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City of Gainesville Basin Planning Initiative: A Report with Recommendations

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CITY OF GAINESVILLE BASIN PLANNING INITIATIVE:

A Report with Recommendations

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I. INTRODUCTION

The city of Gainesville drains, or is drained by, four surface water basins.[1] Both the City of Gainesville and Alachua County share political responsibility for each of these basins. Three of the basins, Blues Creek Basin, Hogtown Creek Basin, and most of the Paynes Prairie Basin are "seep/stream to sink systems," also referred to as closed basins because they do not drain to larger systems that discharge to tide. These systems begin as wetlands then express themselves as surficial watercourses before draining into sinks that connect directly to the Floridan Aquifer. The urban creek basins in Gainesville and Alachua County have been significantly impacted by development, much of which occurred prior to the emergence of contemporary water management policy. As a result, there are currently significant management issues facing the City of Gainesville and Alachua County. The process of basin planning, a comprehensive approach to water resource management that emphasizes a watershed perspective, can assist in addressing these management issues.

Basin planning in Gainesville is already underway. There is significant public interest in preserving the interrelated surface water and wetland systems that contribute to the unique character of the Gainesville community. While the scale of Gainesville's watershed systems is relatively small, consisting mainly of creeks, there is considerable concern about protecting these resources. Most of these creeks flow through a highly urbanized environment before disappearing back into the Floridan Aquifer, which is the state's largest source of drinking water. In addition, creeks and wetlands are the lifeblood for significant natural areas such as Paynes Prairie Preserve State Park and San Felasco Preserve State Park. Because much of Gainesville's development occurred before stormwater management and buffer requirements, many of the creek ecosystems are seriously degraded. As a result, watershed management issues have been receiving increasing attention within a dynamic policy environment.

The recent revisions to the conservation element of Gainesville's comprehensive plan and Land Development Regulations[2] along with and the recent Creek Summit[3] illustrate the high level of governmental and citizen involvement in Gainesville's watershed issues. This increasing level of activity suggests that a "vision" for Gainesville's watershed is emerging. Analyzing decisions that have already been made in terms of conceptual frameworks for basin planning helps to clarify this vision. Similarly, by analyzing options that exist for future planning efforts, the City can select a process to further its own vision for its watersheds and translate this vision into an effective management plan.

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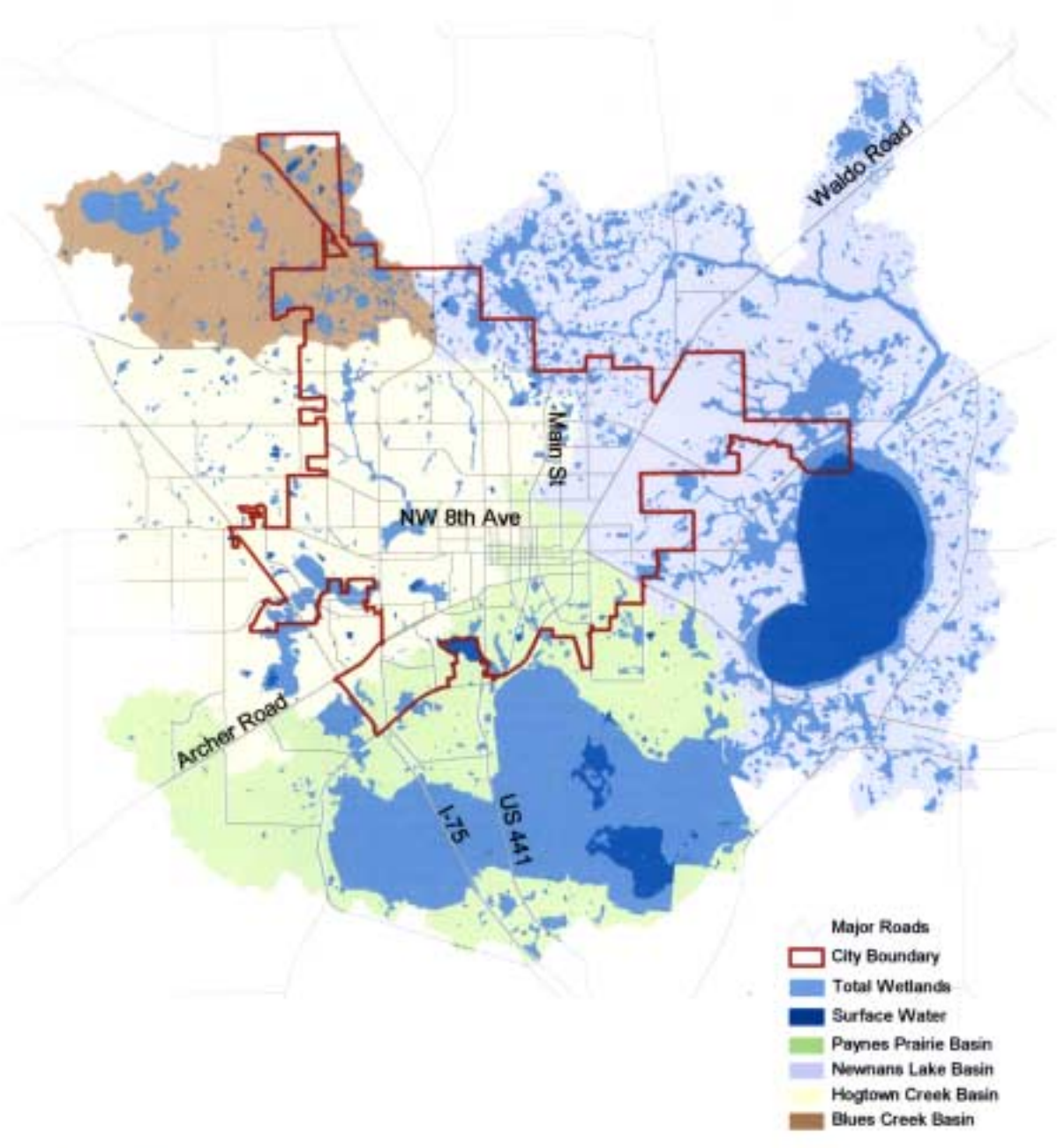
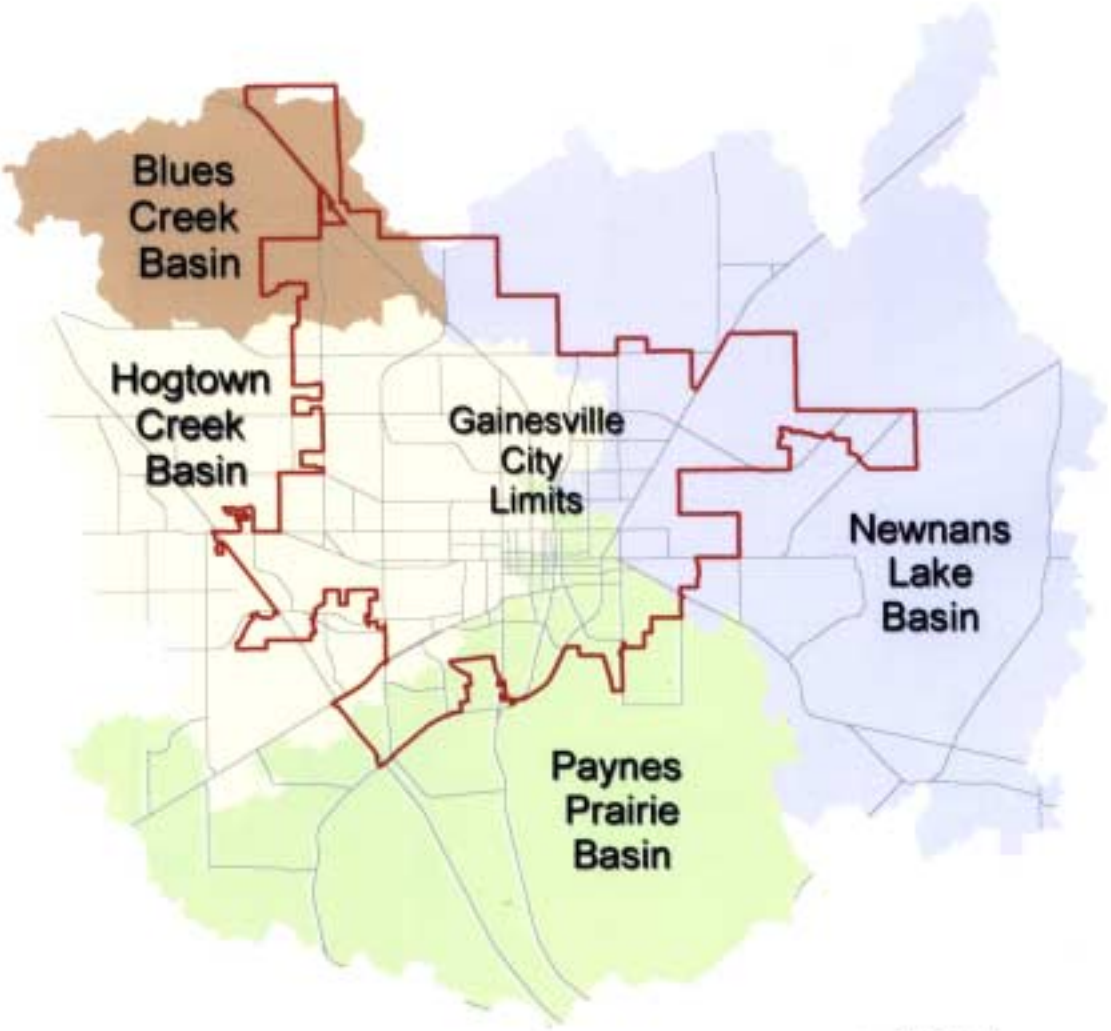
[1] See Maps 1 and 2, which illustrate the four watershed basins.

[2] An Ad Hoc Committee on Wetland and Creek Regulations, which was formed by the Gainesville, City Commission met from January 18, 2002 to April 26, 2002. This Committee transmitted changes to the Conservation, Open Space and Groundwater Recharge Element of the City's Comprehensive Plan and proposed draft Land Development Regulations to implement the revised element. See letter from Richard Hamann, Walter Rosenbaum, and Thomas Crisman to the Gainesville City Commission, April 26, 2002. Hereinafter "Ad Hoc Committee Letter."

[3] The City of Gainesville hosted the Gainesville Creeks Summit on October 29, 2002 for the purposes of sharing information about the creeks and developing ideas about how agencies and groups can work together to restore and protect the quality of these urban watersheds.


Waldo Road
Main St
NW 8th Ave
Archer Road
I-75
US 441
Major Roads
City Boundary
Total Wetlands
Surface Water
Paynes Prairie Basin
Newnans Lake Basin
Hogtown Creek Basin
Blues Creek Basin
Basin Planning Study Area
City of Gainesville Basin Planning Initiative
University of Florida Conservation Clinic
March 2003
0 1 2
Distance in Miles


Blues
Creek
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Hogtown
Creek
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Gainesville
City
Limits
Newnans
Lake
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Paynes
Prairie
Basin
Major Roads
City Boundary
Paynes Prairie Basin
Newnans Lake Basin
Hogtown Creek Basin
Blues Creek Basin
Gainesville Planning Basins
City of Gainesville Basin Planning Initiative
University of Florida Conservation Clinic
March 2003
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Distance in Miles

Section II of this report examines conceptual frameworks for basin planning and some of the implications for these frameworks in Gainesville. Section III provides a general physical characterization of the four major watershed basins in the Gainesville area as well as an overview of management issues. Section IV describes the process and results of a geographic information systems (GIS) analysis of Gainesville's watersheds and wetlands systems. Section V explores the institutional framework for planning in Gainesville, focusing on regulations that affect basin creeks and wetlands. Section VI provides an overview of the major planning tools that are used in watershed planning. Section VII discusses potential methods of implementing watershed planning. Finally, section VIII discusses the experiences of West Eugene, Oregon that may be relevant to planning efforts in Gainesville.

II. CONCEPTUAL FRAMEWORKS FOR BASIN PLANNING

A. Characterizing Gainesville's Watershed Goals

An analysis of relevant literature and the experiences of other communities illustrates that there are a wide variety of planning tools available in the emerging field of community watershed planning. At the same time, there is uncertainty about how best to characterize the City's goals of watershed-related planning. Is Gainesville's goal to develop a watershed management plan? Is it to develop a wetlands management plan? Is it to develop a watershed-based wetlands plan? Is it to develop a creek restoration plan? Gainesville's long-term watershed goals have not been clearly articulated, and thus there is some uncertainty about how to go about accomplishing them.

The series of articles that appeared in the Gainesville Sun in May of 2002[4] and the Gainesville Creek Summit illustrate the fact that there is widespread concern for the future of Gainesville's creeks. Channelization, erosion, sedimentation, water quality, and the loss of aquatic and riparian habitat are degrading all of the creeks. Many of the problems associated with Gainesville's creeks are directly related to loss and degradation of wetland function and the fact that the creeks often serve as the drainage system for urban development. Historically, there were no stormwater retention requirements for development. Through the process of development, wetland and upland areas were often replaced with impermeable surfaces. As a result, the important functions of storage and flow-attenuation were diminished. During rainstorms, large amounts of runoff flow into Gainesville's creeks. This runoff often contains high levels of nutrients and other pollutants. Wetlands and stormwater retention ponds provide important filtration functions. When these functions are sacrificed, the result is a water quantity and water quality problem for Gainesville's creek systems.

The fact that many of the problems confronting Gainesville's creeks today are the result of a historical legacy of development complicates the problem of how to address them. In addition to preventing future degradation of Gainesville's wetlands and creeks, there is substantial interest in improving their current condition. The process of restoring creek and

[4] Ron Matus, *Crippled Creeks: the First of an Eight-part Series on Gainesville's Troubled Treasures*, THE GAINESVILLE SUN, Apr. 28, 2002, at A-1.

wetland ecosystems, or even wetland functions through stormwater retrofitting, is complicated, expensive, and in some cases impossible. Thus, it may be productive for the community to clarify its goals and focus the scope of its watershed planning efforts.

Although there may be uncertainties about the long-term goals for Gainesville's watersheds, conservation commitments have been made and some policy approaches have been selected. For example, as discussed below, the City's comprehensive plan has adopted a wetlands policy that reflects a basin approach. In addition, the City's proposed Land Development Regulations regarding mitigation, also discussed below, reflect a "management-oriented" approach. These decisions reflect an evolving "vision" for Gainesville's watershed. It is not yet clear to what extent Gainesville is willing to make the more ambitious commitments associated with substantial watershed restoration goals. At the same time, the commitments that have been made have not ruled out these possibilities. Thus, further clarification of Gainesville's vision for its watersheds may help achieve both more immediate and long-term goals. Watershed based planning provides the means to reach that vision.

B. Rationale for a Watershed Approach

There has been a significant trend in recent years toward planning that focuses on larger hydrologic units rather than isolated water bodies. By focusing on hydrologic units, issues concerning water bodies such as Gainesville's creeks and wetlands can be examined within a landscape context that recognizes the hydrological and ecological relationships between these natural features. Such an analysis can result in planning decisions that are more comprehensive and effective.[5]

The idea of combining wetlands management with watershed planning has been examined by the Association of State Wetlands Managers (ASWM), an influential group with scientific expertise and strong relationships with Federal and state agencies.[6] This idea of linking watershed planning with wetland management has become increasingly popular and ASWM is trying to clarify the concept of watershed planning.

ASWM has identified many critical issues in watershed planning efforts across the country. Notable issues include the problem of defining what a watershed plan is, the process of conducting a watershed plan, and how to implement plans. The ASWM claims that all watershed plans should at least **identify wetland areas and attempt to manage them in a watershed and landscape context in a sustainable fashion**.[7]

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[5] One of the principal recommendations of the National Research Council, Committee on Mitigating Wetland Losses was that regulation and mitigation of wetlands should be based on a watershed approach. See NATIONAL RESEARCH COUNCIL, COMPENSATING FOR WETLAND LOSSES UNDER THE CLEAN WATER ACT (2001).

[6] See the Association of State Wetland Managers webpage: <http://www.aswm.org/>.

[7] White and Shabman, *National Wetland Mitigation Banking Study Watershed-Based Wetlands Planning: A Case Study Report*. Report 95-WMB-8. December. Alexandria, Virginia: Institute for Water Resources. [Online]. Available at: <http://www.wcr-iwr.uace.army.mil/iwr/pdf/95wmb8.pdf>. Hereinafter "White and Shabman."

While ASWM does not suggest that watershed planning should follow a specified procedure, it does suggest that effective watershed plans incorporate the following steps:

- identify problems;
- bring together key actors and the public;
- formulate goals; define the watershed;
- inventory and map wetlands;
- analyze data;
- establish development plans for particular areas;
- implement plans;
- monitor implemented plans.

Much like ASWM, the EPA's office of Water, Oceans, and Watersheds (OWOW)[8] is a strong advocate of what it calls the "Watershed Protection Approach."[9] While much of EPA's advocacy of the watershed approach appears to be directed at water quality, EPA clearly intends for watershed plans to be comprehensive and include wetlands and habitat issues. [10] A consistent theme in EPA's notion of planning is an emphasis on the process component, especially on bringing stakeholders together to identify problems (or risks) to the watershed and determining acceptable solutions to address these problems.[11]

EPA's OWOW staff describes its framework for watershed planning as a circular process that includes: characterizing the system, developing a watershed vision, setting priorities, evaluating solutions, implementing actions, monitoring the system, and then returning back to characterizing the system. This circular process embodies an **adaptive management approach** to watershed planning, which allows for modification of a watershed plan in order to account for unforeseen circumstances or unexpected results of management activities.[12]

The support of both ASWM and EPA for a watershed approach are but a few of many examples of institutional support for a comprehensive perspective to managing water resources. Gainesville's recently adopted conservation element of its comprehensive plan establishes the policy that the City "shall work with local regional and state environmental agencies…to develop basin management plans, which shall identify wetlands of special concern, disturbed wetlands, and appropriate sites for mitigation."[13] Furthermore, the plan "shall also consider those factors affecting the structure and function of wetlands."[14]

C. Major Categories of Watershed Planning

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[8] *See* <http://www.epa.gov/owow/>

[9] This approach has three main principles: 1) risk-based targeting, 2) stakeholder involvement, and 3) integrated solutions. White and Shabman at 3.

[10] *Id*.

[11] *Id*. at 4.

[12] See e.g. Thomas T. Ankersen & Richard Hamann, *Ecosystem Management and the Everglades: A legal and Institutioal Analysis*, 11 Journal of Land Use & Environmental Law 473, 500 (1996).

[13] Policy 1.1.5; Conservation Open Space and Groundwater Recharge Element

[14] *Id*.

Watershed-based wetland planning efforts have been loosely grouped into two categories: 1) **protection-oriented** and 2) **management oriented**.[15] In reality these two categories may represent endpoints of a continuum of planning approaches, rather than hard-and-fast distinctions. Nevertheless, this dichotomy is useful for examining some of the major perspectives on watershed and wetland planning in Gainesville.

A **protection-oriented approach** is primarily focused on maintaining the existing wetland resource through a watershed or area-wide plan. Such plans typically view compensatory mitigation as an alternative of last resort, such as when a regulatory taking would otherwise occur. If a protection-oriented plan were completely successful, all development would avoid wetlands impacts, even in cases whether there are wetlands of low functional value on economically valuable sites. When a permit to allow development of a wetland is allowed, mitigation is to be done by the applicant on-site and in-kind.

In contrast, a **management-oriented approach** to planning emphasizes the classification of wetland parcels in order to achieve a watershed vision that includes development needs and no net loss of wetlands function. Such a plan considers both economic and ecological goals and specifies which areas within a watershed should be protected, where development should be allowed to occur, and where restoration should occur. Wetland functions can be disaggregated and distributed across the landscape, and in some cases outside the watershed. The underlying rationale of this approach is that it is possible to exchange development in low value wetlands for restoration of wetlands of higher ecological value. This is the approach followed by the state of Florida and its Water Management Districts, as well as Alachua County and the City of Gainesville through proposed and adopted comprehensive plan elements, respectively.

D. The Gainesville Approach

In Gainesville, there has been some tension between those who advocate a protection-oriented approach and those who advocate a management oriented-approach. The desire of some citizens for a protection-oriented approach is exemplified by firm resistance to the use of compensatory mitigation to offset the loss of wetlands. This resistance is embodied in a proposed charter amendment regarding the preservation of Gainesville wetlands, and in a recently withdrawn challenge to the comprehensive plan conservation element.[16]

In contrast, the Ad Hoc Committee on Wetlands and Creeks suggested a more flexible approach to wetland conservation that permits compensatory mitigation, but limits it to Gainesville's watersheds, a novel community-based approach in Florida. The Committee noted

[15] White and Shabman at 3.

[16] The text of the proposed charter amendment is as follows:

> Wetlands within the boundaries of the city of Gainesville shall be preserved and shall be protected from any alteration. Undisturbed buffers shall be maintained around wetlands. Wetlands damaged after the effective date of this charter amendment shall be restored to their original condition at the owner's expense. This charter amendment shall be implemented by ordinance.

that while there are many examples of unsuccessful wetlands mitigation, there are also many successes.[17] Thus, the Committee emphasized the need for more comprehensive planning on a basin-wide scale that recognized the need for a balance between conservation and development goals. For example, the Committee noted that some Gainesville wetlands were of higher quality than others, and that not all wetlands were capable of being restored.[18] Furthermore, the Committee suggested that development should be allowed in some areas if the functions of the wetlands could be replaced through wetlands mitigation and appropriate stormwater systems.

The Committee drafted a set of comprehensive plan conservation element policies and land development regulations (LDRs) and recommended that the Gainesville City Commission adopt them. The City Commission adopted the policies. The LDRs remain pending. The LDRs provide a flexible approach to wetlands management that tends to reflect the management-oriented approach's rationale that development in low value wetlands can be exchanged for restoration, enhancement, or creation of wetlands of higher ecological value within local basins. Thus, there is significant legal and institutional momentum for a management approach to watershed planning in Gainesville.

III. BASIN CHARACTERIZATION

A. Overview

Gainesville is located within four watershed basins: Blues Creek Basin, Hogtown Creek Basin, Newnans Lake Basin, and Paynes Prairie Basin. These are depicted in Map 1. A majority of the City, and its basins, lie within a region known as the northern highlands or plateau with an average elevation of 145-200 ft. Towards Paynes Prairie the topography begins to shift to the karst lowland type with an average elevation of less than 100 ft.[19]

There are three soil groups present within the Gainesville region. The Plio-Pliestocene group, averaging 6m in thickness, comprises the surface layer of the northern highlands with the majority of its particulate being made up of quartz and other silicate based sands. Just underneath the Plio-Pliestocene layer is the middle Miocene Hawthorne group. The Hawthorne group is mainly clayey sand made up of phosphate, dolomite, and limestone. The lower Eocene Ocala group is a clean, chalky, limestone comprised of 98% carbonates and 2% quartz.[20]

The Blues Creek and Hogtown Creek basins are **seep-to-sink** systems with base-flows originating seepage from the superficial intermediate aquifers and surface water runoff. The Blues Creek basin can be classified as a rural to semi-urban watershed, while the Hogtown Creek basin is an urban watershed. The Newnans Lake and the Paynes Prairie watersheds are lake basins. The tributaries to these systems have base-flows originating from seeps and springs fed

[17] Letter from Ad Hoc Committee at 3.
[18] *Id*.
[19] Mossa, Joann, J.L. Rahn, and M.R. Zorn. A Field Trip Held in Conjunction with the Florida Society of Geographers Annual Meeting: Feb. 19-20, 1993. Hereinafter "Mossa."
[20] Mossa.

by the superficial and intermediate aquifers, eventually draining into the Floridan Aquifer. The Newnans Lake basin is a rural to urban watershed, and Paynes Prairie basin is an urban watershed on the North Rim, but more rural on the South Rim.[21]

B. Blues Creek Basin

Blues Creek basin is a 24-km^2 watershed which lies 8 km northwest of the Gainesville city limits whose dominant features are Alachua Slough, Blues Creek, and Sanchez Prairie. Blues Creek is the primary watershed feature within the basin. The tannin-stained waters originate in the plateau region west of the University of Florida Institute of Food and Agricultural Sciences experimental agricultural station near San Felasco Hammock state park. Flatwoods, bayheads, cypress domes, marshes, and mesic hammocks characterize the region.[22] Topographic maps indicate that this may be associated with a large wetlands complex whose dominant feature is known as "Buck Bay."

The flatwoods are predominantly Pine species (*P. palustris*, *P. elliotti*, *P. serotina*) with little understory vegetation. What understory vegetation does exist incudes Stagger Bush spp. (*Lyonia ferruginea and Lyonia fruticosa),* Wax Myrtle (*Myrica cerifora*)*,* Gallberry (*Ilex glabra*)*,* Bartram Palm (*Serenoa repens*)*,* Shiny-Leaved Blueberry (*Vaccinium myrsinites*)*, and* Deerberry (*Vaccinium stamineum*)*.* The few herbaceous species that were noted include Bracken Fern (*Pteridium aquilinum*) and Reindeer Moss (*Cladonia spp*.) The bayheads have a mosaic of Laurel Oak (*Quercus laurifolia*), Pignut Hickory (*Carya glabra*), Southern Magnolia (*Magnolia grandifolia*), and Saw Palmetto (*Serena repens*).

The cypress dome canopies are dominated by Bald Cypress (*Taxodium distichum*), Blackgum (*Nyssa sylvatica var. biflora*), Florida Elm (*Ulmus americana*), Sweet Gum (*Liquidambar styraciflua*), Laurel Oak, and Water Oak (*Quercus nigra*). Understory vegetation incudes Carolina Ash (*Fraxinus caroliniana)*, Elderberry (*Sambucus canadensis*), Parsley Hawthorn (*Crataegus marshalli)*, and Ironwood (*Carpinus caroliniana*). Some noted herbaceous species are Bead Fern (*Onoclea sensibilis*), Nesum Simmond's Aster (*Aster simmondsii*), Florida violet (*Viola floridana*), and Water Paspalum (*Paspalum repens*). The marsh and pond areas have a makeup of Button Bush (*Cephalanthus occidentalis*), Dahoon (*Ilex cassine*), Fetterbush (*Leucothoe racemosa*), and Wax Myrtle (*Myrica cerifora*), Barnyard Grass (*Echinochloa crusgalli*), Coast Cockspur Grass (*Echolchloa walteri*), Cattail (*Typha latifolia*), Water Hemlock (*Cicuta mexicana*), and Swamp Rose (*Rosa palustris*). Moist soil vegetation like Dotted Smartweed (*Polygonum panctatum*), Sedge spp. (*Carex spp*.), False Nettle (*Bohmeria cylindrica*), Creeping Cucumber (*Melotheria pendula*), Greater Marsh St. John's Wart (*Traidinum walteri*), and Pennsylvania Bittercress (*Cardamine pensylvanica*) are noted in

[21]Alachua County Environmental Protection Department, *Gainesville Creeks: A Status Report on Baseflow, Water Quality, Stormwater, and Ecosystem Health. Draft*, October 2002. Hereinafter "Gainesville Creeks Report."
[22] Dunn, William J. *Plant Communities and Vascular Flora of San Felasco Hammock, Alachua County, Florida*, M.S. Thesis University of Florida, 1982. Hereinafter "Dunn."

exposed margins. Aquatic species present include Lesser Duckweed (*Lemna minor*), Duckweed (*Siorodela oligrhiza*), Mosquito Fern (*Azolla caroliniana*), Floating Moss (*Salvinia rotundifolia*), Mud-Midget (*Walfiella floridana*), and Frog's-Bit (*Limnobium spongia*).

The mesic hammocks, or southern hardwood mixed forests, are made up of a variety of vegetation consisting of an upper-canopy of Oak species (*Q. laurifolia, Q. nigra, Q. falcutta*), Hickory Spp. (C. *glabra, C. tometosa*), Southern Magnolia, Sweet Gum, Blackgum, and Loblolly Pine (*Pinus Taeda*). The understory vegetation is predominantly American Holly, Florida Dogwood (*Cornus florida*), and Sparkleberry (*Vaccinium arboreum*).[23]

A narrow stream channel and stream banks that reach 10m in height characterize the intermediate area of the Blues Creek watershed. The basin's vegetation is comprised mostly of mesic hammock (mixed hardwoods) that lies within the borders of San Felasco state park. The watershed drops off the Highlands plateau with a loss of 175 feet in elevation on its way to the lowlands of Sanchez Prairie. Exposed limestone outcrops and exposed clayey substrate within the stream banks identify the scouring of the Hawthorne layer. The stream channel begins to widen and water velocities begin to slow as Blues Creek enters the lowlands of Sanchez Prairie.[24]

The Sanchez Prairie lowlands act as a flood plain during times of high flow after large rain events within the basin. As waters overtake the banks of the lower portion of Blues Creek, sheet-flows of water envelope the lowland forests. Low water velocity, wide stream channels, and detrital muck are common within this region. The lowland forest is also type of mesic hammock comprised of Basswood (Tilia caroliniana), Oak Spp. (*Q. virginia*, *Q. laurifolia, Q. nigra*), Sweetgum, American Elm, Pine spp. (*P. glabra, P. Taeda*), Maple spp. (*A. barbatum, A. rubrum*), Pignut Hickory (*Carya glabra*), Box Elder (*Acer negundo*), Sugarberry (*Celtus laevigata*), Gray Dogwood (*Cornus Foemina*), Carolina Ash, American Holly (*Ilex opaca*), Ironwood, Wax Myrtle, and Rappit-eye Blueberry (*Vaccinium ashei*). Moist depressions will hold Water Elm (*Planera aquatica*), and Button Bush. Blues Creek eventually enters the Floridan Aquifer through a sink in Big Otter Ravine.[25]

The Blues Creek Basin is considered a rural to semi-urban watershed; thus, detrimental effects of diminished riparian buffer zones, storm-water runoff, and pollution are a less critical issue within the basin. Residential encroachment, runoff from the IFAS agricultural facility, and intrusion of exotic vegetation may be affecting the watershed, and should be monitored and be controlled. Although exotic vegetation is not a pressing issue, it should be noted that a report by the Alachua County Board of County Commissions and the City of Gainesville noted the presence of Chinese Tallow (*Sapium Sebiferum*) and species of exotic Bamboo, which are highly

[23] See Dunn.
[24] Alachua County Board of County Commissioners in Partnership with the City of Gainesville, *Blues Creek Ravine: Florida Communities Trust Acquisition Proposal*, June 2000. Hereinafter "Florida Communities Trust Acquisition Proposal."
[25] See Dunn.

invasive exotics.[26] A significant portion of this watershed has been acquired under the Florida Communities Trust Program.

C. Hogtown Creek Basin

The Hogtown Creek basin is an urban watershed that begins in Northeast Gainesville and drains to the west side of the city of Gainesville; the watershed is made up of Hogtown Creek, Rattle Snake Creek, Springstead Creek, Pine Forest Creek, Ridge View Creek, Glenn Springs Creek, Possum Creek, Three Lakes Creek, Millhopper Creek, Monterey Creek, Royal Park Creek, Beville Creek, Lake Alice Watershed, Lake Kanapaha, Rutledge Drain, and Liberty Drain.[27] Two main creek systems characterize the basin: Hogtown Creek and Possum Creek. Hogtown Creek is eighty percent urban watershed with sixty-five percent of the creek running through low density residential, fifteen percent running through high density commercial, and twenty percent running through a mixture of agriculture, and institutional areas.[28]

Hogtown Creek is a seep-to-sink system with headwaters that originate from seeps and springs fed by the superficial and intermediate aquifers. The creek begins its base-flow from seepage wetlands in the vicinity of Northwest 53rd Avenue and 13th Street in an area comprised of pasture, low density residential, and mixed hardwood wetland forest with canopy cover. As the Creek enters Gainesville's more residential areas, the riparian buffers decrease and stream-bank erosion increases within the system, exposing the Hawthorne layer. The riparian buffer increases in size near where a tributary, Springstead Creek, enters the Hogtown Creek system. As the creek enters the heavily developed area near Northwest 29th avenue, the channel is reinforced with concrete, and the creek receives input from storm-water drainage systems. At this point, there is little to no riparian buffer. Because of increased velocities from the channelized sections of the stream, bank erosion is prevalent in the down-stream residential area approaching Northwest 8th Avenue. Moreover, riparian habitat is greatly altered. A relatively intact floodplain riparian forest serves as a water retention and sediment deposition area during peak flow events near Northwest 8th Avenue. As Hogtown Creek approaches 34th Street, it is artificially channelized and altered. It eventually discharges into the Hogtown Prairie, Haile sink, and ultimately the Floridan aquifer.[29]

Ninety percent of the Possum Creek system flows through urban areas with sixty five percent comprising medium density residential, twenty-five percent comprising commercial, and ten percent made up of agriculture, and semi-natural forest. Possum Creek begins North of Devil's Millhopper and intersects Hogtown Creek near 8th Avenue. Possum Creek is a seep-to-sink system, receiving water from seeps and springs attached to the superficial and intermediate aquifers. The upper area of the Creek is a riparian zone with heavy streambed scouring and steep banks. As Possum Creek approaches the residential riparian forested/residential areas of 39th Avenue, its bank heights drop and stream velocity decreases. Eventually the stream channel

[26] Florida Communities Trust Acquisition Proposal.
[27] LDR Recommendations, 2002
[28] Gainesville Creeks Report
[29] *Id*.

becomes undecipherable and sheet-flow is dominant. The channel reforms as it enters a forested area with buffers greater than 18m. In the residential areas approaching Hogtown Creek water is pumped from the creek for residential irrigation.[30] Closer to Hogtown, the stream is artificially channelized and devoid of vegetative buffer zones. Even though some areas of Possum Creek are channelized, much of its natural sinuosity is intact.[31]

The upland forest and pasture areas of the Hogtown and Possum Creeks consist of Loblolly Pine, Ironwood, Hickory spp., and Sweet Gum. The wetland forest that resides in the residential areas of the Creeks consists of Red Maple, Cypress spp., Southern Magnolia, and Cherry (*Prunus spp.*) trees. Much of the non-forested vegetation in the pasture and non-canopy areas of the watershed is primarily Sedge spp. (*Cyperas and Carex spp.*), Buttonbush, Water Hemlock (*Cicutta mexicana*), Wild rice (*Ziziniia aquatica*), and Bullrush (*Scirpus validus*). The understory vegetation consists of Solomon's Seal (*Polygonatum biflorum*), Cabbage Palm (*Sable palmetto*), Dwarf Palmetto (*Sable minor*), and Dog Fennel (*Eupatorium capillifolium*). Macrophytic vegetation consists of native Species of Bamboo, Lizard's Tail (*Saururus cernuus L.*), Golden Club *(Orontium aquaticum L.*), and Juncus spp.[32]

In-stream sedimentation is a severe problem and little to no benthic vegetation persists. In some areas of the Creek and its tributaries the Hawthorne layer is exposed. Much of the Riparian buffer is considered to be of little native faunal value because it consists heavily of invasive exotics: Hydrilla (*Hydrilla verticillata*), Alligator weed (*Alternanthera philaxeroides*), Parrot Feather (*Myriophyllum aquaticum*), Elephant Ear (*Xanthosoma sagittifolium*), Mexican Petunia (*Ruellia brittoniana*), Coral Aridisia (*Ardisia crenata*), English Ivy (*Hedera helix*), Wandering Jew (*Zebrina pendula*), Air Potato (*Dioscorea bulbifera*), Chinese Tallow, Ligustrum Spp. and Heavenly Bamboo (*Mandina domestica*). There is evidence of non-point and point source pollution in both Hogtown and Possum Creek.[33] The Department of Environmental Protection has listed the Cabot Carbon/Koppers Corporations site (Northewest 23rd Avenue and Main Street) on the national priorities list. Historical contamination from pine tar discharge and chemicals such as creosote, pentachlorophenol, and copper-chromium-arsenic (CCA) may have lasting effects on soil, groundwater, and the shallow aquifer.[34] Springstead Creek flows through this site.

D. Newnan's Lake Basin

The Newnan's Lake basin is made up of Hatchet Creek, Little Hatchet Creek, Gum Root Swamp, Sunnyland Creek, Lake Forest Creek, and Newnan's Lake.[35] The dominant stream channels within the Newnan's Lake Basin are Lake Forest Creek, Little Hatchet Creek, and Hatchet Creek. Lake Forest Creek is a small tributary that that flows east to west through urban

[30] *Id.*
[31] *Id*.
[32] *Id*.
[33] *Id*.
[34] See <http://www.dep.staste.fl.us/waste/key_areas/wc/documents/summary/007.pdf>.
[35] LDR Recommendations, 2002

and rural parts of Gainesville. Much of the creek watershed is state owned, with some institutional usage near the headwaters.[36] Newnan's lake is currently in a very impaired state. A restoration program involving Newnan's is currently one of the projects being addressed by the St. John's River Water Management District.[37]

The headwaters of Little Forest Creek are piped and channelized near local utilities. Emerging from a pipe near State Road 20, the Creek's base-flow is channelized and the stream banks and channels are heavily eroded. The base-flow is predominantly fed by seep and spring outflow from the superficial and intermediate aquifers, ultimately ending up in Newnan's Lake. Canopy cover and riparian buffer are minimal in this area and consist of Oak Spp., Red Cedar (*Juniperus silicicola*), Sweet Gum, and Pine spp. (P. teada, P. elliotti). Emergent vegetation is compromised; it is mainly weedy and invasive: Taro (*Colocasia esulenta*), Parrot Feather, and Water Hyacinth (*Eichhomia crassipes*). As the Creek leaves urban area of its headwaters, vegetation coverage improves.[38]

The intermediate area of the watershed begins to improve canopy cover with stands of Oak spp., Hickory, Sweet Gum, and Pine spp. The understory vegetation mimics psuedo-natural conditions with a mosaic of Wax Myrtle, Holly spp., and Stagger Bush (*Lyonia lucidia*). Much of the other understory vegetation present consists of exotics. Because of up-stream channelization, there is a great deal of silt deposition within the creek bed. The lower portion of the creek enters a varied habitat of pasture, pine flatwoods, and riparian forest before it enters Newnan's Lake. Potential sources of pollution could be attributed to fertilizer and other agricultural runoff.

Little Hatchet Creek's watershed is comprised of residential, commercial, and institutional land.[39] Little Hatchet Creek's base-flow originates from springs and seeps from the superficial and intermediate aquifers near a subdivision at Northwest 53rd Avenue, the same physiographic region that serves as the headwaters for Hogtown Creek and Blues Creek. The upper portion of the creek is channelized with moderate canopy cover. The Murphree Wellfield and Water Treatment Plant lies within the headwaters of Little Hatchet Creek. As the creek approaches the Airport Industrial Park, it is heavily channelized through artificial means and receives runoff from airport runways. As the base-flow leaves the airport, severe silt deposition and bank erosion is prevalent. Near Northeast 39th Avenue, the stream dynamics of the Creek begin to change.[40]

Stream banks become less severe and water velocity slows as Little Hatchet Creek enters Gumroot Swamp Conservation Area. Dominant flow is sheet-flow and the stream channel becomes indecipherable. Habitats are varied, consisting of floodplain swamp (Bald Cypress

[36] Gainesville Creeks Report
[37] For an overview of the Newnan's Lake Restoration Program, see: <http://sjr.state.fl.us/programs/acq_restoration/s_water/orangecr/overview.html.>
[38] Gainesville Creeks Report
[39] *Id*.
[40] *Id*.

dominant), pine flatwoods, pond cypress domes, and mesic hammocks. Dominant canopy vegetation includes Oak spp., Maple spp., Sweet Gum, Cypress spp., and Pine spp. Understory vegetation is predominantly Cherry, Elderberry, Wax Myrtle, and Palmetto Spp. Aquatic Macrophytes consist of Juncus spp. and St. John's Wart (*Cinnimomum spp*.).[41]

Little Hatchet Creek flows predominantly through natural areas in the middle and southern portions of its watershed. Residential and commercial runoff is problematic and evident. Bank erosion, stabilization and sediment deposition down stream from the airport affect potential habitat.

Hatchet Creek is a seep and spring fed system from the superficial and intermediate aquifers.[42] Hatchet Creek originates west of County Road 225 and northeast of 53rd Avenue. Much of the watershed is state owned with intact buffers and over twenty percent naturally vegetated landscape. A small area near State Road 225 is predominantly monoculture Pine forest, but natural buffers are intact. Evidence of stream bank erosion, channel scouring and sediment deposition can be seen near the pipe outflow where Hatchet Creek crosses under State Road 225. Overall, habitat integrity and biodiversity are intact within the watershed. Agricultural runoff is the primary threat to the system.[43]

Little Hatchet Creek has natural undisturbed areas and varied habitat. There are mixed hardwood forests, cypress swamps, Pond Pine *(Pinus serotina*) swamps, upland Longleaf Pine forests, and Turkey Oak Stands (*Q. laevis*). Much of the canopy is made up of Titi (*Cyrilla racemiflora*), Cypress spp., Oak spp., Pine spp., Red, Hickory, Holly, Water Tupelo (*Nyssa aquatica),* and Sweet Gum. The understory and groundcover vegetation is comprised of Redbud Rhododendron (*Rhododendron spp*.), Grape (*Vitus Spp.*), Royal Fern (*Osmunda regalis*), Crossvine (*Bignonia coppeolata*), and Stagger Bush.[44]

E. Paynes Prairie Basin

The Paynes Prairie basin consists of Sweetwater Branch, Rosewood Lateral, Tumblin Creek, Bivens Arm, Extension Ditch, Calf Pond Creek, Alachua Sink, and the Paynes Prairie watershed.[45] The main channel tributaries include Tumblin Creek and Sweetwater Branch, both of which are seep-to-sink systems with a base-flow comprised of seep and spring outflow from the superficial and intermediate aquifers. The creeks ultimately end up draining into the Floridan Aquifer within the Paynes Prairie watershed and the Alachua Sink respectively. Tumblin Creek is a highly urbanized system within the city of Gainesville.

Tumblin Creek is comprised of sixty percent impermeable streambed due to artificial channelization. The dominant land uses include residential single-family dwellings, commercial

[41] *Id*.
[42] Gainesville Creeks Report
[43] *Id*.
[44] *Id*.
[45] LDR Recommendations, 2002.

restaurants and strip malls, and institutional outflow from Shands hospital. The entire watershed, accept for Bivens Arm Nature area, is developed; moreover, vegetative buffer does not exist, or is minimal, in most of the system. [46]

The headwaters of Tumblin Creek are channelized through pipes and culverts near 8th Avenue and 13th Street. The upper portions of the watershed are covered with anthropocentric debris. Due to stream channelization and lack of sinuosity, storm events are eroding natural stream banks and exposing historic landfill debris in areas near Shands Hospital. Moreover, the intense channelization is causing severe sedimentation in the lower reaches of Tumblin Creek. Existing canopy cover and other vegetative habitat are considered poor, and in-stream diversity of benthic invertebrates is considered to be the most inadequate out of any system within Gainesville. The lower reaches of Tumblin Creek (Bivens Arm floodplain) are considered to be the least disturbed area within the watershed. Many opportunistic invasive and exotic plants are present in this area.[47]

Most of the understory vegetation that does exist along the creek system is comprised of invasive exotics. Buffer width ranges from greater than 18m in Bivens Arm to zero along commercial areas. Native vegetation that does exist includes a moderate canopy of Water Oak, Sweet Gum, Cabbage Palm, and Loblolly Pine. Non-native species indicative of poor canopy cover include Camphor (*Cinamomum camphora).* Understory vegetation includes Mexican Petunia, and other invasive exotics such as Ligustrum (*Ligustrum lucidum*), Coral Ardisia. There is almost no aquatic vegetation present. Bivens Arm, whose main water source is Tumblin Creek, is the outflow of the creek system. It is a hyper-eutrophic system receiving a great deal of urban runoff. Bivens Arm is plagued with aquatic weeds including Hydrilla, Water Hyacinth, Water Lettuce (*Pistia stratiotes*), and Taro. Confounding the poor quality of habitat are the many sources of pollution entering the creek and lake, including sewage leaks and stormwater from commercial site parking lots and residential dwellings.[48]

Sweetwater Branch is also a highly disturbed urban watershed within Gainesville. Ninety percent of the watershed is developed with the upper one-third comprising residential and commercial development and the lower two-thirds commercial, industrial, and institutional development. The upper portions of the watershed reside on the northern highlands Plateau with moderate to patchy canopy cover. As the stream progresses, the canopy cover increases and the streambed cuts into the Hawthorne layer.[49]

The headwaters of the creek are channelized and artificially stabilized with concrete. The stream is not above ground until it reaches the Duck Pond residential community where a weir structure controls flow. The stream historically received heavy nutrients from a resident population of ducks. The stream continues to the GRU Main Street sewage treatment plant where it receives effluent outflow from the facility. The heavy outflow from GRU results in

[46] Gainesville Creeks Report
[47] Gainesville Creeks Report
[48] *Id*.
[49] *Id*.

stream bank and bed erosion, exposing the Hawthorne layer. Sweetwater Branch eventually enters Paynes Prairie and here it discharges into Alachua Sink and the Floridan Aquifer.[50]

Sweetwater Branch is considered the second most-impaired watershed within the Gainesville area; eighty percent of the system is lacking benthic invertebrate habitat. Facilitating the lack of habitat is sand deposition, little to no streamside buffer, peak flow during storm events, and unstable banks. Moreover, pollution input from the Duck Pond area, GRU, and an abandoned city dump, confound the detrimental effects on the stressed system.[51]

The native canopy vegetation that is present consists of Box, Water Oak Pignut Hickory, Ironwood, Sugarberry, and Sweet Gum. The understory vegetation includes Elderberry, Mexican Petunia, Taro, and Air Potato. Like Tumblin Creek, Sweetwater Branch has a lack of aquatic vegetation. What aquatic vegetation is present is exotic, such as Hydrilla.[52]

IV. GIS AS A DECISION-MAKING TOOL FOR WATERSHED PLANNING

For basin planning, the use of Geographic Information Systems (GIS) provides an invaluable planning tool that can be used to generate both spatial and numeric data that can assist decision-making at various scales. This section describes the process and results of a GIS analysis that was performed in order to better characterize management issues surrounding Gainesville's system of creeks and wetlands.

A. The Analysis Process

In developing this report, GIS was used to generate information about Gainesville's watersheds and wetland systems in a three-step process that provided a snapshot of the current status of these resources.

The first step of this process involved gathering and synthesizing the data from a variety of sources. Multi-agency involvement in this project—including the city, county, and water management districts—provided several sources of GIS data that were then re-projected and synthesized into a single format. Additional GIS data were obtained through the Florida Geographic Data Library (FGDL), which is part of the Geoplan Center at the University of Florida. The FGDL is a centralized clearinghouse for GIS data obtained from various state and national agencies. Data sets were provided in differing projections, thus it was necessary to re-project and standardize all of the data used in this project to the Albers projection to match that used by FGDL. It is important to note that data used was existing data provided by theses sources. Thus, any discrepancies in the underlying data are the result of errors in data-gathering by those sources.

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[50] *Id*.
[51] *Id*.
[52] *Id*.

The second step of the process involved generating tables of numeric data for three broad analysis categories: a general basin analysis, a more detailed basin characteristics analysis, and a wetland habitat analysis. The General Basin Analysis Table (Table 1) provides an overview of the watershed basins, the total number of wetlands, and the distribution of these resources within both city and county jurisdictions. The Basin Characteristics Table (Table 2) is a comparative analysis that identifies potential threats to wetland systems, the amount of protection currently given to these resources, and breaks down how these factors are distributed throughout the basins, within the city boundary, and within county jurisdiction. The Wetland Habitat Analysis (Table 3) identifies the distribution of wetland communities throughout the entire study area and within each basin.

Displaying these data spatially is the final step of this GIS process. A series of maps was created that graphically represent important data gathered from the tables described above. The ability to analyze these maps alongside the numeric tables is an invaluable way to assist the planning process.

B. Analysis Results

All four of the watershed basins studied in this report comprised a total of 138,159 acres. Within these boundaries, 29,710 acres—22% of the total basin land area—are considered wetlands, the majority of which are located in the Newnans Lake and Paynes Prairie Basins.

In terms of wetland habitat composition, the basins appear to consist of a roughly even mix of forested and non-forested habitat types. Forested wetlands comprise 51% of the total wetland acreage, with wetland mixed forest the most common habitat type. Non-forested wetlands encompass 49% of the acreage with freshwater marsh predominant. Approximately 13% of the total basin wetlands are located within the city boundary, and face the greatest threat from development. When the urban services boundary is added to this area, the number of potentially impacted wetlands reaches 25% of the total.

As Alachua County becomes increasingly urbanized, land use conversion is becoming one of the greatest threats to these wetland resources. Although 66% of all wetlands are located within existing conservation lands, the most threatened wetlands are located within the city boundary. Of the 3,940 acres of wetlands located within the city boundary, 48% are subject to development (e.g. in a land use classification other than conservation). In addition, 14% of all wetlands are either partially or entirely adjacent to land within the city boundary that has been designated “improved” (i.e. developed).

Another threat to these wetlands is the distribution and proximity of paved roads, which fragment natural systems and act as conduits for invasive species and pollutants. At the scale of the four basins, approximately 68% of all wetlands are located within 100 meters of a paved road surface. When this threat is analyzed at the scale of the city boundary, the numbers are even more impressive—of the 3,940 acres of wetlands within the city, 76% fall within this 100-m distance. The wellfield zone in the upper part of the study region is another consideration. The

"cone of influence" of this zone extends into an area of high conservation interest, and encompasses 10% of total wetland acreage. There is no indication that the wellfield is affecting these wetlands. However, wellfields in other parts of Florida have been known to affect wetland hydrology. Subsurface geology may preclude this result here, but it should be carefully monitored.

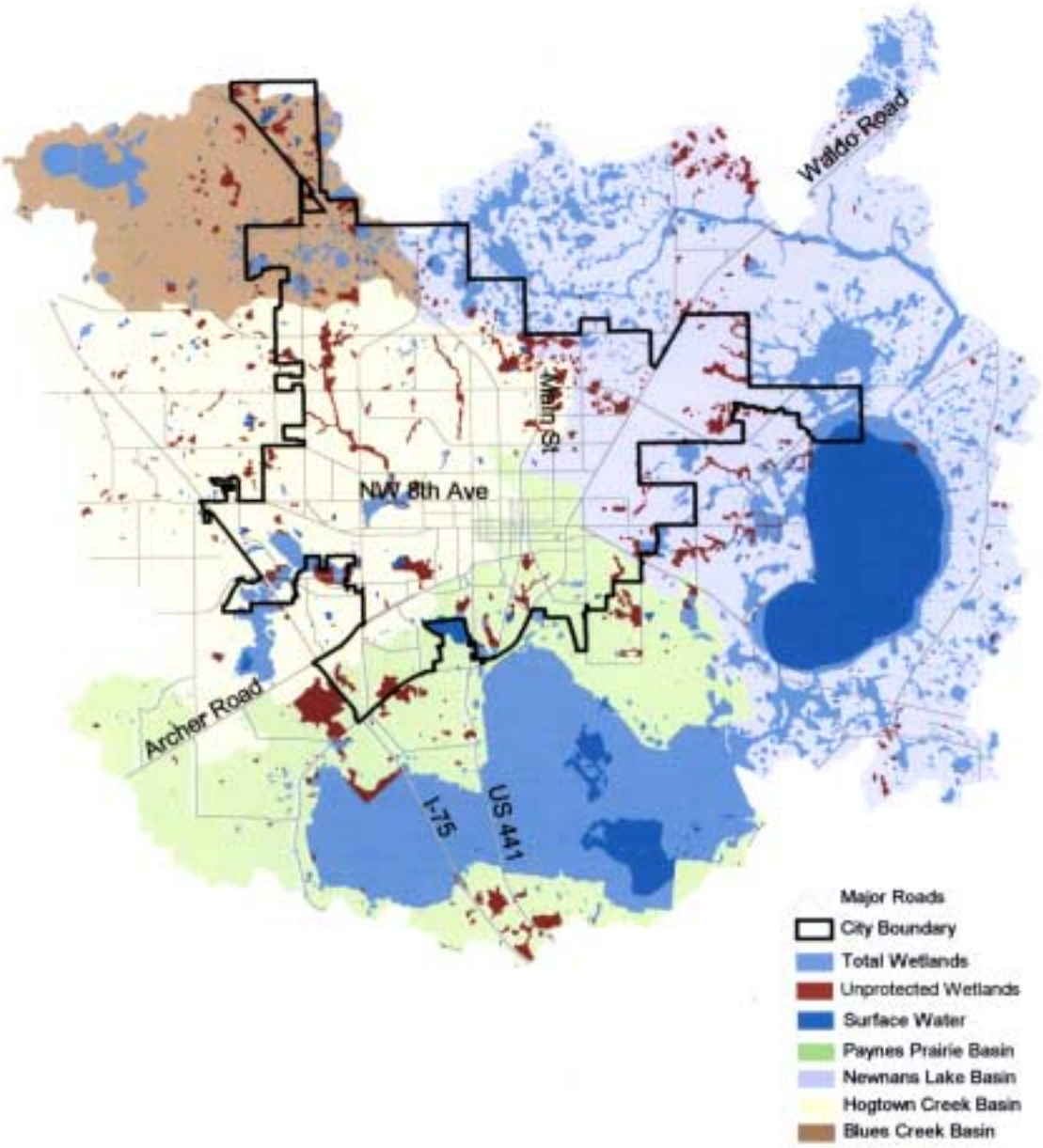
C. Issues and Recommendations

Wetlands are sensitive natural systems. Disturbances that affect one portion of a wetland have the ability to affect the entire system. If any part of an individual wetland, regardless of size, was contained in or adjacent to a value in question, the entire area of that wetland was included in the calculation. Although this was the approach taken for this report, it will be necessary to formulate a more advanced method for analyzing wetland systems in Gainesville and Alachua County.

GENERAL BASIN ANALYSIS	Total within all Basins	Blues Creek Basin	Hogtown Creek Basin	Newnans Lake Basin	Paynes Prairie Basin
total land area of the basins	138,159	13,020	32,615	37,861	54,663
area of wetlands	29,710	1,896	2,421	11,189	14,204
wetlands as % of individual basin land area	22%	15%	8%	29%	30%
total area of open water (lakes)	7,806	122	234	6,056	1,394
approximate number of wetlands	1,690	160	219	1,010	301
wetland area within the city boundary	3,940	650	1,429	1,520	341
% of total wetlands within the city boundary	13%	2%	5%	5%	1%
wetland area within county jurisdiction	25,770	1,246	992	12,684	10,848
% of total wetlands within county jurisdiction	87%	4%	3%	43%	37%
area of wetlands within the city urban services boundary	3,601	138	934	1,526	1,003
% of total wetlands located within the urban services boundary	12%	0.5%	3%	5%	3%
% of total wetlands located within both the city limits and urban services boundary	25%	3%	8%	10%	5%

BASIN CHARACTERISTICS ANALYSIS (calculations in acres)	Total Amount within all Basins	Total Amount within City Boundary	Total Amount within County Boundary
area of total wetlands	29,710	3,940 (13%)	25,770 (87%)
area of riparian wetlands	17,271 (58%)	2,099 (7%)	15,172 (51%)
area of all other wetlands (non-riparian)	12,438 (42%)	1,841 (6%)	10,597 (36%)
wetlands within the "cone of influence" of the well-field	2,980	1,097	3
% of total wetlands within the well-field	10%	4%	6%
% of wetlands overlaying the "confined" aquifer zone	11,634 (39%)	2,237 (7%)	9,396 (32%)
% of wetlands overlaying the "perforated" aquifer zone	18,033 (61%)	2,578 (9%)	15,455 (52%)
% of wetlands overlaying the "unconfined" aquifer zone	50 (0.2%)	n/a	50 (0.2%)
wetland area within 100m of paved roads	20,262 (68%)	2,991 (10%)	17,271 (58%)
wetland area within 100m of unimproved roads	24,130 (81%)	2,681 (9%)	21,449 (72%)
wetland area adjacent to agricultural land	12,976 (44%)	1,041 (4%)	11,935 (40%)
wetland area adjacent to upland forest	22,123 (74%)	3,675 (12%)	18,447 (62%)
wetlands protected by existing conservation lands	19,754 (67%)	1,469 (5%)	18,285 (62%)
wetlands protected by "potential" conservation lands	5,772 (19%)	568 (2%)	5,204 (18%)
% of total wetland area subject to development	4,184 (14%)	1,907 (6%)	2,277 (8%)
wetland area within city limits	n/a	3,940	n/a
% of wetlands within city limits subject to development	n/a	48%	n/a
wetland area adjacent to land within city limits zoned for conservation	4,188 (14%)	1,718 (6%)	2,470 (8%)
wetland area adjacent to improved parcels within city limits	4,219 (14%)	4,219 (14%)	n/a

WETLAND HABITAT ANALYSIS (calculations in acres)	Total within all Basins	Blues Creek Basin	Hogtown Creek Basin	Newnans Lake Basin	Paynes Prairie Basin
Area of Forested Wetlands	15,244 (51%)	1,785 (6%)	1,775 (6%)	1624 (5%)	10,061 (34%)
bay swamps	60	n/a	n/a	n/a	60
shrub swamps	17	17	n/a	n/a	n/a
lake and river swamp (bottomland hardwood)	213	n/a	n/a	n/a	213
mixed wetland hardwoods	524	23	30	31	441
wetland coniferous forest	525	n/a	16	60	449
Cypress	1,681	50	452	169	1,010
wet flatwoods	164	70	n/a	0	95
wetland mixed forest	11,518	1,083	1,277	1,364	7,795
hydric hammock	543	543	n/a	n/a	n/a
Area of Non-Forested Wetlands	14,466 (49%)	111 (0.4%)	646 (2%)	12,581 (42%)	1,127 (4%)
freshwater marshes	7,711	50	114	7,270	278
wet prairies	3,400	n/a	197	3,022	182
emergent aquatic vegetation	280	15	92	145	27
ephemeral ponds	46	46	n/a	n/a	n/a
submergent aquatic vegetation	33	n/a	33	n/a	n/a
mixed scrub-shrub wetlands	2,994	n/a	210	2,144	640



Wetlands Unprotected by Existing or Proposed Conservation Lands

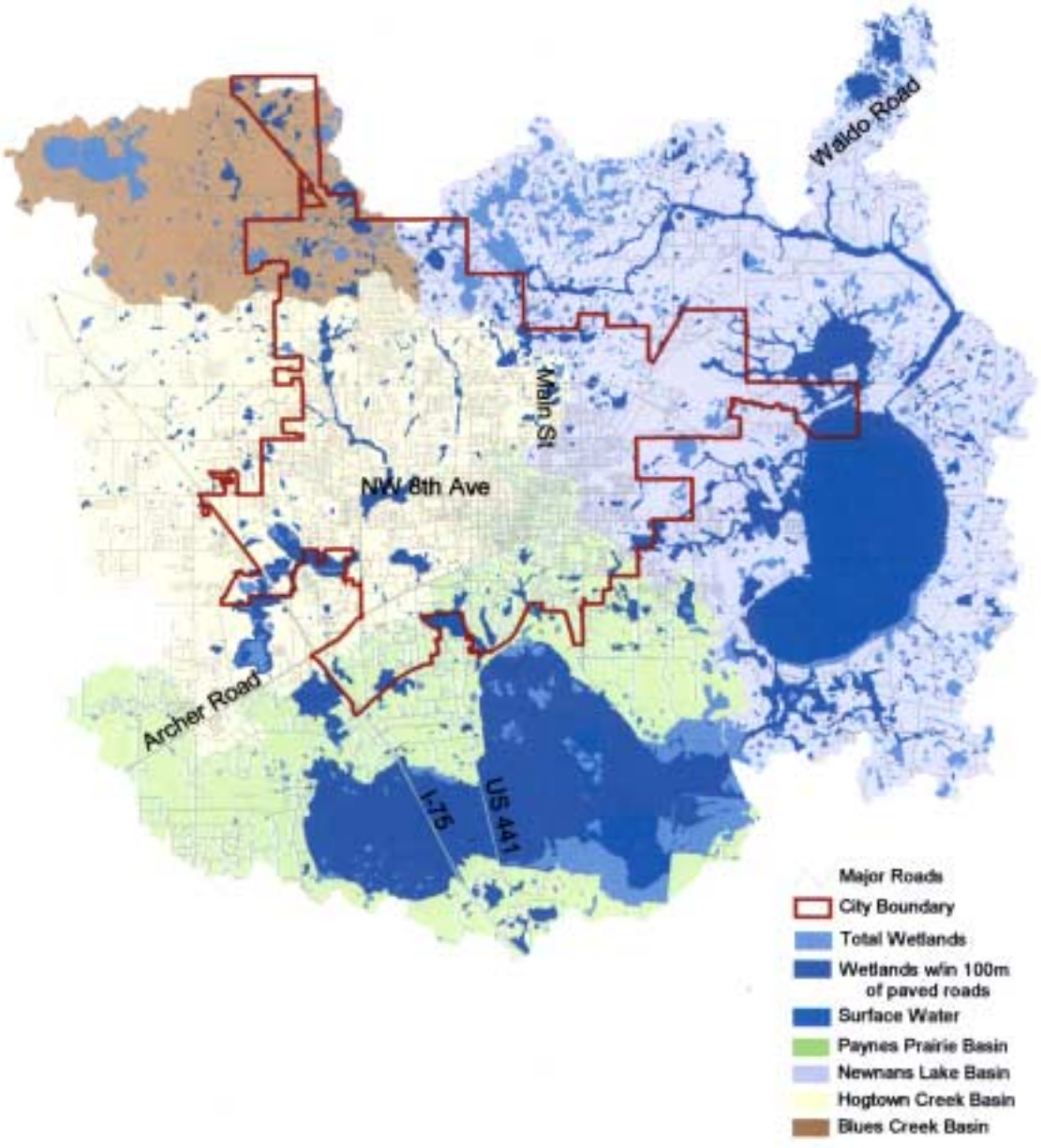
City of Gainesville Basin Planning Initiative

University of Florida Conservation Clinic

March 2003

0 1 2

Distance in Miles



Wetlands Within 100 meters of Paved Roadways

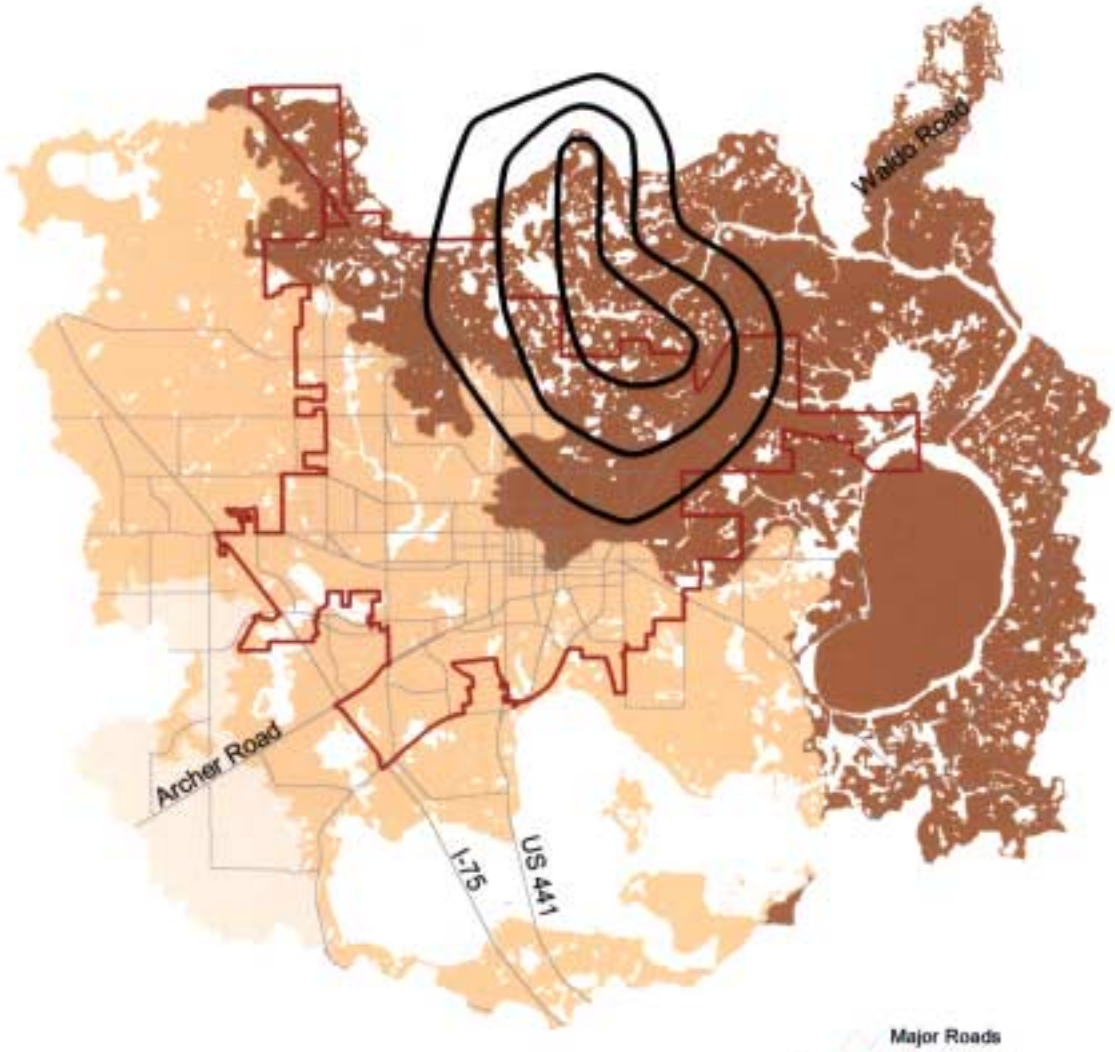
City of Gainesville Basin Planning Initiative

University of Florida Conservation Clinic

March 2003

0 1 2

Distance in Miles



Aquifer Confinement in Relation to the City of Gainesville Wellfield

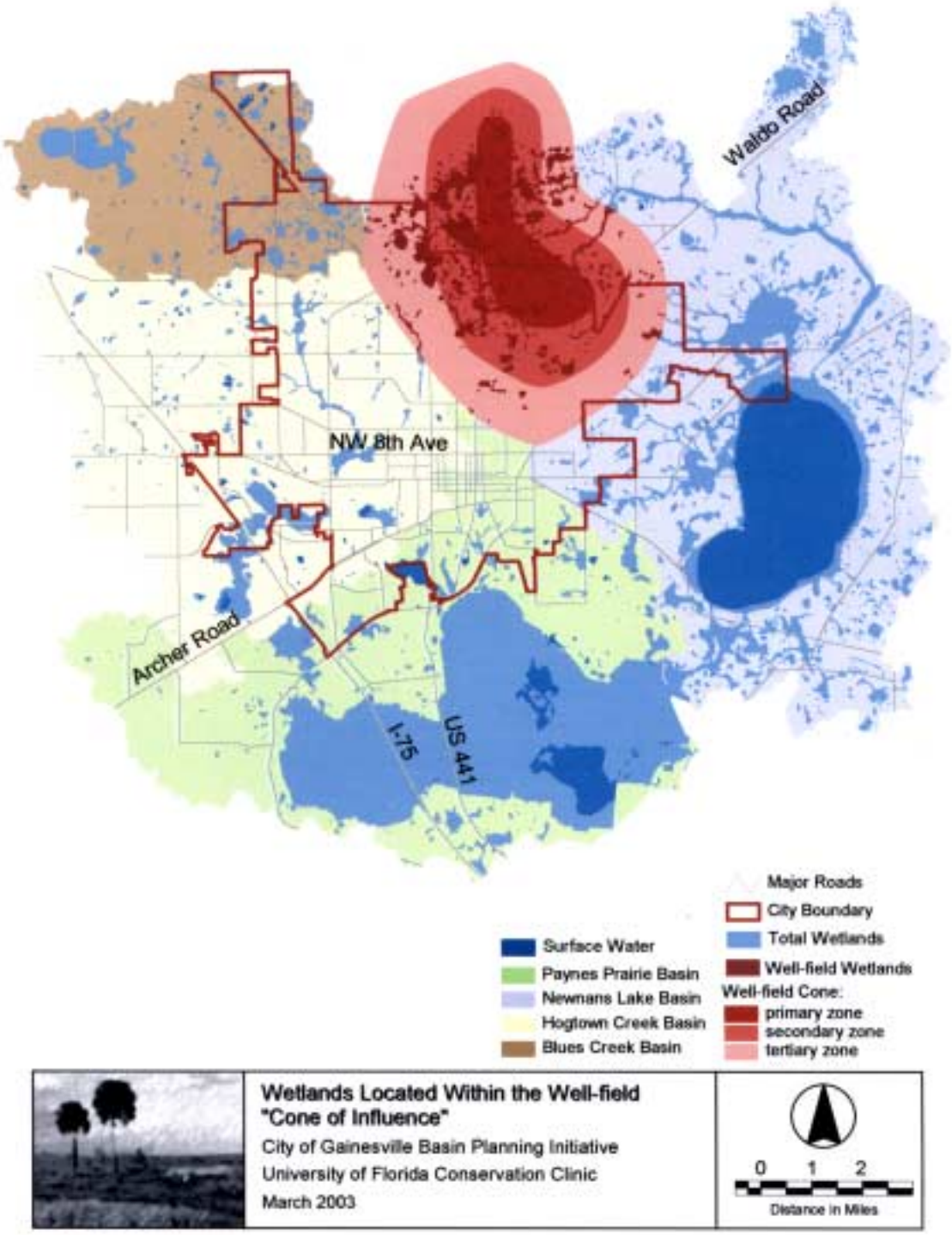
City of Gainesville Basin Planning Initiative

University of Florida Conservation Clinic

March 2003

0 1 2

Distance in Miles


Waldo Road
NW 8th Ave
Archer Road
I-75
US 441
Major Roads
City Boundary
Total Wetlands
Well-field Wetlands
Well-field Cone:
primary zone
secondary zone
tertiary zone
Surface Water
Paynes Prairie Basin
Newmans Lake Basin
Hogtown Creek Basin
Blues Creek Basin
Wetlands Located Within the Well-field "Cone of Influence"
City of Gainesville Basin Planning Initiative
University of Florida Conservation Clinic
March 2003
0 1 2
Distance in Miles

For example, Paynes Prairie is the largest contiguous wetland system within the four study basins. However, it consists of relatively few individual data fields. If a small portion of the prairie is selected as being adjacent to or overlapping another data set, a disproportionately large portion of the prairie may be selected and could inflate numeric values.

There is a need for standardized data sets of existing wetland resources that can be utilized by analysts within both city and county agencies. There are discrepancies between the agencies over which data sets are the most valid for obtaining wetland data (for example, the National Wetlands Inventory versus water management district land use data). A decision should also be made regarding which land use classification code should be used. Standardizing these basic data sets will facilitate communication between agencies and interest groups.

When performing this type of analysis, it is important to note that the final product is only as good as the data used to produce it. In any GIS data set, errors may exist that can affect intended results. This study was conducted at a landscape scale, which can accommodate slight discrepancies in data. However, as basin planning progresses it will be necessary to investigate questions at a finer scale. To answer these questions with the highest level of credibility, additional data and fieldwork will be necessary.

V. INSTITUTIONAL FRAMEWORK

A. Proprietary Interests in Basin Creeks

The basin creeks fall into three ownership categories: 1) those that are publicly owned, 2) those that are privately owned, and 3) those that are privately owned but subject to a drainage easement or a utility easement held by the city or county. Many of the basin creeks are privately owned. This presents a significant issue for basin management planning. However, the question of who owns the creek bottom is separate from the question of who owns the water. The Florida Supreme Court has held that water cannot be privately owned unless captured.[53] Consequently, the *water* in the basin creeks is held in trust by the state and the true issue, in terms of property interests, lies in who controls the creek *bottom*. If the creeks are "navigable," they are property of the state by virtue of its sovereignty.[54] Navigability is determined on a case-by-case basis. The water body has to have been used or have been capable of being used as a highway for waterborne trade and travel conducted by the customary modes of that period.[55] If this is shown, the government possesses the land up to the ordinary high-water line.[56] Given their small size and intermittent nature, the basin creeks are probably not navigable and therefore not property of

[53] Village of Tequesta v. Jupiter Inlet Corp, 371 So.2d 663, (Fla. 1979) (Property owner instituted claim for inverse condemnation and injunction arguing the village's depletion of water from the aquifer beneath its property effectively deprived the owner of its beneficial use of its property rights in the aquifer).
[54] FLA. CONST. art. X, §11.
[55] David Guest, *Navigable Waters in Florida: The Public Trust Doctrine, What "Navigable" Means In Fact and In Law, And How to Identify The Boundary Between Land And Water*. Florida Environmental and Land Use Law Section Treatise.
[56] Martin v. Busch, 93 Fla. 535, 112 So. 274 (1927).

the state.

The centerline of the creek often forms the boundary between two parcels, adding to the ownership complexity. However, the city, county, or state may hold a drainage easement or utility easement over the creek bottom and sides.[57] A limited review of property records suggests that creeks or portions of creeks were used to facilitate drainage for development, and subdivision plat maps reveal easements along some creek sections. Restoration and maintenance that also fulfill a drainage function are probably permissible. However, at some point activities necessary to achieve creek restoration and management goals may depart from, or even be contrary to, the purposes for which the easement was granted, creating potential liability for incursions on private property.

The City currently uses a form drainage easement and utility easement that allows the city to construct, operate, and maintain drainage facilities and public utility facilities on property.[58] However, much of the development along Gainesville's creeks occurred decades ago. Thus, a parcel's easement, if it exists at all, may contain language substantially different from the form easement. In order to perform creek management, the easement must expressly allow such activities or the activities must fall within the general scope of the easement's purpose. Hall v. City of Orlando,[59] states, "Every easement carries with it by implication the right, sometimes called a secondary easement, of doing what is reasonably necessary for the full enjoyment of the easement itself...[but] that right is limited and must be exercised in such reasonable manner as not injuriously to increase the burden upon the servient tenement [...])."[60] The extent to which restoration activities represent a "secondary purpose" to a drainage easement requires further analysis. The language of the county's form drainage easement is very similar to that of the city.

Public prescriptive easements are another way in which the city could conduct activities along the creeks. These easements are acquired through means similar to adverse possession. The city must prove the creek area in question has been continuously used and serviced by the city with knowledge, but not acquiescence, of the owner of the property for seven years.[61] Given the extent to which drainage openly benefits city residents, it may be difficult to demonstrate a lack of acquiescence.

B. Regulations Affecting the Basin Creeks and Wetlands

The creeks and wetlands within the basins are regulated by the federal, state, and local

[57] To what extent the city or county holds easements over the creeks must be investigated further by the city. A record of established easements is not maintained by the city and the easements do not appear to be uniformly recorded on the deeds and thus accessible by the owner. This can lead to serious disagreements between the city and property owner, who may not even know that an easement exists, over what the scope of the easement entails.
[58] See Attachment B for a standard drainage easement.
[59] 555 So.2d 963 (Fla. 5th DCA 1990).
[60] *Id*. at 966.
[61] While F.S. § 95.361 addresses roads, it may be possible for an analogy between roads and creeks. Further research is required to address this theory.

governments.[62] The regulations of all entities must be examined to ensure that the city's actions are consistent with them and to determine the limits of the city's authority. The state, for instance, preempts the field of wetland delineation,[63] and once the State-wide Uniform Wetland Mitigation Assessment Method goes into effect,[64] it will be the exclusive means for determining the amount of mitigation needed to offset adverse impacts to wetlands and other surface waters. It will also be the sole means to determine the awarding and use of mitigation bank credits.

The U.S. Department of the Army and the U.S. Army Corps of Engineers (USACOE) along with the Florida Department of Environmental Protection (DEP) and the five water management districts regulate dredge and fill in Florida's waters, while DEP and the water management districts regulate the construction of stormwater facilities.[65] The EPA issues National Pollution Discharge Elimination System (NPDES) permits. Florida has been approved to administer the program locally. [66] EPA also reviews USACOE permit applications, sets minimum water quality standards, and sets guidelines for state environmental programs. The City and Alachua County also assert regulatory jurisdiction over wetlands and surface waters, and regulate stormwater facilities, as discussed more fully below.

C. Federal and State Total Maximum Daily Load (TMDL) Administration

Section 303(d) of the Clean Water Act requires the state to submit lists to the EPA of surface waters that do not meet applicable water quality standards. Chapter 62-303, Laws of Florida, sets forth the process by which the state accomplishes this mandate. According to the 2002 Update to Florida's 303(d) List of Impaired Surface Waters formulated by DEP and submitted to EPA on October 1, 2002, five of Gainesville's creeks are on the state's impaired waters list: Hatchet Creek, Little Hatchet Creek, Hogtown Creek, Sweetwater Branch Creek, and Tumblin Creek.[67] Newnans Lake and Alachua Sink are also impaired water bodies.[68] Once the lists are accepted by the EPA, Total Maximum Daily Loads[69] (TMDLs) must be established for the impaired waters within 12 years.[70]

For planning and regulatory purposes, the Florida Department of Environmental Protection (DEP) has divided Florida into 52 watershed basins that are separated into five groups. While all of Gainesville's watersheds fall within Group 1, three of Gainesville's watershed basins are entirely within the Ocklawaha Basin. Blues Creek, however, is located

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[62] The city and county have the authority to regulate activities within creeks and wetlands under their home rule power unless preempted by the state.
[63] See <http://www.dep.state.fl.us/water/wetlands/erp/rules/rulestat.htm>.
[64] Anticipated effective date is Summer 2003. See *id*.
[65] See <http://www.dep.state.fl.us/water/wetlands/erp/dffact.htm>
[66] Orange Creek Basin Surface Water Management Plan, May 1996.
[67] See <http://www.dep.state.fl.us/water/tmdl/2002_303d_update.htm>.
[68] See *id*.
[69] A TMDL is the maximum amount of a particular pollutant a water body can assimilate without violating the applicable State water quality standards. Based on the TMDL, States allocate the pollutant load to point and nonpoint sources.
[70] See <http://www.dep.state.fl.us/water/tmdl/verified.htm>

within the Suwannee Basin.[71] DEP's recently established Watershed Management Program[72] (WMP) is a staggered five-phase, five-year cycle designed to assess each group of watershed basins. Each year, a different group enters Phase 1, the initial basin assessment. The Group 1 basins were the first to begin the WMP, and Phase 1 was recently completed. Much of the information for the impaired surface waters came from information obtained during this phase. The Group 1 basins are now entering Phase 2 of the WMP. This phase involves supplementing existing data to further characterize basin conditions, investigating areas with identified or potential water quality problems, evaluating the effectiveness of management actions, and collecting data for TMDL development. The following year Phase 3 will begin, during which a more detailed data analysis and the development of TMDLs will occur. Phase 4 focuses on the development of a Basin Management Action Plan (BMAP).

The BMAP is developed by watershed stakeholders and the DEP to specify how established goals will be achieved by recommending management activities, establishing who is responsible for implementation, establishing a schedule for implementation, and noting how the effectiveness of the plan will be assessed. While the plan will focus on implementation of TMDLs developed in the basin, it will also address more general watershed goals. Finally, the cycle ends with Phase 5 and the implementation of the BMAP. Eventually DEP will coordinate the issuance and revision of NPDES permits during this last phase. It is intended that this phase will continue until the management goals are achieved or revised. However, at the end of the fifth year the entire cycle will begin anew.

D. Local Creek and Wetland Regulation

Because the watershed basins are not confined within local political boundaries, the city and county regulations for surface waters and wetlands should be fairly consistent in order to facilitate basin-scale management. The following discussion highlights some important similarities and differences in their respective regulations. At the time of the compilation of this report, Alachua County's proposed comprehensive plan was being challenged, therefore both the existing and proposed comprehensive plan policies and LDRs will be compared. The city's proposed comprehensive plan and LDRs are discussed unless otherwise noted.

Mitigation is available when a wetland is degraded or loses function. All wetlands in the county are regulated.[73] The same holds true for the city as it follows the DEP's guidelines found at 62-340, F.A.C.[74] Under the City's comprehensive plan amendment, avoiding wetland degradation or loss of function is a "highest priority."[75] Projects that cause degradation that is unavoidable are only allowed when the project is "clearly in the public interest."[76] Wetland

[71] It is noteworthy that while Hogtown Creek, Sweetwater Branch, and Tumblin Creek are within the Ocklawaha Basin, these stream to sink systems do not discharge surface water into the Ocklawaha River Basin.
[72] See <http://www.dep.state.fl.us/water/tmdl/cycle.htm>
[73] Alachua County Comprehensive Plan Conservation and Open Space Element 4.7.1 ("Wetlands of all sizes shall be regulated without exception").
[74] Proposed LDR § 30-301(a)(2).
[75] City Comprehensive Plan Conservation, Open Space and Groundwater Recharge Element 1.1.1.b.
[76] *Id*.

destruction may occur in the county when there is no other upland site on the same parcel or contiguous parcel under the same ownership where development activity may occur, every effort has been made to minimize wetland loss and degradation, or the wetlands to be converted are of minimal function and value.[77] Proposed county Conservation and Open Space Element (COSE) policy 4.7.4 allows wetland degradation or loss of function when the applicant has taken every reasonable step to avoid and minimize adverse impact to the wetlands and the applicant has shown one of the following circumstances: minimal impact activity, overriding public interest, or all economically beneficial or productive use of the property is otherwise precluded.

Interestingly, proposed county comprehensive plan COSE policy 4.7.7.4 would require mitigation to be permitted only within the boundaries of Alachua County and, if possible, within the affected local watershed.[78] Additionally, the county would prioritize mitigation receiving areas within the county, as well as study the possibility of establishing a local mitigation bank.[79] This appears to complement the proposed city LDR requiring mitigation to be performed within the same basin or sub-basin.[80] The county follows the Mitigation Ratio Guidelines promulgated by the St. Johns River Water Management District.[81] Likewise, the city's wetland mitigation regulation, Sec. 30-302(d), states that mitigation shall be accomplished in accordance with appropriate water management district standards and additional city regulations.[82] Thus, it appears that the city and county "management-oriented" wetland policy compliment one another, and further the goal of shared basin management.

E. Creek and Wetland Buffers

Buffers are integral to protecting the ecological value of wetlands and surface waters. Proposed city land development regulation (LDR) Sec. 30-302 requires a 75-foot buffer from the landward extent of a regulated lake or a 35-foot buffer from the break in slope at the top of the bank of any regulated creek. Regulated creeks and lakes are those that are delineated as such on the map entitled "Surface Waters and Wetlands District."[83] Development activity must occur at an average minimum distance of 50 feet from the landward extent of any wetland or surface water, other than a regulated lake or creek. Proposed county comprehensive plan COSE policy 3.6.8 requires a minimum buffer width of 75 feet from surface waters and wetlands, 200 feet from Outstanding Florida Waters, and 300 feet from a surface water or wetland if a listed plant

[77] LDR § 359.11(1).
[78] This policy may violate 373.4135(2), Fla. Stat. (2002), discussed later in the paper, which prohibits local governments from denying use of a mitigation bank or offsite regional mitigation because of its location outside of the jurisdiction of the local government.
[79] COSE 4.7.7.5
[80] Proposed LDR 30-302(d)(7)b.
[81] Alachua County Comprehensive Plan COSE policy 4.7.7 would still follow the guidelines of the SJRWMD, but mitigation ratios of less than 5:1 would never be accepted.
[82] A proposed charter amendment that will be on the ballot on April 8, 2003 could significantly effect basin planning. It states "[w]etlands within the boundaries of the City of Gainesville shall be preserved and shall be protected from any alteration. Undisturbed buffers shall be maintained around wetlands. Wetlands damaged after the effective date of this charter amendment shall be restored to their original condition at the owner's expense."
[83] LDR § 30-301(a)(1).

or animal species has been documented within that area. The existing county regulation Sec. 359.07, however, requires the width of the buffer to be determined on a case-by-case basis with the minimum width set at 75 feet for surface waters designated Outstanding Florida Waters and 35 feet for all other natural and mitigation surface waters or wetlands.

An analysis of potential conflict between the city regulations and the SJRWMD rules is necessary. The city may adopt land development regulations more restrictive than the requirements in the WMD rules, and if so, the more restrictive regulations must be followed. However, if the differences between the city regulations and WMD rules cannot be reconciled, the WMD rules apply.[84] The proposed regulation requiring off-site mitigation to be performed within the same sub-basin or basin might cause the most concern. However, while a local government cannot deny the use of a mitigation bank or required offsite mitigation due to its location outside of the jurisdiction of the local government,[85] it may be able to deny it for other reasons such as its location outside of the basin impacted by the proposed project.

City and county buffer policies are reasonably consistent, although the proposed county policies go substantially further. In either case, wetland buffers may be insufficient to avoid degradation as a result of encroaching development. Moreover, creek buffers are restrictions on activities, but not tools for affirmative management and rehabilitation.

F. Stormwater Management

Many view stormwater management as a key ingredient in any recipe to accomplish basin wide management. This is especially true in urbanized settings to achieve healthy watersheds. Stormwater retrofitting is a requirement in most urban areas, including Gainesville and Alachua County. A thorough analysis of Gainesville's stormwater program is beyond the scope of this report. This section provides an overview of the City's National Pollutant Discharge Eliminations System (NPDES) stormwater requirements and briefly compares the policies of Gainesville and Alachua County.

1. Overview of NPDES Stormwater Management in Gainesville[86]

EPA developed the federal NPDES stormwater permitting program in two phases. Phase I, promulgated in 1990, addresses the sources of stormwater runoff with the greatest potential to degrade water quality including "medium" and "large" municipal separate storm sewer systems (MS4s) located in incorporated places and counties with populations of 100,000 or more, and in eleven categories of industrial activity. For example, one such activity is large construction activity that disturbs five or more acres of land.

[84] Fla. Const. Art. VIII §§ 1(g), 1(t), and 2(b).
[85] § 373.4135(2), Fla. Stat. (2002).
[86] The information in this subsection was partially adapted from a brief summary provided by the City of Gainesville Public Works Department.

Phase II, promulgated in 1999, addresses additional sources of concern, including certain "small" MS4s and small construction activity disturbing between 1 and 5 acres, that must be permitted by March 10, 2003. In Florida, the Department of Environmental Protection is authorized by the EPA to implement and enforce the NPDES program.

Gainesville is currently involved in an Urban Area NPDES Joint Partnership (Phase II). The purpose of the NPDES Joint Partnership is to reduce program costs incurred from implementing NPDES Phase II requirements by sharing resources, where appropriate, to avoid the duplication of services between the parties. The partnership is between the City of Gainesville (City), Alachua County (County) and the Florida Department of Transportation (FDOT). The area affected by the agreement is the Gainesville Urban Area limits as determined by the 2000 U.S. Census.

The Partnership will develop an NPDES Stormwater Management Plan for each entity. These plans will fit under existing Stormwater Management Master Plans.
Elements of the NPDES SM Plan include:

- Enhanced Mapping - Waters of the United States located in Alachua County, one foot contour maps and storm sewer maps within the Gainesville Urban Area are being developed within a Geographic Information System format.

- Illicit Discharge - The Alachua County Environmental Protection Department will manage the Illicit Discharge Detection and Elimination Program. The purpose of this program will be to detect and eliminate non-point sources of pollution entering our water bodies through the municipal separate storm sewer system.

- Public Outreach - The program will support and supplement existing organizations that educate individuals and businesses as to what actions can be taken in order to reduce non-point source pollution.

- Operation BMPs - City and county field operations crews will implement Best Management Practices (BMPs) that will help to reduce erosion from construction sites and maintenance operations. This program will also address maintenance activities located at operations storage facilities. Educational programs that teach field personnel how to detect illicit discharge and how to implement BMPs will be a part of the program.

2. City and County Stormwater Policies[87]

Some basin issues, like volume and velocity, may be addressed through stormwater management. Objective 2.2 of the city comprehensive plan Conservation, Open Space, and

[87] Gainesville's current stormwater management ordinances can be found in the city code, at: <http://livepublish.municode.com/5/lpext.dll?f=templates&fn=main-j.htm&vid=10819>. See Art. VIII, Division 2, Subdivision 2, § 30-270 – Stormwater management generally; erosion and sedimentation control; design and maintenance of facilities.

Groundwater Recharge Element (COSGRE) focuses on improving the quality of stormwater entering the lakes and creeks. Policy 2.2.2 requires the city to adopt LDRs that reduce the amount of impervious parking surface allowed within environmentally significant areas as compared to impervious allowances outside these areas. Additionally, policy 2.2.3 requires the city to continue to have LDRs that meet or exceed best management practices for stormwater management. The city currently operates a stormwater utility and taxes property owners in order to manage and maintain the city's stormwater system. New development is required to take stormwater into consideration and retain runoff from impervious surfaces on-site.

Proposed county Stormwater Management Element policy 1.1.3 states that the county will "investigate the feasibility of establishing a Stormwater Utility for the purposes of funding improvements to the existing systems and the on-going monitoring and maintenance of all stormwater management systems." Policy 2.3 mandates that priorities for correcting volume and pollution abatement deficiencies in existing County-maintained stormwater management systems be scheduled in the Capital Improvements Program.

G. Wildlife and Habitat Considerations

To accomplish goals beyond the protection of wetlands and surface waters, basin management planning should take into account the possible presence of protected species, wildlife habitat including uplands, wetlands-dependent uplands species, and the control of invasive exotic species. The city and county comprehensive plans and regulations should cohesively target these issues. The adopted city comprehensive plan contains several policies covering these matters:

- Land development regulations must be adopted that protect identified threatened, endangered, list, or candidates for being listed plants, animals, or habitats. COSGRE 2.4.2
- Land development regulations are to be developed for appropriate setbacks for wetland containing listed plant or animal species. [88] COSGRE 1.1.1.b.10
- Invasive trees and shrubs are to be removed from city rights-of-way and invasive vegetation must be excluded from plant material permitted in landscape plans.[89] COSGRE 3.1.5 and 3.1.6

The adopted county comprehensive plan also contains several objectives and policies covering these matters:

- Native vegetation in natural surface waters, buffers, and natural floodways is to be retained in its natural state. Harvesting, cutting, and clearing activities are restricted to the removal of non-native species. COSE 4.6.8
- A buffer of 300 feet is required when a listed species is present in the wetland.[90]
- The importance of maintaining the overall ecological integrity of the wetlands community is

[88] The currently proposed LDRs do not address this requirement.
[89] The currently proposed LDRs do not address this requiment.
[90] This buffer width is currently under challenge.

recognized, partially through the maintenance of viable populations of endangered, threatened, and species of special concern. COSE 4.7.5.b.1

- The use of native wetland plant species to create wetland habitat is required, where design allows, in newly constructed stormwater retention and detention ponds. COSE 4.7.11
- An entire objective is devoted to maintenance and enhancement of biodiversity within the county. COSE 4.9

H. Planning Projects Affecting the Basins

The state's water management districts (WMD) are responsible for managing the quantity and quality of waters within their boundaries. Gainesville's four basins are divided between the jurisdiction of the St. Johns River Water Management District (SJRWMD) and the Suwannee River Water Management District (SRWMD). SJRWMD's jurisdiction covers the vast majority of Newnans Lake Basin and all of Hogtown Creek Basin and Paynes Prairie Basin. Suwannee's jurisdiction includes all of the Blues Creek Basin and a sliver of Newnans Lake Basin. SJRWMD has delineated its own set of four basins within its jurisdiction.[91] One, the Orange Creek Basin, which consists of sub-basins that include all of the Newnans Lake Basin, Hogtown Creek Basin, and Paynes Prairie Basin. The Orange Creek Basin Advisory Council (Council) formed in 1993.[92] The Council was composed of 11 representatives of the residential and business communities and local, regional, and state governments, including the Florida Department of Environmental Protection at Paynes Prairie, SJRWMD, Alachua County Environmental Protection Department, and the City of Gainesville's Department of Public Works.

The Orange Creek Basin Surface Water Management Plan, formulated by the Council, purports to be a comprehensive, holistic, and inclusive basin-wide approach to water resource management modeled after the District's Surface Water Improvement and Management (SWIM) plans. The basin-wide goals include: the restoration and maintenance of the basin's natural hydrology, the restoration and protection of aquatic and wetland communities and their habitats, the protection and enhancement of water quality, the rehabilitation and maintenance of fisheries, and the enhancement of recreational and aesthetic values. More specifically, and to the extent possible, quantitative goals for the sub-basins are to be developed as the basin diagnostic projects are completed. The diagnostic projects include performing water quality and hydrologic monitoring, examining wetland/water resource protection through new land acquisition, and performing hydrologic modeling. No diagnostic projects have been completed and thus no quantitative goals have been formulated. The plan is non-regulatory.

VI. MAJOR PLANNING TOOLS

[91] Under Chapter 373, Florida Statutes, SJRWMD has authority "as the lead agency responsible for developing and implementing restoration and management initiatives in the basin."
[92] Orange Creek Basin Surface Water Management Plan, May 1996.

This section explores some of the major policy tools and approaches that are relevant in watershed and wetlands planning.[93] A few of these tools, while they may or may not be directly useful in addressing Gainesville's watershed planning needs, are commonly encountered in discussion of wetlands and watershed planning. Furthermore, the concepts embodied in these tools have been foundational to many watershed-based wetlands planning efforts throughout the United States.[94] Thus, discussion of these planning tools provides important background and may illustrate planning mechanisms that meet Gainesville's needs.

A. Special Area Management Plans

Special Area Management Plans (SAMPs) are meant to be comprehensive plans for natural resource protection and reasonable economic growth. SAMPs typically occur when there is a significant conflict between economic growth and environmental protection. Indeed, the purpose of a SAMP is to resolve recurring inter-jurisdictional conflicts over the preservation or development of valuable natural resources.[95]

Although originally authorized by the Coastal Zone Management Act and overseen by the National Oceanic and Atmospheric Administration, the Corps of Engineers applies the term to inland areas as well.[96] The Corps has the authority to work with local governments to develop SAMPs because of its responsibilities under Section 404 of the Clean Water Act.[97] SAMPs generally include wetland classification, a high degree of public participation, and a variety of implementation methods. The Corps applies four criteria for participating in a SAMP:

1) the area must be environmentally sensitive and face strong development pressure,
2) the public must be involved in the process,
3) there must be a sponsoring local agency, and
4) all parties must agree at the outset that the plan will result in a regulatory end product.[98]

These four criteria reflect the Corps regulatory program approach to planning. The Corps is selective in choosing whether to participate in watershed planning efforts. Also, the Corps is interested in the plan ending in a definitive regulatory product. This typically involves some entity identified by the plan to assume some level of permitting authority form the Corps, such as a Programmatic General Permit, or will allow the Corps to streamline certain permit applications

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[93] See generally White and Shabman.
[94] For example, many of the case studies explored in White and Shabman are Special Area Management Plans. See generally White and Shabman.
[95] White and Shabman at 19.
[96] The Corps of Engineers has extended the SAMP concept to inland areas not covered by the CZMA. The Corps Regulatory Guidance Letter No. 86-10 (Oct. 2, 1986) noted that "This process of collaborative interagency planning within a geographic are of special sensitivity is just a s applicable in non-coastal areas." See White and Shabman at 4.
[97] 1977 Amendments to the CWA authorized the Corps to issue general permits on a state, regional, or nationwide basis covering certain categories of activities. White and Shabman at 19.
[98] *Id*.

(Regional General Permit). The requirement of a definitive regulatory product "raises the stakes" for those participating in the planning process. Arguably, this may make it more difficult for participants in planning efforts to reach consensus.

Past experiences have demonstrated that the Corps participation in SAMPs has often been motivated by the desire for a definitive regulatory end-product, such as the issuance of a General Permit.[99] The plans are very labor intensive, involving many technical components. They typically involve the identification of wetlands, categorization, and the analysis of planning alternatives, as well as extensive public and interagency participation.[100]

In contrast to Advanced Identification, discussed below, SAMPs not only identify wetland resources, but also analyze management alternatives and categorize wetlands to facilitate future decision-making.[101] Nevertheless, some SAMPS in which the Corps participates are not as analytically thorough as some would desire.[102]

A SAMP was developed by the Corps for Bird Drive Basin in Dade County between 1992 and 1995, and is still in effect. The Department of Environmental Protection and Metropolitan Dade County (Department of Environmental Resources Management) entered into a Memorandum of Understanding on April 27, 1993 that directs that applicants requiring mitigation within the basin will contribute a specified amount of money to Miami-Dade County, which is in turn used to implement the "Hole in the Donut" Mitigation Bank within Everglades National Park.[103]

B. Advanced Identification

Although they are sometimes referred to as "plans," Advanced Identification (ADID) projects are merely efforts to collect information on the location and functions of wetlands of a specified area in advance of permit applications and to identify wetlands generally suitable or unsuitable to be filled. ADIDs are undertaken by the EPA in cooperation with the Corps of Engineers and in consultation with states. They may be initiated by agencies or by a request from any other party. The information collected in ADIDs is not binding and cannot be used directly as the basis of regulatory decisions.

ADIDs are undertaken for several reasons. First, they can be used to provide information to developers about the likelihood of receiving a permit in particular areas. Second, ADIDs can save regulators time in making permit decisions. Third, it has been suggested that ADIDs help educate the public about wetlands contained in an area. Fourth, ADIDs can assist local planning

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[99] White and Shabman at 6.
[100] *Id*.
[101] *Id*. at 4
[102] *Id*.
[103] See Department of Environmental Protection Website at:
<http://www.dep.state.fl.us/water/wetlands/docs/erp/overview.pdf.>

efforts by providing an assessment of wetland resources and predicting where development is likely to be allowed.[104]

While, ADIDs are not plans in themselves, they may be important components of plans. In many cases of watershed-based wetlands planning, an EPA ADID project provided needed information about the location and functional value of wetlands that facilitated the categorization and planning effort.

ADIDs have been developed for western Biscayne Bay (for the shoreline east of Cutler Ridge), the Florida Keys (Monroe County), the Loxahatchee River (Palm Beach County), Eastern Everglades (near the 8 ½ square-mile area), and Rookery Bay (Collier County). These ADIDs help applicants identify areas where permitting difficulties can be expected, but they do not otherwise directly affect the state permitting process. An ADID for western Broward County was developed but never approved by the EPA.[105]

C. Regional Off-site Mitigation Areas

Regional Offsite Mitigation Areas (ROMAs) are projects that facilitate environmental creation, preservation, enhancement, or restoration, typically in wetlands mitigation contexts. ROMAs are areas that provide mitigation for five or more applicants or for 35 or more acres of adverse impacts.[106] Money to establish ROMAs is donated or paid as mitigation. The Florida Department of Environmental Protection, a water management district, or a local government can sponsor ROMAs, which must be established and operated under a memorandum of agreement (MOA). The memorandum of agreement must be between the governmental entity proposing the mitigation project and the DEP or water management district, as appropriate. Such memoranda of agreement need not be adopted by rule but must meet the statutory criteria.[107] At a minimum, the memorandum of agreement must contain the following for each project authorized:

> 1) a description of the work that will be conducted on the site and a timeline for completion;
> 2) a timeline for obtaining any required environmental resource permit;
> 3) the environmental success criteria that the project must achieve;
> 4) the monitoring and long-term management requirements that must be undertaken for the project;
> 5) an assessment of the project in accordance with §373.4136(4)(a)-(i), until the adoption of the uniform wetland mitigation assessment method pursuant to § 373.414(18);

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[104] Indeed, in many cases an EPA ADID project provided needed information about the location and functional value of wetlands that facilitated the categorization and subsequent planning efforts.
[105] See Florida Department of Environmental Protection Website at: <http://www.dep.state.fl.us/water/wetlands/docs/erp/overview.pdf.>
[106] See Florida Stat. Ann. § 373.4135.
[107] See *id*.

6) a designation of the entity responsible for the successful completion of the mitigation work;
7) a definition of the geographic area where the project may be used as mitigation; 8) full cost accounting of the project, including annual review and adjustment;
9) provision and a timetable for the acquisition of any lands necessary for the project;
10) a provision for preservation of the site;
11) provision for application of all moneys received solely to the project for which they were collected;
12) provision for termination of the agreement and cessation of use of the project as mitigation if any material contingency of the agreement has failed to occur.[108]

ROMAs benefit a property owner preparing to build on their property that contains wetlands. A ROMA provides an additional option for developers that are required through their permit to perform mitigation. Such mitigation is required to have a defined environmental benefit, which a ROMA can ensure. When an application is received for a development within a wetland, the applicant can indicate their intent to use the established ROMA as a mitigation option. This can streamline the permit process. The ROMA can allow money to be donated or paid as mitigation for other single-family projects within the defined service area.[109]

The Florida Department of Environmental Protection and the St. Johns River Water Management District have entered into a Memorandum of Agreement regarding the Cummer Trust ROMA Plan, a project involving 21,931 acres in northern St. Johns County. Similarly, the City of Jacksonville, the Florida Department of Environmental Protection, and the St. Johns River Water Management District are currently preparing to enter into a Memorandum of Agreement regarding the mitigation of wetland impacts of projects within the Better Jacksonville Plan.

D. Urban Watershed Restoration

One general approach that has been used to address watershed concerns, such as those of Gainesville's creek systems and associated wetlands, can be described as urban watershed restoration. Urban streams and rivers have become the focus of restoration efforts throughout many parts of the country. The motivating factors underlying these programs vary. For some the goal is to improve water quality for receiving waters. In others, the objective is to enhance the urban environment and provide recreational areas. These emerging urban watershed restorations efforts are unique in that they target stormwater treatment and habitat enhancement to rehabilitate urban streams.[110]

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[108] *Id*. at § 373.4135(6)(c)
[109] See DEP website at <http://www.dep.state.fl.us/south/erp/ROMA.htm>
[110] *Assessing the Potential for Urban Watershed Restoration*. WATERSHED PROTECTION TECHNIQUES. 1(4): 166-172. Hereinafter "Urban Watershed Restoration." Available online at: <http://www.stormwatercenter.net/Practice/142-Restoration.pdf>

In discussing urban watersheds, a concept of **watershed scale** has been recommended.[111] An urban watershed may be several square miles in area and consist of several stream systems, as is the case in Gainesville. A **sub-watershed** usually encompasses first or second order tributaries to the main stream and has a drainage area of approximately 1,000 to 1,500 acres (which may vary regionally).[112] A sub-watershed consists of several **catchments** that usually have drainage area between 50 and 500 acres. It is recommended that watershed restoration be conducted at the sub-watershed scale for three reasons. First, not all sub-watersheds within an urban watershed will have the same level of impervious cover, and therefore impacts and restoration opportunities often differ between sub-watersheds. Second, it is easier to identify structural restoration sites and other opportunities at the sub-watershed level. Third, local neighborhoods often fall within the scale of the sub-watershed, which makes it easier to target pollution prevention efforts. Finally, and arguably most importantly, the sub-watershed scale is small enough to accurately measure the percentage of sub-watershed area that can be treated by stormwater retrofits.[113] These areas are referred to as **control areas**, and can be important concepts when choosing priority sub-watersheds for restoration.

While watershed restoration often takes decades to implement, sub-watershed restoration efforts can be accomplished in shorter periods of time.[114] Thus, by concentrating on one sub-watershed at a time improvement to that aquatic system can be measured while contributing improvements to the watershed as a whole.

It is notable that Gainesville's proposed Land Development Regulations provide for the establishment of four watershed planning basins: the Newnan's Lake Basin, the Paynes Prairie Basin, the Hogtown Creek Basin, and the Blues Creek Basin.[115] Furthermore, the land development regulations establish an order of mitigation preference with regards to these four basins that favors mitigation in the same basin and the same sub-basin. [116] The mandate of the comprehensive plan's goal that the city work to develop basin management plans in combination with the establishment of the four basins suggests that the modular approach of urban watershed restoration is well suited to Gainesville's existing watershed and wetlands planning framework.

The Urban Watershed Restoration Process involves a three-pronged approach that uses: 1) **stormwater retrofitting**, 2) **pollution prevention**, and 3) **stream enhancement**. This process is recommended to achieve realistic improvements in aquatic communities for urban streams with the sub-watershed context.[117] The Gainesville basins require all of these.

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[111] Urban Watershed Restoration at 9.
[112] *Id*.
[113] *Id.* at 10.
[114] *Id*.
[115] See § 30-302(d)(7)b.
[116] §30-302(d)(8) states: "Order of Mitigation Preference. The order of preference for the location of the mitigation area in relation to the impacted area is as follows: a. In the same sub-basin; b. In the same basin; c. In another basin." City of Gainesville Proposed Comprehensive Plan Conservation, Open Space and Groundwater Recharge Element
[117] Urban Watershed Restoration at 10-11.

The **stormwater retrofitting** prong involves identifying sub-watersheds, locating candidate retrofit sites, and determining how much area within the sub-watersheds can be controlled through retrofitting. Candidate retrofit sites meeting initial criteria[118] are field-verified using a retrofit inventory sheet[119] and cataloged into a retrofit inventory. This inventory can be used to compute the amount of area that can be controlled and cost estimates. Watershed managers can use various scoring systems to allocate resources and develop an implementation approach for the construction of specified projects.

The **pollution prevention** prong of watershed restoration involves identifying and implementing source control measures within selected sub-watersheds. The objective is to control pollution at its source. Due to the fact that much water pollution is non-point in nature, watershed education and behavior modification play an important role in reducing pollution levels.[120] One method to identify source control opportunities targets the major land uses within a sub-watershed (industrial land uses, which are permitted under the NPDES program, may be addressed separately). Identifying commercial property owners allows the formation of business coalitions throughout the sub-watershed for commercial clusters or groups of similar businesses together (e.g. vehicle maintenance, food service, warehouse, general retail, etc.). Field investigations are then conducted to look for the presence or absence of pollution prevention practices.[121] This information can be used to educate business owners and encourage voluntary compliance among business coalitions. Local governments may consider incentives to promote participation in such a program, such as special tax incentives, advertising subsides for environmentally friendly business, or special subsidies for stormwater practice implementation. Concerns raised about commercial business on Southwest 13th Street, from which untreated runoff flows directly into Tumblin Creek, illustrate the need for such an approach in Gainesville.[122] Gainesville's Urban Area Stormwater Partnership is designed to address many of these issues, as is the recently enacted Alachua County Water Quality Ordinance.[123]

The **urban stream enhancement procedures** prong involves assessing the conditions of in-stream aquatic habitats and working to improve their quality. In many urban streams, physical changes to channel geometry and habitat are so severe that there are few places that can accommodate healthy aquatic communities. In order to restore healthy and diverse aquatic communities, it is often necessary to physically reconstruct in-stream habitat structure. Potential enhancement tools include reestablishing pool/riffle sequences, providing fish cover, stabilizing channel morphology, removing fish barriers, and re-vegetating riparian areas. Such tools are

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[118] *Id* at 11.
[119] See *id*. at 13.
[120] *Id*.
[121] See *id*. at 13, Table 4.
[122] At the recent creek summit a presentation by Chris Bird, Director of the Alachua County Environmental Protection Department, raised these concerns.
[123] See <http://environment.alachua-county.org/Pollution_Prevention/Water_Quality/Water_Quality_Ordinance/water_quality_ordinance_page.htm>. Pursuant to a recent citizen initiated charter amendment, this ordinance preempts all conflicting municipal ordinances.

used after first dividing stream networks into smaller reach lengths and performing stream condition assessments.[124]

It has been suggested that before expending lots of resources, watershed managers must ask whether the watersheds can really be restored.[125] While some things can always be done to improve water quality for receiving waters, certain constraints exist within the urban environment that may make complete restoration extremely difficult if not impossible.[126] For this reason, some wetland scientists prefer to use the term "rehabilitation," or "enhancement" which do not suggest a return to pre-development conditions. Key criteria to consider include: whether there is available public land; whether streams and waterways are open channels; whether biological data is available for the water body; whether impervious cover is moderate (less than sixty percent); whether the local government has a stream buffer program; and whether stormwater detention structures have been historically installed in the watershed in question.[127]

While interest in urban watershed restoration has grown, there have been relatively few urban watershed restoration plans completed and even fewer that have been implemented.[128] Consequently, there is little data available about the costs of implementing a complete urban watershed restoration plan. A realistic program that recognizes limitations of a restoration program and targets a specific approach is essential. An effective watershed restoration program is most likely to reach successful results when conducted at the sub-watershed level.

A comprehensive watershed restoration plan incorporates several complementary aspects. Stormwater retrofits can mitigate altered stormwater runoff and reduce pollutant loads, but are not enough to revive an aquatic ecosystem. Pollution prevention helps reduce pollutants at the source but does not affect the peak flows and erosive conditions within a stream. Stream habitat restoration may provide increased stream channel stability and create conditions where aquatic species might prosper, but without reductions in pollutant load, biological diversity is not likely to improve. Thus, it is important to approach urban watershed restoration in a comprehensive manner where each element plays a role in improving the watershed conditions.[129]

Gainesville is currently engaged in the process of stormwater retrofitting, as is illustrated by the current plans for the Depot Avenue stormwater park.[130] Similarly, concerns expressed by

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[124] One potential method is the Rapid Stream Assessment Technique. See Galli, J. *Rapid Stream Assessment Technique (RSAT) Evaluation Method*. Unpublished Notes. Metropolitan Washington Council Of Governments, Washington, DC. Excerpts available online at <http://www.stormwatercenter.net/monitoring%20and%20assessment/rsat/smrc%20rsat.pdf>

[125] Urban Watershed Restoration at 9-10.

[126] *Id*. For example, in the ultra-urban setting streams may be piped, increasing the difficulty of restoration. However, it is notable that in Gainesville there are plans to uncover previously piped portions of Hogtown Creek as a part of proposed stormwater projects.

[127] *Id*. at 9.

[128] *Id*.

[129] *Id*. at 14.

[130] *See* Depot Avenue Eco-Development Project Biannual Report, online at <http://www.cce.ufl.edu/current/depot/report.html#1>.

agencies and citizens at the Creek Summit reflect interest in reducing pollution levels and improving in-stream habitat. Thus, it is fair to say that Gainesville is currently engaged in some type of urban watershed restoration program. A more explicit articulation of these goals, as discussed in the recommendations section, may help facilitate such watershed restoration.

VII. PLAN IMPLEMENTATION

A. Intergovernmental Coordination

As the creeks are not solely within the jurisdiction of the city, there must be strong intergovernmental coordination in order to develop effective basin management plans. Coordination may be obtained by harmonizing regulatory approaches, entering statutorily authorized interlocal agreements, and/or entering less formalized memoranda of agreement, or pursing other formal and informal avenues of cooperation. Probably the easiest approach is for the city and county to harmonize their regulatory approaches, which are already fairly consistent. At this time it is difficult to determine exactly how consistent the city and county comprehensive plans will be to their recent adoptions and subsequent challenges. However, in the key area of mitigation, the adopted plans are quite similar and both regulate all wetlands. Differences do exist in the width of buffers and other policies that might have some impact on the implementation of basin management plans.

Alternatively, the city and county could enter into an interlocal agreement. The Florida Interlocal Cooperation Act of 1969[131] permits local government units to exercise jointly any power, privilege, or authority which such agencies share in common which each might separately exercise.[132] The statute also specifies what the contract may provide for, such as the purpose of the agreement, duration of the agreement, methods of financing the purpose, and the manner of adjudicating disputes.[133] An interlocal agreement between the city and county might be necessary to ensure the long-term viability of the basin management plans, especially if off-site mitigation is located outside the jurisdiction of the city, in receiving areas designated by the county. The agreement would also ensure that the two entities act cohesively in making any decisions affecting the basins.[134]

Finally, as a third option, a memorandum of agreement between the city, county, and a water management district to implement basin management based on agreed priorities. These are not statutorily created like interlocal agreements and are more limited in scope. However, they also enable the local government to adopt non-local partners like a water management district. In the context of mitigation, a memorandum of agreement is necessary when "an

[131] § 163.01, Fla. Stat. (2002).
[132] § 163.01(4), Fla. Stat.
[133] § 163.01(5), Fla. Stat.
[134] One idea raised at the Gainesville Creek Summit was that an intergovernmental forum to address watershed issues be modeled after the Metropolitan Transportation Planning Organization. Presentation of Teresa Scott, public works director for the City of Gainesville.

environmental creation, preservation, enhancement, or restoration project, including regional offsite mitigation areas, for which money is donated or paid as mitigation, that is sponsored by [...] a local government and provides mitigation for five or more applicants for permits under this part, or for 35 or more acres of adverse impact [...]."[135] The memorandum of agreement establishes the criteria that each project must meet, which include a description of the work to be conducted, the environmental success criteria that the project must receive, and provision for the preservation of the site.[136]

B. Harmonization Attempts

One possible approach is to form a unified mitigation wetland plan between the city and county. Policies of the city and county comprehensive plans already seem to allow for such a partnership. For instance, as the county is less densely populated, it could establish mitigation receiving areas in each watershed basin and the city could send required mitigation to them. However, there may still be instances where mitigation reception is more appropriate within the city, and the county could send mitigation. A partnership such as this reflects the basin approach to wetland management, rather than one premised on political jurisdiction.

Another planning tool is the use of impervious cover thresholds to focus growth into watershed zoning districts where development would have the least impact on stream water quality. Since 1991, two governments in Delaware, New Castle County and the City of Newark, have administered zoning ordinances which utilize impervious cover thresholds to protect sensitive water resource areas during new development.[137] Both governments have adopted Water Resource Protection Area (WRPA) ordinances to protect the quantity and quality of ground and surface water supplies. Since the WRPAs are classified as overlay zoning districts, a more rigorous and protective level of review and scrutiny is ensured during the land development review process**.** In New Castle County, WRPA ordinances limit the amount of impervious surface coverage for new development in aquifer, wellhead, recharge, and reservoir water resource protection areas.

WRPA ordinances are the foundation for an even more protective zoning code to protect entire watersheds using impervious cover techniques. Researchers suggest that impervious cover thresholds for new development be established on a watershed-by-watershed basis. One article divided urban land uses into three categories based on impervious coverage. In watersheds with a low pollutant potential of less than 10% impervious coverage, the goal is to protect water quality with an emphasis on preservation of open, natural space. In watersheds with a medium pollutant potential of 10% to 20% impervious cover, the goal is to limit degradation of water quality with zoning techniques and best management practices. And in areas of high pollutant potential exceeding 20% impervious, redevelopment should be encouraged.

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[135] § 373.4135(6), Fla. Stat. (2002).
[136] § 373.4135(6)(b-c), Fla. Stat.
[137] Gerald J. Kauffman, Tammy Brant, & Anne Kitchell, "The Role of Impervious Cover as a Watershed Zoning and Land Use Planning Tool in the Christina River Basin of Delaware."
<http://www.wr.udel.edu/publications/apaimpervious paper.pdf>

C. Non-regulatory Approaches

In addition to intergovernmental regulation and regulatory approaches, non-regulatory approaches may also be effective tools to basin management planning. For instance, landowners may be granted incentives to become "good creek stewards." Such stewardship might mean the landowner voluntarily allows the city to conduct management activities of the creek within the buffers or the landowner re-establishes a floodplain habitat. The possible incentives could vary in amount and range anywhere from tax-breaks to certificates of recognition.

The conversion of existing drainage easements into some broader restoration entitlement, such as a conservation easement, or the establishment of conservation easements where no easement previously existed, could also facilitate creek restoration efforts. This approach may require the city to expend some amount of money, but since the proportion of land purchased in relation to the entire parcel will likely be small, the cost should not be too high. Arguably, the value of the grantor's parcel may rise if the city can revitalize the creeks. A conservation easement would primarily benefit the city by providing it with more control of the creek area and allowing it to perform activities on the creeks not recognized by a drainage easement. Additionally, since the terms of a conservation easement are flexible, the property owner and local government can likely formulate terms that please both. Potential terms might include the limitation of public access to the easement land to satisfy the property owner and the granting of ecological management rights to the city to satisfy the city's needs.

Another possibility involves the purchase of the entire parcel of property abutting creeks whenever it goes on the market. Key parcels for flood control could be targeted. Since much of Gainesville along creeks has been built out, this option can contribute, but not necessarily solve, creek management issues. Moreover, with acquisition comes management, already an issue for many local governments, including Gainesville and Alachua County.

Education of the general public can play a very important role in improving the quality of local creeks. Increasing community awareness that individual actions, such as the use of excess fertilizer on lawns, can affect water quality will encourage individuals to change their behaviors. Education campaigns can help reduce the levels of "pointless" non-point pollution. Such campaigns could encourage neighborhood associations to promote watershed-friendly practices.

D. Methods of Financing Watershed Basin Planning

Financing basin management plans is obviously a concern. If a local mitigation program is established by the city, fees paid for mitigation can be directed toward the watershed projects. State and federal governments also offer various grants to assist watershed-planning projects.

Examples of revenue sources include:

- Stormwater Management Utility Fee - This already existing city fee can be increased or

redirected to allocate more funds toward watershed basin management. The county comprehensive plan calls for the establishment of a stormwater utility fee. Combining all or a portion of revenues generated by these fees and dedicating these to joint projects may ban an effective basin planning approach.

- Stormwater Program Fees
- State Revolving Fund Water Pollution Control Program[138] - This program provides low-interest loans for planning, designing, and constructing water pollution control facilities. Nearly any type of water pollution control activity is eligible for funding. Funding occurs through federal and state appropriations. Each year DEP solicits project information for pre-construction and construction loans. The loan terms include a 20-year amortization and low-interest rates.
- SWIM and WMD Co-operative Program - While DEP has general oversight of this program, the WMDs are primarily responsible for the planning and implementation of restoration and protection plans. SWIM is designed to correct and prevent surface water problems in water bodies that have state or regional significance. State funding through the Ecosystem Management and Restoration Trust Fund is limited to the costs of detailed planning for and implementation of programs prepared for priority water bodies. Additional funds may come from the federal government, WMDs, and other state programs.
- Section 319(h) Stormwater/Nonpoint Source Grants[139] - These grant funds can be used to implement projects or programs that will help to reduce nonpoint sources of pollution. The projects or programs must be conducted within the state's NPS priority watersheds, which are the state's SWIM watersheds. All projects must include at least a 40% non-federal match. Examples of possible projects include: nonpoint pollution reduction in priority watersheds, public education programs on nonpoint source management, groundwater protection from nonpoint sources, and so on. Approved projects are contracted with the DEP and managed by staff of the Stormwater/Nonpoint Source Management Section.
- Florida Forever[140] - As the successor to Preservation 2000, this program promotes environmental land acquisition, restoration of damaged environmental systems, increased protection of land by acquisition of conservation easements, etc. The city or county can nominate an area needed for watershed basin protection to the state for acquisition.
- Alachua County Forever - This program seeks to acquire, protect, and manage environmentally sensitive lands, protect water resources, wildlife habitat, and natural areas suitable for resource-based recreation. Privately-owned land key for watershed basin protection might be attainable through the funds of this program if the owner is a willing seller.
- Solid Waste Trust Fund.

VIII. EXPERIENCES OF OTHER COMMUNITIES: the Eugene, Oregon Model

One of the best examples of a community addressing wetland issues through a watershed approach is that of Eugene, Oregon. The approach that was used in Eugene is considered rather

[138] <http://www.dep.state.fl.us/water/wff/cwsrf/>
[139] <http://www.dep.state.fl.us/water/stormwater/319h.htm>
[140] <http://www.dep.state.fl.us/lands/carl_ff/>

successful and has served as a model for other areas of the country. Due to the fact that Eugene obtained a good deal of federal funding, and was designed to serve as an important test case for watershed planning, there is currently a wealth of information available about the process used there.[141] The challenge that Eugene attempted to overcome was to "integrate the scientific aspects with human processes, so that sound decisions can be made about the wetland resources."[142]

A complete exploration of the process used in Eugene is beyond the scope of this report. Rather, this report attempts to provide a brief overview of the context of the West Eugene Wetlands Plan. Some of the significant characteristics of the Plan are highlighted. Finally, a general comparison between the situation in Gainesville and West Eugene indicates that there are similarities between the two communities and that further analysis of the experiences in West Eugene may prove especially useful in developing a community watershed plan for the Gainesville area.

A. Overview of the West Eugene Wetlands Plan

The West Eugene Wetlands Plan covers a 16 square-mile area within the city limits of Eugene Oregon. In 1987 a significant amount of wetlands were "discovered" in the city's primary growth area, which had been zoned for industrial use. In order to address the resulting wetlands "crisis," the City opted to undertake a comprehensive planning effort (which was termed a "Wetland Conservation Plan") to address wetland mitigation and development. The City chose to prepare a plan that would identify wetlands in advance and determine, based on study and community involvement, which wetlands deserved protection and which should be designated for eventual fill and development.[143]

In 1989, West Eugene contracted with the Lane County Council of Governments to be the project manager of the West Eugene Wetland Special Area Study. Federal and state regulators agreed to let the City address wetlands through the planning process. This process included wetland inventories and evaluation, seven citizen workshops, field trips, newsletters, hundreds of one-on-one conversations, some field visits to individual properties, development of seven alternatives, and a draft plan. This process culminated in public hearings before Lane

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[141] Much of the relevant information about the West Eugene Wetlands Plan is available online. Links to this information can be reached from the West Eugene Wetlands Program homepage, available at <http://www.ci.eugene.or.us/wewetlands/default.htm>. For a more in-depth overview of the planning process, see "West Eugene Wetlands—From Crisis to Opportunity," available at <http://www.ci.eugene.or.us/wewetlands/CaseStudy/cover.html>. Hereinafter "From Crisis to Opportunity." See also, Steven C. Gordon "An Alternative to the Traditional Wetlands Regulatory Approach: the West Eugene Wetlands Plan and Program." Available at <http://www.ci.eugene.or.us/wewetlands/alts.htm>. Hereinafter "Gordon." For general advice on preparing wetlands management programs, see Hints on Preparing A Comprehensive Wetland Management Plan. Available at <http://www.ci.eugene.or.us/wewetlands/hints.html>. Hereinafter "Hints on Preparing A Comprehensive Wetland Management Plan."

[142] See From Crisis to Opportunity.

[143] See Gordon.

County and City of Eugene Planning Commissions and the City Council and Board of County Commissioners.

In August 1992, the Council and Commissioners adopted the West Eugene Wetland Plan. In 1993 the Plan was submitted to the Oregon Division of State Lands and the Corps. In September 1994, the Division of State Lands, Corps, and the EPA approved the inventory and the Plan. This plan was the first "wetland conservation plan" approved in the state of Oregon. It was also the first plan in the nation to be approved by EPA and the Corps to be followed with a streamlined permitting process, known as the "**abbreviated processing procedure**" (**APP**) and "**letter of permission**" (**LOP**), which the Corps approved in November 1994.[144]

B. Citizen Involvement

One of the defining characteristics of the West Eugene Wetlands Plan was the high degree of stakeholder involvement. State and federal agencies, non-governmental interest groups, and the general public were all included in the planning process. This was done through intensive public outreach programs such as hearings and public workshops rather than by forming a citizen advisory committee.[145] Planning staff made a concerted effort to include the public by attending town hall meetings, preparing and distributing fact sheets, developing a mailing list, and circulating newsletters. The West Eugene Wetlands Plan's vision, its goals and objectives, were greatly influenced by public input.

C. Ability to Secure Funding

Although the Lane County Council of Governments coordinated the plan, much of the work was greatly influenced by a multi-agency technical advisory committee, and many agencies individually contributed significant resources to the effort. EPA facilitated the planning process by providing approximately $250,000 in planning funds; EPA also funded a $50,000 ADID project that mapped wetlands in the area and assessed their functions. EPA has also administered a $100,000 Congressional appropriation to the Lane County Council of Governments to fund development of materials from the West Eugene Wetlands experience as a model for other communities. The Corps also participated in the planning process as a member of the technical advisory committee. The Corps conducted a $300,000 reconnaissance study of the Amazon Channel to determine how environmental values could be improved. The Corps selected West Eugene as a national demonstration site for restoration of prairie type wetlands. The Corps was also a key player in the plan's implementation. The Corps approved the West Eugene Wetlands Plan and worked to establish alternative permitting procedures under Section 404 (requiring letters of permission rather than standard individual permits).[146]

Although it may be unrealistic for other communities to secure such extensive funding, the West Eugene experience illustrates that avenues of funding may be available and that such

[144] See From Crisis to Opportunity.
[145] See *id*.
[146] White and Shabman at 22.

funding can greatly facilitate watershed goals. The fact that so much funding was invested into Eugene reflects the federal intention for the area to serve as a model for other communities; in a sense the project served as a laboratory for other parts of the country. The fact that Gainesville is home to the University of Florida, one of the largest research institutions in the United States, suggests that there may be potential to take advantage of the University's resources. Such resources may include financial assistance or technical expertise of professors and students. Thus, it may be possible for Gainesville to serve as a laboratory for urban watershed restoration in the state.

D. Categorization of Wetlands and Future Use

Wetlands in the Eugene planning area were identified and their functions assessed by an EPA ADID project.[147] Several other studies of the watershed were conducted during the early phases of the planning process. This information was used to develop alternative management categories of wetlands, such as those that were suitable for development, restoration, and protection. This categorization effort was a key element of the plan.[148] It has been noted, "The main strength of the West Eugene Wetlands Plan is that it puts conservation and development decisions within a context; it adds certainty for environmental and development interests."[149]

The final plan categorization mapped the specific wetland parcels that were to be protected, developed, and restored, and uplands to be protected as buffers. About 1000 acres were recommended for protection or enhancement, while 288 were recommended for development. This meant that if fully and successfully implemented, the plan would result in a net gain of wetland function.

A variety of considerations were made in determining wetland parcel designations, including ecological criteria such as water quality and stormwater runoff, socio-economic criteria, such as recreational concerns and proximity to urban services.[150] The categorization process resulted in specific guidelines for wetland mitigation, depending on the characteristics of the particular wetland and its location in the watershed. The final plan was directed at producing an overall net gain of wetland functions.

At the present it is not clear to what extent such an improvement in overall wetland functions is feasible in Gainesville. Nevertheless, there have been increasing efforts to gather data on the creek and wetland systems in the area.[151] Such information could serve as the basis for such categorization systems. Similarly, the comprehensive plan, which reflects an assumption that some wetlands are more appropriate for preservation while others are more appropriate for development, is conducive to categorization. Thus, implementing the existing

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[147] See discussion of ADIDs, above section VI.B.
[148] White and Shabman at 22.
[149] See Gordon.
[150] Details regarding the criteria for categorizing wetlands are given in "The West Eugene Wetlands Plan" Appendix B. City of Eugene, Oregon, 1992.
[151] For example, the Alachua County Department of Environmental Protection is completing a comprehensive Creeks Report.

Gainesville Comprehensive Plan may be well suited to an approach such as that used in the West Eugene Wetlands Plan.

E. Wetland protection methods

The West Eugene Wetlands Plan examined 21 methods for protecting wetland parcels that had been designated for protection through the Plan. Of these methods, six were selected for use in the plan: 1) best management practices, 2) riparian setbacks, 3) environmental or natural resource zoning districts, 4) strengthening existing policies and regulations, 5) public education, and 6) land acquisition. These six recommendations were selected because they could be incorporated into citywide policies and ordinances and applied to designated sites within the study area.

F. Implementation

The EPA, the Corps of Engineers, and the Oregon Division of State Lands have approved the plan. These agencies feel that the plan adequately meets state and federal laws regarding wetlands production and development, including adequate mitigation and alternatives analysis. The Corps is issuing an alternative permitting procedure to help implement the plan. Rather than issue individual permits, the Corps will require "letters of permission" that demonstrate that the proposed development action, and mitigation if necessary, is consistent with the plan. Implementation has also been facilitated by the successful efforts of the Eugene City Council to lobby for Federal Land and Water Conservation Funds to the Eugene District Bureau of Land Management to purchase lands in West Eugene to help implement the plan. As of May 1995, BLM had received $4.47 million of funds for this purpose.[152]

G. Advantages and Disadvantages

The plan is widely seen as a success story and is hailed as a model by Federal agencies and the Association of State Wetland Managers. Unlike many other plans, Eugene attempted to focus on **multiple water resource objectives**, including wetlands protection, stormwater management, water quality improvement, flood plain management, recreation, and economic development. In addition, the plan was completed through extensive public and agency involvement. The plan has been characterized as management-oriented because it includes categorization of sites (i.e. to be developed, preserved, restored, etc.). The Plan exemplifies a categorization effort that is **parcel-specific**, meaning that decisions were made with reference to individual parcels of land rather than in more broadly based rule criteria for future decisions.

Although the West Eugene Wetlands Plan is one of the farthest along of the wetlands plans that were examined in White and Shabman's influential case study report on wetland planning,[153] these authors indicated some of the potential problems associated with watershed

[152] White and Shabman at 22.
[153] See generally White and Shabman.

planning. For example, the overall planning process took over seven years. In addition, even though West Eugene was fortunate to have received Federal funding to carry out the planning process and implement the plan, the costs of undertaking such an extensive planning effort were significant (i.e. staff time, technical studies, etc.). In addition, some problems may have stemmed from the plan's somewhat rigid characterizations. Some landowners whose lands were not purchased by the BLM may have felt that their lands were "taken," while some environmentalists felt that some wetlands were not adequately protected. It has been noted that in light of these concerns, the high degree of planning intensity used in West Eugene may not be appropriate for every part of the country. Further assessment of the level of interest on the part of the Gainesville community and an evaluation of the resources available is necessary to determine whether such an intensive and comprehensive planning approach is feasible for Gainesville.

H. West Eugene and Gainesville

Despite the fact that Gainesville may currently lack some of the extensive federal resources that became available to Eugene, there is much that can be learned from the West Eugene experience. Eugene is similar to Gainesville in terms of its size, the fact that it is has a large state university with technical resources, and most importantly, that it has a relatively small–scale watershed.[154]

There is a good deal of rather detailed information from Eugene's wetland planning experience that is readily available online. Among the resources that have emerged through the West Eugene experience is a list of "hints" on developing a comprehensive wetland plan, which appear very relevant to watershed planning in general. Some of these general recommendations for developing an effective comprehensive wetlands plan are as follows:

1) consider the scope and nature of wetlands
2) conduct good inventory and assessment
3) consider advantages of a comp wetland plan vs. permitting process
4) develop a vision
5) be realistic in assessing development goals and needs
6) think of multiple objectives
7) develop a work program and budget
8) develop citizen involvement program
9) encourage agency cooperation
10) think about implementation early in the process[155]

There is currently a good amount of data and maps available on Gainesville's creek and wetland system. By first clarifying its "vision" for its watershed goals, Gainesville may be better

[154] Gainesville and Eugene both contain a system of creeks, as opposed to rivers, which have been the focus of concern in some other communities.
[155] See Hints on Preparing A Comprehensive Wetland Management Plan.

able to coordinate resources and be more successful in implementing both short and long-term conservation goals. Reference to the experience of Eugene may help facilitate these goals.

XI. CONCLUSIONS AND RECOMMENDATONS

Listed below are some of the significant conclusions of policy importance to establishing basin management plans in Gainesville and Alachua County. Recommendations that will advance basin planning are also provided. These conclusions and recommendations are the result of the research conducted in preparing this report and represent the consensus of the authors.

I. General Basins Characterization

- The City of Gainesville drains, or is drained by, four surface water basins.
- These include the Hogtown Creek Basin, the Blues Creek Basin, the Newnans Lake Basin, and the Paynes Prairie Basin.
- The City of Gainesville and Alachua County share political responsibility for each of these basins.
- Blues Creek, Hogtown Creek and most of the Paynes Prairie Basin are "seep/stream to sink systems," also referred to as closed basins, because they do not drain to larger systems that discharge to tide.
- These systems begin as wetlands then express themselves as surficial watercourses before draining into sinks that connect directly to the Floridan aquifer.
- The Newnans Lake Basin represents the upper reaches of the Orange Creek Basin System, which drains into the Ocklawaha River, which in turn is a tributary to the St. Johns River, which drains to tide.
- Due to nutrient enrichment, Newnans Lake is one of the most eutrophic lakes in Florida.
- However, the principal causes of the high nutrient loading in Newnans Lake remains unclear, but are likely anthropogenic in nature.
- The Paynes Prairie Basin, a state preserve, also largely a closed basin system, is being detrimentally affected by stormwater runoff from severely degraded, highly urbanized creek systems (Sweetwater Branch and Tumblin Creek).
- Hogtown Creek, Sweetwater Branch, Tumblin Creek, and Newnans Lake have all been declared "impaired waters" under section 303(d) of the Clean Water Act.

II. Creek Systems

- The urban creek basins and sub-basins in Gainesville/Alachua County have been significantly impacted by urban development, much of which occurred prior to the emergence of contemporary water management policy.

- In addition to its headwaters the Hogtown Creek Basin supports two other major wetlands. The 8th Ave. Floodplain Wetlands and Hogtown Prairie where the creek discharges into Haile Sink and the Floridan aquifer.

- The Hogtown creek system (including tributaries), Sweetwater Branch and Tumblin creek have historically served as the urban stormwater conveyance system for greater Gainesville, typically without treatment prior to discharge into the creek system.

- Natural topographically determined sub-basins and catchments have been altered through urban stormwater infrastructure that connects to the natural creek system.

    - In many cases there is little detailed information concerning the hydrologic configuration of sub-basins and catchments and how and where artificial conveyances tie into the natural drainage system.

    - In many cases non-point source discharges are collected and discharged to creeks as "point sources."

    - Thus the extent to which stormwater retrofitting can aid rehabilitation of the natural creek system in some areas remains unclear due to limitations on suitable pervious surfaces and urban development intensity.

- Hogtown Creek and its tributaries have begun to cut into the Hawthorne formation increasing phosphorus loading downstream.

- With the exception of its headwaters, Blues Creek lies largely in public ownership.

    - Dominant wetland features associated with Blues Creek are its headwaters, Fox Pond and Sanchez Prairie.

III. Headwaters

- The headwaters for Blues Creek, Hogtown Creek, Possum Creek and Little Hatchet Creek, as well as Turkey Creek, Hatchet Creek, and several tributary creeks flowing into the Santa Fe River all form from a swath of wetlands perched on a topographic high in north Gainesville/Alachua County.

    - The dominant wetland feature in this large wetland complex is known as "Buck Bay."

- Seepage and overflow from this wetlands complex feeds into the creek systems listed above.

- The buck bay wetlands complex is to these creeks what the Green Swamp in Central Florida is to the Peace River, Myakka River, Withlacoochee River, Hillsborough River, and Ocklawaha River.

- A significant portion of the Buck Bay wetlands complex lies over and within the cone of influence of the City of Gainesville well field, which pumps water from the Floridan aquifer.

- The Buck Bay wetlands complex has been significantly impacted by silviculture (ditching, drainage and clear cutting) and urban drainage and is interlaced by several major transportation corridors.

IV. Wetlands

- Most wetlands in the Gainesville basins are riparian wetlands and most riparian wetlands are associated with the Newnans Lake and Paynes Prairie basins.

- There is no reliable estimate of historic wetland loss in the Gainesville basins.

- The rarest wetland type in the Gainesville basins is "ephemeral wetlands."

    - Ephemeral wetlands are wetlands that are seasonally inundated and as a result support unique species compositions.

    - Most remaining ephemeral wetlands are found in the Blues Creek basin.

- Roughly 50% of the wetlands within the City of Gainesville currently enjoy some sort of conservation status.

- Existing and proposed wetland buffers are inadequate to fully protect wetland functions, especially in the case of small isolated wetlands.

    - As a result wetlands will continue to lose functionality as development encroaches on them.

V. Legal/Institutional Considerations

- The basin creeks may not be navigable under Florida law and as a result much of the land beneath the creeks is probably privately owned.

- However navigability is a complex question of law and fact that is addressed on a case by case basis.

- Portions of some of the creeks are subject to drainage easements held by governmental entities but the exact nature and extent of these easements is difficult to ascertain.

    - The extent to which creek rehabilitation or stream enhancement can take place as a matter or right under the authority of a drainage easement is uncertain.

- The City of Gainesville's newly adopted comprehensive plan conservation element mandates basin planning.

- Both the city and the county allow offsite mitigation but restrict its geographic application, to the basins and the county boundary respectively.

    - The county's restriction on mitigation to within its political boundaries may be unlawful.

- Federal and Florida law permit silviculture activities within wetlands and Florida's Right to Farm law restricts local government regulation of such activities.

VI. Planning Approaches

- Both Gainesville and Alachua County are currently undertaking activities that are consistent with and advance basin management planning.

- These activities are consistent with a "management-oriented" approach that emphasizes planning and regulatory flexibility, including off-site mitigation.

- However, these activities are not conducted pursuant to a formal integrated holistic watershed approach pursuant to agreed plan that establishes priorities within individual basins.

- The city of Eugene, Oregon wetlands plan represents a useful substantive and procedural model that could be adapted to Gainesville's needs.

    - The Eugene model also adopts a "management oriented approach."

VII. Recommendations

- City/county intergovernmental basin cooperation should be formalized.
- Basin management and creek rehabilitation plans should be jointly developed.
- City and county creek and wetland regulation and management practices, including offsite mitigation, should be harmonized.
- Basin and sub-basin community support organizations should be established and charged with promoting community basin awareness.
- The extent to which existing creek bottom ownership, drainage easements and buffer jurisdiction can legally support restoration activities should be clarified.
- Dedicated basin maintenance and restoration financing mechanisms should be established.
- The urban stormwater conveyance system should be mapped and its hydrology established.
- Maps depicting artificial drainage should be integrated with maps depicting natural drainage.
- All basin wetlands should be advance identified for preservation, restoration and mitigation, if appropriate.
- Systems of basin importance like the greater Buck Bay wetlands complex/creek headwaters should be a priority for public acquisition and restoration.
- Where creek bottoms and buffers are privately owned, consideration should be given to establishing some form of legal arrangement (such as conservation easements) with property owners to allow creek rehabilitation to occur.
- Realistic restoration and management goals should be established that take into account the current land use and biophysical status of the basins.
- Unnamed regulated creeks should be given names.
- Basin-by-basin creek and wetland management priorities should be established and mitigation-receiving areas should be determined based on these priorities.
- Mitigation projects should be locally monitored and monitoring data should be systematically maintained and reviewed as a function of the basin management planning process.