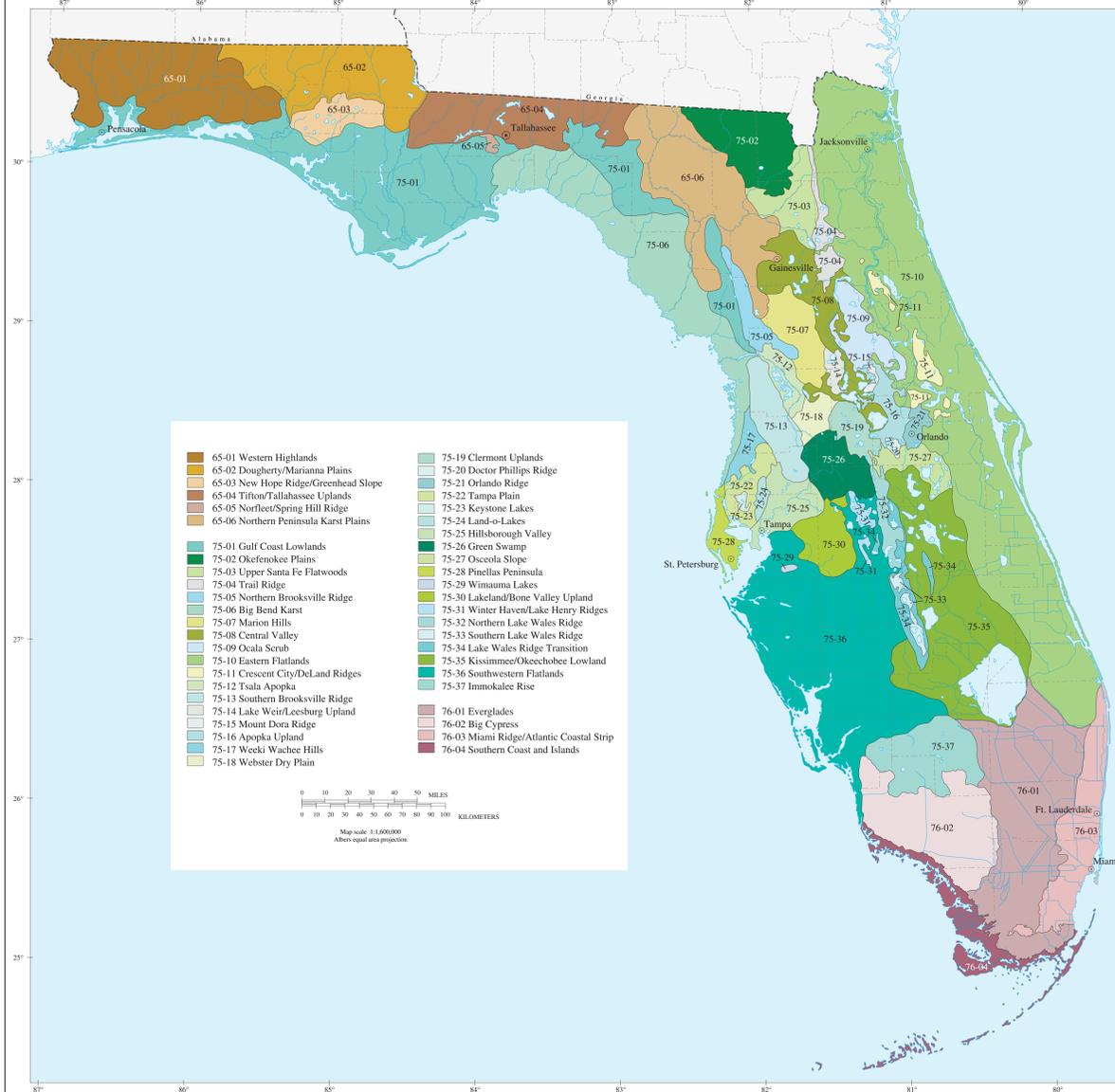


Lake Regions of Florida

Florida's lakes provide important habitats for plants, birds, fish, and other animals, and comprise a valuable resource for human activities and enjoyment. More than 7,000 lakes are found in Florida, and they occur in a variety of ecological settings. The physical, chemical, and biological diversity of these lakes complicates lake assessment and management. In many states, it has been shown that water resources can be managed more effectively if they are viewed within a regional framework that reflects differences in their quality, quantity, hydrology, and their sensitivity or resilience to ecological disturbances. To develop cost-effective lake management strategies that protect or restore water quality in Florida lakes, regional differences in the capabilities and potentials of lakes must be considered. Hydrologic unit or basin frameworks are often used for water quality assessments and ecosystem management activities, but these units or basins do not correspond to the spatial patterns of characteristics that influence the physical, chemical, or biological nature of Florida lakes.

General patterns of geology and physiography have been used previously to explain regional differences in Florida lake water chemistry (Canfield and Hoyer 1988; Polman and Canfield 1991), and ecosystem characteristics of Florida lakes have been summarized (Brenner et al.

1990). Building on this work, as well as on a Florida ecoregion framework (Griffith et al. 1994), we have defined these forty-seven lake regions as part of the Florida Department of Environmental Protection's (FL DEP) Lake Bioassessment/Regionalization Initiative. The spatial framework was developed by mapping and analyzing water quality data sets in conjunction with information on soils, physiography, geology, hydrology, vegetation, climate, and land use/land cover, as well as relying on the expert judgment of local limnologists and resource managers. This framework delineates regions within which there is homogeneity in the types and quality of lakes and their association with landscape characteristics, or where there is a particular mosaic of lake types and quality. More detailed descriptions of methods, materials, and lake region characteristics can be found in Griffith et al. (1997). The identifier for each lake region consists of two numbers: the first number (65, 75, or 76) relates to the United States Environmental Protection Agency (US EPA) ecoregion number (Omernik 1987; US EPA 1997), and the second number refers to the Florida lake regions within an ecoregion. The Florida lake regions and associated maps and graphs of lake chemistry are intended to provide a framework for assessing lake characteristics, calibrating predictive models, guiding lake management, and framing expectations by lake users and lakeshore residents.



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Small ponds and reservoirs on the sandy soils are typical in region 65-01.



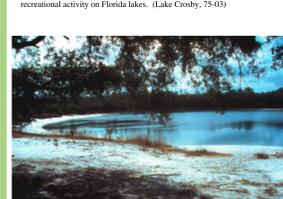
Some coastal dune lakes in 75-01 contain freshwater fish, with saltwater fish in the more saline bottom layers.



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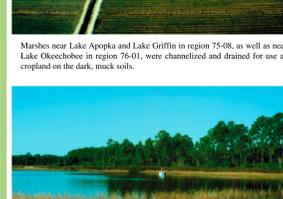
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65-01 The rolling hills of the **Western Highlands** lake region are covered by mixed hardwood and pine forest, with some cropland and pasture. It is a region of streams, but very few natural lakes. The region contains some oxbow lakes and other lowland lakes of the river floodplains. A few ponds and small reservoirs for cattle or recreation have been created by damming up small drainage. Similar to the streams of the region that feed these small reservoirs, they would generally contain softwater, low to moderate nutrient lakes, if lake management inputs were low. However, most lakes in this region, including Karst, Hurricane, and Bear lakes, are being artificially limed and fertilized in an attempt to increase fish production. Phosphorus values have increased for some of these lakes from the 10-20 µg/L range in the 1970s to more than 70 µg/L by the 1990s.

65-02 The **Dougherty/Marianna Plains** lake region is an eroded limestone area that is generally more flat than the regions to the east and west, with agriculture as a dominant land use. Elevations are generally 100 to 200 feet, but include Florida's high point of 345 feet in northwest Walton County. The Florida aquifer is at or near the surface in much of the region. The solution activity on the limestone bedrock has formed numerous sinkholes, caverns, springs, and other sink features. Many lowland oxbow lakes and oxbow ponds are bayou dune swamps, or gum ponds, contain ponds and small lakes surrounded by cypress trees and other hydrophytic vegetation. The limestone is exposed in some areas, but in other areas, sands and clayey sands reach thicknesses of over 200 feet. The chemical characteristics of the water are generally softwater, low to moderate nutrient lakes, with some acidic, lowland oxbow lakes that contain peat, muck, clayey sand, and most lakes surrounded by cypress trees and other hydrophytic vegetation. The limestone is exposed in some areas, but in other areas, sands and clayey sands reach thicknesses of over 200 feet. The chemical characteristics of the water are generally softwater, low to moderate nutrient lakes, with some acidic, lowland oxbow lakes that contain peat, muck, clayey sand, and most lakes surrounded by cypress trees and other hydrophytic vegetation.

65-03 The **New Hope Ridge/Greenhead Slope** is an upland sand ridge region, 100-300 feet in elevation, with a relatively high density of solution lakes for the Florida Panhandle. Similar to other well-drained upland sand ridge areas in Florida, the region is a high recharge area for the Floridan aquifer. It contains clear, acidic, softwater lakes of extremely low mineral content. The lakes are very low in nitrogen and phosphorus, low in chlorophyll *a*, and are among the most oligotrophic lakes in the United States. Along with the lakes in the Trail Ridge region (75-04), these are some of the most acid-sensitive lakes in Florida. Lakes connected to stream drainages, such as Black Double Lake and Lighter Log Lake in Washington County are more colored.

Many clearer lakes are found in region 65-03, and a few clearer lakes, such as Lake Cassidy, occur in 65-02.

65-04 The characteristics of the **Tifton/Tallahassee Uplands** region change distinctly from west to east. The region contains a heterogeneous mosaic of mixed forest, pasture, and agricultural land. The dissected Tifton Upland in the western part of the region has few if any natural lakes, but many small ponds and reservoirs created on stream channels. The southwest part of the region consists of thick sand delta deposits and contains one small reservoir, Lake Myrtle (Levy County), and a large reservoir, Lake Talquin, impounded in 1929, is the second-oldest large reservoir in Florida. To the east of the Ochlocknee River, in Leon County, karst features are more evident with many solution basins, swampy depressions and some large swamp lakes. Some lakes, such as James and Buckhorn, drain periodically when their karst drainage system becomes impinged. Lakes in this region tend to be slightly acidic to neutral, colored, softwater lakes with moderate nutrient levels. Some lakes have high pH and conductivity values because groundwater is pumped in to counteract draining.

65-05 The **North/Spring Hill Ridge** lake region contains small, upland, clear, low-nutrient, acidic lakes that differ from the darker, swampy, moderate nutrient lakes of the Tifton/Tallahassee Uplands (65-04) and Gulf Coast Lowlands (75-01). The region is an eroded limestone area that is generally more flat than the Gulf Coast Lowlands, with elevations generally 60-120 feet. Acid-tolerant aquatic plants are found here, as most of the lakes have pH levels less than 5.5. Some lakes and ponds show some color associated with rain events, especially Moore Lake and Lofton Ponds.

65-06 The **Northern Peninsula Karst Plains** region is generally a well-drained flat to rolling karst upland containing a diverse group of small lakes. The natural vegetation consists of longleaf pine/scrub oaks or hardwood forests on the richer soils, but agriculture is now extensive in much of the region. With some areas underlain by the geologically diverse Miocene Hawthorn Group or by undifferentiated Quaternary sediments, nutrient levels are variable, but many lakes have high phosphorus. The region's nutrient values are some of the highest in northern Florida. Many of the lakes are located in an area between Live Oak and Lake City. Groundwater connections as well as human activities elevate the conductivity and phosphorus in some lakes around Lake City. The mosaic of lake types in this region has a wide-ranging distribution of chemical and physical characteristics, but in general the lakes tend to be slightly acidic, with low to moderate alkalinity, high nutrients, and some color.

Lake conditions vary in this suburbanized residential area north of Tallahassee, occur in 65-04.



Clearcut logging around Lake Five-0 in region 65-03.



Lake conditions vary in this suburbanized residential area north of Tallahassee, occur in 65-04.

75-01 Several types of lakes occur in the **Gulf Coast Lowlands** lake region, including coastal dune lakes, flatwoods lakes, "edge lakes", river floodplain or oxbow lakes (Dead Lake), and reservoirs (Deer Point Lake). Most of the lakes tend to be darkwater, acidic, softwater lakes with low to moderate nutrients. Coastal dune lakes have higher sulfate, sodium, and chloride levels than inland lakes, and can freshen or turn salty depending on rainfall, saltwater input, or salt spray. Flatwoods lakes receive the majority of their water from direct rainfall and runoff from surrounding poorly drained soils. Sag ponds or "edge lakes" are found at the foot of relict marine terrace spurs or where soluble limestone that is near the surface abuts an upland of thick insoluble sands. An example is Chunky Pond near the western edge of the Northern Brooksville Ridges (75-05).

75-02 The **Okefenokee Plains** lake region consists of flat plains and terraces with pine flatwoods and swamp forests over peat, muck, clayey sand, and phosphatic deposits. The few lakes in the region are primarily in the southern part, and include Ocean Pond, Palestine Lake, Swift Creek Pond, and Lake Fisher. These are highly acidic, darkly colored, softwater lakes. The region's median pH value of 4.7 is the lowest of all Florida lake regions. Although Ocean Pond is one of Florida's most acidic lakes, it supports a sustained sport fishery for largemouth bass, black crappie, bluegill, and other centrarchids. Phosphorus values for the lakes are generally in the 10-20 µg/L range, but Swift Creek Pond has higher phosphorus values and there may be other phosphatic areas. An example is Chunky Pond near the western edge of the Northern Brooksville Ridges (75-05).

75-03 The **Upper Santa Fe Flatwoods** region, with elevations generally 120-180 feet, is an area of pine flatwoods with some swamp forests. Lakes in this region include Alto, Butler, Crosby, Hampton, Hickory Pond, Little Santa Fe, Punchbowl, Rowell, Sampson, and Santa Fe. The lakes occur on thin Plio-Pleistocene sediments that overlie the deeply weathered sand and kaolinitic clay of the Miocene Hawthorn Group. The lakes of the region are slightly acidic, colored, with low to moderate nutrients. The pH and alkalinity levels are slightly higher than the Okefenokee Plains (75-02) to the north, and phosphorus levels of the lakes are relatively low, averaging in the 10-15 µg/L range. Lakes Rowell and Sampson have different water chemistry values due to wastewater treatment plant discharges from the city of Starke via Alligator Creek.

75-04 From a narrow ridge in the north, the **Trail Ridge** lake region broadens to the south, becoming a karstic landscape with numerous solution depressions and lakes. The region is dominated by well-drained, nutrient-poor upland soils, such as the Candler, Apopka, Astutula, and Tavares series, with longleaf pine/xerophytic oak vegetation. Lakes in the Trail Ridge region are mostly small, acid, clear, oligotrophic lakes. To the south, conductance and macrophytes in the lakes tend to increase. Atmospheric deposition might be contributing to some acidification of lakes in this region. Kingsley Lake is one of the largest lakes in the region and one of the deeper lakes in Florida. It differs from other Trail Ridge lakes, with higher pH, alkalinity, and a different cation/anion mix that reflects groundwater inputs.

75-05 The **Northern Brooksville Ridge** region has an irregular land surface, with elevations varying over short distances from about 75 feet to 100 feet. The region is dominated by longleaf pine/scrub oaks and turkey oak vegetation of longleaf pine and turkey oak. Soils are of the Candler-Apopka-Astutula association. The thick sand sequence is underlain by clayey phosphatic sediments of the Alachua Formation. It is this underlying relatively insoluble Miocene-age clastics that provide the ridge's resistance to solution and lowering of elevation compared to surrounding limestone plains areas. Several ponds are located west of Archer and another group of lakes is located in the southern end in the Rainbow Lakes Estates area. These lakes are generally acidic, with moderately low nutrients and color.

75-06 In the **Big Bend Karst** region, Miocene to Eocene-age limestone is at or near the surface from eastern Wakulla County south to Pasco County. The inland parts of the region are typified by pine flatwoods and swamp forest on poorly drained Spodosol soils. The Big Bend coast is characterized by coastal salt marshes and mangrove, rather than the barrier islands or beaches of the Gulf Coast Lowlands (75-01). Reflecting the limestone influence, pH, alkalinity, and conductivity values in lakes are very high for this part of Florida. Nutrient levels are moderately low and lake color is variable but generally low. Lake Rousseau is a large reservoir on the Whitlawcochee River at the Levy/Citrus county line, and often has an abundance of hydrilla plant growth.

75-07 The **Marion Hills** lake region, generally 75-180 feet in elevation, is an area of horse farms, pasture for cattle, cropland, and mixed evergreen/deciduous forests. Miocene-age Hawthorn Group sediments of clayey sands compose much of the hill systems, with the Eocene-age Ocala Limestone near the surface in much of the intervening karst terrain. The region has few if any natural lakes, but contains about a dozen small ponds and some wet prairie areas. Pond chemistry is likely to be alkaline in locations influenced by the near-surface limestone, and less so for lakes in the hilly Hawthorn sands.

75-08 **Central Valley** lakes tend to be large, shallow, and eutrophic, although lake size and type are variable. The lakes tend to have abundant macrophytes or are green with algae. Total phosphorus values are mostly in the 20-80 µg/L range, alkalinity values range widely, and pH values are generally greater than 6.5. The northern lakes in sandy deposits, such as Lake Eaton, Lochloosa Lake, Newnans Lake, Orange Lake, and Lake Wauberg, are characterized as softwater eutrophic lakes, and tend to have lower pH and darker water than the southern lakes. The southern lakes, such as Apopka, Carrizo, Egan, Harris, Eotis, Yale and Griffin, often receive mineralized groundwater as well as surface inflows through nutrient-rich soils, and are eutrophic to hypertrophic hardwater lakes. Canals have altered the natural flow patterns for many of these southern lakes in the Oklawaha chain, and agricultural activities at the muck soils, along with municipal and industrial wastes, have added chemicals and nutrients to the connected surface water system.

75-09 The **Ocala Scrub** is a region of ancient dunes with excessively drained, dry sandy soils (Candler and Astutula series) and sand pine scrub forests. The western two-thirds of the region is underlain by deeply weathered Miocene-age Hawthorn Group deposits, and contains more clayey sand and areas of longleaf pine and turkey oak. Elevations range from 75-180 feet. The eastern portion is lower in elevation and contains medium to fine sand and silt developed on Pleistocene-age sand dunes. The Ocala Scrub contains acid, mostly clearer, low-nutrient lakes. The clear lakes are generally on the highly sandy ridges, moderate color lakes are in lower transitional areas, and some prairie lakes can have darker water.

75-10 Due to landform variety and latitudinal extent, the **Eastern Flatlands** forms a diverse lake region. It is ribbed by low sand ridges, intervening valleys, and swampy lowlands that parallel the coast. The St. Johns River and its associated large lakes are the dominant physical features of the area. There are a mix of different lake types in the region. The St. Johns River lakes tend to be alkaline, hardwater, eutrophic, colored lakes. To the south, the upper St. Johns marsh lakes are also alkaline, mesotrophic to eutrophic, darkwater lakes, but the chemical characteristics are somewhat lower than in the north. Flatwoods lakes in the region are acid to slightly acidic, colored, softwater lakes of moderate mineral content, with variable trophic states. Coastal edge lakes and dredged "bail" ponds are found along the more populated seaboard area.

75-11 The **Crescent City/Deland Ridges** lake region includes several upland ridges such as Palatka Hill, Crescent City Ridge, Deland Ridge, and the Geneva-Chulotua-Oviedo Sandhills. Thick sandy soils of the Candler and Astutula series are typical, with natural vegetation of longleaf pine/scrub oaks forests and some sand pine scrub forests. Many lakes in the region are clear, oligotrophic lakes of low mineral content that obtain the majority of water from direct rainfall and surface/subsurface inflows through well-drained sandy soils. More mesotrophic lakes of moderate mineral content that receive inputs of groundwater also occur. Some lakes at the edge of the ridges receive water inputs from poorly-drained soils, and are included with the darker, small lakes of the Eastern Flatlands (75-10).

75-12 **Tsala Apopka** is an erosional valley with thin surficial sands over Eocene-age Ocala Limestone. Limestone is at the surface on the east side of the Whitlawcochee River within the region. Tsala Apopka Lake to the west of the Whitlawcochee River is an area of clearwater, marshes, ponds, and lakes. There are generally three open-water pool areas: the Floral City Pool, the Inverness Pool, and the Hernandez Pool. The "lake" gets shallower and turns to marsh as one moves east. Tsala Apopka water bodies are alkaline, hardwater, and eutrophic. The average lake pH is often greater than 7.5. Color decreases and conductivity increases as one moves from the Floral City Pool in the south to Hernandez Pool in the north.

75-13 The **Southern Brooksville Ridge** region has a very irregular surface, similar to the Northern Brooksville Ridge (75-05), but reaches higher elevations, with several hills between 200 and 300 feet. These hills and ridges are often covered by hammock, turkey oak, and longleaf pine vegetation communities, and drainage is generally internal to the Floridan aquifer. Orange to reddish-orange clay sands occur the length of the ridge and cap many of the hills in the immediate Brooksville region. The lakes tend to have higher alkalinity, conductivity, and nitrogen than lakes in the Northern Brooksville Ridge. Although a few lakes are acidic, most are neutral to alkaline, slightly colored, mesotrophic or meso-eutrophic lakes. Some lake phosphorus values appear low due to dense aquatic macrophyte growth.

75-14 The **Lake Weir/Leesburg Upland** region, with elevations generally 75-125 feet, stretches from Lake Weir Lake in the north to the city of Leesburg in the south. Soils are mostly sandy, well-drained Candler, Apopka, and Astutula series, and the underlying material consists of deeply weathered clayey sand of the Miocene Hawthorn Group. The natural vegetation was primarily longleaf pine and xerophytic oaks. Lake Weir is the largest lake in the region and there are numerous small lakes among citrus groves. These are generally clear, neutral to low nutrient lakes.

75-15 The **Mount Dorra Ridge** lake region is composed of high sand hills, 75-180 feet in elevation, with well-drained acidic soils of the tsalita and Apopka series. There are many small, circumneutral, clear lakes of low color, having low nutrients, low chlorophyll *a*, and moderate alkalinity. Nutrient and color values tend to be slightly less than the adjacent Apopka Upland (75-16), and pH, alkalinity, and conductivity are higher than the Lake Weir/Leesburg Upland (75-14). Sleepy sloping sand hills and old orange groves surround the hills.

75-16 The **Apopka Upland** region consists of residual sand hills modified by karst processes, with many small 75-16 lakes and scattered shallow lakes. Candler, Apopka, and Tavares are typical well-drained upland soils, and elevations range from 70-150 feet. The physical and chemical characteristics of the lakes are varied, and lake water levels can fluctuate during drought periods. There are a few acidic, clear, softwater lakes of low mineral content, but most are neutral to alkaline clear lakes with low to moderate nutrients. Some of the higher nutrient lakes may lack macrophytes. Darker water lakes that are circumneutral to alkaline also occur.

75-17 The **Weeki Wachee Hills** area is an area of Pleistocene sand dunes, 20-80 feet in elevation, with numerous solution basins. The region includes mostly upland-type, well-drained sandy soils, such as Candler, Astutula, and Tavares series, and natural vegetation of longleaf pine/scrub oaks and sand pine scrub. The lakes have circumneutral pH, with moderately low alkalinity and nutrients, and low chlorophyll *a* values. Nutrient values are slightly lower than the adjacent Southern Brooksville Ridge (75-13). Although some have slight color, these are mostly clearer lakes.

76-01 The **Everglades** lake region begins south of Lake Okechobee to include the Everglades Agricultural Water, tree-lands, and marsh prairies, with cropland in the north, ranges in elevation from sea level to twenty feet. Peat, muck, and some clay are the main surficial materials over the limestone. Wide sloughs, marshes, and some small ponds contain most of the surface water in this "River of Grass" region. Canals drain much of the water in some areas.

76-02 The **Big Cypress** is a flat region, 5 to 30 feet in elevation and slightly higher than the Everglades, covered by pine flatwoods, open scrub cypress, prairie type grasslands, and extensive marsh and wetlands. Poorly drained soils overlie limestone, calcareous sandstones, muck, swamp deposit mucks, and algal muds. Lakes are generally absent from the region.

76-03 The **Miami Ridge/Atlantic Coastal Strip** is a heavily urbanized region, sea level to 25 feet in elevation, with coastal ridges on the east and flatter terrain to the west. The western side originally had wet and dry prairie marshes and oak and sawgrass marshes, but much of that is now covered by cropland, pasture, and suburbs. To the south, the Miami Ridge extends from near Hollywood south to Homestead and west into Long Pine Key of Everglades National Park. It is a gently rolling rock ridge of oolitic

75-18 The low-relief **Webster Dry Plain**, with elevations generally 75-125 feet, has only a thin veneer of sand or clayey sand over the Ocala Limestone and contains few lakes. The drainage is primarily internal, and only during wet years and high water tables do shallow, temporary lakes exist in the solution depressions. The small shallow lakes can vary widely in their characteristics; some having high pH, alkalinity, and conductivity with variable nutrients, color, and clarity, while other prairie lakes are more acidic and dark.

75-19 The **Clermont Uplands** is a region of prairies, swampy solution lakes, and low to high sand hills covered by citrus groves. Elevations range from 100 feet in the lower swamp and prairie areas to 300 feet on the highest hills of the Sugar Loaf Mountains. The natural vegetation consists of pine flatwoods, water-tolerant grasses, and hardwood swampy forests in the lowlands, and longleaf pine/xerophytic oaks on the well-drained uplands. Lakes of this region tend to be slightly acidic, softwater lakes that are oligotrophic to slightly mesotrophic. Some lakes have low color and high Secchi values, while other lakes that receive drainage from the Green Swamp (75-26), such as Lake Louisa, are very dark.

75-20 **Doctor Phillips Ridge** is a small ridge of thick sands with elevations of 100-170 feet, and contains over 30 solution depression lakes. The sandy soils of the Tavares-Zolfo-Milho formation are predominant. The lakes in this region are generally clear, circumneutral, and low in nutrients. As a group, these are some of the clearest lakes in central Florida. The clearer lakes tend to be deeper than the others in the region, and the slightly darker lakes, such as Lake Sheen, are lower in elevation or have water, lowland-type soils near the lake. Lake Floy is darker with unusually high nutrients, but is heavily impacted by road and stormwater drainage.

75-21 The **Orlando Ridge** is an urbanized karst area of low relief, with elevations from 75-120 feet. Longleaf pine and xerophytic oaks were the dominant trees of the natural vegetation, with soils primarily of the Tavares, Smyrna, and Pometti series. Miocene-age coarse quartz sands and pebbles imbedded in kaolinitic clay form the ridge. Phosphorus sand and clayey sand are at a shallow depth. Lakes in this region can be characterized as clear, alkaline, hardwater lakes of moderate mineral content. They are mesotrophic to eutrophic, with phosphorus levels generally between 20-50 µg/L, but it is difficult to distinguish between effects of urbanization and natural phosphorus levels here. Lakes are more phosphatic than the Crescent City/Deland Ridges (75-11), and only slightly more than the Apopka Upland (75-16).

75-22 The low-relief **Tampa Plain** region is drained mostly by the Palmettoche