APPENDIX B. DESCRIPTION OF RIVER SEGMENTS USED IN THE WSIS STUDY

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The St. Johns River is an enormously diverse system of estuarine, lacustrine, riverine, and wetland features. The varying features of the river are not randomly distributed, but are aligned with underlying patterns of geology, geomorphology, hydrology, and climate, which ultimately determine wetland, soil, water quality, and many biological patterns. Owing to this diversity, we realized that it was first necessary to divide it into a manageable number of segments or regions with more uniform characteristics. A similar rationale and similar processes have been employed to regionalize other landscape features, such as ecoregions (Omernik, 1995.), and Florida lakes (Griffith, et al. 1997). Our regionalization (Figure 1) considered geomorphology, hydrology, water quality, wetland characteristics, soils, and other characteristics that vary in a systematic way along its course. We attempted to conserve existing basin boundaries.

The St. Johns River and its floodplain cover an area of 2372 km^2. The dominant features of the entire St. Johns River floodplain are open water (39.2%), shallow marsh (15.6%), and hardwood swamp (14.6%), with lesser amounts of wet prairie (6.3%), hydric hammock (4.2%), shrub swamp (4.1%), and embedded uplands (7.0%). Several other types, such as tidal marshes of *Juncus roemerianus* and *Spartina alternaflora* are important locally.

The wetlands of the river exhibit a strong geographical pattern. Tidally driven salt marshes occur only near the mouth of the river. Upstream there follows a long segment containing few floodplain wetlands, which then transitions into a reach extending to Lake Monroe, along which hardwood swamps are the characteristic wetland type. Moving further south, and especially upstream from SR46 at RK 310, herbaceous wetlands types become the dominant type, although hardwood swamps associated with tributary streams frequently encroach into the floodplain.

We divided the river was divided into nine, relatively homogeneous segments (Figure 1):

1. Mayport to Fuller Warren Bridge (Mill Cove), RK 0 to RK39.6
2. Fuller Warren Bridge to Flemming Island (Doctor's Lake); RK 39.6 to RK 65
3. Flemming Island to Little Lake George (Deep Creek), RK 65 to RK 163.1
4. Little Lake George to Astor (Lake George), RK 163.1 to RK 204.3
5. Astor to the Wekiva River (Lake Woodruff), RK 204.3 to RK 253.7
6. Wekiva River to St. Road 46 (Central Lakes: Lakes Monroe, Jesup, and Harney) RK 253.7 to RK 310
7. St Road 46 to State Road 520 (Anastomosing Channels: St. Road 50), RK 310 to RK 378

8. St Road 520 to Three Forks Marsh (Chain-of-Lakes: Lakes Poinsett, Winder, Washington, Sawgrass and Helen Blazes); RK 378 to RK 442.8 and

9. Three Forks Marsh to Fort Drum Creek (Blue Cypress Lake). RK442.8 to approximately 50 kilometers south of headwaters

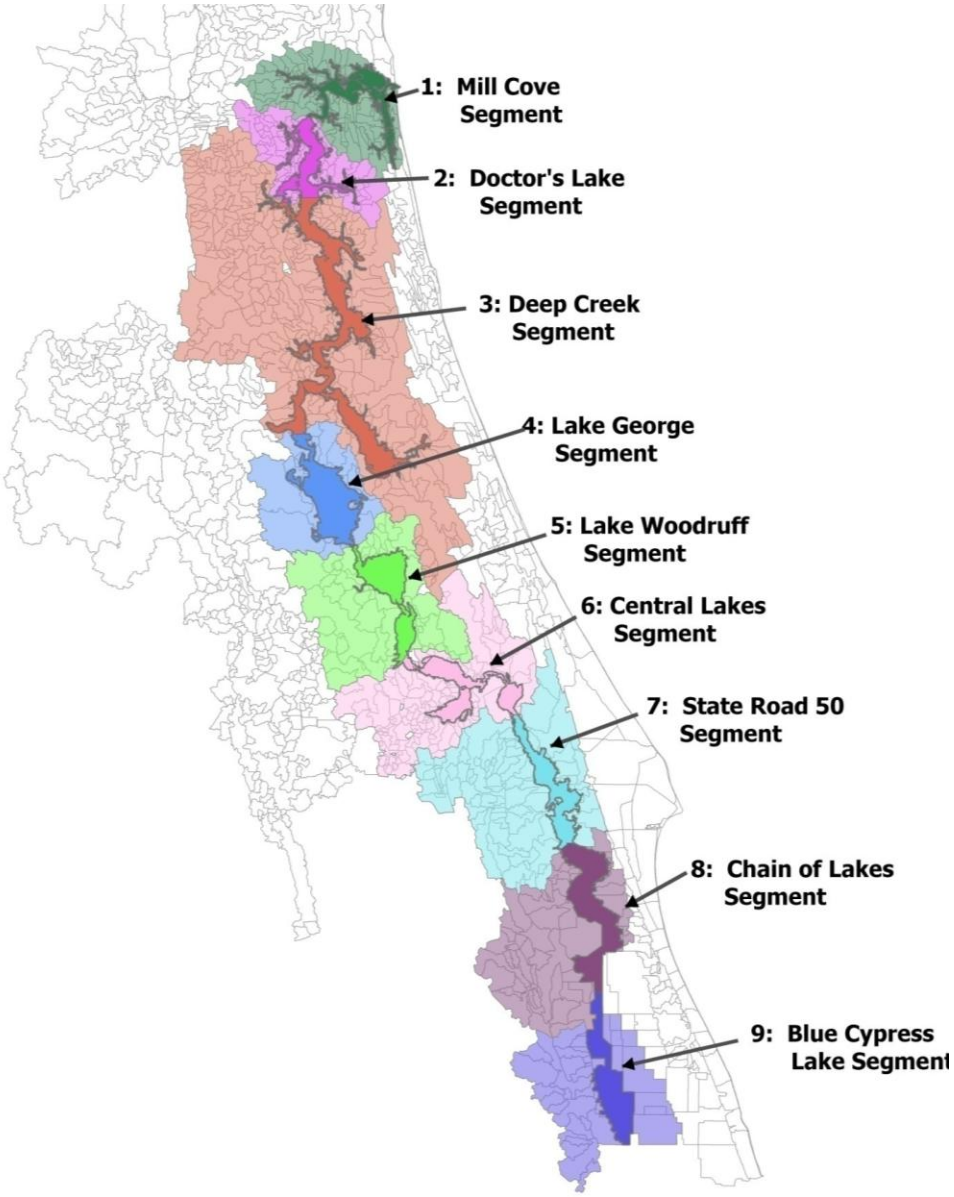


Figure 1. Regionalization of the river: segment floodplain (dark color) and local drainage (light color).

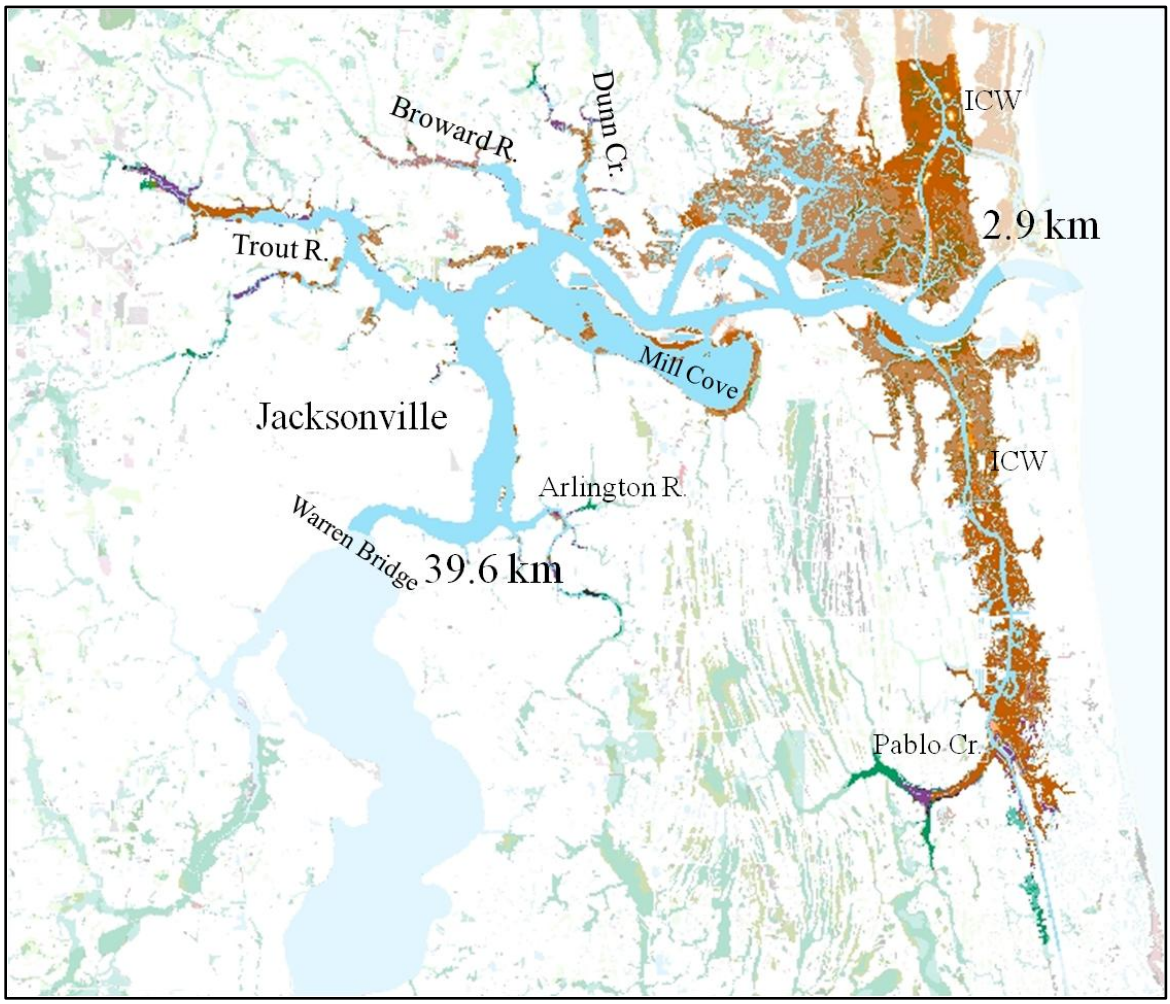
Descriptive elements related to wetland features are addressed in the following section, Wetland Inventories by River Segment, include: segment length and total area, geomorphology, hydrology, salinity, wetlands, shoreline ratio, soils, wetland dependent species, connections to other systems and environmental history, and relative likelihood of impacts from altered stage or salinity.

Segment 1 - Mill Cove Segment

Segment 1 extends a length of 39.6 kilometers from the river mouth to the Fuller Warren Bridge (Figure 2). The local basin (Figure 3) covers an area of 1056 km2 and contains a substantial coverage of urbanized land use (37.7%) (SJRWMD, 2006). Wetlands (22.2%), forest (18.0%), and water (10.5%) make up much of the remainder. Agricultural land use is uncommon (2.8%). The approximate floodplain area, including open water, is 187.2 km^2 .. The river here is estuarine and appears to occupy a flooded river valley. This segment exhibits the highest tidal energy with the semidiurnal tides having a range from 0.6 to 1.5 meters in amplitude NOAA, 2008. The river here is essentially at sea level and stage is strongly tidally dominated. Salinity is highly variable, but generally falls in the range of 6 to 21 ppt. Water covers much of the floodplain (46%), but there are large areas of wetland in the lower part of the river and lesser amounts associated with tributaries entering the system (3). The greatest amount of wetland cover is made up of *Juncus roemerianus* (18%) and *Spartina alternaflora* (16%). *Spartina* occupies the saltier and more deeply flooded area and *Juncus* tends to occupy fresher or less often flooded ground. The shoreline ratio in this reach is overall high (low along the main channel, but very high in the marshes). This contributes to the high environmental value of the marshes, which provide abundant habitat for fish, shore and wading birds, and a host of invertebrate species such as oysters, shrimp, and crabs, as well as the diamond back terrapins, which feed upon them. The wetland soils here are Tisonia mucky peat, which is a hemist (histosol with a mix of fibrous and well decayed materials) and has high sulfur content (Figure 4). A number of tributaries enter the river in this segment. These include Dunn Creek, Broward River, Trout River, Arlington River and Pablo Creek, among others. It is likely that flow from these creeks has a significant effect on salinity levels in the system. The river is connected through the Intracoastal Waterway (ICW) and by a continuous landscape of marshes to the estuary of the Nassau River to the north. On the south, it is connected by a long dredged section of the ICW to the Tolomato River estuary.

The landscapes of River Segment 1 have undergone significant change. Since 1943, the city of Jacksonville has grown substantially and many areas formerly in forest or rangeland cover are now covered by residential or commercial development. Where urbanization has not occurred, reforestation following the near complete cutting of the upland pine forests has taken place. Most of these are now in commercial pine plantations. The river channel itself has also undergone major change. By 1943, the dredging of the ICW was essentially complete and the main St. Johns River channel had also been substantially deepened. The Dames Point Cut Off, a

channel that straightens the course of the river north of Mill Cove, had not at that time been constructed and a substantial area of salt marsh existed in the area that is now Blount Island (most of which was created from dredge spoil). In addition, some areas of open water have become filled with sediment and now support marsh vegetation. Sea level rise (approximately 2.4 mm / year) appears to have caused the tree line in many of the tributaries of the river to have receded and salt tolerant vegetation to have moved upstream. This has also been accompanied by enlargement and elaboration of drainage channels in the estuarine portion of these streams (possibly in response to increased tidal flow).



187.20 Sq.km

Wetlands Group	Area, Sq.km	% of area
Water group	85.69	45.77%
Juncus roemerianus	34.13	18.23%
Spartina alternaflora	29.69	15.86%
Upland	17.30	9.24%
Other Wetlands	13.38	7.15%
Tidal Flats	7.00	3.74%
Total	187.20	

Figure 2. Segment 1 wetlands.

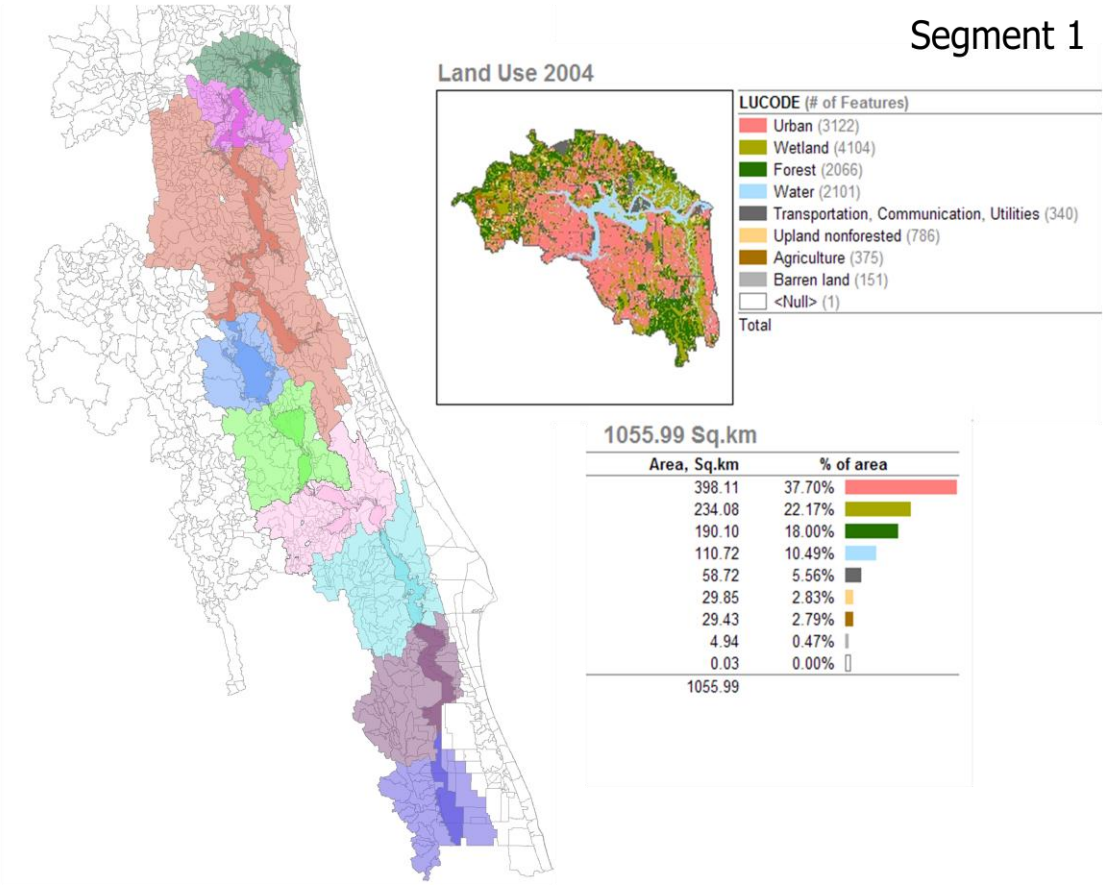


Figure 3. Segment 1 land use

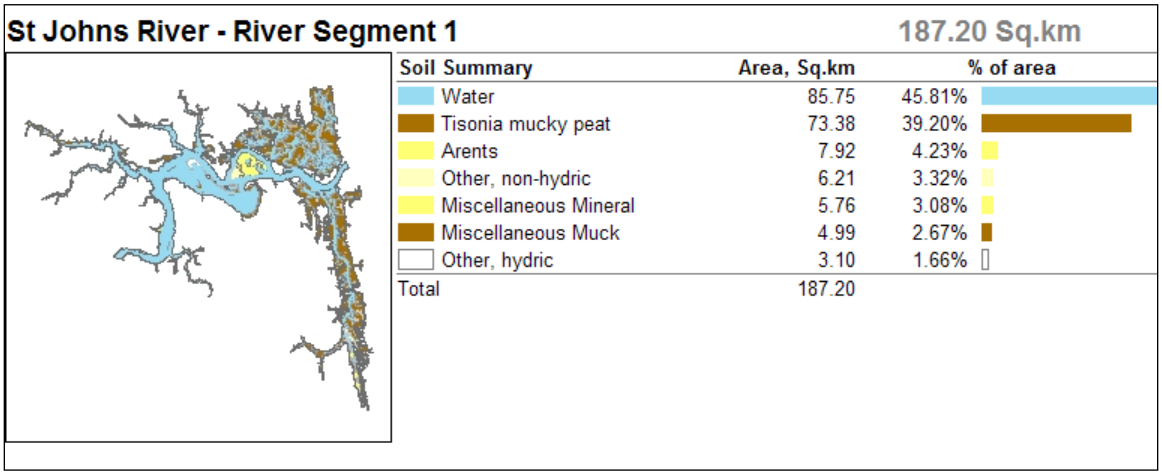


Figure 4. Segment 1 soils.

Segment 2 – Doctor's Lake Segment

Segment 2, at 25.4 km in length is the shortest and smallest in area (153 km2) of the river segments (Figures 5, 6, and 7). The local drainage basin (779 km2) is the most urbanized (39.5%) of the river segments (Figure 5). Wetlands (18.2), forest (17.1), and water (17.1), are also important landscape components, but agricultural land use is rare (1.7%). Segment 2 extends from the Fuller Warren Bridge south to a line in the vicinity of Fleming Island. This line represents the transition from the oligohaline and occasionally mesohaline conditions in segment 2 to the fresh to oligohaline conditions of segment 3. Salinity generally falls in a range of 1 to 7 ppt., but can fall to near zero or spike to greater than 20 ppt. The river in this segment is estuarine and occupies a broad flooded valley and is joined by several tributaries, notably the Ortega River and Julington Creek, the lower portions of which have been flooded by rising sea levels. Tides are low in amplitude (ca. 0.3 to 0.6m) but regular. Reverse flow occurs about 25% of the time, indicating the importance of marine influence in this segment, which lies essentially at sea level. The floodplain is mostly water covered (80%) and with the exception of Moccasin slough, just south of the inlet to Doctor's Lake, the associated wetlands are only to be found well upstream in the river's tributaries (Figure 6). The wetlands at Moccasin slough contain small but notable (<1%) marshes of *Spartina bakeri* (a salt tolerant species), but the majority of the wetlands in this river segment are hardwood swamps (11%). The absence of wetlands along the shoreline of the St. Johns River is probably attributable to the absence of floodplain habit along this reach, where the shoreline generally rises quite steeply from the edge of the river and provides significant habitat only for upland species. Many areas of shoreline have been developed and are bordered by sea walls or other fabricated structures; the shoreline ratio is very low. Soils in this segment (Figure 7) are predominantly Maurepas muck, a sapric histosol with a very deep organic horizon (NRCS, 2007). Among the wetland dependent species that occur in this segment are various waterfowl and wading birds, manatee, river and marsh clams, shrimp and crabs (Curtis, this volume).

Currently, some cypress mortality along the St. Johns River's edge can be observed. This may be attributable to salinity events, which regularly exceed the 2 to 3 ppt they are able to tolerate. Moreover, many cypress along the river's edge have been observed to have root systems, which are strongly asymmetrical. Roots are absent on the riverward side of the tree and the landward roots grow upward into the soils of less salty wetland or uplands.

A comparison of current and 1943 historic aerial photographs shows that some areas may have become saltier (perhaps because of sea level rise) and others, judging from shifts in the vegetation, may have become fresher. In the Ortega River, both phenomena are seen. In the lower portion of the river, areas formerly with hardwood swamp cover have become dominated by black needlerush, which is tolerant of higher salinity levels. Further upstream, areas that

appear to have been covered by *Spartina bakeri* in 1943 are now covered by shrub swamp and hardwood swamp growth, indicating fresher conditions. This conversion of S. bakeri to shrub swamp or forest is also seen in Julington Creek. A possible explanation for these changes is increased flow of fresh water in these tributaries that has resulted from the urbanization of the drainage basins of each stream. Moccasin Slough, in contrast to these areas, appears to have undergone relatively little vegetation change.

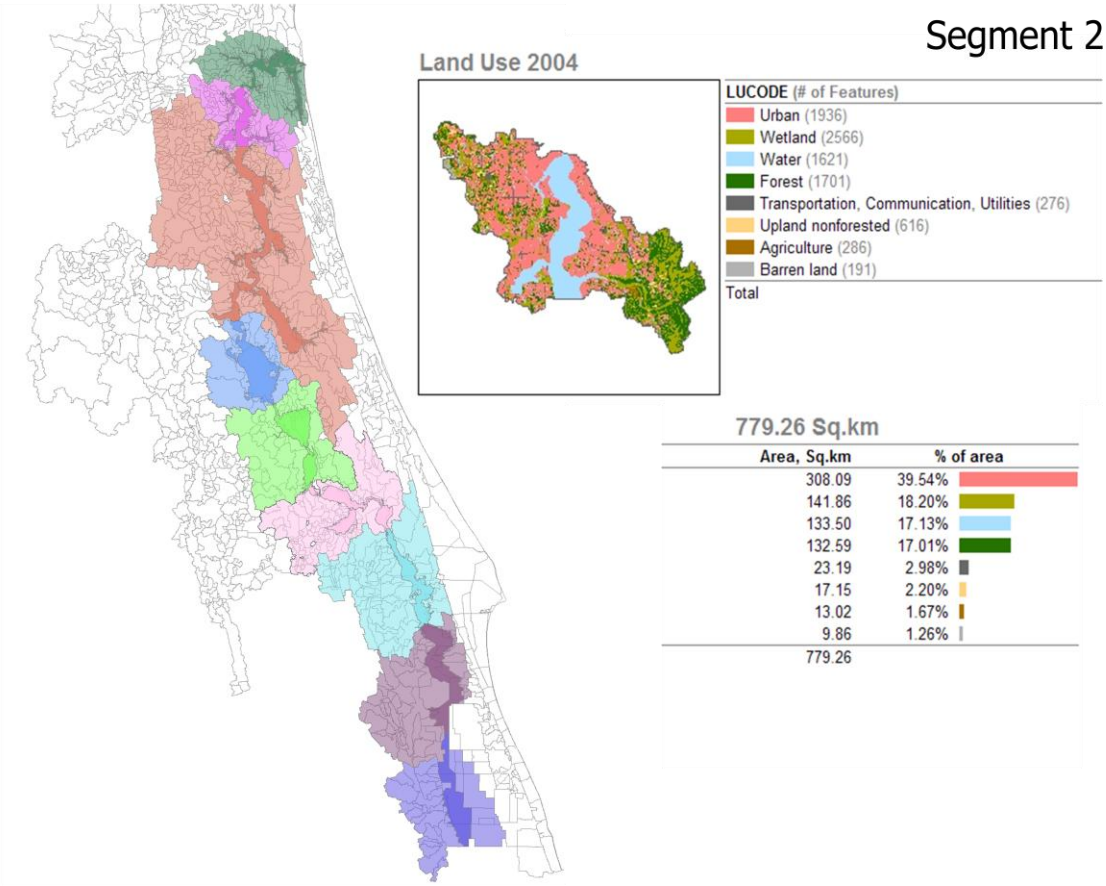
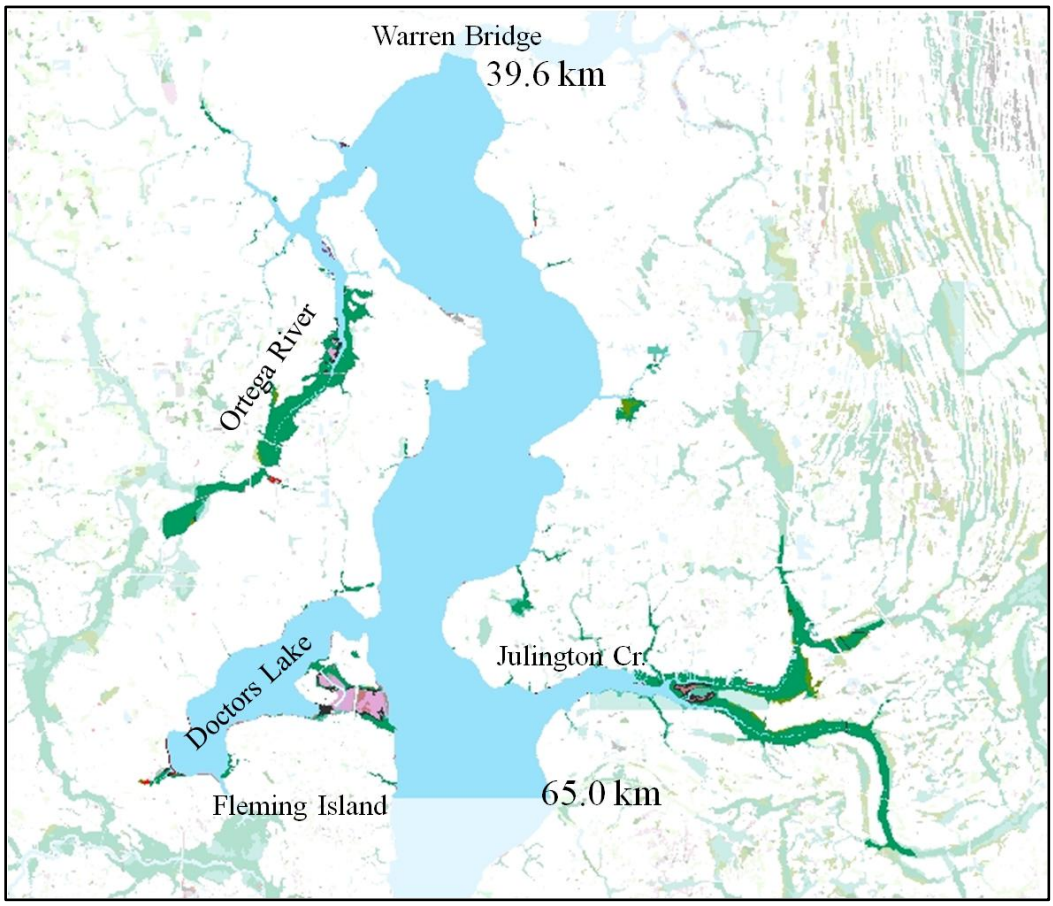


Figure 5. Segment 2 land use.



150.60 Sq.km

Wetland_Group	Area, Sq.km	% of area
Water group	120.54	80.03%
Hardwood Swamp	16.21	10.76%
Upland	8.48	5.63%
Other Wetlands	5.32	3.53%
Total	150.60	

Figure 6. Segment 2 wetlands.

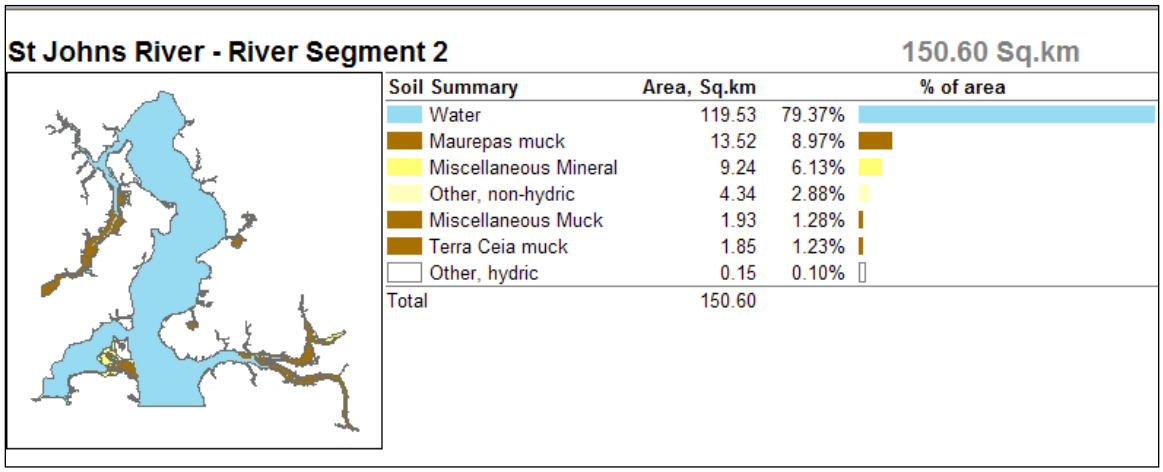


Figure 7. Segment 2 soils.

Segment 3 – Deep Creek Segment

The Deep Creek Segment is by far the longest (100.1 km) and largest in area (579.5 km2) of the river segments (Figure 8). Upland forest (41%) is the dominant land cover of the 5370 km2 local basin. This is followed by a sizable wetland component (26.0%). Urban (11.1%), agriculture (8.8%), and water (6.9%) make up the remainder (SJRWMD, 2006). Much of the agricultural land use in the basin falls within the Hastings agricultural area and drains to the river by way of Deep Creek. The river itself is mainly estuarine in character and, in common with the downstream segments, occupies a flooded valley at near sea level. South of Palatka (127.4 RK) the river develops a more fluvial pattern, meanders more and exhibit side channels in some areas. Even here, however, the river is at or very near sea level. Tides are very low in amplitude (0.15 to 0.4 m) and the water is of relatively low salinity (0.2 to 0.5 ppt), although it may exceed 10 ppt under exceptional conditions (Ceric and Winkler, unpublished data). Reverse flow occurs approximately 16% of the time. Wetlands are a prominent feature (41.4%) and are dominated by hardwood swamps (28.2%) and other forested communities (Figure 9). Wetlands occur both in the lower reaches of the many tributaries in this segment and in the river's immediate floodplain, most commonly on Terra Ceia muck, a saprist of herbaceous origin (Figure 10). Aquatic beds of *Vallisneria* are very common and are considered to be a decisive environmental feature of the St. Johns River in this segment. Wetland fauna species include manatee, wading birds, water fowl, blue crab, shrimp and alligator. A portion of the primary range of black bear in Florida occurs near the Ocklawaha River at the southern part of the Deep Creek section and most of the Deep Creek section is considered to be secondary range for this species (myfwc.com, 2004).

Crescent Lake is associated with this river segment, to which it is connected by Dunn's Creek. Along the far shore of Crescent Lake, there are several extensive stands of *Spartina bakeri* and other herbaceous species, which indicate saltier conditions. The lake itself is not salty so the salt

in these communities may be coming to the surface from the geological formations underlying the landscape. Another area of herbaceous vegetation lies embedded within a hardwood swamp near Bayard point just south of Green Cove Springs. Since 1943 it appears to have diminished in area due to the encroachment of hardwoods, although it is not clear why this feature was there in the first place or why it changed.

The shoreline ratio in this segment is low, primarily due to the great extent of open water.

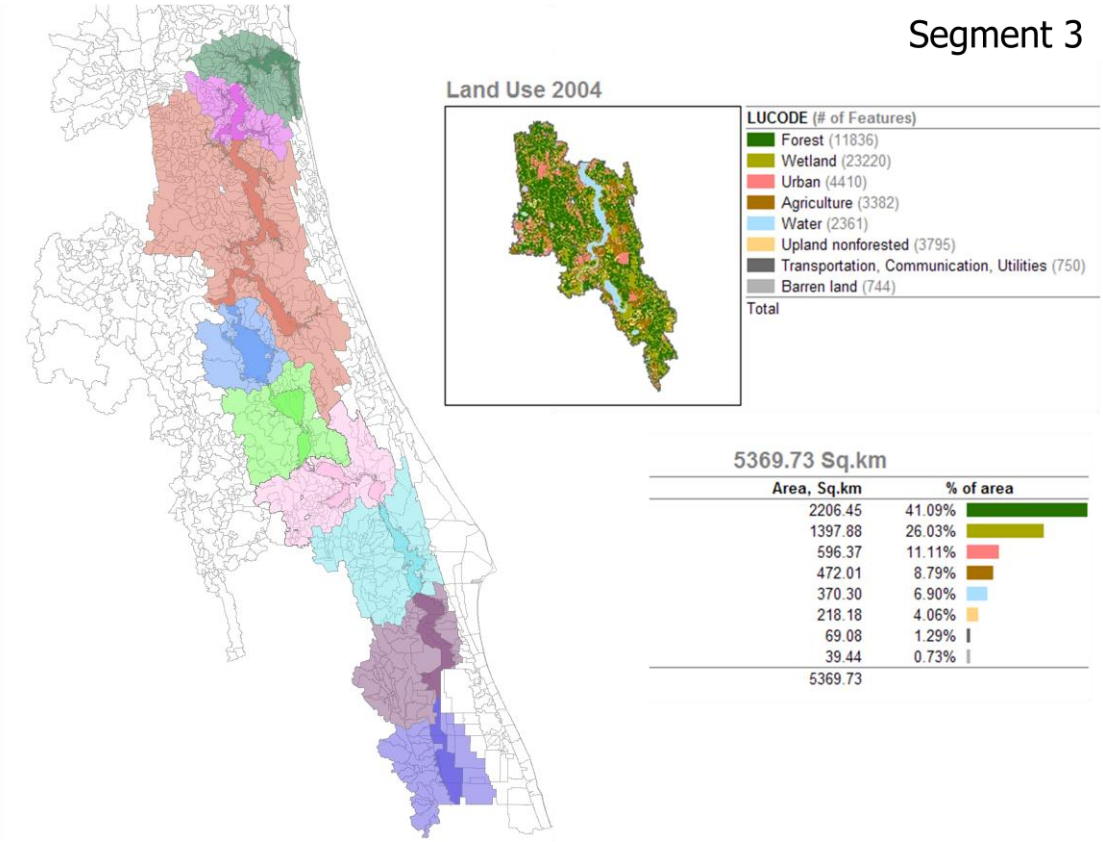
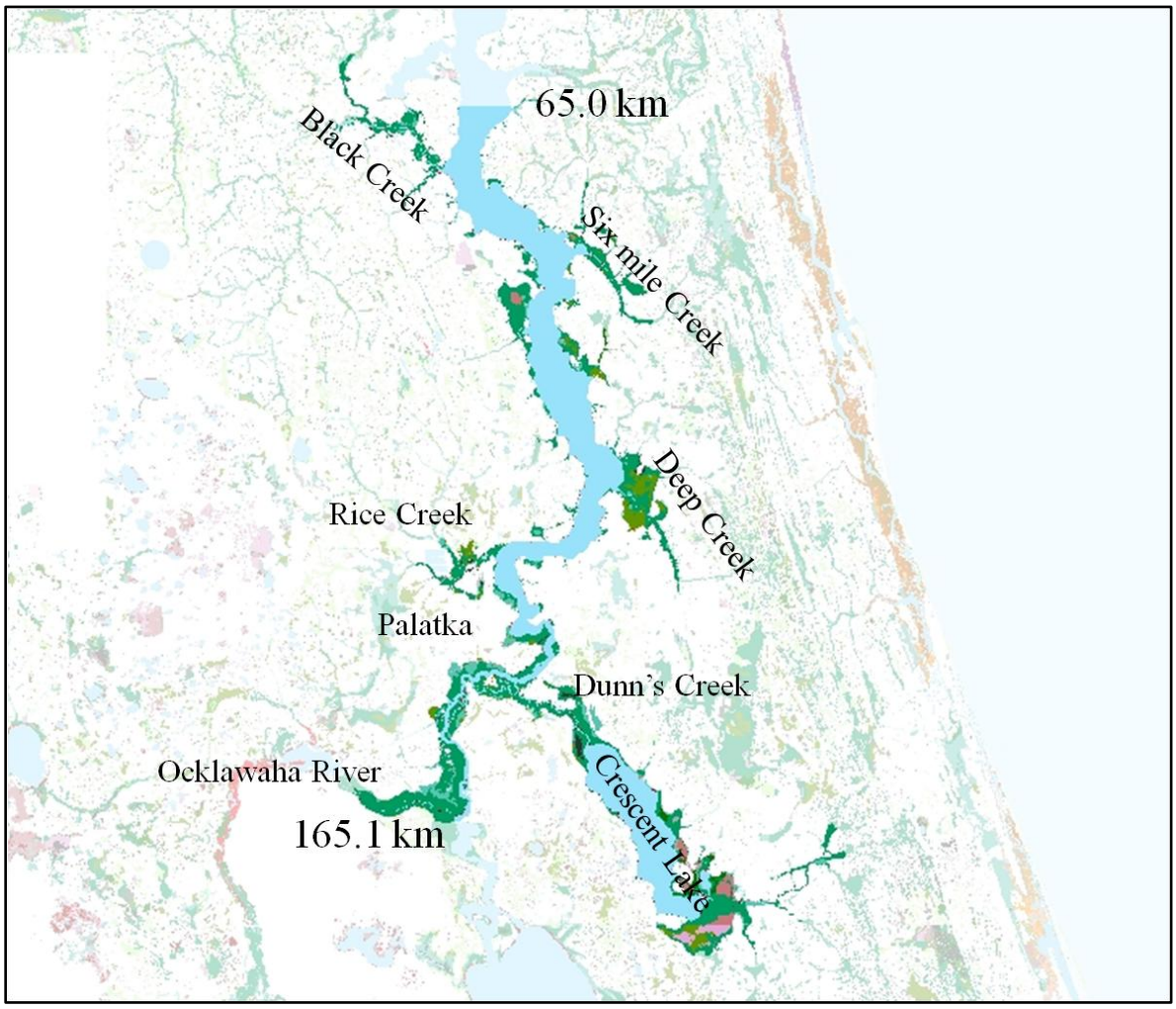


Figure 8. Segment 3 land use.



581.51 Sq.km

Wetlands Group	Area, Sq.km	% of area
Water group	291.68	50.16%
Hardwood Swamp	164.12	28.22%
Upland	48.83	8.40%
Hydric Hammock group	29.30	5.04%
Other Wetlands	26.83	4.61%
Bayhead group	20.51	3.53%
Total	581.51	

Figure 9. Segment 9 wetlands.

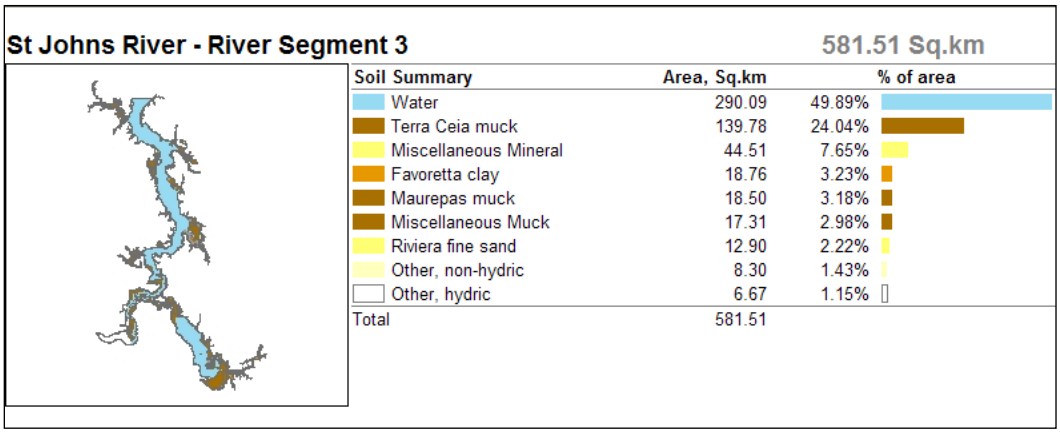


Figure 10. Segment 3 soils.

Segment 4 – Lake George Segment

The 41.2 kilometer long Lake George Segment is dominated by Lake George, a lacustrine feature with some estuarine characteristics (Figure 11). The 1061 km2 local drainage basin is predominantly upland forest (49.1%), open water (21.5%), and wetland (18.8%). Urban and agriculture cover 4.1 and 3.8%, respectively (SJRWMD, 2006).

Lake George has regular tides of low amplitude (<0.5 feet) and is considered to be the head-of-tide for the St. Johns River, although exceptional tides may push further upstream (NOAA data, 2007) . The entire segment covers an area of 204.3 km2, the majority of which is open water (68%). This dominance by water and relatively smooth shorelines may account for its very low shoreline ratio (0.002). Lake George is near sea level and is very shallow over most of its extent. The bed of the lake, in common with all of the St. Johns River as far south as Lake Harney, is below sea level and salinity levels generally fall near 0.5 ppt., from which it only deviates slightly. In this segment the contributions to the water budget of spring flow are conspicuous. Among the largest are Salt Springs (80.9 cfs), Silver Glen Springs (104 cfs), Croaker Hole Spring (76.2 cfs), Juniper Springs 10.6 cfs), and Fern Hammock springs (12.5 cfs), among others (Table 1). Other less known springs and seeps may also contribute significantly to St. Johns River flow.

The predominant wetlands (Figure 12) of the St. Johns River floodplain are hardwood swamp (12.9%) and hydric hammock (10%), although there are lesser amounts of other types, some of which (e.g. deep marsh) are of very high environmental value, or are rare or unusual in their occurrence (i.e. inland, non-tidal salt marshes) (SJRWMD, 2002) . Large acreages of submerged aquatic vegetation dominated by *Vallisneria americana* occur in this river segment, although they are not a primary focus of this chapter (see Dobberfuhl, this volume). Many wetland

dependent fauna species occupy this segment of the river. These include manatee, wading birds, waterfowl, black bear (primary habitat), crabs, and many valuable fish species.

Much of the Lake George basin is in public land ownership and has been largely protected from development pressures. However, an examination of early photographs, (SCS, 1942) along with recent images reveals that a series of salt-influenced marshes, primarily on the southeast side of the Lake George, have undergone change. These areas, which were formerly dominated by *Spartina bakeri* and other salt tolerant species, are now predominantly covered by shrub and early successional forest vegetation. Some remnants remain, which are unusual in their dominance by halophytes, including Sarcocornia and other highly salt adapted forms. Non-vegetated salt flats, notable for their absence of vascular plants because of the very high levels of salt in the soil, are also found here. The soils are dominated by Terra Ceia and other mucks, although mineral soils are prominent in some areas (NRCS, 2007) (Figure 13).

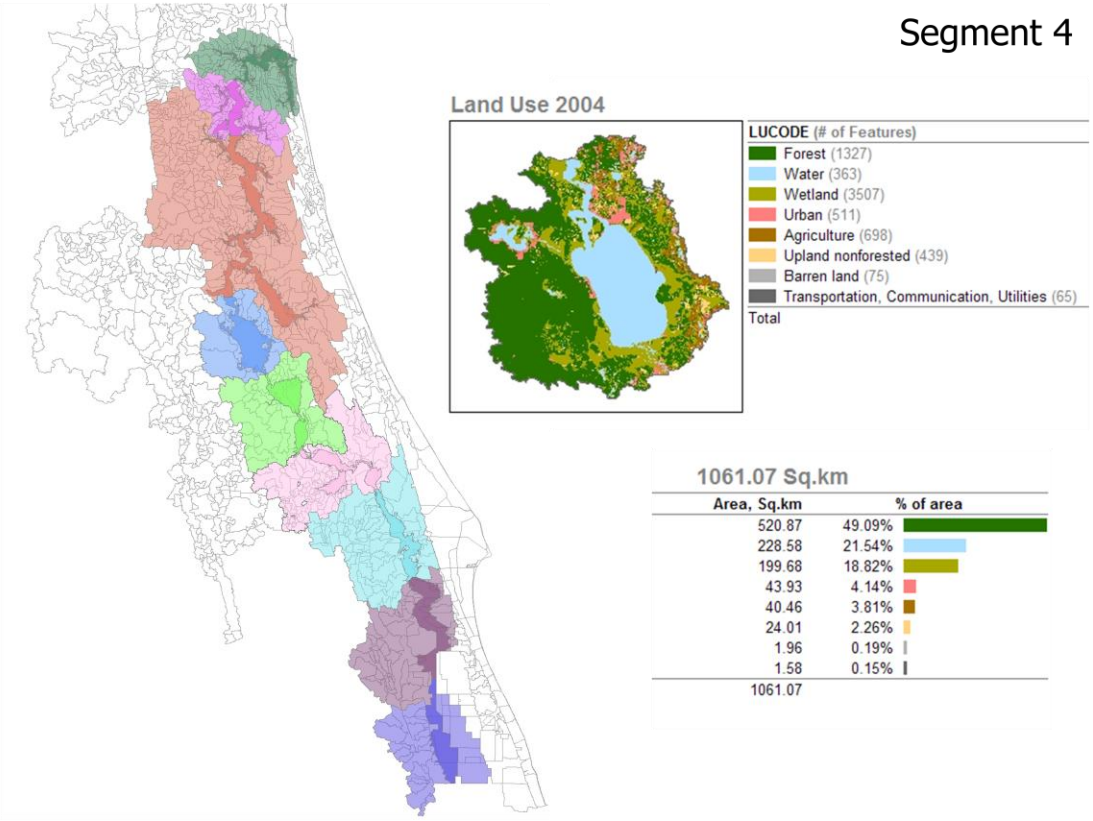
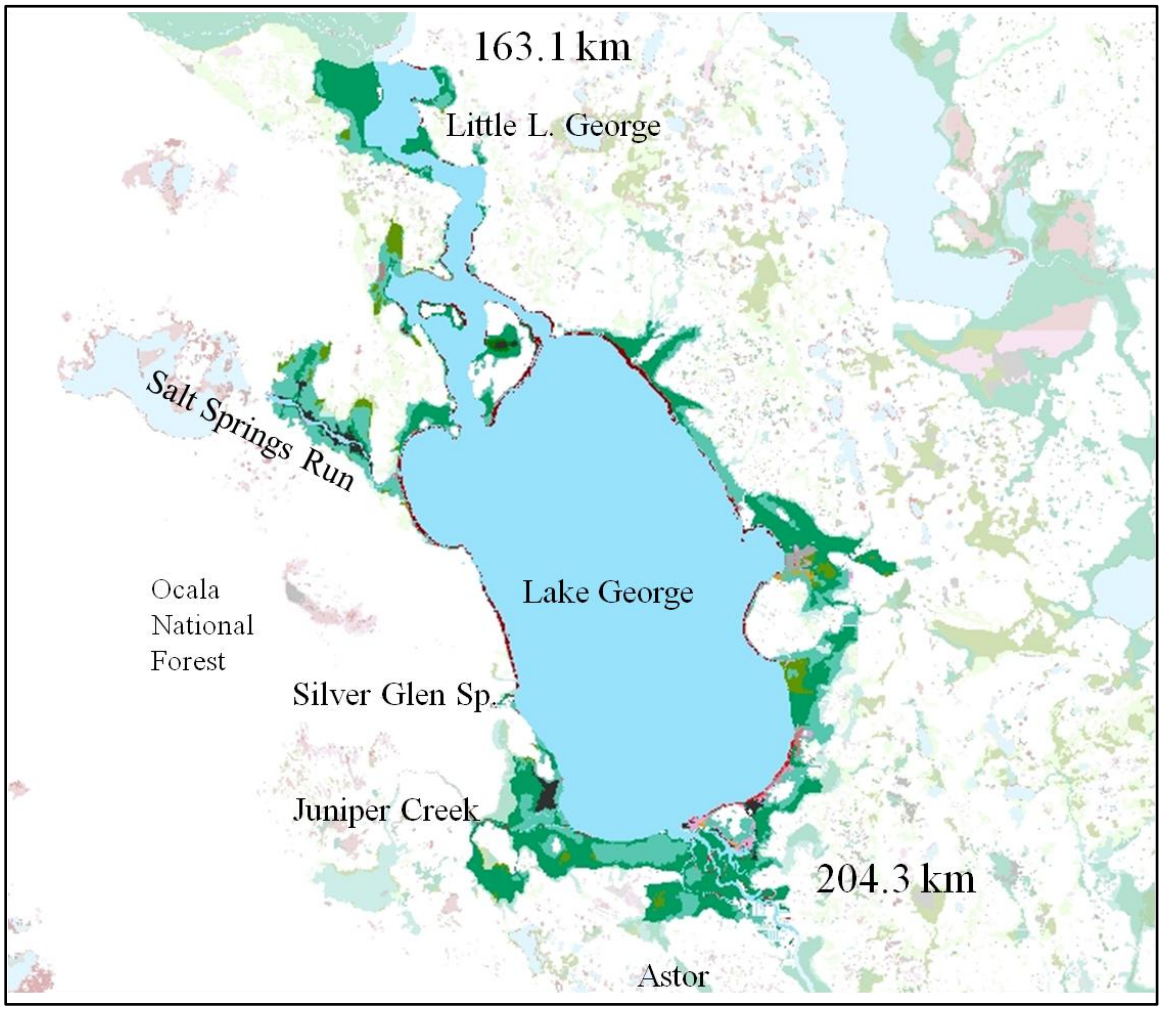


Figure 11. Segment 4 land use.



294.86 Sq.km

Wetlands Group	Area, Sq.km		% of area
Water group	199.59	67.69%	
Hardwood Swamp	37.99	12.88%	
Hydric Hammock group	29.49	10.00%	
Upland	13.92	4.72%	
Other Wetlands	13.73	4.66%	
Total	294.86		

Figure 12. Segment 4 wetlands.

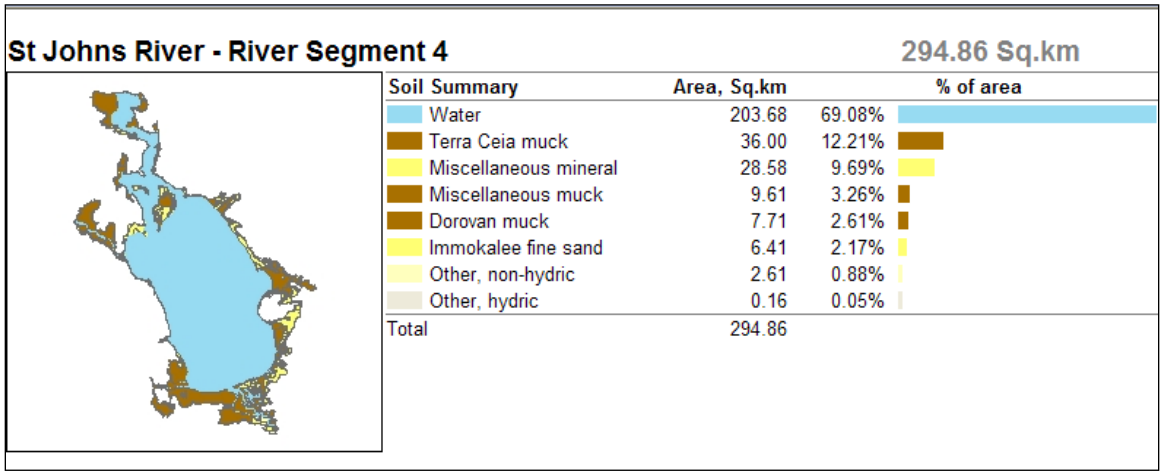


Figure 13. Segment 4 soils.

Table 1. Springs contributing to flow in the St. Johns River.

Spring	**County**	**Mean CFS**	**Initial Segment Springs Flows Into**
Pottsburg Creek Spring	Duval	1.29	1
Segment Total			
W.W. Gay Spring	Clay	0.14	2
Wadesboro Spring	Clay	0.98	2
Segment Total		**1.12**	
Apopka Spring	Lake	30.6	3
Blue Spring - Marion	Marion	7.8	3
Blue Spring Yal Pool	Lake	2.75	3
Boulware Spring	Alachua	0.3	3
Bugg Spring Run	Lake	11.5	3
Catfish Springs	Marion	7.8	3
Double Run Spring	Lake	2.93	3
Glen Springs	Alachua	0.31	3
Green Cove Spring	Clay	3.05	3
Guordneck Spring	Lake	48.2	3
Holiday Springs Dstm	Lake	3.35	3
Lake Lowry Seep East	Clay	2.82	3

Magnesia Spring	Alachua	0.79	3
Mooring Cove Springs	Lake	0.53	3
Nashua Spring	Putnam	0.12	3
Orange Spring	Marion	2.69	3
Sandys Spring	Lake	0.13	3
Satsuma Spring	Putnam	1.11	3
Silver Springs	Marion	761	3
Sun Eden Spring	Lake	0.23	3
Welaka Spring	Putnam	7.91	3
Whitewater Springs	Putnam	1.41	3
Segment Total		**897.33**	
Beecher Springs	Putnam	9.13	4
Croaker Hole Spring	Putnam	76.2	4
Fern Hammock Springs	Marion	12.5	4
Forest Springs	Putnam	0.29	4
Juniper Springs	Marion	10.6	4
Morman Branch Springs	Marion	7.41	4
Mud Spring	Putnam	1.16	4
Salt Springs	Marion	80.9	4
Silver Glen Springs	Marion	104	4
Sweetwater Springs	Marion	12.9	4
Segment Total		**315.09v**	
Alexander Springs	Lake	104	5
Barrel Spring	Orange	0.25	5
Blackwater Springs	Lake	1.4	5
Blue Algae Boil	Lake	0.14	5
Blue Spring - Volusia	Volusia	157	5
Blueberry Spring	Lake	0.07	5
Boulder Springs	Lake	0.19	5
Camp La No Che Spring	Lake	0.7	5
Cedar Springs	Lake	0.03	5
Droty Spring	Lake	0.62	5
Ginger Ale Springs	Seminole	0.11	5
Green Algae Boil	Lake	0.14	5

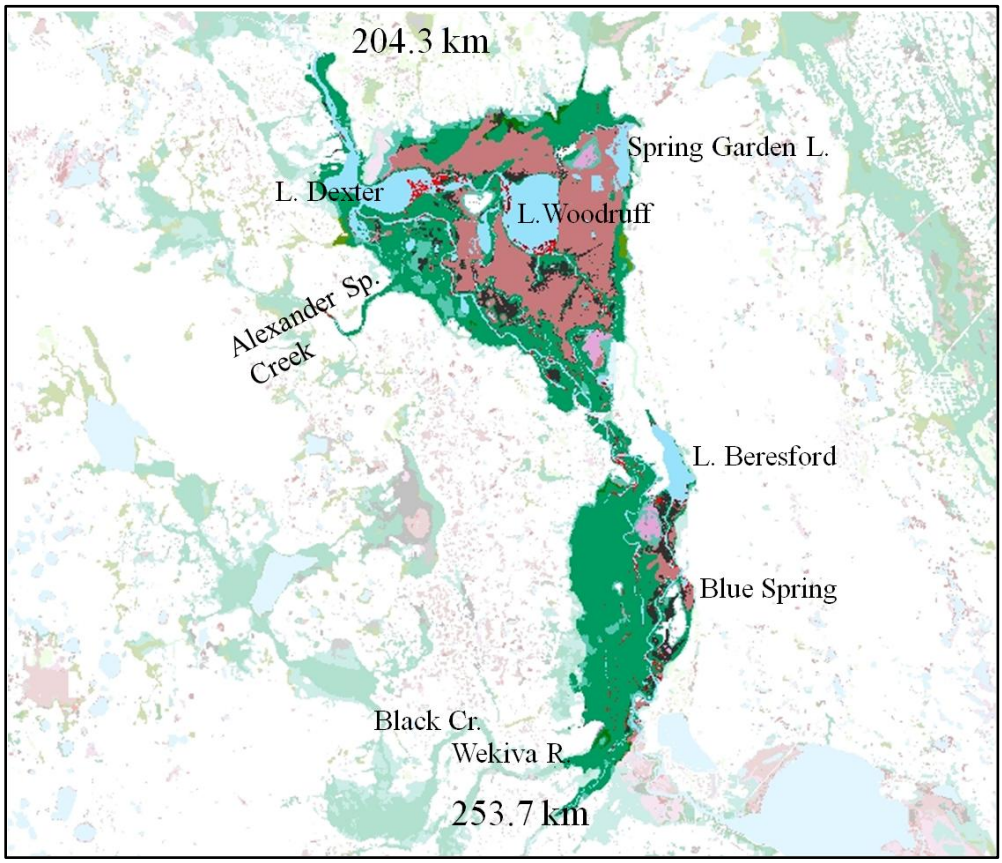
Island Spring	Seminole	7.83	5
Markee Spring	Lake	0.25	5
Messant Spring	Lake	14.7	5
Miami Springs	Seminole	5.05	5
Moccasin Springs	Lake	0.29	5
Mosquito Springs Run	Lake	1.59	5
Nova Spring	Seminole	8.52	5
Palm Springs - Lake	Lake	0.63	5
Palm Springs - Seminole	Seminole	6.88	5
Pegasus Spring	Seminole	2.8	5
Ponce de Leon Springs	Volusia	27.6	5
Rock Springs	Orange	57.9	5
Sanlando Springs	Seminole	19.6	5
Seminole Springs - Lake	Lake	32.5	5
Sharks Tooth Spring	Lake	0.15	5
Snail Springs	Lake	0.09	5
Starbuck Spring	Seminole	14.3	5
Sulphur Spring	Orange	0.74	5
Wekiwa Springs	Orange	67.1	5
Witherington Spring	Orange	4.7	5
Segment Total		**537.87**	
Clifton Springs	Seminole	1.44	6
Gemini Springs	Volusia	10	6
Green Springs	Volusia	1.4	6
Lake Jessup Spring	Seminole	1.04	6
Seminole Spring	Volusia	0.05	6
Segment Total		**13.93**	

Segment 5. Lake Woodruff Segment

Although the Lake Woodruff segment is 49.2 km in length along the main St. Johns River channel, the presence of side channels, islands, meanders, dead-end channels, various back waters, and connected lakes – together with the relatively low total surface water area – results in a high shoreline ratio (Figures 14, 15, 16). Fluvial river channels are a prominent aspect of this segment, although there are several significant lakes (Dexter, Woodruff, Spring Garden, and Beresford), as well. Spring flow, including that of Alexander Springs, DeLeon Spring, Blue Spring, Rock Springs, and Wekiva Springs, was well as many lesser springs (Table 1), contribute greatly to St. Johns River flow. Salinity in the Lake Woodruff segment is somewhat elevated (0.3 to 0.6 ppt) owing to saline groundwater influence. Hardwood swamps cover much of the floodplain (43.4%). Shallow marshes, primarily of *S. bakeri*, or in some cases *Cladium jamaicense*, are the dominant wetland type around Lakes Woodruff and Dexter and in additional isolated patches, (Figure 16). Most of these herbaceous communities are heavily influenced by salts in the soil (P. Kinser, personal observation). The most extensive soils are Terra Ceia muck, Everglades mucky peat, and Bluff sandy clay loam (Figure 15). Wetland dependent fauna species are very abundant and include waterfowl and wading birds of many types, manatee, alligator, and a conspicuously large population of turtles (P. Kinser, personal observation). This area is also primary habitat for Black Bear.

The 1568 km^2 local drainage basin contains a predominance of upland forest (35.4%) and wetlands (26.9%), but urban (16.7), and agricultural (11.2%) land uses are also significant (SJRWMD, 2006) (Figure 16). The diminished width of the river in this segment and the presence of only a few large lakes accounts for the relatively small percentage of water (5.0%).

An inspection of 1943 and 2004 aerial images shows that many hectares of the floodplain that were formerly dominated by herbaceous wetland vegetation have now become forested wetlands. Other changes or impacts include logging, channel and canal dredging, and the cutting of river meanders for navigation. Spoil was placed in many places along the riverbank and have now become forested upland habitat features, although these are of limited extent.



217.03 Sq.km

Wetlands Group	Area, Sq.km	% of area
Hardwood Swamp	94.25	43.43%
Shallow Marsh	45.27	20.86%
Water group	33.43	15.40%
Hydric Hammock group	14.95	6.89%
Shrub Swamp	12.25	5.65%
Other Wetlands	10.63	4.90%
Upland	6.20	2.86%
Total	217.03	

Figure 14. Segment 5 wetlands.

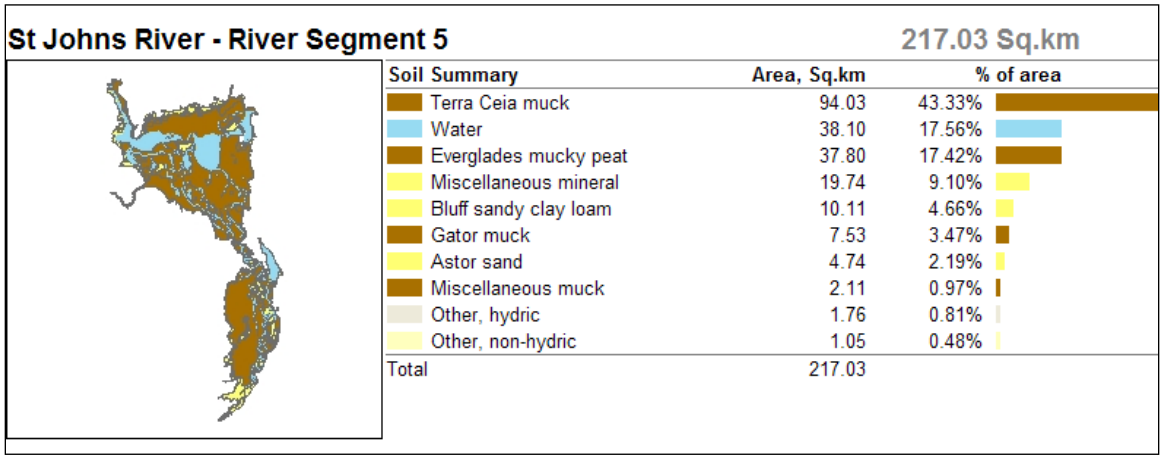


Figure 15. Segment 5 soils.

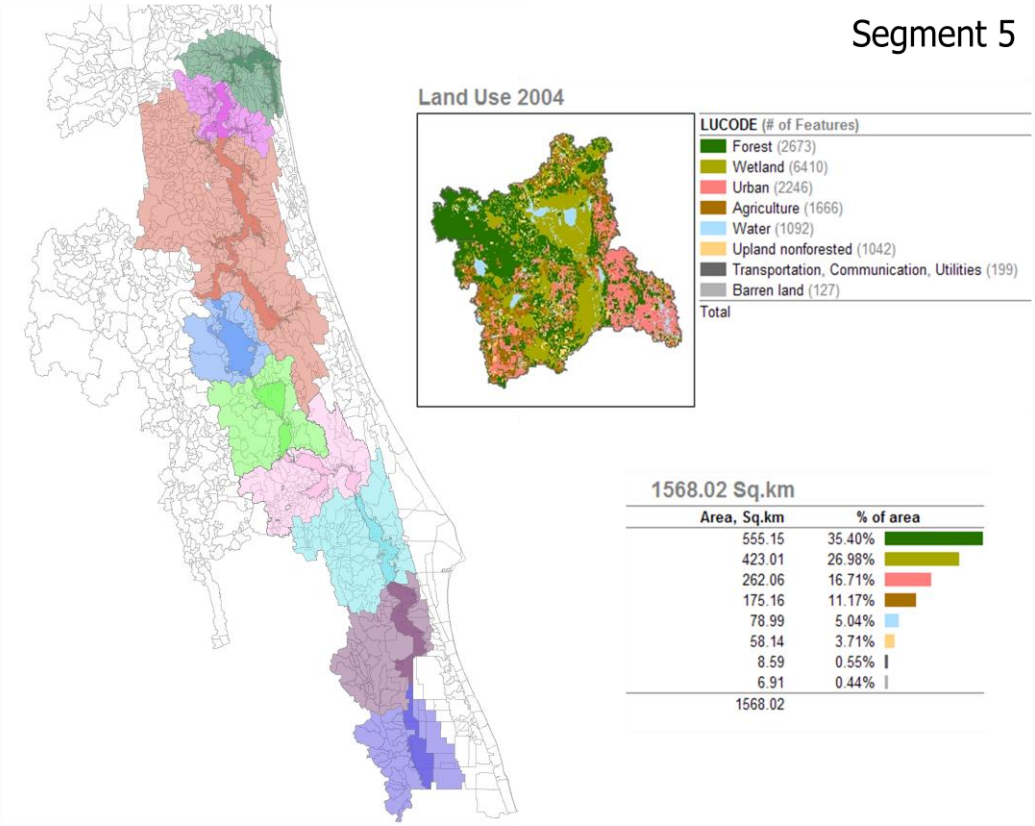


Figure 16. Segment 5 land use.

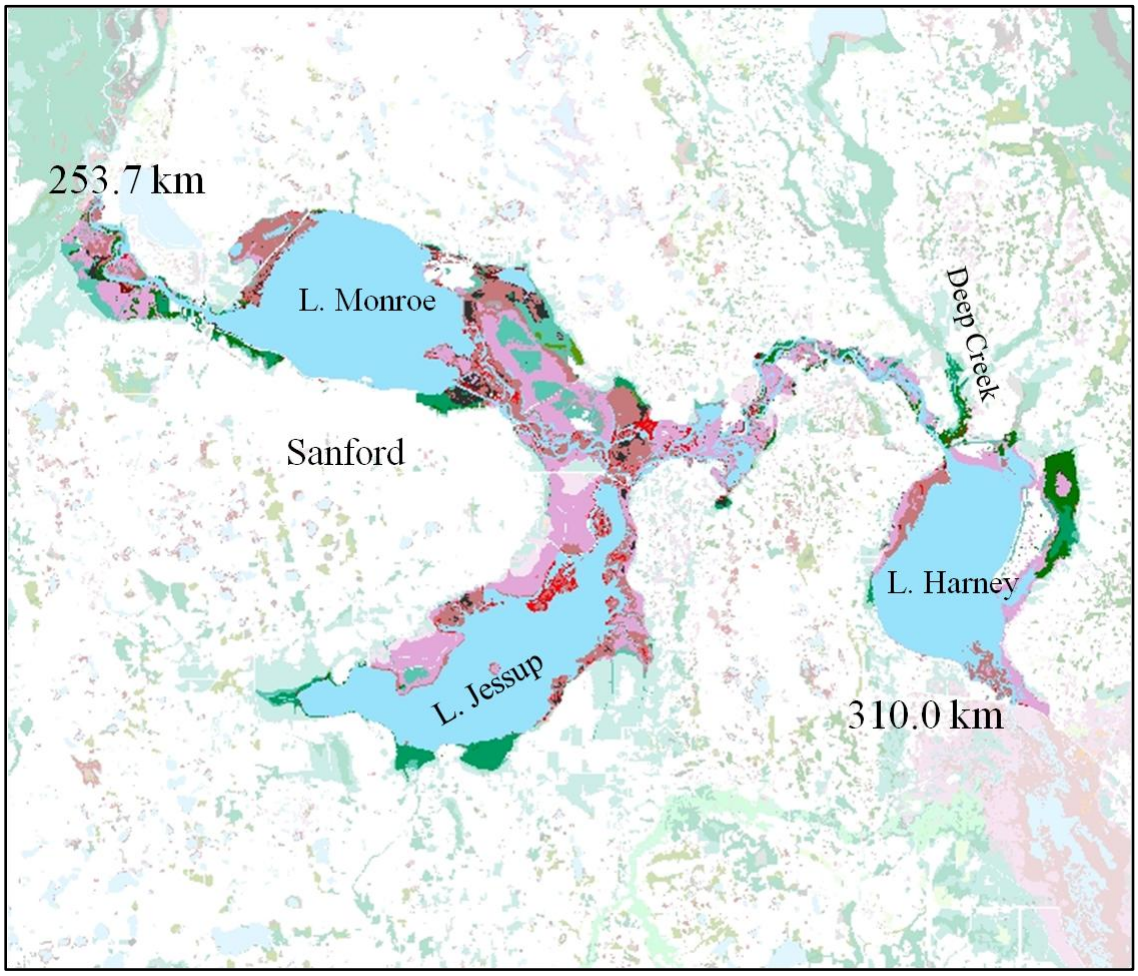
Segment 6. Central Lakes Segment

River segment 6 contains three large lakes, Monroe, Jesup, and Harney (Figure 17). Harney and Monroe are both flow-through lakes, but Jesup, although connected to the river is offset from the main river flow and is more greatly influenced by conditions in its local basin.

The Segment 6 local basin (Figure 18) contains significant urbanized land use (28.8%). Wetlands remain a significant landscape component (26.6%), followed by upland forest (17.0%), and agriculture (10.6%). The three large lakes contribute to the 9.7% water coverage (SJRWMD, 2002).

The total St. Johns River length in this segment, which covers an area of 198 km2, is 56.3 km, the greater part of which falls in the long fluvial river channel between lakes Harney and Monroe. Segment 6 as a whole is a mix of lacustrine and riverine features. Groundwater contributions from known springs are modest, but indirect contributions may be of more consequence. Salinity levels within this segment generally fall in the range of 0.3 to 0.8 ppt, although some specific water bodies may be considerably more saline (A. Ceric, S. Winkler, unpublished data). Although open water is the dominant aquatic feature in this segment (54.8%), wetlands are common and consist primarily of wet prairie and shallow marsh herbaceous communities. Many of these wetland communities are composed of species that tolerate elevated salinities and in some areas communities adapted to hypersaline conditions, i.e. salt flats, have developed (P. Kinser, personal observation). Many of these herbaceous wetland communities have been used for cattle grazing, although much of the lands formerly in that use have now come under public ownership . The dominant soils in the area are Nittaw muck, a predominantly mineral soil with a thin organic epipedon, manatee fine sand and Terra Ceia muck (Figure 19). Waterfowl, wading birds, and alligator are common in this segment. The manatee is found to some degree in Lake Monroe, and may venture upstream from this point. Marine fish such as mullet and stingray are also found in this river section although it is far removed from the ocean.

In the period between 1943 and the present, as evidenced by examination of aerial photographs, there has been considerable development in the basin, in particular around Sanford, Winter Springs, Oviedo and in the suburbs of Orlando.



198.06 Sq.km

Wetlands Group	Area, Sq.km	% of area
Water group	108.59	54.83%
Wet Prairie	30.42	15.36%
Shallow Marsh	21.10	10.65%
Hydric Hammock group	9.53	4.81%
Other Wetlands	8.77	4.43%
Upland	7.85	3.96%
Hardwood Swamp	6.82	3.45%
Cypress	4.94	2.49%
Total	198.06	

Figure 17. Segment 6 wetlands and water bodies.

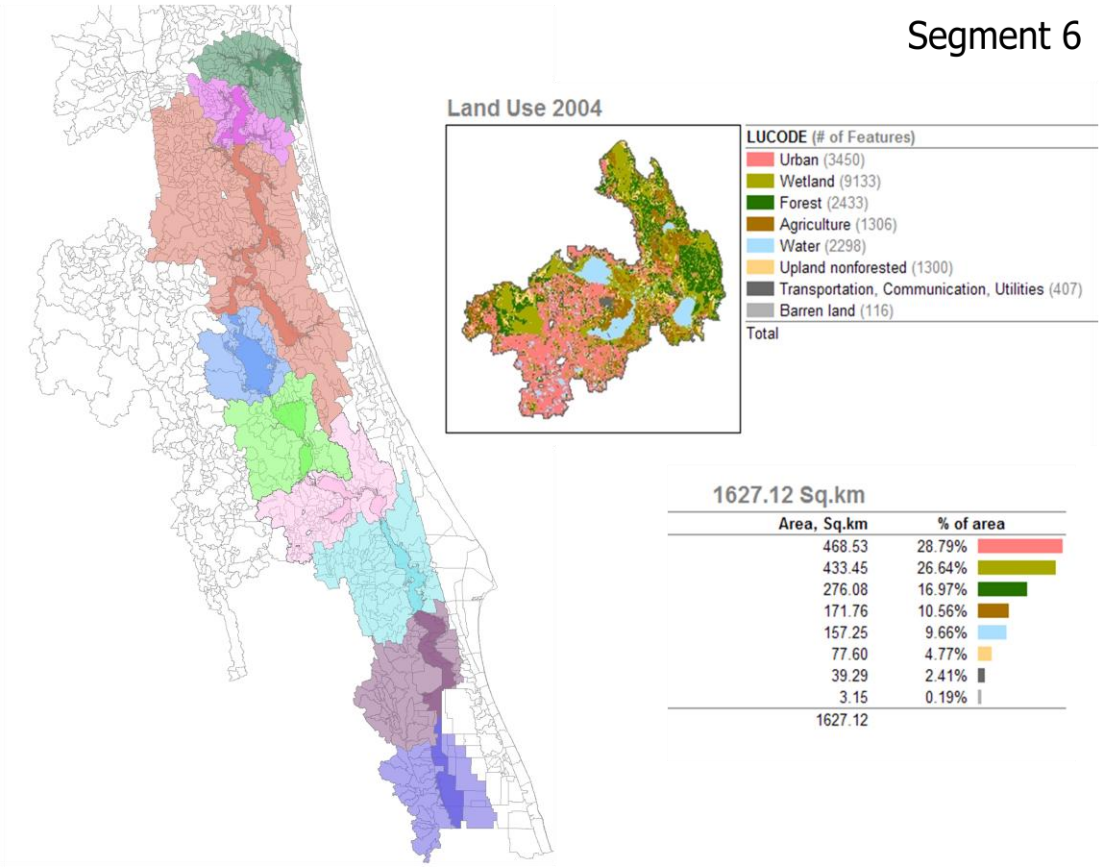


Figure 18. Segment 6 land use.

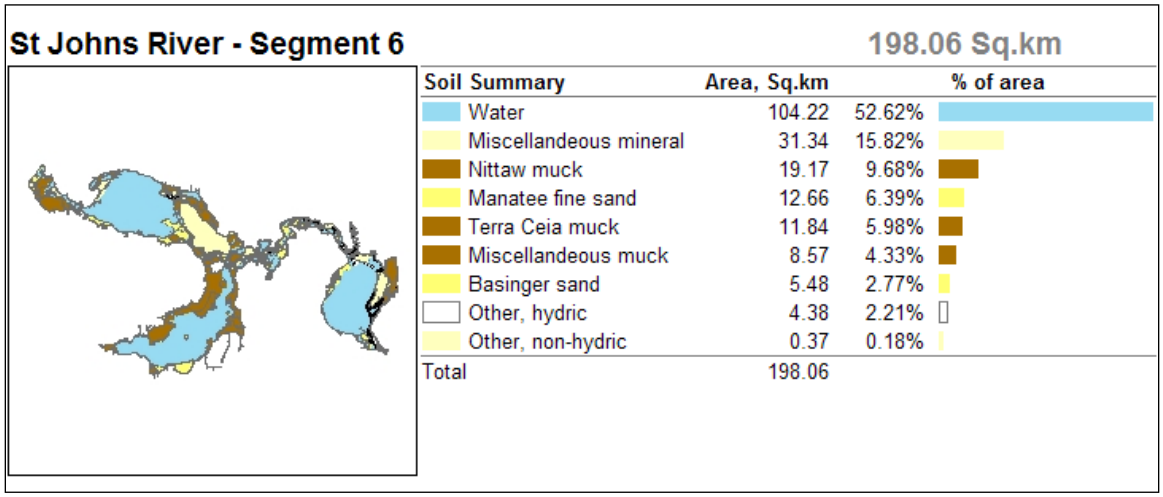


Figure 19. Segment 6 soils.

Segment 7. State Road 50 – Anastomosing Channels Segment

River segment 7 extends from Puzzle Lake to the outlet of Lake Poinsett and is 68 kilometers in length. This segment is the most truly riverine in character of all of the river segments (Figure 20). In this 189 km2 segment, much of which is in public ownership, there is a complex pattern of Anastomosing channels that are generally stable in position (D. Rosgen, 1996). A series of streams enter the system from the west. These include Jim Creek, Tootoosahatchee Creek, and the Econlockhatchee River, among others. Drainage from a series of lakes (Ruth, Longman and Salt) also enters the river along this stretch. The St. Johns River here has a moderate rate of fall before reaching Lake Harney, upstream from this segment, which can be considered to be the local base-level feature for the southern sections of the river. Lake Harney also appears to exert a strong back-water / hydraulic dam effect on river segment 7, prolonging the duration of flooded conditions (especially in more upstream areas, such as Puzzle Lake). Salinity in the St. Johns River here is not high (0.3 to 0.7 ppt) generally but may be considerably higher in portions of the floodplain, which are dominated by shallow marsh (30%) and wet prairie (38%). These are most often dominated by the salt tolerant grass, *Spartina bakeri*. Many areas of hypersalinity occur, especially in the St. Johns National Wildlife Refuge and along the east side of the river north to Lake Harney (P. Kinser, personal observation). Total wetland cover is 86.7% and the shoreline ratio (.027) is higher than in any other segment of the river. The narrow, Anastomosing channels of the St. Johns River are responsible for the prominence of edge habitat here. Hardwood swamps and hydric hammocks cover a small portion of the landscape (ca 8% together), but are mainly associated with tributaries entering the river from the west. The presence of hardwood swamps may indicate the lower salt content of these inflowing streams . This segment provides significant habitat for species favoring edge habitat, in particular wading

birds. It was also the location of the last colony of the Dusky Seaside Sparrow, prior to its extinction in the 1980's.

Floridana fine sand and other mineral soils dominate the floodplain landscape (Figure 21), although Tomoka muck is prevalent in some low areas near the river channel (NRCS, 2007) .

The local basin for segment 7 is the only basin in which wetlands (38.9%) are the predominant component. It is followed by agriculture (23.1%, primarily pasture), urban (15.6%), forest (9.2%), and a small water (3.9%) component (SJRWMD, 2006) (Figure 22).

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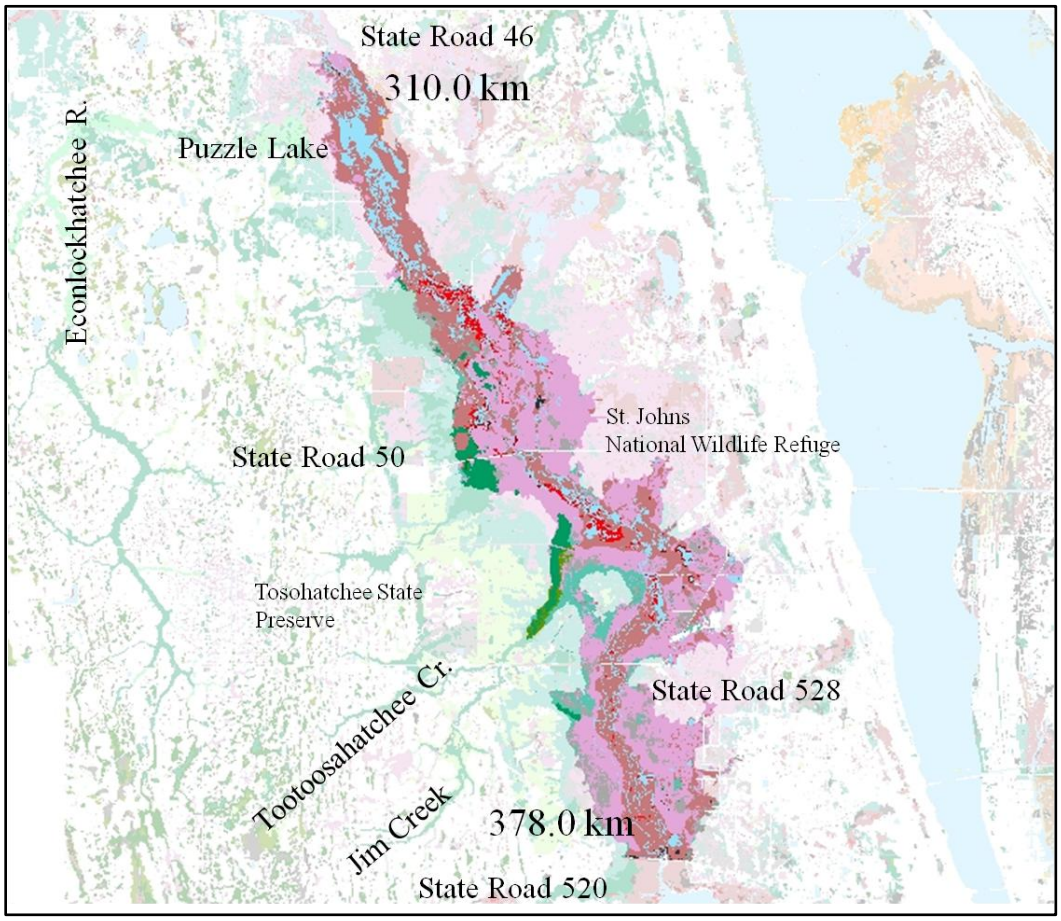
An inspection of aerial photographs from the 1940s show relatively little evidence of major change in the river and its immediate floodplain other than some minor encroachment of transitional shrub vegetation into some areas of wet prairie.



185.79 Sq.km

Wetlands Group	Area, Sq.km	% of area
Wet Prairie	71.29	38.37%
Shallow Marsh	55.70	29.98%
Water group	22.66	12.19%
Transitional Shrub	12.55	6.76%
Hydric Hammock group	8.50	4.58%
Hardwood Swamp	6.43	3.46%
Floating Marshes	4.63	2.49%
Upland	2.04	1.10%
Other Wetlands	1.98	1.07%
Total	185.79	

Figure 20. Segment 7 wetlands and water bodies.

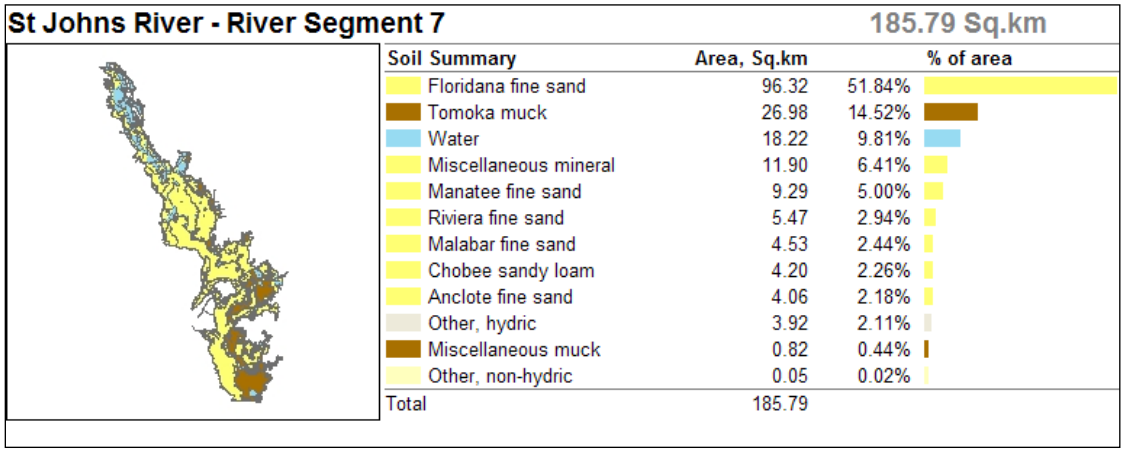


Figure 21. Segment 7 soils.

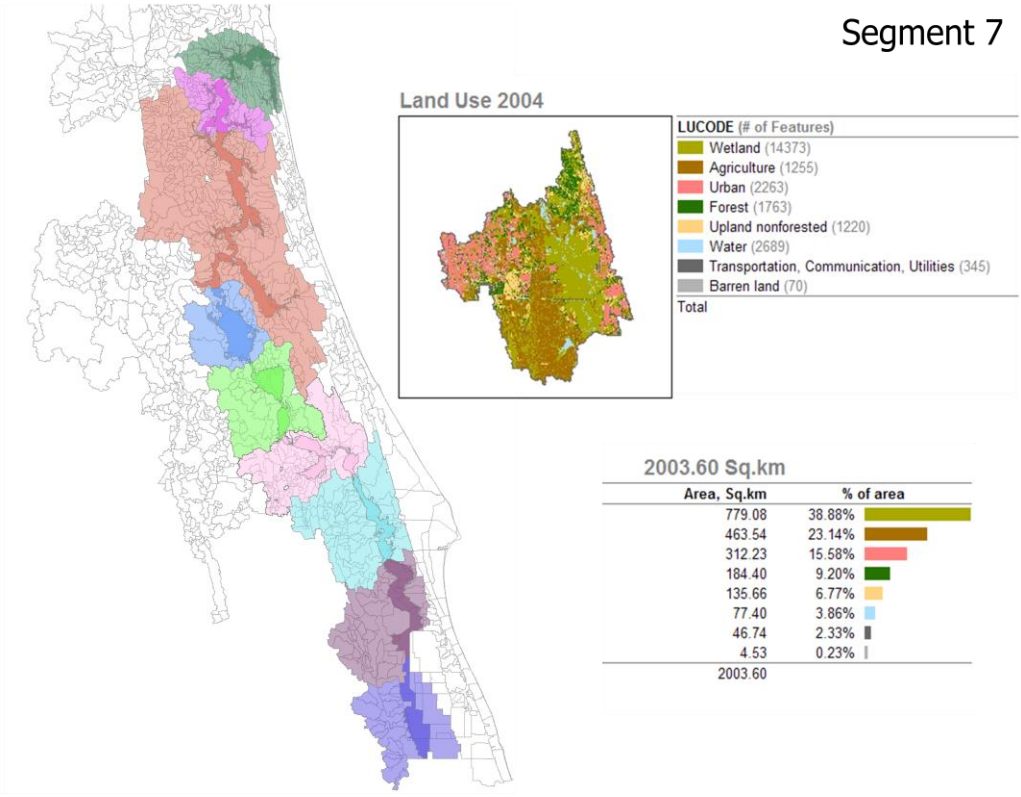


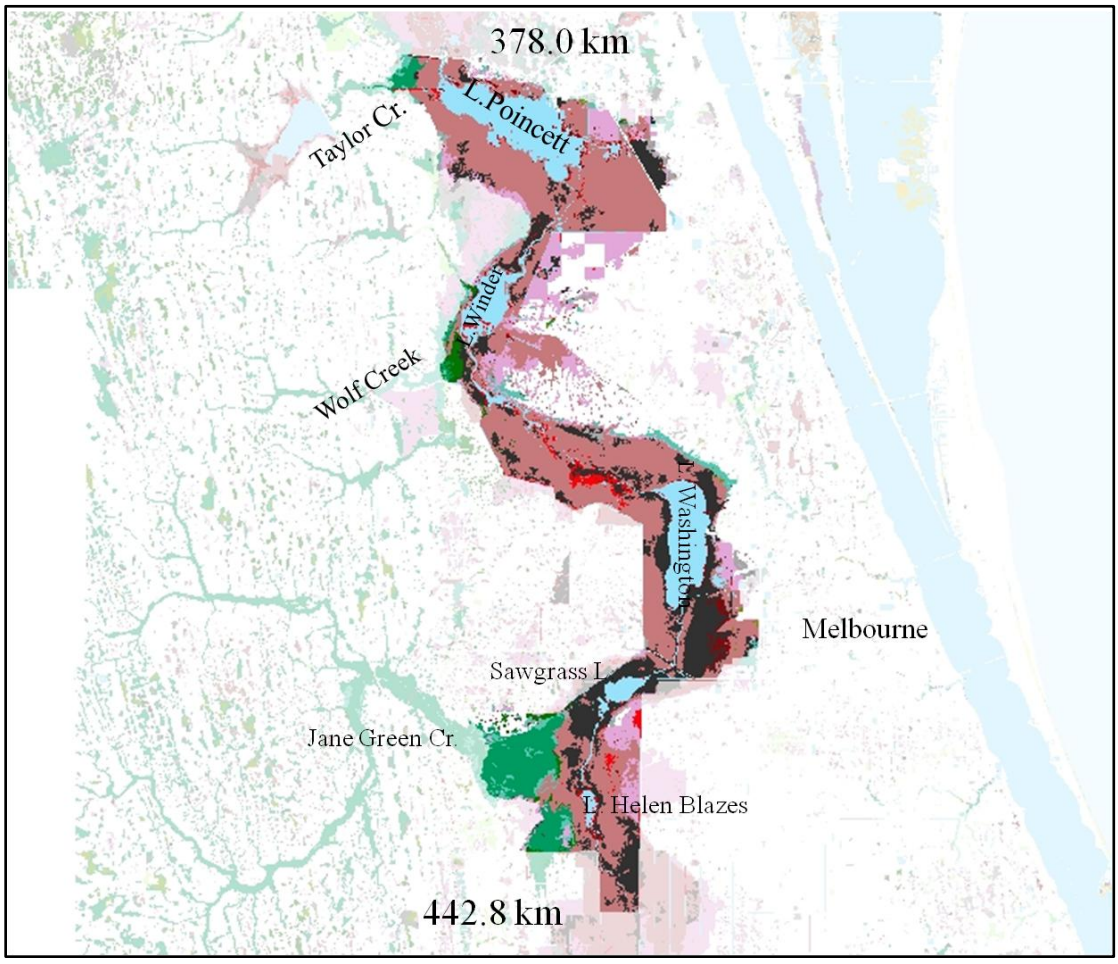
Figure 22. Segment 7 land use.

Segment 8. Chain of Lakes Segment

The 65 km of segment 8 pass through a series of five lakes, Helen Blazes, Sawgrass, Washington, Winder, and Poinsett that are connected by a single narrow channel of low sinuosity (Figure 23). This segment, much of which is in public ownership, begins at the first open water channel of the St. Johns River in an area known as the Three-Forks Marsh. The system contains both riverine and lacustrine components and is driven by rainfall and runoff. The western tributaries, including Jane Green Creek, Wolf Creek, and Taylor Creek, may contribute as much or more flow to the river as the riverine flow from segment 9 (L. Keenan, personal communication). Groundwater seepage from the surficial aquifer appears also to be of some importance. The water in the river is fresh (salinity <0.2 ppt.), but significant levels of salt may be present in the soils of some adjacent wetlands; unfortunately this has not been sufficiently studied. In spite of the series of lakes, water covers only 14% of the floodplain area. The wetland area (75 % of the total) is primarily in shallow marsh (38%, shrub swamp (15%), and wet prairie (9%). Hardwood swamp forms a lesser coverage (5%) that enters the flood plain along its western margin in association with inflowing tributaries. The dominant soils are Micco mucky peat, Tomoka muck, Floridana fine sand and Everglades mucky peat (NRCS, 2007) (Figure 24). The shoreline ratio in this segment is high (0.013) reflecting the extensive and narrow river channel and the very irregular shorelines of the lakes in this segment. This segment provides significant habitat for wading birds, waterfowl, and alligators.

The local basin of 1705 km2 is dominated by agriculture (50.9%), much of which is on former wetland (Figure 25). Wetlands remain a significant component (33.3%). Urban (4.2%), forest (3.4%), and water (3.5%) constitute most of the remainder (SJRWMD, 2006).

The floodplain in this segment has been extensively encroached upon by agricultural development. The floodplain has been reduced in size by one third to one-half. Numerous canals have also been constructed some of which serve to drain wetland areas near the river and others connect more distant wetlands to the river and provide more rapid drainage than existed naturally. Shrub swamp vegetation, primarily willows, has increased markedly in the floodplain of this segment.



310.89 Sq.km

Wetlands Group	Area, Sq.km	% of area
Shallow Marsh	119.21	38.34%
Shrub Swamp	46.85	15.07%
Water group	43.43	13.97%
Upland	33.41	10.75%
Wet Prairie	28.52	9.17%
Hardwood Swamp	16.58	5.33%
Other Wetlands	15.51	4.99%
Hydric Hammock group	7.35	2.37%
Total	310.89	

Figure 23. Segment 8 wetlands and water bodies.

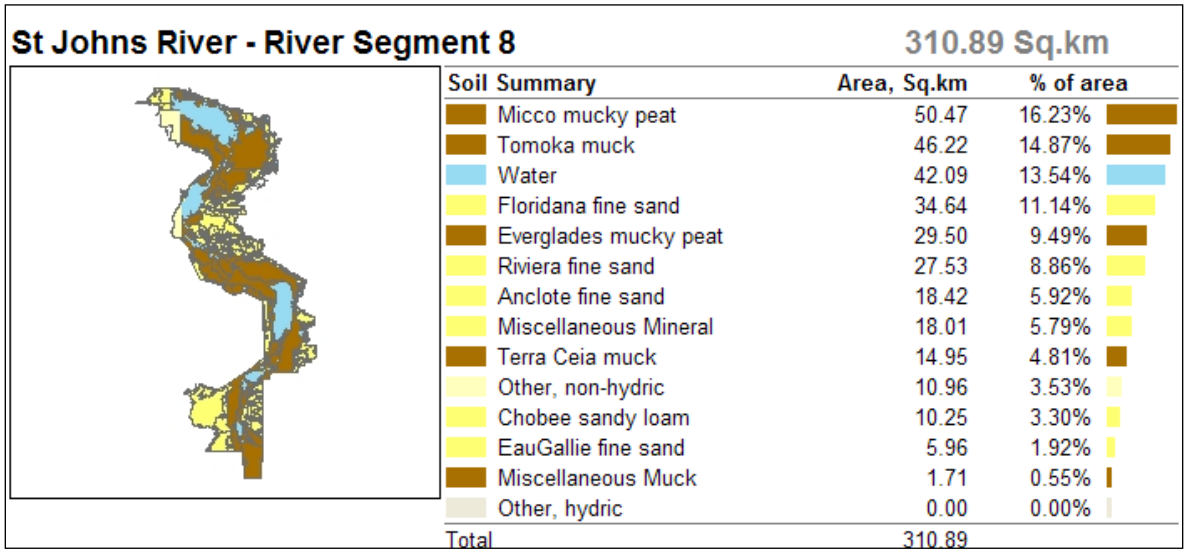


Figure 24. Segment 8 soils.

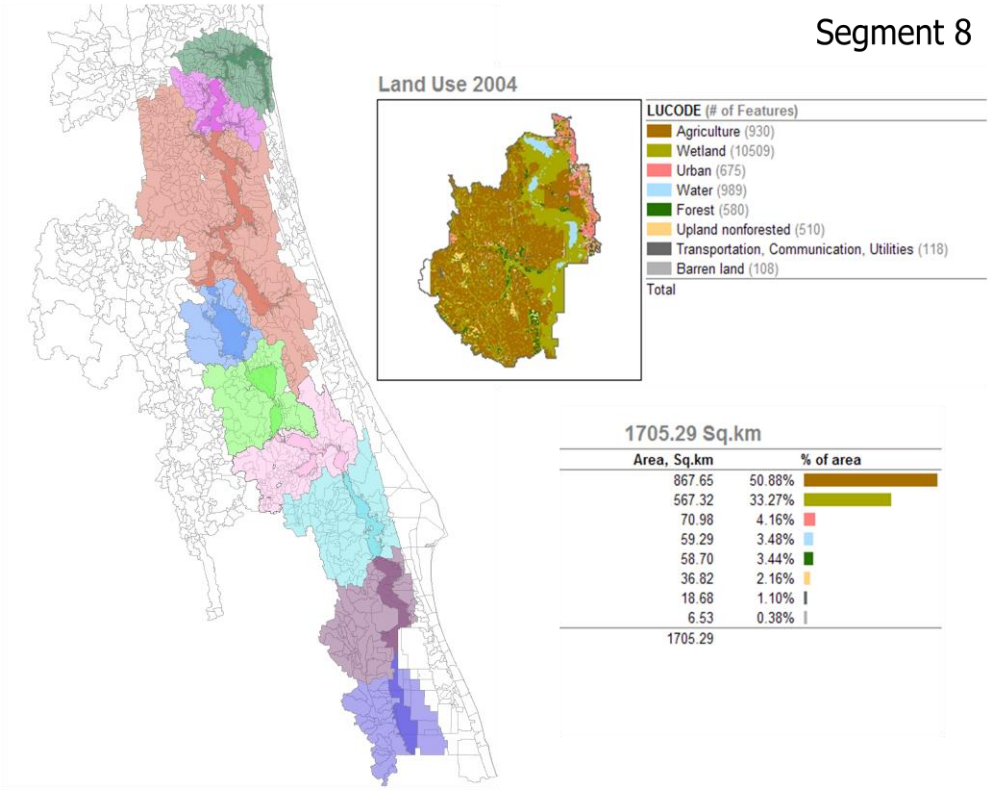


Figure 25. Segment 8 land use.

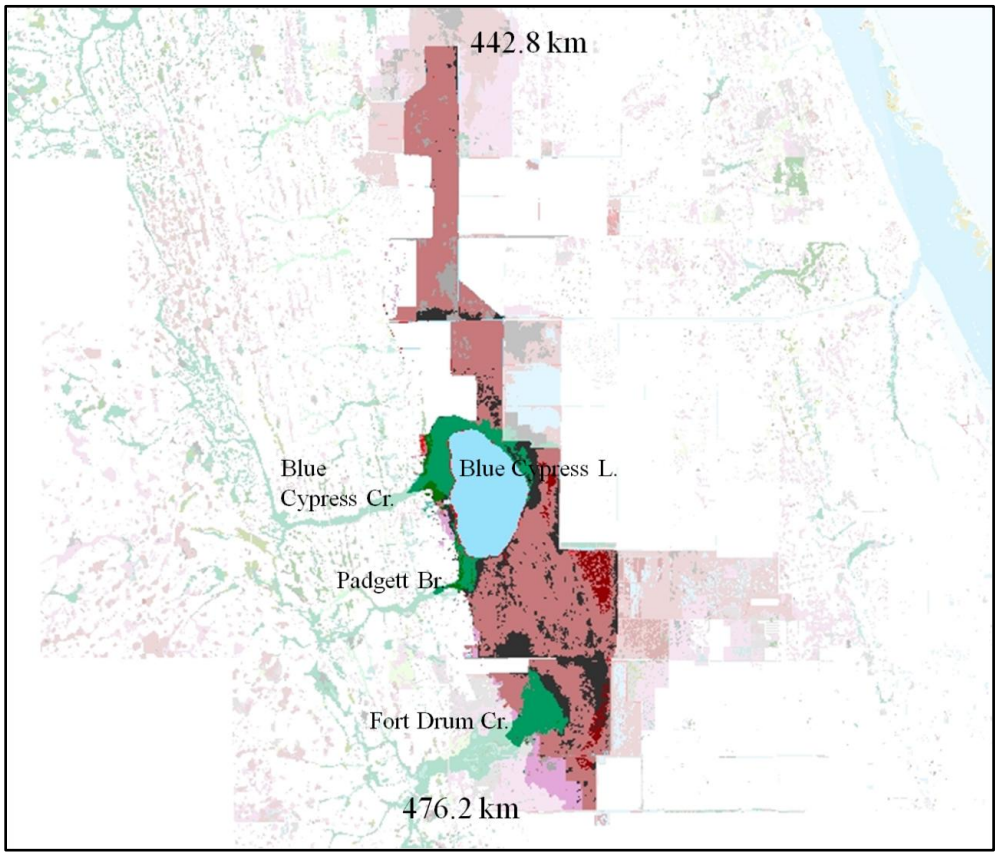
Segment 9. Blue Cypress Lake Segment

Segment nine, although not subject to planned water supply withdrawals, is included here to provide a complete description of the St. Johns River and for its connection and contribution to downstream segments (Figure 26). It is 33.4 km in length and covers an area of 246 km2. Historically the floodplain covered a far larger area, but much of the area was leveed and drained for agricultural development. Some areas have been restored but do not currently function as part of the natural floodplain. Pumps, levees, and other structures are very much a part of the system, which otherwise functions hydrologically as a headwater wetland. Blue Cypress Lake, a relatively unimpacted lacustrine feature is the only significant area of open water. Several forested tributaries, Fort Drum Creek, Padgett Branch, and Blue Cypress Creek flow in from the west, bringing in a significant amount of flow. Direct rainfall is an important contributor and groundwater flow from the shallow aquifer may be of importance in some areas. The water here is very fresh. Conductivity and alkalinity are much lower than in other river segments, but color is higher. Wetlands, which make up 77% of the floodplain area, are dominated by shallow marsh (47%) and shrub swamp (11%). The marshes are predominantly a mosaic of sawgrass, maidencane, and water lily communities, not unlike the pattern seen in large areas of the Everglades (Lowe, 1983); willows and cattail appear to be increasing in cover. The soils in this

segment are almost all organic and include Terra Ceia muck, Everglades mucky peat, and Gator muck soils (NRCS, 2007) (Figure 27). The shoreline ratio is low (.007) reflecting the relatively simple shore line relative to the area of Blue Cypress Lake. Wading birds, which use slough habitat, and waterfowl, which use both the sloughs and the open waters of Blue Cypress Lake, find habitat here. Alligators are also abundant. The federally listed, endangered Everglades snail kite, which both nests and feeds here, is of major concern in the management of this river segment.

The largest component of land use (Figure 28) in this once highly wetland dominated basin is agriculture (47.8%). Wetlands remain a significant, although diminished, component at 36.3%. Water coverage (7.1%) is largely attributable to Blue Cypress Lake, and is followed by small urban (2.2%) and forest (2.9%) components (SJRWMD, 2006).

Historically, this river segment has undergone much change. The most conspicuous and potentially damaging is the great reduction in the floodplain. Most of this area was converted to pastureland and ultimately to citrus, where it is now an important part of the Indian River Citrus District, where 75% of Florida's grapefruit crop originates.



246.19 Sq.km

Wetlands Group	Area, Sq.km	% of area
Shallow Marsh	115.37	46.86%
Upland	30.14	12.24%
Shrub Swamp	28.15	11.43%
Water group	27.46	11.15%
Hardwood Swamp	20.43	8.30%
Other Wetlands	9.81	3.98%
Wet Prairie	8.92	3.62%
Deep Marsh	5.88	2.39%
Total	246.19	

Figure 26. Segment 9 wetlands and water bodies.

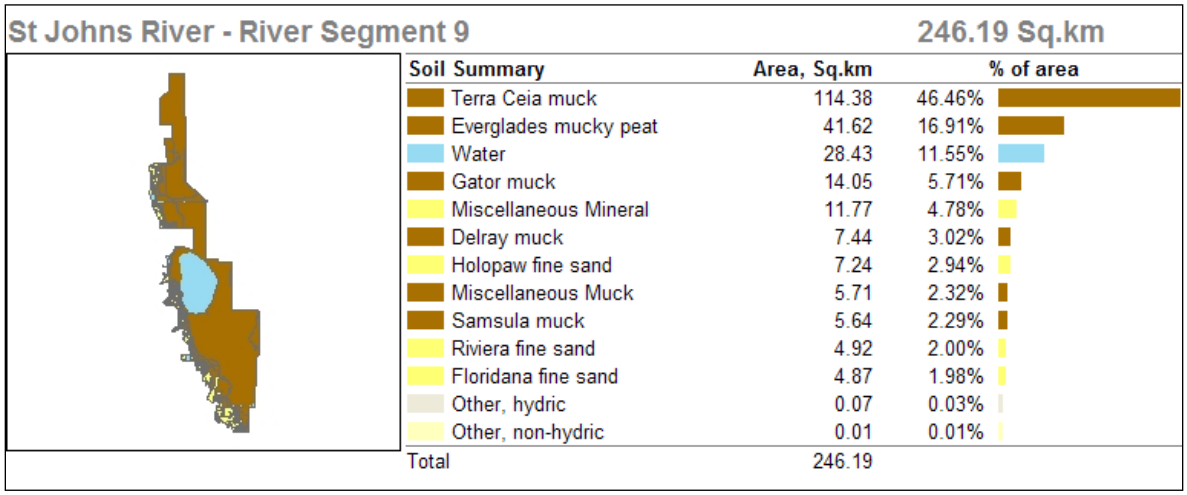


Figure 27. Segment 9 soils.

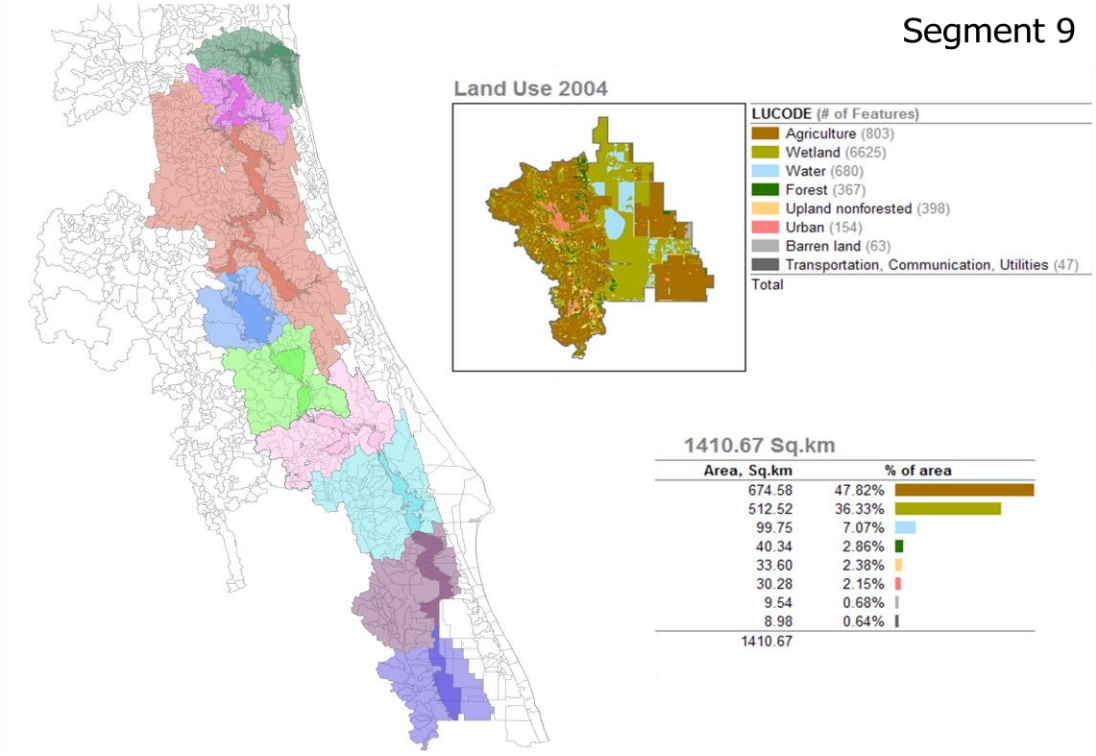


Figure 28. Segment 9 land use.