

Chapter 3 - Affected Environment

## INTRODUCTION AND GENERAL DESCRIPTION

This chapter describes the existing environment of the Wekiva Wild and Scenic River System and the surrounding region. The chapter is focused on the outstandingly remarkable values of the river system as identified in the study that led to its designation.

The Wekiva Wild and Scenic River System is in Orange, Seminole, and Lake counties in north-central Florida. The surface watershed, or drainage basin, of the river system is approximately 242 square miles in size, with its northernmost extent reaching into Marion County. The aquifer recharge area, or springshed, of the river system extends beyond this surface water drainage basin (primarily to the south and west). The interaction between surface and groundwater is very complex. Within the springshed, rainwater percolates through porous limestone and karst geologic features, and eventually reaches the Floridan aquifer. This groundwater eventually resurfaces via the many springs throughout the basin and flows downstream via surface streams and rivers. Groundwater generally flows in a southwest-to-northeast direction through the springshed. The sizes of the surface and groundwater basins make the Wekiva River System a primary hydrologic feature of Orange, Seminole, and Lake counties.

The Orlando metropolitan area is southsoutheast of the Wekiva River System. Although the Wekiva River itself does not run through the developed north suburbs of Orlando, these developed lands cover the southern quarter of the river's watershed. More than two million people live within 30 miles of the Wekiva River System. Much of the land adjacent to the river system is in public ownership, with the majority being owned by the state of Florida and the St. Johns River Water Management District. Other public lands owned by various local governments (e.g., county parks), the Lake County Water Authority, and the federal government (Ocala National Forest) also exist within the watershed or springshed. Almost all of the private lands adjacent to the river system are within Seminole and Lake counties.

#### THE WEKIVA RIVER SYSTEM

The Wekiva River System is a complex hydrologic network, consisting of the Wekiva River and its tributaries, springs, seepage areas, lakes, streams, sinkholes, and recharge areas. The river system is influenced by landscapes within two separate boundaries. The first is the boundary of the Wekiva River surface water drainage basin. A substantial portion of this area is in public ownership. The second boundary is that of the Wekiva springshed, which encompasses a much larger landscape within which water percolates and travels through underground strata to eventually emerge at the springs.

The dynamics of this type of river system are complex, involving continual exchanges of groundwater recharge and discharge as well as surface runoff during rainstorms. The rivers and streams in the Wekiva River System are fed by both springs and surface runoff. Although the springs provide a relatively consistent flow of fresh water throughout the year (in water flow volume and temperature), the seasonal variations in surface runoff flows may be substantial. Elevations within the Wekiva basin range from sea level to about 70 feet above sea level. The local climate is considered subtropical, with an average annual temperature of 72 degrees. Daily maximum Fahrenheit temperatures in the summer are typically in the low- to mid-90s. The average annual rainfall in the Wekiva basin is 52 inches, with June through October being the rainiest season.

This dynamic hydrological system and the local climate combine to provide ideal conditions for a diverse variety of natural communities in the river basin, such as pine flatwoods, wet and dry prairie, hydric hardwood hammocks, longleaf pine and wiregrass, xeric scrub oak, sand pine scrub, swamp, and marsh communities. These communities support numerous species of plants and animals, some of which are endangered, threatened, or species of special concern.

This document focuses on the resources and values of the waterways that are designated components of the Wekiva Wild and Scenic River System. When Congress designated the Wekiva River System as a national wild and scenic river in October 2000, the following waterways were included given their unique *wild*, *scenic*, and/or *recreational* qualities:

- Wekiva River (*wild* segments and *recreational* segments)
- Rock Springs Run (*wild* segments and *recreational* segments)
- Wekiwa Springs Run (*scenic* segment)
- Black Water Creek (wild, scenic, and *recreational* segments)

The Little Wekiva River and Seminole Creek were not designated as components of the wild and scenic river system.

#### Wekiwa Springs and Wekiwa Springs Run

Wekiwa Springs is an artesian flow in Wekiwa Springs State Park, a 7,800-acre publicly owned park managed by the Florida Park Service, an agency of the Florida Department of Environmental Protection. Wekiwa Springs Run flows about 1 mile before connecting with Rock Springs Run to form the Wekiva River.

Wekiwa Springs is a second magnitude spring with exposed limestone from the Hawthorn Formation just below the water's surface. The spring discharges about 48 million gallons per day of crystal clear water from at least five horizontal caverns 14 feet below the surface in a kidney shaped pool. The spring and its vicinity are extremely popular for swimming and sunning activities. Estimated peak summer use of the main spring area is between 1,200 and 1,500 persons per day. The bank adjacent to part of the pool has been bulkheaded, and ladders provide swimmer access to the water. Facilities near the main spring area include a canoe concession, snack bar, playground, two picnic pavilions, restrooms, a visitor center, and paved parking. A portion of the slope leading down to the spring is maintained as a grassy area for sun bathing, picnicking, viewing nature, and other uses.

#### **Rock Springs and Rock Springs Run**

Rock Springs, another second magnitude spring, is in Kelly Park, a 237-acre park owned by Orange County. Rock Springs represents one of the few areas in central Florida where the limestone of the Hawthorn Formation is exposed. The primary discharge, originating at the base of a partially submerged limestone bluff, produces an average discharge of about 41.8 million gallons per day. The spring run begins at the spring point of discharge and continues for several hundred feet until it divides into two flows. One flow forms a large public swimming area with concrete retaining walls on two sides. Both flows rejoin below the swimming area, and the spring run then flows northward for about 1.5 miles before turning south. Rock Springs Run continues southward for approximately 9 miles before meeting Wekiwa Springs Run to form the Wekiva River. There are no road crossings or bridges over Rock Springs Run. Most of the land along Rock Springs Run is in public ownership, much of which is a floodplain. This floodplain area is about 3 miles wide, east to west.

#### Wekiva River

The Wekiva River flows approximately 14.2 miles from the confluence of Wekiwa Springs Run and Rock Springs Run to the St. Johns River. The Wekiva River is fed by a combination of natural springs as well as about 130 square miles of watershed in north Orange County and northwest Seminole County, and approximately 112 square miles of watershed in Lake County.

One-quarter mile downstream of its beginning, the Wekiva River receives discharge from Miami Springs (aka Sweetwater) Run/Canal. The area between the inflow from Miami Springs and about 3.75 miles farther downstream, where the Little Wekiva River enters, is called Wekiva Swamp. Numerous islands characterize this area. The water is often clear, but can remain tannic for some time after a storm. Approximately 6 miles downstream of Wekiwa Springs, the floodplain narrows and sediments change from organic silts to sand. From here the river meanders northeast towards the St. Johns River. Wekiva Falls Run/Canal, a 2,000-foot tributary originating at Wekiva Falls campground, merges with the Wekiva River just south of the SR 46 bridge. This bridge, at river mile 6.1, is the only crossing over the Wekiva River. Black Water Creek joins the Wekiva River about 1 mile upstream of the confluence of the Wekiva River and the St. Johns River.

#### **Black Water Creek and Seminole Creek**

Black Water Creek is a major tributary to the Wekiva River. Its headwaters are at Lake Dorr in the Ocala National Forest. Upstream of the confluence with Seminole Creek, Black Water Creek is fed by groundwater seepage and a small spring and outflow from Lake Norris. The creek falls an average of 1.9 feet per mile over 16 miles between Lake Norris and the Wekiva River. It has an expansive floodplain and a sinuous and braided channel with many deadwood snags. Black Water Creek, from Lake Norris to where it joins the Wekiva River, is included as part of the wild and scenic river system. Through this stretch, Black Water Creek has four crossings, including Sand Road at mile 4.72 within Seminole State Forest, State Road 44 (SR 44) at river mile 11.75, County Road 44A (CR 44A)at river mile 11.8, and Lake Norris Road at about river mile 16.8.

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Seminole Creek, a tributary of Black Water Creek, originates at Seminole Springs and travels through Seminole Swamp before joining Black Water Creek. Springs contribute a larger portion of the flow downstream of the confluence with Seminole Creek than upstream. Seminole Creek flows across private lands and is in near pristine condition.

For the purpose of this environmental assessment, it should be noted that while Black Water Creek is included as part of the officially designated Wekiva Wild and Scenic River System, Seminole Creek is not.

#### Little Wekiva River

The Little Wekiva River basin receives drainage from an urbanized 42-square-mile area west and north of downtown Orlando. The river flows northward for 15 miles from Lake Lawne just north of SR 50 in Orange County through Altamonte Springs in Seminole County. The flow of the Little Wekiva is augmented by five springs. The Little Wekiva River flows into one of the southern arms of the Wekiva Swamp and on into the Wekiva River about half way between Wekiwa Spring and where the Wekiva River joins the St. Johns River. Although the Little Wekiva provides significant source of water into the Wekiva River, it is not included in the Wekiva Wild and Scenic River System.

#### Springs

There are 31 named springs within the Wekiva River System. Six of these feed directly or indirectly into the Wekiva River, four feed into Rock Springs Run, five feed into the Little Wekiva River, and 16 feed into the Black Water Creek and Seminole Creek drainage basin. Wekiwa Spring and Rock Springs are second magnitude springs, and the remaining 29 springs have a lower flow. Taken together, this complex of springs provides hundreds of millions of gallons of water per day into the various drainages of the Wekiva River basin. The water that feeds the springs, which in turn feeds the headwaters (or spring runs) of two major tributary streams for the Wekiva River, is groundwater. Florida's spring systems are governed by complex hydrologic forces that cause water recharge of the underlying aquifer through permeable soils or fissures. After traveling through a network of underground karst conduits and porous limestone, the water eventually returns to the surface. The water that appears at springs may have been under the ground for days, weeks, months, years, or decades depending upon its path from the surface and through the aquifer. Much of the water in the Wekiva River System comes from rain that falls outside the boundaries of public lands in an area known as the Wekiva springshed. Although the boundaries of surface watersheds are relatively easy to identify, springshed boundaries are more difficult to define. Furthermore, the quality and quantity of water in the aquifer and springs is affected by land uses just as surface waters are affected by land uses.

## DEMOGRAPHICS

All counties in the Wekiva River basin have had considerable population growth and urban expansion in recent decades, with the Orlando metropolitan area being a primary growth catalyst. According to U.S. Census Bureau estimates for 2008, the largest percentage increase in population in the study area during the past two decades occurred in Lake County, where population rose from 152,104 in 1990 to 307,243 in 2008. This amounts to a 102% increase in less than 20 years. Rapid growth rates have also been noted in Seminole and Orange counties. During the same time period, Seminole County has had a population increase of 43% (from 287,529 to 410,854), and Orange County has had a 58% increase (from 677,491 to 1,072,801).

Of the three counties, Lake County remains the most rural county and has the lowest population density. According to the 2000 U.S. census, Lake County had a population density of 221 people per square mile, whereas Orange and Seminole counties had population densities of 988 and 1,186 people per square mile, respectively. However, as the census information suggests, Lake County is becoming more and more developed, with increased population and urbanization. The Interstate 4 corridor in Seminole County to the east of the Wekiva River is also being rapidly developed. These trends will continue to (1) decrease the amount of open space land around the perimeter of Wekiva River basin, and (2) increase the recreation pressure on the Wekiva River because of substantial population growth near the river and the surrounding parklands.

#### **CONSERVATION LANDS**

More than 76,000 acres of land in the Wekiva basin and its environs have been purchased for conservation and are now managed by public agencies at the local and state levels. Furthermore, much of the Wekiva National Wild and Scenic River System are within or adjacent to public conservation lands (see Conservation Lands map). This public ownership is largely why the Wekiva River System remains relatively undeveloped and holds its wild and scenic river status. See table 3 for a listing of public conservation lands.

A small portion of the northern Wekiva basin is protected as part of the Ocala National Forest.

#### State Lands

The state of Florida accounts for the largest acreage of public land in the Wekiva River basin, in the form of state parks, a state reserve, and a state forest. Most of Rock Springs Run, much of the Wekiva River, and a significant portion of Black Water Creek, run through these state-owned lands. Thus, the management of these state lands plays a very important and direct role in protecting and sustaining the Wekiva Wild and Scenic River System.







# **Conservation Lands**

Wekiva Wild and Scenic River National Park Service / U.S. Department of the Interior P99 / 100423 / DSC / Aug 2010

Management Agency	Area Managed
Florida Department of Environmental	39,284 acres + Wekiva River Aquatic Preserve
Protection (FDEP)	
Florida Division of Recreation and Parks	
Wekiwa Springs State Park	
Rock Springs Run State Reserve	7,722 acres
Lower Wekiva River Preserve State Park	14,150 acres
Katie's Landing	17,405 acres
	6 acres
Coastal and Aquatic Managed Areas (CAMA)	
Wekiva River Aquatic Preserve	About 8,000 acres of sovereign submerged lands
	located "waterward" of ordinary high water on all of
	the Wekiva River, 3 miles of the Little Wekiva River, 1
	mile of Rock Springs Run, and the lower 3 miles of
	Black Water Creek.
Florida Department of Agriculture and	27,063 acres (includes 2,922 acres owned by St. Johns
Consumer Services (FDACS)	River Water Management District)
Florida Division of Forestry (FDOF)	
Seminole State Forest	6 649 perce
	0,040 dlies
(JINVIVID)	3 660 acros
County Water Authority or LCWA)	5,000acres
Wekiya River Buffer Conservation Area	2 483 acres
Lake County Water Authority $(I \subset WA)$	784 acres
Lake Tracy	445 acres
Bear Track Preserve	185 acres
Wolfbranch Sink	154 acres
Lake County	332 acres
Ellis property (next to Seminole Forest)	60 acres
Mt. Plymouth Lake	184 acres
South Pine Lakes properties	128 acres
Orange County	531 acres
Kelly Park	237 acres
Fazio property	160 acres
Strite property	83 acres
Apopka Blue Sink (city of Apopka)	40 acres
Seminole County	40
Wilson's Landing Park	19 acres
Wekiva Parkway and Protection Act	1,580 acres
acquisitions (snared management)	(Lake County and St. John's River Water Manage-
	ment District own 211 acres; Orange County and
	St. John's Kiver Water Wanagement District own
	5 TO ACTES; THE BOARD OF TRUSTEES OF THE INTERNAL
	Orlando Orango County Expression Authority
	owns 522 acros)
Orange County "Pine Plantation"	TIFE 345 acres Orange County 40 acres
TOTAL ACRES OF PUBLIC CONSERVATION	76 153 acres
I AND	70,155 acres

# TABLE 3. PUBLIC CONSERVATION LANDS IN THE WEKIVA RIVER BASIN

The Florida Department of Environmental Protection - Division of Recreation and Parks (also known as the Florida Park Service or FPS) manages more than 39,000 acres in three parks: Wekiwa Springs State Park, Rock Springs Run State Reserve, and Lower Wekiva River Preserve State Park. These three parks include stretches of the Wekiva River, Rock Springs Run, and Black Water Creek. The Florida Department of Agriculture and Consumer Services–Division of Forestry (FDOF) manages more than 27,000 acres which comprise Seminole State Forest. This state forest includes and abuts segments of Black Water Creek and the Wekiva River. In addition to "fee-simple" acquisition, the state of Florida has purchased conservation easements on approximately 2000 acres of private land, which are committed to conservation but are owned and managed privately.

The St. Johns River Water Management District (SJRWMD or the district) is another state-sponsored agency that holds title to approximately 9,600 acres and has acquired conservation easements for an additional 1,000 acres. Approximately 3,000 acres owned by the district adjacent to Black Water Creek is managed by the Florida Division of Forestry as part of Seminole State Forest. The district's Lake Norris Conservation Area is managed cooperatively by the district and the Lake County Water Authority.

#### Local Government and Local Agency Lands

The only county-owned lands that contain portions of a the designated wild and scenic river are Orange County's Kelly Park at Rock Springs and Seminole County's Katie's Landing and Wilson's Landing Park. The 237acre Kelly Park is managed by the Orange County Parks and Recreation Division of the Community and Environmental Services Department. Kelly Park contains Rock Springs and a short segment of Rock Springs Run. The 6-acre Katie's Landing and 19-acre Wilson's Landing Park are both managed by the Seminole County Parks and Recreation Division of the Leisure Services Department. Both of these county parks serve primarily as boat landing sites for the Wekiva River.

Other county and municipal parks also exist in the Wekiva River basin, but these do not contain designed rivers or streams. In addition to city- and county-owned lands, the Lake County Water Authority (a special district within Lake County) owns lands in the Wekiva River basin such as Lake Tracy, Wolfbranch Sink, and Bear Track Preserve. The authority also helps manage the SJRWMD lands, particularly the Lake Norris Conservation Area.

#### **Private Conservation Lands**

The Audubon Society owns a tract of land adjacent to the Wekiva River between river mile 9 and river mile 10 that is encumbered by a conservation easement, and thus is held for conservation purposes. The land is managed in conjunction with the adjacent SJRWMD lands. In addition to this, a 1,600-acre private mitigation bank, known as the "Wekiva Mitigation Bank" operates within the basin. This bank, permitted by the Florida Department of Environmental Protection, is in east Lake County just south of the proposed Wekiva Parkway and is surrounded by Rock Springs Run State Reserve. Wetland and upland restoration occurs on the site in exchange for development impacts elsewhere in the basin.

#### MANAGEMENT OF PUBLIC LANDS

Most publicly owned land in the Wekiva River basin is generally managed and used in a way that balances resource conservation with public recreation. However, each government management agency has its own individual management priorities. Typically, these differences in land and water management are made more apparent by comparing the recreational uses that are allowed on each tract of public land. The allowed recreational uses will be discussed in more detail in the "Recreation Values" section later in this chapter.

The various public land agencies generally have missions that provide outdoor recreation and nature experiences for the public while protecting natural resources. In general, most of the county parks in Lake, Orange, and Seminole counties are managed with a high priority placed on active and passive recreation in a natural setting. Although the three state parks in the basin (Wekiwa Springs State Park, Rock Springs Run State Reserve, and Lower Wekiva River Preserve State Park) are all managed by the Florida Division of Recreation and Parks, they each have slightly different land management priorities. For example, Wekiwa Springs State Park has a relatively strong emphasis on diverse recreation opportunities and public access, and Rock Springs Run State Reserve and Lower Wekiva River Preserve State Park place a higher priority on resource protection. Although the latter two parks provide ample recreational opportunities and public access, the allowable recreational uses and access tend to be more passive and/or selective.

The remaining public lands in the basin are managed by agencies that hold management priorities in conserving a particular resource, such as a forest or water. Thus, although the Florida Division of Forestry, the St. Johns River Water Management District, and the Lake County Water Authority all allow public access and recreation, their respective lands are managed in a way that places a high priority on protecting the resource so that the resource may available for future use.

The Florida Department of Environmental Protection, Office of Coastal and Aquatic Managed Areas, manages more than 8,000 acres of sovereign submerged lands, designated as part of the Wekiva River Aquatic Preserve. The aquatic preserve includes the Wekiva River and the lower reaches of Rock Springs Run, Black Water Creek, and the Little Wekiva River. The Wekiva River Aquatic Preserve also includes a portion of the St. Johns River, from Interstate 4 just west of Sanford, to SR 44, just west of Deland. All of the wild and scenic river segments covered in this plan have been designated as "Outstanding Florida Waters" (OFWs) under Chapter 62-4 of the *Florida Administrative Code*. Although this status gives these river segments the highest protection from water quality degradation that is possible under state regulatory programs, it does not completely prohibit surface water discharges or eliminate all sources of pollution. Public land holdings are shown on the previous Conservation Lands map.

# EXISTING LAND USES AND DEVELOPMENT ON PRIVATE LAND

As noted in the previous section, much of the land adjacent to the Wekiva River System is in public ownership and is managed according to the conservation and recreation policies of the various management entities. Exceptions to the public ownership include private agricultural lands and private lands that are developed with residential and commercial land uses. More specifically, some existing single-family residential development and a commercial outfitter are located just downstream of Kelly Park on Rock Springs Run. Residential development and commercial outfitters also exist along the middle section of the Wekiva River in Lake and Seminole counties (both upstream and downstream of the SR 46 bridge). Private agricultural lands are primarily along the Black Water Creek drainage basin, downstream of Lake Norris. A large tract of private agricultural and undeveloped land referred to as "Seminole Woods" is surrounded by Seminole State Forest. With the exception of grazing that occurs on some of the upland fringes of Seminole Woods and silviculture, most of this private tract is currently in an undeveloped and undisturbed condition.

Larger areas of private lands exist beyond the designated waterways but within the Wekiva drainage basin and springshed. These areas include a mix of residential, commercial, and agricultural properties. Development ranges **CHAPTER 3: AFFECTED ENVIRONMENT** 

from agricultural uses and very low-density rural-residential land uses (predominantly in east Lake County and northwest Orange County) to high-density residential, commercial, and industrial-urban land uses in the greater Orlando metropolitan area of Orange and Seminole counties.

# OUTSTANDINGLY REMARKABLE VALUES (RESOURCES THAT COULD BE AFFECTED)

Chapter 1 of this environmental assessment includes a brief description of each outstandingly remarkable value identified in the Wekiva Wild and Scenic River System Comprehensive River Management Plan (scenic, recreation, wildlife and habitat, historic and cultural, and water quality and quantity) and why it is outstandingly remarkable. This chapter provides more detailed descriptions and current condition of these values.

## SCENIC VALUES

The Wekiva River System is an exceptional visual resource on local, state, and national levels. Scenic values include the landscape within direct view of the river and existing recreation sites and facilities that are directly related to the river. This river system provides ample opportunities for nature observation and education, nature photography, and scenery appreciation. Many of the river segments are in a pristine state. As a result, they present the opportunity to see an unspoiled part of natural Florida. In addition to being of high quality, the scenic resources of the Wekiva River System are also abundant, because the Wekiva River and its tributaries combine to provide many miles for natural exploration. The crystal clear waters of the springs and rivers; the unspoiled blackwaters of Black Water Creek; and the mosaic of sandhills, flatwoods, hammock, scrub, and wetland communities surrounding the river system all contribute to make the area a unique scenic resource of national value.

Given the expanding urbanization of central Florida, the amount and quality of open lands and natural scenery in Lake, Seminole, and Orange counties is decreasing. Thus, as population and urban growth continue, the scenic value of the Wekiva River System will be more and more important to the community and its residents.

The scenery as one journeys down the various reaches of the Wekiva River and Rock Springs Run matches the scenery that would be expected in each segment's classification. The wild segments are in their natural state with mostly native vegetation along the banks. The landscapes are primarily floodplain swamp and hydric hammock on Rock Springs Run and the upper Wekiva River. On the lower Wekiva River, a mix of upland and wetland vegetation types predominate close to the river until the river enters the floodplain of the St. Johns River about 1 mile from the confluence. Occasionally, parts of Rock Springs Run are blocked by downed trees from storms. Although inconvenient for boating, the downed trees can lend a sense of wilderness to the river reach and improve aquatic habitat. It should be noted, however, that downed trees can be a significant hazard to beginning paddlers. Aquatic preserve staff and contractors spend considerable time removing navigational hazards throughout the Wekiva River System.

Motorized boats, particularly on the Wekiva River, create visual, auditory, and even olfactory disturbance for paddlers. Personal watercraft (e.g., Jet skis) use may be increasing, and if so could create more impacts. Low-flying airplanes, primarily commercial passenger jets banking overhead on approach to the Sanford Airport, are a relatively recent phenomenon. Noise and visual disturbance associated with low-flying aircraft diminish the values of *scenic* and *wild* segments of the river system.

Private shoreline development in the form of residences, boat launch facilities, docks, and decks have negatively affected scenic values of the river, particularly within the recreational segment. The visual impact of the SR 46 bridge, in the center of a *recreational* segment of the Wekiva River, is also a disturbance to scenic values. Plans are in place for a new bridge over the Wekiva River as part of the integrated Wekiva Parkway/SR46 design. The new bridge will have a higher structure spanning more of the riparian corridor.

Vandalism, soil compaction, and bank erosion occurring on Shell Island and other shell middens along the Wekiva River are intrusive and can damage significant cultural resources; these activities can also remind visitors of the outside world, potentially detracting from a wilderness experience. Similarly, litter along the river system, along the shoreline, and at the bottom of the river channel detracts from the scenic value of the river(s). The most common litter items are beer and soda cans. Other items frequently encountered include plastic bags and cups and Styrofoam (cups, bait cups, coolers). Fishing line and tackle is occasionally found in the river or entangled in vegetation along the shore, or overhanging the water.

Given the number of canoeists and boaters on the Wekiva River System, litter clean-up presents a constant challenge for resource managers. Aquatic preserve staff conduct at least 12 cleanups per year with volunteers and often pick up debris during regular work activities. Kings Landing canoe rental, at the top of Rock Springs Run, requests that its patrons do not take beverage containers on the water.

Signs on the river can detract from the experience if they are adrift or in disrepair. The Florida Division of Recreation and Parks has a plan in place to clean up old signs and is in the process of installing new ones.

Invasive and exotic plant species also affect the scenic value of the Wekiva River System. When these waterways get infested with exotic plants or algae blooms, scenic values can be considered impaired. This adverse impact is particularly noticeable when invasive aquatic plants take over a reach of river to a point where the surface water is no longer visible.

Black Water Creek provides the potential for a peaceful, scenic experience with predominantly native riparian and floodplain vegetation. Its narrow and sinuous route through the Seminole State Forest, Lower Wekiva River Preserve State Park, and St. Johns River Water Management District lands provides for a challenging and excellent backcountry paddle. Not all of Black Water Creek is navigable, depending on water level and downed trees or other vegetation that may inhibit passage. Roadway bridges traverse Black Water Creek at Sand Road, SR 44, CR 44A, and Lake Norris Road. The bridges over SR 44 and CR 44A are very close together, thus magnifying the adverse impact upon scenic qualities where these two roads cross the creek.

#### **RECREATION VALUES**

The Wekiva River, Wekiwa Springs Run, Rock Springs Run, and Black Water Creek serve as a major recreational resource for central Florida, particularly the large Orlando metropolitan area. Recreational activities in the Wekiva basin include canoeing/kayaking, bank fishing, boat fishing from motor and nonmotorized boats, personal watercraft use, picnicking, camping (primitive, developed, and horse), tubing, swimming, snorkeling, wildlife watching, hiking, horseback riding, and hunting. The Wekiva River/Rock Springs Run Canoe Trail is officially designated as part of Florida's statewide system of greenways and trails.

For the purposes of this assessment, access points for recreation are defined as areas where people can access the rivers from public or private lands. Rest stops are places where people recreating stop their boats and get out. Takeouts are places where people remove their boats from the water or complete their trip and exit the river. Access points, rest stops, and takeouts can be either designated or nondesignated, and can be on public or private land. The recreational opportunities on the various waterways of the Wekiva Wild and Scenic River System are described below. See the previous Conservation Lands map for the locations of public lands associated with riverbased recreation in the Wekiva River System.

#### Wekiva River and Wekiwa Springs Run

The Wekiva River is one of the few remaining near-pristine riverine systems in central Florida, and its natural springs have been enjoyed by people since Native Americans first occupied this area. Today, people come to this river to enjoy the opportunities provided by its cool, clear waters and diverse ecosystems. Access to the river is from public lands (state and county), private businesses/ boating operations, private residential properties, and the St. Johns River. Designated public access along the Wekiva River includes Wilson's Landing County Park and Katie's Landing, with Wekiwa Springs State Park providing public access on Wekiwa Springs Run. Private canoe/kayak facilities that offer access along the Wekiva River are currently Wekiva Island and Wekiva Falls Resort. A private canoe/kayak concessioner also operates within Wekiwa Springs State Park.

Wekiwa Springs State Park. This state park is at the headwaters of the Wekiva River and offers a glimpse of what central Florida looked like when the Timucuan Indians fished and hunted along the river banks long ago. The 7,722-acre park has more than 215,000 visitors and more than 55,000 campers a year. The main spring area is the most used area in the park, particularly during the peak season. Recreational opportunities at Wekiwa Springs State Park include swimming, hiking, biking, horseback riding, snorkeling, wildlife watching, tubing, picnicking, camping, and canoeing/ kayaking. Wekiwa Springs State Park Nature Adventures is the park's canoe/ kayak concessioner that rents approximately 200 boats per day on weekends and 60 boats per day on weekdays during the busiest season (March to November). A concession stand provides refreshments. Picnic areas and

shelters are provided in the areas around Wekiwa Spring and Sand Lake. A playground is in the spring picnic area, along with a volleyball area and horseshoe pit. A museum and visitor center houses exhibits on natural and cultural history. The park has 9 miles of equestrian trails, 8 miles of biking trails (plus use of equestrian trails for biking), and 13.5 miles of trails for hiking. Wekiwa Springs State Park also provides 60 full-facility campsites (water, electricity, fire pit, picnic table, and restroom/ showers), along with a primitive camping area. Primitive camping opportunities provided along Rock Springs Run within Wekiwa Springs State Park include two canoe camping sites (Otter Camp and Big Buck Camp).

Lower Wekiva River Preserve State Park. This park spans about 6 miles of the St. Johns River, the lower 4 miles of the Wekiva River, as well as the lower reaches of Black Water Creek. This system of blackwater streams and wetlands provides habitat for black bears (Ursus americanus floridanus), river otters (Lutra Canadensis), American alligators (Alligator missippiensis), and wood storks (Mycteria americana). Although natural resource protection is a priority in this 17,405acre state park, some limited recreational opportunities are available. Recreational activities include canoeing/kayaking, horseback riding, primitive horse camping, hiking, biking, and wildlife watching. Canoeists and kayakers can travel through the park along the St. Johns River, the Wekiva River, and Black Water Creek. However, the park's only launch/ takeout access point is at Katie's Landing (described below in more detail). Visitors can use the self-guided 2.5mile nature trail at the south end of the park to get an overview of the park, or they can travel some of the 18 miles of multiuse trails on foot, horseback, or bike in the northern portion of the park. Horses are not allowed in the southern portion of the park. The Lower Wekiva River Preserve State Park also offers primitive horse camping opportunities in designated areas of the northern portion of the park. Horse stalls and corrals are avail-

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able. Camping reservations are made via Wekiwa Springs State Park.

Katie's Landing. This landing is a public canoe/kayak launch site just north of SR 46, and is managed as part of Lower Wekiva River Preserve State Park. This site started out as a fish camp, canoe operation, and private campground in the late 1940s and was sold to the state in late 2001.

The state will continue to manage Katie's Landing as a canoe/kayak launch and takeout site and provide parking, restrooms, and a picnic facility. In the future, the boat concessioner at Wekiwa Springs State Park may offer a shuttle service to pick up boaters who rented canoes and kayaks at the state park upstream. There will be no swimming or motorized boat launching because of the surrounding shallow waters and fragile eelgrass beds.

Wilson's Landing. This landing is a 19-acre Seminole County facility developed in 2004 that includes a small pavilion, a pier on the Wekiva River, restrooms, and paved parking area. Wilson's Landing has functioned as an unofficial launch and takeout site for canoes and kayaks.

**Rock Spring Run State Reserve.** This reserve also includes a large stretch of the Wekiva River, which runs along its eastern boundary. This state park is described below in the recreation summary for Rock Springs Run.

Wekiwa Springs State Park — Nature Adventures. This private concessioner operates out of Wekiwa Springs State Park. This concessioner provides canoe and kayak rentals and guided river tours. Visitors launch from the spring and can paddle down Wekiwa Springs Run about 1 mile to the Wekiva River. Paddlers have the option of continuing on to Katie's Landing.

Wekiva Island. This is a privately owned facility that offers an opportunity for power boat, canoe, and kayak launching in addition to bait, tackle, and food sales. This private facility also rents canoes and kayaks. Wekiva Island is also used as a takeout point for boats that are rented from Kings Landing along Rock Springs Run.

Wekiva Falls Resort. This resort, along the Wekiva River, offers motorboat tours of the river (seating capacity of more than 20/boat), as well as canoe and kayak rentals. Resort guests can also use the marina to launch their boats. Wekiva Falls Resort has more than 800 recreational vehicle (RV) sites, along with laundry, showers, a fishing and camping supply store, picnic sites, and a swimming beach surrounding a large artesian well that flows to the Wekiva River.

Wekiva River Haven. This privately owned facility is downstream of Katie's Landing and has closed in recent years. Before closure, this facility rented small motorboats and catered primarily to anglers by offering bait, food, and other supplies. The future use and management of this property is unknown.

# **Rock Springs Run**

Rock Springs Run's diverse scenery, unique plant communities, and excellent paddling opportunities make it a popular recreation destination. The run twists and turns for 8 miles as it winds its way to the Wekiva River through various habitats including pine flatwoods, marsh land, and subtropical and dense hardwood forests. A few private homes and cabins can be seen for the first 0.25 mile of the run, but the remainder of the run is undeveloped and generally pristine as it flows through public land. Rock Springs and the upper parts of Rock Springs Run can be accessed at Kelly Park. Canoeists and kayakers can access the Rock Springs Run at Kings Landing, a private outfitter about a 0.5 mile downstream from Kelly Park, or from the Wekiva River farther downstream. Navigating Rock Springs Run can be a challenge for beginning paddlers because of many fallen trees and submerged vegetation in the run. Three primitive canoe/kayak campsites along

the run can be reserved through Wekiwa Springs State Park.

Kelly Park. This park is Orange County's highest use park and is home to the headwaters of Rock Springs Run. Rock Springs bubbles up from a cleft in a limestone outcropping and feeds the run as it flows to the Wekiva River. The 237-acre park is a popular getaway for local residents and visitors alike, and it is managed by the Orange County Parks and Recreation Division (a branch of the Community and Environmental Services Department). The park has about 300,000 visitors per year. During the summer the park often reaches capacity, causing many potential visitors to be refused entry. Recreational activities in Kelly Park include swimming, snorkeling, tubing, picnicking, hiking, biking, volleyball, wildlife watching, and camping (25 full-facility campsites and a primitive camping area). Many visitors rent or bring inner tubes and put them in at Rock Springs. Visitors then tube down the 1-mile run to the main swimming area. The 20-to 30minute trip winds through limestone outcroppings and natural pools that attract many swimmers during warm months. An extensive series of boardwalks allows access to different areas of the park while lessening impacts to the shoreline.

Rock Springs Run State Reserve. This reserve spans the shoreline of both Rock Springs Run and the Wekiva River. Sand pine scrub, pine flatwoods, swamps, and miles of pristine shoreline make this 14,150-acre reserve a refuge of natural beauty. Although there are no boat launch access points to the Wekiva River and Rock Springs Run from the reserve, boaters can travel through the reserve on both rivers after accessing the water at one of the designated launch sites upstream or downstream. Reserve visitors can also enjoy bicycling, hiking, horseback riding, canoe camping, horse camping, wildlife watching, and hunting (in autumn). The reserve provides more than 15 miles of multiuse trails for hiking, biking, and equestrian use. Primitive camping opportunities include two canoe camping sites (Indian Mound Camp on Rock

Springs Run and Buffalo Tram Camp on the Wekiva River). Guided trail rides and horse rentals are available. The Florida Park Service also recently contracted with a concessioner to operate a Wekiva River launch access in the reserve. Hunting is allowed in Rock Springs Run State Reserve and on the adjacent Seminole State Forest for about 24 days each year between September and early January. No camping or horseback riding is allowed during scheduled hunting days.

Kings Landing. This landing is a private canoe livery on the western end of Rock Springs Run, just downstream from Kelly Park. The business currently rents about 100 canoes per month, with an anticipation of increased use in the future. Kings Landing has been in existence for decades and was shut down for several months after the 2004 and 2005 hurricanes caused widespread damage and blockage of the run. The business was purchased in 2007 by its current owner who has renovated the facility. Canoe renters from Kings Landing have an 8-mile run down Rock Springs Run to Wekiva Island at the upper reach of the Wekiva River. The Wekiva Island operator provides a takeout ramp and space for vehicle parking and canoe storage for Kings Landing customers.

Wekiwa Springs State Park. This park also includes a large stretch of Rock Springs Run, which runs along its northeastern border. This state park was described above in the recreation summary for the Wekiva River and Wekiwa Springs Run.

# **Black Water Creek**

This creek flows out of Lake Norris and runs through St Johns River Water Management District lands; Seminole State Forest; a large, forested, private property; and Lower Wekiva River Preserve State Park on its way to the Wekiva River. As its name implies, Black Water Creek is a beautiful, dark water stream that flows through undeveloped forests. The dark waters are a result of the tannic conditions in the water. Although Black Water

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Creek is several miles long, the creek is much less accessible than Rock Springs Run, Wekiwa Springs Run, or the Wekiva River. Black Water Creek only has one public canoe facility (at Lake Norris Conservation Area) and a few minimally developed launch sites downstream from there on Seminole State Forest lands. Dense vegetation and downed trees in the creek make boating on Black Water Creek challenging. Given the limited access and undeveloped state of Black Water Creek and its surroundings, the creek provides opportunities for solitude and backcountry, nonmotorized boating. In addition to the limited boat access via Seminole State Forest and the Lake Norris Conservation Area, small nonmotorized boats are sometimes able to access the lower reach of Black Water Creek at its confluence with the Wekiva River. There are currently no private concessioners on Black Water Creek.

Seminole State Forest. This state forest includes more than 27,000 acres and is managed by the Florida Division of Forestry (a branch of the Florida Department of Agriculture and Consumer Services). This ecologically diverse forest contains 13 different natural communities - almost all of the naturally occurring vegetative communities found in central Florida. Recreation opportunities in the forest include hiking, picnicking, camping, fishing, wildlife watching, biking, and hunting. Forest access is available from SR 44 and SR 46; however, a state forest use permit is required for drive-in access. Day use entrance fees are collected at self-service pay stations near the entrance gates. Seminole State Forest provides three designated river access points suitable for nonmotorized boats along Black Water Creek. Two of the access points are from campsites and one is a day use launch site. There are no boat access points on the Wekiva River. More than 20 miles of multiuse trails are available for hiking, biking, and equestrian use. Seminole State Forest also provides one primitive canoe campsite on Black Water Creek (Moccasin Springs Camp), four primitive campsites along hiking trails, and two large primitive group campsites in open

fields. As with Rock Springs Run State Reserve, portions of Seminole State Forest are open to hunting at selected times in the fall (in the portion of the forest designated as a wildlife management area).

Lake Norris Conservation Area. This area was purchased by the St. Johns River Water Management District to protect the extensive hardwood swamp on the western shore of the lake and the shoreline of Black Water Creek. Lake Norris is a spectacular blackwater lake that supports a variety of bird life, including abundant osprey. The upland portion of the conservation area consists of improved pasture, scrub, and a small amount of planted pine. Available recreation activities include hiking, wildlife viewing, primitive camping, fishing, horseback riding, bicycling, and canoeing. Canoes are available for public use through the Lake County Water Authority, which helps manage the conservation area. Motorized vehicles are prohibited.

Lower Wekiva River Preserve State Park. This park also lies along a significant stretch of Black Water Creek. This state park was described above in the recreational summary for the Wekiva River.

#### WILDLIFE AND HABITAT VALUES

As noted earlier, the complex hydrological system of the Wekiva River basin and the area's climate combine to create favorable conditions for a wide array of natural communities in the river basin. Some of these natural communities include pine flatwoods, wet and dry prairie, hydric hardwood hammocks, longleaf pine and wiregrass, xeric scrub oak, sand pine scrub, swamp, and marsh communities. These communities support a biologically diverse collection of upland, wetland, and aquatic plant and animal species, some of which are listed as endangered, threatened, or species of special concern.

Consistent with the National Wild and Scenic River designation, wildlife considered in this environmental assessment will be limited to those species whose lives are directly linked to the river system. The Florida black bear is included for its regional importance as an umbrella species and its regular use of floodplain swamps along the Wekiva River system. The most relevant area of the basin to be considered in this environmental assessment, relative to wildlife and habitat, is the 100-year floodplain and the Wekiva River Riparian Habitat Protection Zone. Invasive exotic species, where they represent a threat to the continued existence of native species, will be considered within this value.

For the purposes of fulfilling requirements of NEPA, the wildlife species and habitat included in this analysis will be limited to the species that are: (a) listed as threatened or endangered at a state or federal level; and (b) could be affected by the proposed action. Species listed as species of special concern in the state do not necessitate NEPA analysis. However, this analysis includes some additional information on certain species of special concern to help tell the story of the overall ecological system in the Wekiva basin.

The committee's management plan for the Wekiva Wild and Scenic River System provides additional information on wildlife and habitat not included in this environmental assessment. Please refer to the committee's management plan for additional information (contact Wekiva Wild & Scenic River System Advisory Management Committee).

#### Background

The Wekiva River watershed and the habitat it provides are at the southern end of an important wildlife corridor that connects protected state lands to the Ocala National Forest. An extensive floodplain of hardwood forest, as much as 3 miles wide, provides habitat for several species designated as endangered, threatened, or of special concern. The Wekiva River basin is at a transitional area between temperate and subtropical climatic zones. The species overlaps result in one of the richest floral compositions in Florida (NPS 1999). Unusual plant species found in the Wekiva basin include red buckeye, chinquapin, and Carolina basswood, species more commonly associated with Appalachia. This richness extends also to plant communities, with the following 14 different native plant communities identified in the Wekiva River basin:

wet flatwoods baygall mesic flatwoods floodplain swamp scrubby flatwoods hydric hammock sandhills flatwoods/prairie/marsh lake scrub spring-run stream upland hardwood forest and blackwater stream upland mixed forest aquatic and terrestrial cave xeric hammock

This diverse array of natural communities is home to a wide variety of wildlife species. For example, one of the state's largest populations of Florida black bear, a state-threatened species, uses the protected riparian corridor to move between Ocala National Forest and large patches of conservation lands that comprise the Wekiva-Ocala Greenway in Orange, Seminole, and Lake counties. The wood stork (Mycteria americana), a federal endangered species, nests in cypress trees in the Wekiva River Aquatic Preserve (the aquatic preserve) and is often observed foraging in the river shallows. Other protected species inhabiting the Wekiva River basin include the bald eagle (Haliaeetus leucocephalus), a state protected species. The little blue heron (Egretta caerulea), tri-colored heron (Egretta tricolor), and limpkin (Aramus guarauna) are state species of special concern.

The river system also provides food and habitat for the river otter (*Lutra canadensis*) and American alligator (*Alligator mississippiensis*). West Indian manatees (*Trichechus manatus*), state and federally listed as

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endangered, have been observed in the lower reaches of the Wekiva River.

Two aquatic invertebrates unique to the Wekiva River are the Wekiwa Springs hydrobe (*Aphaostracon monas*) and the Wekiwa siltsnail (*Cincinnatia wekiwae*) (NPS 1999). In addition, the Orlando cave crayfish (*Procabarus acherontis*) is restricted to groundwater sites associated with six or seven spring cave systems of the low Wekiva River basin (FDEP 2005).

#### **Special Status Species**

Special status species in the Wekiva River basin are those listed as *endangered*, *threatened*, or *species of special concern* by the U.S. Fish and Wildlife Service (USFWS) and the Florida Fish and Wildlife Conservation Commission (FWC). The federally listed species are protected under the terms and provisions of the Endangered Species Act, and the state-listed species are protected under Rules 68A-27.003, 68A-27.004, and 68A-27.005 of the *Florida Administrative Code*. All of these species are also monitored and tracked by the Florida Natural Areas Inventory (FNAI).

As noted above, although numerous state species of special concern live in the Wekiva River basin (e.g., limpkin, little blue heron), this NEPA analysis focuses only on state and federally listed threatened and endangered species. A list of threatened, endangered, and special concern species that may exist in the project area and the state and federal status of each are identified in appendix C. There are 37 plants and lichens, 5 reptiles, 9 birds, and 2 mammals listed (see appendix C for a specific list of these species). There are no gastropods (snails and allies), arachnids, decapods (crabs, crayfish, shrimp), grasshopper and allies, beetles, caddisflies, butterflies and moths, fish, or amphibians in the Wekiva River System that are listed as threatened or endangered at a state or federal level.

Following is some additional information on some special status species. Once again, although The National Environmental Policy Act does not require the analysis of state species of special concern, some of the following species narratives are provided as background information about the Wekiva River System.

Florida black bear (Ursus americanus *floridanus*) — The Florida black bear is a state-listed *threatened* species that uses the Wekiva basin and is of regional importance. Florida black bears occupy a diversity of habitats including upland forests, wetlands, and floodplains. They also frequent the riparian corridor. The Florida black bear is considered an umbrella species because successful protection of its habitat will benefit not only the bear, but many other species within the basin that collectively constitute a healthy ecosystem. The bears in the Wekiva River basin are considered part of the larger Ocala bear population, one of eight recognized bear populations in Florida. The Ocala population is medium in size relative to the state's other populations, yet it has the highest roadkill mortality rate. Between 1976 and 2002, 503 of the 1,340 bears killed on Florida roads were from the Ocala population. Bear-human conflicts are on the rise statewide, primarily on private properties adjacent to or near conservation lands. There has not been a documented incident of a black bear harming a person in Florida; however, humans have substantial impacts on bears. The Ocala bear population led in the number of human-bear conflict reports from 1978 to 2002 (3,027). These conflicts include bears breaking into food storage areas, ransacking garbage, and occasionally attacking livestock. A chronic problem within neighborhoods near bear habitat is that individual bears routinely seek out garbage from dumpsters or garbage that is left in unsecured containers outside of residences. The act of intentionally feeding a bear is prohibited in Florida, yet enforcement is nearly impossible.

If a bear has been fed or learns to consider developed areas as reliable food sources, consequences to the bear can be tragic. Once a bear becomes a nuisance, the Florida Fish and Wildlife Conservation Commission may be contacted to trap and relocate it (usually to the Ocala National Forest). Bear relocations are often unsuccessful, in which case FWC staff may resort to euthanasia. A multifaceted approach is currently used to address bear conflicts within and around the Wekiva basin park system. Bear-proof dumpsters and trash receptacles for the parks have been purchased with funds contributed by Defenders of Wildlife or through regular state agency budgets. Additional bearproof receptacles have been donated by the U.S. Forest Service. Educational materials regarding bear-human conflicts include materials designed by the Florida Fish and Wildlife Conservation Commission, a presentation on bears was developed by state staff, and printed materials are provided to residents of nearby subdivisions.

West Indian manatee (*Trichechus manatus*) — Manatees are occasional visitors to the lower Wekiva River but do not venture far upriver, presumably because of shallow water. Although the St. Johns River is designated critical habitat for this federally endangered species, no waters in this environmental assessment are so designated. More boat traffic entering the Wekiva River from the St. Johns River could expose manatees to increased propeller-caused injuries and disturbance, especially given the narrow and shallow dimensions of the Wekiva River.

Bald eagle (*Haliaeetus leucocephalus*) — Formerly listed as threatened under the federal Endangered Species Act, the bald eagle was removed in June 2007 because of significant gains in its population. The bald eagle, however, remains protected under the federal Bald and Golden Eagle Protection Act. Bald eagles are frequently seen along the Wekiva River System preying on fish. There are eight known bald eagle nest sites within the Wekiva River Protection Area. Annual nest surveys flights are conducted by the Florida Fish and Wildlife Conservation Commission.

Wood stork (Mycteria americana) -The wood stork rookery in the northeastern area of the basin has been unoccupied since at least 1999, probably because of unsuitable water levels in the basin that adversely impact nesting success. Wood stork nesting success depends on two primary factors — the availability of adequate food sources at the onset of the nesting season and the presence of sufficient water to support alligators that patrol the waters and consume raccoons, the primary nest predator of wood storks. Wood storks forage in shallow (6"–10") waters of marshes, swamps, ditches, canals, and lakes where fish are concentrated. Below-normal rainfall and the resulting lack of adequate local food resources may have prevented nesting in recent years.

Limpkin (Aramus guarauna) — The limpkin is listed as a state species of special concern. Monthly surveys of limpkins and other bird species have been conducted by volunteers and Wekiva River Aquatic Preserve staff during the last two years. When compared to surveys conducted in 1992 and 2002, the recent surveys indicate a stable population of limpkins in the Wekiva River basin. The channeled apple snail, or golden snail (Pomacea canalicu*lata*), a large invasive exotic, has been found in nearby Lake Brantley and may soon infest the Wekiva River. It is unknown what effects these exotic snails may have on the limpkin's main food source, native apple snails (Pomacea paludosa) or their habitat, and ultimately, limpkins. Channeled apple snails feed on eelgrass and are serious pests in a number of other countries.

# Bluenose shiner (*Pteronotropis welaka*) — The bluenose shiner has been reported

to occur within the Wekiva River System and a limited number of sites in the panhandle of Florida. However, its population numbers are not well known in either region. It is currently listed as a species of greatest conservation need by the Florida Fish and Wildlife Conservation Commission. One specimen of this rare minnow species was collected during a fish and macroinvertebrate study of the Wekiva River in 1999. The authors noted that it was found in eelgrass habitat, an important habitat for a number of aquatic species.

Orlando cave crayfish (*Procambarus* acherontis), Wekiwa Springs hydrobe (*Aphaostracon monas*), and Wekiwa siltsnail (*Cincinnatia wekiwae*) — These species are endemic to the Wekiva River basin and are designated as species of Greatest Conservation Need by the Florida Fish and Wildlife Conservation Commission because of their geographically narrow distribution and because the status and trend of their populations are unknown (FWC 2007). They are candidates for state listing as species of special concern, awaiting further information on their current status.

The Wekiwa Springs hydrobe and Wekiwa siltsnail were discovered in the 1970s in and near the Wekiwa Springs State Park main spring area and in the very upper reaches of the spring run. The Orlando cave crayfish is restricted to groundwater sites associated with six or seven spring cave systems of the lower Wekiva River basin (FDEP 2005). Within the Wekiva River basin state parks, this species has only been recorded inside Wekiwa Springs State Park. It has been seen periodically in the spring at the mouth of the underwater cavern.

A survey of the Wekiwa Springs State Park during May 2002 did not find the Orlando cave crayfish. A survey in 1997 also failed to detect any of the three species, and the report cited the need to sample specifically for these species within the caves and spring outlets. Water quality and quantity and overall condition of the springs are probably the most important issues regarding the conservation of these invertebrates.

#### Habitat Connectivity

The Wekiva basin is recognized as the southern part of a contiguous landscape of ecologically connected habitat extending from Wekiwa Springs State Park northward through the waterways, wetlands, and uplands of the Wekiva and St Johns river basins and into the Ocala National Forest. The overall health the Wekiva River basin ecosystem and the biodiversity of natural communities in it are inextricably linked to this larger conservation landscape. Establishing a secure and contiguous corridor of public conservation lands in this area has been a focus of attention of the Wekiva-Ocala Greenway Project and past land acquisition programs. Protecting wildlife and habitat values of the federal Wekiva Wild and Scenic River System over the long term will depend largely on successful completion of this state land acquisition effort.

#### **Management Issues**

Invasive and Exotic Species. The aquatic, wetland, and terrestrial habitats in the Wekiva River basin are all directly affected by the introduction and spread of invasive, exotic plant and animal species. Because these opportunistic species often outcompete native species and degrade or displace native habitat, the overall biodiversity of the Wekiva River natural system is threatened by such species. The presence and abundance of invasive and exotic species can be used as an indicator of ecosystem health.

Invasive aquatic plants, listed by the Florida Exotic Pest Plant Council, such as wild taro (*Colocasia esculenta*), hydrilla (*Hydrilla verticillata*), water lettuce (*Pistia stratiotes*), and water hyacinth (*Eichhornia crassipes*), may adversely affect aquatic habitats. These invasive aquatic plants are considered one of the biggest challenges for public land managers in the Wekiva basin. East Indian hygrophila (*Hygrophila hydrosperma*), an exotic invasive aquatic plant, is established in the Little Wekiva River, but is not yet widespread in the basin.

Staff and contractors for the Wekiva River Aquatic Preserve (the aquatic preserve) and the Florida Fish and Wildlife Conservation Commission's Bureau of Invasive Plant Management (the bureau) treat these aquatic weeds with periodic herbicide treatments. Wild taro is especially difficult to control, requiring multiple treatments each season because currently available herbicides are only partly effective. Wild taro grows along stream banks and forms large floating mats that can impede navigation. Floating mats are generally not treated with herbicides because of their potential to break up into smaller pieces and spread to new sites downstream.

The bureau coordinates with and funds herbicide contractors who treat exotics and maintain navigability. The aquatic preserve staff focus primarily on various exotic species that the contractor does not treat — such as Chinese tallow, para grass, wild taro, and torpedo grass. The aquatic preserve records indicate about 40 acres of exotics are treated each year. One staff member works almost full time on exotics control and also conducts special herbicide treatments for hydrilla in Wekiwa Lagoon. Although this work clearly keeps exotics in check, all of these exotics are prolific, and it is extremely difficult to eliminate them. The aquatic preserve staff also control the proliferation of nuisance cattails (Typha sp.), a native plant that tends to restrict passage on the river system if not managed. Nuisance cattails are present along one section of Rock Springs Run and along one section of the Wekiva River near Katie's Landing.

Some notable invasive and exotic faunal species in the Wekiva River basin are described below.

Armored catfish (Pterygoplichthys disjunctivus) and brown hopolo (Hoplosternum littorale) — Armored catfish have been seen in large numbers in Wekiwa Springs, and brown hopolo were confirmed present in Rock Springs Run in 2005. Armored catfish feed on algae attached to rocks, logs, vegetation, and even manatees. Manatees are clearly agitated by these fish. Armored catfish excreta is likely contributing to increased nutrient levels that may further exacerbate algal blooms and weed infestations. State park staff observations indicate that these fish are increasing erosion of shorelines by burrowing to create spawning cavities. Since 2003, state biologists and volunteers have removed many armored catfish from the Wekiva Spring area. This removal is conducted during most of the year and as often as weekly during winter cold spells when the fish tend to concentrate near the spring.

The brown hopolo (*Hoplosternum littorale*), another exotic fish species, has been found in Rock Springs Run in recent years. This fish typically thrives in weedy areas with low oxygen levels. Currently, the brown hopolo is not being targeted for control because further research is needed to assess the effects of this fish on the Wekiva River System.

Channeled apple snail (Pomacea *canaliculata*) — The channeled apple snail is an invasive exotic snail from South America that is found in Lake Brantley, near the Wekiva River. Although a great potential exists for invasion, this species has not yet been observed in the Wekiva River System. The channeled apple snail is much larger than the native apple snail that limpkins depend upon for food. This species has been known to feed on eelgrass and other native aquatic vegetation. The impacts from these snails on native apple snails and native plants, invertebrates, and fishes are unknown and difficult to predict. It is known that channeled apple snails feed on eelgrass and are serious pests in a

number of countries. Limpkins are known to feed on channeled apple snails in other aquatic systems.

Habitat Fragmentation. Habitat fragmentation is the result of large blocks of contiguous landscape being broken into smaller patches, often separated by roads and subdivisions. Although much of the Wekiva River basin is conserved in contiguous pieces of public lands, some areas are fragmented by development or roads (not contiguous). In addition, some critical wildlife movement corridors in the basin are still unprotected and in private ownership, leaving them vulnerable to fragmentation. Roads and development contribute to habitat fragmentation that particularly affects wide-ranging mammals like the Florida black bear. Birds can also be affected by habitat fragmentation if patches of required habitat are not located within sufficient proximity to each other to allow for population dispersion.

Fragmentation causes both a direct and indirect loss of wildlife habitat. Black bears, for example, favor large blocks of natural habitat and tend to avoid small patches, roads, and developments. Thus a divided landscape — even one consisting of quality habitat may lose functionality. Fragmentation also makes it difficult to maintain natural communities and manage habitat for wildlife use through actions such as prescribed fire. The ultimate results of fragmentation are diminished biodiversity and a loss of usable habitat for wildlife.

Road Mortality. Roads in the Wekiva basin have the highest rate of bear mortality in the state. One hundred bears, the highest rate among all counties, were killed in vehicle collisions in Lake County between 1976 and 1995. State Road (SR) 46 and SR 19 in Lake County were identified as having the highest rate of roadkills during that time period. Wekiva River State Park staff conducted a study of wildlife use and roadkills near the original SR 46 wildlife underpass from November 2001 to August 2003, including deployment of cameras, installation and maintenance of vegetation to guide wildlife to the underpass, and conducting track counts near those locations. Wildlife underpasses on SR 46 and other roads have been shown to decrease roadkill of bears and other wildlife, but seven bears still were killed on SR 46 in the Wekiva basin in 2005 and 2006. To accommodate the safe passage of wildlife, plans for the Wekiva Parkway include raised sections of the new parkway, and relocating the junction of SR 46 and CR 46A outside the primary ecological corridor.

**Recreational Impacts on Fish and Wildlife** Habitat (see also Recreation Values). Recreation is included here as an issue to the extent that it impacts wildlife and habitat values. Certain forms of recreation, such as the use jet skis and motorboats, may be incompatible with the protection of habitat and wildlife depending on the location or extent of their use. For example, motorized watercraft can create noise or wakes that disturb wildlife, and boat propellers can damage eelgrass beds or harm manatees. Similarly, even nonmotorized boating can have substantial effects on wildlife habitat if the amount of human use is excessive or the timing or location of the use is inappropriate. Given the heavy recreational use of the Wekiva River System, (e.g., canoeing), these types of adverse impacts on wildlife and wildlife habitat already exist in some areas.

Litter and discarded monofilament fishing line in the river or tangled in the tree canopy also pose a threat to wildlife. However, it should be noted that nature-based recreation and ecotourism, when properly managed, can be an important asset to the protection of wildlife and habitat by building public awareness and appreciation for the Wekiva River System and the national wild & scenic river program.

**Prescribed Fire.** Prescribed fire is an important land management tool for maintaining a healthy ecosystem. Although fire is often associated with the management of upland systems, it also plays a role in the management of wetlands and other natural communities that provide important habitat. With fire being a natural component of many natural communities and ecosystems in Florida, the absence of fire may allow these natural communities to become overgrown, less diverse, or transition to other habitat types. Some plant species even require fire as part of their reproductive life cycle. A regular regimen of prescribed fires that mirrors the frequency of wildfires that occurred naturally before European settlement can be a significant contributor to the health of the natural system. These prescribed fires also reduce vegetative fuel loads on the landscape, which reduces the risk for very intense, uncontrolled wildfires that can be devastating to both natural systems and private property.

For example, the Florida Division of Forestry uses prescribed fire to manage Seminole State Forest. This is critical for the maintenance of scrub habitat, which is important to the Florida scrub-jay (*Aphelocoma coerulescens*), a federal and state threatened species. The Florida Division of Forestry also works with the Florida Parks Service to conduct prescribed burns on Wekiwa Springs State Park, Rock Springs Run State Reserve, and Lower Wekiva River Preserve State Park. According to the management plan for these three state parks, the Florida Parks Service attempts to burn at least 6,000 acres of the Wekiva River Basin State Parks each year.

In some areas, the ability to conduct prescribed burns has been made difficult by residential or commercial development located next to or within habitats that require fire. As a result, in some areas, land managers have had to resort to less effective and more costly mechanical means of reducing fuel loads. Expanded education and outreach programs for private landowners and business owners in the area would help improve their understanding of the importance of prescribed fires and the dangers of fire suppression.

Nutrient Load Impacts on Biodiversity (See also Water Quality and Quantity Value). Nutrient loading is included here as an issue to the extent that it impacts wildlife and habitat values. Aquatic species and rare invertebrates associated with spring vents are particularly sensitive to water quality and an imbalance in nutrient content. In addition, invasive aquatic species, including algae, thrive on higher nutrient levels in the river water. The proliferation of algae and other invasive species can have many adverse biological effects on individual aquatic wildlife species and natural communities. Increased quantities and frequencies of invasive aquatic species growth and algal blooms in springs, spring runs, and the river channel are symptomatic of a growing problem within the Wekiva River System.

The natural background level of nitrates in Florida springs is typically 0.2 milligrams/liter (mg/L) or less. The Florida Springs Task Force, in its November 2000 report, identified 1.0 mg/L as a threshold at which normal spring biological functions are degraded. The recently adopted total maximum daily loads (TMDLs) identify targets specific to the Wekiva River System to be 0.065 mg/L for total phosphorus and 0.286 mg/L for nitrates. Springs in the Wekiva River System have already exceeded this level.

# HISTORIC AND CULTURAL RESOURCE VALUES

Historic and cultural resource values comprise the cultural resource types recognized and described by the National Park Service: archeological resources, historic structures, cultural landscapes, ethnographic resources, and museum collections. This environmental assessment primarily addresses archeological resources that are the physical evidence of past human activity and can represent both prehistoric and historic occupations.

## **Historical Overview**

For millennia, the Wekiva basin area has provided abundant natural resources for human occupation. The spring runs, rivers, hardwood hammocks, and dense forests offered food, water, shelter, and breeding sites for many forms of wildlife and provided excellent plant and animal food for human inhabitants. Numerous archeological and historic sites have been recorded in the general region. Remains of now extinct Pleistocene megafauna and large herd animals have been found with the distinctive fluted projectile points made by Paleo-Indians (11,000-8,000 BC. The Early Archaic Period (8000-6000 BC) continued the tradition of hunters and gatherers but with increased populations. The most readily identifiable sites are the mounds and middens along riverbanks. These features are typically domestic refuse heaps of shell, stone tools, animal bone, ceramics, and other artifacts. A mound or midden may also contain human burials, ceremonial artifacts, and other grave items.

The first major occupation of the St. Johns River valley occurred during the Mount Taylor Period (6000-2000 BC), as evidenced by large freshwater shell middens; burials in a wet environment (cemeteries and middens); and stemmed, broad-bladed projectile points. The Orange Period (2000-500 BC) marked the appearance of ceramics, an apparent increase in population size, sociopolitical complexity, and territorial range. The St. Johns Period (500 BC-AD1565) showed a continued preference for mound building, but the later part of the period was also marked by profound changes in Native American lifeways including European influences. European artifacts are occasionally found in St. Johns Period burial mounds and middens (Milanich and Fairbanks 1980; Milanich 1994). Most of the sites in the Wekiva River basin date from the Orange and St. Johns II periods (ca. 2500 BC to post AD 800) (Weisman 1993).

Although central Florida was not occupied by the Europeans during the Spanish-British period (1500-1820), Hernando DeSoto's Florida expedition (1539-1540) marked the beginning of a steep decline in the Native American populations in the state. During the next 150 years, Timucuan Indians in central and east Florida were forced to migrate or succumbed to European diseases. Other tribes fled to north Florida from invasions of their homelands in Georgia and Alabama in the 1700s. The Seminole Indians, who primarily descended from these cultures, used the Wekiva River headwaters for hunting and traveled the river as a route to the St. Johns River during the early 1800s.

However, by the 1820s, central Florida was also in use by early European-American settlers, and the Wekiva River and spring appear on several military maps. There was a minor military road running from Fort Mellan (Sanford) to Fort Mason (Eustis), which passed through the spring area. Early maps show little of the Wekiva area other than a trading post and trapping area.

In 1842 (at the close of the Second Seminole War) Congress passed the Armed Occupation Act giving 160 acres to any man who would live on the property and cultivate at least 5 acres. By the mid-1800s the Wekiva River basin was used by settlers for farming and milling lumber and grain. The area around Rock Springs and Wekiwa Springs became a focal point for early settlers. The town of Clay Springs was started around Wekiwa Springs. The spring outlet served as a landing spot for suppliers.

Cotton farming and cypress logging were major crops near Rock Springs Run, which was dammed to power a sawmill and a gristmill. Another sawmill was built on the upper Wekiva River, and a gristmill operated in Wekiwa Springs until the Civil War. A mound indicating the site of the dam for this mill still remains along Mill Creek. During the Civil War a Federal Company camp was located at Rock Springs.

In 1865, after the Civil War ended, another homesteading act encouraged settlers into the area. During this time, steamships and barges used Wekiwa Springs as a loading and unloading point. The town of Clay Springs supported a wharf and warehouse for cargo steamers navigating the St. Johns River to the Wekiva River from the town of Mellonville (now Sanford). Around 1875 the settlement of Markham was established and supported by the railroad system and Wekiva River. Three sites are connected with this time period in the Markham Woods area, including an African American cemetery and church.

The South Florida Railroad broke ground in 1880 to connect Sanford, Lake Mary, Longwood, and Altamonte Springs with Jacksonville. Shortly thereafter the Sanford-Lake Eustis rail line was built with connections in Sorrento, Mount Dora, Eustis, and the former town of Ethel (in what is now Rock Springs Run State Reserve). The wooden bridge that crossed the Wekiva River (near what is today Lake Markham Road) eventually burned down, and much of the original rail bed was removed. Portions of this railroad network have since been converted into a bike trail as part of the Seminole County Rails to Trails program.

The tourism industry also arrived in the 1880s when Wekiwa Springs was still known as Clay Springs. In 1906 the name of Clay Springs was changed to Wekiwa Springs. Facilities at Wekiwa Springs included a hotel, a sanitarium, cabins, a picnic area, bathhouses, and a rail toboggan ride. Hotels and other recreational facilities operated until the Great Depression, after which the buildings either burned or were dismantled.

By the late 1800s the making of turpentine was also an important economic activity in the area. Many catfaced pines and clay turpentine pots can still be found. The logging of cypress in the bottomlands of the Wekiva and St. Johns rivers also began at this time.

Construction of the first roads in Lake County began in 1915. Before that time, the rivers served as the main transportation with steam and paddlewheel boats. The economic base of the region during the first park of the 20th century was primarily cattle and ranching, along with farming, citrus groves, lumber, and turpentine. From 1900 to 1940 agriculture was a major portion of the economy in Seminole County, with vegetables transported all over the country by rail. Timber logging became widespread in the region by the late 1930s.

Some old logging (or tram) roads and railroad grades still exist. One elevated grade occurs in the sandhill community at Wekiwa Springs State Park, and runs north-south through the entire unit. This grade was constructed in the late 1850s for a passenger railway from Eustis to Orlando that never came to fruition, but it was used to support the timber industry at Wekiwa Springs.

Some of the old tramways are still visible, while others built through the floodplain swamp and hydric hammock communities have revegetated with hardwoods. Evidence of old logging equipment and portions of the railroad tramway still remain on public lands in some areas.

In 1941 the Apopka Sportsman's Club purchased land in the Wekiwa Springs area from the Wilson Cypress Company for hunting, fishing, and other recreational uses. In 1969 the state purchased the property from the sportsman's club for the Wekiwa Springs State Park, which opened in 1970. Since then the Wekiva River basin area has experienced major growth influenced by the opening of Walt Disney World in the early 1970s.

# Management Issues

Florida Statutes, Chapter 267, requires that each state agency having direct or indirect jurisdiction over a proposed state or stateassisted undertaking shall consider the effect of the undertaking on any historic property that is included in, or eligible for inclusion in, the National Register of Historic Places (National Register). The statute requires that each agency afford the Florida Division of Historical Resources (FDHR) a reasonable opportunity to comment with regard to such an undertaking. In consultation with the division, each state agency must also establish a program to locate, inventory, and evaluate all historic properties under the agency's ownership or control that appear to qualify

for the National Register. Florida statutes prohibit the removal of artifacts from these sites without a permit from the Bureau of Archaeological Research, a bureau within the division. In addition, all federally funded projects also require consultation with division staff under Section 106 of the National Historic Preservation Act. Federally funded projects are also subject to other laws and executive orders pertaining to consultation with federally recognized tribes.

Numerous previously recorded and documented historic and cultural resources have been catalogued in the Florida Master Site File maintained by the Florida Division of Historical Resources. Most previously recorded sites in the area have been on state lands. However, only small portions of land in the Wekiva River basin have been adequately surveyed for cultural resources. Therefore, it is likely that there are other unrecorded historic and cultural sites present.

Small test pits have been excavated in several of the mounds revealing pottery fragments, animal bones, and shell. Several points and pottery fragments have been found by swimmers and divers in and around the main spring outlet at Wekiwa Springs State Park. In many areas along Rock Springs Run and the Wekiva River, midden sites are found on the accessible dry land, and some sites are used extensively as resting and picnic locations by boaters and canoeists, leading to degradation.

At present, there are 54 known archeological sites on public lands in the Wekiva River basin area (see appendix D). Fifty of these sites are in the aquatic preserve or state parks and include an underwater shipwreck, 32 middens, a prehistoric village site, 4 preceramic lithic waste scatter sites, 3 African American sites including a cemetery and church, an artifact scatter site, 4 isolated finds, a cemetery in the town of Ethel, a burial mound, a logging tramway, and a refuse site with the remains of a windmill. The other four sites are in the Wekiva River Buffer Conservation Area (type of site is unknown), Seminole State Forest (a limited surface scatter of pottery from a probable campsite), and Kelly Park (evidence of pre-Columbian settlement and an early homestead site). Tramways constructed for logging at the turn of the century severely altered hydrological regimes over vast areas within the Wekiva basin. To restore hydrology, culverts have been installed along various tramways. Several miles of tramway have been removed in Rock Springs Run State Reserve and Lower Wekiva River Preserve State Park. Tramways have also been breached (partially removed) in Seminole State Forest as mitigation projects.

On private lands in the vicinity of the Wekiva River, there are 36 known archeological sites including 7 middens, 3 prehistoric habitations, a lithic waste scatter, 15 artifact scatter sites, 5 isolated finds, a burial mound, a site with the remains of a windmill, an American homestead site (19th century), a site with the remains of a sawmill (including segments of railroad grade and historic road), and an undated American site (20th century) (see appendix D for a complete list).

All of these elements certainly have regionally significant resource values and may well have national significance but have not been studied for inclusion as National Historic Landmark sites.

## WATER QUALITY AND QUANTITY VALUES

Water resources are critical to the nature of a national wild and scenic river. Water quality is strongly linked to land uses and human activities in and along the river corridor and in the larger region that contribute groundwater and surface water to the Wekiva River System. Flow volume and rate are also affected by human activities and long-term climate patterns that affect rainfall, which is the fundamental source of water for the river system. Because water quality and quantity depend on both the surface water drainage basin and the groundwater capture area of springs in the Wekiva River System, the surface watershed and springshed are both considered when analyzing this value.

Given the influence of land use on surface water and groundwater, the rapid conversion of natural and agricultural lands to suburban development throughout much of the watershed and springshed poses a threat to water quality and water quantity in the Wekiva River System. For example, an increase in impervious surface due to development can increase surface runoff and reduce infiltration to the aquifer. Pollutant and nutrient loading can also be worsened by more intensive development that brings increased use of chemicals and fertilizers for lawns and landscaping, runoff from roads, and wastewater discharges to surface water and groundwater.

All of the waterways in the Wekiva Wild and Scenic River System are classified as Outstanding Florida Waters, the state's highest designation for water quality. The character of the water ranges from the crystalclear flows from the artesian springs and spring runs to the tannin-colored waters of blackwater creeks and streams. Water quality and quantity, affected by springflow and drainage from adjacent land, contribute to the popularity of the springs and river system as recreational resources and to the overall health and integrity of the ecosystems in the basin.

Additional significant information on water quality and quantity is included in the management plan under the subsections titled

"Recent Initiatives Pursuant to the Wekiva Parkway and Protection Act" "Strategies to Reduce Nutrient Loads" "Strategies to Conserve Groundwater"

# Water Quality

Much of the material in this section is cited from the pollutant load reduction goal (PLRG) study (Mattson et al. 2006) that was completed by the St. Johns River Water Management District as directed by the Wekiva Parkway and Protection Act. Additional water quality data was drawn from the semiannual "EcoSummary" reports by FDEP staff

The wide range of water quality attributes in the Wekiva Wild and Scenic River System is particularly distinctive compared to other Florida rivers — ranging in appearance from the very clear waters of spring outlets and spring runs to the naturally dark tannic waters found in Black Water Creek. The wide range of water quality attributes also contributes to a high diversity of aquatic communities and habitats that support numerous animal and plant species, including invertebrates that are unique to springs of the Wekiva River System. Appendix E, which summarizes historical water quality data for the Wekiva River and Rock Springs Run, shows the considerable differences in these river segments, especially for conductivity, color, total organic carbon, and chlorophyll-a.

A detailed review of the water quality status of the Wekiva River and Rock Springs Run was included in the recent PLRG study (Mattson et al. 2006). These rivers have high concentrations of dissolved minerals because of their natural setting in an area typified by karstinfluenced geology. However, water quality in some reaches is also influenced by inflows of surface water with dark color and acidity from decomposing vegetation.

One distinctive characteristic of the Wekiva River is that spring flow is a significant component of the total flow of the river. Therefore, the water quality of the freshwater springs that contribute to the Wekiva is an especially important contributor to the river's overall water quality. Based on average annual flow rates, the two largest springs in the Wekiva River System are Wekiwa Springs and Rock Springs, which are among the most southern of east Florida's freshwater springs. These two springs are situated next to limestone outcroppings, which are rare in central Florida and indicate that the top of the Floridan Aquifer is at or near the land surface. Studies completed during the 2000 FDEP statewide stream bioassessment program included sampling for the Wekiva River and Rock Springs Run. Results show high concentrations of nitrate in both streams— higher than those in 95% of other Florida streams and nutrient levels high enough to potentially support high levels of algal growth in both waterways.

Elevated nitrate concentrations are a concern for many of Florida's freshwater springs (Florida Springs Task Force 2000 and 2006). A concentration of 0.20 mg/L is widely cited as the naturally occurring base line (background concentration) for Florida springs. In the springs of the Wekiva River System, nitrate concentrations greatly exceed the threshold of 0.45 mg/L used by FDEP staff to indicate potential groundwater-surface water impacts. The high levels of nitrates in the springs that feed that Wekiva system are related to present and past agricultural use as well as present suburban land uses.

Some of the largest contributors to the nitrogen levels in the Wekiva River System are from: (1) domestic onsite wastewater disposal systems (e.g., septic systems); (2) centralized municipal wastewater treatment plants; and (3) fertilizer applications to agricultural land and urban landscapes.

Trend analysis since 1984, done as part of the PLRG study, shows a decline in nitrate and total phosphorus for the Wekiva River. However, even with these declines, the concentrations greatly exceed those considered healthy for a spring-fed stream. Nitrate concentrations within both waterways were found to be high (> 1 mg/L) at the spring outlets. This corresponds to observations that the highest biomass of attached algae was found in and around the springs.

The groundwater that contributes to each of the springs in the Wekiva River System may be strongly influenced by land use activities, especially agriculture and suburban or urban development that are far from the river system itself. Also, nutrient loading from agricultural uses in past years may still be affecting water quality of the springs.

#### Water Quantity and River Flow

Preserving the volume of water and the discharge characteristics of a river are important management considerations for any river system. This is particularly important to sustain a wild and scenic river given the effect that flow has on aquatic communities, ecosystem processes, water quality, and river recreation. For the Wekiva River System, water volume and flow characteristics are influenced by spring flow, water storage characteristics of adjacent floodplains, and land use (including agriculture and urban or suburban development). The effects of development that took place before current statewide stormwater management practices went into effect are particularly important (pre- to mid-1980s).

Suburban development has affected the Little Wekiva to a much greater degree than the Wekiva and has changed this tributary's flow characteristics so that peak flow rates are higher, resulting in channel scouring and erosion. These problems translate into water quality impacts downstream, past the confluence of the Little Wekiva and Wekiva rivers.

Most of the Wekiva River's flow originates from springs. Flow data for Wekiwa Spring and Rock Springs show a trend of decreasing spring flow from the early 1970s until 2003. Decreasing flow trends were also noted for springs along the Little Wekiva River (Palm, Sanlando, and Starbuck Springs). Factors that may be causing this decline include the effects of urbanization and reduced recharge because of increased impervious surface, groundwater pumping, and a long-term decline in annual rainfall. Among the FDOT study's "findings of fact" were that urbanization of the Rock Springs groundwater contributing area was responsible for a 10% to 15% decrease in spring flow. Urbanization that results in a loss of groundwater recharge, especially loss of infiltration because of pavement, was also

discussed in the study as an important factor in flow declines.

In 1992 the St. Johns River Water Management District adopted minimum flows and levels (MFLs) for the Wekiva River at SR 46, Black Water Creek at SR 44, and eight springs along the Wekiva and its tributaries (Messant, Miami, Palm, Rock, Sanlando, Seminole, Starbuck, and Wekiwa). These levels are intended to protect the water resources and ecology of the area from harm because of water withdrawals. Pursuant to the Wekiva Parkway and Protection Act, minimum flows and levels for Rock Springs and Wekiwa Springs were reviewed and analyzed again, and were determined to be sufficiently protective of the water resource. A reevaluation of the Wekiva River and Black Water Creek minimum flows has recently been completed.

To ensure that the Wekiva River System minimum flows and levels and the other environmental resources in the area are protected, the St Johns River Water Management District recently amended its consumptive use permitting rules regarding the use of groundwater, with specific limitations on the amount of additional groundwater that can be developed within a geographic area designated as the Central Florida Coordination Area. This area includes some, but not all, of the Wekiva springshed.

# **CLIMATE CHANGE**

Climate change is perhaps the most farreaching and irreversible threat the national park system has ever faced (NPCA 2007). Climate change in this context refers to a suite of human-accelerated changes occurring in Earth's atmospheric, hydrologic, and oceanic systems. These changes, including increased global air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level, provide unequivocal evidence that the climate system is warming.

Although the warming trend, commonly referred to as global warming, is discernable over the entire past century and a half, recent decades have exhibited an accelerated warming rate with 11 of the last 12 years ranking among the 12 warmest years on record. Most of the observed temperature increase can be attributed to human activities that contribute greenhouse gases. These greenhouse gases particularly carbon dioxide from the burning of fossil fuels - cause Earth's atmosphere to act like a blanket and trap the sun's heat. While the insulating effect (or greenhouse effect) of our atmosphere is important to living systems, the rapid increase in greenhouse gases since the mid 19th century has turned the thermostat up higher than to what our systems are adapted.

Although climate change is a global phenomenon, it manifests differently in different places. One of the most dramatic effects of global warming is the impact on sea level. A rising sea level could affect natural and cultural resources, and is likely to interfere with public use and enjoyment of coastal and low-lying parks. In addition to possible impacts to Florida's low-lying land areas, this encroachment of sea water could also alter the aquatic conditions and chemistry of inland freshwater systems. For example, the freshwater of some inland rivers may become brackish by mixing with more sea water. Similarly, and perhaps a more likely scenario for the Wekiva basin, the increase in elevation and spatial extent of sea water may also affect groundwater springsheds in Florida by increasing hydrologic pressure on the alreadydepleted springsheds and causing further increase in groundwater salinity in some areas.

Many places in the world have already observed and recorded changes that can be attributed to climate change, and trends suggest that a drying of historically wetter landscapes within the Wekiva basin and springshed may be occurring. This too can result in changes to the health and distribution of natural communities.

Climate change is a long-term phenomenon. The likelihood that significant effects will be seen during the life of the river management plan is fairly certain, but the impacts on the Wekiva River System have not been specifically determined at this time.

Implementing either alternative in this environmental assessment would have very little effect on the cumulative level of greenhouse gases or other climate change factors (e.g., carbon footprint) when viewed regionally. However, there are several management directions that individual agencies could take that would reduce their contribution to climate change. Examples of these include adding insulation and weatherproofing to existing buildings, employing solar panels to generate electricity, using highmileage vehicles, and providing educational messages about reducing our impact on the climate. These programs and others could be implemented under either of the alternatives and would contribute towards the global effort to reduce human-caused climate change if implemented.