Santa Fe River Springs Biological/Botanical Survey,
With Focus on Submerged Aquatic Vegetation;
Selected Santa Fe River Springs,
Alachua, Columbia and Gilchrist Counties, Florida
March 2017

Prepared For:
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INTRODUCTION

AUTHORIZATION

Karst Environmental Services, Inc. (KES) was contracted by the Alachua County Environmental Protection Department (ACEPD) (Client) to perform an aquatic biological/botanical survey in order to assist with documenting the current biological/botanical conditions in selected springs along the Santa Fe River. This data will provide baseline information to support springs restoration efforts. The surveys were conducted from March 27 through March 30, 2017. Conditions at that time were ideal for this study, as the river was clear and relatively low due a somewhat dry winter and spring, with all surveyed springs having good flow due to sufficient ground water levels.

The Santa Fe River (SFR) is located in northern Florida, running east to west for a length of 121 kilometers (75 miles). The Santa Fe River flows west from its headwaters at Lake Santa Fe, Little Lake Santa Fe, and the Santa Fe Swamp, near Keystone Heights to its confluence with the Suwannee River near Branford, Florida. The Santa Fe River basin occupies approximately 3,574 km^2 (1,380 square miles). The river runs along, and defines borders for, northern Alachua, south-western Bradford, southern Union, southern Columbia, northern Gilchrist, and south-eastern Suwannee Counties. (Hunn, & Slack, 1983.)

The Santa Fe River consists of two distinct hydrogeologic regimes. The portion of the Upper SFR from Santa Fe Lake and Swamp to just below the Olustee Creek confluence is primarily a surface stream, fed by runoff from lakes, swamps, tributaries, pine flatwoods, and seepage. In this 54 km (33.5 mile) long 'blackwater' section, the river's flow is dark, tannic, and slightly acidic, with low dissolved solids. The falling level of the aquifer in this area has resulted in the Upper SFR's flow often ceasing, and being now largely controlled by rainfall events. Large rainfall events in this portion, especially those that generate flood level conditions, will send high volumes of dark waters downstream.

The remaining 67 km (41.5 miles) of the river, including the Upper SFR downstream from Santa Fe Spring and all of the Lower SFR, flows through a karstic terrane, with a majority of water entering the river derived from the Floridan Aquifer. The river's bottom in this section consist predominantly of exposed bedrock.. The salient feature of the Lower Santa Fe River is its high number and concentration of individual springs and spring groups. The spring groups include those of Hornsby, Poe, Lilly, Rum Island, Gilchrist Blue, and Ginnie/Devil's Eye. The collective effect of the waters discharging from these springs into the waters of the SFR is significant. (Hornsby & Ceryak, 1998.) (Scott, et. al. 2004.)

It is important to note that four of this survey's springs and their runs - Hornsby, Treehouse Rise, Poe and Little Devils Springs are listed as Outstanding Florida Springs (OFS). Six OFS' are located on the Santa Fe River; Ichetucknee Head Springs, Devils Ear/Eye, Poe, Hornsby, Treehouse, and Columbia Springs. Section 373.802(4), Florida Statutes (F.S.), defines "Outstanding Florida Springs" or "OFS" to include all historic first magnitude springs, as determined by the Florida Department of Environmental Protection (FDEP) using the most recent Florida Geological Survey springs bulletin, and the following additional six springs:

DeLeon, Peacock, Poe, Rock, Wekiva, and Gemini. The statutory definition includes the spring runs associated with these springs and spring groups.

In addition, several of these springs are included with two FDEP delineated springshed Priorty Focus Areas (PFA), the Devil's System and the Hornsby-Treehouse Springshed. The Devils System Springshed includes Gilchrist Blue, Naked, Ginnie, July, Dogwood and Twin Springs. (FDEP, 2017.)

PURPOSE

The primary goal of this study was to document current conditions of submerged aquatic vegetation (SAV) in the pools and runs of selected springs in the lower Santa Fe River (SFR), and create a baseline for future surveys. Spring pools and runs surveyed included: Hornsby, Treehouse (aka Double Rise), Poe, Lilly, Rum Island, Gilchrist Blue, Naked, Little Devils (along with Devil's Ear and Eye Springs is part of the Devil's Ear, Eye & Little Devils Complex), July, Ginnie, Dogwood and Twin Springs. See Figure 1.

Specifically, KES designed, planned and conducted a survey of selected spring runs that included taking video and photo documentation of existing conditions, identification of SAV, their distribution and relative abundance, sketch maps, and spreadsheets and narrative reports for each site. See Table 1.

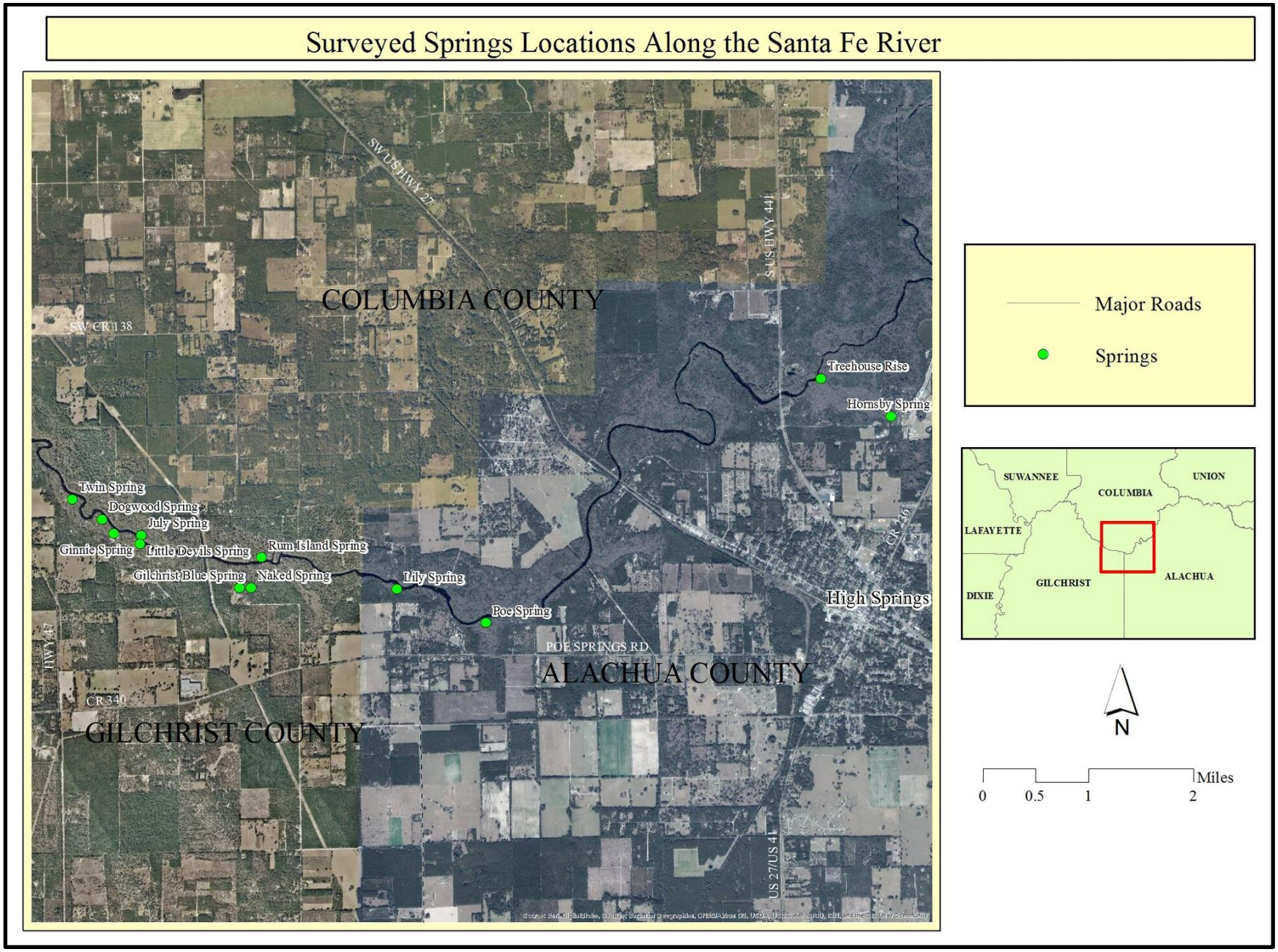

Figure 1. Map of the Santa Fe River Biological/Botanical Study area.

Santa Fe River Spring Runs Sub-Aquatic Vegetation Survey; March, 2017

By Karst Environmental Services, Inc. for Alachua County Environmental Protection Department

Table 1. List of SAV Survey Springs, Locations and Discharges.

Spring Name	County	Santa Fe River Bank Side	Longitude (Decimal Degrees)	Lattitude	Length of Run (In Feet)	Magnitude Rating	Measured Discharge (In CFS)	Discharge Msmt. Date
Hornsby Spring*	Alachua	Left	-82.593201	29.850355	1353	1st	46.27	7/6/2017
Treehouse Rise*,**	Alachua	Left	-82.602877	29.854886	230	1st**	268.04	7/17/2017
Poe Spring*	Alachua	Left	-82.648973	29.825716	300	2nd	40	7/6/2017
Lily Spring	Gilchrist	Left	-82.661212	29.829717	330	2nd	39.69	9/30/1997
Rum Island Spring	Columbia	Right	-82.679831	29.83352	183	3rd	32.11	7/12/2016
Gilchrist Blue Spring	Gilchrist	Left	-82.682851	29.8299	1225	2nd	60.1	7/19/2017
Naked Spring	Gilchrist	Left	-82.681274	29.829918	407	3rd	-	-
Devils Ear, Eye & Little Complex;	Gilchrist	Left	-82.69659	29.835159	300	1st	239	7/21/2009
Devils Ear Spring*	Gilchrist	Left	-82.69662	29.835313	-	1st	120	11/4/1997
Devils Eye Spring*	Gilchrist	Left	-82.696648	29.835151	-	2nd	38.7	4/29/2010
Little Devils Spring	Gilchrist	Left	-82.697022	29.834587	-	3rd	2.06	11/4/1997
July Spring	Columbia	Right	-82.696396	29.836175	180	1st	44.49	7/20/2017
Ginnie Spring	Gilchrist	Left	-82.700121	29.836339	300	2nd	43.22	7/20/2017
Dogwood Spring	Gilchrist	Left	-82.701793	29.838056	230	2nd	5.24	10/10/2006
Twin Spring	Gilchrist	Left	-82.705864	29.840454	200	2nd	19.55	11/4/1997

*Outstanding Florida Spring (OFS)

**Treehouse Rise is a resurgence of Hornsby Spring discharge and Santa Fe River swallet waters, with some additional groundwater components.

Table 1. List of SAV Survey Springs, Locations and Discharges. (Discharge data represents most recent available data from Suwannee River Water Management District.)

SCOPE OF WORK

Survey tasks included:

1. The placement of a fiberglass tape down the approximate center of the spring pool and run, an SAV inventory of the entire pool and run, noting species, location, abundance and conditions relative to the tape and designated transect intervals. and video passes of the entire length of the spring pools and runs. Photo sets of the pools and runs highlighting SAV and general conditions were also taken at regular intervals.

2. Creation of data sets for each spring pool and run.
   A spring run data set includes; SAV data spreadsheet, sketch map, photo set and video.

3. Preparation of a narrative description and summary report for each spring pool and run.

PERSONNEL

Primary KES personnel for this survey included Tom Morris, Biologist and Peter Butt, Project Manager. Support was provided by Matt Hubner, Field Technician and Georgia Shemitz, photography and data support.

The KES team was assisted by ACEPD staff members Greg Owen and Alexandria Whann. Michael Hein of Water & Air Research, Inc. (Water & Air) conducted the algal identification.

METHODS

Submerged aquatic vegetation surveys, along with related photo and video documentation, were conducted at each spring and run site in the following manner:

SUBMERGED AQUATIC VEGETATION SURVEY

1. Open reel fiberglass tapes were used to establish and define the transects used at each spring pool and run. The zero end of a 300 foot tape was secured at an appropriate boundary location at the water's edge on the upstream bank of each spring pool.

2. The tape was deployed and positioned as close as possible down the center of the spring pool and run, so as to divide the pool and run into a right and left side. The reel end of the tape was anchored with metal rods or weights to maintain tension. If a change in run direction during tape positioning was required, the tape was deflected with additional weights at the point of deviation. See Figure 2.

Figure 2. Run transect tapes deployed down the center of Hornsby Spring Run.

3. If the pool and run transect was more than 300 feet long, additional tape(s) of varying length were connected and deployed in a serial fashion.

4. Observations were made using snorkeling gear, with very shallow segments of pools and runs completed by wading.

5. All data and observations were recorded on waterproof plastic slates.

6. A biologist recorded the presence and relative abundance of submerged aquatic vegetation (SAV) present on either side of the tape, typically along fifty foot transect intervals.

7. The relative abundance scale used in the field rated presence as:
   1/Low; present/minimal.
   2/Medium; common in the transect segment.
   3/High; dominant/plentiful.

8. Higher taxa were identified to the genus, and if possible, to the species level. Macrophytic algae (*Chara* sp. and *Nitella* sp.) were identified to the genus level only. Chain forming algae species, with a filamentous habit, were all recorded as Filamentous Algae, and the label will be used in the singular sense, even though disparate taxa were likely present. See Table 2 for a list of the common and scientific names of plants identified in this survey.

9. Spreadsheets for each pool and run site were developed into Tables that list the taxa present, the abundance rating of each taxa in each transect interval and the cumulative abundance score (CAS) of each taxa for the site. The CAS score was made by tallying the relative abundance estimates for each taxon's occurrence in the right and left sides of all the survey intervals. References to the appropriate photos and videos are also listed for each transect interval. Tables 4 through 15 cover all the basins and runs surveyed are included in Appendix I.

10. The CAS of each taxa found along an entire transect is ranked in the 'Description of Vegetation' section of each spring pool and run discussed below. The ranking of the taxa present in each run are listed in descending order of cumulative abundance, with their score listed in parenthesis. Note: Due to the variation in the total transect lengths of each site, the cumulative abundance scores are not directly comparable between sites. The intent of the scores is to provide a summary of vegetation conditions at each site. See Table 3 for a summary of cumulative abundance of vegetation type by spring site.

Santa Fe River Spring Runs Sub-Aquatic Vegetation Survey; March, 2017	
By Karst Environmental Services, Inc., for the Alachua County Environmental Protection Department	
Table 2. List of Vegetation Types Identified During Survey.	
Survey Plant Species List	Name used for the purposes of this Survey & Tables in **Bold.**
Common Name:	**Scientific Name:**
Algae (Filamentous); several possible species/genera, including (but not limited to):	
Water Felt	*Vaucheria* sp.
Lyngbya	*Lyngbya wallei*
Water Silk	*Spirogyra* sp.
Alligator weed*	*Alternanthera philoxeroides*
Bladderwort	*Utricularia* sp.
Chara (Muskgrass)	*Chara* sp.
Coontail*	*Ceratophyllum demersum*
Eelgrass	*Vallisneria americana*
Hydrilla	*Hydrilla verticillata*
Hygrophila	*Hygrophila polysperma*
Ludwigia (Purple ludwigia)	*Ludwigia repens*
Naiad	*Najas guadalupensis*
Spatterdock	*Nuphar advena*
Stonewort	*Nitella* sp.
Tapegrass	*Sagittaria kurziana*
Watercress*	*Rorippa* sp.
Water moss	*Fontinalis* sp.
Water pennywort	*Hydrocotyle umbellata*
*Found at one site only.	

Table 2. List of Vegetation Types Identified During Survey

Santa Fe River Spring Runs Sub-Aquatic Vegetation Survey; March, 2017

By Karst Environmental Services, Inc. for Alachua County Environmental Protection Department

Table 3. Cumulative Abundance Summary of Vegetation Type by Site.

	Cumulative Abundance Scores for each Spring Basin and Run site:											
Site:	**Hornsby**	**Treehouse**	**Poe**	**Lilly**	**Rum Island**	**Gilchrist Blue**	**Naked**	**Little Devils**	**July**	**Ginnie**	**Dogwood**	**Twin**
Date Surveyed:	**3/29/2017**	**3/29/2017**	**3/30/2017**	**3/30/2017**	**3/30/2017**	**3/27/2017**	**3/27/2017**	**3/28/2017**	**3/28/2017**	**3/28/2017**	**3/28/2017**	**3/28/2017**
Length of Survey Transect*:	1353'	230'	300'	330'	183'	1225'	407'	300'	180'	300'	230'	200'
Vegetation Type:												
Algae	125	30	61	34	24	13	18	19	18	12	15	16
Alligator weed**			1									
Bladderwort						1	20	6		6		
Chara						38			1			
Coontail**						5						
Eelgrass						32	11			1		
Hydrilla					8	57	29	4	7	4	6	2
Hygrophila			2	8		14		15	20	3	5	6
Ludwigia	6	1	15	2	16	66	24	3	3	25	16	1
Naiad	114		2			44	25		2			2
Spatterdock	2								2			
Stonewort	12	1		2	1	53	16		5			
Tapegrass	6					84	24			2	1	1
Watercress**						1						
Water moss						20		5	7	7		
Water pennywort	3	1	2	2	2	23	16	4	2	4	6	2

*Note: Due to the extreme variation in the total transect lengths of each site, the cumulative abundance scores are not directly comparable between sites. The intent of the scores is to provide a summary of vegetation conditions at each site.

Abundance Rating:	(Estimate of relative abundance per species at interval.)
Low (or Present)	1
Medium	2
High	3

Survey Plant Species List	Name used for the purposes of this Survey & Tables in **Bold.**		
Common Name:	**Scientific Name:**	**Common Name:**	**Scientific Name:**
Algae (Filamentous); several possible species/genera, including (but not limited to):		**Hygrophila**	*Hygrophila polysperma*
Water Felt	*Vaucheria* sp.	**Ludwigia** (purple ludwigia)	*Ludwigia repens*
Lyngbya	*Lyngbya wallei*	**Naiad**	*Najas guadalupensis*
Water Silk	*Spirogyra* sp.	**Spatterdock**	*Nupahr advena*
Alligator weed**	*Alternanthera philoxeroides*	**Stonewort**	*Nitella* sp.
Bladderwort	*Utricularia* sp.	**Tapegrass**	*Sagittaria kurziana*
Chara (Muskgrass)	*Chara* sp.	**Watercress****	*Rorippa* sp.
Coontail**	*Ceratophyllum demersum*	**Water moss**	*Fontinalis* sp.
Eelgrass	*Vallisneria americana*	**Water pennywort**	*Hydrocotyle umbellata*
Hydrilla	*Hydrilla verticillata*	**Found at one site only.	

Table 3. Cumulative Abundance Summary of Vegetation Type by Site.

PHOTOGRAPHY AND VIDEO

An underwater photographic record of each transect segment was made using a GoPro camera and is included with this report as 'Photo Database'. Each transect photo set was logged/labeled in the field on a slate that recorded run location, date, transect segment and direction of travel. Sets of selected photos, each labeled as "(Site name) Photo #", for each transect segment include views of general underwater and vegetation conditions relative to the fiberglass tape, and salient features and surface views as appropriate. A photographic record was also made of some of the spring pools and runs from the surface using conventional digital cameras. Sets of these photos, with each labeled as "(Site name) Photo #", are also included in this database.

A video record of each transect was made using a GoPro camera and is included with this report as 'Video Database'. Each transect video was logged/labeled in the field on a slate that recorded transect location, date and direction of travel along the transect. Videos record general underwater and vegetation conditions relative to the fiberglass tape and other salient features. Surface views were often included at the start and finish of each video. Areas too shallow for underwater video were also recorded as surface views. While some runs were recorded as a single continuous video, others may have two or more separate videos of the transect traverse. Videos are labeled with the site name, fiberglass tape reference and date. At the end of runs having confluence of each spring run with the SFR, video transects were made of the river bottom from the run confluence across to the opposite bank of the SFR, and then back across to that run's confluence. These transects are labeled with the preface 'SFR X-sec @'.

GIS AND MAPPING

Maps were created using lattitude and longitude marks collected in the field in conjunction with photo sets using a Garmin GPS 76 Marine Navigator, and a Garmin GPSMaps64. Lattitude and longitude were collected in the WGS 84 datum, and uploaded to Arc Map to generate maps for the report. Lattitude and longitude locations which were obviously wrong due to instrument error were corrected in Arc Map, using field notes and aerial imagery as a guide when selecting placement of photo locations. Maps are included in the text as Figures.

ALGAE AND OTHER SAMPLING AND ANALYSIS

ACEPD staff collected benthic algae, Gastropoda (snails) and additional SAV samples from selected springs. The samples were delivered to Water & Air Research, Inc. of Gainesville Florida for identification of taxa.

WATER QUALITY SAMPLING AND ANALYSIS

Water quality grab samples were collected by ACEPD staff and shipped to TestAmerica Laboratories, Inc. of Savannah, Georgia, for nitrate-nitrite as N, potassium and phosphorus analysis. Additional field parameters were measured by ACEPD staff with a YSI Professional Plus Multiparameter meter for specific conductance, temperature, pH and dissolved oxygen, along with turbidity. See Table 18 and TestAmerica Analytical Report in Appendix III.

RESULTS AND OVERVIEW

The SAV of twelve spring pools and runs along the lower SFR were surveyed along tape transects for species composition, distribution and relative abundance. Twelve species of higher taxa, two species of macrophytic algae, one species of aquatic moss and several types of filamentous algae were present in varying amounts. See Table 2 for a list of common and scientific names of extant SAV, and Table 3 for a summary of Cumulative Abundance Scores for SAV at each spring. Tables 4 through 15 shows the occurrence and abundance ratings for SAV, by interval, along each transect as well as cumulative abundance scores (CAS). Table 16 shows algal taxa identified by Water & Air at six springs. Table 17 includes Gastropoda and other vegetation identifications, also by Air & Water. Table 18 shows recent water quality data for all survey springs.

Of the nine parameters shown in Table 18, nitrate-nitrite (as N) was of interest, as it ranged from 0.21 mg/L at Poe Spring, to 2.4 mg/L at Gilchrist Blue Spring. All of the springs surveyed, with the exception of Poe Spring, were above 0.35 mg/L, the Florida numeric nitrate criterion for spring vents and the nitrate concentration-based Total Maximum Daily Load (TMDL) for the Santa Fe River system. Dissolved oxygen (DO) ranged from 0.2 to 3.81 mg/L, with the highest values in the springs of the Devils System springshed.

Filamentous algae was present at every spring and was the dominant or near dominant vegetation type at nine springs, based on its percentage of the cumulative abundance scores (PCAS), which ranged between 26 percent at July Spring to 91 percent at Treehouse Rise. It comprised less than ten percent of the cumulative abundance score at only two springs, Gilchrist Blue Spring and Naked Spring , with its lowest PCAS of about three percent recorded at Gilchrist Blue Spring. At six of the springs (Poe, Rum Island, Little Devils, July, Dogwood and Twin) algal biomass was present at moderate nuisance levels, and at three springs (Hornsby, Treehouse and Lily) it was present at extreme nuisance levels. Every spring, except possibly Gilchrist Blue Spring and Naked Spring, would probably have greater nuisance levels of filamentous algae if recreational activities did not detach benthic filamentous algae from substrates.

Ludwigia and water pennywort were the only other taxa present at every spring, with their highest PCAS of 33 and 12 percent, respectively, recorded at Dogwood Spring. Ludwigia was also a significant part of the SAV at Rum Island Spring (32 %), Ginnie Spring (39%), Poe Spring (18%), Gilchrist Blue Spring (15%) and Naked Spring (14%). Ludwigia biomass did not reach nuisance levels at any spring.

Naiad was present at six springs, with a high PCAS of about 43 percent recorded at Hornsby Spring. It was also a significant part of the SAV at Gilchrist Blue Spring and Naked Spring, with PCAS of about 13 and 19 percent, respectively. Naiad biomass reached nuisance levels only at Hornsby Spring.

Eelgrass and tapegrass are considered ecologically significant hallmark species for Florida springs, and were once common in the spring pools and runs of the lower SFR, as well as the SFR itself. Eelgrass was present at only three springs, and was a small but significant part of the SAV only at Naked Spring and Gilchrist Blue Spring, with PCAS of six and seven percent, respectively. Only a very small remnant stand was present in the Ginnie Spring pool. Tapegrass

fared somewhat better, being present in six springs. However, it was a significant part of the SAV only at Gilchrist Blue Spring and Naked Spring, with PCAS of 19 and 13 percent, respectively.

Hydrilla, an invasive exotic species, was present at eight springs, with its highest PCAS of about 16 percent at Rum Island and Naked Springs, 12 percent at Gilchrist Blue and Dogwood Springs, and ten percent at July Spring. It is worthy of mention that the Little Devils Spring pool and run were at one time almost completely filled with hydrilla in spite of repeated hand-removal efforts, but was present in low amounts during this study, with a PCAS of only 7 percent. Hydrilla biomass did not reach nuisance levels at any spring.

Hygrophila, a more recent exotic invader in the SFR, was also present at eight springs. It was most abundant at July Spring with a PCAS of about 30 percent, followed by Little Devils Spring (mostly near the SFR) with a PCAS of about 27 percent, Twin Spring (20%) and Lily Spring (17%). It was only a small part of the more diverse SAV at Gilchrist Blue Spring (3 %), possibly a result of resistance to invasion by established plant communities. However, the former owners of Blue Spring Park and Campground have engaged in hand removal of hygrophila in the past (Kim Davis, personal communication) Hygrophila biomass reached nuisance levels only at July Spring and near the SFR at Little Devils Spring, with PCAS of about 30 and 27 percent, respectively.

Gilchrist Blue Spring and the associated Naked Spring had the healthiest and most diverse SAV of all the springs surveyed. Gilchrist Blue Spring had the highest number of taxa (14) and the most extensive aquatic beds, with only 16 percent of its CAS comprised of hydrilla and hygrophila, the two dominant invasive aquatic plants in the lower SFR. Naked Spring had nine taxa, five less than Gilchrist Blue, but these were more evenly represented than the Blue Spring taxa. Hydrilla and hygrophila also comprised 16 percent of the CAS at Naked Spring.

July Spring had extensive and dense beds of SAV, but these were dominated by hydrilla and hygrophila, which made up 40 percent of the CAS. Filamentous algae comprised another 26 percent of the CAS, while six other taxa made up the remainder.

Hornsby Spring run also had extensive and dense SAV beds, but these were dominated almost exclusively by filamentous algae and naiad, which made up 47 and 43 percent of its CAS, respectively, or 90 percent of its total CAS. Algal and naiad biomass was present at high nuisance levels. Both taxa formed long thick strands in the brisk current of the run. Most surfaces were covered with nuisance level growth of filamentous algae in the spring pool.

Treehouse Rise was almost completely dominated by extremely dense beds of filamentous algae, comprising over 90 percent of its CAS. Algal biomass was present at extreme nuisance levels and formed long thick ropey strands in the moderate current of the run.

NARRATIVE DESCRIPTIONS

HORNSBY SPRING POOL AND RUN

LOCATION AND DESCRIPTION

Hornsby Spring is located in Camp Kulaqua 1.6 miles north of High Springs approximately 0.6 miles inland from the left bank of the Santa Fe River (SFR), in Alachua County. It is historically a first magnitude spring, and is listed as an OFS. The spring pool has been developed and managed as a private park recreation area. See Figure 3. This survey of Hornsby Spring pool and run was conducted on March 29, 2017, between the hours of 10:45 to 14:50. (All times presented herein are Eastern Standard Daylight Savings Time.)

The spring pool is roughly circular and about 140 feet in diameter. Water discharges from a large vent that is about 30 to 40 feet deep and a smaller vent to the south that is about 15 feet deep; most of the pool is less than five feet deep with a sandy bottom. The run flows westerly for about 5000 feet to the SFR. The upper part of the run flows through low floodplain swamp in a fairly well defined channel, which varies in width from about 30 to 50 feet, and is up to seven feet deep. About 1400 feet down the run, near the downstream end of the vegetation survey, some of the flow enters Treehouse Swallet and is conveyed underground to the SFR. Flow in this conduit reverses direction during floods and Treehouse Swallet functions as a rise.

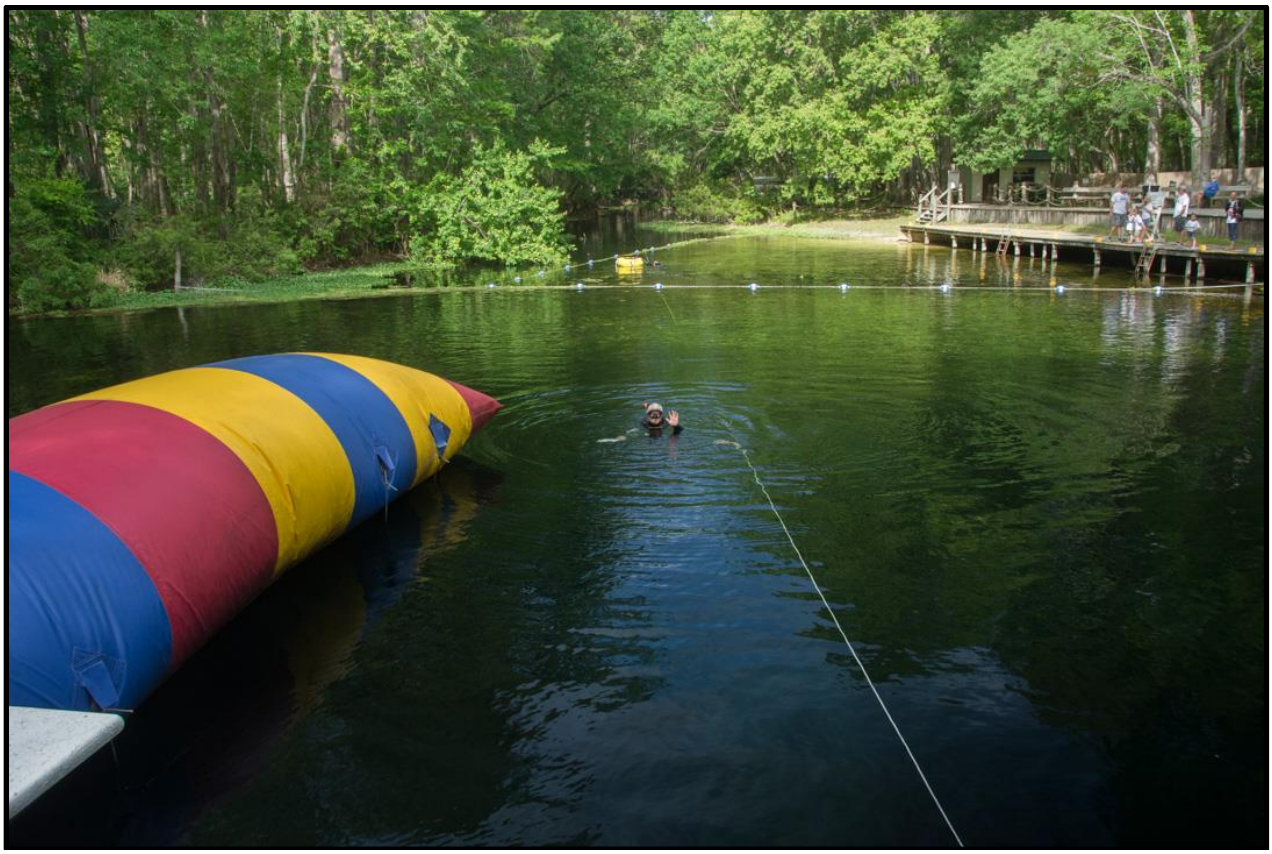

Figure 3. View of Hornsby Spring pool and run.

Below Treehouse Swallet the run enters a broad swampy area, flowing among and around bald cypress (*Taxodium distichum*), gum (*Nyssa* sp.) and ash (*Fraxinus* sp.) trees for about 1600 feet to Hornsby Swallet, which directs the flow underground to the SFR at Treehouse Rise. This was the historic end of the surface run, except during floods, until a narrow canal, about 2000 feet long, was dredged to the SFR at Darby Spring, just above the Highway 441 bridge. (Butt, et. al. 2017.) See Figure 4.

TRANSECT PLACEMENT

The survey tape was run out and positioned five times, in a sequential manner, for a total transect length of 1,353 feet, encompassing four 300-foot and one 153-foot tape run. See Figure 5. The transect started at the shoreline immediately north of the diving board platform in the Hornsby Spring pool, and ended just upstream of the Treehouse Swallet. At several locations an intermediate location on the tape was anchored to the bottom where a change in direction was required to maintain appropriate positioning. The tape was the reference for vegetation occurrence and abundance estimates, made within 26 50-foot survey intervals and one 53-foot interval. (See Hornsby Photos 1-109.)

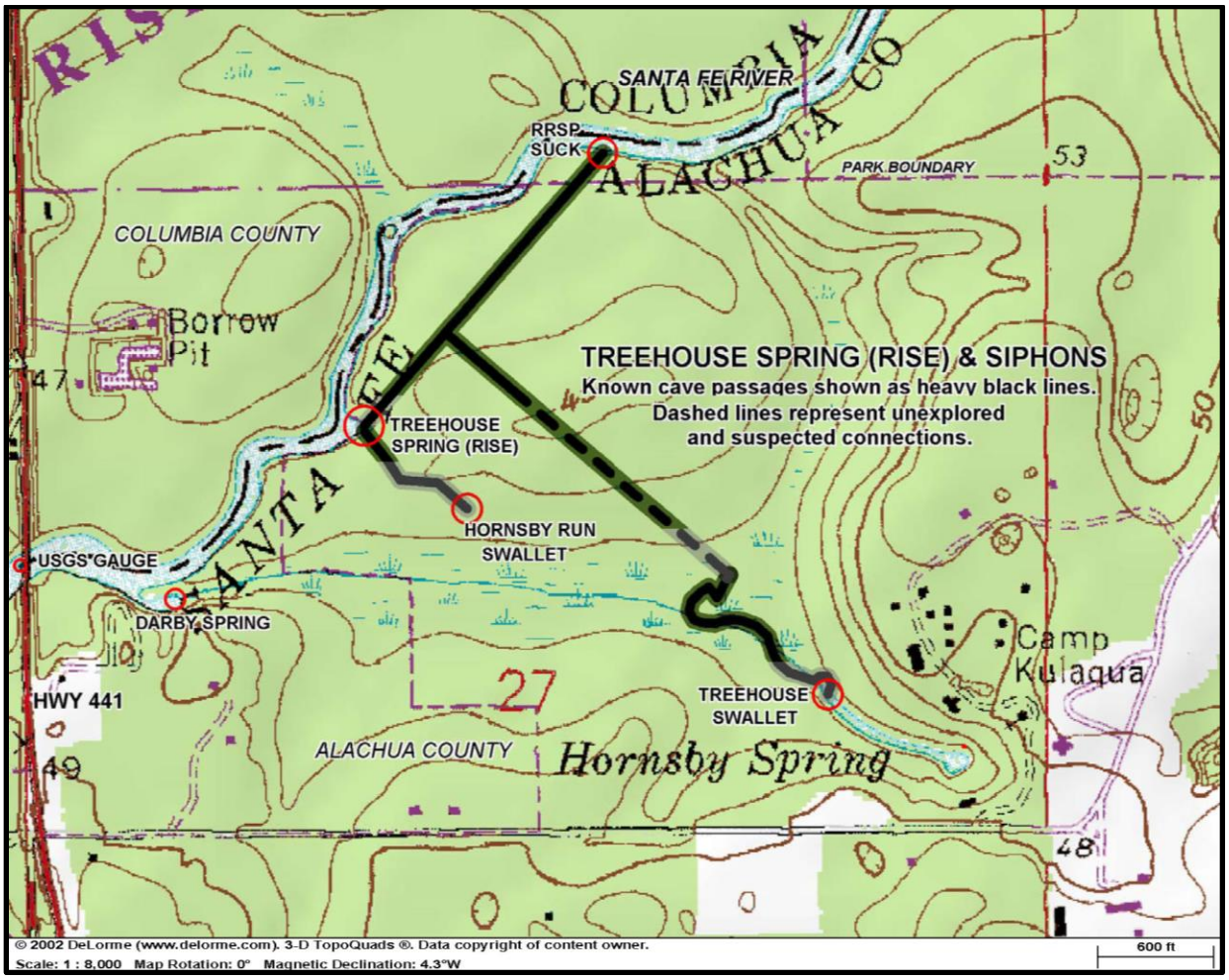

Figure 4. Map of the Hornsby Spring area, showing relationship of run swallets, cave passages, rises and the Santa Fe River. (From Butt, et. al. 2017.)

DESCRIPTION OF VEGETATION

Seven taxa were found in the pool and run. The ranking of each taxa, in descending order of cumulative abundance, and their score (in parenthesis) is: filamentous algae (125); naiad (114); stonewort (12); ludwigia (6); tapegrass (6); water pennywort (3); and spatterdock (2). See Table 4; Hornsby Spring Cumulative Abundance Summary of Vegetation Type in Appendix I. (See Table 2 for a complete list of the common and scientific names of plants identified in this survey. See Table 3 for the summary of cumulative abundance of vegetation type by spring site.)

The first 200 feet of the transect, encompassing four survey intervals, lies mostly within the spring pool and was dominated by benthic filamentous algae, which covered most surfaces in varying amounts, and received a high cumulative abundance rating. A very small amount of spatterdock was present in the pool. Spatterdock remained uncommon in the rest of the 1,353 feet of transect, observed only one more time in the 350 to 400-foot interval.

At 200 feet the pool narrows to form the spring run. Shadier conditions prevail in the run, but filamentous algae abundance remained high. For the remainder of the 1,353 feet of transect, filamentous algae was present in every survey interval, usually in moderate to high amounts. Naiad first showed up in the 200 to 250-foot interval and was present in this and all remaining intervals in moderate to high amounts. From this point onward, naiad and filamentous algae were the dominant vegetation in the run.

Stonewort was present in low to moderate abundance in seven of nine 50-foot intervals between 300 and 750 feet. It was not present in the run below 750 feet.

Tapegrass occurred in low abundance within five intervals, but was most abundant in the swift current of the shallow waters near the transect end.

A single algal grab sample was collected 250 feet downstream along Tape 2 by ACEPD. Algal samples were identified by Water & Air and found to be dominated by *Batrachospermum macrospora*. For the complete report of filamentous algae present, see Table 16 in Appendix II.

OBSERVATIONS AND COMMENTS

Water movement (flow rate) was gentle in the spring pool allowing filamentous algae to form many vertical stalagmite-like structures. This growth habit is a result of diurnal oxygen production and subsequent bubble entrapment in the algal mass, creating buoyancy, which lifts up part of the mat, creating a "lava lamp" effect. In the spring run the current increased significantly, and the algal masses tended to form long horizontal strands and patches oriented downstream. Naiad and stonewort also displayed this growth form but in a more extreme fashion. In many parts of the run, the elongated vegetative masses almost filled the run, forcing the investigators to swim through narrow channels.

Unidentified hydrobiid snails (Family Hydrobiidae) were present in very low numbers in the pool and the first hundred feet of the run. However, their numbers increased markedly below the first boardwalk gazebo at 700 feet downstream, and remained high to the end of the transect. The surfaces of logs and rocks were gritty with their tiny shells, and snails could be observed in fluffy filamentous algae mats, where they were easy to see. (Hydrobiid snails have small,

dextrally-coiled shells and are common throughout Florida, with some species showing a high degree of endemism.)

No other types of snails were observed in the pool and run until the vicinity of the old treehouse, near the end of the transect, where two species of larger snails (a ram's horn type and a spiral type) were present in low numbers. The spiral type was later identified by Water & Air as *Amnicola dalli.*

One loggerhead musk turtle (*Sternotherous minor minor*) was seen about half way down the run. This species is reported to have been once common here, but has suffered a decline in numbers (Jerry Johnson, personal communication).

Tom Morris (personal communication) examined the spring run down to Treehouse Swallet in August 2015. He found it almost devoid of submerged aquatic vegetation, except for a few sprigs of naiad and sagittaria and estimated that benthic filamentous algae covered over 90% of the bottom.

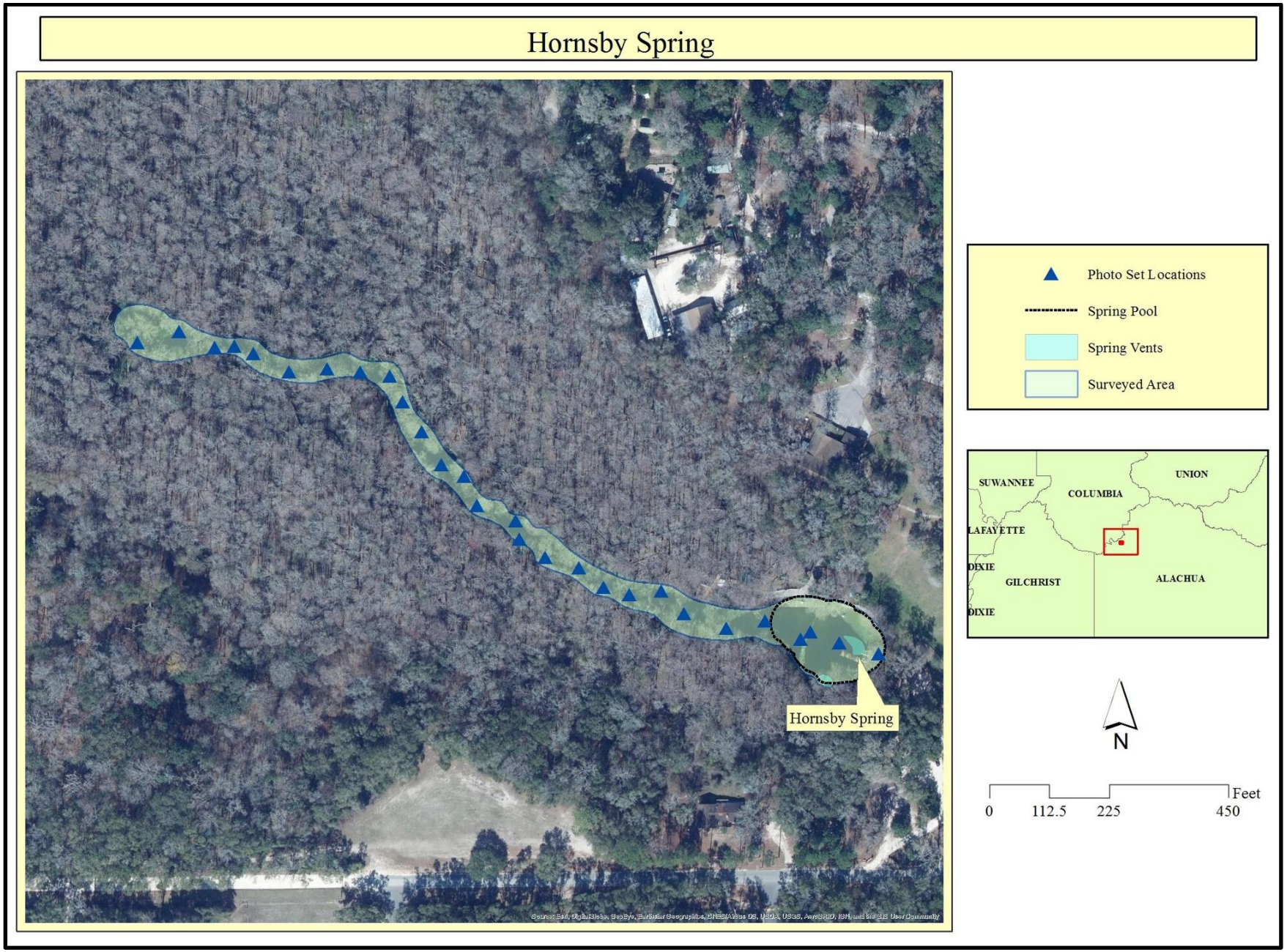

Figure 5. Map of Hornsby Spring pool and run. Shaded area covers survey transect.

TREEHOUSE RISE POOL AND RUN

LOCATION AND DESCRIPTION

The Treehouse Rise pool and run, also known as Treehouse Spring, is located in a cove about 2,100 feet upstream of the Hwy 41/441 bridge on the left bank of the SFR, in Alachua County. See Figure 6. This survey of the Treehouse Rise pool and run was conducted on March 29, 2017, between the hours of 16:37 to 17:15.

The Treehouse Rise pool is the terminus for two large underwater caves, the Boundary Swallet Cave (shown as RRSP Suck on Fig. 4) and Hornsby Run Swallet Cave, whose downstream entrances are located near each other along the northern and eastern side of a steep-walled 40 to 50 feet deep pool. The caves discharge a mixture of surface water and groundwater into the Santa Fe River. Beyond the deep pool, the Treehouse Rise run is shallow, less than about four feet deep, with a rocky bottom. Soft sediments, consisting mainly of fine sand, are present along the pool and run margins. There was a gentle current in the run during the survey. The hydrology of the area is complex and deserves a brief description, as it has a direct bearing on Treehouse Rise water quality.

Figure 6. View of Treehouse Rise towards the Santa Fe River.

A portion of SFR flow is shunted underground at Boundary Swallet, located about 2,500 feet upstream to the northeast of Treehouse Rise along the left bank of the river. The lost water resurges some time later at Treehouse Rise. However, the hydrology is complicated by a smaller cave, Treehouse Swallet Cave, which is an underground tributary to Boundary Swallet Cave along its east wall. This cave is a conduit for Hornsby Spring water that has gone underground in the Hornsby run at Treehouse Swallet, about 2,600 feet to the ESE of Treehouse Rise. Furthermore, a vertical conduit in the floor of the Treehouse Swallet Cave adds a significant volume of clear groundwater to the flow of the cave. These disparate waters discharge at the Boundary Swallet Cave Rise portion of the Treehouse Rise pool. (Woody Jasper and Tom Morris, personal communication.) (Butt, et. al. 2017.)

Hornsby Spring discharge that is not captured by Treehouse Swallet continues down a swampy run to Hornsby Run Swallet, where it flows underground to discharge in the Treehouse Rise pool at the Hornsby Swallet Cave Rise portion of the Treehouse Rise pool. When the SFR water levels are sufficiently high a portion of the Hornsby Spring discharge continues past the Hornsby Run Swallet to the SFR via a small dredged canal. See Figure 4.

TRANSECT PLACEMENT

The survey tape was secured at the shoreline at the east end of the Treehouse Rise pool, and was laid out almost due west in a straight line for 230 feet, which positioned it more or less down the middle of the pool and run. See Figure 7. Part of the transect passed over the deep part of the pool. The run terminus was not well defined, and was estimated by referencing shoreline geometry. The far end of the tape was anchored with weights. The tape was the reference for vegetation occurrence and abundance estimates within four 50-foot and one 30-foot survey interval. (See Treehouse Photos 1-16.)

DESCRIPTION OF VEGETATION

Four taxa were found in the pool and run. The ranking of each taxon, in descending order of cumulative abundance, and their score (in parenthesis) is: filamentous algae (30); ludwigia (1); stonewort (1); and water pennywort (1). See Table 5; Treehouse Rise Cumulative Abundance Summary of Vegetation Type.

Filamentous algae dominated almost all surfaces of the Treehouse Rise pool and run, including the rocky bottom, sandy margins, and snags. Where current was of sufficient velocity, generally in the middle of the run, the filamentous algae was strung out downstream in long ropey masses. Ludwigia, stonewort and water pennywort were present in very small amounts, mostly near the shoreline out towards the river.

Algae samples were collected by ACEPD and analyzed by Water & Air. The dominant algae was identified as *Vaucheria* sp. For the complete report of filamentous algae present, see Table 16 in Appendix II.

OBSERVATIONS AND COMMENTS

The algal abundance in the Treehouse Rise pool margins and run would certainly qualify as extreme nuisance overgrowth. SAV was not surveyed in the deep part of the Treehouse Rise pool due to the limitations of visibility and the snorkel gear used.

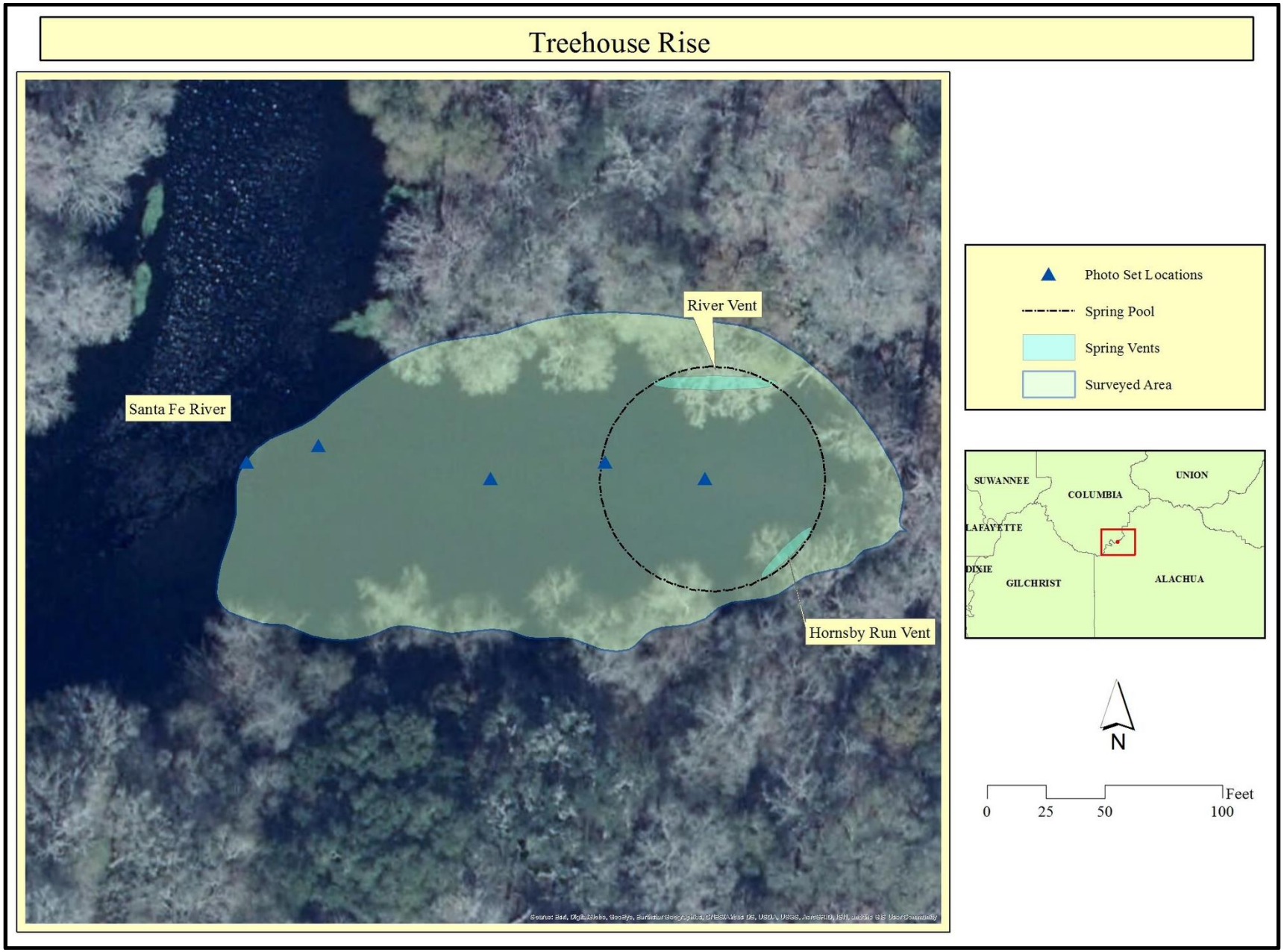

Figure 7. Map of Treehouse Rise pool and run. Shaded area covers survey transect.

POE SPRING POOL AND RUN

LOCATION AND DESCRIPTION

Poe Springs is a second magnitude spring located three miles west of High Springs, on the left bank of the SFR, within Poe Springs County Park, in Alachua County. It has been developed as a recreation area. See Figure 8. This survey of the Poe Spring pool and run was conducted on March 30, 2017, between the hours of 10:06 to 11:15.

Figure 8. View of Poe Spring run, looking from the Santa Fe River towards the spring pool.

The spring pool is about 100 feet in diameter and bordered on one side by a concrete retaining wall. Water discharges from several elongated vents at the bottom of a 20 feet deep conical depression on the south side of the pool. The discharge flows through a shallow 160 feet long and about 15 feet wide run to the SFR. The water is generally clear with a greenish tinge. The shallow parts of the pool and run have a sand, rock, or soft sediment bottom. The deep part of the pool has a sloping sand bottom with limestone exposed around the vents.

TRANSECT PLACEMENT

The survey tape was secured at the southeast bank of the pool, and was laid out northwest in a straight line for 300 feet, which positioned it more or less down the middle of the pool and run. See Figure 9. The run terminus was well-defined by shoreline morphology. The tape was the reference for vegetation occurrence and abundance estimates within six 50-foot survey intervals. (See Poe Photos 1-28.)

DESCRIPTION OF VEGETATION

Six taxa were found in the pool and run. The ranking of each taxon, in descending order of cumulative abundance, and their score (in parenthesis) is: filamentous algae (61); ludwigia (15); naiad (2); water pennywort (2); hygrophila (2); and alligator weed (1). See Table 6; Poe Spring Cumulative Abundance Summary of Vegetation Type.

Filamentous algae was the most common vegetation type present in the spring pool and run, occurring in all six survey intervals. Algae was most abundant in the first four intervals (0 to 200 feet), which included the pool and upper run, receiving mostly high abundance ratings, and moderately abundant in the remaining two intervals (200 to 300 feet), which covered the lower run. Ludwigia, the next most common taxon, was present in every survey interval, usually near the pool and run margins, with mostly low to medium abundance ratings. Naiad, pennywort and hygrophila each occurred in two survey intervals with low abundance ratings. Alligator weed occurred in the first interval, with a low abundance rating.

OBSERVATIONS AND COMMENTS

Filamentous algae was most abundant in the parts of the pool less frequented by bathers, whose activities detach benthic algae. This includes the deep area surrounding the spring vents and the shallow southwest side of the pool where soft sediments and more natural conditions deter bathers. Without recreational impact, the entire bottom of the pool would likely be covered by algae.

Tom Morris (unpublished survey) found small amounts of *Chara sp*. at Poe Springs in August 2015. However, no chara was present during this survey.

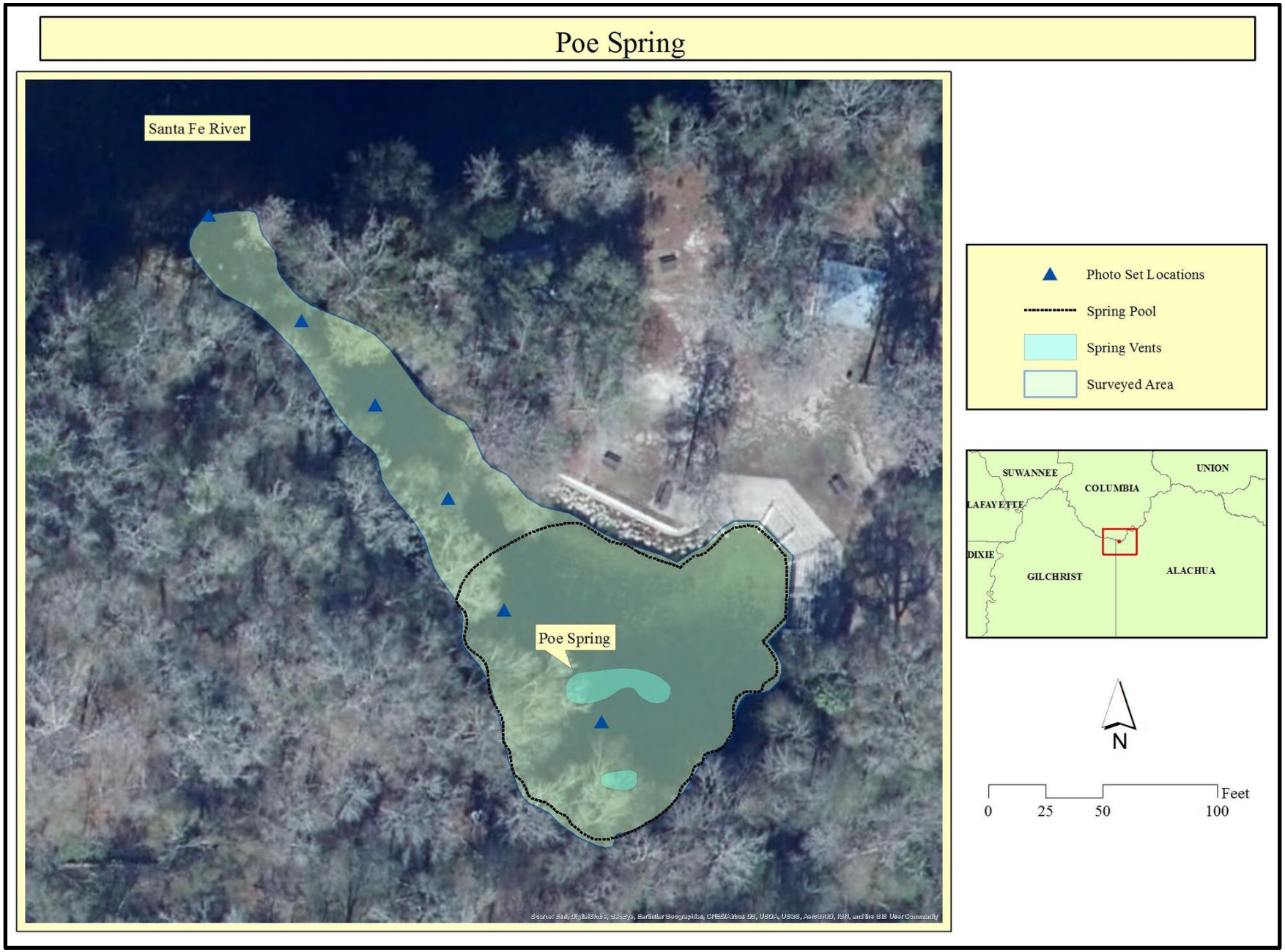

Figure 9. Map of Poe Spring pool and run. Shaded area covers survey transect.

LILY SPRING POOL AND RUN

LOCATION AND DESCRIPTION

Lily Spring is a small privately owned second magnitude spring located about four miles west of High Springs on the left bank of the SFR, in Gilchrist County. Several vents discharge clear but somewhat brownish water into an elongated pool near the head of a shallow 330 foot long run. See Figure 10. This survey of the Lily Spring pool and run was conducted on March 30, 2017, between the hours of 14:52 to 15:36.

Figure 10. View of Lily Springs run towards the headspring area.

TRANSECT PLACEMENT

The survey tape was secured at the head of the pool, about 20 feet upstream and west of the vents. See Figure 11. It was laid out, with several redirections, more or less down the middle of the pool and run, for 330 feet. The run terminus was well-defined by shoreline morphology. The tape was the reference for vegetation occurrence and abundance estimates within six 50-foot and one 30-foot survey interval. (See Lily Photos 1-27.)

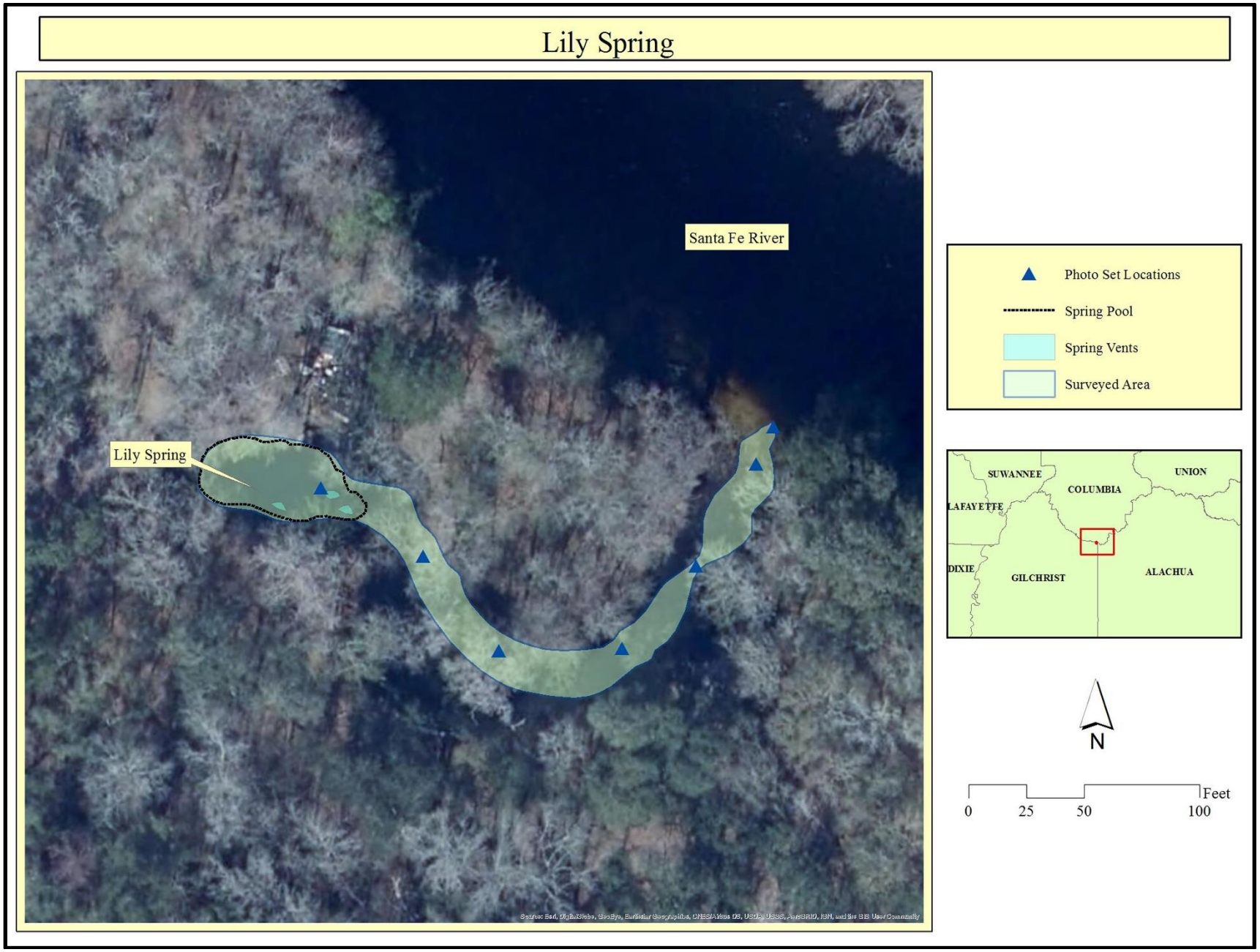

Figure 11. Map of Lily Spring pool and run. Shaded area covers survey transect.

DESCRIPTION OF VEGETATION

Five taxa were found in the pool and run. The ranking of each taxon, in descending order of cumulative abundance, and their score (in parenthesis) is: filamentous algae (34); hygrophila (8); ludwigia (2); stonewort (2); and water pennywort (2). See Table 7; Lily Spring Cumulative Abundance Summary of Vegetation Type.

Filamentous algae was by far the most common vegetation type present in the spring pool and run, occurring in all seven survey intervals. Algae was most abundant in the first three intervals (0 to 150 feet), which included the pool and upper run, receiving high abundance ratings, and moderately abundant in the remaining two intervals (150 to 330 feet), which covered the lower run. Hygrophila was the next most common taxon and was present, with low to medium abundance ratings in the first three survey intervals, usually near the pool margins. Water pennywort, ludwigia and stonewort were present in minor amounts.

OBSERVATIONS AND COMMENTS

The filamentous algal abundance in Lily Spring is well into the category of nuisance overgrowth, especially in the pool and upper run. The lower run supported less algae, but showed evidence of recent disturbance, probably by artifact hunters overturning bottom materials and the frequent walking of the run by paddlers and bathers, activities which would detach benthic algae. Lily is a popular stop for paddlers.

RUM ISLAND SPRING POOL AND RUN

LOCATION AND DESCRIPTION

Rum Island Spring is a second magnitude spring located in Rum Island Springs County Park, five miles west of High Springs, on the right bank of the SFR, in Columbia County. The spring is developed as a recreation area. See Figure 12. This survey of the Rum Island Spring pool and run was conducted on March 30, 2017, between the hours of 12:45 to 13:30.

The spring pool is large, roughly 100 feet in diameter and up to five feet deep, with extensive shallow areas. The ten feet deep spring vent is the deepest part of the pool, and is offset to the west-central part of the pool. There is no well-defined run. The indistinct mouth of the pool, based on SFR shoreline morphology, is about 130 feet wide. Clear spring water forces its way 20 to 30 feet beyond the mouth and out into the river under normal river conditions. When the river rises, the spring is covered with dark river water.

Figure 12. View of Rum Island Spring pool and run, viewed towards the Santa Fe River.

TRANSECT PLACEMENT

The survey tape was secured at the north shoreline of the pool, just east of a wooden deck. It was run out in a straight line for 183 feet in a southwest direction. See Figure 13. The end of the tape terminated beyond the pool mouth, but within the part of the river generally influenced by spring discharge. The tape was the reference for vegetation occurrence and abundance estimates within three 50-foot and one 30-foot survey interval. (See Rum Island Photos 1-15.)

DESCRIPTION OF VEGETATION

Five taxa were present in the pool and run. The ranking of each taxon, in descending order of cumulative abundance, and their score (in parenthesis) is: filamentous algae (24); hygrophila (16); hydrilla (8); water pennywort (2); and stonewort (1). See Table 8; Rum Island Spring Cumulative Abundance Summary of Vegetation Type.

Filamentous algae was the most abundant vegetation type in the Rum Island Spring pool. It was absent in the 0 to 50 feet interval, where bathers in the shallow water detach benthic algae. Farther along the transect, between 50 to 183 feet, algae was present in moderate to high levels in all intervals. The next most common taxon was hygrophila, which was scattered throughout the pool and along the pool margins, from low to high abundance levels. Hydrilla was also scattered in the pool and along the pool margins, ranking from low to high abundance. Water pennywort was present in low amounts in only two intervals, both near the shoreline. Stonewort was barely present, found in low levels at only one shoreline location.

OBSERVATIONS AND COMMENTS

Rum Island Spring is subject to strong recreational impacts. The sandy shoreline and shallow nature of the pool is attractive to families with small children, and their activities have eliminated most of the shoreline and shallow water vegetation, including filamentous algae.

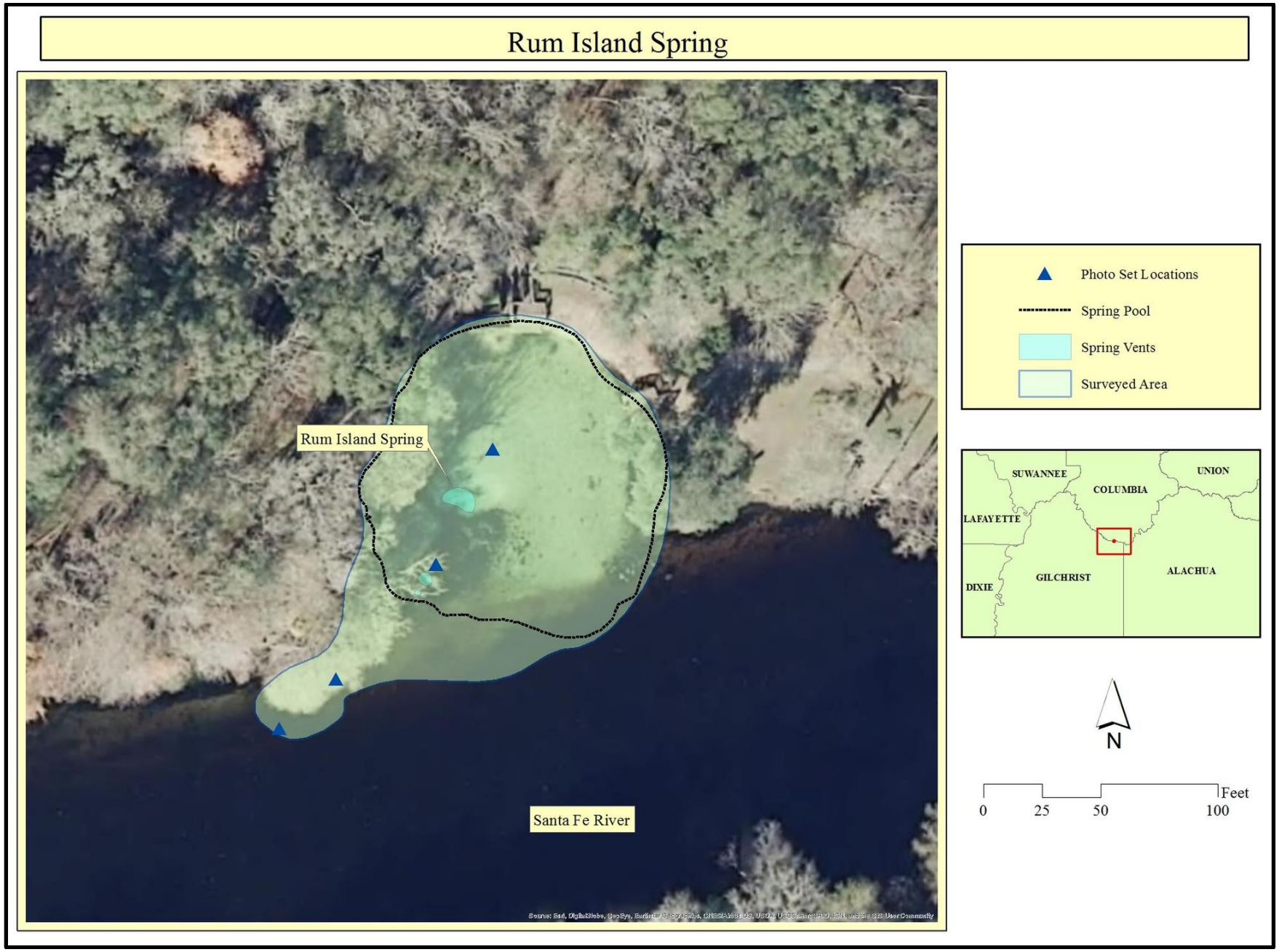

Figure 13. Map of Rum Island Spring pool and run. Shaded area covers survey transect.

GILCHRIST BLUE SPRING POOL AND RUN

LOCATION AND DESCRIPTION

Gilchrist Blue Spring is a second magnitude spring located within Blue Springs Park and Campground, 5.2 miles west of High Springs, on the left bank of the SFR, in Gilchrist County. See Figure 14. The Blue Springs Park and Campground has recently been purchased by the State of Florida.

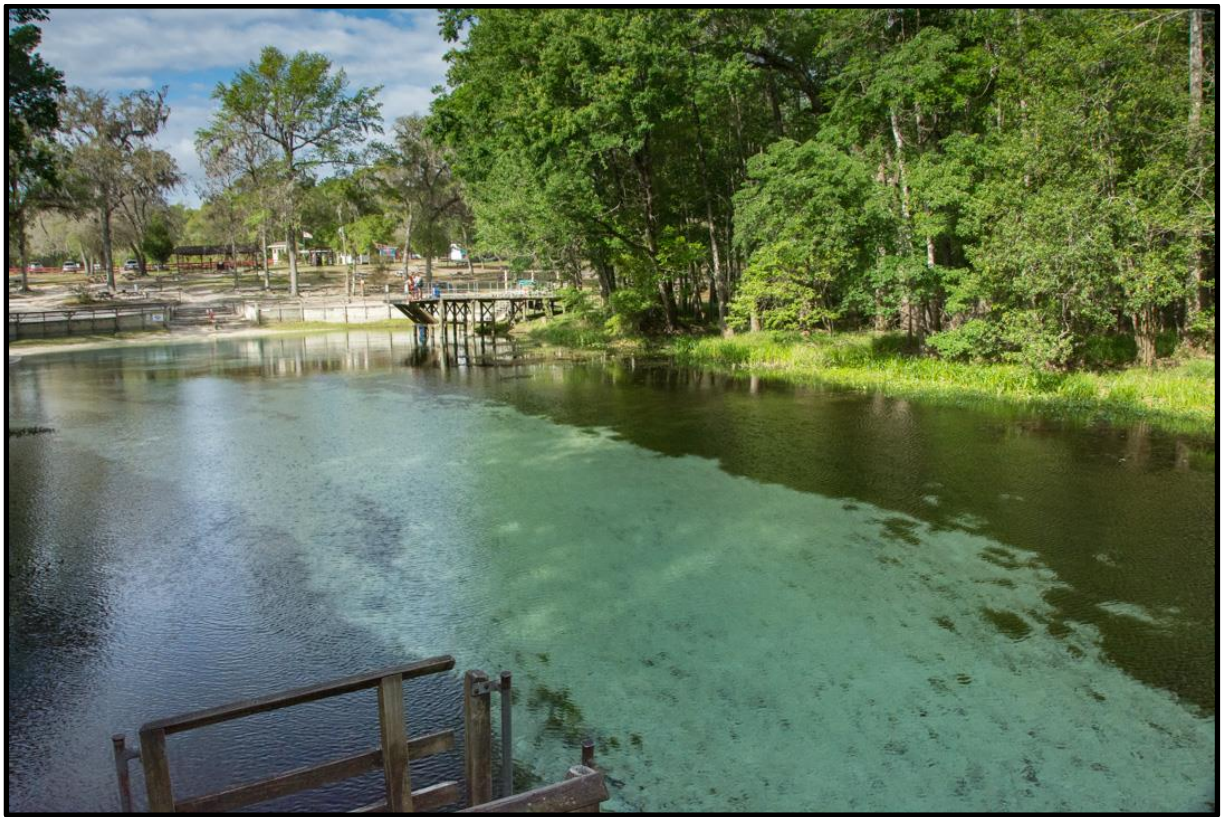

Figure 14. View of Gilchrist Blue Spring run from boardwalk towards the spring pool.

The spring pool lies at the base of a fifteen feet high sandy upland slope at the edge of the SFR floodplain. The pool is about 100 feet in diameter, and groundwater discharges from several linear vents at the base of an underwater limestone bluff at about twenty feet deep. Water flows north through the floodplain for about 1200 feet to the SFR in a run that varies from about 20 to 60 feet wide and from about one to six feet deep. This is the longest and most expansive run in the lower reach of the SFR and tends to be heavily vegetated where recreational activities are limited. This survey of the Gilchrist Blue Spring pool and run was conducted on March 27, 2017, between the hours of 12:30 to 16:35.

Three smaller springs, Naked, Johnson and Little Blue, are tributary to the main run. Naked Spring is the largest, and contributes about a third of the spring group discharge.

TRANSECT PLACEMENT

The survey tape was run out and positioned five times, in a sequential manner, for a total transect length of 1,225 feet, encompassing three 300-foot, one 225-foot, and one 100-foot tape runs. See Figure 15. The transect started at the south shoreline of the pool, just north of a wooden stairway, and ended at the SFR. The tape was positioned more or less down the center of the spring pool, and within a central vegetation-free channel in the run, so as to divide the pool and run into a right and left side.

At several locations the tape had to be anchored to the bottom where a change in direction was required to maintain appropriate positioning. The tape was the reference for vegetation occurrence and abundance estimates, made within one 25-foot, one 29-foot, one 71-foot, one 150-foot, and nineteen 50-foot long survey intervals, for a total of 23 survey intervals. (See Gilchrist Blue Photos 1-108.)

DESCRIPTION OF VEGETATION

Fourteen taxa were present in the pool and run. The ranking of each taxon, in descending order of cumulative abundance, and their score (in parenthesis) is: tapegrass (84); ludwigia (66); hydrilla (57); stonewort (53); naiad (44); chara (38); eelgrass (32); water pennywort (23); water moss (20); hygrophila (14); filamentous algae (13); coontail (5); bladderwort (1); and watercress (1). See Table 9A; Gilchrist Blue Spring Cumulative Abundance Summary of Vegetation Type.

The first survey interval (0 to 71 feet) traversed the length of the spring pool. Most of the shallow part of the pool is free of vegetation due to recreational impacts. Hydrilla and filamentous algae were the only submerged aquatic vegetation in the pool. Hydrilla was most abundant on the slope on the left side of the pool, near the diving platform, but several small patches were scattered about the pool. Filamentous algae cover was sparse and limited to a small loose patch in the deep area east of the diving platform.

The spring run below the pool is characterized by a central channel, with a sandy or rocky bottom, flanked by generally thick beds of SAV. The aquatic beds were almost always wider and more expansive on the left side of the channel. The central vegetation-free channel is the result of recreational impacts, as visitors commonly walk up and down the center of the spring run.

Thirteen species of SAV were present in the aquatic beds flanking the central channel below the spring pool, including bladderwort, chara, coontail, eelgrass, hydrilla, hygrophila, ludwigia, naiad, stonewort, tapegrass, watercress, water moss and water pennywort. Several species, especially tapegrass, occasionally formed moderately-sized pure stands, but generally individual stands were small or of mixed species composition. Filamentous algae was limited to a few small patches in the central channel.

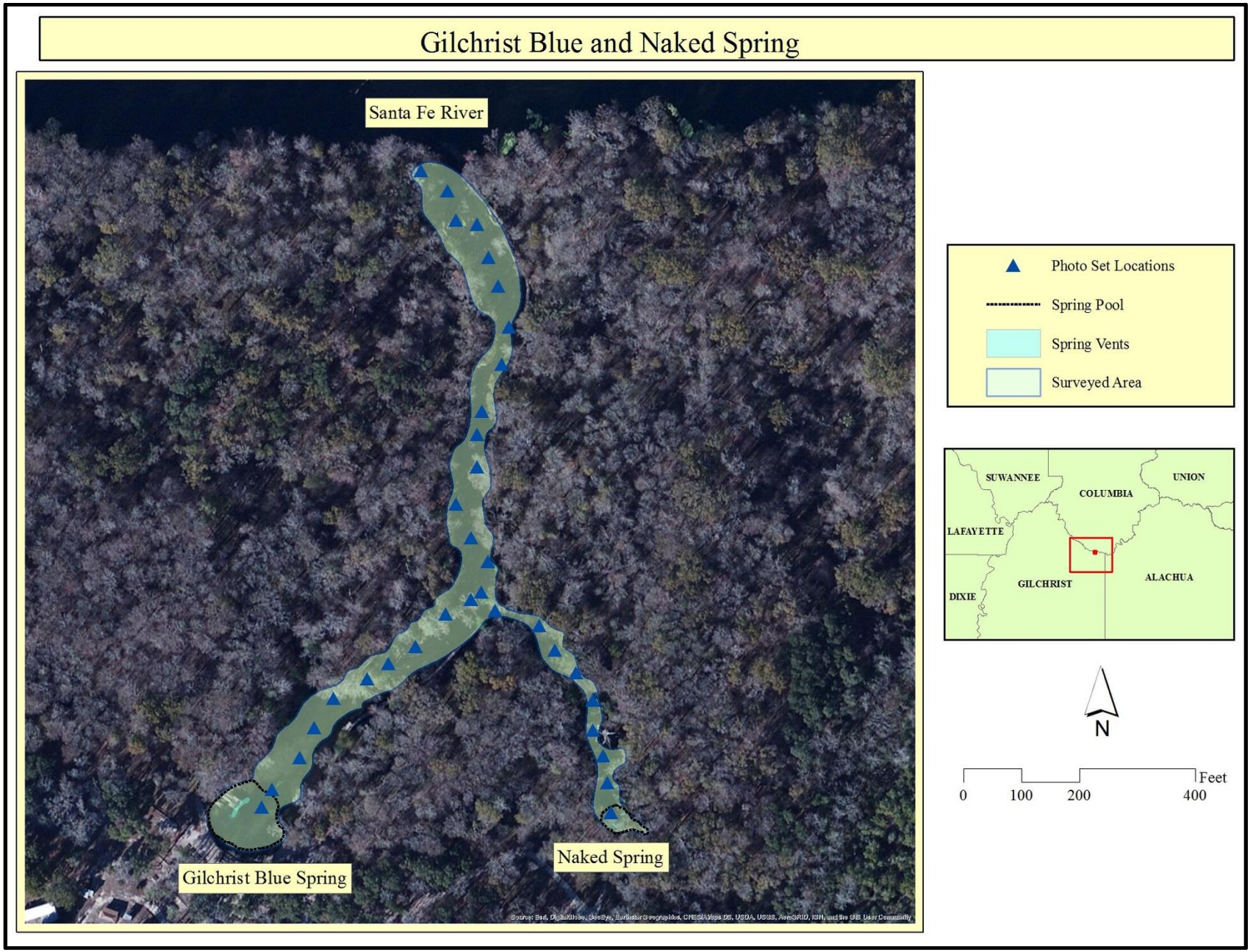

Figure 15. Map of Gilchrist Blue Spring and Naked Spring pools and runs. Shaded area covers survey transects.

Tapegrass, water pennywort, and hygrophila were more abundant on the right side of the transect, while ludwigia, stonewort, chara and eelgrass were more abundant on the left side of the transect. There was not much difference for the other species.

The number of taxa in each survey interval varied from two species (counting filamentous algae as a species) in the pool to eleven species in the 1,025 to 1,075 feet interval. After the large increase in species at the 100 to 250 feet interval, the number of taxa present in each interval generally rose slightly farther downstream and then declined near the SFR.

A single algal grab sample was collected along Tape 3, 175 feet downstream, by ACEPD. Algal samples were identified by Water & Air and found to be dominated by *Vaucheria* sp. For the complete report of filamentous algae present, see Table 16 in Appendix II.

OBSERVATIONS AND COMMENTS

Gilchrist Blue Spring (and the associated Naked Spring) had the healthiest and most diverse flora of the springs examined during this survey. The scarcity of benthic filamentous algae in the pool and the central channel of the run is probably the result of mechanical dislodgement by bathers and the strong current present at the time of the survey. However, the scarceness of filamentous algae in the flanking aquatic beds were flow is gentle (a condition that often favors excessive algal growth) was surprising, especially in light of the nuisance overgrowth of algae in nearby springs. The scarcity of filamentous algae may be the result of competition for space and/or nutrients by other taxa in the aquatic beds.

GILCHRIST BLUE SPRING RUN SUPPLEMENTAL VEGETATION TRANSECTS

A supplemental submerged aquatic vegetation (SAV) survey was carried out in the Gilchrist Blue Spring run on March 31, 2017 by means of cross-sectional line intercept transects. The results are summarized in Tables 9B and 9C, and Figure 16.

Line intercept data is tabulated on the basis of plants lying under a straight line cutting across a plant community. Line intercept transects can define vegetation patterns fairly quickly and provide a useful baseline for future reference. SAV generally spreads by vegetative growth and tends to display clumped or gradient distribution, which lends itself to straightforward description by line intercept transects.

Seven line intercept transect locations were chosen to include representative cross-sections of the Gilchrist Blue Spring run, from just below the spring pool and downstream to near the SFR confluence.

The line intercept transects were set up by stretching a 100 foot fiberglass tape across the width of the run as perpendicular as practicable to the long axis of the run. The management of Blue Springs Park and Campground wanted no permanent stakes, nails, tags, or other markers installed on the dock or along the shoreline; therefore, for each transect the zero end of the tape was temporarily attached to an appropriate easternmost boardwalk piling (with cord) and the reel end of the tape was fixed to a temporary metal stake positioned at the far shoreline (left bank).

Santa Fe River Spring Runs Sub-Aquatic Vegetation Survey; March, 2017							
By Karst Environmental Services, Inc. for Alachua County Environmental Protection Department							
Table 9C. Gilchrist Blue Spring Run Supplemental Vegetation Transects;							
Number/Percent of One-Foot Intervals Encompassing Native/Non-native SAV Species/Bare Bottom.							
March 31, 2017							
	Coverage (in feet)						
Transect #:	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Bare sand	38	10	6.5	16	9	7.5	30
Non-native/Invasive (Hydrilla)	56	44	25.5	2	12.9	0	1.5
Native Species	26	30	57.5	73	75.5	66.5	23
	Percent Coverage (%)						
Transect #:	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Bare sand	32	12	7	18	9	10	55
Non-native/Invasive (Hydrilla)	47	52	28	2	13	0	3
Native Species	22	36	64	80	75	90	42

Table 9C. Gilchrist Blue Spring Run Supplemental Vegetation Transects; Categories of Substrate and Vegetation Cover and Distribution in Feet and Percent.

The line intercept transects were planned to cover the width of the run from bank to bank. The attachment point pilings coincided with the right bank at two of the transect locations, but were between one and ten feet west of the right bank at the other five transect locations. Therefore, the distance from the attachment point to the right bank at the latter locations were measured and recorded as a negative number, with the piling attachment being the zero point. Distances to the left bank from the tape attachment point were recorded as positive numbers.

Hurricane Irma collapsed several sections of the boardwalk in September of 2017 including pilings that were used as transect reference points. However, the piling locations were still obvious, so permanent markers were placed on nearby trees and GPS locations were recorded, so transect locations can be easily replicated.

Vegetation patterns were documented by wading along the tape and observing the distribution of distinctive single or mixed species aquatic beds beneath the tape, the margins of which were defined down to one half foot intervals along the tape. The species within intervals were recorded and estimates of relative abundance on a scale of one through three (for low, medium and high) were made for each species. Data was recorded on plastic slates.

As shown in Table 9B, the seven transects varied in length from 45 feet to 98.5 feet. The vegetative cover across all transects averaged 72%, with a maximum coverage of 86% at three transects, and a minimum coverage of 40% at transect seven, nearest the SFR confluence.

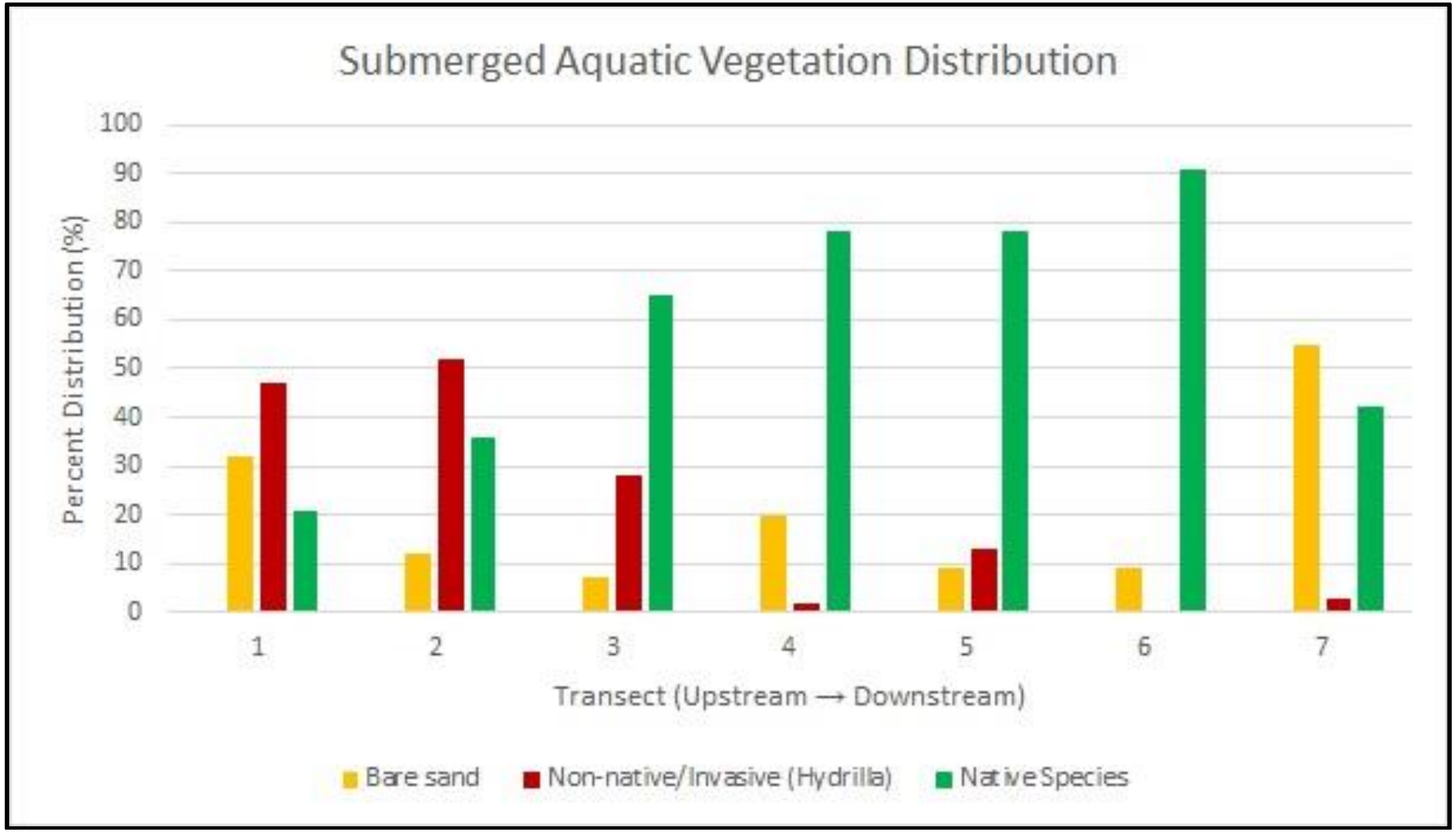

Figure 16. Gilchrist Blue Springs Run Submerged Aquatic Vegetation Distribution in seven cross-sectional transects.

In the upstream six transects the majority of bare bottom, which ranged from 6.5 feet to 38 feet wide, was associated with a vegetation-free central channel, probably kept open primarily by swimmers, waders, and boaters. The proximity of transect seven to the SFR confluence and its periodic dark water influence may be an added factor in its thirty-foot wide vegetation free zone.

Eight taxa of SAV were present along the seven transects, ranging from a low of two taxa at Transect Two to a high of seven taxa at Transect Five. Several species of emergent and floating wetland plants (lily, sedges, water lettuce and water hemlock) were recorded near the shorelines of three transects but are not included in this discussion, which is limited to SAV. Remarkably, no beds of filamentous algae were found along the transects.

The most widespread SAV taxa along the line intercept transects were tapegrass and hydrilla. They were each present in six of the seven transects, and in 22 and 19 of the 57 multi-foot transect intervals, respectively. Ludwigia was present along five transects and in 11 intervals. Musk-grass was present along four transects and in eight intervals. Naiad and watercress were each present along three transects and in six and seven intervals, respectively. Eelgrass was present along two transects and in six intervals. Finally, coontail and water-moss were present along only one transect each, and in one interval each.

Table 9C shows the number of one foot intervals, along each transect, encompassing native SAV species, non-native/invasive hydrilla, and non-vegetated bare bottom. Table 9C shows hydrilla was the dominant vegetation type along Transect 1 (47%) and Transect 2 (52%), while native SAV species were dominant along the remaining 5 transects, ranging from 42% to 90%. Non-vegetated bare bottom ranged from 7% to 55%, and was the dominant bottom type only along Transect 7 (55%).

Figure 16 graphically shows the distribution, in percent, of native SAV taxa, hydrilla and non-vegetative bottom along the seven line intercept transects. As noted above, hydrilla was the dominant taxa at two transects (Transects 1 and 2) but was a minor component at the remaining five transects, especially Transects 4, 5 and 6. Bare non-vegetated bottom was most extensive at Transects 7 and 1, covering about 55% and 32% of the transects, respectively. Native taxa dominated Transects 3, 5 and 6, covering between 65% and 90% of the transects.

NAKED SPRING POOL AND RUN

LOCATION AND DESCRIPTION

Naked Spring is a second magnitude spring located within Blue Springs Park and Campground, 5.2 miles west of High Springs, on the left bank of the SFR, in Gilchrist County, and 520 feet east of Gilchrist Blue Spring. See Figure 17. This survey of the Naked Spring pool and run was conducted on March 27, 2017, between the hours of 17:12 to 18:30.

The spring pool lies along the edge of the SFR floodplain. The five to eight feet deep pool is about 35 feet in diameter, and groundwater discharges from a linear vent at about twelve feet deep. Water flows northwest through the floodplain for about 400 feet to the Gilchrist Blue Spring run. The Naked Spring run varies from about 10 to 25 feet wide with a maximum depth of about five feet.

TRANSECT PLACEMENT

The survey tape was secured at the shoreline at the head of the pool, about 15 feet southeast of the spring vent. See Figure 15. It was laid out, with several redirections, more or less down the middle of the pool and run, for 407 feet, ending at the overhead boardwalk along the main Gilchrist Blue Spring run. The run terminus was well-defined by shoreline morphology.

Figure 17. View of Naked Spring run, from boardwalk towards the headspring.

The tape was the reference for vegetation occurrence and abundance estimates within seven 50-foot survey intervals and one 57-foot interval. (See Naked Photos 1-39.)

DESCRIPTION OF VEGETATION

Nine taxa were present in the pool and run. The ranking of each taxon, in descending order of cumulative abundance, and their score (in parenthesis) is: hydrilla (29); naiad (25); ludwigia (24); tapegrass (24); bladderwort (20); filamentous algae (18); water pennywort (16); stonewort (16); and eelgrass (11). Of the taxa present in Naked Spring, all nine occurred in similar abundance in the first three out of eight survey intervals and eight occurred in the next three intervals. See Table 10; Naked Spring Cumulative Abundance Summary of Vegetation Type.

Vegetation in the middle of the pool and part of the pool shoreline has been heavily impacted by recreational activities, but the rest of the pool supported a lush growth of submerged aquatic vegetation, dominated by bladderwort and naiad. Eelgrass, hydrilla, ludwigia, water pennywort and filamentous algae were moderately abundant, and stonewort was present in low amounts.

The spring run below the pool is characterized by a central channel, with a sandy bottom, flanked by generally thick beds of SAV; the central vegetation-free channel is the result of recreational impacts, as park visitors often walk up and down the middle of the spring run. The same species present in the pool were also present in the run, with the addition of eelgrass. Algae, eelgrass, bladderwort, and water pennywort became less abundant farther downstream, and tapegrass became more abundant.

All taxa were present on both sides of the survey tape in more or less equal abundance, except for water pennywort, which favored the right side of the transect.

OBSERVATIONS AND COMMENTS

Naked Spring had a healthy and diverse flora, similar to Gilchrist Blue Spring. However, the narrow point spread (cumulative abundance score spread =18) highlights the relative uniformity, or evenness, of the vegetation in Naked Spring compared to Gilchrist Blue Spring (cumulative abundance score spread = 83). The most striking difference between the springs was the occurrence of filamentous algae at moderate abundance levels in the Naked Spring pool and among the SAV of the upper run and its relative absence in the Gilchrist Blue Spring run.

LITTLE DEVILS SPRING POOL AND RUN

LOCATION AND DESCRIPTION

Little Devils Spring is a third magnitude spring located 6.2 miles west of High Springs, on the left bank of the SFR, in the Ginnie Springs Outdoors resort, in Gilchrist County. See Figure 18. It is part of the Devils Ear, Eye and Little Devils Spring complex. These springs have been developed as a recreation area. This survey of the Little Devils Spring pool and run was conducted on March 28, 2017, between the hours of 10:45 to 12:00.

Figure. 18. View of Little Devils run, viewed from the headspring towards the Santa Fe River.

The spring pool lies within the SFR floodplain. The rocky pool is oval-shaped and about 50 feet long and 25 feet wide. Groundwater gently discharges vertically from a large fissure in the center of the pool that is about 20 feet long, four feet wide and 50 feet deep. Water flows north through the floodplain in an eight foot deep and 20 foot wide heavily shaded run for about 250 feet to the SFR. The run widens as it passes Devils Eye Spring along its right bank, and approaches its confluence with the SFR. Devils Ear Spring lies in the SFR immediately beyond the run. Devils Eye Spring and Devils Ear Spring, along with July Spring across the SFR, are a first magnitude spring group that discharge groundwater into the river. Cave mapping suggests that the water discharging at Little Devils Spring is distinct from the Devils/July spring group. See Figure 19.

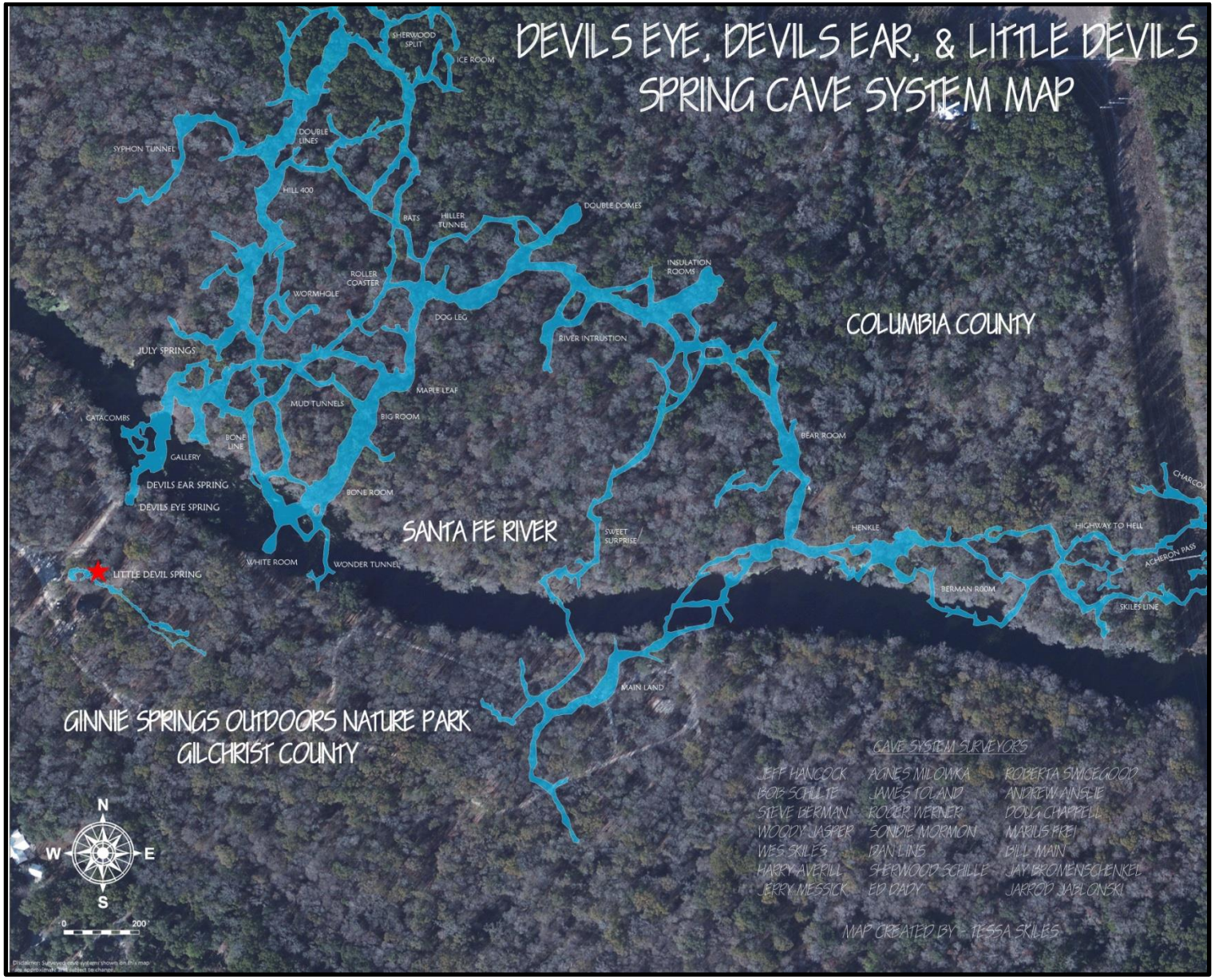

Figure 19. Map of the Devils Eye/Ear Cave System. Devils Eye, Ear and July Springs share a common water source as shown in the map. Little Devils Spring and cave can be seen as separate features that are connected to Devils Eye via the Little Devils Run.

TRANSECT PLACEMENT

The tape was secured at the shoreline at the south end of the Little Devils pool. See Figure 20. The tape was positioned more or less down the middle of the pool and run for 300 feet, with one slight directional deviation, ending just a few feet before Devils Ear Spring. The tape was the reference for vegetation occurrence, and abundance estimates, within six 50-foot survey intervals. (See Little Devils Photos 1-26.)

DESCRIPTION OF VEGETATION

Seven taxa were present in the pool and run. The ranking of each taxon, in descending order of cumulative abundance, and their score (in parenthesis) is: filamentous algae (19); hygrophila (15); water moss (7); bladderwort (6); hydrilla (4); water pennywort (4); and ludwigia (3). See Table 11; Little Devils Spring Cumulative Abundance Summary of Vegetation Type.

Algae was the dominant vegetation type and was present along the bottom and sloping banks on both sides of all seven survey intervals, with low to medium relative abundance scores. Hygrophila was also present in each interval, becoming more abundant near the river. Water moss and bladderwort were mostly confined to the tree root micro-habitat along the banks of the last two intervals, near the downstream wooden stairs on the right bank of the run.

OBSERVATIONS AND COMMENTS

This run at one time supported a large biomass of SAV, but higher taxa were present in only small amounts, especially in the first four intervals of the transect, which are upstream of Devils Eye Spring discharge. The owner and operator of the Ginnie Springs Outdoor Resort believes the decline in SAV biomass is not entirely the result of recreational activities, but possibly due to other, unknown, factors.

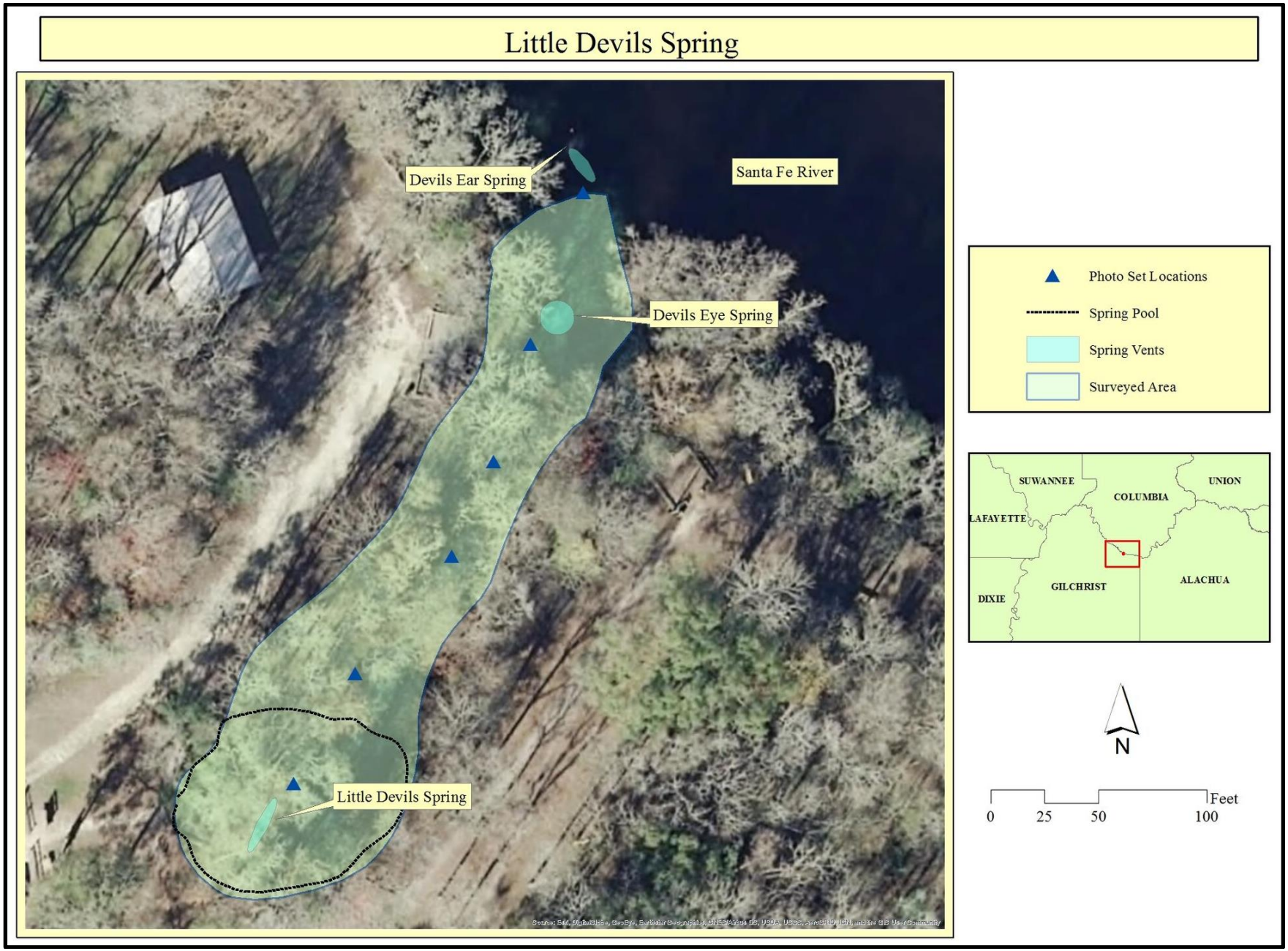

Figure 20. Map of Little Devils Spring pool and run. Shaded area covers survey transects.

JULY SPRING POOL AND RUN

LOCATION AND DESCRIPTION

July Spring is a second magnitude spring located 6.2 miles west of High Springs, on the right bank of the SFR, about 350 feet north of Devils Ear Spring in the Ginnie Springs Outdoors resort, in Columbia County. see Figure 21. The spring is undeveloped and in a more or less natural state but sees frequent use as a recreation area, mainly for snorkeling and swimming. This survey of the July Spring pool and run was conducted on March 28, 2017, between the hours of 12:30 to 13:45.

Figure 21. View of July Spring headspring area.

The pool is about 50 feet in diameter, and groundwater discharges vigorously from a narrow crack in the northeast corner that is about 15 feet long and 12 feet deep. Water flows southwest in a 50 to 70 feet wide run for about 160 feet to the SFR. The average depth of the run is about seven feet. Groundwater discharging at July, Devils Eye and Devils Ear Spring all originates from the same cave (see Figure 19).

TRANSECT PLACEMENT

The tape was secured at the shoreline at the north end of the pool. The tape was run for 180 feet in a southwest direction, and positioned more or less down the middle of the pool and run. See Figure 22. The tape was the reference for vegetation occurrence, and abundance estimates, within three 50-foot survey intervals and one 30-foot interval. (See July Photos 1-17.)

DESCRIPTION OF VEGETATION

Ten taxa were present in the pool and run. The ranking of each taxon, in descending order of cumulative abundance, and their score (in parenthesis) is: hygrophila (20); filamentous algae (18); water moss (7); hydrilla (7); stonewort (5); ludwigia (3); naiad (2); spatterdock (2); water pennywort (2); and chara (1). See Table 12; July Spring Cumulative Abundance Summary of Vegetation Type.

Hygrophila was the dominant taxon and was especially abundant in the first three survey intervals but declined in abundance near the river. Filamentous algae showed the opposite pattern, increasing in abundance near the river. Hydrilla was present in each interval, but in low abundance. Water moss was found on tree roots and logs along the left side of the pool.

Four algae samples were collected at July Springs by ACEPD. The first sample was collected near the main vents of July Spring and was greenish in color and identified as being primarily an aquatic moss, *Fontinalis*. However, a mix of *Phormidium* sp. and *Synedra ulna* was also present in the sample. The second sample was collected near the vent was dark colored in appearance and identified as being dominated by *Vaucheria* sp. Two additional grabs were collected at the locations 150 feet downstream on the tape. The sample collected near Lightning Spring was identified as being dominated by *Vaucheria* sp. The sample collected off a log close to Lightning Spring was identified as being dominated by *Spirogyra* sp. (Lightning Spring is a small spring vent located along the right bank of the SFR just upstream of the July Run confluence.) All samples were delivered to Water & Air for analysis. For the complete report of filamentous algae present, see Table 16 in Appendix II.

OBSERVATIONS AND COMMENTS

The July Spring pool supported the most extensive and robust stand of hygrophila found in this survey.

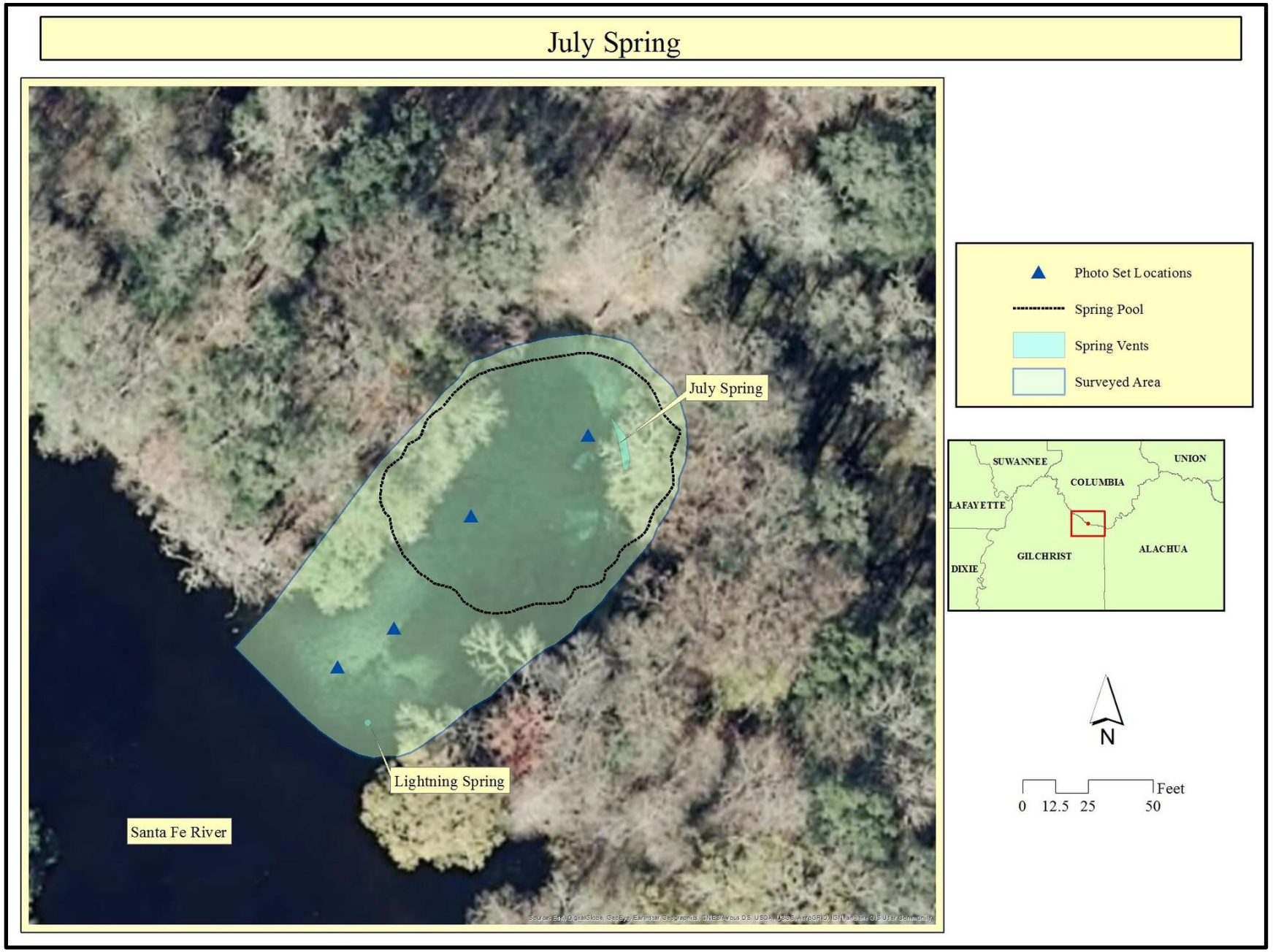

Figure 22. Map of July Spring pool and run. Shaded area covers survey transects.

GINNIE SPRING POOL AND RUN

LOCATION AND DESCRIPTION

Ginnie Spring is a second magnitude spring located 6.2 miles west of High Springs, on the left bank of the SFR, in the Ginnie Springs Outdoors resort, in Gilchrist County. See Figure 23. The spring has been developed as a recreation area. This survey of the Ginnie Spring pool and run was conducted on March 28, 2017, between the hours of 14:50 to 15:33.

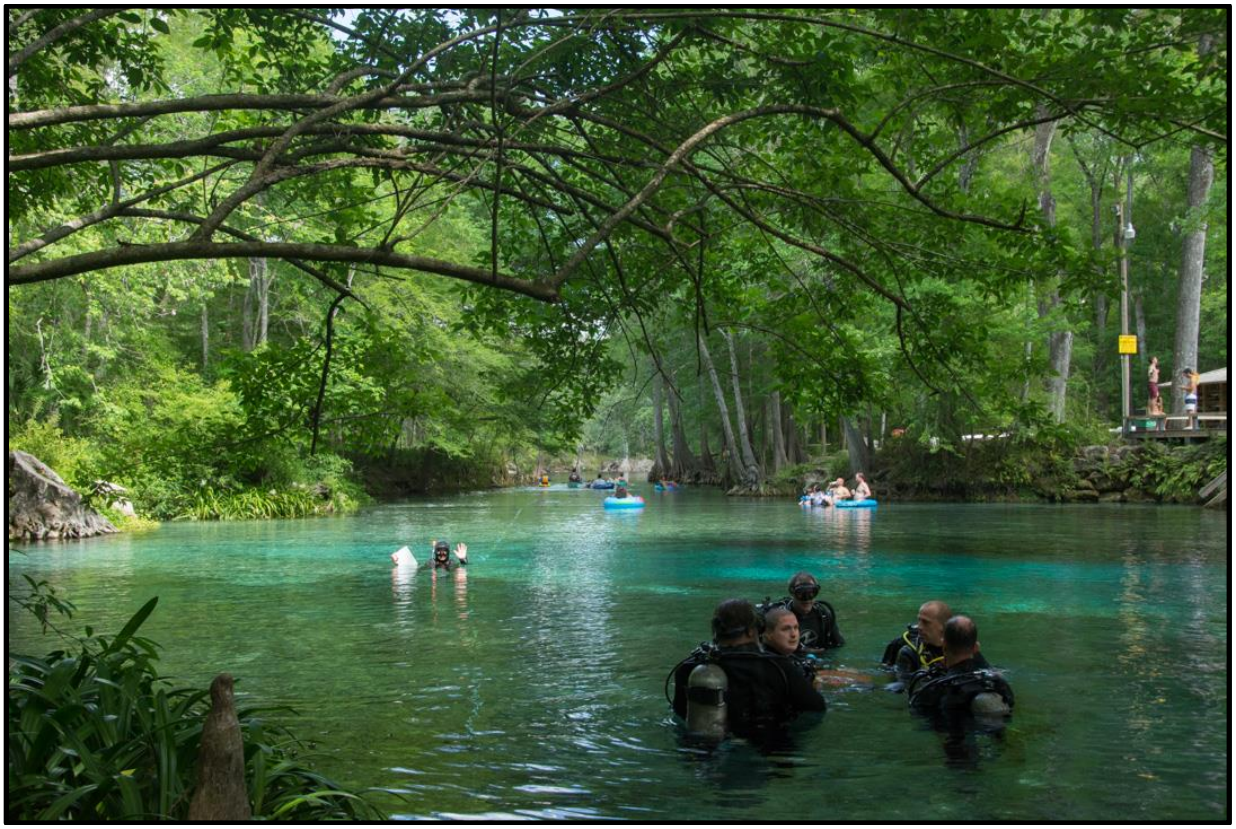

Figure 23. View of Ginnie Spring, across pool to run and the Santa Fe River.

The spring pool lies within the SFR floodplain. The rocky pool is about 90 feet in diameter, and groundwater discharges from a linear vent at about fifteen feet deep. Water flows north through the floodplain in a shallow run for about 200 feet to the SFR. The run varies from about 20 to 30 feet wide with a maximum depth of about four feet.

TRANSECT PLACEMENT

The tape was secured at the shoreline in the southwest part of the pool. It was laid out in a straight line, slightly left of the middle of the pool, and down the run for 300 feet. See Figure 24. The run terminus was well-defined by shoreline morphology. The tape was the reference for vegetation occurrence and abundance estimates within six 50-foot survey intervals. (See Ginnie Photos 1-26.)

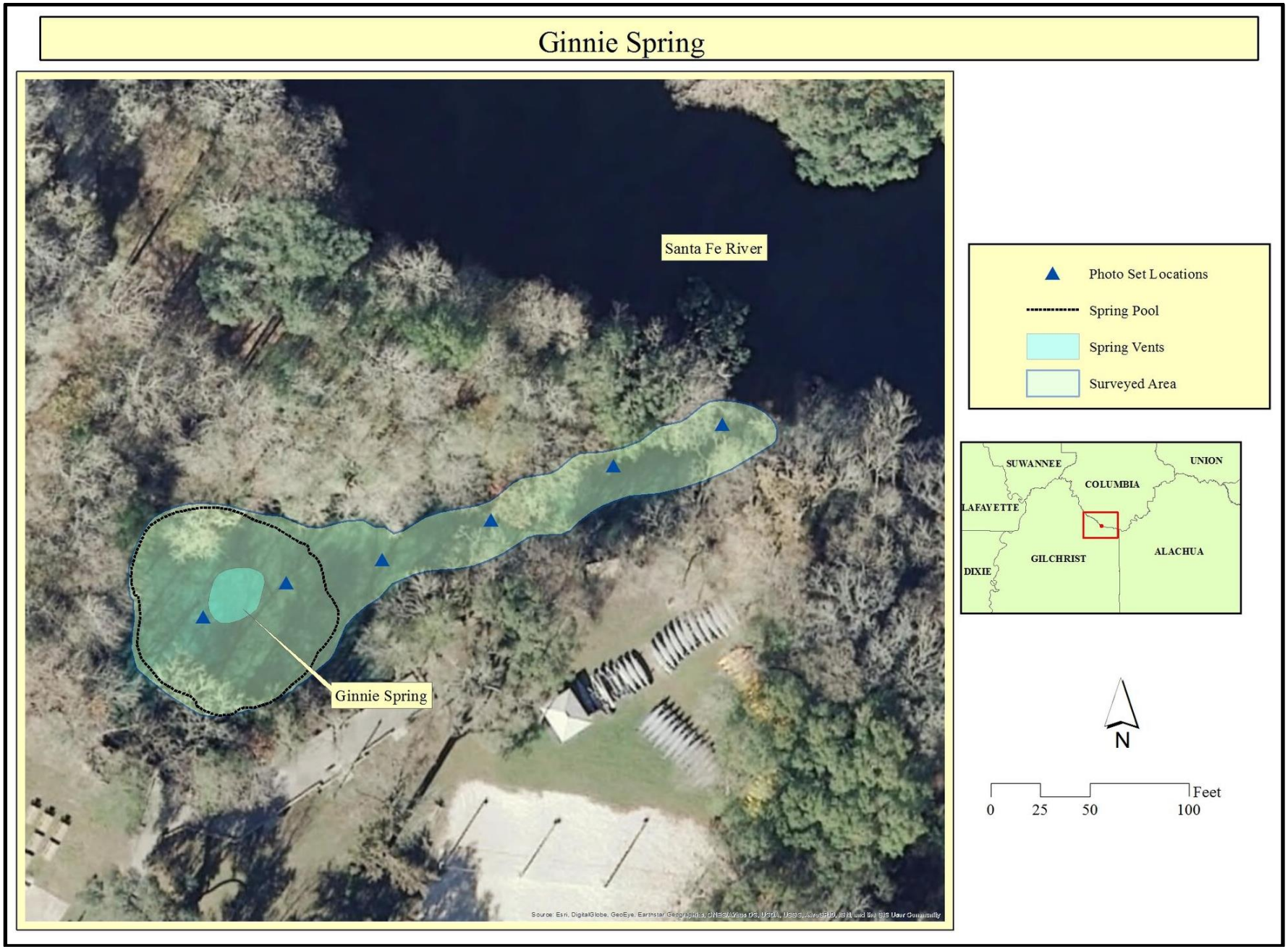

Figure 24. Map of Ginnie Spring pool and run. Shaded area covers survey transects.

DESCRIPTION OF VEGETATION

Nine taxa were present in the pool and run. The ranking of each taxon, in descending order of cumulative abundance, and their score (in parenthesis) is: ludwigia (25); filamentous algae (12); water moss (7); bladderwort (6); water pennywort (4); hydrilla (4); hygrophila (3); tapegrass (2); and eelgrass (1). See Table 13; Ginnie Spring Cumulative Abundance Summary of Vegetation Type.

Submerged aquatic vegetation was largely absent in most the Ginnie Spring pool and run. This includes the shallow rocky and sandy parts of the pool and run, as well as the deep part of the pool near the spring vents, an area popular with SCUBA divers. Vegetation was almost completely restricted to the bank margins.

Ludwigia was the dominant species, and was present along the banks on both sides of all seven survey intervals, with estimated low to high relative abundance within the vegetated margin. Filamentous algae was also present in low amounts on both sides of each interval.

OBSERVATIONS AND COMMENTS

This pool and run at one time supported a large biomass of SAV, but higher taxa were present in only small amounts. The owner and operator of the Ginnie Springs Outdoor Resort, believes this is not entirely the result of recreational activities, but possibly due to other, unknown, factors. The low level of benthic algae in the bulk of the pool and run is probably due to dislodgment by recreational activities.

DOGWOOD SPRING POOL AND RUN

LOCATION AND DESCRIPTION

Dogwood Spring is a second magnitude spring located 6.3 miles west of High Springs on the left bank of the SFR, in the Ginnie Springs Outdoors resort, in Gilchrist County. See Figure 25. The spring is developed as a recreation area. This survey of the Dogwood Spring pool and run was conducted on March 28, 2017, between the hours of 16:15 to 17:10.

Figure 25. View of Dogwood Spring, viewed from the headspring towards the run.

The pool is about 40 feet in diameter. Groundwater discharges from a 15 feet deep vent on the east side of the pool and flows about 250 feet north to the SFR. The run is about 20 feet wide and 5 feet deep and is fairly shaded. The pool and run have a sandy bottom, except around the vent, where limestone is exposed.

TRANSECT PLACEMENT

The tape was secured at the shoreline to a cypress root at the southeast end of the pool. The tape was run for 230 feet in a northwest direction, and positioned more or less down the middle of the pool and run. See Figure 26. The tape was the reference for vegetation occurrence and abundance estimates within four 50-foot survey intervals and one 30-foot interval. (See Dogwood Photos 1-21.)

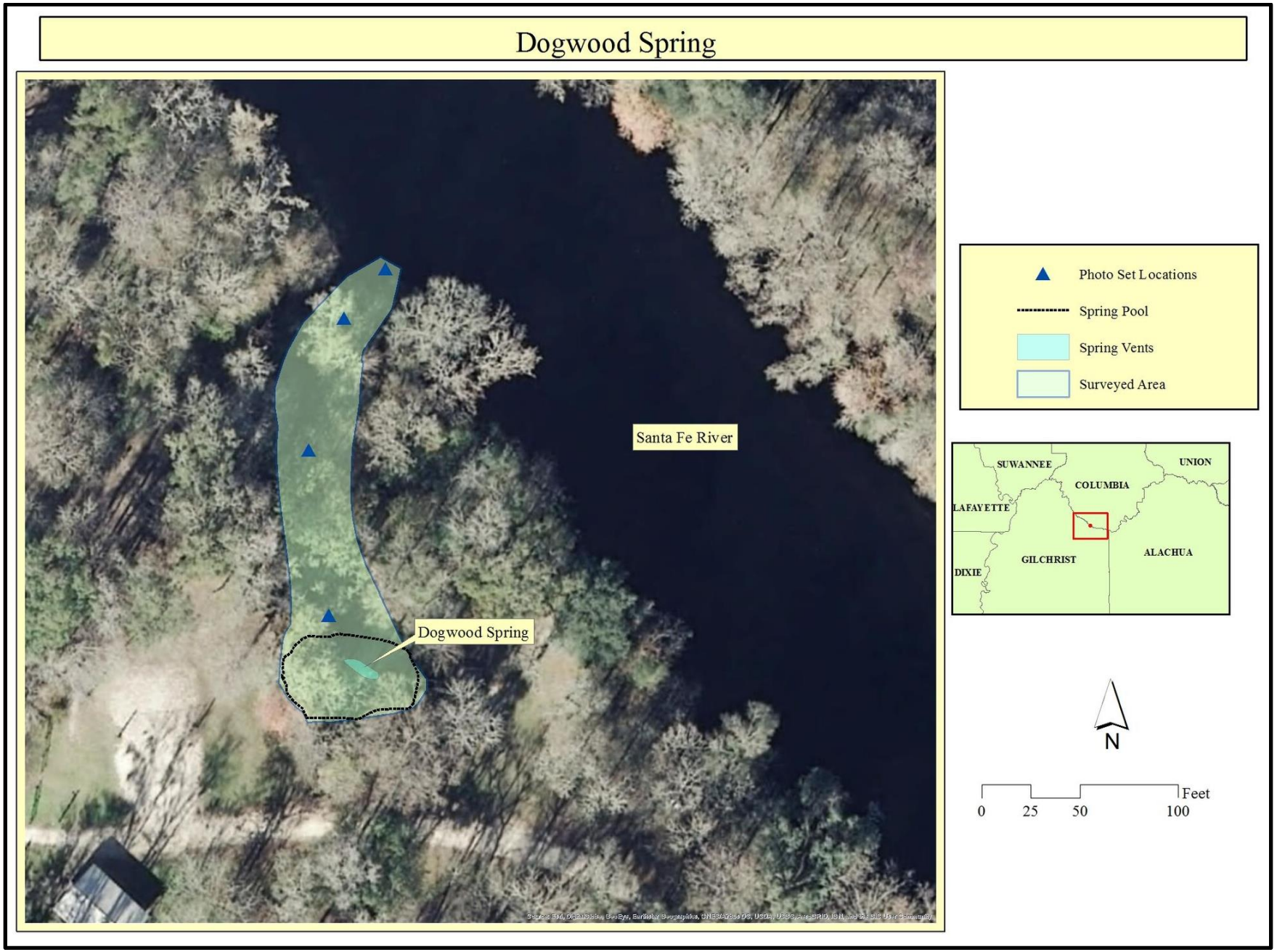

Figure 26. Map of Dogwood Spring pool and run. Shaded area covers survey transects.

DESCRIPTION OF VEGETATION

Six taxa were present in the pool and run. The ranking of each taxon, in descending order of cumulative abundance, and their score (in parenthesis) is: ludwigia (16); filamentous algae (15); hydrilla (6); water pennywort (6); hygrophila (5); and tapegrass (1). See Table 14; Dogwood Spring Cumulative Abundance Summary of Vegetation Type.

Filamentous algae and hygrophila were the dominant taxa. Filamentous algae was irregularly distributed in all survey intervals in moderate to high abundance and covered most surfaces, including submerged tree roots. Ludwigia was present in low to moderate amounts in every survey interval among the submerged roots lining the steep banks of the pool and run. Hydrilla, hygrophila and water pennywort were sporadic in occurrence and in low abundance. A very small patch of tapegrass was present in the pool.

Algae samples were collected by ACEPD and identified by Water & Air. The algae sample was identified as being dominated by *Vaucheria* sp. For the complete report of filamentous algae present, see Table 16 in Appendix II.

OBSERVATIONS AND COMMENTS

This pool and run at one time supported a large biomass of SAV, but higher taxa were present in only small amounts. The owner and operator of the Ginnie Springs Outdoor Resort, believes this is not entirely the result of recreational activities, but possibly due to other, unknown, factors.

TWIN SPRING POOL AND RUN

LOCATION AND DESCRIPTION

Twin Spring is a second magnitude spring located 6.6 miles west of High Springs and one-half mile upstream of Dogwood Spring, on the left bank of the SFR, in the Ginnie Springs Outdoors resort, in Gilchrist County. See Figure 27. The spring has been developed as a recreation area. This survey of the Twin Spring pool and run was conducted on March 28, 2017, between the hours of 17:36 to 18:05.

Figure 27. View of Twin Spring, from the stairs at the headpool area towards the run.

The pool is oval-shaped, about 120 by 35 feet, oriented in an east-west direction. Groundwater discharges from a fissure near the center of the pool, and flows north 200 feet to the SFR. The run is about ten feet wide and four feet deep. The pool and run have a sandy bottom except where limestone is exposed at the vent.

TRANSECT PLACEMENT

The tape was secured at the shoreline to a cypress root at the southwest end of the pool. The tape was run for 200 feet in a northeast and then north direction, and positioned more or less down the middle of the pool. See Figure 28. The tape was the reference for vegetation occurrence, and abundance estimates, within four 50-foot survey intervals. (See Twin Photos 1-15.)

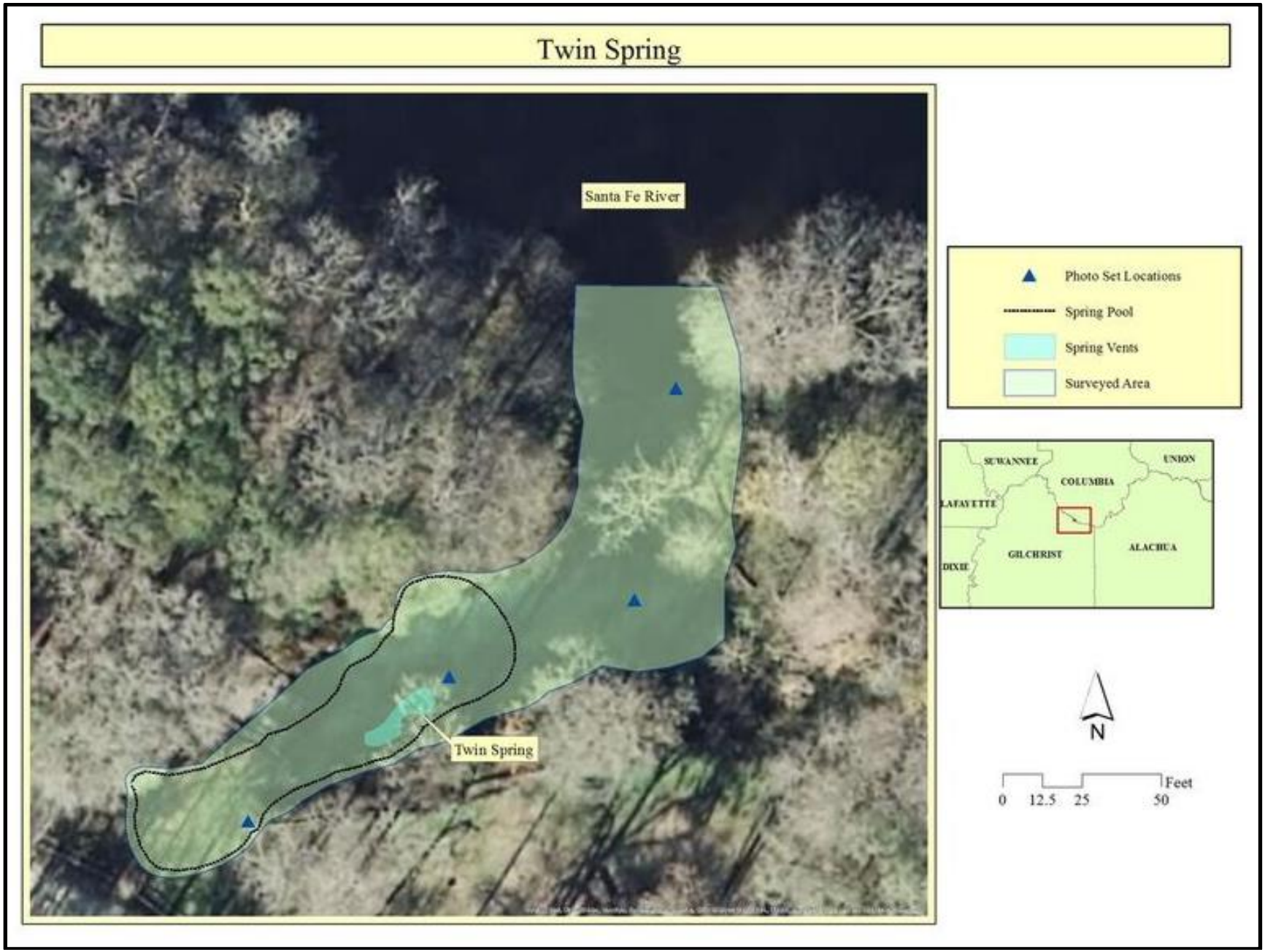

Figure 28. Map of Twin Spring pool and run. Shaded area covers survey transects.

DESCRIPTION OF VEGETATION

Seven taxa were present in the pool and run. The ranking of each taxon, in descending order of cumulative abundance, and their score (in parenthesis) is: filamentous algae (16); hygrophila (6); hydrilla (2); water pennywort (2); naiad (2); tapegrass (1) and ludwigia (1). See Table 15; Twin Spring Cumulative Abundance Summary of Vegetation Type.

Filamentous algae was the dominant taxon and was growing on most surfaces not disturbed by recreational activities. It was most abundant near the river. The remaining six taxa were found in small amounts, mostly along the pool and run margins and among submerged tree roots.

Algae samples were collected by ACEPD and identified by Water & Air. The sample was dominated by *Oscillatoria princeps*. For the complete report of filamentous algae present, see Table 16 in Appendix II.

OBSERVATIONS AND COMMENTS

This pool and run at one time supported a large biomass of SAV, but higher taxa were present in only small amounts. The owner and operator of the Ginnie Springs Outdoor Resort, believes this is not entirely the result of recreational activities, but possibly due to other, unknown, factors.

RECOMMENDATIONS

Speculation regarding the major changes in vegetation that have been observed in the lower Santa Fe River springs in recent decades have focused on natural influences such as floods, dark water vs. clear water periods, herbivore activities (such as turtles) and aquifer level changes, as well as anthropogenic influences including groundwater extraction, contamination from agricultural and landscaping nutrient loading and pesticide applications in the springsheds, recreational impacts and the introduction of exotic species.

This survey represents an initial effort to establish a baseline of SAV conditions at the major springs of the lower SFR. Future surveys at suitable intervals and in a similar comprehensive manner could help with the understanding of the effects that natural and anthropogenic changes are having on the springs of the lower Santa Fe River.

In addition to continuance of this survey of SAV in springs and runs, historically vegetated shoals in this section of the Santa Fe River also should be surveyed in a similar manner. Selected shoals could be identified , and a comprehensive baseline survey performed. Additional surveys could then be conducted in conjunction with the spring/run surveys.

REFERENCES

Butt, P. L., T. L. Morris, and W. C. Skiles. 2007. Swallet/Resurgence Relationships on the Lower Santa Fe River, Florida. Report prepared for Water Resource Associates, Inc., Tampa, Florida, 27 p.

Florida Dept. of Environmental Protection (FDEP). 2017. Priority Focus Areas for Devil's Spring System and Hornsby Spring (Draft). Div. of Environmental Assessment and Restoration, FDEP, Tallahassee, Florida. 20 p.

Hornsby, D., and R. Ceryak. 1998. Springs of the Santa Fe River Basin in Florida. WR99-02, Suwannee River Water Management District, Live Oak, Florida, 178 p.

Hunn, J. D., and L. J. Slack. 1983. Water resources of the Santa Fe River basin, Florida. U. S. Geological Survey Water-Resources Investigations Report 83–4075, prepared in cooperation with Suwannee River Water Management District, Tallahassee, Florida, 105 p.

Scott, T. M., G. H. Means, R. P. Meegan, R. C. Means, S. B. Upchurch, R. E. Copeland, J. Jones, T. Roberts, and A. Willet. 2004. Springs of Florida. Florida Geological Survey Bulletin No. 66, Tallahassee, Florida, 377 p.

APPENDIX I

CUMULATIVE ABUNDANCE SUMMARIES OF VEGETATION TYPE; TABLES 3-15

Santa Fe River Spring Runs Sub-Aquatic Vegetation Survey; March, 2017

By Karst Environmental Services, Inc. for Alachua County Environmental Protection Department

Table 3. Cumulative Abundance Summary of Vegetation Type by Site.

	Cumulative Abundance Scores for each Spring Basin and Run site:											
Site:	**Hornsby**	**Treehouse**	**Poe**	**Lilly**	**Rum Island**	**Gilchrist Blue**	**Naked**	**Little Devils**	**July**	**Ginnie**	**Dogwood**	**Twin**
Date Surveyed:	**3/29/2017**	**3/29/2017**	**3/30/2017**	**3/30/2017**	**3/30/2017**	**3/27/2017**	**3/27/2017**	**3/28/2017**	**3/28/2017**	**3/28/2017**	**3/28/2017**	**3/28/2017**
Length of Survey Transect*:	1353'	230'	300'	330'	183'	1225'	407'	300'	180'	300'	230'	200'
Vegetation Type:												
Algae	125	30	61	34	24	13	18	19	18	12	15	16
Alligator weed**			1									
Bladderwort						1	20	6		6		
Chara						38			1			
Coontail**						5						
Eelgrass						32	11			1		
Hydrilla					8	57	29	4	7	4	6	2
Hygrophila			2	8		14		15	20	3	5	6
Ludwigia	6	1	15	2	16	66	24	3	3	25	16	1
Naiad	114		2			44	25		2			2
Spatterdock	2								2			
Stonewort	12	1		2	1	53	16		5			
Tapegrass	6					84	24			2	1	1
Watercress**						1						
Water moss						20		5	7	7		
Water pennywort	3	1	2	2	2	23	16	4	2	4	6	2

*Note: Due to the extreme variation in the total transect lengths of each site, the cumulative abundance scores are not directly comparable between sites. The intent of the scores is to provide a summary of vegetation conditions at each site.

Abundance Rating:	(Estimate of relative abundance per species at interval.)
Low (or Present)	1
Medium	2
High	3

Survey Plant Species List — Name used for the purposes of this Survey & Tables in **Bold.**

Common Name:	**Scientific Name:**
Algae (Filamentous); several possible species/genera, including (but not limited to):	
Water Felt	*Vaucheria* sp.
Lyngbya	*Lyngbya wallei*
Water Silk	*Spirogyra* sp.
Alligator weed**	*Alternanthera philoxeroides*
Bladderwort	*Utricularia* sp.
Chara (Muskgrass)	*Chara* sp.
Coontail**	*Ceratophyllum demersum*
Eelgrass	*Vallisneria americana*
Hydrilla	*Hydrilla verticillata*
Hygrophila	*Hygrophila polysperma*
Ludwigia (Purple ludwigia)	*Ludwigia repens*
Naiad	*Najas guadalupensis*
Spatterdock	*Nupahr advena*
Stonewort	*Nitella* sp.
Tapegrass	*Sagittaria kurziana*
Watercress**	*Rorippa* sp.
Water moss	*Fontinalis* sp.
Water pennywort	*Hydrocotyle umbellata*

**Found at one site only.

Santa Fe River Spring Runs Sub-Aquatic Vegetation Survey; March, 2017

By Karst Environmental Services, Inc. for Alachua County Environmental Protection Department

Table 4. Hornsby Spring Cumulative Abundance Summary of Vegetation Type

Hornsby Spring Pool and Run

March 29, 2017 Start: 10:45 Finish: 14:50 (EST/DST)

Vegetation Type: **Tape Interval:** (All measurements in feet.)

	Tape 1												**Tape 2**					
	0-50/ Spring Pool		**50-100**		**100-150**		**150-200**		**200-250**		**250-300**		**300-350 (0-50)**		**350-400 (50-100)**		**400-450 (100-150)**	
	Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Algae	3	3	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3	3
Ludwigia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naiad	-	-	-	-	-	-	-	-	-	2	2	2	2	2	2	3	3	3
Spatterdock	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	-	-
Stonewort	-	-	-	-	-	-	-	-	-	-	-	-	2	1	2	-	-	2
Tapegrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Water pennywort	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
See Hornsby Photo:	1,2,3,4,5		6,7,8,9		10,11,12,13		14,15,16,17		18,19,20,21		22,23,24,25		26,27,28,29		30,31,32,33		34,35,36,37	
See Hornsby Surface Photo:	S1		S2		S3				S4		S5		S6		S7		S8	
See Hornsby Video:	Hornsby Run Video 1		Hornsby Run Video 1		Hornsby Run Video 1		Hornsby Run Video 1		Hornsby Run Video 1		Hornsby Run Video 1		Hornsby Run Video 2		Hornsby Run Video 2		Hornsby Run Video 2	

Abundance Rating: (Estimate of relative abundance per species at interval.)

Low (or Present)	1
Medium	2
High	3

Survey Plant Species List Name used for the purposes of this Survey & Table in **Bold.**

Common Name:	**Scientific Name:**
Algae (Filamentous); several possible species/genera, including (but not limited to):	
Water Felt	*Vaucheria* sp.
Lyngbya	*Lyngbya wallei*
Water Silk	*Spirogyra* sp.
Bladderwort	*Utricularia* sp.
Chara (Muskgrass)	*Chara* sp.
Coontail	*Ceratophyllum demersum*
Eelgrass	*Vallisneria americana*
Hydrilla	*Hydrilla verticillata*
Hygrophila	*Hygrophila polysperma*
Ludwigia (Purple ludwigia)	*Ludwigia repens*
Naiad	*Najas guadalupensis*
Spatterdock	*Nuphar advena*
Stonewort	*Nitella* sp.
Tapegrass	*Sagittaria kurziana*
Watercress	*Rorippa* sp.
Water moss	*Fontinalis* sp.
Water pennywort	*Hydrocotyle umbellata*

Santa Fe River Spring Runs Sub-Aquatic Vegetation Survey; March, 2017

By Karst Environmental Services, Inc. for Alachua County Environmental Protection Department

Table 4. Hornsby Spring Cumulative Abundance Summary of Vegetation Type

Hornsby Spring Pool and Run

March 29, 2017

Vegetation Type:	**Tape Interval:**	(All measurements in feet.)															
	Tape 2						**Tape 3**										
	450-500 (150-200)		**500-550 (200-250)**		**550-600 (250-300)**		**600-650 (0-50)**		**650-700 (50-100)**		**700-750 (100-150)**		**750-800 (150-200)**		**800-850 (200-250)**		**850-900 (250-300)**	
	Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Algae	3	3	2	2	2	2	2	2	2	2	3	2	2	2	2	1	2	1
Ludwigia	-	-	-	-	-	-	1	-	1	1	-	-	-	-	1	-	-	-
Naiad	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Spatterdock	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stonewort	1	1	-	-	-	-	-	1	-	1	-	1	-	-	-	-	-	-
Tapegrass	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-
Water pennywort	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-
See Hornsby Photo:	38,39,40,41		42,43,44,45		46,47,48,49		50,51,52,53		54,55,56,57		58,59,60,61		62,63,64,65		66,67,68,69		70,71,72,73	
See Hornsby Surface Photo:	S9		S10		S11		S12		S13		S14		S15				S16, S17	
See Hornsby Video:	Hornsby Run Video 2		Hornsby Run Video 2		Hornsby Run Video 2		Hornsby Run Video 2		Hornsby Run Video 3		Hornsby Run Video 3		Hornsby Run Video 3		Hornsby Run Video 3		Hornsby Run Video 3	

Abundance Rating:	(Estimate of relative abundance per species at interval.)
Low (or Present)	1
Medium	2
High	3

Survey Plant Species List	Name used for the purposes of this Survey & Table in **Bold.**		
Common Name:	**Scientific Name:**	**Common Name:**	**Scientific Name:**
Algae (Filamentous); several possible species/genera, including (but not limited to):		**Hygrophila**	*Hygrophila polysperma*
Water Felt	*Vaucheria* sp.	**Ludwigia** (Purple ludwigia)	*Ludwigia repens*
Lyngbya	*Lyngbya wallei*	**Naiad**	*Najas guadalupensis*
Water Silk	*Spirogyra* sp.	**Spatterdock**	*Nuphar advena*
Bladderwort	*Utricularia* sp.	**Stonewort**	*Nitella* sp.
Chara (Muskgrass)	*Chara* sp.	**Tapegrass**	*Sagittaria kurziana*
Coontail	*Ceratophyllum demersum*	**Watercress**	*Rorippa* sp.
Eelgrass	*Vallisneria americana*	**Water moss**	*Fontinalis* sp.
Hydrilla	*Hydrilla verticillata*	**Water pennywort**	*Hydrocotyle umbellata*

Santa Fe River Spring Runs Sub-Aquatic Vegetation Survey; March, 2017

By Karst Environmental Services, Inc. for Alachua County Environmental Protection Department

Table 4. Hornsby Spring Cumulative Abundance Summary of Vegetation Type

Hornsby Spring Pool and Run

March 29, 2017

Vegetation Type:	**Tape Interval:**	(All measurements in feet.)

	Tape 4												**Tape 5**						
	900-950 (0-50)		**950-1000 (50-100)**		**1000-1050 (100-150)**		**1050-1100 (150-200)**		**1100-1150 (200-250)**		**1150-1200 (250-300)**		**1200-1250 (0-50)**		**1250-1300 (50-100)**		**1300-1353 (100-153)**		**Cumulative**
	Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		**Abundance**
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	**Score**
Algae	2	2	1	1	3	1	2	2	2	3	2	2	2	3	2	3	2	1	125
Ludwigia	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	6
Naiad	3	3	3	3	2	3	2	2	2	2	2	2	2	2	2	2	2	-	114
Spatterdock	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Stonewort	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12
Tapegrass	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-	1	6
Water pennywort	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	3
See Hornsby Photo:	74,75,76,77		78,79,80,81		82,83,84,85		86,87,88,89		90,91,92,93		94,95,96,97		98,99,100,101		102,103,104,105		106,107,108,109,110		
See Hornsby Surface Photo:			S18		S19		S20		S21		S23		S24		S25		S26		
See Hornsby Video:	Hornsby Run Video 4 & 4.1		Hornsby Run Video 4		Hornsby Run Video 4		Hornsby Run Video 4		Hornsby Run Video 4		Hornsby Run Video 4		Hornsby Run Video 5		Hornsby Run Video 5		Hornsby Run Video 5 & 6		

Abundance Rating: (Estimate of relative abundance per species at interval.)

Low (or Present)	1
Medium	2
High	3

Survey Plant Species List Name used for the purposes of this Survey & Table in **Bold.**

Common Name:	**Scientific Name:**
Algae (Filamentous); several possible species/genera, including (but not limited to):	
Water Felt	*Vaucheria* sp.
Lyngbya	*Lyngbya wallei*
Water Silk	*Spirogyra* sp.
Bladderwort	*Utricularia* sp.
Chara (Muskgrass)	*Chara* sp.
Coontail	*Ceratophyllum demersum*
Eelgrass	*Vallisneria americana*
Hydrilla	*Hydrilla verticillata*
Hygrophila	*Hygrophila polysperma*
Ludwigia (Purple ludwigia)	*Ludwigia repens*
Naiad	*Najas guadalupensis*
Spatterdock	*Nuphar advena*
Stonewort	*Nitella* sp.
Tapegrass	*Sagittaria kurziana*
Watercress	*Rorippa* sp.
Water moss	*Fontinalis* sp.
Water pennywort	*Hydrocotyle umbellata*

Santa Fe River Spring Runs Sub-Aquatic Vegetation Survey; March, 2017

By Karst Environmental Services, Inc. for Alachua County Environmental Protection Department

Table 5. Treehouse Rise Cumulative Abundance Summary of Vegetation Type

Treehouse Rise (aka Treehouse Spring) Pool and Run

March 29, 2017 Start: 16:37 Finish: 17:15 (EST/DST)

Vegetation Type: **Tape Interval:** (All measurements in feet.)

Tape 1

	0-50/ Spring Pool		**50-100**		**100-150**		**150-200**		**200-230**		**Cumulative**
	Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		**Abundance**
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	**Score**
Algae	3	3	3	3	3	3	3	3	3	3	30
Ludwigia	-	-	-	-	-	-	1	-	-	-	1
Stonewort	-	-	-	-	-	-	-	1	-	-	1
Water pennywort	-	-	-	-	-	-	1	-	-	-	1
See Treehouse Run Photo:	1,2,3,4		5,6,7		8,9,10,11		12,13,14		15,16		
See Treehouse Run Video:	Treehouse Run Video 1		Treehouse Run Video 1		Treehouse Run Video 1		**Treehouse Run Video 1**		Treehouse Run Video 1		

Abundance Rating: (Estimate of relative abundance per species at interval.)

Low (or Present)	1
Medium	2
High	3

Survey Plant Species List Name used for the purposes of this Survey & Table in **Bold.**

Common Name:	**Scientific Name:**	**Common Name:**	**Scientific Name:**
Algae (Filamentous); several possible species/genera, including (but not limited to):		**Hygrophila**	*Hygrophila polysperma*
Water Felt	*Vaucheria* sp.	**Ludwigia** (Purple ludwigia)	*Ludwigia repens*
Lyngbya	*Lyngbya wallei*	**Naiad**	*Najas guadalupensis*
Water Silk	*Spirogyra* sp.	**Spatterdock**	*Nuphar advena*
Bladderwort	*Utricularia* sp.	**Stonewort**	*Nitella* sp.
Chara (Muskgrass)	*Chara* sp.	**Tapegrass**	*Sagittaria kurziana*
Coontail	*Ceratophyllum demersum*	**Watercress**	*Rorippa* sp.
Eelgrass	*Vallisneria americana*	**Water moss**	*Fontinalis* sp.
Hydrilla	*Hydrilla verticillata*	**Water pennywort**	*Hydrocotyle umbellata*

Santa Fe River Spring Runs Sub-Aquatic Vegetation Survey; March, 2017

By Karst Environmental Services, Inc. for Alachua County Environmental Protection Department

Table 6. Poe Spring Cumulative Abundance Summary of Vegetation Type

Poe Spring Pool and Run

March 30, 2017 Start: 10:06 Finish: 11:15 (EST/DST)

Vegetation Type: **Tape Interval:** (All measurements in feet.)

Tape 1

	0-50/ Spring Pool				**50-100**				**100-150**				**150-200**				**200-250**				**250-300**				**Cumulative**
	Bank/Run Side		Basin Margins		Bank/Run Side		Basin Margins		Bank/Run Side		Run Margins		Bank/Run Side		Run Margins		Bank/Run Side		Run Margins		Bank/Run Side		Run Margins		**Abundance**
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	**Score**
Algae	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	1	1	2	2	61
Alligator weed**	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Hygrophila	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-	-	-	-	2
Ludwigia	-	-	1	1	-	-	1	1	-	-	2	1	-	-	2	1	-	-	3	-	-	-	2	-	15
Naiad	-	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	2
Water pennywort	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	2
See Poe Run Photo:	1,2,3,4,5,6				7,8,9,10				11,12,13,14				15,16,17,18				19,20,21,22,23				24,25,26,27,28				
See Poe Run Video:	Poe Run Video 1				Poe Run Video 1				Poe Run Video 1				Poe Run Video 1				Poe Run Video 1				Poe Run Video 1				

Abundance Rating: (Estimate of relative abundance per species at interval.)

Low (or Present)	1
Medium	2
High	3

Survey Plant Species List Name used for the purposes of this Survey & Table in **Bold.**

Common Name:	**Scientific Name:**
Algae (Filamentous); several possible species/genera, including (but not limited to):	
Water Felt	*Vaucheria* sp.
Lyngbya	*Lyngbya wallei*
Water Silk	*Spirogyra* sp.
Alligator weed**	*Alternanthera philoxeroides*
Bladderwort	*Utricularia* sp.
Chara (Muskgrass)	*Chara* sp.
Coontail	*Ceratophyllum demersum*
Eelgrass	*Vallisneria americana*
Hydrilla	*Hydrilla verticillata*
Hygrophila	*Hygrophila polysperma*
Ludwigia (Purple ludwigia)	*Ludwigia repens*
Naiad	*Najas guadalupensis*
Spatterdock	*Nuphar advena*
Stonewort	*Nitella* sp.
Tapegrass	*Sagittaria kurziana*
Watercress	*Rorippa* sp.
Water moss	*Fontinalis* sp.
Water pennywort	*Hydrocotyle umbellata*

**Found at this site only.

Santa Fe River Spring Runs Sub-Aquatic Vegetation Survey; March, 2017

By Karst Environmental Services, Inc. for Alachua County Environmental Protection Department

Table 7. Lily Spring Cumulative Abundance Summary of Vegetation Type

Lily Spring Pool and Run

March 30, 2017 Start: 14:52 Finish: 15:36 (EST/DST)

Vegetation Type: **Tape Interval:** (All measurements in feet.)

Tape 1

	0-50/ Spring Pool		**50-100**		**100-150**		**150-200**		**200-250**		**250-300**		**300-330**		**Cumulative**
	Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		**Abundance**
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	**Score**
Algae	3	3	3	3	3	3	2	2	2	2	2	3	2	1	34
Hygrophila	2	2	2	1	1	-	-	-	-	-	-	-	-	-	8
Ludwigia	-	1	-	1	-	-	-	-	-	-	-	-	-	-	2
Stonewort	-	-	-	-	-	-	-	-	-	-	1	-	1	-	2
Water pennywort	-	2	-	-	-	-	-	-	-	-	-	-	-	-	2
See Lily Run Photo:	1,2,3,4,5,6,7		8,9,10,11		12,13,14,15		16,17,18,19		20,21,22		23,24,25		26,27		
See Lily Run Video:	Lily Run Video 1 & 2		Lily Run Video 1 & 2		Lily Run Video 1 & 2		Lily Run Video 1		Lily Run Video 1		Lily Run Video 1		Lily Run Video 1		

Abundance Rating: (Estimate of relative abundance per species at interval.)

Low (or Present)	1
Medium	2
High	3

Survey Plant Species List Name used for the purposes of this Survey & Table in **Bold.**

Common Name:	**Scientific Name:**
Algae (Filamentous); several possible species/genera, including (but not limited to):	
Water Felt	*Vaucheria* sp.
Lyngbya	*Lyngbya wallei*
Water Silk	*Spirogyra* sp.
Bladderwort	*Utricularia* sp.
Chara (Muskgrass)	*Chara* sp.
Coontail	*Ceratophyllum demersum*
Eelgrass	*Vallisneria americana*
Hydrilla	*Hydrilla verticillata*
Hygrophila	*Hygrophila polysperma*
Ludwigia (Purple ludwigia)	*Ludwigia repens*
Naiad	*Najas guadalupensis*
Spatterdock	*Nuphar advena*
Stonewort	*Nitella* sp.
Tapegrass	*Sagittaria kurziana*
Watercress	*Rorippa* sp.
Water moss	*Fontinalis* sp.
Water pennywort	*Hydrocotyle umbellata*

Santa Fe River Spring Runs Sub-Aquatic Vegetation Survey; March, 2017

By Karst Environmental Services, Inc. for Alachua County Environmental Protection Department

Table 8. Rum Island Spring Cumulative Abundance Summary of Vegetation Type

Rum Island Spring Pool and Run

March 30, 2017 Start: 12:45 Finish: 13:30 (EST/DST)

Vegetation Type: **Tape Interval:** (All measurements in feet.)

Tape 1

	0-50/ Spring Pool				**50-100**				**100-150**				**150-183**				**Cumulative**
	Bank/Run Side		Basin Margins		Bank/Run Side		Basin Margins		Bank/Run Side		Run Margins		Bank/Run Side		Run Margins		**Abundance**
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	None	Right	Left	Right	None	**Score**
Algae	-	-	-	-	-	3	2	2	3	3	2	-	3	3	3	-	24
Hydrilla	-	-	-	2	-	1	3	1	-	-	-	-	-	1	-	-	8
Hygrophila	-	-	-	1	1	2	1	1	2	-	1	-	2	2	3	-	16
Stonewort	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
Water pennywort	-	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	2
See Rum Island Run Photo:	1,2,3,4				5,6,7,8				9,10,11,12				13,14,15				
See Island Rum Run Video:	Rum Run Video 1				Rum Run Video 1				Rum Run Video 1				Rum Run Video 1				

Abundance Rating: (Estimate of relative abundance per species at interval.)

Low (or Present)	1
Medium	2
High	3

Survey Plant Species List Name used for the purposes of this Survey & Table in **Bold.**

Common Name:	**Scientific Name:**
Algae (Filamentous); several possible species/genera, including (but not limited to):	
Water Felt	*Vaucheria* sp.
Lyngbya	*Lyngbya wallei*
Water Silk	*Spirogyra* sp.
Bladderwort	*Utricularia* sp.
Chara (Muskgrass)	*Chara* sp.
Coontail	*Ceratophyllum demersum*
Eelgrass	*Vallisneria americana*
Hydrilla	*Hydrilla verticillata*
Hygrophila	*Hygrophila polysperma*
Ludwigia (Purple ludwigia)	*Ludwigia repens*
Naiad	*Najas guadalupensis*
Spatterdock	*Nuphar advena*
Stonewort	*Nitella* sp.
Tapegrass	*Sagittaria kurziana*
Watercress	*Rorippa* sp.
Water moss	*Fontinalis* sp.
Water pennywort	*Hydrocotyle umbellata*

Santa Fe River Spring Runs Sub-Aquatic Vegetation Survey; March, 2017

By Karst Environmental Services, Inc. for Alachua County Environmental Protection Department

Table 9A. Gilchrist Blue Spring Cumulative Abundance Summary of Vegetation Type

Gilchrist Blue Spring Pool and Run

March 27, 2017 Start: 12:30 Finish: 16:35 (EST/DST)

Vegetation Type:	**Tape Interval:**	(All measurements in feet.)																
	Tape 1								**Tape 2**									
	0-71/Spring Pool		**71-100**		**100-250**		**250-300**		**300-350 (0-50)**		**350-400 (50-100)**		**400-450 (100-150)**		**450-500 (150-200)**		**500-525 (200-225)**	
	Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Algae	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bladderwort	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chara	-	-	-	-	-	-	-	1	-	1	-	3	-	2	-	-	2	-
Coontail	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eelgrass	-	-	-	-	1	1	-	-	-	1	-	2	-	-	-	-	-	-
Hydrilla	1	2	1	3	3	3	3	3	2	1	2	3	2	2	2	2	2	1
Hygrophila	-	-	-	-	-	1	-	-	-	-	-	-	1	-	1	-	-	-
Ludwigia	-	-	-	-	2	2	-	-	-	2	2	-	2	2	2	-	-	2
Naiad	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	2	2
Stonewort	-	-	-	-	-	-	-	-	-	2	1	1	1	-	2	2	-	2
Tapegrass	-	-	-	-	2	-	3	3	2	-	3	2	2	2	2	2	2	2
Watercress	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Water moss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water pennywort	-	-	-	-	2	-	-	1	-	-	-	-	-	-	-	-	-	-
See Gilchrist Blue Run Photo:	1,2,3,4,5		6,7,8,9		10,11,12,13,14,15,16, 17,18,19,20,21,22		23,24,25,26		27,28,29,30		31,32,33,34		35,36,37,38		39,40,41,42		43,44,45,46	
See Gil. Blue Run Surface Photo:	S1, S2		S3, S4		S4, S5		S6, S7, S8		S8		S8		S9		S9		S10, S11	
See Gilchrist Blue Run Video:	Blue Run Video 1 & 2		Blue Run Video 2		Blue Run Video 2		Blue Run Video 2		Blue Run Video 2		Blue Run Video 2		Blue Run Video 2		Blue Run Video 2		Blue Run Video 2	

Abundance Rating:	(Estimate of relative abundance per species at interval.)
Low (or Present)	1
Medium	2
High	3

Survey Plant Species List Name used for the purposes of this Survey & Table in **Bold.**

Common Name:	**Scientific Name:**
Algae (Filamentous); several possible species/genera, including (but not limited to):	
Water Felt	*Vaucheria* sp.
Lyngbya	*Lyngbya wallei*
Water Silk	*Spirogyra* sp.
Bladderwort	*Utricularia* sp.
Chara (Muskgrass)	*Chara* sp.
Coontail	*Ceratophyllum demersum*
Eelgrass	*Vallisneria americana*
Hydrilla	*Hydrilla verticillata*
Hygrophila	*Hygrophila polysperma*
Ludwigia (Purple ludwigia)	*Ludwigia repens*
Naiad	*Najas guadalupensis*
Spatterdock	*Nuphar advena*
Stonewort	*Nitella* sp.
Tapegrass	*Sagittaria kurziana*
Watercress	*Rorippa* sp.
Water moss	*Fontinalis* sp.
Water pennywort	*Hydrocotyle umbellata*

Santa Fe River Spring Runs Sub-Aquatic Vegetation Survey; March, 2017

By Karst Environmental Services, Inc. for Alachua County Environmental Protection Department

Table 9A. Gilchrist Blue Spring Cumulative Abundance Summary of Vegetation Type

Gilchrist Blue Spring Pool and Run

March 27, 2017

Vegetation Type:	**Tape Interval:**	(All measurements in feet.)															
	Tape 3*												**Tape 4**					
	525-575 (0-50)*		**575-625 (50-100)**		**625-675 (100-150)**		**675-725 (150-200)**		**725-775 (200-250)**		**775-825 (250-300)**		**825-875 (0-50)**		**875-925 (50-100)**		**925-975 (100-150)**	
	Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Algae	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-
Bladderwort	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Chara	-	2	-	-	-	-	-	2	2	2	-	2	1	1	1	-	-	1
Coontail	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eelgrass	-	2	-	2	-	2	-	-	-	2	-	3	-	3	-	2	1	2
Hydrilla	2	2	-	2	1	-	2	1	-	-	-	-	1	-	-	-	-	2
Hygrophila	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	-
Ludwigia	2	2	2	2	-	2	-	2	-	2	-	2	-	2	-	2	2	2
Naiad	-	2	2	2	2	2	2	1	2	2	2	2	2	2	-	1	-	-
Stonewort	2	2	2	2	2	2	2	2	-	2	2	2	-	-	-	2	2	1
Tapegrass	3	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	2	2
Watercress	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water moss	-	-	-	-	-	-	-	-	-	-	-	-	2	1	2	2	-	2
Water pennywort	1	-	-	-	-	-	-	-	1	-	1	-	2	1	2	2	2	-
See Blue Run Photo:	47,48,49,50,51		52,53,54,55,56		57,58,59,60,61		62,63,64,65		66,67,68,69		70,71,72,73		74,75,76,77,78,79,80		81,82,83,84		85,86,87,88	
See Blue Run Surface Photo:	S12		S13		S13		S14, S15		S16		S17		S18, S19		S20		S21, S22, S23	
See Blue Run Video:	Blue Run Video 3		Blue Run Video 3		Blue Run Video 3		Blue Run Video 3		Blue Run Video 3		Blue Run Video 3		Blue Run Video 4		Blue Run Video 4		Blue Run Video 4	

*Naked Spring Run Intersect

Abundance Rating: (Estimate of relative abundance per species at interval.)

Low (or Present)	1
Medium	2
High	3

Survey Plant Species List Name used for the purposes of this Survey & Table in **Bold.**

Common Name:	**Scientific Name:**	**Common Name:**	**Scientific Name:**	**Common Name:**	**Scientific Name:**
Algae (Filamentous); several possible species/genera, including (but not limited to):		**Eelgrass**	*Vallisneria americana*	**Tapegrass**	*Sagittaria kurziana*
Water Felt	*Vaucheria* sp.	**Hydrilla**	*Hydrilla verticillata*	**Watercress**	*Rorippa* sp.
Lyngbya	*Lyngbya wallei*	**Hygrophila**	*Hygrophila polysperma*	**Water moss**	*Fontinalis* sp.
Water Silk	*Spirogyra* sp.	**Ludwigia** (Purple ludwigia)	*Ludwigia repens*	**Water pennywort**	*Hydrocotyle umbellata*
Bladderwort	*Utricularia* sp.	**Naiad**	*Najas guadalupensis*		
Chara (Muskgrass)	*Chara* sp.	**Spatterdock**	*Nuphar advena*		
Coontail	*Ceratophyllum demersum*	**Stonewort**	*Nitella* sp.		

Santa Fe River Spring Runs Sub-Aquatic Vegetation Survey; March, 2017

By Karst Environmental Services, Inc. for Alachua County Environmental Protection Department

Table 9A. Gilchrist Blue Spring Cumulative Abundance Summary of Vegetation Type

Gilchrist Blue Spring Pool and Run

March 27, 2017

Vegetation Type:	**Tape Interval:**		(All measurements in feet.)								
	Tape 4						**Tape 5**				
	975-1025 (150-200)		**1025-1075 (200-250)**		**1075-1125 (250-300)**		**1125-1175 (0-50)**		**1175-1225 (50-100)**		**Cumulative**
	Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		**Abundance**
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	**Score**
Algae	-	1	-	1	1	1	1	1	2	1	13
Bladderwort	-	-	-	-	-	-	-	-	-	-	1
Chara	2	2	2	2	2	2	2	-	-	1	38
Coontail	2	1	2	-	-	-	-	-	-	-	5
Eelgrass	2	-	2	-	2	1	1	-	-	-	32
Hydrilla	2	2	-	-	1	1	-	-	-	-	57
Hygrophila	1	-	2	-	2	-	2	-	2	-	14
Ludwigia	2	3	2	3	3	3	3	3	2	2	66
Naiad	2	2	-	2	2	-	-	2	-	-	44
Stonewort	2	1	-	2	2	2	2	2	-	2	53
Tapegrass	2	-	2	2	2	-	-	-	-	-	84
Watercress	-	-	-	-	-	-	-	-	-	-	1
Water moss	-	2	2	2	-	-	2	1	2	-	20
Water pennywort	2	1	2	-	-	1	-	1	-	1	23
See Blue Run Photo:	89,90,91		92,93,94,95		96,97,98,99,100		101,102,103,104		105,106,107,108		
See Blue Run Surface Photo:	S24		S25, S26		S27, S28		S29, S30		S31, S32		
See Blue Run Video:	Blue Run Video 4		Blue Run Video 4		Blue Run Video 4		Blue Run Video 5		Blue Run Video 5		

Abundance Rating:	(Estimate of relative abundance per species at interval.)
Low (or Present)	1
Medium	2
High	3

Survey Plant Species List — Name used for the purposes of this Survey & Table in **Bold.**

Common Name:	**Scientific Name:**
Algae (Filamentous); several possible species/genera, including (but not limited to):	
Water Felt	*Vaucheria* sp.
Lyngbya	*Lyngbya wallei*
Water Silk	*Spirogyra* sp.
Bladderwort	*Utricularia* sp.
Chara (Muskgrass)	*Chara* sp.
Coontail	*Ceratophyllum demersum*
Eelgrass	*Vallisneria americana*
Hydrilla	*Hydrilla verticillata*
Hygrophila	*Hygrophila polysperma*
Ludwigia (Purple ludwigia)	*Ludwigia repens*
Naiad	*Najas guadalupensis*
Spatterdock	*Nuphar advena*
Stonewort	*Nitella* sp.
Tapegrass	*Sagittaria kurziana*
Watercress	*Rorippa* sp.
Water moss	*Fontinalis* sp.
Water pennywort	*Hydrocotyle umbellata*

Santa Fe River Spring Runs Sub-Aquatic Vegetation Survey; March, 2017

By Karst Environmental Services, Inc. for Alachua County Environmental Protection Department

Table 9B. Gilchrist Blue Spring Run Supplemental Vegetation Transects Page 1 of 3

March 31, 2017

Line Intercept	**Notes:**	**Vegetation Type:**												
Tape Intervals:		**Hydrilla**	**Tapegrass**	**Ludwigia**	**Eelgrass**	**Chara**	**Naiad**	**Water Pennywort**	**Coontail**	**Watercress**	**Water Moss**	**Water Lettuce**	**Water Hemlock**	**Swamp Lily**
(All measurements in feet.)														
Transect 1	Tape anchored on west side boardwalk piling number 6 (29.83030, -82.68204).													
0 - 3	Bank exposed, dry, sedges.							1						
3 - 17	-	3		1										
17 - 55	Sand bottom with hydrilla fragments.	1												
55 - 85	-	3												
85 - 90	-	3		1										
90 - 97	-	3												1
97 - 98.5	Sedges.													
98.5	End transect.													
Transect 2	Tape anchored on west side boardwalk piling number 13 (29.83024, -82.68233).													
-1	Shoreline is one foot east of piling. Mud bottom.													
0 - 6	-	3												
6 - 9.5	-	1	3											
9.5 - 17	Bare sand.													
17 - 25	-	3												
25 - 27	-	3	1											
27 - 29.5	Sand patch, no plants.													
29.5 - 54	-	2	2											
54	End transect.													
Transect 3	Tape anchored to west side boardwalk piling number 19 (29.83030, -82.68204).													
-3	Shoreline is three feet east of piling.	2												
0 - 2	-	1								1				
2 - 5	-		2			2								
5 - 11.5	-	3	2											
11.5 - 18	Bare sand bottom.													
18 - 19	-		2											
19 - 23	-	3	2											
23 - 31	-	1	1			3								
31 - 37	-			1		3								
37 - 42	-	2		1		1								
42	End transect.													

Santa Fe River Spring Runs Sub-Aquatic Vegetation Survey; March, 2017

By Karst Environmental Services, Inc. for Alachua County Environmental Protection Department

Table 9B. Gilchrist Blue Spring Run Supplemental Vegetation Transects Page 2 of 3

March 31, 2017

Line Intercept	**Notes:**	**Vegetation Type:**												
Tape Intervals:		**Hydrilla**	**Tapegrass**	**Ludwigia**	**Eelgrass**	**Chara**	**Naiad**	**Water Pennywort**	**Coontail**	**Watercress**	**Water Moss**	**Water Lettuce**	**Water Hemlock**	**Swamp Lily**
(All measurements in feet.)														
Transect 4	Tape anchored to west side boardwalk piling number 29. Piling is at intersection of Blue Spring run and Naked Spring Run (29.83070, -82.6817)													
0 - 2	-			3										
2 - 7	-		3											
7 - 23	Sand bottom.													
23 - 32	-		3											
32 - 36	-						3							
36 - 47	-		3			3								
47 -56	-			1	3		1							
56 - 61	Soft mud bottom.													
61 - 63	-				2									
63 - 65	-	2		1										
65	End transect.													
Transect 5	Tape attached to west side boardwalk piling number 40 (29.83118, -82.68173).													
-2	Shoreline is two feet east of piling.									3		1		
0 - 10.5	-	1	1							3				
10.5 - 18.5	-		3											
18.5 - 27.5	Sand bottom.													
27.5 - 37	-		3											
37 - 39	-		3			2								
39 - 48	-		3											
48 - 51	-		2				2							
51 - 56	-			3			3							
56 - 57.5	-		1				3							
57.5 - 60	-			1						2				
60 - 62.4	-	2												
62.4	End transect.													

Santa Fe River Spring Runs Sub-Aquatic Vegetation Survey; March, 2017

By Karst Environmental Services, Inc. for Alachua County Environmental Protection Department

Table 9B. Gilchrist Blue Spring Run Supplemental Vegetation Transects Page 3 of 3

March 31, 2017

Line Intercept	**Notes:**	**Vegetation Type:**												
Tape Intervals:		**Hydrilla**	**Tapegrass**	**Ludwigia**	**Eelgrass**	**Chara**	**Naiad**	**Water Pennywort**	**Coontail**	**Watercress**	**Water Moss**	**Water Lettuce**	**Water Hemlock**	**Swamp Lily**
(All measurements in feet.)														
Transect 6	Tape anchored to west side boardwalk piling number 47 (29.83137, -82.68164).													
-3	Shoreline is three feet east of piling.							1				1	1	
0 - 3.5	Sedges.									1			1	
3.5 - 8	-		3				1							
8 - 15.5	Sand and bedrock bottom.													
15.5 - 23	-		3											
23 - 30	-		2		2									
30 - 37	-		1		3									
37 - 39	-				2					3				
39 - 41	-				3									
41 - 49	Mud bottom with embedded tree branches.								1	2				
49	End transect.													
Transect 7	Tape anchored to west side boardwalk piling number 58 (29.83187, -82.68154).													
-10	Shoreline is ten feet east of piling.					1		2						
0 - 2	-			3										
2 - 3.5	Shallow, swift current.	2	3											
3.5 - 33.5	Bottom rocky, shallow.													
33.5 - 40	Water moss on rocks.			3		1					3			
40	End transect.													

Abundance Rating:	(Estimate of relative abundance per species at interval.)
Low (or Present)	1
Medium	2
High	3

Survey Plant Species List						**Additional taxa for this transect survey.**	
Common Name:	**Scientific Name:**	**Common Name:**		**Scientific Name:**		**Common Name:**	**Scientific Name:**
Algae (Filamentous); several possible species/genera, including (but not limited to):		**Hygrophila**		*Hygrophila polysperma*		**Swamp Lily**	*Hymenocallis crassifolia*
Water Felt	*Vaucheria* sp.	**Ludwigia** (Purple ludwigia)		*Ludwigia repens*		**Water Hemlock**	*Cicuta maculata*
Lyngbya	*Lyngbya wallei*	**Naiad**		*Najas guadalupensis*		**Water Lettuce**	*Pistia stratiodes*
Water Silk	*Spirogyra* sp.	**Spatterdock**		*Nuphar advena*			
Bladderwort	*Utricularia* sp.	**Stonewort**		*Nitella* sp.			
Chara (Muskgrass)	*Chara* sp.	**Tapegrass**		*Sagittaria kurziana*			
Coontail	*Ceratophyllum demersum*	**Watercress**		*Rorippa* sp.			
Eelgrass	*Vallisneria americana*	**Water moss**		*Fontinalis* sp.			
Hydrilla	*Hydrilla verticillata*	**Water pennywort**		*Hydrocotyle umbellata*			

Santa Fe River Spring Runs Sub-Aquatic Vegetation Survey; March, 2017

By Karst Environmental Services, Inc. for Alachua County Environmental Protection Department

Table 10. Naked Spring Cumulative Abundance Summary of Vegetation Type

Naked Spring Pool and Run

March 27, 2017 Start: 17:12 Finish: 18:30 (EST/DST)

Vegetation Observed: **Tape Interval:** (All measurements in feet.)

	Tape 1												**Tape 2**				
	0-50/ Spring Pool		**50-100**		**100-150**		**150-200**		**200-250**		**250-300**		**300-350 (0-50)**		**350-407 (50-107)**		**Cumulative**
	Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		**Abundance**
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	**Score**
Algae	2	2	2	2	2	2	2	2	-	-	1	-	1	-	-	-	18
Bladderwort	3	3	2	2	2	2	2	1	2	-	-	-	-	-	1	-	20
Eelgrass	2	2	2	2	-	-	-	-	2	-	1	-	-	-	-	-	11
Hydrilla	2	2	2	2	-	2	2	2	2	2	2	2	1	2	2	2	29
Ludwigia	2	2	2	2	2	3	2	1	2	2	2	-	-	-	2	-	24
Naiad	3	2	2	2	2	2	2	2	2	2	2	-	-	-	2	-	25
Stonewort	-	1	-	-	-	1	2	2	2	2	1	1	1	1	1	1	16
Tapegrass	-	-	-	2	-	1	-	1	2	2	2	2	3	3	3	3	24
Water pennywort	2	-	2	2	2	-	2	2	2	-	2	-	-	-	-	-	16
See Naked Run Photo:	1,2,3,4,5,6,7,8,9,10		11,12,13,14,15		16,17,18,19		20,21,22,23		24,25,26,27		28,29,30,31		32,33,34,35		36,37,38,39,40		
See Naked Run Surface Photo:															S1		
See Naked Run Video:	Naked Run Video 1		Naked Run Video 1		Naked Run Video 1		Naked Run Video 1		Naked Run Video 2		Naked Run Video 2		Naked Run Video 3		Naked Run Video 3		

Abundance Rating: (Estimate of relative abundance per species at interval.)

Low (or Present)	1
Medium	2
High	3

Survey Plant Species List Name used for the purposes of this Survey & Table in **Bold.**

Common Name:	**Scientific Name:**
Algae (Filamentous); several possible species/genera, including (but not limited to):	
Water Felt	*Vaucheria* sp.
Lyngbya	*Lyngbya wallei*
Water Silk	*Spirogyra* sp.
Bladderwort	*Utricularia* sp.
Chara (Muskgrass)	*Chara* sp.
Coontail	*Ceratophyllum demersum*
Eelgrass	*Vallisneria americana*
Hydrilla	*Hydrilla verticillata*
Hygrophila	*Hygrophila polysperma*
Ludwigia (Purple ludwigia)	*Ludwigia repens*
Naiad	*Najas guadalupensis*
Spatterdock	*Nuphar advena*
Stonewort	*Nitella* sp.
Tapegrass	*Sagittaria kurziana*
Watercress	*Rorippa* sp.
Water moss	*Fontinalis* sp.
Water pennywort	*Hydrocotyle umbellata*

Santa Fe River Spring Runs Sub-Aquatic Vegetation Survey; March, 2017

By Karst Environmental Services, Inc. for Alachua County Environmental Protection Department

Table 11. Little Devils Spring Cumulative Abundance Summary of Vegetation Type

Little Devil's Spring Pool and Run

March 28, 2017 Start: 10:45 Finish: 12:00 (EST/DST)

Vegetation Type: **Tape Interval:** (All measurements in feet.)

Tape 1

	0-50/ Spring Pool		50-100		100-150		150-200		200-250		250-300		Cumulative
	Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Abundance
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Score
Algae	1	1	2	2	2	2	2	2	1	-	2	2	19
Bladderwort	-	-	-	-	1	-	-	-	2	1	2	-	6
Hydrilla	-	-	-	-	1	-	-	1	-	-	1	1	4
Hygrophila	1	1	1	1	1	1	-	1	1	2	2	3	15
Ludwigia	-	-	-	1	-	-	-	-	-	-	-	2	3
Water moss	-	-	-	-	-	-	-	-	2	2	1	-	5
Water pennywort	-	-	1	1	-	-	-	1	-	1	-	-	4
See Devil's Run Photo:	1,2,3,4,5		6,7,8,9		10,11,12,13		14,15,16,17		18,19,20,21		22,23,24,25,26		
See Devil's Run Surface Photo:	S1, S2		S2		S3		S4		S5		S6		
See Devil's Run Video:	LD Run Video 1 & 2		LD Run Video 1		LD Run Video 1		LD Run Video 1		LD Run Video 1		LD Run Video 1		

Abundance Rating: (Estimate of relative abundance per species at interval.)

Low (or Present)	1
Medium	2
High	3

Survey Plant Species List Name used for the purposes of this Survey & Table in **Bold.**

Common Name:	**Scientific Name:**	**Common Name:**	**Scientific Name:**
Algae (Filamentous); several possible species/genera, including (but not limited to):		**Hygrophila**	*Hygrophila polysperma*
Water Felt	*Vaucheria* sp.	**Ludwigia** (Purple ludwigia)	*Ludwigia repens*
Lyngbya	*Lyngbya wallei*	**Naiad**	*Najas guadalupensis*
Water Silk	*Spirogyra* sp.	**Spatterdock**	*Nuphar advena*
Bladderwort	*Utricularia* sp.	**Stonewort**	*Nitella* sp.
Chara (Muskgrass)	*Chara* sp.	**Tapegrass**	*Sagittaria kurziana*
Coontail	*Ceratophyllum demersum*	**Watercress**	*Rorippa* sp.
Eelgrass	*Vallisneria americana*	**Water moss**	*Fontinalis* sp.
Hydrilla	*Hydrilla verticillata*	**Water pennywort**	*Hydrocotyle umbellata*

Santa Fe River Spring Runs Sub-Aquatic Vegetation Survey; March, 2017

By Karst Environmental Services, Inc. for Alachua County Environmental Protection Department

Table 12. July Spring Cumulative Abundance Summary of Vegetation Type

July Spring Pool and Run											
March 28, 2017	Start:	12:30	Finish:	13:45	(EST/DST)						
Vegetation Type:	**Tape Interval:**		(All measurements in feet.)								
	Tape 1										
	0-50/ Spring Pool		**50-100**		**100-150**		**150-180**		**Cumulative**		
	Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		**Abundance**		
	Right	Left	Right	Left	Right	Left	Right	Left	**Score**		
Algae	1	2	2	2	2	3	3	3	18		
Chara	-	-	-	-	1	-	-	-	1		
Hydrilla	1	1	1	1	1	1	-	1	7		
Hygrophila	3	3	3	3	3	3	1	1	20		
Ludwigia	1	-	1	-	-	1	-	-	3		
Naiad	1	-	-	-	-	1	-	-	2		
Spatterdock	-	-	1	-	-	-	1	-	2		
Stonewort	-	-	1	1	1	-	1	1	5		
Water moss	-	3	-	2	-	2	-	-	7		
Water pennywort	-	-	-	1	-	-	1	-	2		
See July Run Photo:	1,2,3,4,5		6,7,8,9		10,11,12,13		14,15,16,17				
See July Run Video:	July Run Video 1		July Run Video 1		July Run Video 1		July Run Video 1				

Abundance Rating:	(Estimate of relative abundance per species at interval.)
Low (or Present)	1
Medium	2
High	3

Survey Plant Species List	Name used for the purposes of this Survey & Table in **Bold.**		
Common Name:	**Scientific Name:**	**Common Name:**	**Scientific Name:**
Algae (Filamentous); several possible species/genera, including (but not limited to):		**Hygrophila**	*Hygrophila polysperma*
Water Felt	*Vaucheria* sp.	**Ludwigia** (Purple ludwigia)	*Ludwigia repens*
Lyngbya	*Lyngbya wallei*	**Naiad**	*Najas guadalupensis*
Water Silk	*Spirogyra* sp.	**Spatterdock**	*Nuphar advena*
Bladderwort	*Utricularia* sp.	**Stonewort**	*Nitella* sp.
Chara (Muskgrass)	*Chara* sp.	**Tapegrass**	*Sagittaria kurziana*
Coontail	*Ceratophyllum demersum*	**Watercress**	*Rorippa* sp.
Eelgrass	*Vallisneria americana*	**Water moss**	*Fontinalis* sp.
Hydrilla	*Hydrilla verticillata*	**Water pennywort**	*Hydrocotyle umbellata*

Santa Fe River Spring Runs Sub-Aquatic Vegetation Survey; March, 2017

By Karst Environmental Services, Inc. for Alachua County Environmental Protection Department

Table 13. Ginnie Spring Cumulative Abundance Summary of Vegetation Type

Ginnie Spring Pool and Run

March 28, 2017 Start: 14:50 Finish: 15:33 (EST/DST)

Vegetation Type: **Tape Interval:** (All measurements in feet.)

Tape 1

	0-50/ Spring Pool		50-100		100-150		150-200		200-250		250-300		Cumulative
	Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Abundance
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Score
Algae	1	1	1	1	1	1	1	1	1	1	1	1	12
Bladderwort	2	-	-	-	1	-	1	1	1	-	-	-	6
Eelgrass	-	1	-	-	-	-	-	-	-	-	-	-	1
Hydrilla	1	-	-	-	1	-	-	-	-	1	-	1	4
Hygrophila	-	-	-	-	-	-	-	-	1	-	1	1	3
Ludwigia	2	2	2	2	2	3	3	1	2	2	2	2	25
Tapegrass	-	-	-	-	-	-	-	-	-	1	-	1	2
Water moss	2	1	-	-	-	-	-	-	1	-	3	-	7
Water pennywort	-	-	-	2	-	-	-	1	-	1	-	-	4
See Ginnie Run Photo:	1,2,3,4,5,6		7,8,9,10		11,12,13,14		15,16,17,18		19,20,21,22		23,24,25,26		
See Ginnie Run Surface Photo:	S1		S2		S3								
See Ginnie Run Video:	Ginnie Run Video 1		Ginnie Run Video 1		Ginnie Run Video 1		Ginnie Run Video 1		Ginnie Run Video 1		Ginnie Run Video 1		

Abundance Rating: (Estimate of relative abundance per species at interval.)

Low (or Present)	1
Medium	2
High	3

Survey Plant Species List Name used for the purposes of this Survey & Table in **Bold.**

Common Name:	Scientific Name:	Common Name:	Scientific Name:
Algae (Filamentous); several possible species/genera, including (but not limited to):		**Hygrophila**	*Hygrophila polysperma*
Water Felt	*Vaucheria* sp.	**Ludwigia** (Purple ludwigia)	*Ludwigia repens*
Lyngbya	*Lyngbya wallei*	**Naiad**	*Najas guadalupensis*
Water Silk	*Spirogyra* sp.	**Spatterdock**	*Nuphar advena*
Bladderwort	*Utricularia* sp.	**Stonewort**	*Nitella* sp.
Chara (Muskgrass)	*Chara* sp.	**Tapegrass**	*Sagittaria kurziana*
Coontail	*Ceratophyllum demersum*	**Watercress**	*Rorippa* sp.
Eelgrass	*Vallisneria americana*	**Water moss**	*Fontinalis* sp.
Hydrilla	*Hydrilla verticillata*	**Water pennywort**	*Hydrocotyle umbellata*

Santa Fe River Spring Runs Sub-Aquatic Vegetation Survey; March, 2017

By Karst Environmental Services, Inc. for Alachua County Environmental Protection Department

Table 14. Dogwood Spring Cumulative Abundance Summary of Vegetation Type

Dogwood Spring Pool and Run

March 28, 2017 Start: 16:15 Finish: 17:10 (EST/DST)

Vegetation Type: **Tape Interval:** (All measurements in feet.)

Tape 1

	0-50/ Spring Pool		**50-100**		**100-150**		**150-200**		**200-230**		**Cumulative**
	Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		**Abundance**
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	**Score**
Algae	2	2	2	1	2	1	1	1	2	1	15
Hydrilla	1	1	-	1	-	1	-	1	-	1	6
Hygrophila	1	-	-	1	-	-	1	1	1	-	5
Ludwigia	2	1	2	2	2	2	2	2	-	1	16
Tapegrass	1	-	-	-	-	-	-	-	-	-	1
Water pennywort	-	1	1	-	-	1	1	1	-	1	6
See Dogwood Run Photo:	1,2,3,4,5,6,7		8,9,10,11		12,13,14,15		16,17,18		19,20,21		
See Dogwood Run Surface Photo:	S1, S2		S3		S4		S5		S6		
See Dogwood Run Video:	Dogwood Run Video 1		Dogwood Run Video 1		Dogwood Run Video 1		Dogwood Run Video 1		Dogwood Run Video 1		

Abundance Rating: (Estimate of relative abundance per species at interval.)

Low (or Present)	1
Medium	2
High	3

Survey Plant Species List Name used for the purposes of this Survey & Table in **Bold.**

Common Name:	**Scientific Name:**	**Common Name:**	**Scientific Name:**
Algae (Filamentous); several possible species/genera, including (but not limited to):		**Hygrophila**	*Hygrophila polysperma*
Water Felt	*Vaucheria* sp.	**Ludwigia** (Purple ludwigia)	*Ludwigia repens*
Lyngbya	*Lyngbya wallei*	**Naiad**	*Najas guadalupensis*
Water Silk	*Spirogyra* sp.	**Spatterdock**	*Nuphar advena*
Bladderwort	*Utricularia* sp.	**Stonewort**	*Nitella* sp.
Chara (Muskgrass)	*Chara* sp.	**Tapegrass**	*Sagittaria kurziana*
Coontail	*Ceratophyllum demersum*	**Watercress**	*Rorippa* sp.
Eelgrass	*Vallisneria americana*	**Water moss**	*Fontinalis* sp.
Hydrilla	*Hydrilla verticillata*	**Water pennywort**	*Hydrocotyle umbellata*

Santa Fe River Spring Runs Sub-Aquatic Vegetation Survey; March, 2017

By Karst Environmental Services, Inc. for Alachua County Environmental Protection Department

Table 15. Twin Spring Cumulative Abundance Summary of Vegetation Type

Twin Spring Pool and Run										
March 28, 2017	Start:	17:36	Finish:	18:05	(EST/DST)					
Vegetation Type:	**Tape Interval:**		(All measurements in feet.)							
	Tape 1									
	0-50/ Spring Pool		**50-100**		**100-150**		**150-200**		**Cumulative**	
	Bank/Run Side		Bank/Run Side		Bank/Run Side		Bank/Run Side		**Abundance**	
	Right	Left	Right	Left	Right	Left	Right	Left	**Score**	
Algae	2	2	2	2	2	-	3	3	16	
Hydrilla	-	-	-	-	1	1	-	-	2	
Hygrophila	1	1	-	1	1	1	1	-	6	
Ludwigia	-	-	-	-	-	-	-	1	1	
Naiad	-	-	-	1	-	-	1	-	2	
Tapegrass	-	-	-	-	-	-	-	1	1	
Water pennywort	1	-	-	1	-	-	-	-	2	
See Twin Run Photo:	1,2,3,4		5,6,7		8,9,10,11		12,13,14,15			
See Twin Run Surface Photo:	S1		S2,S3,S4		S5		S6			
See Twin Run Video:	Twin Run Video 1		Twin Run Video 1		Twin Run Video 1		Twin Run Video 1			

Abundance Rating:	(Estimate of relative abundance per species at interval.)									
Low (or Present)	1									
Medium	2									
High	3									
Survey Plant Species List		Name used for the purposes of this Survey & Table in **Bold.**								
Common Name:	**Scientific Name:**						**Common Name:**			**Scientific Name:**
Algae (Filamentous); several possible species/genera, including (but not limited to):							**Hygrophila**			*Hygrophila polysperma*
Water Felt	*Vaucheria* sp.						**Ludwigia** (Purple ludwigia)			*Ludwigia repens*
Lyngbya	*Lyngbya wallei*						**Naiad**			*Najas guadalupensis*
Water Silk	*Spirogyra* sp.						**Spatterdock**			*Nuphar advena*
Bladderwort	*Utricularia* sp.						**Stonewort**			*Nitella* sp.
Chara (Muskgrass)	*Chara* sp.						**Tapegrass**			*Sagittaria kurziana*
Coontail	*Ceratophyllum demersum*						**Watercress**			*Rorippa* sp.
Eelgrass	*Vallisneria americana*						**Water moss**			*Fontinalis* sp.
Hydrilla	*Hydrilla verticillata*						**Water pennywort**			*Hydrocotyle umbellata*

APPENDIX II

PERIPHYTON, GASTROPODA & ADDITIONAL SAV IDENTIFICATION

Table 16. ACEPD Springs Algae Samples & Laboratory Analyses (Water & Air Research, Inc. Periphyton Report)

Table 17. Additional SAV and Gastropoda Identification; Santa Fe River Springs & Runs

Santa Fe River Spring Runs Sub-Aquatic Vegetation Survey; March 2017

By Karst Environmental Services, Inc. for Alachua County Environmental Protection Department

Table 16. ACEPD Springs Algae Samples & Laboratory Analyses

Data for this table provided by ACEPD. Algae identifications were performed by Water & Air Research, Inc. of Gainesville, FL.

		Location:	Hornsby	Treehouse	Blue Spring Run	July Spring	July Spring	July Spring	July Spring	Dogwood Spring	Twin Spring
Qualitative Algal Samples;		**County:**	Alachua Co.	Alachua Co.	Gilchrist Co.	Columbia Co.	Columbia Co.	Columbia Co.	Columbia Co.	Gilchrist Co.	Gilchrist Co.
List of dominant filamentous algal taxa		**Tape Position or Specific Location:**	2-250	East Ledge	5-176	Near Lightning Spring	Log	Green Vent	Dark Vent	D/S of Vent	Floating
and large chain-forming diatoms.		**Date:**	3/29/2017	3/29/2017	3/27/2017	3/28/2017	3/28/2017	3/28/2017	3/28/2017	3/28/2017	3/28/2017
		Time:			15:30					16:30	
Division or Class	**Taxon**										
cyanobacteria	Oscillatoria limosa (Blue Green Algae)			1							1
cyanobacteria	Oscillatoria princeps (Blue Green Algae)									1	3
cyanobacteria	Oscillatoria sp. (Blue Green Algae)			1			1			1	
cyanobacteria	Phormidium sp. (Blue Green Algae)			1		1	1	1		1	
cyanobacteria	Plectonema wollei (Blue Green Algae)								1	1	
Chlorophyta	Hydrodictyon reticulatum (Green Algae)					1					
Chlorophyta	Rhizocolonium hieroglyphicum (Green Algae)			1						1	
Chlorophyta	Spirogyra spp. (Green Algae)						3				1
Xanthophyceae	Vaucheria sp. (Red Algae)	1	3	3	3			3	3		
Rhodophyta	Batrachospermum macrospora (chantransia stage)	3									
Bacillariophyceae	Melosira undulata								1		
Bacillariophyceae	Pleurosira laevis (large, chain forming diatom)							1			
Bacillariophyceae	Synedra ulna (large side by side diatom)	1	1	1	1	1	1				
Bacillariophyceae	Terpsinoe musica (large, chain forming diatom)		1	1				1	1	1	

Relative Dominance (relative within sample - not between samples).

3	**Taxa with large cells and common in sample.**
2	**Taxa with smaller cells or less common.**
1	**Taxa only occasionally seen in sample.**

Notes:

Periphyton samples collected from natural substrata.

July Spring/near Lightning Spring - numerous pennate diatoms present.

July Spring/green vent - dominant taxa is *Fontinalis* (aquatic moss), many pennate diatoms present.

Twin - numerous pennate diatoms present.

Treehouse - numerous pennate diatoms present.

Santa Fe River Spring Runs Sub-Aquatic Vegetation Survey; March 2017						
By Karst Environmental Services, Inc. for Alachua County Environmental Protection Department						
Table 17. Additional SAV and Gastropoda Identification; Santa Fe River Springs and Runs						
Data for this table provided by ACEPD.		Biological identifications were performed by Water & Air Research, Inc. of Gainesville, FL.				
Spring Name:	**Naked Spring**	**Ginnie Spring**	**July Spring**	**Hornsby Spring**	**Lily Spring**	**Poe Spring**
Date Collected:	3/27/2017	3/28/2017	3/28/2017	3/29/2017	3/30/2017	3/30/2017
Time Collected:	1730	-	-	-	-	-
Location:	0-50	-	-	Indicated as (Tape #)	-	-
SAV Taxa:	*Utricularia* sp.	*Luwigia repens*	*Eleocharis baldwinii*	cf. *Sagittaria kurziana** (Tape 1)	*Hygrophila polysperma***	*Hygrophila polysperma***
	Najas guadalupensis			cf. *Sagittaria kurziana** (Tape 2)	*Najas guadalupensis*	
	Hydrilla verticillata			*Najas guadalupensis* (Tape 3)		
				Eleocharis baldwinii (Tape 3)		
Comments:	No flowers: cf.*U. gibba*			*Need flowers to be sure		**Exotic invasive
Gastropoda:	*Elimia athearni*	*Elimia athearni*	None collected.	*Amnicola dalli*	*Planorbella duryi*	*Pseudosuccinea columella*
		Planorbella sp.		Hydrobiidae (LPIL)	*Amnicola dalli*	*Laevapex fuscus*
		Unidentified snail, immature			Hydrobiidae (LPIL)	Hydrobiidae (LPIL)
Comments:	found in the vegetation	All found in the vegetation		All found in the vegetation	All found in the vegetation	All found in the vegetation

APPENDIX III

SANTA FE RIVER SPRINGS WATER QUALITY DATA

Table 18. Santa Fe River Springs Water Quality Data, March 2017

TestAmerica Laboratories Inc. Analytical Report

Santa Fe River Spring Runs Sub-Aquatic Vegetation Survey; March 2017

By Karst Environmental Services, Inc. for Alachua County Environmental Protection Department

Table 18. Santa Fe River Springs Water Quality Data, March 2017

Data for this table provided by ACEPD.

Analyses performed by TestAmerica Laboratories, Inc., Savannah, GA.

Location	Sample Date	Analytes			Field Parameters					
		Nitrate-Nitrite as N	Total Phosphorus	Potassium	Temp	Dissolved Oxygen	Dissolved Oxygen	Specific Conductance	pH	Turbidity
		mg/L	mg/L	mg/L	C°	%	mg/L	µsm/cm	SU	NTUs
Hornsby Spring	3/29/2017	0.57	0.097	1.3	22.4	2.9	0.25	473	7.34	0.2
Treehouse Rise	3/29/2017	0.35	0.11	1.3	29.8	17	1.46	472	7.43	1.32
Poe Spring	3/30/2017	0.21	0.11	1.1	22.4	2.2	0.2	442	7.31	0.28
Lily Spring	3/30/2017	0.41	0.12	1	22.2	7.1	0.62	463	7.35	0.38
Rum Island Spring	3/30/2017	1.7	0.066	0.76	22.5	27.8	2.42	430	7.41	0.2
Gilchrist Blue Spring	3/27/2017	2.4	0.05	0.66	22.5	42.7	3.81	393	7.44	0.28
Naked Spring	3/27/2017	2.4	0.045	0.7	22.5	40.8	3.53	406	7.41	0.34
Little Devils Spring	3/28/2017	2.2	0.062	0.57	22.4	35.3	3.05	366	7.56	0.44
Devil's Eye Spring	3/28/2017	2.2	0.06	0.72	22.4	31.9	2.78	412	7.4	0.22
July Spring	3/28/2017	1.8	0.067	0.72	22.4	29.5	2.56	424	7.39	0.23
Ginnie Spring	3/28/2017	1.9	0.097	0.53	22.4	39.2	3.37	354	7.56	0.13
Dogwood Spring	3/28/2017	1.3	0.057	0.38	22.4	93.6	3.38	334	7.66	0.32
Twin Spring	3/28/2017	1.3	0.057	0.48	22.6	19.6	1.7	270	7.7	0.18
Deer Spring	3/28/2017	1.6	0.083	0.56	22.2	29.3	2.56	312	7.76	0.26