source Water Assessment Program (SWAP)	✓	Under development	FDEP
State Superfund	✓	Continuing effort	FDEP
State RCRA Program incorporating more stringent requirements than RCRA primacy	✓	Established	FDEP
State septic system regulations	✓	Established	FDEP
Underground storage tank installation requirements	✓	Established	FDEP
Underground Storage Tank Remediation Fund	✓	Established	FDEP
Underground Storage Tank Permit Program	✓	Established	FDEP
Underground Injection Control Program	✓	Established	FDEP
Vulnerability assessment for drinking water/wellhead protection	✓	Established	FDEP
Well abandonment regulations	✓	Established	WMD
Wellhead Protection Program (EPA-approved)		Not approved	FDEP
Well installation regulations	✓	Established	WMD*/FDEP

FDEP* — Agency with primary responsibility for this activity.
FDEP — Florida Department of Environmental Protection.
DCA — Florida Department of Community Affairs.
FGS — FDEP's Florida Geological Survey.
WMD — Water Management District.
DACS — Florida Department of Agriculture and Consumer Services.

The task force produced a report delineating current problems in Florida’s spring systems as well as a series of recommended “Action Steps”. This report, entitled “Florida’s Springs: Strategies for Protection & Restoration”, is available online at:

http://www.floridadep.org/secretary/info/pubs/FlSprings.PDF

Early in 2001, the *Florida Springs Task Force II* was formed to guide implementation of the “Action Steps” in the report. During the same year, the Florida Legislature, with the support of the DEP Secretary and Governor, allocated approximately 2.5 million dollars begin the process of protecting and restoring Florida’s springs. The dollars will be spent in three broad areas: research & monitoring, landowner assistance and educational outreach. Some of these projects which will provide data for future 305(b) assessments include quarterly water chemistry monitoring at publicly-owned first magnitude springs, biological assessments using the DEP Stream Condition Index in spring runs, and establishment of continuous stage and flow gaging stations in most first magnitude spring runs. Additionally, a number of varied research projects in spring systems will be funded.

Landowner assistance dollars are currently being spent to identify projects and fund “best management practices” in spring basins, particularly with regard to nutrient management.

Current educational expenditures include development and printing of informational brochures and establishment of educational kiosks at major springs. The Florida Geological Survey is documenting all of Florida’s known springs in an effort to produce an updated “Florida Springs Atlas”.

Dependent on continued funding, future protection efforts will focus on identifying in greater detail ground water spring basins (“springsheds”) and associated land use patterns and threats, continued research and monitoring, and education. An additional goal is to better align springs protection efforts with watershed management efforts currently underway.

Figure 13: Springs of Florida