Technical Support for Establishing Minimum Flows and Levels for the Lower Santa Fe and Ichetucknee Rivers

Suwannee River Water Management District

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Plan Design Enable

Contents

Appendices

Tables

Figures

Page

Acknowledgements

This report was prepared under a contract with the Suwannee River Water Management District for support in establishing minimum flows and levels for the Lower Santa Fe and Ichetucknee Rivers. Field work was completed by Bill Spencer, Ph.D. and Robbie McKinney (SRWMD), David Hall, Ph.D. and Wade Hurt (independent contractors), and Pam Latham, Ph.D. (Atkins). The report was prepared by Pam Latham and Emily Keenan (Atkins). Review was provided by Bill Spencer and Louis Mantini (SRWMD) and Tony Janicki, Ph.D. and Keith Hackett (JEI).

Executive Summary

The purpose of this study was to characterize relationships among vegetation, soils, and elevations in wetlands along the Lower Santa Fe and Ichetucknee rivers and assist the Suwannee River Water Management District (District) in establishing minimum flows and levels (MFLs) for the rivers. The Ichetucknee River flows approximately 6 miles from Ichetucknee Springs to the Santa Fe River, which in turn flows approximately 30 miles to its confluence with the Suwannee River, about 148 miles upstream of the Gulf of Mexico (Figure ES-1).

The permanent ground water flows and clear water of spring-fed rivers of the Lower Santa Fe and Ichetucknee rivers, differentiate them from streams and rivers dominated by surface water flows in other parts of Florida. Studies completed for the Suwannee River floodplain vegetation describe communities similar to those found along the Lower Santa Fe and Ichetucknee rivers. Vegetation classes, plant species importance, soil characteristics, and elevations were characterized along 10 transects in the Santa Fe River and three transects in the Ichetucknee River study corridors. This study may be the first to quantify wetland vegetation specifically along the Lower Santa Fe and Ichetucknee rivers corridor.

Vegetation. Differences in vegetation along the Lower Santa Fe and Ichetucknee river corridors were significant based on importance values (IVs) (calculated using tree species density and basal area) and provided a relative measure of species IV (no units). Eight distinct vegetation communities were identified, with some conspicuous differences in vegetation between the rivers. For example, there was a strong cypress-popash community presence along the Ichetucknee River; while along the Lower Santa Fe River, there was clear dominance (as measured by IV) by one species or the other. Neither bay swamp community nor swamp bay (*Persea palustris*) trees were recorded along the Lower Santa Fe, while tupelos (*Nyssa* spp.) were not recorded along the Ichetucknee River. Water hickory (*Carya aquatica*) dominated the river banks along the Lower Santa Fe River, but was not recorded along Ichetucknee River sampling transects. A total of 11 obligate and facultative wet species (as defined under 62-340.200, 373.421 FS.) were recorded from sample plots along the Ichetucknee River while 20 were recorded along the Lower Santa Fe River. Insert information regarding species in belt transects as necessary. The eight communities are briefly summarized below.

- Bay swamp (Ichetucknee River only): three obligate wetland species (primarily swamp bay), and a single facultative wet species, laurel oak (*Q. laurifolia*).
- Cypress popash swamp (Ichetucknee River only): primarily obligate wetland species cypress and popash *(Fraxinus caroliniana*)
- In nearly equal proportion and a single facultative wet species (red maple, *Acer rubrum).*
- Cypress swamp: dominated by obligate wetland species, primarily bald cypress (*Taxodium distichum*), with a smaller component of popash; facultative wet species recorded on the Lower Santa Fe River, but not the Ichetucknee River.
- Hardwood swamp: three to four obligate wetland species, including cypress and dahoon holly Ilex*. cassine*) on the Ichetucknee River and cypress and water hickory (*Carya aquatica*) on the Lower Santa Fe River, as well as several facultative wet and facultative species; no species particularly dominant on Ichetucknee River, while popash exhibited the greatest dominance on the Lower Santa Fe River.
- Hydric hardwood hammock (Lower Santa Fe River only): includes obligate, facultative wet, facultative, facultative upland, and upland species, with no dominance by any particular species; hornbeam *(Carpinus caroliniana)* and laurel oak (*Quercus laurifolia*) exhibit the greatest, albeit low, dominance.
- Mesic hardwood hammock: (Lower Santa Fe River only): largest component is the facultative wet species hornbeam (*Carpinus caroliniana*), followed by *Q. virginiana* (upland).
- Hardwood cypress (Lower Santa Fe River only): dominated by obligate wetland species cypress, popash, and tupelo), with large component of the facultative wet species red maple and American elm.

- Marsh (Lower Santa Fe River only). Encountered along a single transect. Included only obligate wet herbaceous species pineland pimpernel (*Samolus valerandi*) and Louisiana sedge (*Carex louisianica*), both obligate wet species.

Vegetation was also surveyed in 30 foot wide belt transects along the PCQ sampling transects to document species that occurred less frequently and/or were absent from PCQ sampling plots. Species common to PCQ sampling plots and belt transects along both rivers were red maple, buttonbush, Carolina ash, bald cypress, basswood, and American elm. Six tree species along the Ichetucknee River and three along the Lower Santa Fe River were identified in the belt transects and not the PCQ sampling plots. Three of these were upland species and all but three were found in single communities along a single transect: pumpkin ash (*Fraxinus profunda*), Shumard oak (*Q. shumardii*), and live oak (*Q. virginiana*).

Soils. Soils along the Lower Santa Fe River and Ichetucknee River corridors were typically loamy/clayey except for river banks (sandy) and the bay swamp along the Ichetucknee River (sandy). Soils were typically hydric with the exception of the mesic hardwood hammock. Average depth to seasonal high saturation (SHS) was zero (at surface) for all except the hydric hardwood hammock (along the Ichetucknee River). Average depth to SHS was zero for the hardwood swamp, less than 2 inches for the cypress and hardwood cypress swamps, less than 4 inches for the hydric hardwood hammock, 7 inches in the hydric hardwood hammock, and nearly 10 inches below land surface in the mesic hardwood hammock. Hydric soils also included muck in the cypress popash, hardwood swamp, and hydric hardwood hammock communities.

Elevations. Lowest river channel elevations (thalweg elevations) associated with sampling transects ranged from 25.82 (upstream) to -8.99 (downstream) feet NAVD along the Lower Santa Fe River, a decline of more than 34 feet. The average change in elevations along transects was 8 feet and ranged from 4 to 13 feet for the Lower Santa Fe River. The decline in channel elevations along the Ichetucknee River was 11.44 feet, from 16.40 (upstream) to 4.96 (downstream) feet NAVD88. Changes in elevation along Ichetucknee River transects averaged 10 feet and ranged from 5 to 19 feet, although the second highest change was 11 feet, similar to the changes along Lower Santa Fe River transects. Mean elevations (feet NAVD) of vegetation classes ranged from 13.85 (hardwood swamp) to 32.39 (hardwood cypress) along the Lower Santa Fe River, compared with 15.76 (cypress popash) to 21.60 (hardwood swamp) along the Ichetucknee River.

Relationships among Vegetation, Soils, and Elevations. The contributions of elevation, presence or absence of hydric soils, and depth to SHS were significant in separating vegetation classes in both the Ichetucknee and Lower Santa Fe rivers (Wilks' Lambda $p< 0.0001$ for both rivers).Discriminant Function Analysis (DFA) was successful in differentiating among vegetation classes based on measures of elevation, distance from river channel, and soil parameters along the study corridor. Vegetation classes were distinct in terms of species composition and IV, and environmental variables were significant in accounting for differences between vegetation classes. Elevations (NAVD), elevation relative to edge of water and to channel bottom, and depth to seasonal high water were significant in separating vegetation classes from each other, although overlap in environmental parameters between vegetation classes occurred. Correlations between vegetation class and environmental parameters for the Ichetucknee River were highest for depth to SHS (r^2=1.0) and elevation (feet NAVD) (r^2=0.82) and only slightly lower for elevation relative to EOW (r^2=0.74) and elevation relative to channel bottom (0.71). Correlations for the Lower Santa Fe River were somewhat lower: depth to SHS (r^2=0.53) and elevation (feet NAVD) (r^2=0.42) were slightly lower when compared with elevation relative to edge of water (EOW) (r^2=0.56) and elevation relative to channel bottom (r^2 = 0.55). Relationships were strongest for elevation relative to EOW and depth to seasonal high water for the Ichetucknee River when compared with the Lower Santa Fe River.

Cypress popash swamp, hardwood swamp, and hydric hardwood hammock classes were classified correctly 100 percent of the time along the Ichetucknee River transects, while cypress swamp was correctly classified 60 percent of the time. For the Lower Santa Fe River, hardwood cypress swamp, marsh, and mesic hardwood hammock were classified correctly 100 percent of the time, while hardwood swamp and hydric hardwood hammock were classified correctly 60 and 81 percent of the time, respectively. Overlap among vegetation classes typically occurred among adjacent classes (i.e. those most similar in species composition and elevation).

Wetted Perimeter. Increases in wetted perimeter in all wetland vegetation classes were dramatic over small increases in elevation, illustrating the effect that small changes in inundation can have. Average linear distance of community/one foot change in elevation was greatest for the swamp vegetation classes. The linear extent of habitat/one foot of change in elevation was over 250 feet for the cypress and hardwood cypress vegetation classes along the Lower Santa Fe River; double that of the hydric hardwood hammock class (109.88 feet). The remaining classes along the Lower Santa Fe River transects had less than 46 linear feet of habitat/one foot change in elevation. Although less extreme along the Ichetucknee River transects, the cypress and hardwoods had wetted perimeters of 68.53 linear feet/one foot of change in elevation, compared with less than 32 linear feet of habitat/one foot change in elevation in the other vegetation classes

Conclusions. Vegetation classes sampled along the Lower Santa Fe and Ichetucknee rivers were distinct in terms of species composition and IV, and environmental variables were significant in accounting for differences between vegetation classes. Therefore, measurable environmental parameters such as elevation can provide a basis for establishing MFLs. Within wetlands, depth to SHS appeared to differentiate “drier” (hammocks) from “wetter” wetlands (swamps). Vegetation classes with hydric soils and shallower depths to SHS (less than 3 inches) could be separated further based on elevations. Along the Ichetucknee River, average elevation relative to edge of water (and to channel bottom) were lower for cypress swamp (1.09 feet) and hardwood swamp (1.75 feet) than the cypress popash swamp (2.39 feet), which was in turn, lower than the hydric hardwood hammock. Along the Lower Santa Fe River, elevations relative to edge of water were lowest for hardwood cypress (2.34 feet) and marsh (2.22 feet), compared with cypress (4.89 feet) and hardwood (4.32 feet) swamp. The water level elevations necessary to inundate these vegetation classes may provide a basis for establishing MFLs in the Lower Santa Fe and Ichetucknee rivers.

1. Purpose

The statutory directive for minimum flows and levels (MFLs) included in the Water Resources Act was enacted by the Florida Legislature in 1972. Section 373.042 F.S. of the Act directs each water management district to establish MFLs for surface water bodies, watercourses, and aquifers within their respective jurisdictions. Under the statute, the minimum flow for a given watercourse is defined as the limit at which further withdrawals would be "significantly harmful" to the water resources or ecology of the area. In addition, the determination of MFLs must be based on the "best available" information.

The purpose of this study was to characterize relationships among vegetation, soils, and elevation in wetlands along the Lower Santa Fe and Ichetucknee rivers (Figure 1). Given the assumption that vegetation is a good and easily measured integrator of environmental and historical site conditions, vegetation, soils, and elevation will be used to support the Suwannee River Water Management District (District) in establishing MFLs for the Lower Santa Fe and Ichetucknee rivers.

Instream flows are important to maintaining a functional river or stream system, fish and wildlife habitat, recreation, navigation, and consumptive uses such as irrigation and domestic water supply. MFLs are intended to guide water resource and water supply development to ensure water resource sustainability for people and the natural environment. They will also be used to assist in making water use and other permitting decisions. In summary, MFLs are being established to:

- Address Florida Statute 373.042(1)(a)&(b)
- Protect water resources and ecology
- Determine water availability

The District Governing Board has the final authority to set MFLs within its jurisdiction, using several guidelines provided by the state (and listed below).

- Using the best information available
- When appropriate, setting MFLs to reflect seasonal variations
- Considering the protection of non-consumptive uses of water (e.g. recreation)

This report presents the relationships among vegetation and physical factors, such as elevation and soils that characterize the Lower Santa Fe and Ichetucknee rivers study corridors and may be used in establishing MFLs for vegetation communities.

2. Study Area

The Gulf Coastal Lowlands and the Northern Highlands are separated by the Cody Scarp and make up the two main physiographic regions in the Lower Santa Fe and Ichetucknee river basin. Underlying geologic units include Eocene limestone (near the ground surface in the high-recharge, strongly karst-influenced Gulf Coastal Lowlands), capped by Miocene sediments that tend toward clayey and phosphatic (at or near the surface along the Cody Scarp). Over these, Pliocene and Pleistocene-Holocene sediments are typically sandy at the surface with loamy subsoils or substrate at varying depths.

The Lower Santa Fe and Ichetucknee river basins are part of the larger Suwannee River watershed, which drains about 9,930 square miles in southern Georgia and northern Florida. Ground water influence on river flows is evident in the lower reaches of the river and its main tributary, the Santa Fe River, characterized by numerous ground water springs. The ground water inflow from springs accounts for most of the average annual flow of the lower Suwannee River and supplies nearly all of the flow in the river during periods of low flow in the dry seasons and during droughts (Grubbs and Crandall 2007).

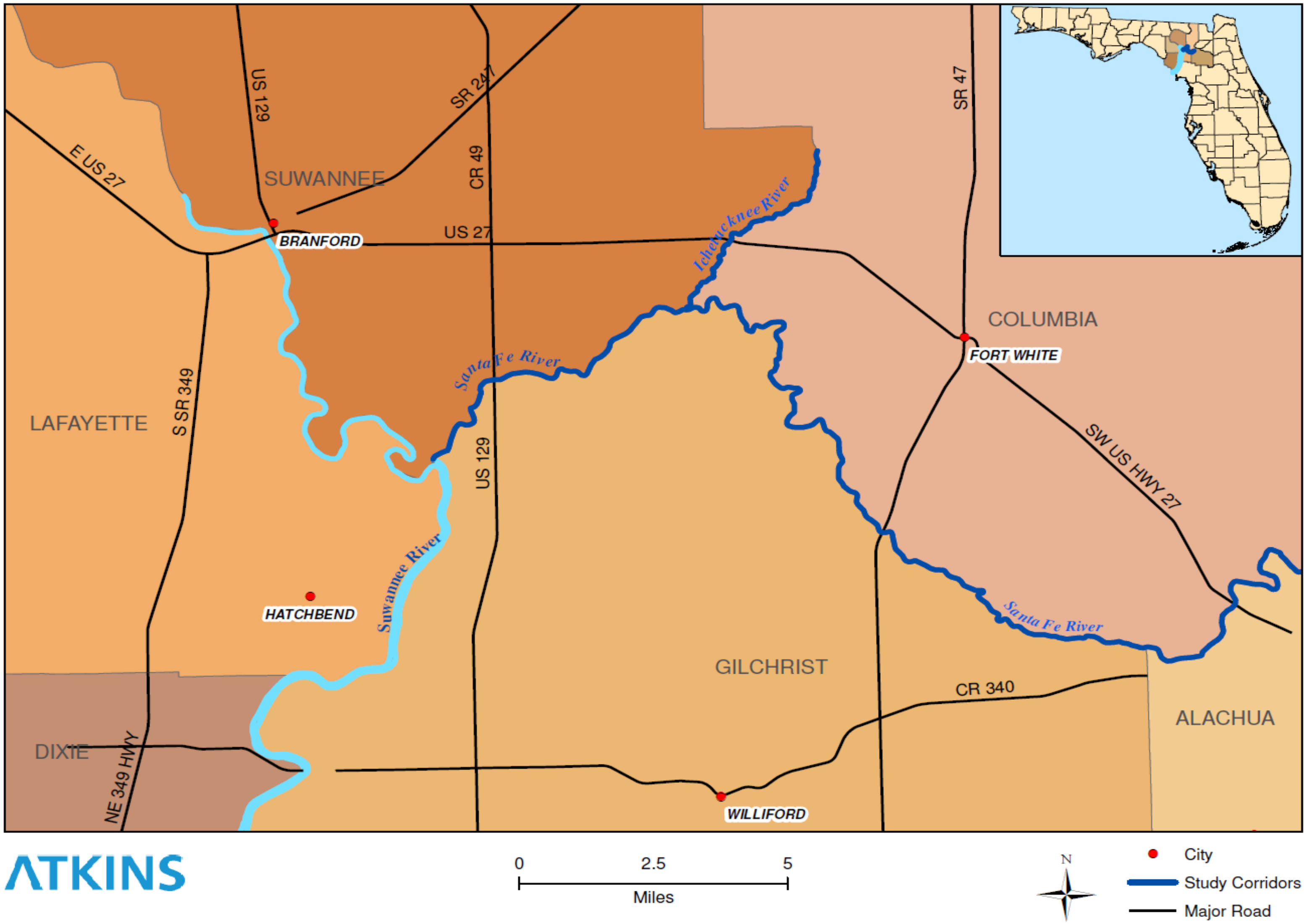
The Santa Fe River basin is approximately 1,380 square miles in size and includes parts of Columbia, Bradford, Union, Alachua counties in Florida, as well as very small portions of the basin in Clay and Union Counties (Figure 1). The surface waters of the river begin in the tannin stained waters of the Santa Fe Swamp, Lake Santa Fe, and Little Lake Santa Fe in Alachua County. The river flows west towards the Suwannee River, disappears into a sinkhole at O'Leno State Park, and emerges again 3 miles away at the Santa Fe River Rise State Park (Grubbs and Crandall 2007). The thalweg elevation (lowest channel cross section elevation) at the upstream end of the Lower Santa Fe River at U.S. Highway 441 is about 26 feet NGVD29 and about -10 feet NGVD29 at its confluence with the Suwannee River. The river ranges from 75 to 100 feet wide and most of the river downstream from Fort White is affected by backwater from the mouth of the Suwannee River under average flow conditions.

Base flows to the Santa Fe are from ground water and springs that flow into the river. Stream flow typically increases from about 850 cubic feet per second (cfs) near High Springs to about 1,600 cfs downstream near Fort White and changes in flows from upstream to downstream (stream flow pickup) correspond to seasonal (and longer time scales) (Clarke 1965). Grubbs (1997) used streamflow and specific conductance, direct (storm) runoff, and ground water to evaluate ground and surface water exchanges along the Lower Santa Fe River and concluded that ground water discharge to the river accounts for all, or nearly all, of the increase in flow in this reach of the Santa Fe River on an average annual basis. Evaluations of the changes in stream flow, which occur along reaches of the Suwannee and Santa Fe Rivers, also indicated that most of the increase in the stream flow pickup along the Suwannee River (below Ellaville) and the Lower Santa Fe River is derived from ground water discharging to these river reaches.

The spring-fed Ichetucknee River is largest tributary to the Santa Fe River and has a surface drainage area of 213 square miles (only 55 square miles of which have a defined drainage network). Nine named springs (Ichetucknee Springs, Cedar Head Spring, Blue Hole Spring, Roaring Springs, Singing Springs, Boiling Spring, Grassy Hole Springs, Mill Pond Spring, and Coffee Spring) and numerous unnamed springs contribute about 350 cfs to the upper reaches of the Ichetucknee River. The Ichetucknee River in turn contributes an average of about 350 cfs to the Lower Santa Fe River (period of record 1917 to 1999). Minimum and maximum measured flows were 240 and 580 cfs, respectively, with about 50 percent of the measured flows ranging between 320 and 400 cfs (Grubs and Crandall 2007).

Both the Santa Fe and Ichetucknee rivers are popular recreation areas and the head spring of the Ichetucknee River is a designated National Natural Landmark (U. S. Department of the Interior 1972). From the end of May until early September, tubing is popular and visitors also enjoy picnicking, snorkeling, canoeing, swimming, hiking, and wildlife viewing.

Figure 1. Location of the Lower Santa Fe and Ichetucknee Rivers in the Suwannee River Water Management District



3. Sampling Methods

An underlying assumption of vegetation classification is that vegetation is the best and most easily measured integrator of environmental and historic site conditions. Sampling methods for this study were designed to provide data needed to characterize the wetlands and associated vegetation and soils along the Lower Santa Fe and Ichetucknee rivers. The methods used in transect selection, data collection, and data analyses are described in the following sections. The locations of 13 sampling transects along both rivers are mapped in Figure 2. Transect selection, field sampling, and data analysis are described in the following sections.

3.1. Transect Selection

Thirteen sampling transects were established along the Lower Santa Fe and Ichetucknee river study corridor, perpendicular to the river channel. The first step in assigning transect locations was a thorough review of potential criteria on which to base the selections. The data used to examine potential criteria for selecting transects are listed below.

- Vegetation communities based on National Wetlands Inventory (NWI) (USFWS 2011) and Florida Gap analysis (Pearlstine et al. 2002) vegetation classification
- U.S. Department of Agriculture/Natural Resources Conservation Service (NRCS) soils classifications and Hydric Soils Groups
- United States Geological Survey (USGS) elevation/topography
- USGS water level gage locations
- Aerial photography
- Land use, e.g. historical alterations

An analysis of the NWI vegetation classes was used as the basis on which to allocate transects among vegetation communities along the river channel, followed by field reconnaissance. Potential transects were designated in areas characterized by native vegetation, little or no disturbance, and riverine wetlands. The vegetation classes identified for this study were based on woody species dominance and generally corresponded with NWI vegetation classes. NWI mapping classes were very broad along the river corridors and indicated drier wetlands along the Ichetucknee River and the upstream Lower Santa Fe River transects, compared with “wetter” wetland classes along the downstream portion of the lower Santa Re River.

Vegetation classes were designated palustrine, with a single exception on Transect BB along the Ichetucknee River, which was identified as riverine, aquatic, with rooted vascular vegetation (river grasses). NWI mapping along the Ichetucknee River indicated predominantly palustrine forested broad leaved deciduous temporarily flooded (PFO1A) and palustrine forested deciduous seasonally flooded (PFO6C). NWI vegetation along the Lower Santa Fe River was primarily PFO6C at upstream transects and broad leaved deciduous, seasonally flooded (PFO1C) at downstream transects. Only transects A and B (upstream) transects on the Lower Santa Fe River did not include temporarily flooded wetlands (based on NWI) and only transects A, J, and L had semi-permanently flooded (PFO6F) wetlands designations (based on NWI). NWI mapping did not specifically identify any cypress swamps (needle-leaved deciduous, PFO2) or cypress mixed (PFO6/PFO2) swamps. The vegetation classes identified along study transects are listed in Table 1, with corresponding classes from other commonly used sources for vegetation community names. Descriptions of the NWI classes (after Cowardin et al. 1979) are provided in Table 2 and Figure 3.

Figure 2. Transect Locations along the LSFI Study Corridors

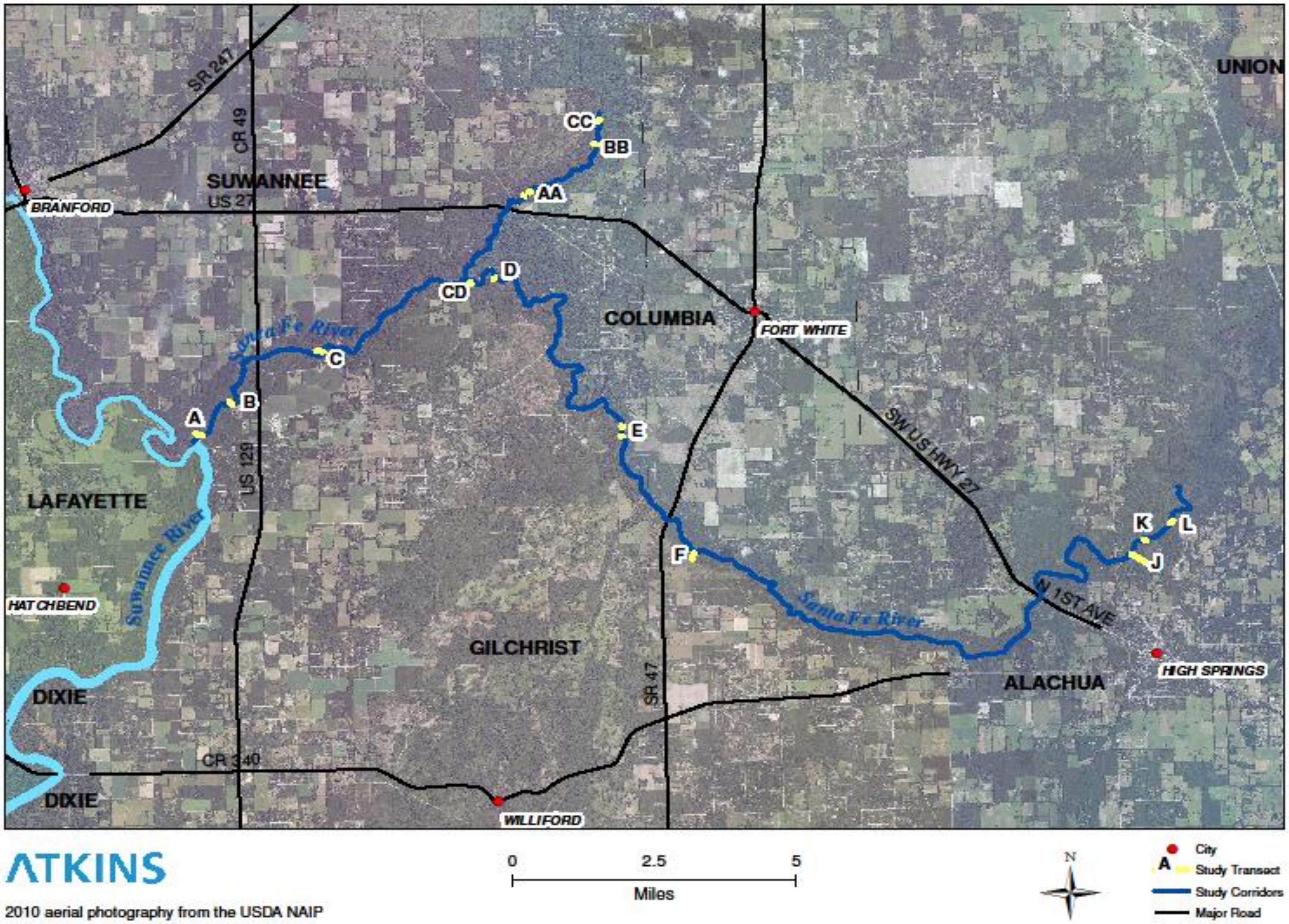


Table 1. NWI classes and Descriptions for the Lower Santa Fe and Ichetucknee River Transects

NWI Vegetation Class	Description	Transects with NWI Classes
PFO6C	Palustrine forested deciduous seasonally flooded	AA, BB, CC, A, B, C, D
PFO6F	Palustrine forested deciduous semi-permanently flooded	A, J, L
PFO1A	Palustrine forested broad leaved deciduous temporarily flooded	all transects except A, B
PFO1C	Palustrine forested broad -leaved deciduous, seasonally flooded	E, F, G, H. I, K
PFO4C	Palustrine forested needle-leaved evergreen seasonally flooded (slash pine)	L
PFO4A	Palustrine forested needle-leaved evergreen temporarily flooded (slash pine)	L
PSS1C	Palustrine shrub/scrub Wetland seasonally flooded	H
R2AB3H	Riverine, aquatic, rooted perennial, vascular vegetation	BB

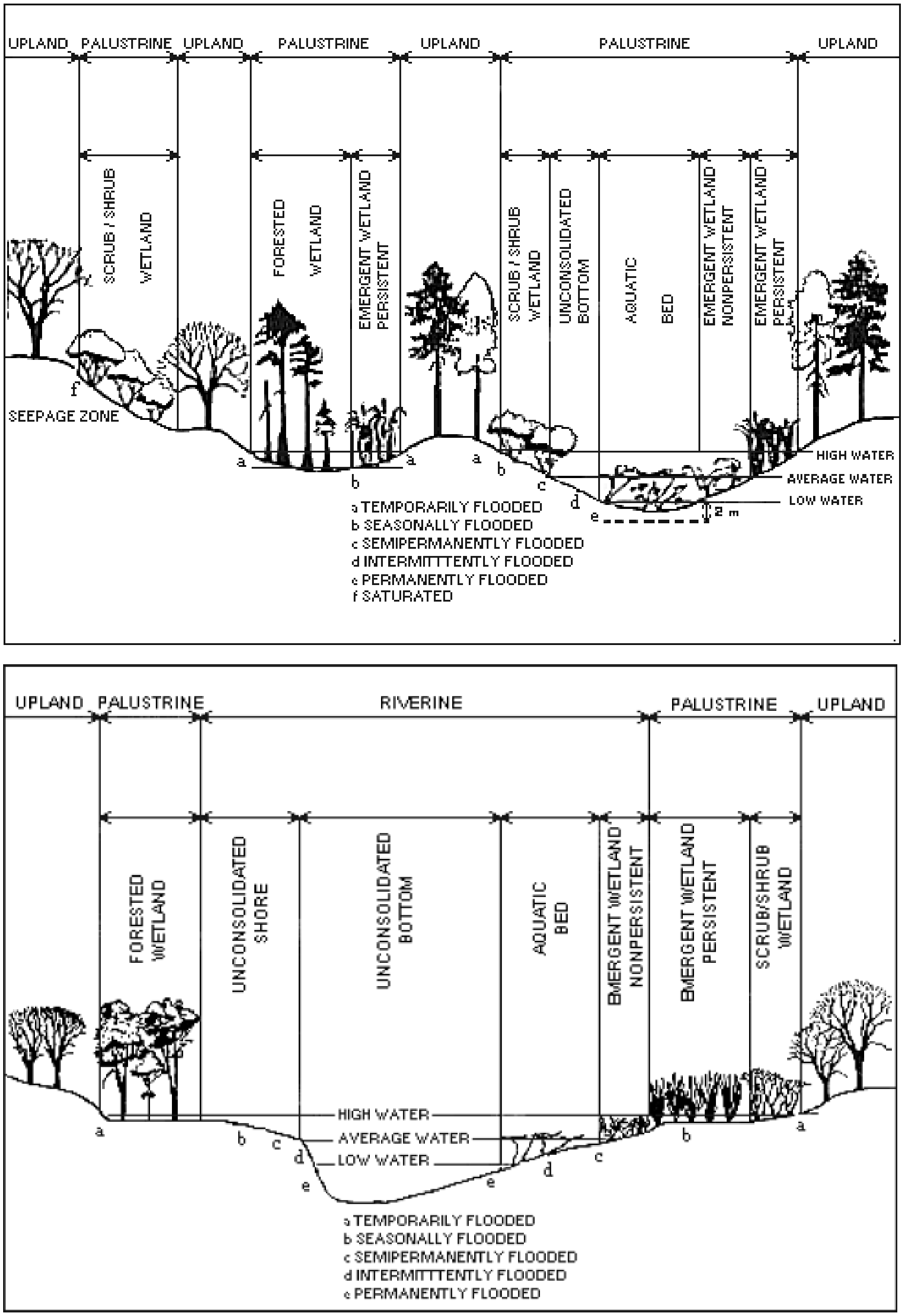
Table 2. Descriptions of NWI Classifications in the River Study Corridors

<table>
<tr><th>NWI Class</th><th colspan="2">Class Description</th></tr>
<tr><td>P_Palustrine
(no further classification)</td><td colspan="2">Non-tidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, in tidal areas with ocean-derived salinity < 0.5 ‰ (parts per thousand, or ppt). Includes wetlands lacking such vegetation, but with (1) area < 20 acres; (2) no active wave-formed or bedrock shoreline features; (3) deepest water depth < 2 m at low water; and (4) salinity less than 0.5 ‰.</td></tr>
<tr><td rowspan="3">P_FO
Palustrine
Forested</td><td colspan="2">Woody vegetation greater than 6 meters (20 feet) tall. Species include both broad and needle leaved deciduous and evergreen categories, e.g. red maple, ash, willows, dogwoods, cypress.</td></tr>
<tr><td>_3
Broad-leaved
Evergreen</td><td>In the SE US Broad-leaved Evergreen Wetlands reach their greatest development. Red bay (Persea borbonia), loblolly bay (Gordonia lasianthus), and sweet bay (Magnolia virginiana) are prevalent, especially on organic soils.</td></tr>
<tr><td>_6
Indeterminate
Deciduous</td><td>This class may include a mix of broad-leaved and needle-leaved deciduous trees such as slash pine, oak, popash, maple, and others. This general description may be due to the difficulty in identifying species as broad-leaved or needle-leaved in aerial photography taken when leaves are absent.</td></tr>
<tr><td rowspan="2">R_2
Riverine
Lower
Perennial</td><td colspan="2">A Riverine system contains all wetlands and deepwater habitats contained within a channel except wetlands dominated by trees, shrubs, persistent emergents and habitats with water containing ocean-derived salts in excess of 0.5 ‰. In a Lower Perennial subsystem the gradient is low and velocity is slow. There is no tidal influence and some water flows throughout the year.</td></tr>
<tr><td>_AB_3
Aquatic Bed Rooted
Vascular</td><td>The class Aquatic Bed includes wetlands and deepwater habitats dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years.</td></tr>
<tr><td colspan="3">Hydrologic Modifiers For Classes and Subclasses (see Figure 3-1 for detail)</td></tr>
<tr><td>A</td><td colspan="2">Temporarily Flooded</td></tr>
<tr><td>B</td><td colspan="2">Saturated</td></tr>
<tr><td>C</td><td colspan="2">Seasonally Flooded</td></tr>
<tr><td>D</td><td colspan="2">Seasonally Flooded/Well Drained</td></tr>
<tr><td>E</td><td colspan="2">Seasonally Flooded/Saturated</td></tr>
<tr><td>F</td><td colspan="2">Semi-permanently Flooded</td></tr>
<tr><td>H</td><td colspan="2">Permanently Flooded</td></tr>
</table>

Figure 3. Features of Habitats of Relevant NWI Classes

Palustrine

Riverine



*After Cowardin, L. M., V. Carter, F. C. Golet, E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U. S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. Jamestown, ND: Northern Prairie Wildlife Research Center Online. http://www.npwrc.usgs.gov/ resource/ 1998/ classwet/classwet.htm (Version 04DEC98).

3.2. Elevation Surveys and Distance to Channel

The landward extent of wetlands along sampling transects generally coincided with the FEMA-designated 10 year floodplain. Vegetation transects (selected as described in previous section) were subsequently established within the 10 year floodplain on the east and west sides of the river channel and then surveyed to the landward extent of wetland vegetation. Elevations were recorded for vegetation sampling points in addition to edge of water (EOW), channel cross-sections, and hydrological/biological indicators. In some cases, transects included only the east side of the river due to development, including concrete walls, along the west side. Elevation data were plotted against distances along transects. Hydrologic indicators of ordinary high water, buttressing, lichen lines, moss lines, and stain lines on trees were also recorded if found along transects. Height of the indicator from the ground surface was measured and included in the elevation surveys. Elevation surveys were combined with Light Detection and Ranging (LiDAR) data and digital elevation models (DEMs) were subsequently developed and used in analyses in addition to ground-survey data. Elevation profiles for each transect are provided in Appendix A. Wetted perimeter graphs for each transect are provided in Appendix B.

Coordinates (XYZ) were provided to Atkins for subsequent vegetation and wetted perimeter analyses. The District developed a digital elevation model (DEM) and provided the data to Atkins. Data quality control (QC) during vegetation analyses indicated a discrepancy in XYZ coordinates between the DEM and surveyed data. The elevation discrepancies between the surveyed and interpolated elevation data and the DEM were large (8 to 12 feet differences along a single transect) and were not consistently larger or smaller. The District subsequently implemented a substantial QC effort and the final DEM data provided to Atkins were consistent with XYZ coordinates surveyed at specific field locations and the transect locations identified during the field efforts. XYZ data used in previous analyses (vegetation communities and soils, extent of communities along elevation gradients, etc.) were subsequently revised and provided to Atkins

3.3. Vegetation Characterization: Mapping and Field Sampling

Vegetation along transects was first mapped to provide some background information prior to field sampling. Transects were then established in the field and sampled.

Vegetation Mapping

District scientists compared NWI classifications with available aerial photography, soils maps, and field observations and used this information to map potential transects prior to sampling. The potential transects were visited by District and Atkins scientists to evaluate transects for additional criteria, including direct influence of river on floodplain, relatively undisturbed conditions, presence of semi-permanent or permanently flooded vegetation, and access to the site. As a result of the field visits, a total of 13 transects were selected for sampling (establishment and verification of transects is described in Appendix C). The NWI classes and corresponding vegetation communities from other commonly used classes are listed in Table 3.

Table 3. Vegetation Classes along the Lower Santa Fe and Ichetucknee Rivers for NWI and other Commonly Used Classifications.

Vegetation Class (Field Identification)	NWI and Cowardin et al. (1979)	Florida Land Use Cover and Forms Classification System (FLUCFCS) (FDOT 1999)	Florida Natural Areas Inventory (FNAI)	Natural Resources Conservation Service (NRCS)	Florida Fish and Wildlife Conservation Commission (FFWCC)	Ecosystems of Florida (Myers and Ewel 1990)	Florida Gap Project
Cypress Swamp	Forested needle-leaved deciduous FO2	6210 - Cypress	Floodplain swamp or Strand swamp	17 - Cypress swamp	12 - Cypress swamp	Cypress strands / Cypress swamps	Cypress Forest Compositional Group
Hydric Hardwood Hammock	Forested broad-leaved deciduous FO1	6170 - Mixed wetland hardwoods	Hydric hammock or Bottomland forest	12 - Wetland hardwood hammock	13 - Hardwood swamp	Mixed hardwood swamps	Swamp Forest Ecological Complex
Hardwood Swamp	Forested broad-leaved deciduous FO1	6170 - Mixed wetland hardwoods	Hydric hammock or Bottomland forest	12 - Wetland hardwood hammock	13 - Hardwood swamp	Mixed hardwood swamps	Swamp Forest Ecological Complex
Mesic Hardwood Hammock	Not applicable	4200 – Upland hardwood forest	Upland hardwood forest	11 - Upland hardwood hammocks	Hardwood hammocks and forests	Hydric hammocks	Swamp Forest Ecological Complex
Hardwood Cypress	Forested needle-leaved and broad leaved deciduous FO2/FO6	6210 - Cypress	Floodplain swamp or Strand swamp	17 - Cypress swamp	12 - Cypress swamp	Cypress strands / Cypress swamps	Swamp Forest Ecological Complex
Cypress Popash Swamp	Forested needle-leaved and broad leaved deciduous FO2/FO6	6210 - Cypress	Floodplain swamp or Strand swamp	17 - Cypress swamp	12 - Cypress swamp	Cypress strands / Cypress swamps	Swamp Forest Ecological Complex
Bay Swamp	Forested broad-leaved evergreen FO3 and/or forested deciduous FO6	Bay swamp - 6110	Baygall	22 - Shrub bog / bay swamp	14 - Bay swamp	Bay swamps	Bay/Gum/Cypress Ecological Complex

Field Sampling

Transects were initially identified using NWI vegetation classes. However, the NWI classes were considered too broad for the level of community characterizations in this study. Communities were subsequently named in the field, based on apparent species dominance and hydrologic regime (e.g. swamp, hammock). Boundaries between communities were identified in the field using a combination of indicators, including, but not limited to:

- General community type (e.g. wetland to upland)
- Species cover (e.g. cypress to oak, obligate wetlands to facultative wets)
- Elevation (e.g. scarp presence)
- Soils (e.g. hydric or nonhydric)

Actions implemented to ensure data were accurate and therefore adequate to meet the needs of the overall project (i.e. to support the establishment of MFLs) included data collection protocols (QA) and verification (QC) by selected experts (described above). QA/QC actions were implemented for sampling along the 10 Lower Santa Fe River transects (A, B, C, CD, D, E, F, J, K, and L) and 3 Ichetucknee River transects (AA, BB, and CC). QA was implemented via standard protocols, i.e. procedures to ensure that the correct process was carried out. QC was implemented to ensure that the product was also accurate and adequate to meet the purpose of the project. QC occurred at 2 levels: the first as field verification and the second as review of the compiled data. Methods used during sampling are outlined below. Greater detail for the QA/QC actions is provided in Appendix D.

- Data sheets were prepared prior to sampling and used as the checklist to ensure that all data were collected. Data recorded included transect and sampling point locations, plant community names, plant species, distance and diameter breast height (DBH) measurements for four trees at each sample point, and for notes.
- GPS coordinates for top of bank (TOB), beginning and end of transect, plant community types, soils characteristic, biological indicators (if present), and other features were recorded and locations were flagged to assist surveyors.
- Plant community names, inundation characteristics, and dominant plant species present were recorded.
- Vegetation sampling plots were located randomly in each vegetation class along transects and the point-centered-quarter (PCQ) sampling method (Mueller-Dombois and Ellenberg 1974) was used to characterize the vegetation. A minimum of three plots from each vegetation class was sampled at each change in dominant species. Density, frequency, basal area, and IV were calculated for each tree species, by transect and vegetation class.
- At each sampling point in each community type (minimum = 3 sample points / community), trees were identified, measured, and recorded for each of four quarters/sampling point, per the PCQ method.
- A complete plant species list was compiled along belt transects for ground, shrub, and tree level vegetation (5 meters wide along entire transect length).

3.4. Soils Characterization

The U.S. Army Corps of Engineers (USACE) Wetlands Delineation Manual defines a hydric soil as one that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part. Under saturated or flooded conditions that are anaerobic for part of the growing season, soil profiles usually acquire unique characteristics that can be relied upon as positive indicators of hydric conditions. Most organic soils (histosols) are hydric, and the extent of decomposition of organic plant materials can be used to classify these soils as muck (highly decomposed remains of plants and other organisms), peaty muck, mucky peat, and peat (partially decomposed remains of plants and other organisms).

Evidence in soil profiles can also indicate flooding in soils that may not be hydric. Importantly, hydric soils are used in characterizing wetlands, not river channels in which organics are washed downstream. For example, flooded river banks that have a high sand content and occur at elevations high enough that flooding is infrequent generally have nonhydric soils, but show signs of flooding such as thin strata of gravel, sand, silt, or clay deposited by flood waters. Other evidence of flooding includes cypress buttressing, moss collars, lichen lines, and water stains. Hydric/nonhydric determinations and seasonal high saturation (SHS) determinations were made to support MFL development for the rivers. Determinations were based on

Depth to seasonal high saturation (SHS) provides an additional quantitative indicator of wetlands extent for the project. Soils data collected in support of MFLs have typically indicated presence (0) or absence (1) of mineral or organic soils, muck, saturation, and inundation to allow inclusion of these characteristics in statistical comparisons (vs. a full qualitative analysis of horizons, grain size, etc.). SHS is the highest depth below the surface where water is expected to remain for a period of approximately 30 or more during the wettest part of years with normal annual and wet season precipitation, with possible flooding (Hurt, G.W. and F.C. Watts 2007).

Soil cores were examined for each sampling point along each transect. Soil cores were exhumed with a soil probe. The presence of hydric or flooding indicators, as well as saturation and/or inundation conditions were evaluated and recorded. The soil profile was examined to a minimum depth of 50 cm (20 inches). In addition, several indicators described in the *Hydric Soil Delineation Indicators* (A5-A9, S5-S6, F1-F9) were evaluated and recorded: a numeric code of “0” was recorded if a characteristic was absent, and a “1” was recorded if the characteristic was present. Soils data were subsequently paired with vegetation and elevation data for analysis.

Once soils data were compiled, hydric indicators were assigned a series of scores for each core sampled. As noted previously, some soils have evidence of flooding, e.g. sandy and steep river banks, although the soils may not show indications of hydric conditions. For example, soils with no evidence of wetland indicators (uplands) were given a soils index of zero while soils with indicators were assigned a value of 1. Depth to SHS was assigned the measured value and ranged from 0 to 15 inches.

- hydric (1)/non-hydric (0)
- sandy (1) / not sandy (0)
- loamy/clayey soil (1) or not (0)
- mucky soil (1) or not (0)
- depth to SHS

3.5. Data Analysis

Elevation, soils, and vegetation data were compared among and between vegetation classes identified in the river corridor. Statistical analyses were performed using SAS statistical software (Cary, NC 1998). Hydrologic flow analyses were performed by the District and used to characterize inundation conditions based on elevations of vegetation classes and other environmental parameters of interest and were not part of the present study. . In addition to the information provided here, tables listing coordinates of transect locations, vegetation types along transects, general soil series, and other data identified by the District, are provided in Appendix E.

3.5.1. Elevations and Wetted Perimeter

Ground elevation data (feet NAVD) were used to compare vegetation, soils, and distance from channel among transects. Normalized (relative) elevations were calculated as the difference between the transect elevations and the river bottom to account for variation due to downstream-upstream elevation gradients.

Wetted perimeter was calculated for vegetation classes in the study corridor to evaluate the potential change in inundated habitat that may be anticipated due to changes in river stage. The wetted perimeter for a vegetation class is the linear distance inundated along a transect that occurs below a particular elevation or water level (river stage). Consequently, as distance from the river channel increases, the total wetted perimeter also increases, but can vary among vegetation classes. Wetted perimeter changes, relative to changes in elevation, were compared using the Kruskal Wallis test, a nonparametric analog to a one-way analysis of variance (ANOVA).

3.5.2. Vegetation

Vegetation classes were differentiated as part of this study using data from transects and subsequently identifying and quantifying species along individual transects. A general method of vegetation class nomenclature was developed based on species dominance (below).

- Species dominance was used to further refine classes using importance values (IVs) of tree species, an index that combines relative density and basal area of tree species

Vegetation data were used to characterize the plant communities. Density, frequency, basal area, and IV were calculated for each tree species, by transect and vegetation class. Density, basal area, and relative dominance values were calculated for each tree species, by transect and vegetation class:

- Density/ 100 square meters* = 100/(average measured distance, in meters)^2
- Frequency = number of times a plant species is encountered along a transect
- Basal area = basal area of individual trees (inches^2)
- Importance value (IV) = relative density + relative frequency + relative basal area

Relationships between vegetation classes and corresponding environmental parameters were examined for this study to ascertain whether there were differences in:

- Species composition and dominance between or among vegetation classes
- Elevation, soils, and distance from channel between or among vegetation classes

Plant species IVs were calculated for woody species in vegetation classes along sampling transects. Due to small sample size (N = 11 transects, N = 6 vegetation classes) and non-normal data distributions, nonparametric statistics were applied to comparisons of species dominance between vegetation classes. The Kruskal Wallis test was used to measure the difference (or lack of difference) in species dominance among vegetation classes. The Wilcoxon Signed Rank test (a nonparametric analog to the paired-t test) was used to evaluate differences in species IV (or “dominance”) between individual communities, for example differences in species dominance between willow marsh and hardwood swamp vegetation classes.

The sample size for comparisons of elevation and soils among vegetation classes was relatively large and a parametric discriminant function analysis (DFA) was used to quantify the contribution of elevation, soils, and distance from river channel in defining vegetation classes, based on relationships between environmental variables and species composition and dominance along sampling transects. A “successful” DFA is one that results in correct pairing of vegetation types and environmental parameters into vegetation classes. P-values indicate the significance of a relationship, e.g. the ability to predict a vegetation class using elevation, while r^2 values indicate the amount of variation in vegetation classes accounted for by each variable.

4. Results and Discussion

The relationships among vegetation classes and environmental variables along the Lower Santa Fe and Ichetucknee river corridors were evaluated using DFA, as described in the previous section. Elevations, soils, and distance to channel were significant in characterizing environmental conditions of vegetation classes along the river. These relationships are described in the following sections

4.1. Elevations

Lower Santa Fe River. Elevations along the Santa Fe River ranged from 25.3 to 27.3 feet NAVD along the first three upstream transects and ranged from -8.5 to 5.2 feet NAVD along the lower three transects farthest downstream. Elevations along transects at the mid-reaches of the river ranged from -1.4 to 12.6 feet NAVD. The net decline in elevation from just downstream of the spring head (transect J) to nearly the confluence with the Suwannee River (transect A) was 35.8 feet over about 30 miles (1.2 feet/mile). However, the total change in elevation along the river was 21.2 feet between the higher mid-reaches of the river and the downstream reaches (Table 4 and Figure 4).

Ichetucknee River. Elevations along the Ichetucknee River ranged from 4.96 to 16.4 feet NAVD along the six mile stretch of river above its confluence with the Santa Fe River. The net decline in elevation from just downstream of the spring head (transect CC) to nearly the Santa Fe River (transect AA) was 11.4 feet over about 6 miles (1.9 feet/mile) (Table 5 and Figure 5).

Changes in elevation were smallest at transects that intercepted shoals or riffles. For illustrative purposes, the elevation profile and associated vegetation along Transect C are graphed in Figure 6 and graphs of all 13 transects are presented in Appendix A.

Table 4. Summary of Elevations along Lower Santa Fe River Transects

	Transect	Transect Distance	Elevation (feet NAVD)					
			Transect Maximum	Transect Minimum	Channel Minimum	Top of Bank	Edge of Water	Hydrologic Indicator Mean
Downstream	A	768	19.87	7.34	-8.56	11.07	4.22	18.61
	B	477	14.41	8.87	-8.99	13.80	4.20	13.55
	C	704	24.70	11.48	-5.20	16.43	7.17	none
	CD	281	18.36	12.76	-1.40	14.99	6.13	none
	D	211	23.77	10.50	-0.53	6.69	7.86	none
	E (downstream)	279	20.59	13.57	surveyed upstream	not surveyed	not surveyed	24.59
	E (upstream)	222	22.19	13.58	3.41	not surveyed	14.40	none
	F	654	23.70	19.21	12.62	21.65	18.33	23.53
	J	1,605	36.07	31.69	27.27	35.62	30.02	35.15
	K	271	38.96	33.51	25.82	34.61	30.08	none
Upstream	L	360	38.94	32.93	25.34	33.92	30.73	none

Figure 4. Channel Bottom, Maximum, and Minimum Elevations along the Lower Santa Fe River Transects

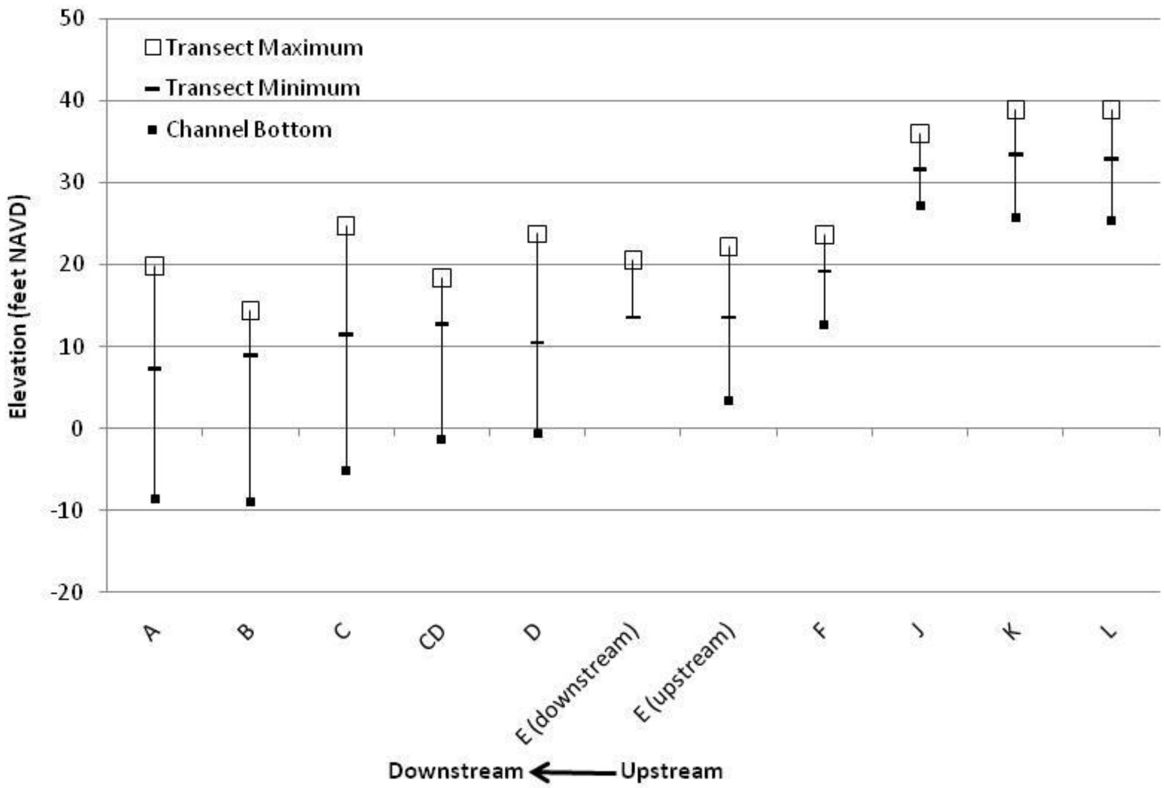


Table 5. Summary of Elevations along the Ichetucknee River

Transect		Transect Distance	Elevation (feet NAVD)					
			Transect Maximum	Transect Minimum	Channel Minimum	Top of Bank	Edge of Water	Hydrologic Indicator (Mean)
Up → Downstream	AA (downstream)	134	21.41	15.27	surveyed upstream	not surveyed	not surveyed	19.43
	AA (upstream)	250	25.86	13.37	4.96	not surveyed	13.37	18.73
	BB (west side)	92	23.77	19.15	surveyed east side	not surveyed	19.15	21.81
	BB (east side)	67	30.43	10.93	13.85	25.75	18.97	20.31
	CC (west side)	186	26.94	20.25	16.40	no point	20.25	22.56
	CC (east side)	126	32.01	20.80	16.40	no point	20.25	none

Figure 5. Channel Bottom, Maximum, and Minimum Elevations along the Ichetucknee River Transects

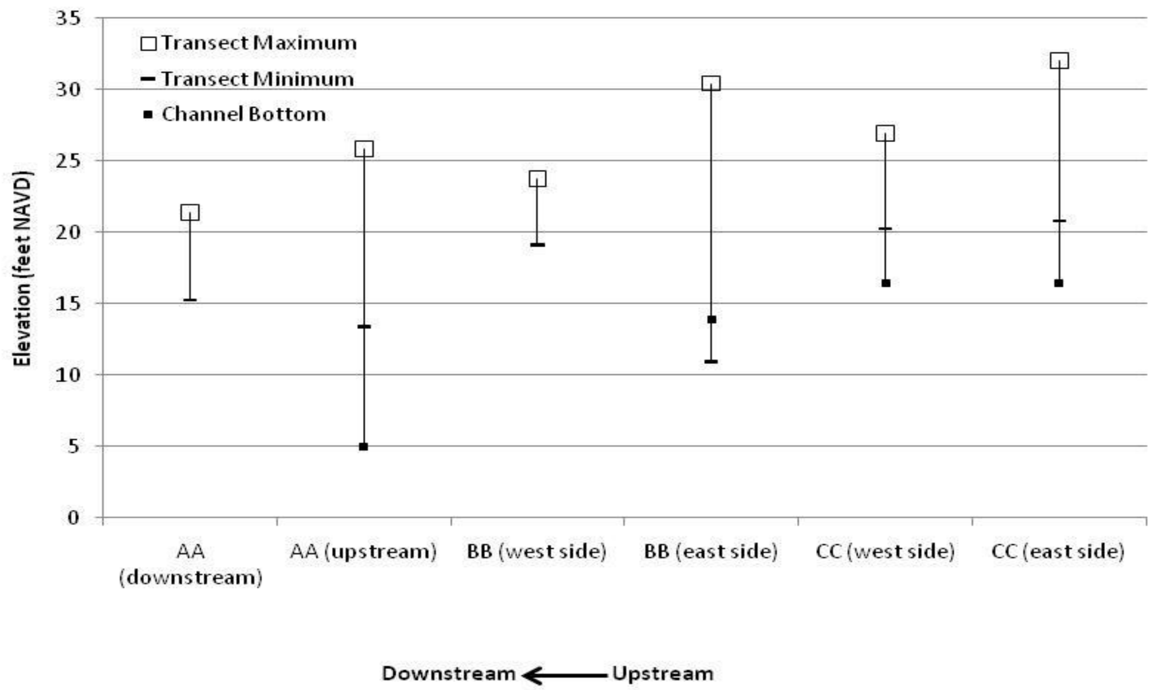
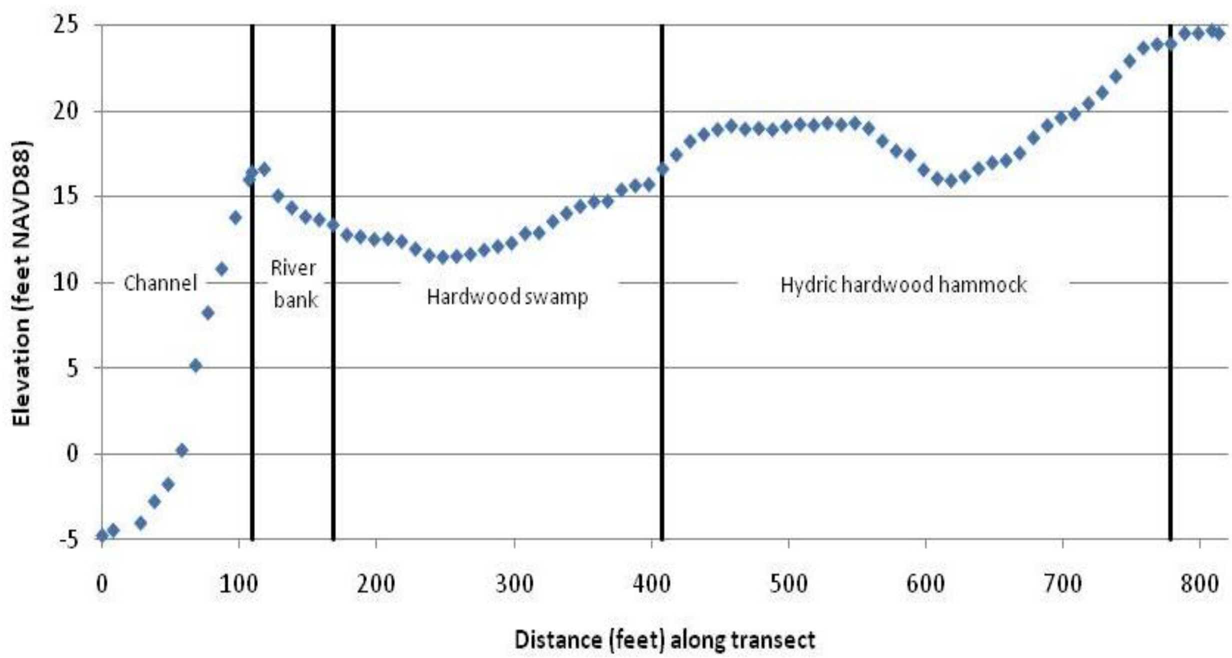


Figure 6. Elevation and Vegetation Profile along Transect C along the Lower Santa Fe River



4.2. Soils

Spodosols, or flatwoods, soils are the dominant soil order throughout Florida and characterize the Lower Santa Fe and Ichetucknee river basin. In contrast, entisols, alfisols, and ultisols form the central ridge. These sandy soils are nearly level, somewhat poorly to poorly drained, with dark sand subsoil layers. Natural systems associated with spodosols are generally flatwoods and wet to dry prairies with ponds and cypress domes (refer back to Figure 6) (Myers and Ewel 1990). Sand, limestone, and clay (USDA/NRCS 1986) components dominate these soils rather than organic materials. In contrast, soils along the St. Johns and Wekiva rivers in the eastern flatwoods physiographic are primarily sandy with significant peaty deposits that indicate extreme anaerobic conditions and saturation for at least 30 consecutive days in most years.

Soils of the Santa Fe and Ichetucknee river basins combined are predominantly sandy in texture with loamy to clayey deposits, organics and sites with sand hill karst terrain with many solution basins. According to the Soil Survey Geographic Database (SSURGO), ultisols cover about 36.7 percent, spodosols (25.8 percent), and entisols (14.7 percent) representing the dominant soil orders in the basin. Less prominent are histosols (2.0 percent), inceptisols (1.1 percent) and alfisols (1.0 percent) (Grunwald et al. 2003). Average elevations of soils along transects are presented in Tables 6 and 7.

FAC Chapter 62-340.550 (Delineation of the Landward Extent of Wetlands and Surface Waters) indicates that inundation for at least seven consecutive days or saturation for at least twenty consecutive days annually constitutes long term hydrologic conditions necessary for the maintenance of hydric soils. Thus, the inundation period necessary for hydric soil conditions is shorter than the two to three weeks required to exclude upland vegetation.

Table 6. Average Elevations of Soils within each Transect along the Santa Fe River

Transect	Non-hydric	N	Hydric	N	Hydric with Muck	N
A	16.94	3	8.86	3		0
B	14.23	1	10.12	5		0
C	18.75	1	15.74	9		0
CD		0	13.12	4		0
D		0	14.28	4	14.44	1
E		0	21.30	6		0
F	22.41	2	20.84	3		0
J		0	32.57	11		0
K		0	34.16	5		0
L	38.69	1	35.28	6		0

Shading indicates absence of soil type.

Table 7. Average Elevations of Soils within each Transect along the Ichetucknee River

Transect	Non-hydric	N	Hydric	N	Hydric with Muck	N
AA	21.41	1	16.19	7	15.77	1
BB	19.11	1	20.16	5	19.78	4
CC	31.05	2	21.72	4	21.68	1

Shading indicates absence of soil type.

4.3. Vegetation Relationships

Differences in vegetation classes along the Lower Santa Fe and Ichetucknee river study corridor were significant based on importance values (IVs) that were calculated using tree species density and basal area and provide a relative measure of species dominance (no units) (Tables 8 and 9).

4.4. Vegetation Classes

Nomenclature. Vegetation classes identified for this study were consistent with, although more specific than, the NWI vegetation classes initially used to map vegetation along transects. The species-specific designations used in this study were retained so that they could be easily combined into a more general context or class if appropriate. While the NWI classes were too general for use in this study, the NWI flooding component may be useful in addressing MFLs. Forested wetlands along the river are consistent with seasonally, semi-permanently, and permanently flooded wetlands, but were not always large enough in areal extent to be included in NWI mapping units.

Class Comparisons. Differences between vegetation classes along the Lower Santa Fe and Ichetucknee river study corridor were significant based on IVs and provided a relative measure of species dominance (no units) (Table 7). For example, species IVs were consistently different between the cypress swamp (first row heading) and the hardwood swamp (second column heading) regardless of transect (Wilcoxon Signed Rank test, $p < 0.01$ level), as well as between these two classes and any of the remaining nine vegetation classes. IVs of individual species for each of these vegetation classes are summarized in Table 7 and graphed in Figure 10.

Differences in vegetation along the Lower Santa Fe and Ichetucknee river corridors were significant based on importance values (IVs) (calculated using tree species density and basal area) and provided a relative measure of species dominance (no units). Eight distinct vegetation communities were identified, with some conspicuous differences in vegetation between the rivers. For example, there was a strong presence of a cypress- popash community along the Ichetucknee River; while along the Lower Santa Fe River, there was clear dominance by one species or the other. Neither bay swamp community nor bay swamp (*Persea palustris*) trees were recorded along the Lower Santa Fe, while tupelos (Nyssa spp.) were not recorded along the Ichetucknee River. Water hickory (*Carya aquatica*) dominated the river banks along the Lower Santa Fe River, but was not recorded along Ichetucknee River sampling transects. A total of 11 obligate and facultative wet species were recorded from sample plots along the Ichetucknee River while 20 were recorded along the Lower Santa Fe River. Insert information regarding species in belt transects as necessary. The eight communities are briefly summarized below.

- Bay swamp (Ichetucknee River only): three obligate wetland species (primarily swamp bay), and a single facultative wet species, laurel oak (*Q. laurifolia*).

- Cypress popash swamp (Ichetucknee River only): primarily obligate wetland species cypress and popash in nearly equal proportion and a single facultative wet species (red maple, *Acer rubrum).*

- Cypress swamp: dominated by obligate wetland species, primarily cypress, with a smaller component of popash; facultative wet species recorded on the Lower Santa Fe River, but not the Ichetucknee River.

- Hardwood swamp: three to four obligate wetland species, including cypress and dahoon holly (*I. cassine*) on the Ichetucknee River and cypress and water hickory on the Lower Santa Fe River, as well as several facultative wet and facultative species; no species particularly dominant on Ichetucknee River, while popash exhibited the greatest dominance on the Lower Santa Fe River.

- Hydric hardwood hammock (Lower Santa Fe River only): includes obligate, facultative wet, facultative, facultative upland, and upland species, with no dominance by any particular specie; hornbeam and laurel oak exhibit the greatest, albeit low, dominance.

- Hardwood cypress (Lower Santa Fe River only): dominated by cypress, red maple, and tupelo, with much smaller component of facultative wet species.

- Mesic hardwood hammock: (Lower Santa Fe River only): largest component is the facultative wet species hornbeam (*Carpinus caroliniana*), followed by *Q. virginiana* (upland).

- Hardwood cypress (Lower Santa Fe River only): dominated by obligate wetland species cypress, popash, and tupelo, with large component of the facultative wet species red maple and American elm.

Table 8. IVs for Tree Species, by Vegetation Class, along the Santa Fe River

Species	DEP Status	Cypress Swamp	Hardwood Swamp	Hardwood Cypress Swamp	Hydric Hardwood Hammock	River Bank	Mesic Hardwood Hammock	Total IV
Carya aquatica	OBL	9.29	36.40	17.51	19.62	136.72		219.54
Cephalanthus occidentalis	OBL	7.97	13.25	7.11	7.50			35.83
Fraxinus caroliniana	OBL	64.74	112.94	43.40	11.60		23.76	256.45
Gleditsia aquatica	OBL		5.52		1.96			7.48
Nyssa aquatica	OBL			32.22				32.22
Nyssa sylvatica var. *biflora*	OBL			8.27	4.08			12.35
Quercus lyrata	OBL	8.57	6.01	9.48	27.50			51.56
Taxodium distichum	OBL	146.12	33.67	74.33	21.29			275.41
Acer rubrum	FACW	13.29	5.86	52.23	10.12			81.50
Carpinus caroliniana	FACW			5.08	69.68	22.28	90.59	187.64
Celtis laevigata	FACW				1.99	21.52		23.50
Crataegus marshallii	FACW			5.03	1.94	21.55		28.52
Forestiera acuminata	FACW	18.97	61.48		14.73			95.18
Ilex decidua	FACW				1.91			1.91
Liquidambar styraciflua	FACW				10.92	25.19		36.11
Pinus glabra	FACW				3.28			3.28
Quercus laurifolia	FACW				55.29	51.59	45.77	152.66
Quercus nigra	FACW			8.01	3.89			11.90
Tilia americana	FACW						22.51	22.51
Ulmus americana	FACW		13.93	37.32	23.38		18.65	93.28
Diospyros virginiana	FAC						17.16	17.16
Ilex vomitoria	FAC					21.16		21.16
Ostrya virginiana	None	31.05	10.94		9.33		21.60	72.91
Quercus virginiana	None						59.95	59.95

Shading indicates absence of species. * Indicates absence of vegetation class.

Table 9. IVs for Tree Species, by Vegetation Class, along the Ichetucknee River

Species	DEP Status	Bay Swamp	Cypress Popash Swamp	Cypress Swamp	Hardwood Swamp	Hydric Hardwood Hammock	Hardwood Cypress Swamp*	Total IV
Cephalanthus occidentalis	OBL	60.28	14.75	63.00				138.03
Fraxinus caroliniana	OBL	73.03	91.79	63.18	24.75			252.76
Ilex cassine	OBL				50.45			50.45
Persea palustris	OBL	141.16						141.16
Taxodium distichum	OBL		117.65	173.82	54.73			346.20
Acer rubrum	FACW		75.80		39.94			115.74
Carpinus caroliniana	FACW					222.46		300.00
Celtis laevigata	FACW				12.84			12.84
Quercus laurifolia	FACW	25.53					25.53	25.53
Tilia americana	FACW				12.31			12.31
Ulmus americana	FACW				57.30			57.30
Myrica cerifera	FAC				24.91			24.91
Carya glabra	UPL				22.77	77.54		22.77

Shading indicates absence of species. * Indicates absence of vegetation class.

Along the Santa Fe River transects, “wetter” to “drier” vegetation communities were reflected in the shift from cypress and hardwood swamps to hydric and hardwood hammocks (Figure 7). Cypress and hardwood swamps were characterized by greater dominance by fewer species and most species were obligate wetland species. In contrast, hydric and mesic hammocks exhibited greater species diversity, no conspicuously dominant species, and many fewer wetland species. The mesic hardwood hammock and river bank vegetation communities along transects included only one obligate wetland tree species (popash) and the hydric hammock included seven of the eight obligate species found in the swamp communities. However, dominance (as measured by IV) by obligate wetland tree species ranged from 10 percent (mesic hardwood hammock) to nearly 50 percent (river bank) of the total possible IV (300) for the hammock and river bank communities and greater than 68 percent for the swamp communities.

The contrast in vegetation classes along the Ichetucknee River transects appeared greater when compared with the Lower Santa Fe River transects as a result of fewer tree species along transects and fewer species characterizing the vegetation communities (Figure 8). For example, the mesic hardwood hammock was characterized by 100 percent hornbeam, a facultative wet species. The remaining “wetter” vegetation communities ranged from 43 (hardwood swamp) to 100 (cypress swamp) percent dominance by obligate wetland species, although three of the four swamps had 75 percent dominance by obligate wetland species.

Figure 7. Importance Values for Tree Species in Vegetation Classes along the Santa Fe River Study Corridor

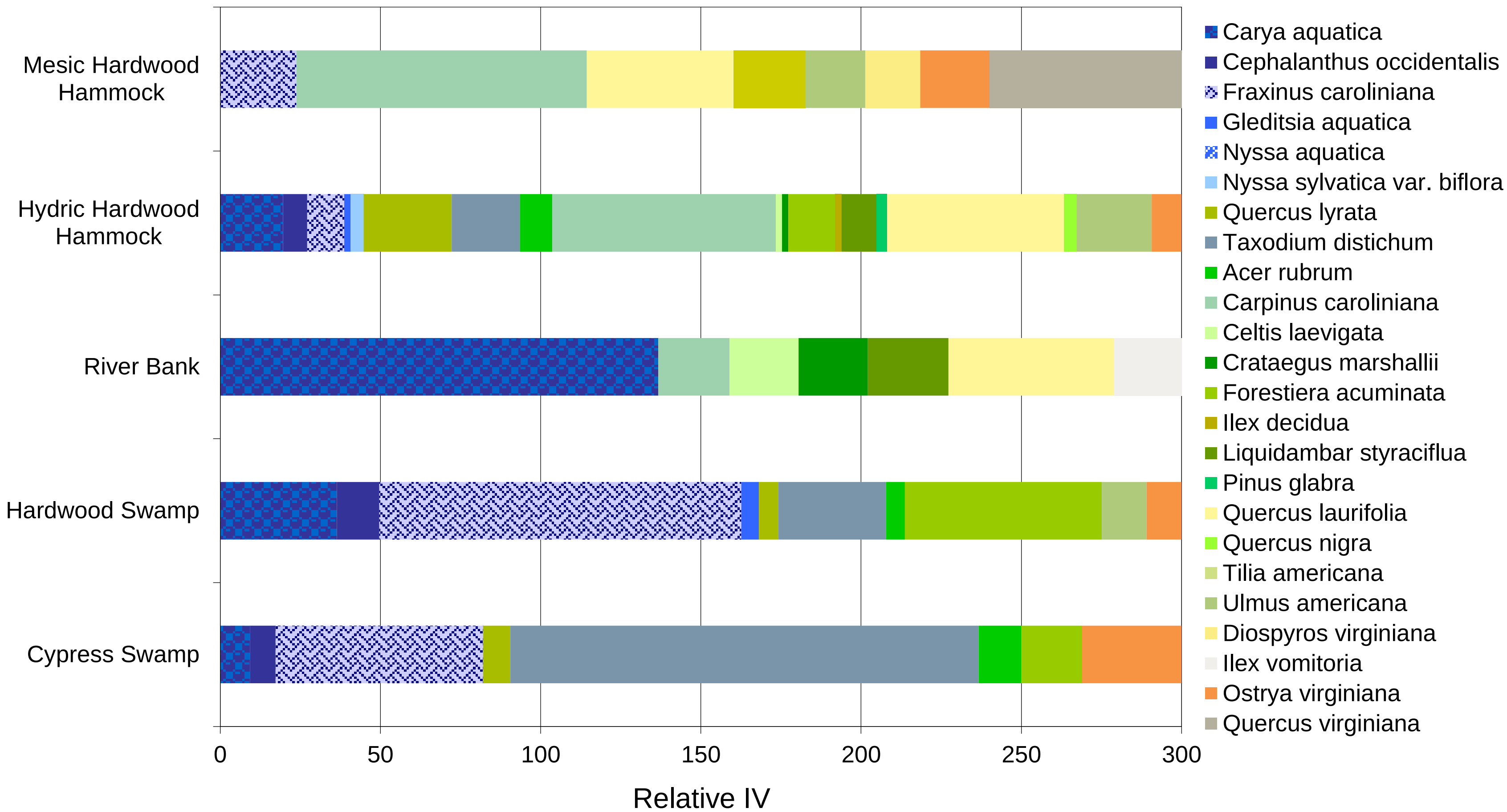
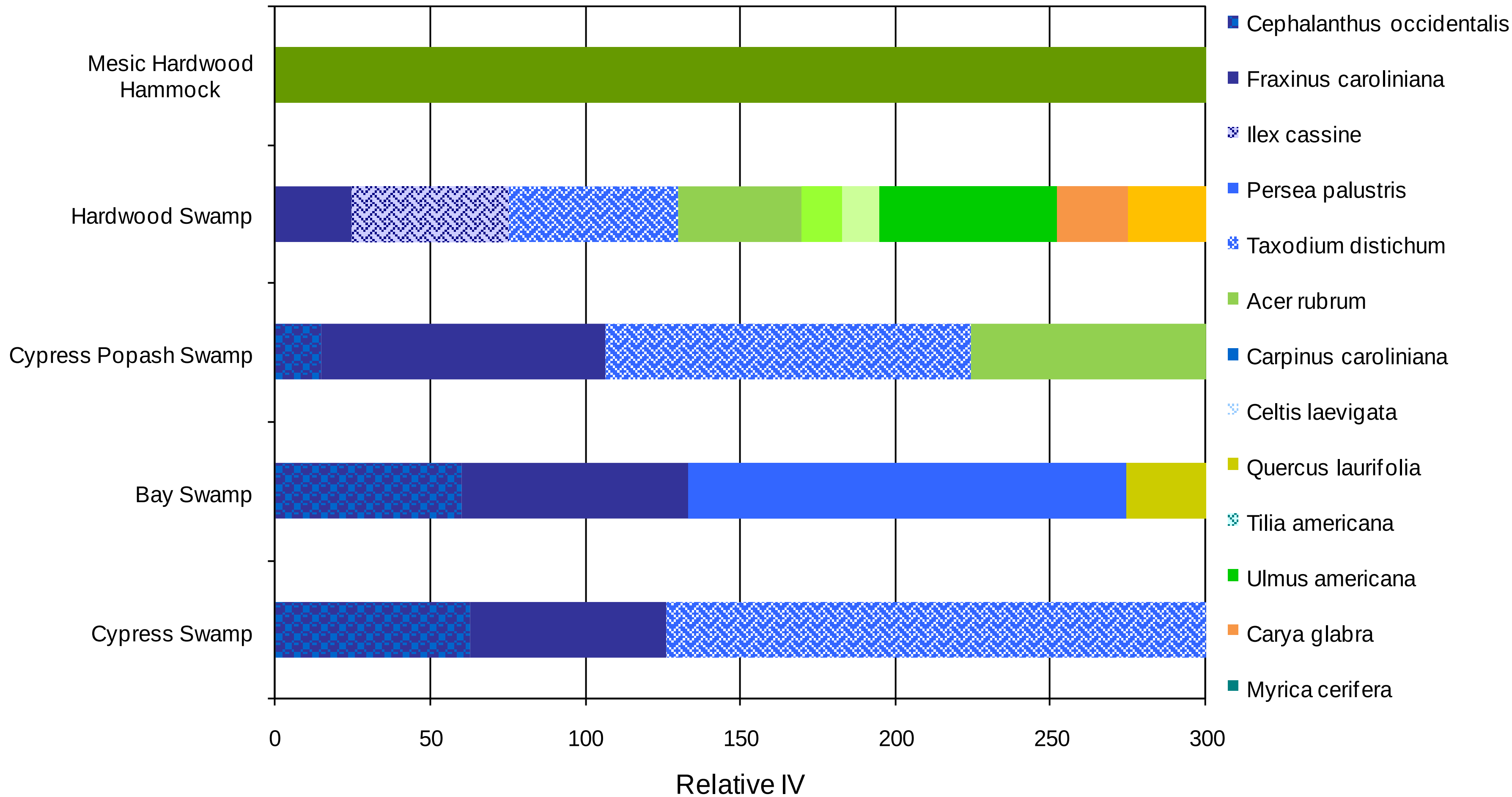


Figure 8. Importance Values for Tree Species in Vegetation Classes along the Ichetucknee River Study Corridor



Species IVs for each vegetation class totalled 300, as described in Section 3.0, and provide a means of comparison among vegetation communities and species. Among vegetation classes, the cypress swamp community had the greatest basal area in (greater than 10,000 in^2/tree) in both rivers (Table 10), indicating much older communities. Interestingly, along the Ichetucknee River, the cypress swamp also had a relatively high tree density as well. The hydric hardwood hammock had the lowest density and the lowest basal area along the Lower Santa Fe River, suggesting fewer trees and smaller trees when compared with the other communities. Similarly, the hardwood swamp had the lowest density and the lowest basal area along the Ichetucknee River. Among species, cypress had by far the largest basal area along both the Lower Santa Fe (108,433 in^2) and Ichetucknee (49,821 in^2) rivers (Tables 11 and 12).

Comparisons of tree basal areas and densities can indicate whether a population is more mature (smaller numbers of larger trees) or in transition in response to a disturbance or change of some sort (increased numbers of smaller trees). A developed tree canopy will shade out new seedlings and inhibit invasion by other species or individuals, which may have an opportunity only when a gap is created by the loss of an older tree and an opening in the canopy. A disturbance that produces a gap in the canopy provides the light necessary for the expansion of new species and individuals. Reduced or loss of stream flows due to rainfall patterns or local ground water withdrawals can also alter vegetation growth and distribution patterns.

Percent Occurrence along Transects. Based on NWI data along transects (described previously) broad leaved deciduous and mixed deciduous vegetation characterized most transects. NWI did not specifically call out cypress swamp for Lower Santa Fe or Ichetucknee transects, yet cypress swamp was probably the most conspicuous vegetation community encountered along sampling transects. The data collected in this study, therefore, appear to represent more specific subsets of the more general NWI vegetation classes. Hydric hardwood hammock, which may be characterized as broad leaved deciduous, occurred along most transects on the Lower Santa Fe River and made up while no single vegetation class occurred along most transects on the Ichetucknee River (Tables 13 and 14).

Table 10. Average Basal Area/Tree for Vegetation Communities Sampled along the Lower Santa Fe and Ichetucknee River Corridors

Lower Santa Fe River						
Measure	**Cypress swamp**	**Hardwood swamp**	**Hydric hardwood hammock**	**Bank**	**Hardwood cypress**	**Mesic hardwood hammock**
BA (in^2)/tree	10,697.8	2,478.3	1,411.1	6,808.5	6,989.7	2,340.0
Density (trees/acre)	35.3	28.2	14.9	40.3	23.5	35.3

Ichetucknee River					
Measure	**Bay Swamp**	**Cypress popash swamp**	**Cypress swamp**	**Hardwood swamp**	**Hydric hardwood hammock**
BA (in^2)/tree	3,363.6	5,179.8	12,333.6	2,557.9	4,452.9
Density (trees/acre)	79.8	79.8	106.4	35.5	159.7

Table 11. Summary of Floodplain Wetland Tree Canopy Composition over all Vegetation Classes along the Lower Santa Fe River

Species	DEP Status	N	Total Basal Area	Mean Basal Area per Tree	Maximum Diameter (DBH, inches)	Relative Dominance Based on Basal Area	Relative Dominance Based on Density
Carya aquatic	OBL	15	54,682.90	364.60	36.90	0.19	0.05
Cephalanthus occidentalis	OBL	11	371.54	8.65	5.20	<0.01	0.04
Fraxinus caroliniana	OBL	48	24,063.63	90.31	44.20	0.08	0.16
Gleditsia aquatic	OBL	2	58.28	8.30	3.30	<0.01	0.01
Nyssa aquatic	OBL	4	12,846.45	546.25	37.10	0.04	0.01
Nyssa sylvatica var. *biflora*	OBL	3	3,181.10	220.54	24.60	0.01	0.01
Quercus lyrata	OBL	10	8,315.77	258.03	28.70	0.03	0.03
Taxodium distichum	OBL	32	108,433.23	494.84	41.50	0.38	0.11
Acer rubrum	FACW	17	13,814.95	148.92	26.50	0.05	0.06
Carpinus caroliniana	FACW	56	7,142.59	31.46	28.50	0.02	0.18
Celtis laevigata	FACW	2	349.36	12.60	4.20	<0.01	0.01
Crataegus marshallii	FACW	3	429.33	10.88	4.30	<0.01	0.01
Forestiera acuminata	FACW	32	867.01	6.02	5.80	<0.01	0.11
Ilex decidua	FACW	1	3.19	1.54	1.40	<0.01	<0.01
Liquidambar styraciflua	FACW	8	2,375.63	29.12	10.60	0.01	0.03
Pinus glabra	FACW	1	371.60	179.08	15.10	<0.01	<0.01
Quercus laurifolia	FACW	18	20,217.75	274.40	43.50	0.07	0.06
Quercus nigra	FACW	3	2,598.35	150.07	23.60	0.01	0.01
Tilia americana	FACW	1	1,172.52	66.48	9.20	<0.01	<0.01
Ulmus americana	FACW	20	11,756.39	130.89	39.20	0.04	0.07
Diospyros virginiana	FAC	1	169.70	9.62	3.50	<0.01	<0.01
Ilex vomitoria	FAC	1	155.34	6.61	2.90	<0.01	<0.01
Ostrya virginiana		12	5,875.24	67.87	15.60	0.02	0.04
Quercus virginiana		2	8,180.09	463.77	24.30	0.03	0.01

Shading indicates that DEP has not assigned a status. N is the number of trees measured.

Table 12. Summary of Floodplain Wetland Tree Canopy Composition over all Vegetation Classes along the Ichetucknee River

Species	DEP Status	N	Total Basal Area	Ave Basal Area (in^2)per Tree	Maximum DBH	Relative Dominance Based on Basal Area	Relative Dominance Based on Abundance
Cephalanthus occidentalis	OBL	12	733.96	3.48	3.50	0.01	0.17
Fraxinus caroliniana	OBL	15	16,935.03	66.53	22.80	0.16	0.21
Ilex cassine	OBL	5	615.33	6.94	4.90	0.01	0.07
Persea palustris	OBL	3	10,582.93	132.56	19.10	0.10	0.04
Taxodium distichum	OBL	17	49,821.80	180.63	26.50	0.48	0.24
Acer rubrum	FACW	6	8,705.41	79.35	21.40	0.08	0.08
Carpinus caroliniana	FACW	3	8,679.46	36.24	8.40	0.08	0.04
Celtis laevigata	FACW	1	142.69	8.04	3.20	0.00	0.01
Quercus laurifolia	FACW	1	632.26	23.76	5.50	0.01	0.01
Tilia americana	FACW	1	20.07	1.13	1.20	0.00	0.01
Ulmus americana	FACW	4	3,471.00	48.91	12.20	0.03	0.06
Myrica cerifera	FAC	2	107.57	3.03	2.40	0.00	0.03
Carya glabra		2	2,654.25	69.84	13.20	0.03	0.03

Shading indicates that DEP has not assigned a status. N is the number of trees measured.

Table 13. Percent Occurrence of the Dominant Vegetation Classes by Transect along the Santa Fe River

Transect	Total Length	Cypress Swamp	Hardwood Swamp	Hardwood Cypress	Hydric Hardwood Hammock	Mesic Hardwood Hammock	River Bank
A	768	61.1			23.4		
B	477		31.4		64.4		
C	704		34.1		52.4		8.4
CD	281		28.5		71.5		
D	211				61.6		
E (both segments)	501				100.0		
F	654		83.2			16.8	
J	1,605			81.8			9.5
K	271			29.5	55.4		15.1
L	360	44.4			55.6		
Total Sampling Points		7	10	12	32	2	3
% Occurrence across all Transects		10.8	17.4	23.9	34.9	1.9	4.3

Shading indicates absence of vegetation class.

Species Absent from PCQ Sampling Plots. Vegetation was also surveyed in 30 foot wide belt transects along the PCQ sampling transects to document species that occurred less frequently and/or were absent from PCQ sampling plots. The species common to PCQ sampling plots and belt transects along both rivers were red maple, buttonbush, Carolina ash, bald cypress, basswood, and American elm. Tree species found in belt transects but not PCQ were typically found along the river bank or in the transition between wetlands and uplands plots. All species in the PCQ plots were found in the belt transects. Six tree species found in the belt transect and not the PCQ sample plots along the Ichetucknee River (pumpkin ash (*Fraxinus profunda*), tupelo (*N. aquatic* var. *biflora*), persimmon (*Diospyros virginiana*) (upland species), overcup oak (*Q. lyrata*), Shumard oak (*Q. shumardii*), and live oak (Q. *virginiana*) (upland species). Pumpkin ash, Shumard oak, and live oak occurred along more than one transect, while tupelo, overcup oak, and persimmon were found only in a single community on a single transect. Three tree species occurred in belt transects and not PCQ sampling plots along the Lower Santa Fe River: pignut hickory (*Carya glabra*) (upland species), swamp dogwood, and swamp chestnut oak (*Quercus michauxii*).

Table 14. Percent Occurrence of the Dominant Vegetation Classes by Transect along the Ichetucknee River

Transect	Total Length	Cypress Popash Swamp	Cypress Swamp	Hardwood Swamp	Mesic Hardwood Hammock	Bay Swamp
AA (upstream)	250	88.0			12.0	
AA (downstream)	134		100.0			
BB (west side)	92		67.4			
BB (east side)	67			74.6		
CC (west side)	186			89.8		
CC (east side)	126					86.5
Total Sampling Points		5	5	5	1	3
% Occurrence across all Transects		25.7	22.9	25.4	3.5	12.7

Shading indicates absence of vegetation class.

4.4.1. Discriminant Function Analysis (DFA)

DFA was used to examine relationships among vegetation classes and environmental variables along the study corridors. Elevations, presence or absence of hydric soils, and depth to SHS accounted for a significant amount of variation in among vegetation classes in both rivers. “Successful” DFA classifications indicate a vegetation class that is relatively distinct in terms of both species composition and IV is also relatively distinct in terms of soils and elevation parameters. Overlap among classes indicates that while species differences were distinct, measures of soils and/or elevation may not be as distinct. Correlations of vegetation classes with the environmental parameters indicate the strength of the relationships and if elevation relationships are strong, then elevation can be used to develop the flows necessary to inundate the corresponding vegetation communities, i.e. vegetation based MFLs.

Classifications and Misclassifications. Wetland vegetation classifications were developed based on species composition and dominance. However, the DFA was used to evaluate the differences in vegetation classes based on environmental parameters and “re-classified” the vegetation classes based on elevation and soil parameters. Fourteen of 16 vegetation classifications on the Ichetucknee River, and 45 out of 59 on the Lower Santa Fe River, were successful, i.e. corresponded to species classifications. Row totals (the “From” classes) in Tables 15 and 16 indicate the percent of the time (and number of times) a vegetation class was classified correctly and incorrectly. Column totals in the tables (the “To” classes) represent the number of times vegetation classes were placed in that column (vegetation class) based on environmental parameters in the DFA analysis.

Ichetucknee River. Vegetation classes were sampled a total of 16 times along the three Ichetucknee River transects, i.e. there were four vegetation classes intercepted a total of 16 times. Previously designated cypress popash swamp, hardwood swamp, and hydric hardwood hammock vegetation classes were classified correctly 100 percent of the time based on soils and elevation data. Classifications were successful 60 percent of the time for the cypress swamp, which was misclassified as cypress popash swamp (the most similar in terms of species composition, soils, and elevation) two out of five times. Cypress popash swamp occurred on four occasions in the field (100 percent) and was classified as cypress popash swamp based on environmental measures on all four occasions (100 percent correct classifications). Cypress swamp was incorrectly classified as cypress popash swamp twice. Column totals indicate six (37.5) percent of the 16 total vegetation class occurrences were classified as cypress popash swamp cypress based on environmental parameters (two of which were incorrect). Three (18.75 percent) of the 16 vegetation class occurrences were correctly assigned to the cypress swamp class, six (37.50 percent) to the hardwood swamp class, and one (6.25 percent) to the hydric hardwood hammock class based on soils and elevations. Overlap among classes was limited to only the cypress swamp, which overlapped with the cypress popash swamp in two of five instances, although cypress popash did not crossover into the cypress swamp: soils values were very similar for these two classes, although elevations in the cypress popash swamp (mean 2.39 feet) elevation relative to EOW = were higher when compared with the cypress swamp (mean 1.09 feet).

Lower Santa Fe River. Hardwood cypress swamp, marsh, and mesic hardwood hammock vegetation classes ("From" column) were correctly classified into the corresponding classes ("To" columns) 100 percent of the time (15 out of a total of 15 occurrences) along the Lower Santa Fe River transects. Hardwood swamp and hydric hardwood hammock were classified correctly 60 and 81.48 percent of the time (28 out of 37 occurrences). In contrast, cypress swamp was correctly classified only 28.57 percent of the time (two out of 7 occurrences). Overlap was typically between similar vegetation classes: e.g. cypress swamp was classified as hardwood cypress and hardwood swamp (two most similar classes in terms of species), indicating some similarity in environmental parameters. Hydric hardwood hammock overlapped with four of the other five vegetation classes, but for only six of 27 occurrences, while hardwood cypress swamp was never misclassified. Column totals indicated that 19 (32.2 percent) of the vegetation class occurrences were classified as hardwood cypress, 11 (18.64 percent) as hardwood swamp, and 21 (35.59 percent) as hydric hardwood hammock. A total of 8 of the 59 vegetation class occurrences were classified as cypress swamp (5.08 percent), marsh (5.08 percent), and mesic hardwood hammock (3.39 percent) and five of these were correctly classified. No vegetation classes were incorrectly classified as hydric hardwood hammock or marsh. Cypress swamp (two occurrences), hardwood swamp (three occurrences), and hydric hardwood hammock (two occurrences) were all misclassified as hardwood swamp.

Table 15. DFA Results for Vegetation Classifications: Ichetucknee River

"From"	"To"				
Community	Cypress popash swamp	Cypress swamp	Hardwood swamp	Hydric hardwood hammock	Total classifications
Cypress popash swamp	100 (4)				100 (4)
Cypress swamp	40 (2)	60 (3)			100 (5)
Hardwood swamp			100 (6)		100 (6)
Hydric hardwood hammock				100 (1)	100 (1)
Total classifications	37.5 (6)	18.75 (3)	37.5 (6)	6.25 (1)	100 (16)
Wilks' Lambda= 0.0000; F=∞; DF=12; p<0.0001					

Variable	R-Square	F Value	Pr>F
Elevation relative to channel	0.71	9.60	0.0016
Elevation relative to EOW	0.74	11.50	0.0008
Soils (hydric or not)	NA	NA	NA
Depth to SHS	1.0	∞	<0.0001
Elevation NAVD89	0.82	17.65	0.0001

Table 16. DFA Results for Vegetation Classifications: Lower Santa Fe River

"From" class	"To" class						
Community	Cypress swamp	Hardwood cypress swamp	Hardwood swamp	Marsh	Hydric Hardwood Hammock	Mesic Hardwood Hammock	Total Classifications
Cypress swamp	28.57 (2)	28.57 (2)	28.57 (2)	14.29 (1)			100 (7)
Hardwood cypress swamp		100 (12)					100 (12)
Hardwood swamp		10 (1)	60 (6)	20 (2)	10 (1)		100 (10)
Marsh				100 (1)			100 (1)
Hydric hardwood hammock	3.70 (1)	7.41 (2)	7.41 (2)		81.48 (22)		100 (27)
Mesic hardwood hammock						100 (2)	100 (2)
Total Classifications	5.08 (3)	32.2 (19)	18.64 (11)	5.08 (3)	35.59 (21)	3.39 (2)	100 (59)

Wilks' Lambda= 0.0446; F=9.61; DF=25; p<0.0001

Variable	R-Square	F Value	Pr>F
Elevation relative to channel	0.5463	12.76	<0.0001
Elevation relative to EOW	0.5576	13.36	<0.0001
Soils (hydric or not)	0.3462	5.61	0.0003
Depth to SHS	0.5307	11.99	<0.0001
Elevation NAVD89	0.4238	7.79	<0.0001

Correlation Results. The contributions of elevation, presence or absence of hydric soils, and depth to SHS were significant in separating vegetation classes in both the Ichetucknee and Lower Santa Fe ($p< 0.0001$ for both rivers). Vegetation classes were distinct in terms of species composition and IV (described in previous section), and environmental variables were significant in accounting for differences between vegetation classes.

Ichetucknee River. Depth to SHS had the highest correlation ($r^2 = 0.82$) with vegetation classes and was due to SHS at the land surface (zero inches) for the three swamp classes and 7 inches for the hammock vegetation class. Elevation relative to the channel bottom ($r^2 = 0.71$), elevation relative to EOW ($r^2 = 0.74$), and elevation in NAVD88 ($r^2 = 0.82$) were also strongly correlated with vegetation class. Presence of hydric soils was not a good predictor of vegetation class for these particular classes because all had hydric soils. Mean values for soils and elevations are listed in Table 17.

Lower Santa Fe River. Overlap in environmental parameters between vegetation classes was more frequent and correlations with environmental parameters were lower for the Lower Santa Fe River. Correlations of vegetation classes with depth to SHS ($r^2 = 0.53$) was similar to elevation relative to the channel bottom ($r^2 = 0.55$) and elevation relative to EOW ($r^2 = 0.56$). Correlations of vegetation class with elevation in NAVD89 ($r^2 = 0.42$) and presence of hydric soils ($r^2 = 0.35$) were lower. Mean soils and elevations values are listed in Table 18.

Relationships between vegetation classes and environmental parameters. Vegetation classes were distinct in terms of species composition and IV and environmental variables were significant in accounting for differences between vegetation classes. Overlap among vegetation classes in the DFA results was limited and indicates that differences in vegetation typically correspond to differences in the environmental parameters. Therefore, measurable environmental parameters such as elevation can provide a basis for establishing MFLs.

Mean values for environmental parameters for each vegetation class are presented in Tables 17 and 18 for both rivers. Wetlands were consistently differentiated from uplands along both rivers by soils characteristics. Within wetlands, depth to SHS appeared to differentiate "drier" wetlands (hammocks) from the "wetter" (swamps/marsh). For example, depth to SHS was typically at land surface for the cypress popash, cypress, and hardwood swamp classes, but averaged 7 inches below land surface for the hydric hardwood hammock on the Ichetucknee River. Average depths to SHS in the cypress, hardwood cypress, and hardwood swamp classes on the Lower Santa Fe River were no more than 2 inches below land surface, while depth to SHS in the hydric hardwood hammock and mesic hardwood hammock on the Lower Santa Fe River averaged 3.8 and 12 inches below land surface, respectively.

Vegetation classes with hydric soils and shallower depths to SHS (less than 3 inches) could subsequently be evaluated based on elevations. Along the Ichetucknee River, elevation relative to EOW and to channel bottom indicated cypress swamp (1.09 feet) and hardwood swamp (1.75 feet) were lower than the cypress popash swamp, which was in turn, lower than the hydric hardwood hammock. Along the Lower Santa Fe River, elevations relative to EOW were lowest for hardwood cypress (2.34 feet) and marsh (2.22 feet), compared with cypress (4.89 feet) and hardwood (4.32 feet) swamp and the pattern was the same for elevation relative to channel bottom for these classes (note that the single elevation of the mesic hardwood hammock was only 4.08 feet, but it did not have hydric soils).

Vegetation was the best predictor of the wetter and drier wetlands along both rivers. All wetlands were characterized by hydric soils. Depth to SHS further refined vegetation classes into wetter and drier vegetation classes and elevations relative to the channel bottom or EOW may refine communities even further. The wettest communities were swamps and the hydric hammocks were the drier wetlands. On the Ichetucknee River, the cypress swamp appeared to be the wettest swamp; while along the Lower Santa Fe River, the hardwood swamp appears to be the wettest swamp.

Table 17. Mean Values for Environmental Parameters Results for Vegetation Classifications: Ichetucknee River

Vegetation Class	Elevation relative to channel bottom	Elevation relative to EOW	Hydric soils (present or not)	Depth to SHS	Elevation NAVD88
Cypress Popash Swamp (N=4)	10.80	2.39	1	0	15.76
Cypress Swamp (N=5)	7.52	1.09	1	0	17.82
Hardwood Swamp (N=6)	6.05	1.75	1	0	21.60
Hydric Hardwood Hammock (N=1)	14.31	5.9	1	7	19.27

Table 18. Mean Values for Environmental Parameters Results for Vegetation Classifications: Lower Santa Fe River

Vegetation Class	Elevation (feet) relative to channel bottom	Elevation (feet) relative to EOW	Hydric soils (present or not)	Depth to SHS	Elevation NAVD88
Cypress Swamp (N=7)	14.51	4.89	0.9	2.0	20.48
Hardwood Cypress (N=12)	5.45	2.35	1.0	0.4	32.39
Hardwood swamp (N=10)	14.46	4.32	1.0	0.0	13.85
Hydric Hardwood Hammock (N=27)	17.96	8.90	0.9	3.8	20.83
Marsh (N=1)	10.60	8.29	1.0	0.0	10.07
Mesic Hardwood Hammock (N=2)	9.80	4.08	0.0	12.0	22.41

****Environmental parameters accounted for a significant amount of variation among vegetation classes and correct classifications ranged from 45.4 percent to 100 percent. Percent correct classifications (outlined in bold in Table 17) are graphed in Figure 15 and described below.

Misclassifications in a DFA occur when a vegetation class is not successfully paired with corresponding environmental parameters and subsequently overlaps with other vegetation classes in regards to soil index, relative elevation, and distance from channel. Overlapping vegetation classes can indicate shared, or similar, habitat based on measured parameters (McNeely 1987). The overlap itself gives no indication of the resource preferences of overlapping species, although it does indicate the habitat being used (Colwell and Futuyama 1971), as well as the similar resource requirements of most plants (Goldberg and Werner 1983).

4.4.2. Wetted Perimeter

Average wetted perimeter (linear distance of community/change in elevation) was greatest for the swamp vegetation classes along both the Lower Santa Fe and Ichetucknee River transects. Wetted perimeter/change in elevation was over 250 linear feet of habitat/one foot of change in elevation for the cypress and hardwood cypress vegetation classes along the Lower Santa Fe River (Table 19); double that of the hydric hardwood hammock class (109.88 feet). The remaining classes along the Lower Santa Fe River transects had less than 46 linear feet of habitat/one foot change in elevation. Along the Ichetucknee River transects, the cypress and hardwoods had wetted perimeters of 68.53 linear feet/one foot of change in elevation, compared with less than 32 linear feet of habitat/one foot change in elevation in the other vegetation classes.

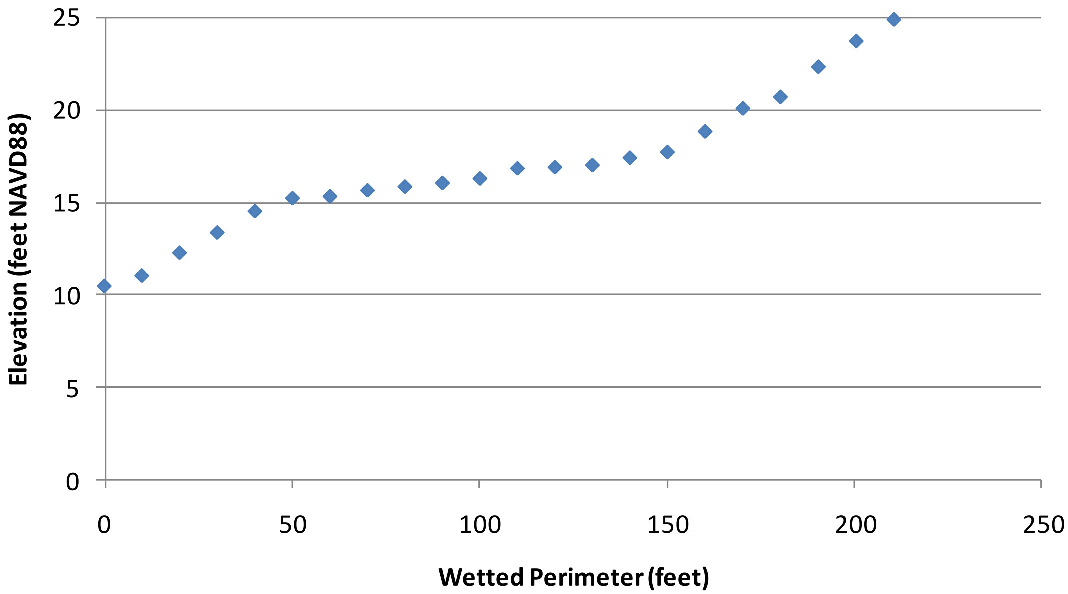
An example of a wetted perimeter graph (Transect D) is presented in Figure 9 and similar graphs for all transects are provided in Appendix B. The three transition and upland classes corresponded to the portion of the curves that indicates a steeper elevation gradient (and less wetted perimeter). These results reflect the small elevation change across wetlands and illustrate the large change in inundated wetlands that can occur as a result of a relatively small change in water level along the rivers.

Table 19. Average Basal Area/Tree for Vegetation Communities Sampled along the Lower Santa Fe and Ichetucknee River Corridors

Lower Santa Fe River					
Cypress swamp	Hardwood swamp	Hydric hardwood hammock	Bank	Hardwood cypress	Mesic hardwood hammock
271.95	143.58	109.88	17.88	297.23	45.25

Ichetucknee River				
Bay Swamp	Cypress popash swamp	Cypress swamp	Hardwood swamp	Hydric hardwood hammock
11.08	31.39	68.53	62.73	6.15

Figure 9. Wetted Perimeter and Associated Median Elevations along Transect D on the Lower Santa Fe River Study Corridor.



4.5. Relationship of Vegetation with Environmental Variables

Relationships among river stage, flow, and elevations were developed by the District for the rivers and are not presented here. However, it is appropriate to address hydrologic conditions such as saturation and inundation that are critical to the development of hydric soils and associated wetland vegetation.

Hydrology. Saturation and/or inundation are critical to the maintenance of wetlands vegetation in floodplains, although overbank flooding is not necessary (Cowardin *et al*. 1979, Reid and Wood 1976), and ground water can strongly influence the extent of wetlands (Light *et al.* 2002). Wetland trees are relatively fast-growing and in five years can generally grow to a height at which it is tolerant of inundation. For example, cypress trees can exceed one meter tall in one to two years (Harms 1973). Cabbage palms are unusual in that they require an initial establishment phase of 30 to 60 years during which they have no above-ground trunk (McPherson and Williams 1996) and flood events at 25 year intervals or more probably restrict the regeneration of cabbage palm. Once established, they are susceptible to only rising sea level, hurricanes, and fires. Therefore, under existing conditions, the tree communities along the Lower Santa Fe and Ichetucknee rivers are not anticipated to change in composition or structure.

Competition. Wetland species occur in wetlands because they are tolerant of saturated and anoxic conditions that preclude upland species. Several studies have indicated that environmental gradients are more important in determining species distributions under physiological stressful conditions such as flooding, while competition may be more important under relatively benign environmental conditions (Grace and Wetzel 1981, others). Species such as laurel oak, which is relatively intolerant of persistent inundation when compared with a species such as cypress or tupelo, can be at a competitive advantage in the absence of persistent flooding and subsequently expand into areas previously dominated by a species such as cypress. There was no indication of recent invasion of wetlands by upland species along the study corridor.

Disturbance. Invasive and non-native species such as Brazilian pepper (*Schinus terebinthifolius*) and paragrass have a competitive advantage under disturbed conditions. Disturbances can occur as fire, flooding, animal activity, etc. and provide an opening into which a species that may not otherwise survive can become established due to the absence of other species. Mature native trees can continue to shade out many invasive species until the native trees die and create openings into which invasive species expand. No exotic species such as Brazilian pepper, Chinese tallow *(Sapium sebiferum),* or camphor tree *(Cinnamomum camphora),* were observed along any of the study transects. Nor were any signs of serious invasion by non-native and invasive species observed.

Inundation Periods in Southeastern Wetlands. The wetland vegetation classes along the Lower Santa Fe and Ichetucknee rivers are subject to seasonal rise and fall in the water table rather than surface water runoff alone, as well as the accumulation of water for a period of time long enough to support extensive wetlands. The tree species identified in wetlands along the rivers were consistent with those described for the Suwannee River (Light *et al*. 2002).

The banks and edges of the Lower Santa Fe and Ichetucknee rivers are generally characterized by narrow, permanently flooded swamps along the river edges that include species such cypress and tupelo. Cypress is an obligate wetland species, tolerant of up to three meters of inundation for more than 10 years, and more tolerant of wetland conditions than the other species documented as part of this study. Consequently, cypress trees appear limited to the river edge where the water table is closer to the land surface and inundation is more persistent. Cypress cannot germinate under flooded conditions and do not grow quickly enough to successfully compete with other wetland tolerant species landward of the river. In addition, fire following logging or drainage (historically common in the larger watershed) can destroy seeds and roots and favor replacement by willows and then mixed hardwoods (Myers and Ewel 1990).

Species that are less flood tolerant, such as cabbage palm and maple occur landward of the cypress, but may reach the banks of the river where the transition to open water is steep. Marshes characterized by grasses and sedges such as wild rice (*Zizania aquatica*) and bulrushes (*Scirpus* spp.), as well as broad-leaved species such as climbing hempweed (*Mikania scandens*) and climbing aster (*Aster carolinianus*) occur at the edges of the river where the break in the canopy permits more light and the elevation change from land to open water is more gradual.

5. Conclusions

Differences in vegetation in forested wetlands along the Lower Santa Fe and Ichetucknee river corridors were significant based on importance values (IVs) and provided a relative measure of species dominance. Eight distinct vegetation communities were identified, with some conspicuous differences in vegetation between the rivers. For example, there was a strong presence of a cypress- popash community along the Ichetucknee River; while along the Lower Santa Fe River, there was clear dominance by one species or the other. Neither bay swamp community nor bay swamp (*Persea palustris*) trees were recorded along the Lower Santa Fe, while tupelos (*Nyssa* spp.) were not recorded along the Ichetucknee River. Water hickory (*Carya aquatica*) dominated the river banks along the Lower Santa Fe River, but was not recorded along Ichetucknee River sampling transects.

Elevations and Soils. Soils were typically loamy/clayey along both rivers, except for river banks (sandy) and the bay swamp along the Ichetucknee River (sandy). Average depth to SHS was zero for the hardwood swamp, less than 2 inches for the cypress and hardwood cypress swamps, less than 4 inches for the hydric hardwood hammock, 7 inches in the hydric hardwood hammock, and nearly 10 inches below land surface in the mesic hardwood hammock. Hydric soils also included muck in the cypress popash, hardwood swamp, and hydric hardwood hammock communities.

Average elevation change along the Lower Santa Fe River transects was 8 feet and ranged from 4 to 13 feet NAVD. Along the Ichetucknee River, transects averaged 10 feet and ranged from 5 to 19 feet. Mean elevations (feet NAVD) of vegetation classes ranged from 33.28 (hardwood cypress) to 15.61 (cypress swamp) along the Lower Santa Fe River, compared with 23.82 (bay swamp) to 17.66 (cypress popash) along the Ichetucknee River. Extent of linear wetted perimeter/one foot change in elevation was conspicuously greater for cypress, hardwood cypress, and hardwood swamps when compared with the other vegetation classes.

Relationships among Vegetation, Soils, and Elevations. Elevation, hydric soils, and depth to SHS were significant in separating vegetation classes ($p< 0.0001$) for both rivers. DFA was successful in differentiating among vegetation classes based on measures of elevation, distance from river channel, and soil parameters along the study corridor. Correlations between vegetation class and environmental parameters for the Lower Santa Fe River were highest for depth to seasonal high saturation (SHS) (r^2=1.0) and elevation (feet NAVD) (r^2=0.82) and only slightly lower for elevation relative to EOW (r^2=0.74) and elevation relative to channel bottom (0.71). Correlations for the Ichetucknee River were lower in comparison to the Lower Santa Fe River: depth to SHS (r^2=0.53) and elevation (feet NAVD) (r^2=0.42) were slightly lower when compared with elevation relative to edge of water (r^2=0.56) and elevation relative to channel bottom (r^2 = 0.55). Cypress popash swamp, hardwood swamp, and hydric hardwood hammock classes were classified correctly 100 percent of the time along the Lower Santa Fe River transects, while cypress swamp was correctly classified 60 percent of the time. For the Ichetucknee River, hardwood cypress swamp, marsh, and mesic hardwood hammock were classified correctly 100 percent of the time, while hardwood swamp and hydric hardwood hammock were classified correctly 60 and 81 percent of the time, respectively.

Conclusions. Vegetation classes sampled along the Lower Santa Fe and Ichetucknee rivers were distinct in terms of species composition and IV, and environmental variables were significant in accounting for differences between vegetation classes. Therefore, measurable environmental parameters such as elevation can provide a basis for establishing MFLs. Within wetlands, depth to SHS appeared to differentiate “drier” (hammocks) from “wetter” wetlands (swamps). Vegetation classes with hydric soils and shallower depths to SHS (less than 3 inches) could be separated further based on elevations. Along the Ichetucknee River, average elevation relative to edge of water (and to channel bottom) were lower for cypress swamp (1.09 feet) and hardwood swamp (1.75 feet) than the cypress popash swamp (2.39 feet), which was in turn, lower than the hydric hardwood hammock. Along the Lower Santa Fe River, elevations relative to edge of water were lowest for hardwood cypress (2.34 feet) and marsh (2.22 feet), compared with cypress (4.89 feet) and hardwood (4.32 feet) swamp. Flows necessary to inundate these vegetation classes may provide a basis for establishing MFLs in the Lower Santa Fe and Ichetucknee rivers.

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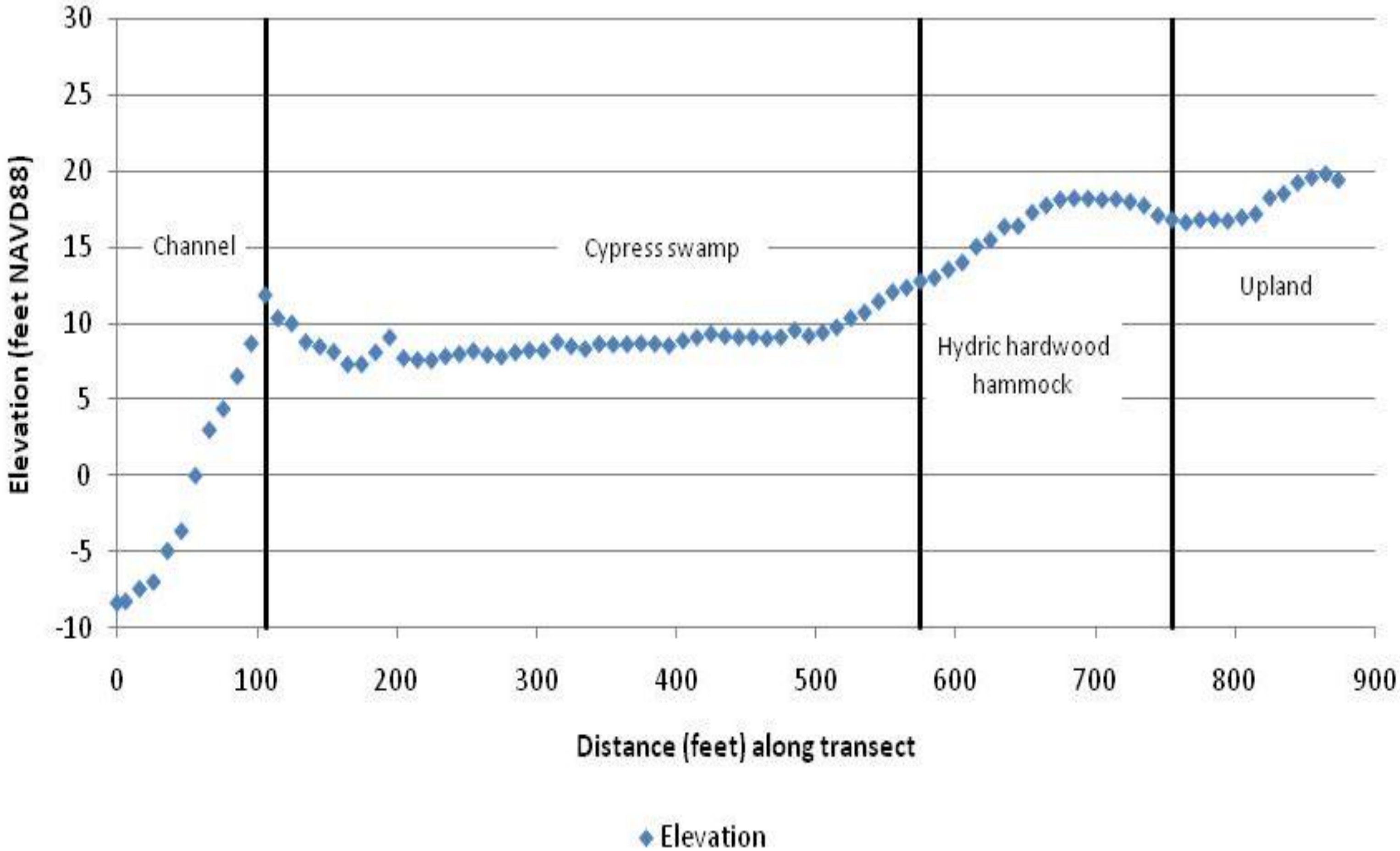
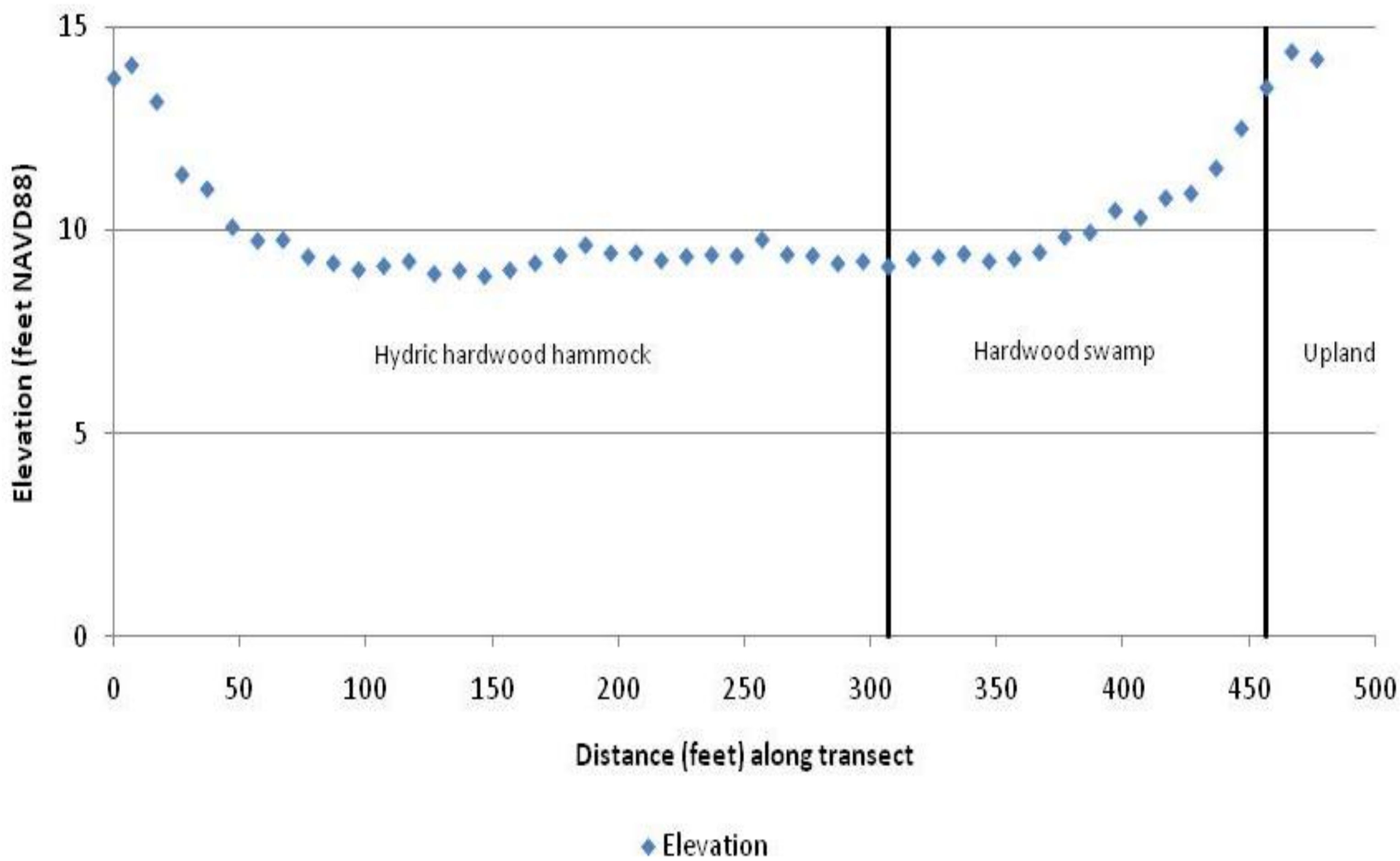
Appendix A

Elevation and Vegetation Profiles for the LSFI Rivers Study Corridor (note that elevation is on the dependent axis and distance from center of channel is on the independent axis)

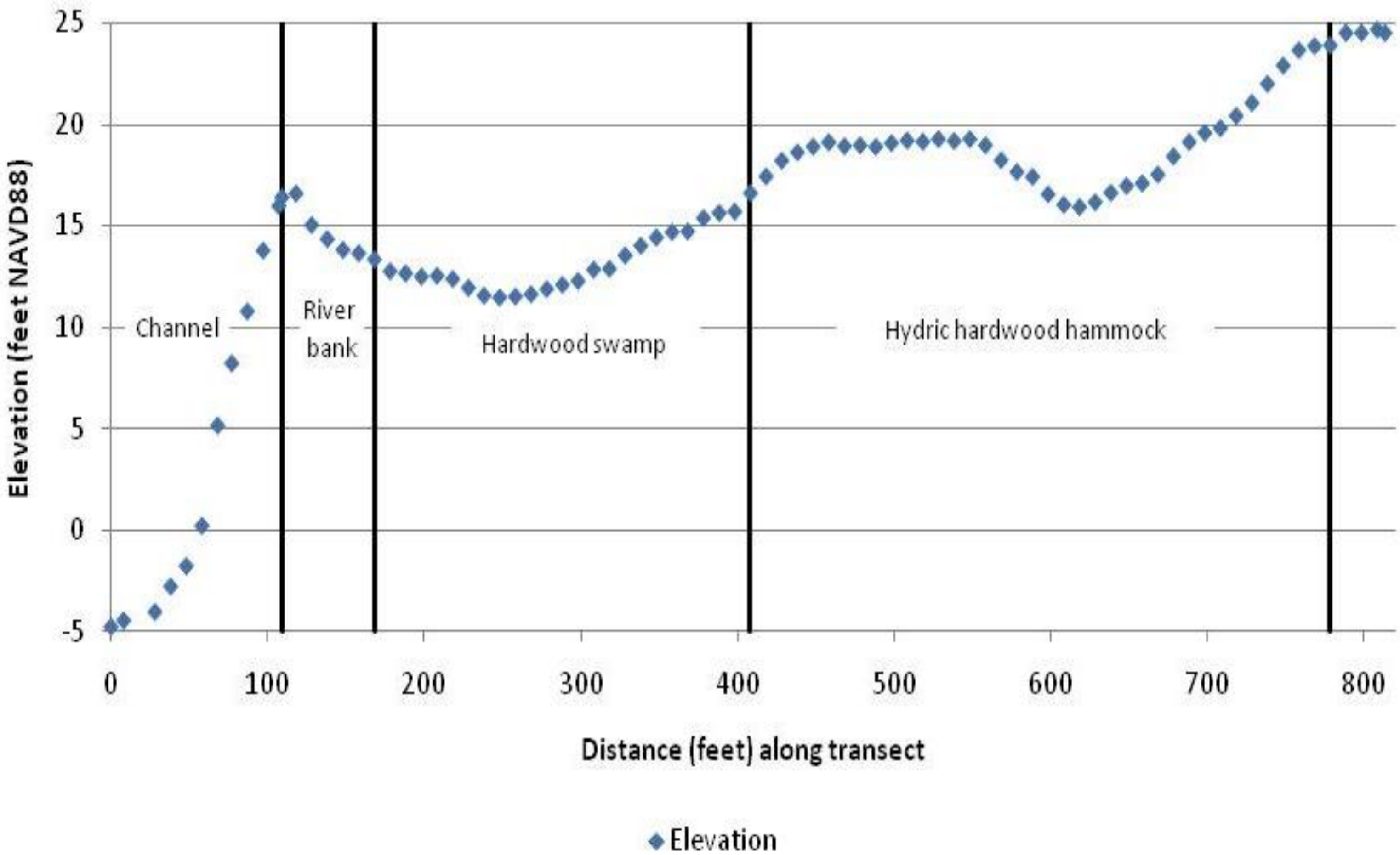
Transect A along the Santa Fe River



Transect B along the Santa Fe River



Transect C along the Santa Fe River



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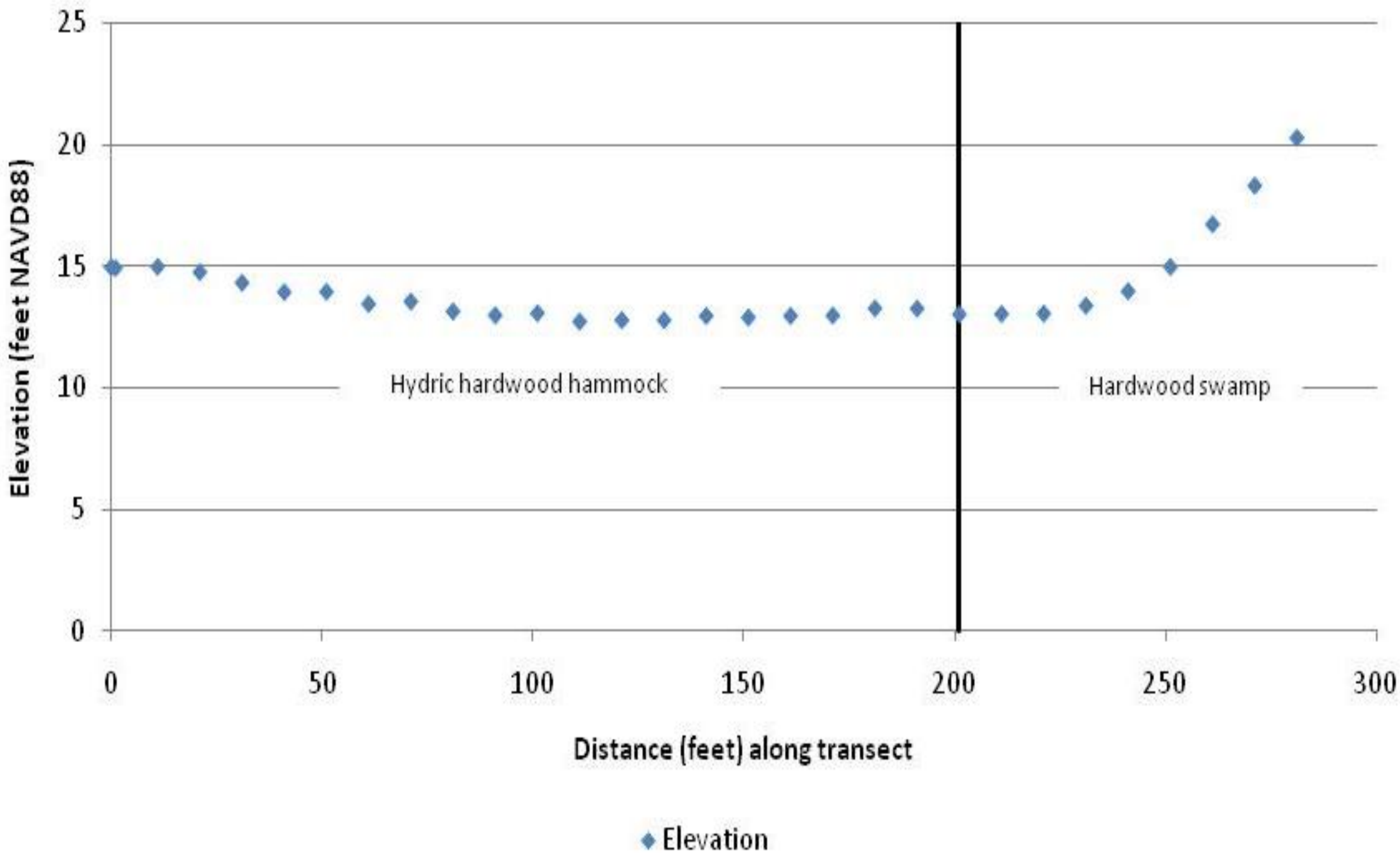
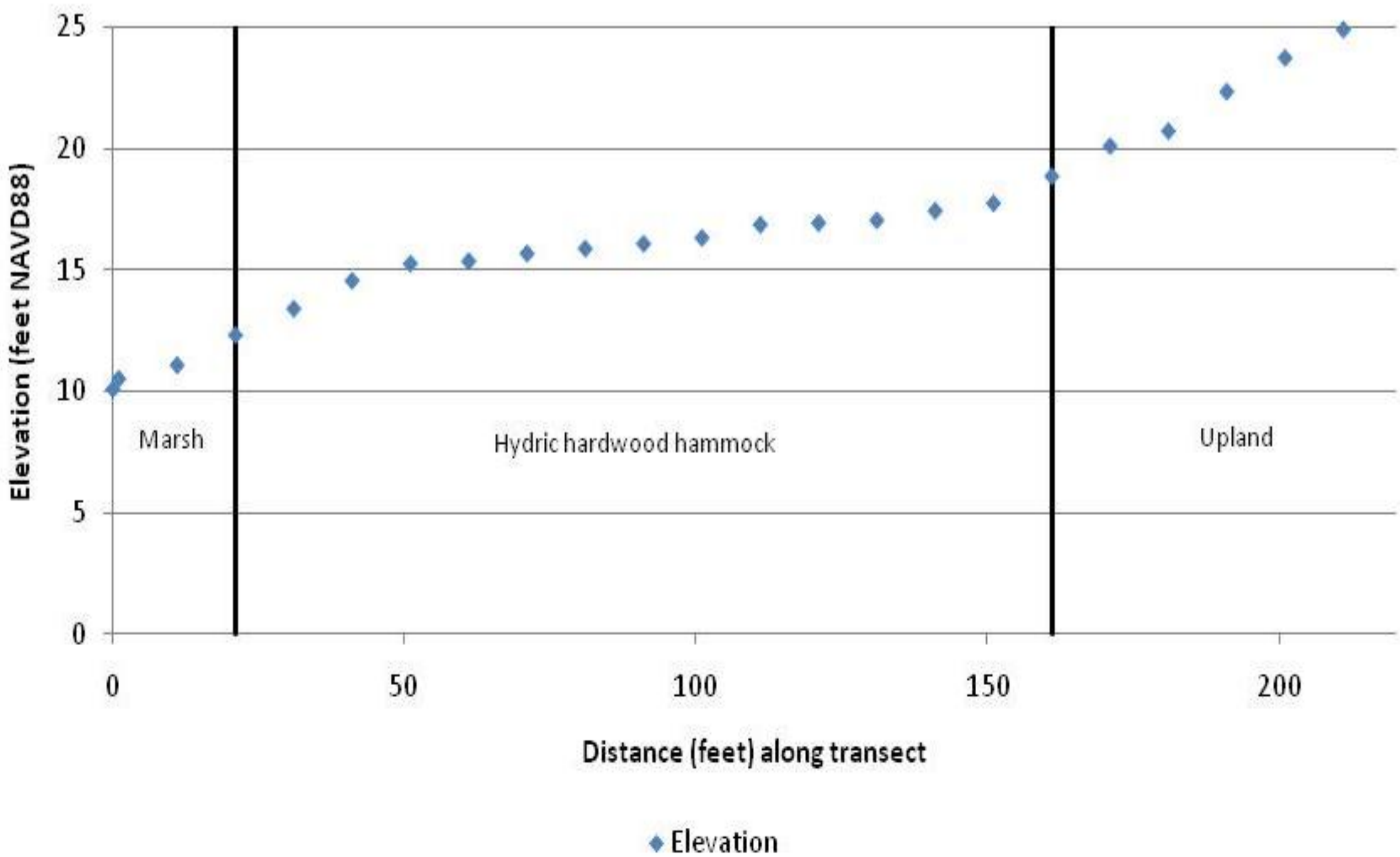
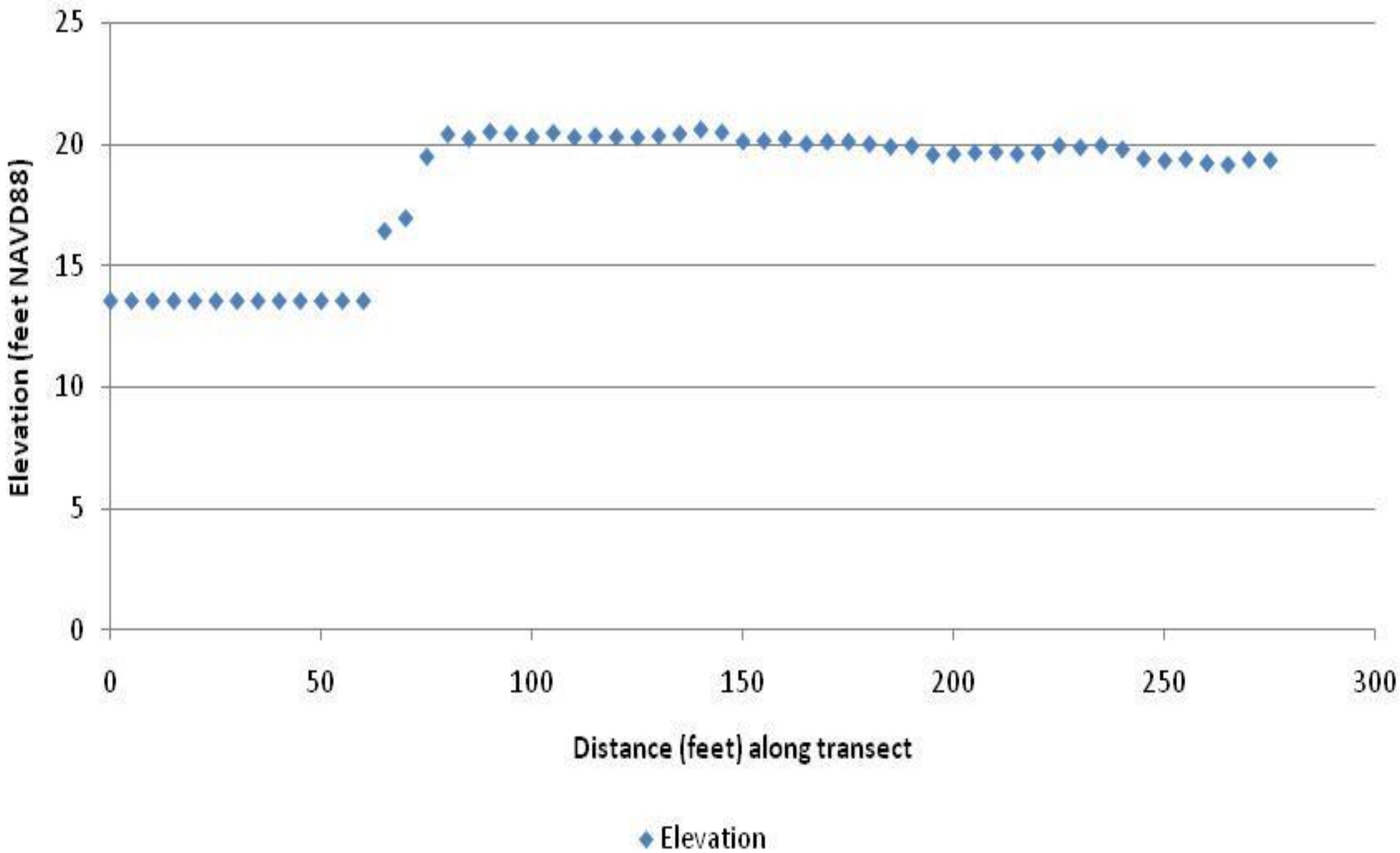


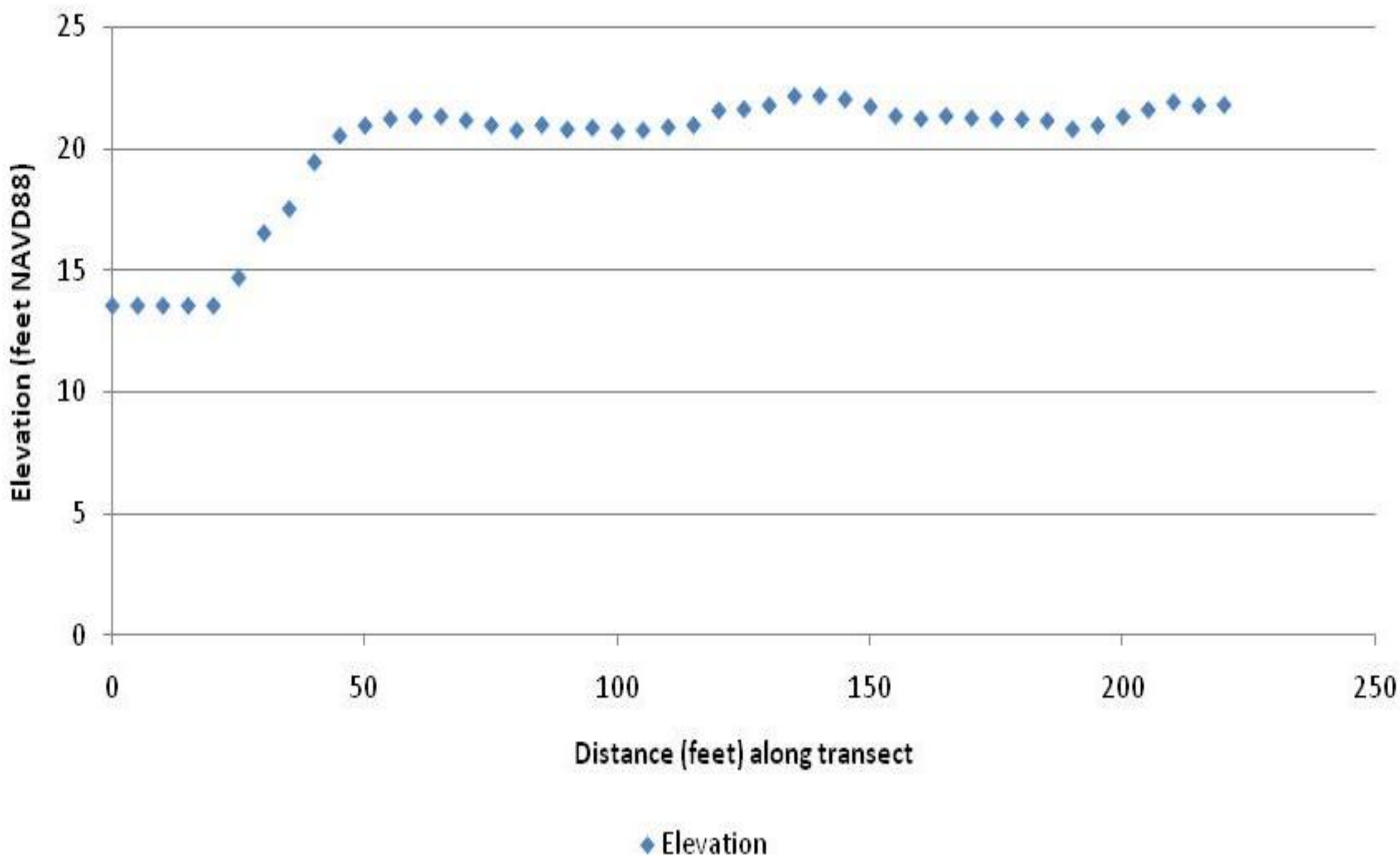
Transect D along the Santa Fe River



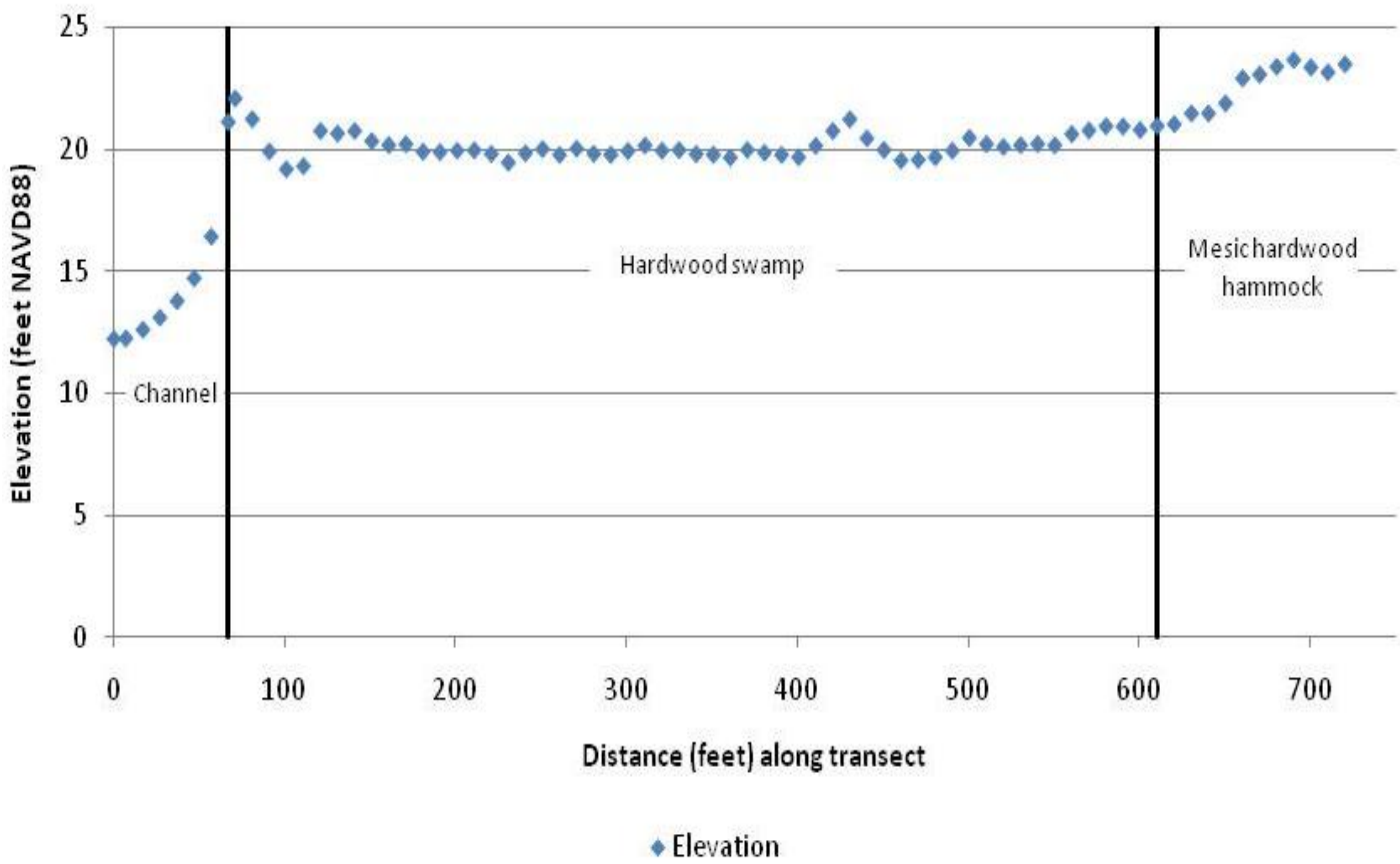
Transect E (downstream) along the Santa Fe River



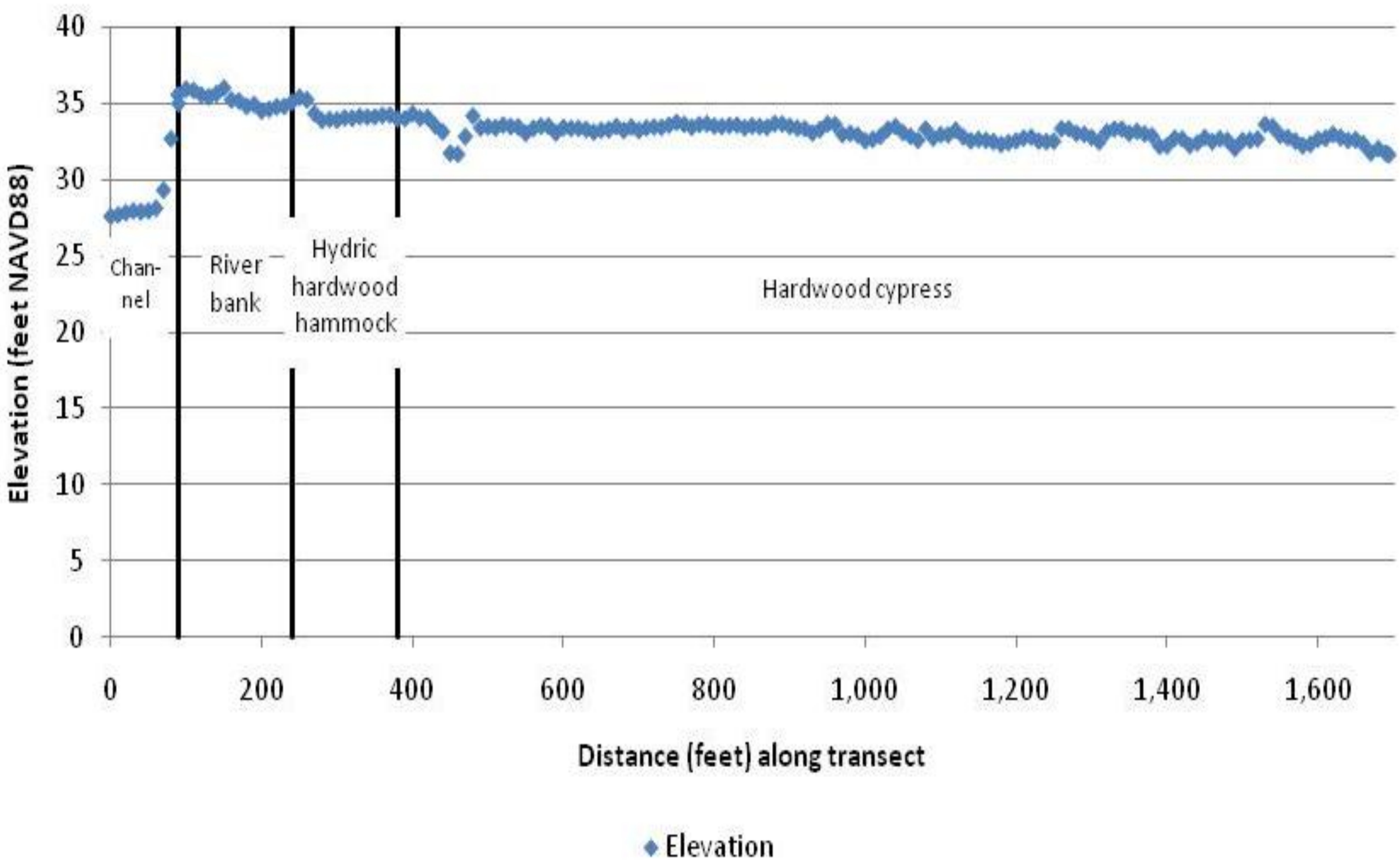
Transect E (upstream) along the Santa Fe River



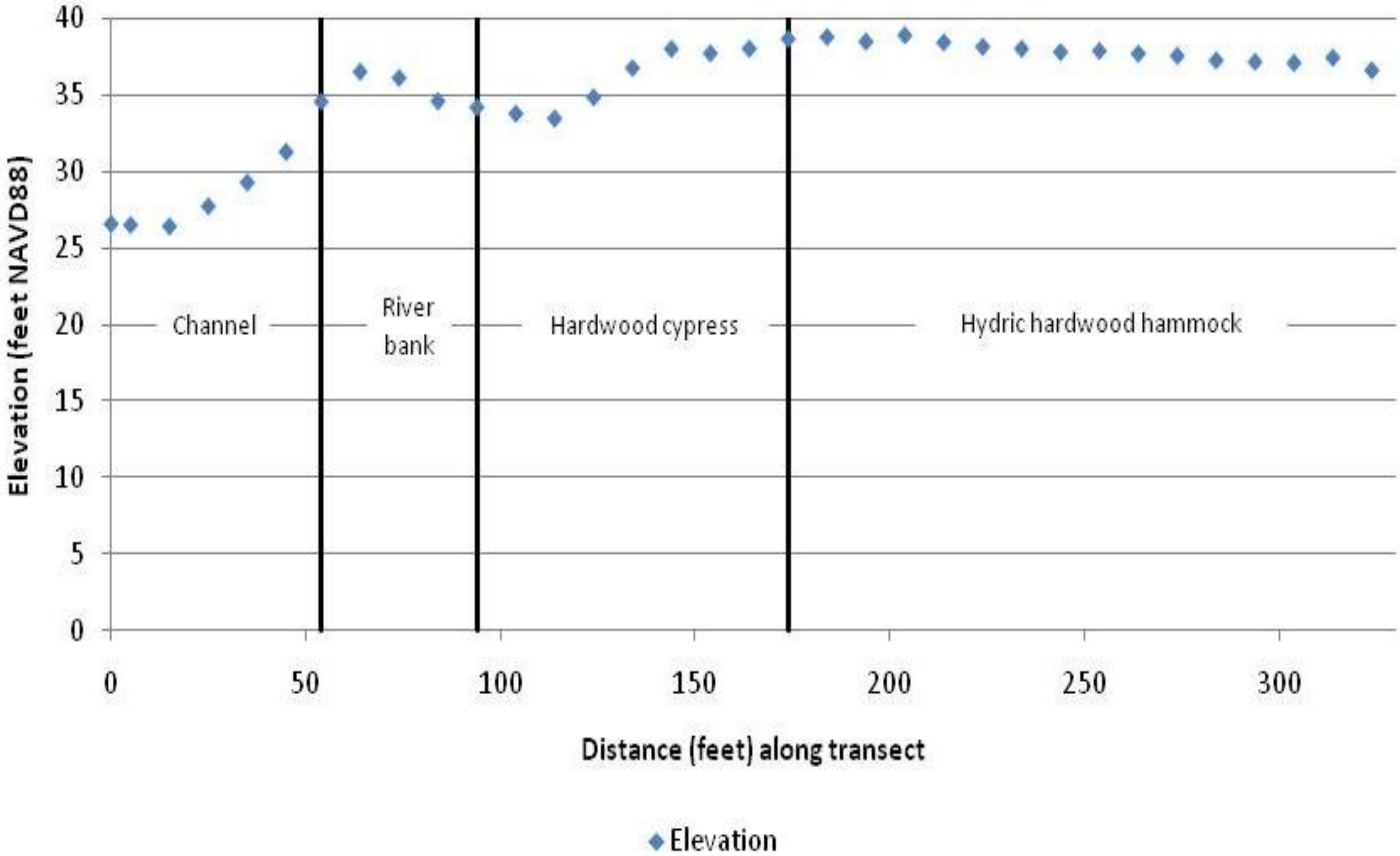
Transect F along the Santa Fe River



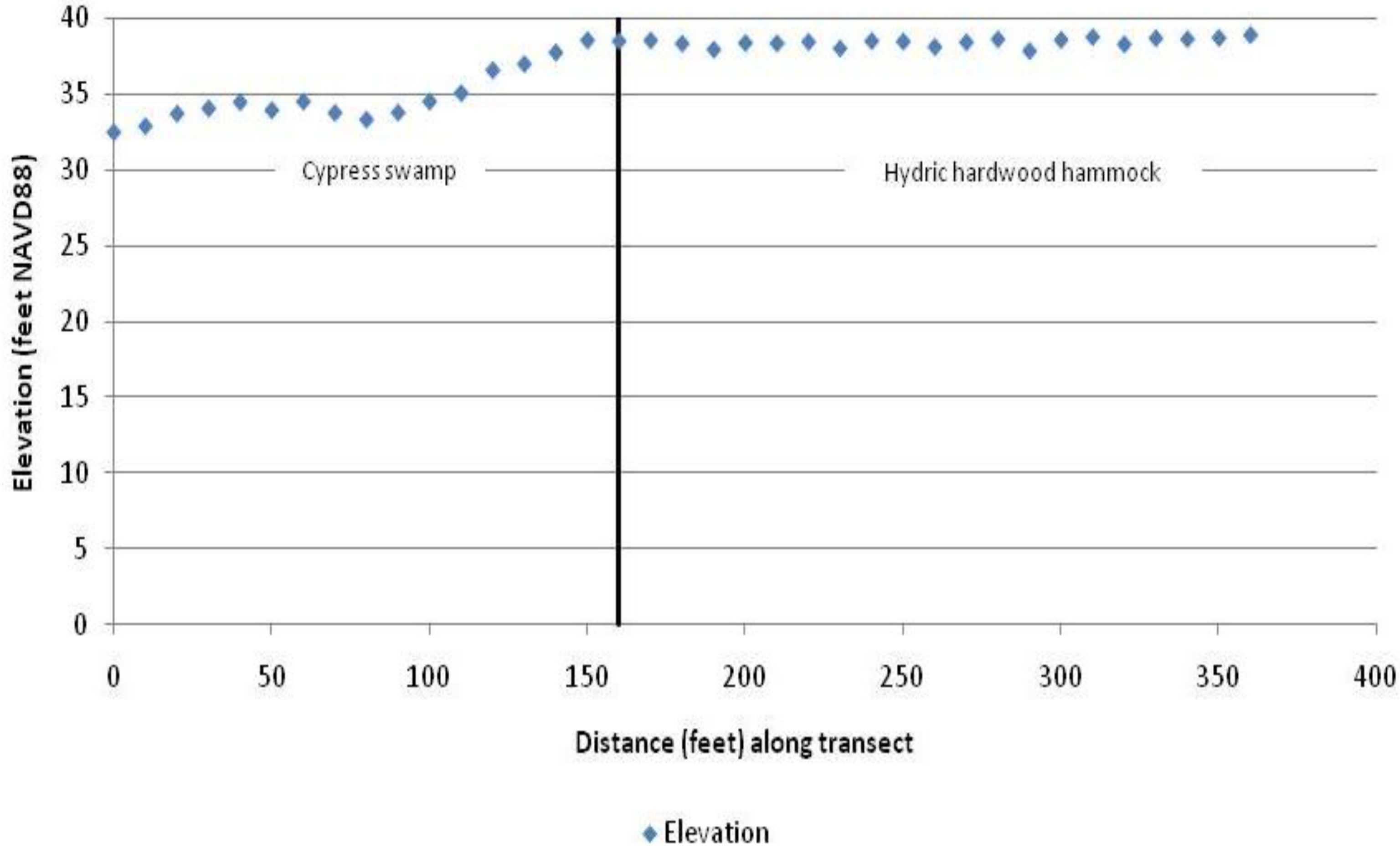
Transect J along the Santa Fe River



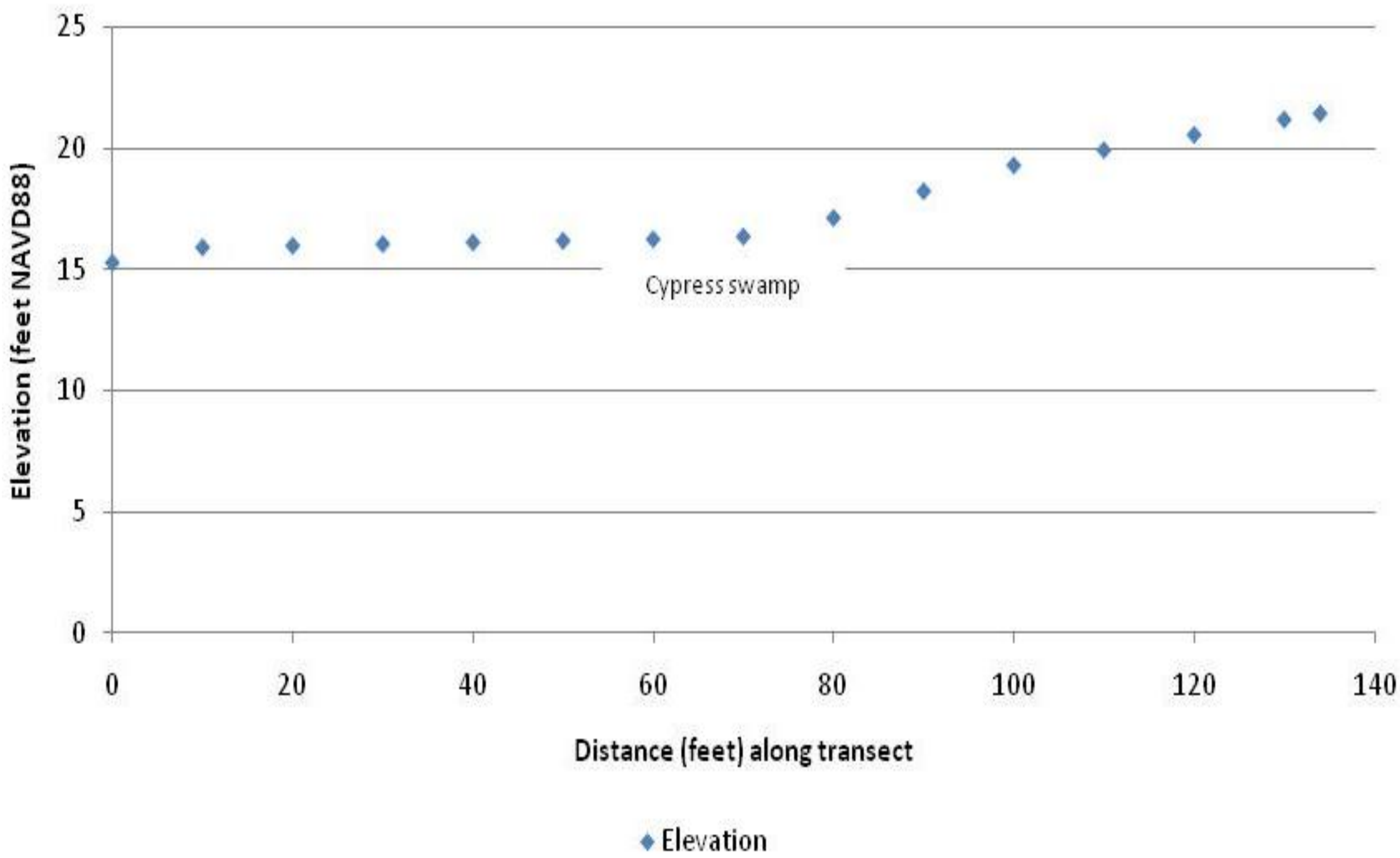
Transect K along the Santa Fe River

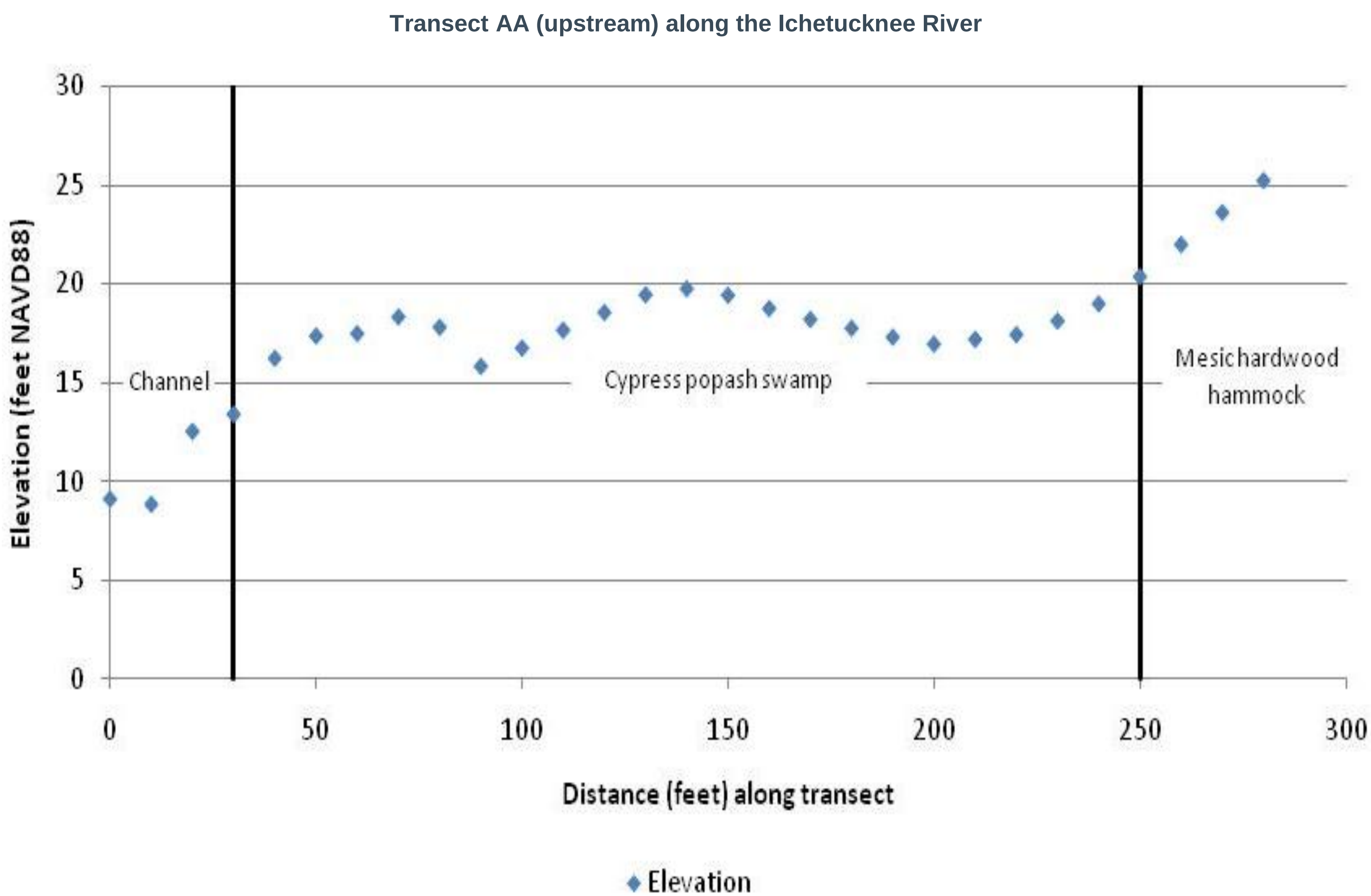


Transect L along the Santa Fe River



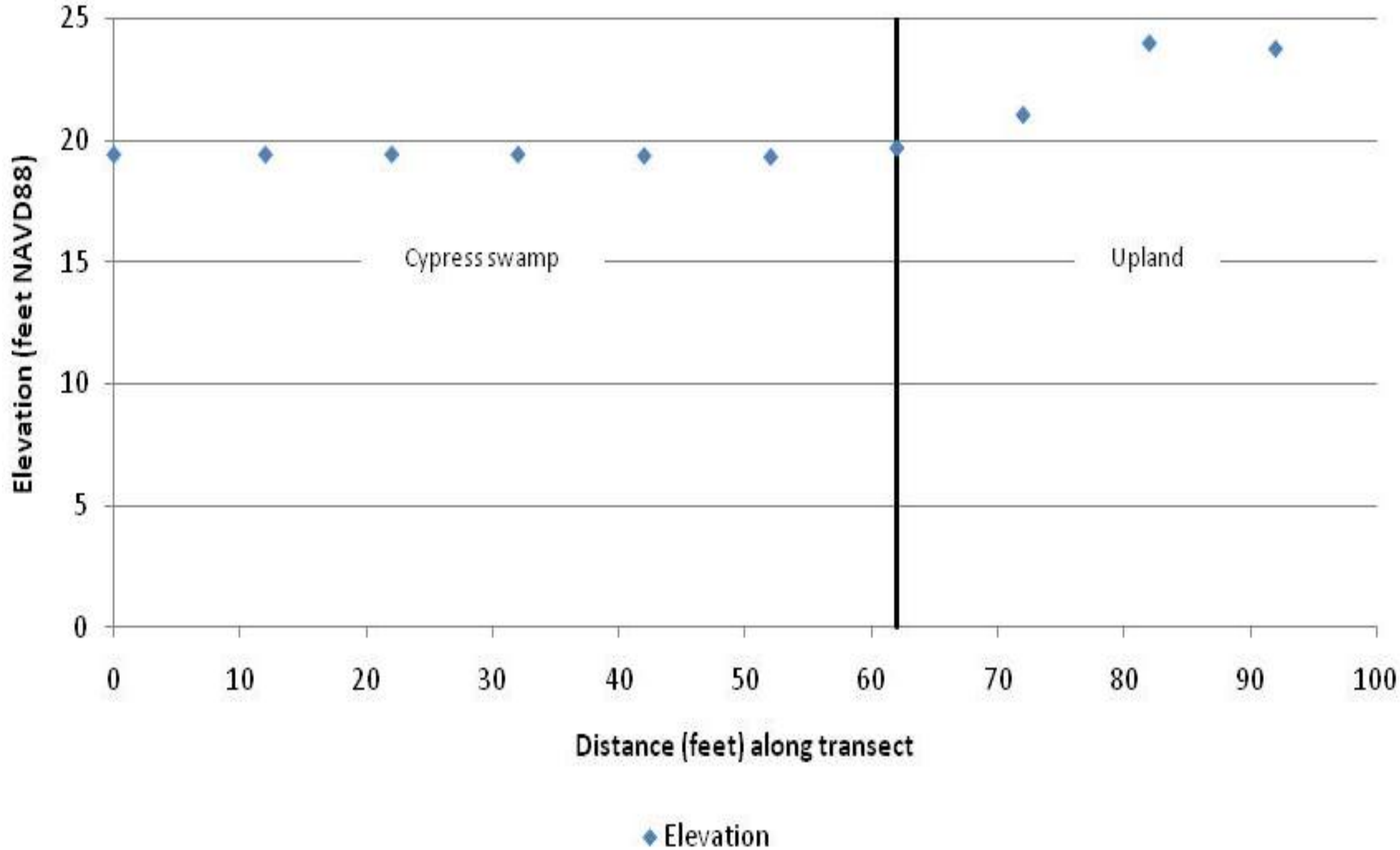
Transect AA (downstream) along the Ichetucknee River



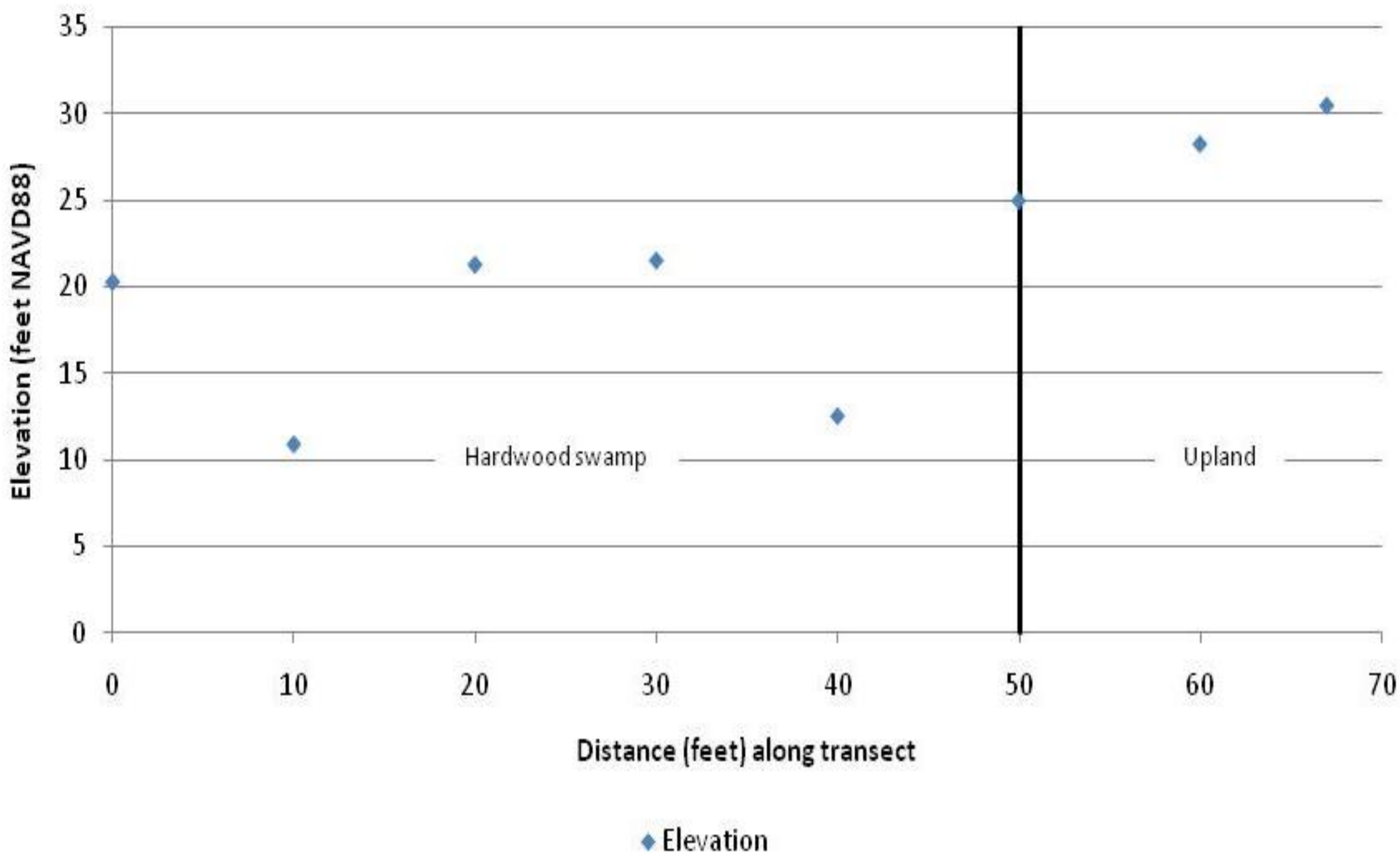


Transect AA (upstream) along the Ichetucknee River
Elevation (feet NAVD88)
Distance (feet) along transect
Channel
Cypress popash swamp
Mesic hardwood hammock
Elevation
0
5
10
15
20
25
30
0
50
100
150
200
250
300

Transect BB (west side) along the Ichetucknee River



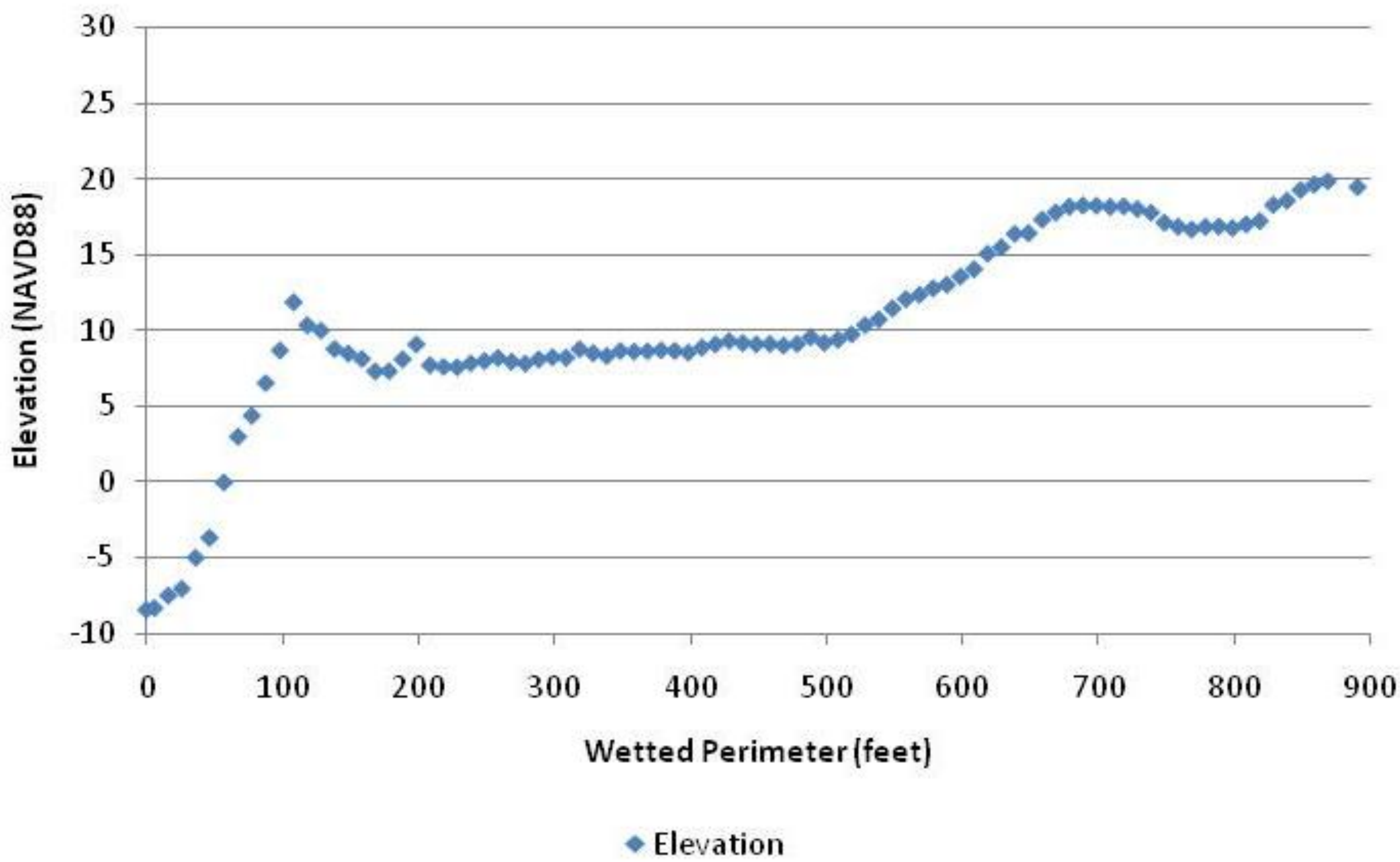
Transect BB (east side) along the Ichetucknee River



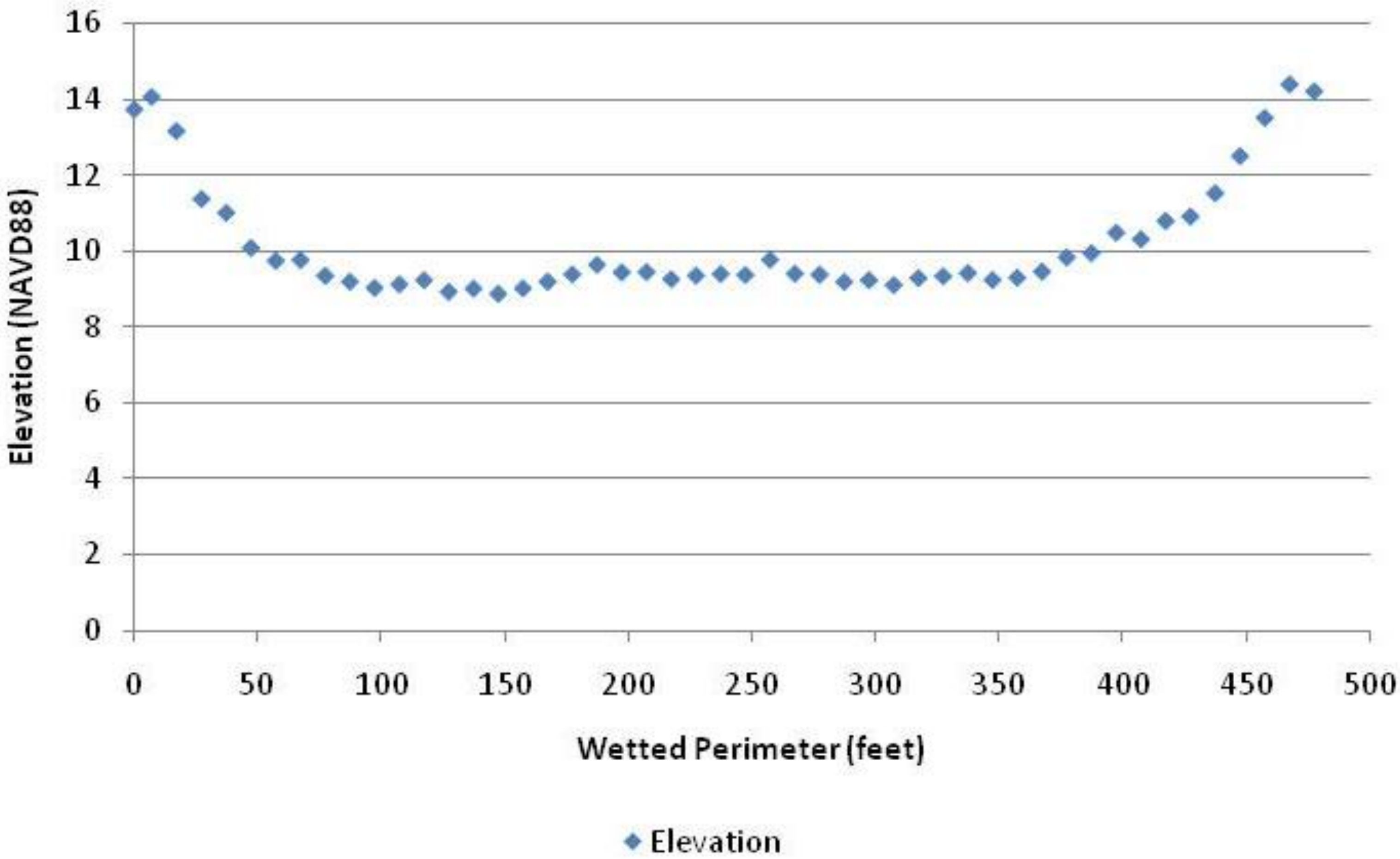
Appendix B

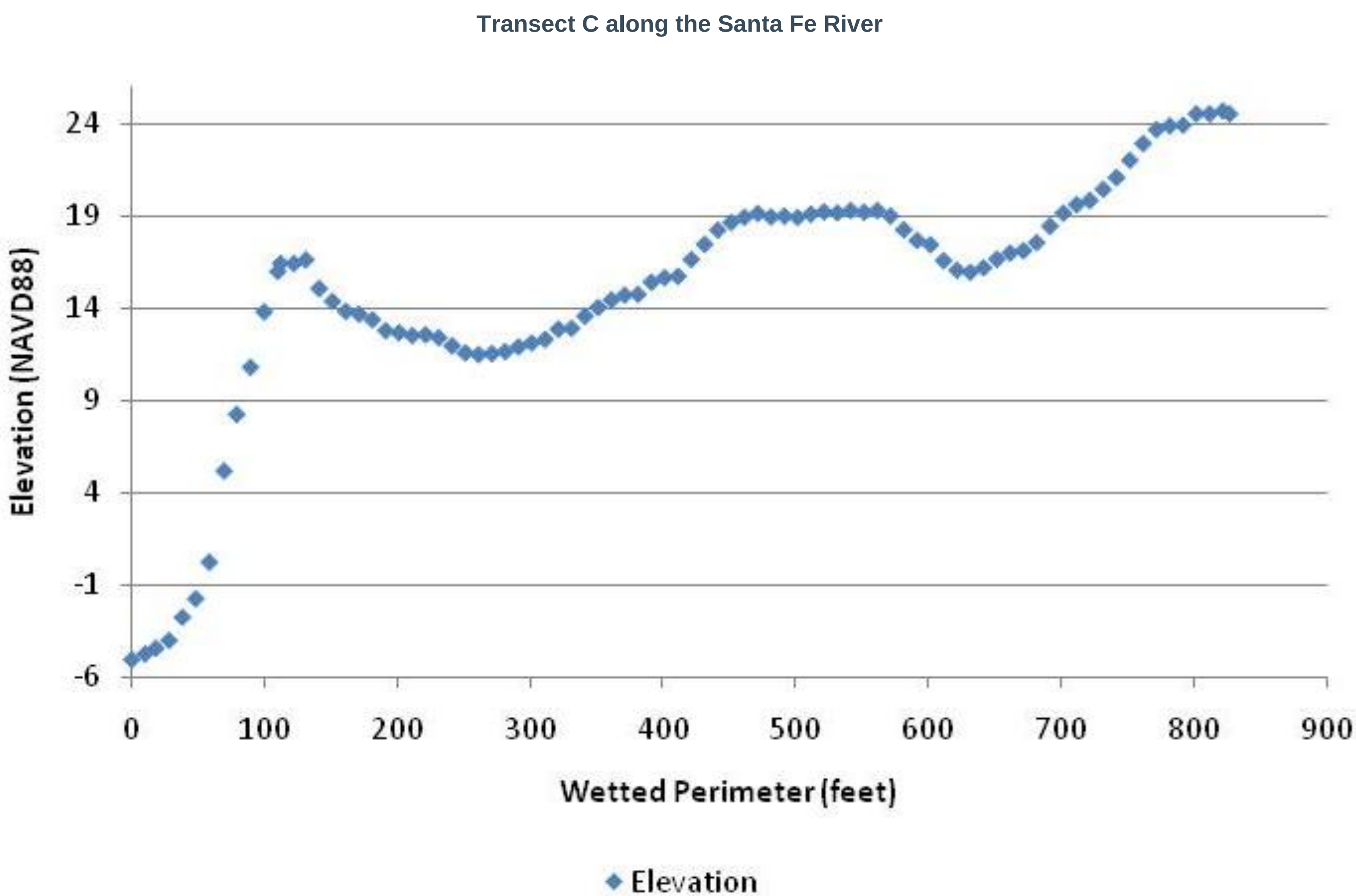
Wetted Perimeter Graphs for the LS&I Study Corridor, from upstream to downstream (note that elevation is on the dependent axis and flooded wetland perimeter on the independent axis)

Transect A along the Santa Fe River

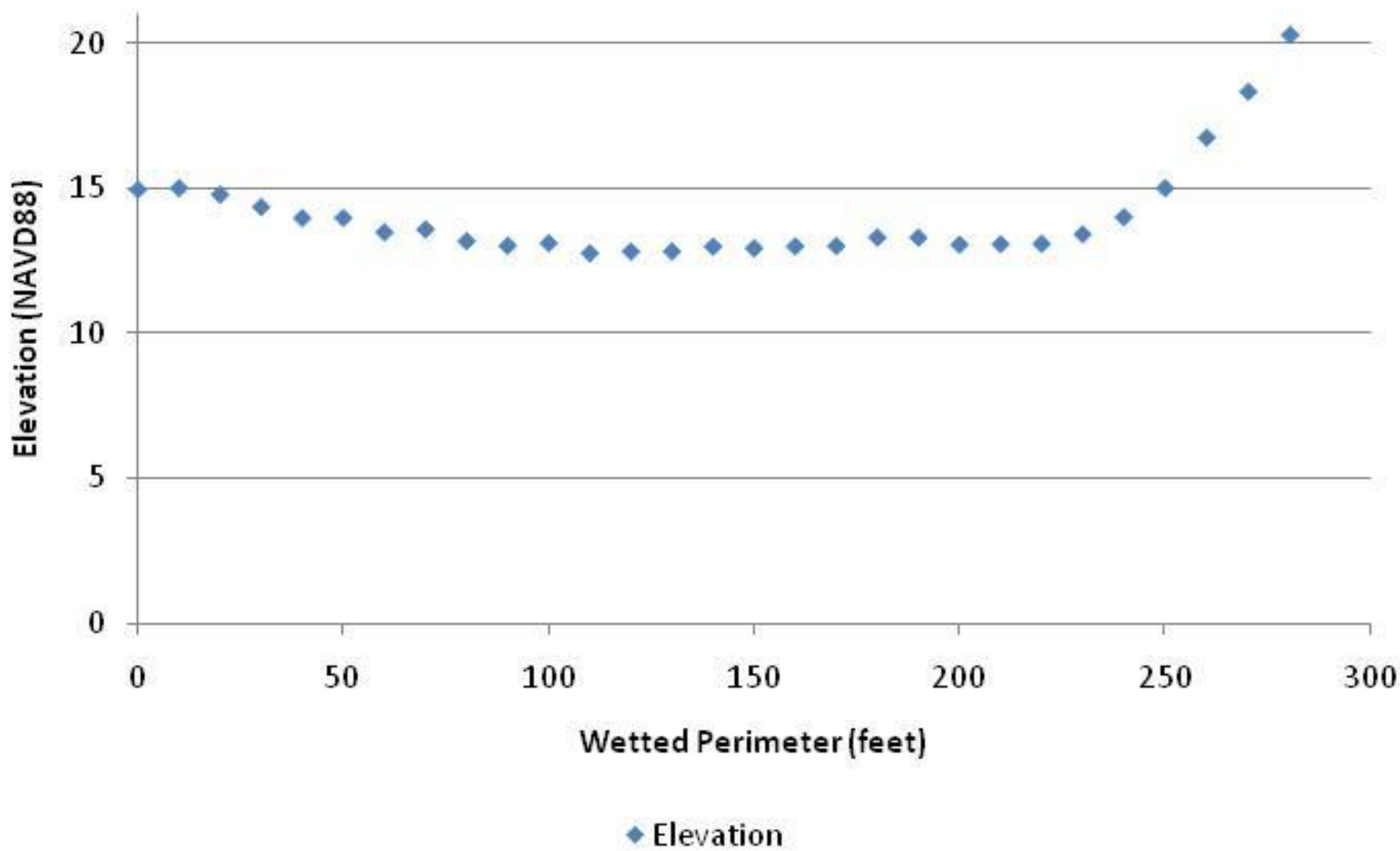


Transect B along the Santa Fe River

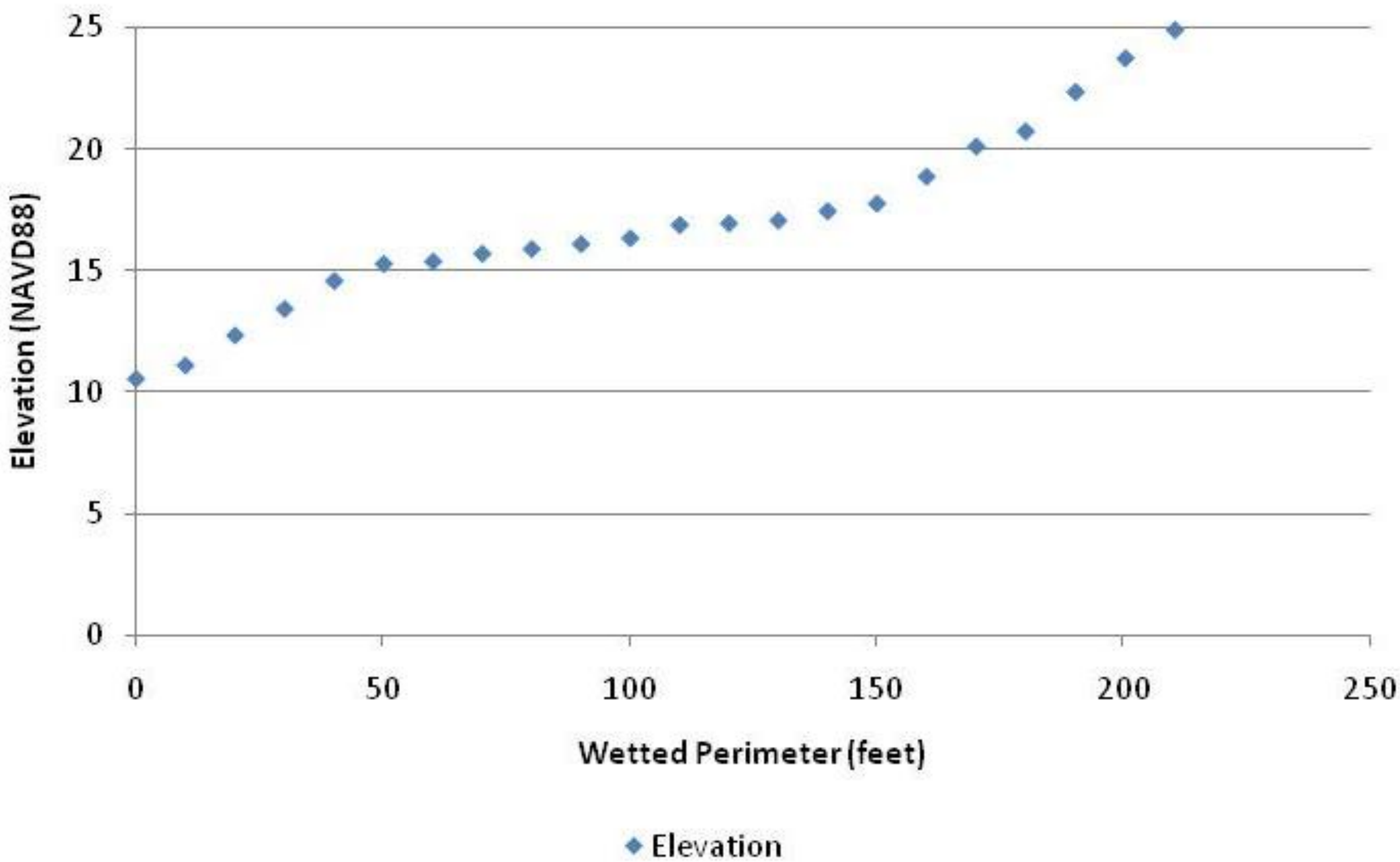



Transect C along the Santa Fe River
24
19
14
9
4
-1
-6
0
100
200
300
400
500
600
700
800
900
Elevation (NAVD88)
Wetted Perimeter (feet)
Elevation

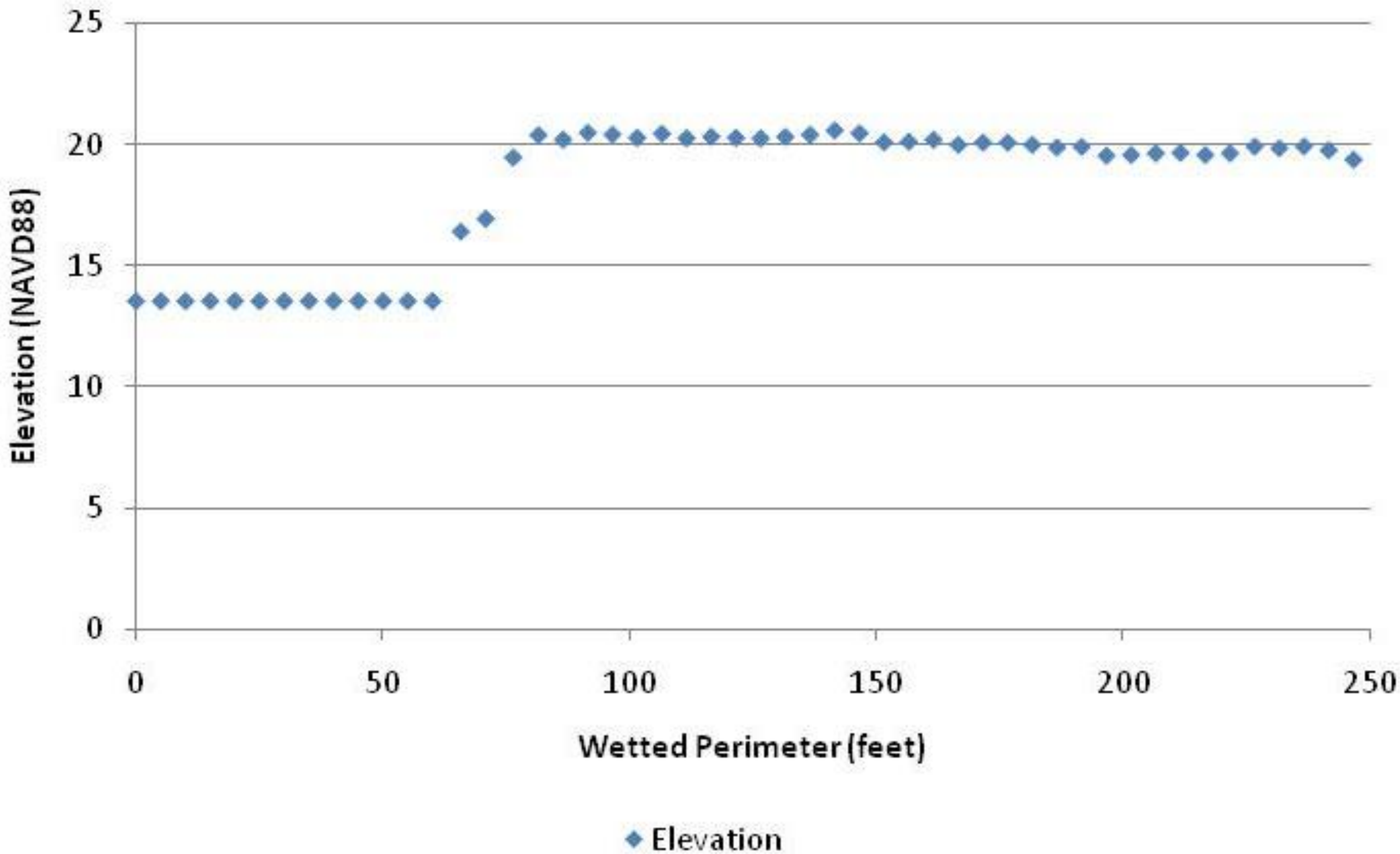
Transect CD along the Santa Fe River



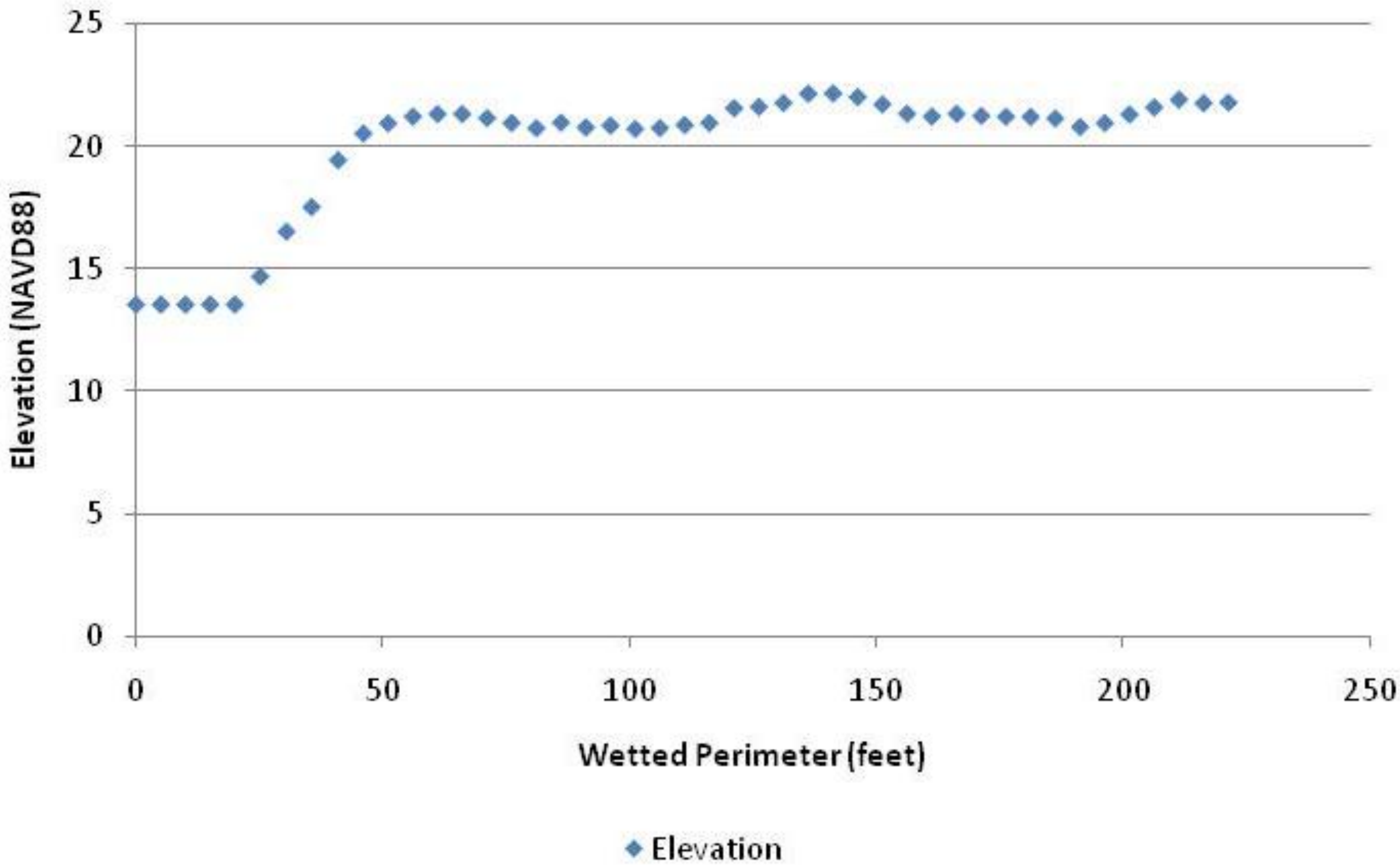
Transect D along the Santa Fe River



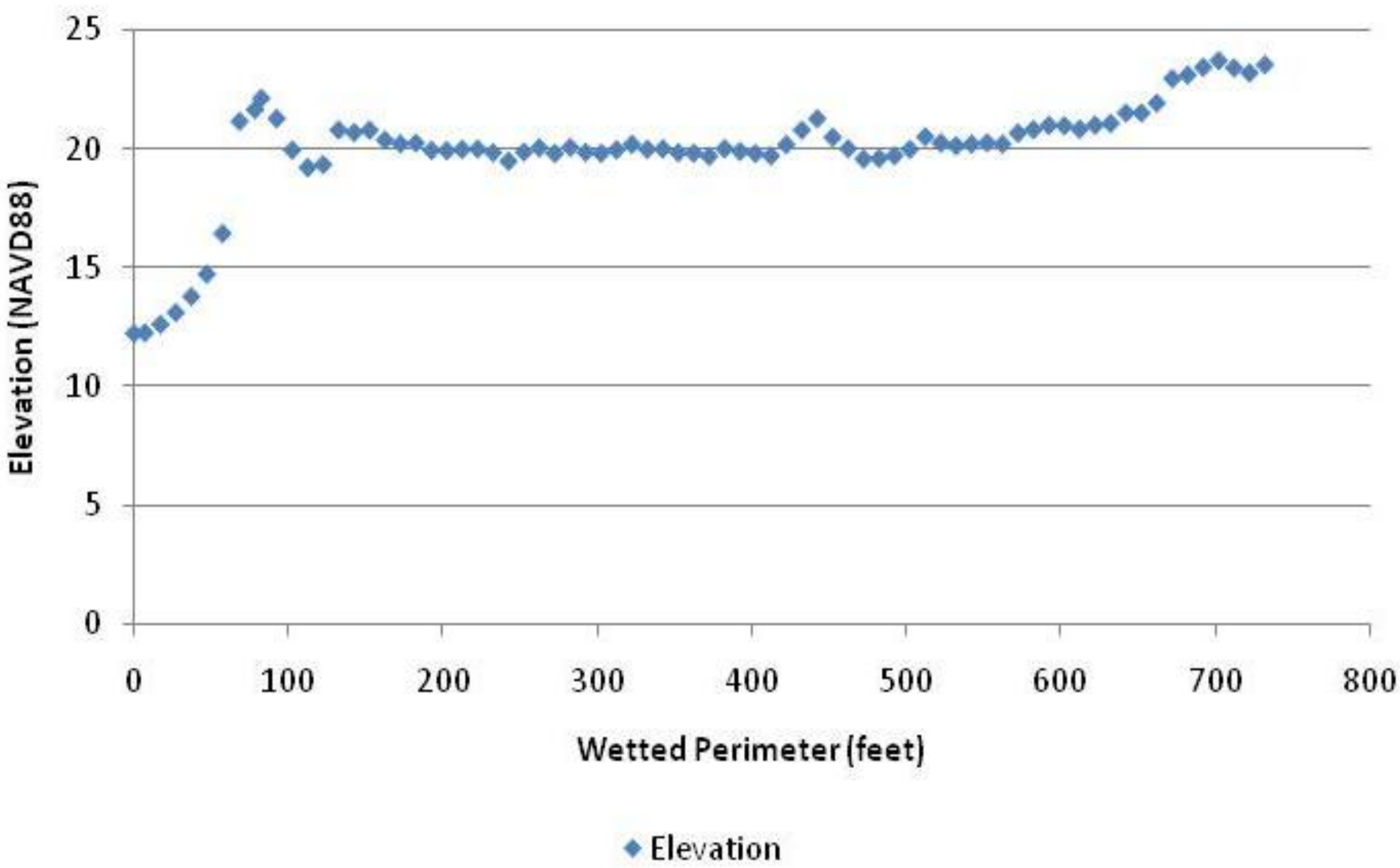
Transect E (downstream) along the Santa Fe River



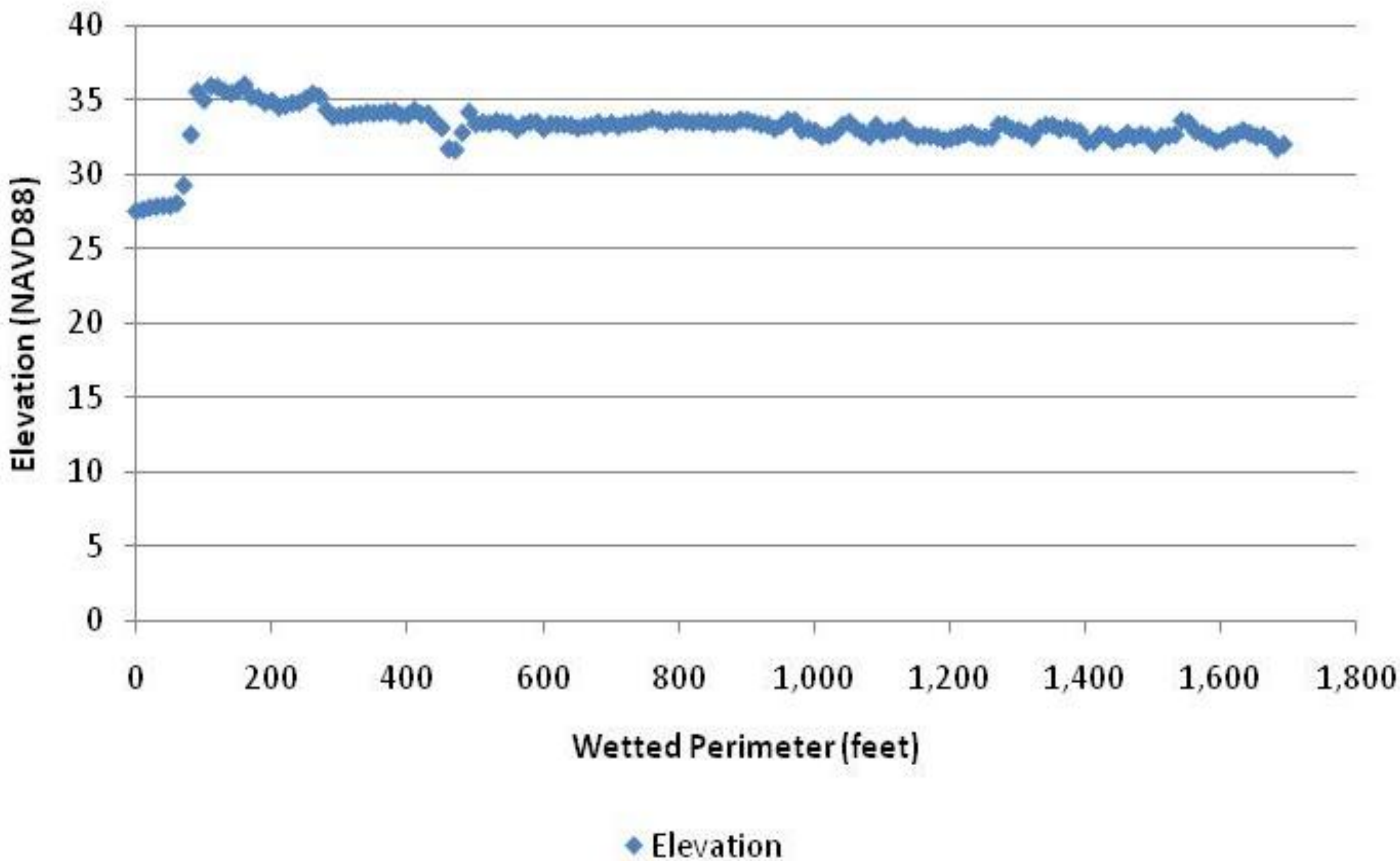
Transect E (upstream) along the Santa Fe River



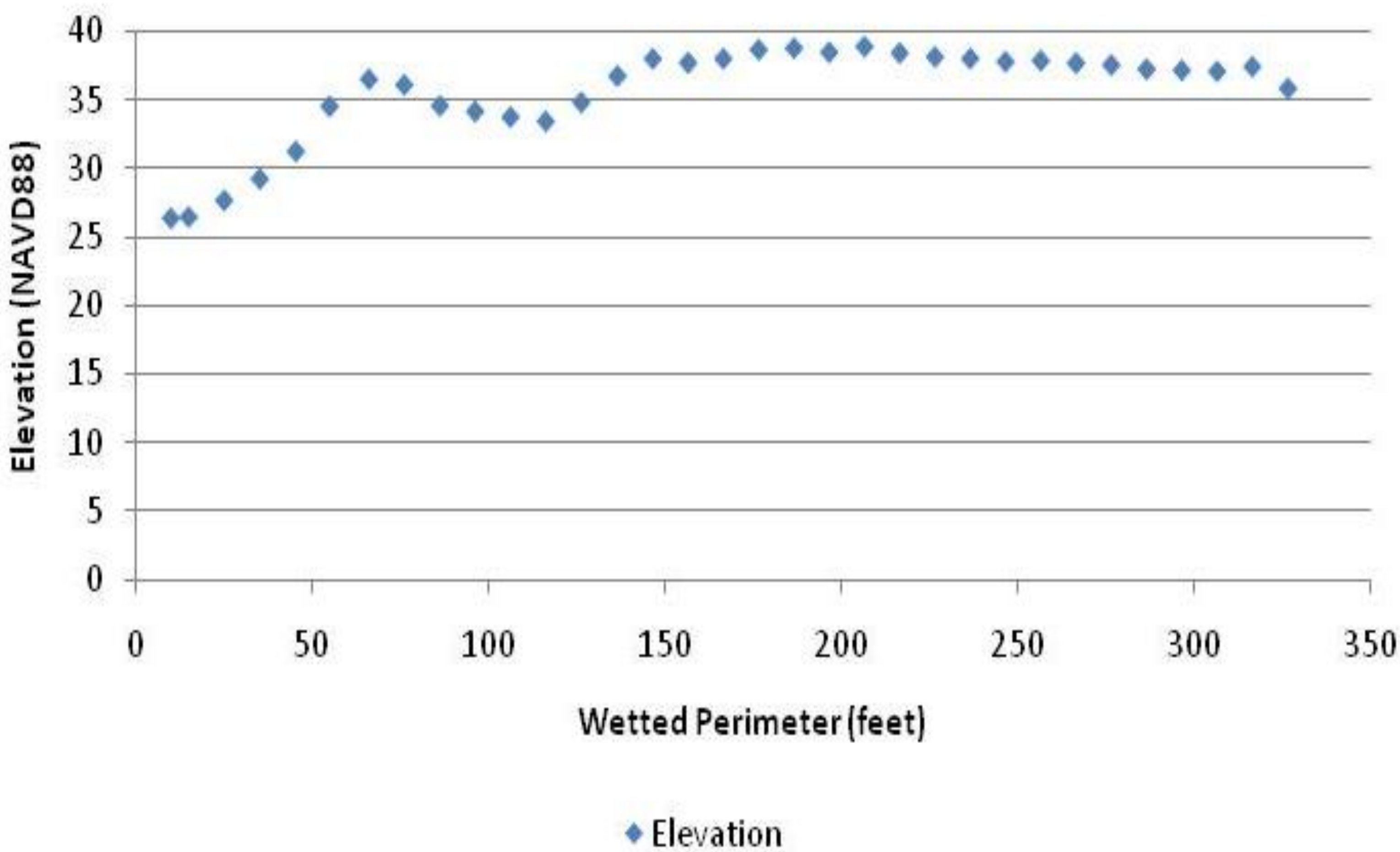
Transect F along the Santa Fe River



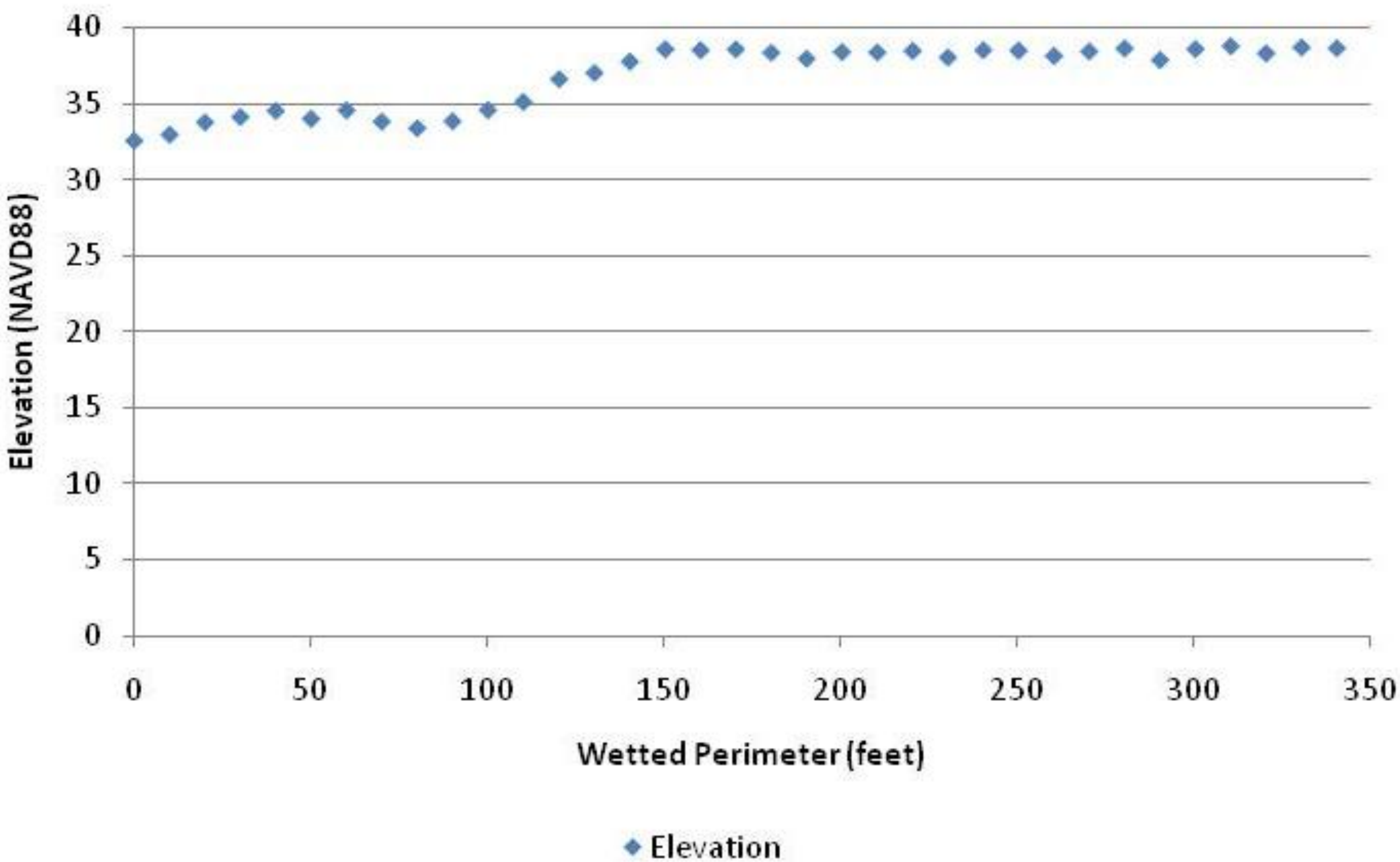
Transect J along the Santa Fe River



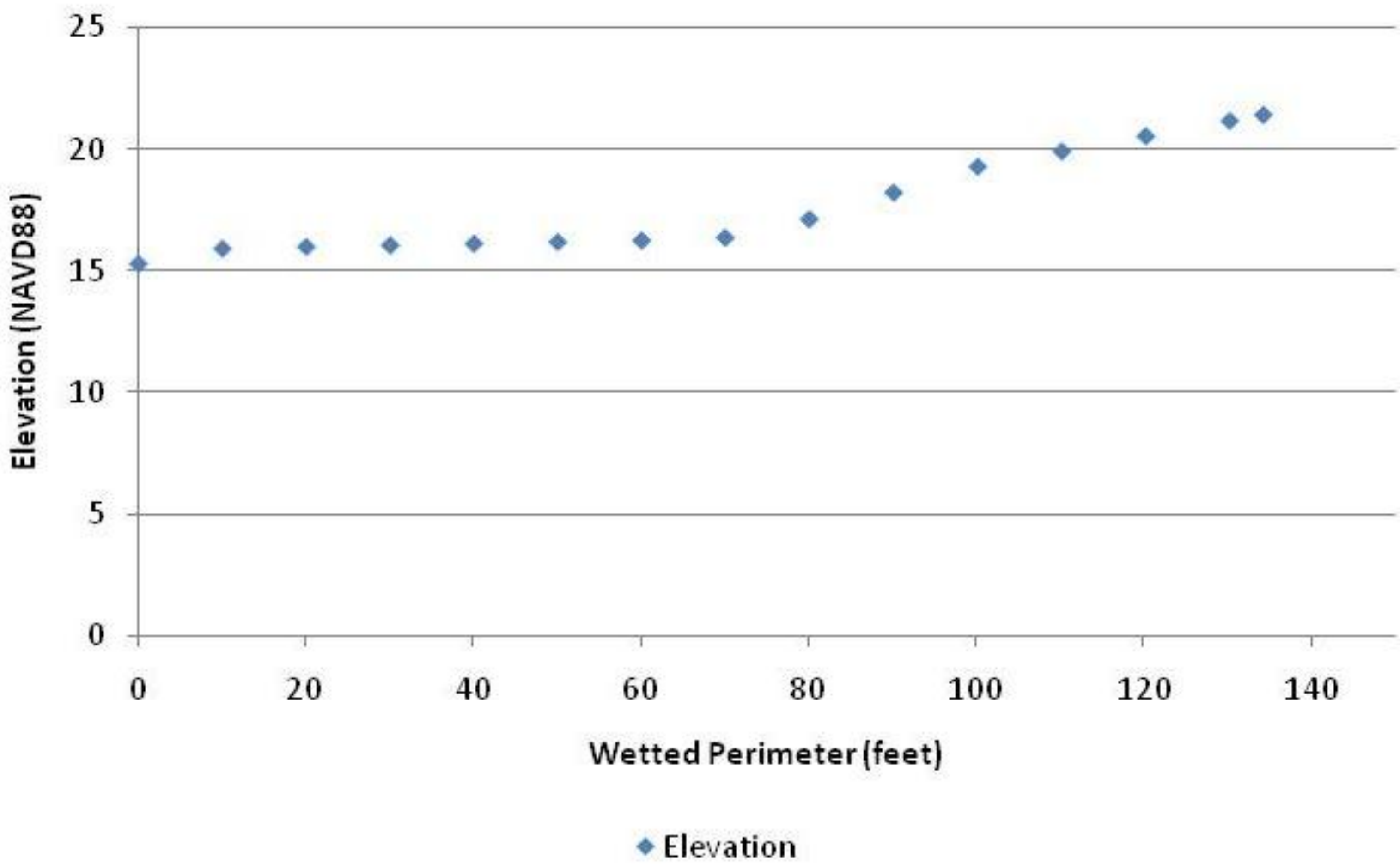
Transect K along the Santa Fe River

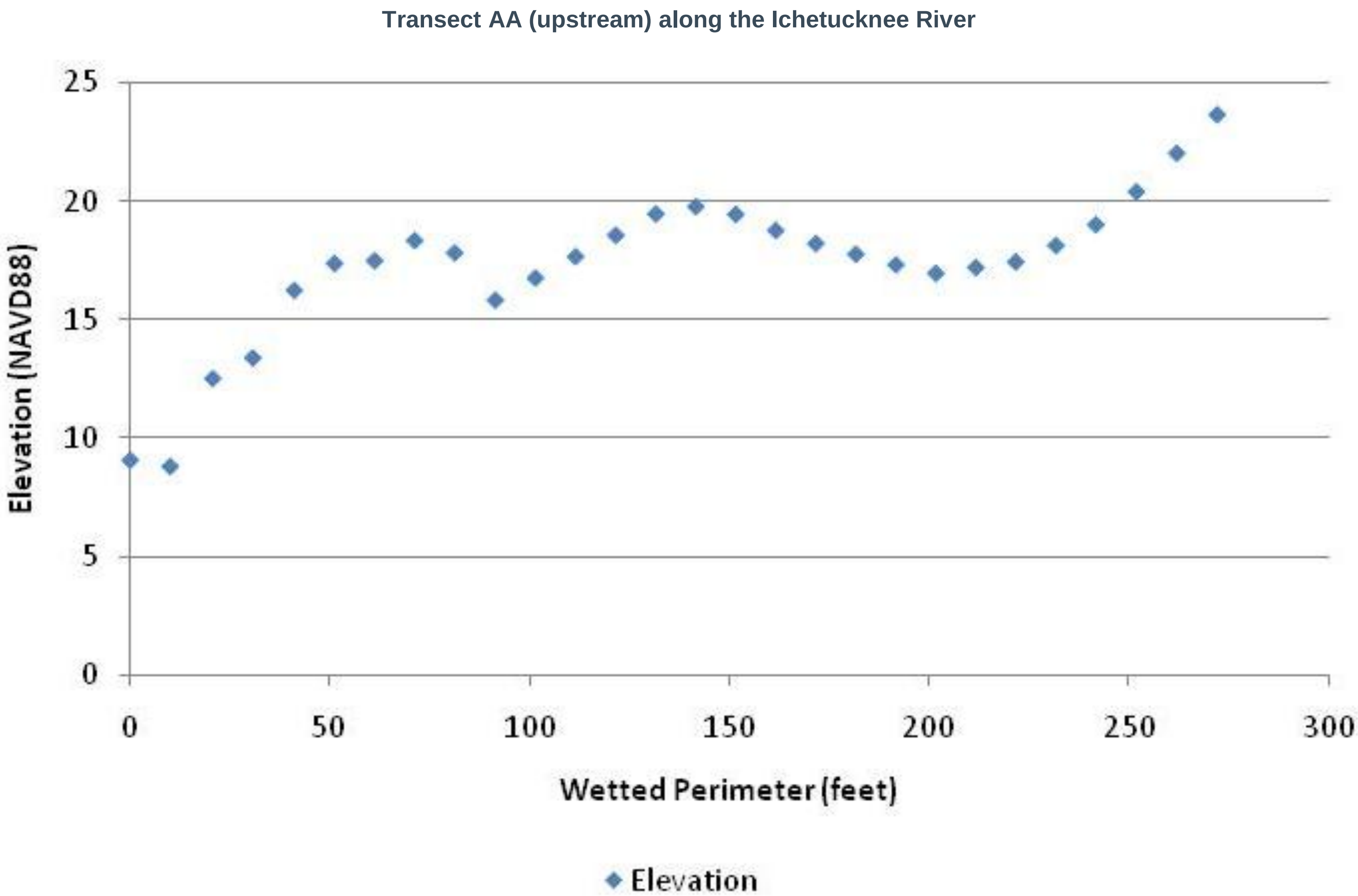


Transect L along the Santa Fe River

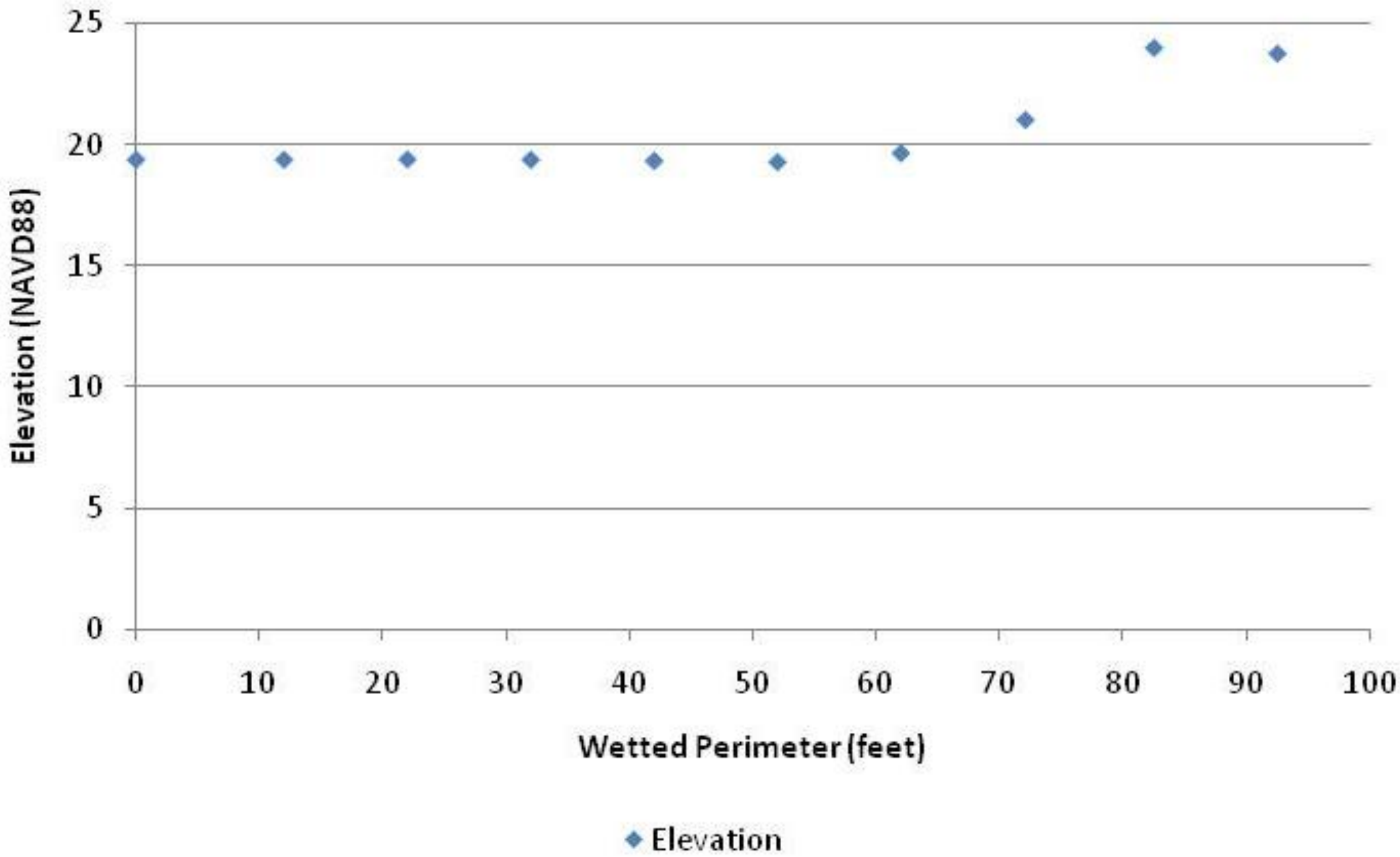


Transect AA (downstream) along the Ichetucknee River

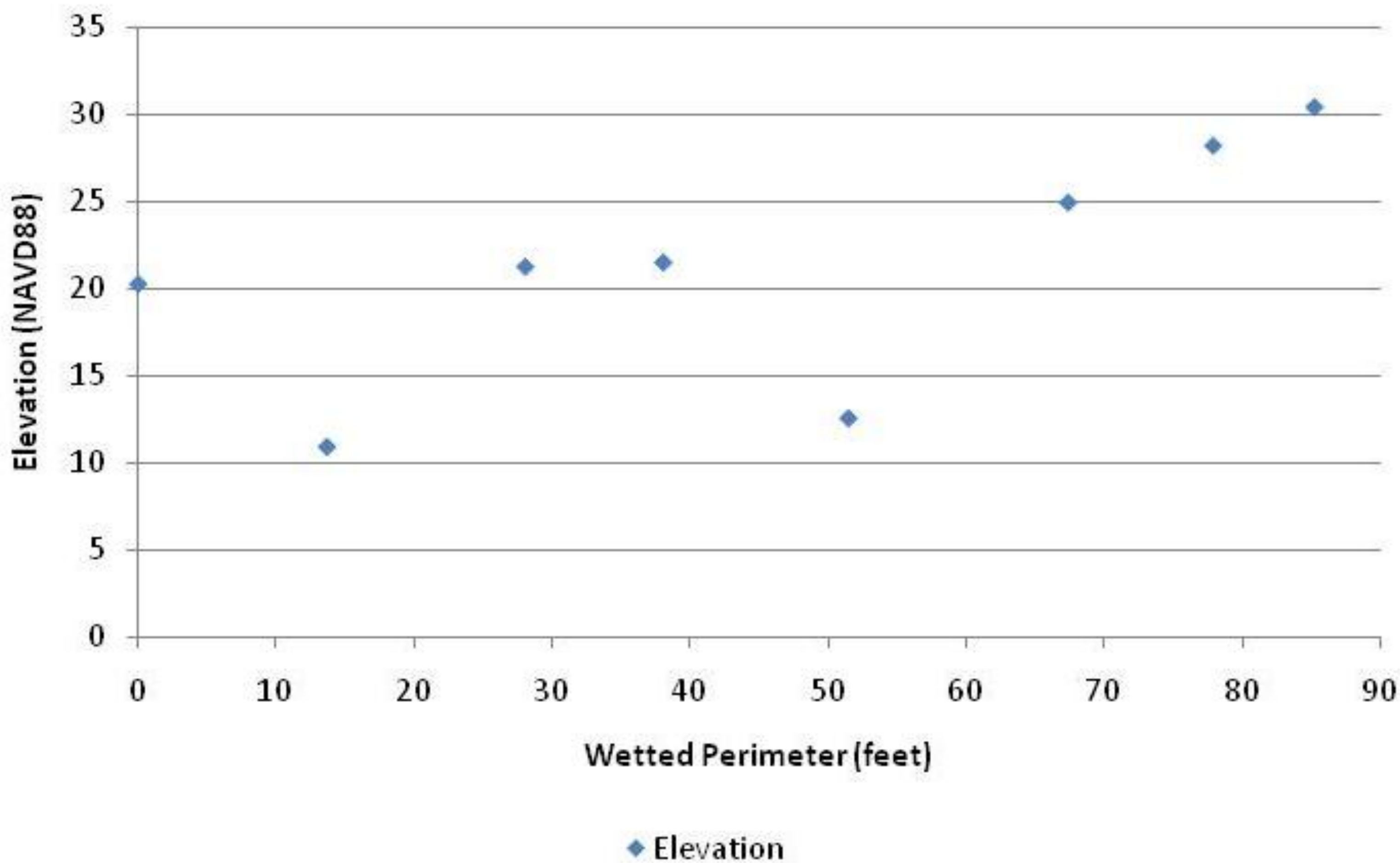



Transect AA (upstream) along the Ichetucknee River
25
20
15
10
5
0
Elevation (NAVD88)
0
50
100
150
200
250
300
Wetted Perimeter (feet)
Elevation

Transect BB (west) along the Ichetucknee River



Transect BB (east) along the Ichetucknee River



Appendix C
Task 1 Technical Note

Technical Note Task 1

Project:	Santa Fe and Ichetucknee Rivers MFL Support to SRWMD	**To:**	Susan Janicki, JEI
Subject:	Progress Report/Task 1	**From:**	Pam Latham, Atkins
Date:	15 Dec 2011	**cc:**	Keith Hackett, JEI

This memorandum documents the efforts completed under Task 1 of the existing contract. Under Task 1, potential sampling transects were visited, screened, and excluded or included for vegetation sampling in support of developing MFLs for the lower Santa Fe and Ichetucknee rivers. Pam Latham (Atkins NA) attended a Kickoff meeting on 3 March to discuss MFL support as a subcontractor to JEI. On March 7 and 8, scientists from the District (Bill Spencer and Robbie McKinney) and Atkins (Pam Latham and Tim Mann) accessed transects by boat and truck. Screening transects consisted of evaluating the appropriateness of transects and the associated vegetation with respect to floodplain vegetation that may be impacted by changes in river flows and water levels. Criteria for sampling included: access to the site (i.e. public lands or permission from owner(s)), direct connection to river, little to no disturbance (i.e. no ditching, draining), and vegetation characteristic of the river floodplain (obligate and facultative wetland plant species and little to no invasive/exotic vegetation). Ten transects along the Santa Fe River (Table 1a) and three transects along the Ichetucknee River (Table 1b) were selected for sampling and are listed and described in the attached tables.

Table 1a. Transect Length (feet) and GPS Locations of Selected Floodplain Features along the Santa Fe River.														
Transect	**Beginning**		**Ending**		**Length**	**Edge of Water**		**Top of Bank**		**Landward Extent of Wetland**		**Hydrological Indicator(s)**	
	Latitude	**Longitude**	**Latitude**	**Longitude**		**Latitude**	**Longitude**	**Latitude**	**Longitude**	**Latitude**	**Longitude**	**Latitude**	**Longitude**
A	29.89009	-82.87649	29.89063	-82.87884	768	29.89000	-82.87645	29.89009	-82.87649	29.89055	-82.87848	29.89020 29.89034 29.89030 29.89032 29.89040 29.89039 29.89042	-82.87666 -82.87673 -82.87682 -82.87693 -82.87752 -82.87754 -82.87795
B	29.89866	-82.86767	29.89962	-82.86870	477	29.89871	-82.86717	29.89880	-82.86721	29.89958	-82.86866	29.89882 29.89880 29.89877 29.89925 29.89927 29.89917 29.89927 29.89933 29.89935	-82.86781 -82.86788 -82.86785 -82.86826 -82.86825 -82.86839 -82.86843 -82.86836 -82.86839
C	29.91330	-82.84071	29.91352	-82.84292	704	29.91325	-82.84061	29.91330	-82.84071	29.91351	-82.84281	none	
CD	29.93257	-82.79738	29.93181	-82.79720	281	29.93266	-82.79792	29.93256	-82.79786	29.93182	-82.79720	none	
D	29.93359	-82.79023	29.93311	-82.79060	211	29.93537	-82.79147	29.93521	-82.79147	29.93325	-82.79050	none	
E (up)	29.88894	-82.75305	29.88902	-82.75375	222	29.88857	-82.75297	29.88859	-82.75236	29.88902	-82.75375	none	
E (down)	29.89124	-82.75296	29.89194	-82.75329	279	29.88857	-82.75297	29.88859	-82.75236	29.89194	-82.75329	29.89188 29.89198 29.89186	-82.75324 -82.75331 -82.75324
F	29.85604	-82.73249	29.85427	-82.73286	654	29.85604	-82.73249	29.85604	-82.73249	29.85427	-82.73286	29.85589 29.85588	-82.73276 -82.73271
J	29.85454	-82.60371	29.85210	-82.59950	1605	29.85457	-82.60374	29.85454	-82.60371	29.85210	-82.59949	29.85217 29.85221 29.85225	-82.59964 -82.59974 -82.59970
K	29.85874	-82.60004	29.85818	-82.59946	271	29.85876	-82.60008	29.85874	-82.60004	29.85818	-82.59947	29.85874	-82.60004
L	29.86307	-82.59219	29.86365	-82.59127	360	29.86322	-82.59218	29.86321	-82.59214	29.86365	-82.59127	29.86307	-82.59219

Table 1b. Transect Length (feet) and GPS Locations of Selected Floodplain Features along the Ichetucknee River													
Transect	Beginning		Ending		Length	Edge of Water		Top of Bank		Landward Extent of Wetland		Hydrological Indicator(s)	
	Latitude	Longitude	Latitude	Longitude		Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
AA (down)	29.95632	-82.78114	29.95661	-82.78140	134	29.95656	-82.78136	Not surveyed	Not surveyed	29.95661	-82.78141	29.95656	-82.78130
												29.95648	-82.78125
												29.95650	-82.78125
AA (up)	29.95754	-82.77978	29.95724	-82.77908	250	29.95754	-82.77978	Not surveyed		29.95724	-82.77908	29.95755	-82.77977
												29.95753	-82.77978
												29.95754	-82.77974
												29.95749	-82.77964
												29.95749	-82.77963
												29.95749	-82.77961
												29.95743	-82.77948
												29.95744	-82.77947
												29.95745	-82.77945
												29.95746	-82.77931
												29.95747	-82.77928
												29.95747	-82.77928
BB (west)	29.97084	-82.76056	29.97061	-82.76069	92	29.97084	-82.76054	Not surveyed		29.97068	-82.76065	29.97072	-82.76062
												29.97071	-82.76063
												29.97070	-82.76061
BB (east)	29.97050	-82.75962	29.97045	-82.75948	67	29.97057	-82.75965	29.97055	-82.75957	29.97045	-82.75947	29.97051	-82.75964
												29.97052	-82.75963
												29.97052	-82.75964
												29.97051	-82.75965
CC (west)	29.97701	-82.75963	29.976627	-82.759241	186	29.97701	-82.75964	Not surveyed		29.97667	-82.75928	29.97666	-82.75928
												29.97670	-82.75928
												29.97669	-82.75925
CC (east)	29.97727	-82.75892	29.97741	-82.75856	126	29.97727	-82.75892	Not surveyed		29.97740	-82.75861	none	

Appendix D
Task 3 Technical Note

Task 3 Technical Note

Project:	Santa Fe and Ichetucknee Rivers MFL Support to SRWMD	**To:**	Keith Hackett, JEI
Subject:	Task 3b: Final QA Report	**From:**	Pam Latham, Atkins
Date:	15 April 2012	**cc:**	Susan Janicki, JEI

This memorandum documents the effort completed for Task 3 *Quality Assurance/Quality Control* under the existing contract and provides the Final QA Report . A summary of the activities implemented and completed, consistent with the Scope of Work.

Purpose

The purpose of Task 3 is to document quality assurance/quality control (QA/QC) procedures that were implemented to ensure that vegetation and soils were accurately characterized and data collected were adequate for analyses in support of establishing MFLs for the lower Santa Fe River and the Ichetucknee River. Data were collected along sampling transects, as described under Task 2. Dr. David Hall (Hall) and Wade Hurt (Hurt) were included as subcontractors to provide QA/QC for plant species identification and soils characterization along transects.

Methods

A total of 13 transects were established along the lower Santa Fe and Ichetucknee rivers for sampling and characterizing vegetation and soils. District scientists identified potential transects based on a review of potential criteria on which to base the selections. The data used to examine potential criteria for selecting transects are listed below.

- National Wetlands Inventory (NWI) data
- U.S. Department of Agriculture/Soil Conservation Service (SCS) soils classifications and Hydric Soils Groups
- USGS elevation/topography
- USGS water level gage locations
- Aerial photography
- Land use, e.g. historical alterations

District scientists compared NWI classifications with available aerial photography, soils maps, and field observations and used to map potential transects. The potential transects were visited by District and Atkins scientists to evaluate transects for additional criteria, including direct influence of river on floodplain, relatively undisturbed conditions, presence of semi-permanent or permanently flooded vegetation, and access to the site. As a result of the field visits, a total of 13 transects were selected for sampling.

QA/QC actions were implemented for sampling along 10 lower Santa Fe River transects (A, B, C, CD, D, E, F, J, K, and L and 3 Ichetucknee River transects (AA, BB, and CC). Actions implemented to ensure data were accurate and therefore adequate to meet the needs of the overall project (i.e. to support the establishment of MFLs) included data collection protocols (QA) and verification (QC) by the selected experts (Hall and Hurt).

QA was implemented via standard protocols, i.e. procedures to ensure that the correct process was carried out. QC was implemented to ensure that the product was also accurate and adequate to meet the purpose of the project. QC occurred at 2 levels: the first as field verification and the second as review of the compiled data.The plan originally included experts in the field for 2 to 3 days of data verification. Changes to this plan are briefly outlined below.

- Locating the transects on the ground (without the benefit of prior elevation surveys) proved more difficult than anticipated and Hall and Hurt had limited opportunities the first 2 days of sampling to verify data under as many conditions as expected. In addition, timely completion of sampling became critical due to District's time constraints and survey. Finally, retaining the experts expedited the QC portion of the sampling.

- Discussions regarding soils indicated that an additional indicator, depth to seasonal high saturation (SHS) could provide an additional quantitative indicator of wetlands extent for the project. Soils data collected in support of MFLs have typically indicated presence (0) or absence (1) of mineral or organic soils, muck, saturation, and inundation to allow inclusion of these characteristics in statistical comparisons (vs. a full qualitative analysis of horizons, grain size, etc.). Hurt's expertise in rapidly identifying SHW made retaining him as a subcontractor for the duration of the project an efficient use of resources.

- Similarly, the effort required for established sampling protocols and the completion of a species list for ground, shrub, and tree level vegetation, required more than one person, and David Hall was retained for the duration of the sampling. This provided parallel QA/QC as data were recorded. As a result of these changes, the sampling was completed much more efficiently with much more extensive verification for all 13 transects.

Quality Assurance. Protocols implemented for QA targeted plant and soils sampling. Atkins established sampling protocols consistent with those used by the SWFWMD for the QA process to ensure that needed data were collected. The Point-Centered-Quarter (PCQ) method of quantitative sampling was implemented. Data sheets were prepared and used for each transect to ensure all data were collected. QA activities completed are listed below.

- Data sheets were prepared prior to sampling and were used as the checklist to ensure that all data were collected. Data sheets included columns for transect and sampling point locations, plant community names, plant species, distance and diameter breast height (DBH) measurements for four trees at each sample point, and for notes.
- GPS coordinates for top of bank (TOB), beginning and end of transect, plant community types, soils characteristic, biological indicators (if present), and other features were recorded and locations were flagged to assist surveyors.
- Short discussions were undertaken at the beginning of each transect to address plant community names, inundation characteristics, and dominant plant species present.
- At each sampling point in each community type (minimum = 3 sample points / community), trees were identified, measured, and recorded for each of four quarters/sampling point, per the PCQ method.

- A complete plant species list was compiled along belt transects for ground, shrub, and tree level vegetation (5 meters wide along entire transect length) by Hall.
- Soil characterizations were performed by Hurt and discussed with scientists present to provide “checks” on consistency of vegetation communities with soils.

Quality Control. Protocols for QC addressed accuracy of data collected. QC actions are listed below.

- Locations associated with vegetation communities and changes in communities, soil and soil saturation characteristics, landward extent of wetlands, transitions from wetlands to uplands, biological indicators (where present), visibly distinct changes in topography (e.g. scarps), top of river bank, etc. were discussed at each change in vegetation community and field verified by Hall and Hurt.
- Field identification of tree species was confirmed for trees at each sampling point by calling out genus/species names for PCQ and receiving verbal confirmation from Hall.
- Hall’s species list was used to cross-reference species names to ensure that species names were recorded correctly for both the PCQ (used for subsequent statistical analyses) and belt transect data (for additional community characterization and QA/QC).
- Hall confirmed wetland or not in the field, based on vegetation.
- Hurt confirmed wetland or not in the field, based on soils.
- Final data sheets were compiled and sent to Hall and Hurt for comments and any inconsistencies were resolved via phone or email.
- GPS coordinates were submitted to District for elevation surveys and then compared with survey data for transect location verification.

Results

Data verified in the field and compiled post-field sampling were submitted to District under Task 1 and included both raw and compiled data for all sampling transects along the lower Santa Fe River and Ichetucknee River. Data verified and subsequently submitted to the District are listed below.

- Raw data sheets for PCQ data, including GPS coordinates for other floodplain features
- Plant species list compiled by Hall for belt transects
- Soils data compiled by Hurt
- Vegetation and soils data compiled by Atkins and verified by Hall and Hurt, with GPS coordinates
- Locations of transects and vegetation communities/soils were mapped and compared with elevation and XY coordinates from the District.

Letters from Hurt and Hall indicating their roles and actions as part of this project are included as attachments to this technical note. Data provided by Hurt and Hall are included as verification.

Previous work on rivers in the SWFWMD indicated that elevations measured at regular intervals along transects adequately characterized the elevation gradient of the community and measuring elevations at each tree sampled is unnecessary. However, elevations at regular intervals along a transect are necessary to develop wetted perimeter graphs. Therefore, XYZ coordinates were provided to Atkins for subsequent vegetation and wetted perimeter analyses. The District subsequently developed a digital elevation model (DEM) and provided the data to Atkins. QC during vegetation analyses indicated a discrepancy in XYZ coordinates between the DEM and surveyed data. The elevation discrepancies between the surveyed and interpolated elevation data and the DEM were large (8 to 12 feet differences along a single transect) and were not consistently larger or smaller. The District subsequently implemented a substantial QC effort and the final DEM data provided to Atkins were consistent with XYZ coordinates surveyed at specific field locations and the transect locations identified during the field efforts. XYZ data used in previous analyses (vegetation communities and soils, wetted perimeter, extent of communities along elevation gradients, etc.) were subsequently revised and provided to Atkins.

Recommendations for future MFL- related sampling transects include completion of elevation surveys following field reconnaissance and transect selection, but prior to sampling to expedite sampling along transects. With transects surveyed prior to sampling, scientists would not spend time finding the transect, re-locating the transect after each sampling; field sampling could be better managed and completed more quickly. The value of including SHS and a complete plant species list will be examined as part of the analysis of vegetation, soils, and elevation analysis.

UF UNIVERSITY of FLORIDA
Institute of Food and Agricultural Sciences
Soil and Water Science Department

October 31, 2011
P.O. Box 110290
University of Florida
Gainesville, FL 32611-0290

During July 2011 I made more than 100 observations on the flood plains of the Santa Fe and Ichetucknee Rivers. Observations were from twenty transects selected by Suwannee River Water Management District (SRWMD) personnel. A hydric soil or nonhydric soil determination was made at each observation. In addition, I made Seasonal High Saturation (SHS) at each observation.

Hydric/Nonhydric determinations were based on Vasilas, L.M, G.W. Hurt, and C. Noble (editors.). 2010. Field Indicators of Hydric Soils in the United States TX. (Version 7.0), USDA, NRCS, Fort Worth, Texas.

SHS is the highest depth below the surface where water is expected to remain for a period of approximately 30 or more during the wettest part of years with normal annual and wet season precipitation. Flooding may also exist. SHS determinations were based on Hurt, G.W. and F.C. Watts. 2007. Using soil morphology for the identification of seasonal high saturation. In Hydric Soils of Florida Handbook, third Edition, G.W. Hurt, (editor). Florida Association of Environmental Soil Scientists. Gainesville, FL

The purpose of these hydric/nonhydric determinations and SHS determinations was to support Minimum Flows and Levels (MFL) development for the stated rivers. A few of the observations consisted of nonhydric soils; most consisted of hydric soils. SHS ranged from zero to fifteen inches. Very few of the observations consisted of organic soil material (muck).

If you need additional information, please let me know.

Sincerely,

Wade Hurt

Soil Scientist

Soils Data: Santa Fe and Ichetucknee Rivers					
Transect	Point	Hydric Status	Hydric Soil Indicator(s) Met*E85	SHS (inches)**	Remarks
A	1_1	Hydric	Sandy Redox (S6)	0	Bedrock at 14"
	1_2	Hydric	Sandy Redox (S6)	0	Bedrock at 13"
	2	Hydric	Sandy Redox (S6) at 3"	3	
		Hydric	Depleted Matrix (F3) at 8"		
	3	Hydric	Stripped Matrix (S6) at 3"	3	
	4	Nonhydric	None	8	
	5_1	Nonhydric	None	12	
	5_2	Nonhydric	None	11	
B	1	Hydric	Umbric Surface (F13) at 4"	4	Top of Bank
	2	Hydric	Redox Dark Surface (F6) at 2"	2	
	3	Hydric	Depleted Below Dark Surface (A11) at 0"	0	
			Depleted Matrix (F3) at 5"		
	4	Hydric	Depleted Below Dark Surface (A11) at 0"	0	
			Depleted Matrix (F3) at 5"		
	5	Hydric	Umbric Surface (F13) at 0"	0	
	6	Hydric	Depleted Below Dark Surface (A11) at 0"	0	
			Depleted Matrix (F3) at 3"	0	
	7	Nonhydric	None	7	Above Wetland Edge
BC1	1	Hydric	Umbric Surface (F13) at 0"	0	
			Depleted Dark Surface (F7) at 4+E55"		
	2	Hydric	Umbric Surface (F13) at 0"	0	
	3	Hydric	Umbric Surface (F13) at 0"	0	
	4	Hydric	Very Shallow Dark Surface (TF12)	0	Rock at 5"
	5	Hydric	Umbric Surface (F13) at 0"	0	
	6	Hydric	Umbric Surface (F13) at 0"	0	
	7	Hydric	Redox Dark Surface (F6) at 1"	1	
	8	Hydric	Redox Dark Surface (F6) at 1"	1	
	9	Nonhydric	None	7.5	S6 at 7.5"
	10	Nonhydric	None	7.5	S6 at 7.5"
C	1	Hydric	Stripped Matrix (S6) at 6"	6	Top of Bank
	2	Hydric	Redox Dark Surface (F6) at 2"	0	Umbric at 0"
	3	Hydric	Redox Dark Surface (F6) at 3"	0	Umbric at 0"
	4	Hydric	Redox Dark Surface (F6) at 3"	0	Umbric at 0"
	5	Hydric	Redox Dark Surface (F6) at 5"	5	
	6	Nonhydric	None	6.5	F6 at 6.5"
	7	Hydric	Sandy Redox (S5) at 5"	5	
	8	Hydric	Sandy Redox (S5) at 5"	5	
	9	Hydric	Sandy Redox (S5) at 6"	6	
	10	Hydric	Depleted Matrix (F3) at 5"	5	
CD	1	Hydric	Umbric Surface (F13) at 3"	3	
			Redox Dark Surface (F6) at 3"		

Soils Data: Santa Fe and Ichetucknee Rivers					
Transect	Point	Hydric Status	Hydric Soil Indicator(s) Met*E85	SHS (inches)**	Remarks
	2	Hydric	Umbric Surface (F13) at 2"	2	
	3	Hydric	Umbric Surface (F13) at 2"	2	
	4	Hydric	Umbric Surface (F13) at 0"	0	
D	1	Hydric	Very Shallow Dark Surface (TF12)	0	
	2	Hydric	Organic Bodies (A6) at 1"	1+F81	
	3	Hydric	Umbric Surface (F13) at 0"	0	
			Redox Dark Surface (F6) at 3"		
	4	Hydric	Redox Dark Surface (F6) at 0"	0	
E	1	Hydric	Redox Dark Surface (F6) at 2"	2	Fragmental Soil
	2	Hydric	Redox Dark Surface (F6) at 3"	3	Fragmental Soil
	3	Hydric	Redox Dark Surface (F6) at 4"	4	
	4	Hydric	Gleyed Matrix (F2) at 6"	6	
	5	Hydric	Gleyed Matrix (F2) at 5"	5	
	6	Hydric	Gleyed Matrix (F2) at 3"	3	
F	1	Hydric	Umbric Surface (F13) at 0"	0	
			Depleted Below Dark Surface (A11) at 0"		
			Depleted Matrix (F3)		
	2	Hydric	Depleted Below Dark Surface (A11) at 0"	0	
			Depleted Matrix (F3)		
	3	Hydric	Depleted Below Dark Surface (A11) at 0"	0	
			Depleted Matrix (F3)		
	4	Nonhydric	None	10	F3 at 10"
	5	Nonhydric	None	14	F3 at 14"
J	1	Hydric	Stripped Matrix (S6) at 6"	6	Top of Bank
	2	Hydric	Sandy Redox at (S5) 3"	3	
			Redox Dark Surface (F6) at 6"		
	3	Hydric	Umbric Surface (F13) at 3"	3	
			Redox Dark Surface (F6)		
	4	Hydric	Redox Dark Surface (F6) at 1"	1	
			Depleted Matrix (F3) at 6"		
	5	Hydric	Umbric Surface (F13) at 0"	0	
			Depleted Dark Surface (F7) at 3+E108"		
	6	Hydric	Umbric Surface (F13) at 1"	1	
	7	Hydric	Umbric Surface (F13) at 0"	0	
	8	Hydric	Umbric Surface (F13) at 0"	0	
	9	Hydric	Umbric Surface (F13) at 0"	0	
	10	Hydric	Umbric Surface (F13) at 0"	0	
	11	Hydric	Depleted Below Dark Surface (A11) at 0"	0	Underlain by Marl
	12	Hydric	Depleted Below Dark Surface (A11) at 0"	0	
			Depleted Matrix (F3)		

Soils Data: Santa Fe and Ichetucknee Rivers					
Transect	Point	Hydric Status	Hydric Soil Indicator(s) Met*E85	SHS (inches)**	Remarks
	13	Hydric	Depleted Below Dark Surface (A11) at 0"	0	
			Depleted Matrix (F3)		
	14	Hydric	Depleted Below Dark Surface (A11) at 0"	0	
			Depleted Matrix (F3)		
			Umbric Surface (F13) at 0"		
K	1	Hydric	Sandy Redox (S5) at 6"	6	Top of Bank
	2	Hydric	Sandy Redox (S5) at 3"	3	
	3	Hydric	Redox Dark Surface (F6) at 0"	0	
	4	Hydric	Umbric Surface (F13) at 1"	1	
	5	Hydric	Depleted Matrix (F3) at 4"	4	
L	1	Hydric	Redox Dark Surface (F6) at 0"	0	
			Hydrogen Sulfide (A4)		
	2	Hydric	Umbric Surface (F13) at 0"	0	
	3	Hydric	Umbric Surface (F13) at 0"	0	
			Redox Dark Surface (F6)		
	4	Hydric	Umbric Surface (F13) at 0"	0	
			Depleted Dark Surface (F7)		
	5	Hydric	Depleted Matrix (F3) at 3"	3	
	6	Hydric	Stripped Matrix (S6) at 5"	5	
	7	Nonhydric	None	9	S6 at 9"
*See Vasilas, L.M, G.W. Hurt, and C. Noble (eds.). 2010. Field indicators of hydric soils in the United States TX. (Version 7.0), USDA, NRCS, Fort Worth, for more information.					
**SHS = Seasonal High Saturation: the highest depth below the surface where water is expected to remain for a period of approximately 30 during the wettest part of years with normal annual and wet season precipitation. Flooding may exist.					

SUWANNEE RIVER WATER MANAGEMENT DISTRICT

MINIMUM FLOWS AND LEVELS

BOTANY TASKS DESCRIPTION

29 October 2011

The following tasks were performed as a part of the team during the minimum flows and levels initial field sampling portion of this contract:

Field Sampling Responsibilities:

1. Helped determine the boundaries of habitats.
2. Helped determine connectivity of transects to the river channels.
3. helped determine the actual location of each transect.
4. Helped determine the direction of each transect.
5. Made plant identifications in the field for all vegetation.
6. Helped with habitat identifications and characterization.
7. Helped with location and identification of hydrologic indicators: ordinary high water, buttressing, lichen lines, moss lines, and stain lines.
8. Identified trees and provided cover estimates for the tree and shrub canopies for each belt plot.
9. Identified herbaceous plants and provided cover estimates for each herbaceous plot.

Report Responsibilities:

1. Provided tables with transects, habitats, species determinations, cover estimates, and Florida wetland designations for all sampled transects and plots for both the Sante Fe and the Ichetucknee Rivers.

David W. Hall

Santa Fe River June 2011 List all species for each habitat					
Date	**Transect**	**Habitat**	**Point**	**Species**	**Cover**
31-May-11	A	Cypress Swamp	1	Erechtites hieraciifolius	3.44
31-May-11	A	Cypress Swamp	1	Conoclinium coelestinum	3.44
31-May-11	A	Cypress Swamp	1	Cephalanthus occidentalis	3.44
31-May-11	A	Cypress Swamp	1	Cyperus strigosus	3.44
31-May-11	A	Cypress Swamp	1	Phyla nodiflora	3.44
31-May-11	A	Cypress Swamp	1	Sabatia difformis	3.44
31-May-11	A	Cypress Swamp	1	Mitreola petiolata	3.44
31-May-11	A	Cypress Swamp	1	Rhynchospora colorata	3.44
31-May-11	A	Cypress Swamp	1	Acmella oppositifolia	3.44
31-May-11	A	Cypress Swamp	1	Dyschoriste humistrata	3.44
31-May-11	A	Cypress Swamp	1	Polygonum punctatum	3.44
31-May-11	A	Cypress Swamp	1	Quercus phellos	3.44
31-May-11	A	Cypress Swamp	1	Ipomoea indica	3.44
31-May-11	A	Cypress Swamp	1	Eupatorium capillifolium	3.44
31-May-11	A	Cypress Swamp	1	Taxodium distichum	3.44
31-May-11	A	Cypress Swamp	1	Pluchea longifolia	3.44
31-May-11	A	Cypress Swamp	1	Boehmeria cylindrica	3.44
31-May-11	A	Cypress Swamp	1	Fraxinus caroliniana	3.44
31-May-11	A	Cypress Swamp	1	Forestiera acuminata	3.44
31-May-11	A	Cypress Swamp	1	Eupatorium serotinum	3.44
31-May-11	A	Cypress Swamp	1	Hyptis mutabliis	3.44
31-May-11	A	Cypress Swamp	1	Samolus valerandi	3.44
31-May-11	A	Cypress Swamp	1	Ulmus americana	3.44
31-May-11	A	Cypress Swamp	1	Gleditsia aquatica	3.44
31-May-11	A	Cypress Swamp	1	Hydrocotyle verticillata	3.44
31-May-11	A	Cypress Swamp	1	Sesbania vesicaria	3.44
31-May-11	A	Cypress Swamp	1	Sideroxylon reclinatum	3.44
31-May-11	A	Cypress Swamp	2	Cyperus strigosus	7.7
31-May-11	A	Cypress Swamp	2	Ulmus americana	7.6
31-May-11	A	Cypress Swamp	2	Dyschoriste humistrata	7.7
31-May-11	A	Cypress Swamp	2	Phyla nodiflora	7.7
31-May-11	A	Cypress Swamp	2	Vitis rotundifolia	7.7
31-May-11	A	Cypress Swamp	2	Samolus valerandi	7.7
31-May-11	A	Cypress Swamp	2	Sabatia difformis	7.7
31-May-11	A	Cypress Swamp	2	Rhynchospora colorata	7.7
31-May-11	A	Cypress Swamp	2	Pluchea longifolia	7.7
31-May-11	A	Cypress Swamp	2	Conoclinium coelestinum	7.7
31-May-11	A	Cypress Swamp	2	Taxodium distichum	7.7
31-May-11	A	Cypress Swamp	2	Sesbania vesicaria	7.7
31-May-11	A	Cypress Swamp	2	Cephalanthus occidentalis	7.7

Santa Fe River June 2011 List all species for each habitat					
31-May-11	A	Cypress Swamp	3	Cephalanthus occidentalis	11.11
31-May-11	A	Cypress Swamp	3	Ipomoea indica	11.11
31-May-11	A	Cypress Swamp	3	Ampelopsis arborea	11.11
31-May-11	A	Cypress Swamp	3	Gleditsia aquatica	11.11
31-May-11	A	Cypress Swamp	3	Quercus nigra	11.11
31-May-11	A	Cypress Swamp	3	Conoclinium coelestinum	11.11
31-May-11	A	Cypress Swamp	3	Sabatia difformis	11.11
31-May-11	A	Cypress Swamp	3	Mitreola petiolata	11.11
31-May-11	A	Cypress Swamp	3	Panicum commutatum	11.11
31-May-11	A	Hydric Hammock	4	Ipomoea indica	1
31-May-11	A	Hydric Hammock	4	Conoclinium coelestinum	3
31-May-11	A	Hydric Hammock	4	Panicum commutatum	60
31-May-11	A	Hydric Hammock	4	Rhynchospora colorata	1
31-May-11	A	Hydric Hammock	4	Ampelopsis arborea	2
31-May-11	A	Hydric Hammock	4	Melothria pendula	1
31-May-11	A	Hydric Hammock	4	Clematis crispa	1
31-May-11	A	Hydric Hammock	4	Gleditsia aquatica	1
31-May-11	A	Upland Hammock	5	Panicum commutatum	1
31-May-11	A	Upland Hammock	5	Smilax bona-nox	12
31-May-11	A	Upland Hammock	5	Vitis aestivalis	1
31-May-11	A	Upland Hammock	5	Amsonia tabernaemontana	4
31-May-11	A	Upland Hammock	5	Celtis laevigata	1
31-May-11	A	Upland Hammock	5	Clematis crispa	2
31-May-11	A	Upland Hammock	6	Panicum commutatum	1
31-May-11	A	Upland Hammock	6	Smilax bona-nox	3
31-May-11	A	Upland Hammock	6	Dichondra carolinensis	1
31-May-11	A	Upland Hammock	6	Forestiera acuminata	1
31-May-11	A	Upland Hammock	6	Panicum anceps	5
31-May-11	A	Upland Hammock	6	Galactia volubilis	1
31-May-11	A	Upland Hammock	6	Ampelopsis arborea	1
31-May-11	A	Upland Hammock	6	Clematis crispa	1
31-May-11	A	Upland Hammock	6	Rubus trivialis	1
31-May-11	A	Upland Hammock	6	Quercus laurifolia	1
31-May-11	B	Hardwood Hydric Hammock	1	Panicum commutatum	4
31-May-11		Hardwood Hydric Hammock	1	Sideroxylon reclinatum	2
31-May-11	B	Hardwood Hydric Hammock	1	Saccharum baldwinii	10
31-May-11	B	Pop Ash Swamp	2	Panicum commutatum	2
31-May-11	B	Pop Ash Swamp	2	Axonopus fissifolius	1
31-May-11	B	Pop Ash Swamp	2	Parthenocissus quinquefolia	1
31-May-11	B	Pop Ash Swamp	2	Gleditsia aquatica	1

Santa Fe River June 2011 List all species for each habitat					
31-May-11	B	Pop Ash Swamp	3	Gleditsia aquatica	1
31-May-11	B	Pop Ash Swamp	3	Rubus trivialis	1
31-May-11	B	Pop Ash Swamp	3	Fraxinus caroliniana	1
31-May-11	B	Pop Ash Swamp	3	Axonopus fissifolius	5
31-May-11	B	Pop Ash Swamp	3	Ulmus americana	1
31-May-11	B	Pop Ash Swamp	3	Panicum commutatum	10
31-May-11	B	Pop Ash Swamp	4	Panicum commutatum	15
31-May-11	B	Pop Ash Swamp	4	Ulmus americana	4
31-May-11	B	Pop Ash Swamp	4	Erechtites hieraciifolius	3
31-May-11	B	Pop Ash Swamp	4	Boehmeria cylindrica	1
31-May-11	B	Pop Ash Swamp	5	Boehmeria cylindrica	20
31-May-11	B	Pop Ash Swamp	5	Fraxinus caroliniana	1
31-May-11	B	Pop Ash Swamp	5	Gleditsia aquatica	1
31-May-11	B	Pop Ash Swamp	5	Paspalum setaceum	50
31-May-11	B	Pop Ash Swamp	5	Panicum commutatum	33
31-May-11	B	Pop Ash Swamp	5	Acmella oppositifolia	4
31-May-11	B	Pop Ash Swamp	5	Erechtites hieracifolia	1
31-May-11	B	Pop Ash Swamp	5	Eupatorium capillifolium	1
31-May-11	BC	Cypress Swamp	1	Conoclinium coelestinum	75
31-May-11	BC	Cypress Swamp	1	Fraxinus caroliniana	1
31-May-11	BC	Cypress Swamp	1	Boehmeria cylindrica	2
31-May-11	BC	Cypress Swamp	1	Panicum rigidulum	20
31-May-11	BC	Cypress Swamp	1	Gleditsia aquatica	1
31-May-11	BC	Cypress Swamp	1	Panicum commutatum	1
31-May-11	BC	Cypress Swamp	2	Conoclinium coelestinum	86
31-May-11	BC	Cypress Swamp	2	Panicum commutatum	10
31-May-11	BC	Cypress Swamp	2	Melanthera nivea	1
31-May-11	BC	Cypress Swamp	2	Gleditsia aquatica	2
31-May-11	BC	Cypress Swamp	2	Cephalanthus occidentalis	1
31-May-11	BC	Hardwood Swamp	3	Boehmeria cylindrica	40
31-May-11	BC	Hardwood Swamp	3	Ipomoea indica	1
31-May-11	BC	Hardwood Swamp	3	Conoclinium coelestinum	28
31-May-11	BC	Hardwood Swamp	3	Panicum commutatum	30
31-May-11	BC	Hardwood Swamp	3	Gleditsia aquatica	1
31-May-11	BC	Hardwood Swamp	4	Conoclinium coelestinum	80
31-May-11	BC	Hardwood Swamp	4	Panicum commutatum	20
31-May-11	BC	Hardwood Swamp	5	no herbaceous cover	0
31-May-11	BC	Hardwood Swamp	6	Ampelopsis arborea	4
31-May-11	BC	Hardwood Swamp	6	Clematis crispa	1
31-May-11	BC	Hardwood Swamp	6	Quercus laurifolia	1
31-May-11	BC	Hardwood Swamp	6	Boehmeria cylindrica	1

Santa Fe River June 2011 List all species for each habitat					
31-May-11	BC	Hydric Hammock	7	Celtis laevigata	1
31-May-11	BC	Hydric Hammock	8	Ampelopsis arborea	1
31-May-11	BC	Hydric Hammock	8	Melanthera nivea	1
31-May-11	BC	Hydric Hammock	8	Celtis laevigata	1
31-May-11	BC	Hydric Hammock	9	Celtis laevigata	1
31-May-11	BC	Hydric Hammock	9	Viburnum obovatum	1
31-May-11	BC	Hydric Hammock	9	Quercus laurifolia	1
31-May-11	BC	Hydric Hammock	9	Acer rubrum	1
31-May-11	BC	Hydric Hammock	9	Clematis crispa	2
31-May-11	BC	Hydric Hammock	9	Vitis aestivalis	2
31-May-11	BC	Hydric Hammock	10	Panicum commutatum	3
31-May-11	BC	Hydric Hammock	10	Clematis crispa	2
31-May-11	BC	Hydric Hammock	10	Celtis laevigata	1
3-Jun-11	C	Berm	1	Smilax bona-nox	3
3-Jun-11	C	Berm	1	Paspalum setaceum	15
3-Jun-11	C	Privet Swamp	2	Panicum commutatum	1
3-Jun-11	C	Privet Swamp	2	Ulmus americana	1
3-Jun-11	C	Privet Swamp	2	Clematis crispa	1
3-Jun-11	C	Privet Swamp	3	Celtis laevigata	1
3-Jun-11	C	Privet Swamp	4	Polygonum punctatum	1
3-Jun-11	C	Privet Swamp	4	Erechtites hieraciifolius	2
3-Jun-11	C	Privet Swamp	4	Melothria pendula	2
3-Jun-11	C	Privet Swamp	4	Dichondra carolinensis	2
3-Jun-11	C	Privet Swamp	4	Melanthera nivea	2
3-Jun-11	C	Hydric Hammock	5	Panicum commutatum	35
3-Jun-11	C	Hydric Hammock	5	Celtis laevigata	2
3-Jun-11	C	Hydric Hammock	5	Melanthera nivea	1
3-Jun-11	C	Hydric Hammock	5	Clematis crispa	1
3-Jun-11	C	Hydric Hammock	5	Dichondra carolinensis	7
3-Jun-11	C	Hydric Hammock	5	Melothria pendula	5
3-Jun-11	C	Hydric Hammock	5	Dyschoriste humistrata	7
3-Jun-11	C	Hydric Hammock	5	Toxicodendron radicans	1
3-Jun-11	C	Hydric Hammock	6	Panicum commutatum	4
3-Jun-11	C	Hydric Hammock	6	Smilax bona-nox	1
3-Jun-11	C	Hydric Hammock	6	Rubus trivialis	5
3-Jun-11	C	Hydric Hammock	6	Polygonum punctatum	1
3-Jun-11	C	Hydric Hammock	6	Clematis crispa	1
3-Jun-11	C	Hydric Hammock	6	Ampelopsis arborea	4
3-Jun-11	C	Hydric Hammock	6	Melothria pendula	2
3-Jun-11	C	Hydric Hammock	6	Dyschoriste humistrata	1
3-Jun-11	C	Hydric Hammock	7	Smilax bona-nox	35

Santa Fe River June 2011 List all species for each habitat					
3-Jun-11	C	Hydric Hammock	7	Dyschoriste humistrata	2
3-Jun-11	C	Hydric Hammock	7	Viola sororia	1
3-Jun-11	C	Hydric Hammock	7	Commelina diffusa	10
3-Jun-11	C	Hydric Hammock	7	Carpinus caroliniana	1
3-Jun-11	C	Hydric Hammock	7	Panicum commutatum	30
3-Jun-11	C	Hydric Hammock	7	Dichondra carolinensis	19
3-Jun-11	C	Hydric Hammock	7	Melothria pendula	1
3-Jun-11	C	Hydric Hammock	7	Ilex vomitoria	1
3-Jun-11	C	Hydric Hammock	8	Melanthera nivea	69
3-Jun-11	C	Hydric Hammock	8	Erechtites hieraciifolius	1
3-Jun-11	C	Hydric Hammock	8	Ampelopsis arborea	1
3-Jun-11	C	Hydric Hammock	8	Celtis laevigata	1
3-Jun-11	C	Hydric Hammock	8	Boehmeria cylindrica	1
3-Jun-11	C	Hydric Hammock	8	Clematis crispa	2
3-Jun-11	C	Hydric Hammock	8	Melothria pendula	3
3-Jun-11	C	Hydric Hammock	8	Panicum commutatum	20
3-Jun-11	C	Hydric Hammock	8	Teucrium canadense	1
3-Jun-11	C	Hydric Hammock	8	Smilax bona-nox	1
3-Jun-11	C	Hydric Hammock	9	Panicum commutatum	85
3-Jun-11	C	Hydric Hammock	9	Melanthera nivea	1
3-Jun-11	C	Hydric Hammock	9	Celtis laevigata	2
3-Jun-11	C	Hydric Hammock	9	Rubus trivialis	8
3-Jun-11	C	Hydric Hammock	9	Melothria pendula	4
3-Jun-11	C	Hydric Hammock	10	Rubus trivialis	4
3-Jun-11	C	Hydric Hammock	10	Parthenocissus quinquefolia	1
3-Jun-11	C	Hydric Hammock	10	Sideroxylon reclinatum	1
3-Jun-11	C	Hydric Hammock	10	Celtis laevigata	1
3-Jun-11	C	Hydric Hammock	10	Smilax bona-nox	2
3-Jun-11	C	Hydric Hammock	10	Panicum commutatum	4
3-Jun-11	C	Hydric Hammock	10	Clematis crispa	6
3-Jun-11	C	Hydric Hammock	10	Melothria pendula	2
3-Jun-11	C	Hydric Hammock	10	Melanthera nivea	1
3-Jun-11	C	Hydric Hammock	11	Boehmeria cylindrica	4
3-Jun-11	C	Hydric Hammock	11	Dichondra carolinensis	5
3-Jun-11	C	Hydric Hammock	11	Panicum commutatum	6
3-Jun-11	C	Hydric Hammock	11	Campsis radicans	4
3-Jun-11	C	Hydric Hammock	11	Celtis laevigata	4
3-Jun-11	C	Hydric Hammock	11	Smilax bona-nox	5
3-Jun-11	C	Hydric Hammock	11	Melothria pendula	4
3-Jun-11	C	Hydric Hammock	11	Dyschoriste humistrata	2

Santa Fe River June 2011 List all species for each habitat					
1-Jun-11	CD	Hydric Hammock	1	Sideroxylon reclinatum	2
1-Jun-11	CD	Hydric Hammock	1	Celtis laevigata	1
1-Jun-11	CD	Hydric Hammock	2	no herbaceous cover	0
1-Jun-11	CD	Hydric Hammock	3	Panicum commutatum	8
1-Jun-11	CD	Hydric Hammock	3	Acer rubrum	1
1-Jun-11	CD	Hydric Hammock	3	Celtis laevigata	1
1-Jun-11	CD	Hydric Hammock	3	Conoclinium coelestinum	2
1-Jun-11	CD	Privet Swamp	4	Quercus laurifolia	1
1-Jun-11	CD	Privet Swamp	4	Acer rubrum	2
1-Jun-11	CD	Privet Swamp	4	Ulmus americana	1
1-Jun-11	D	Herbaceous Floodplain	1	Conoclinium coelestinum	35
1-Jun-11	D	Herbaceous Floodplain	1	Reimarochloa oligostachya	35
1-Jun-11	D	Herbaceous Floodplain	1	Rhynchospora colorata	25
1-Jun-11	D	Herbaceous Floodplain	1	Cyperus strigosus	5
1-Jun-11	D	Hydric Hammock	2	Melothria pendula	2
1-Jun-11	D	Hydric Hammock	2	Panicum commutatum	15
1-Jun-11	D	Hydric Hammock	2	Smilax bona-nox	1
1-Jun-11	D	Hydric Hammock	2	Ulmus americana	1
1-Jun-11	D	Hydric Hammock	2	Acer rubrum	1
1-Jun-11	D	Hydric Hammock	2	Campsis radicans	1
1-Jun-11	D	Hydric Hammock	3	Panicum commutatum	5
1-Jun-11	D	Hydric Hammock	3	Smilax bona-nox	2
1-Jun-11	D	Hydric Hammock	3	Carya aquatica	1
1-Jun-11	D	Hydric Hammock	3	Quercus virginiana	1
1-Jun-11	D	Hydric Hammock	3	Celtis laevigata	1
1-Jun-11	D	Hydric Hammock	3	Axonopus fissifolius	1
1-Jun-11	D	Hydric Hammock	4	Campsis radicans	8
1-Jun-11	D	Hydric Hammock	4	Smilax bona-nox	1
1-Jun-11	E	Hydric Hammock	1	Panicum commutatum	1
1-Jun-11	E	Hydric Hammock	1	Carpinus caroliniana	1
1-Jun-11	E	Hydric Hammock	1	Liquidambar styraciflua	1
1-Jun-11	E	Hydric Hammock	1	Dichondra carolinensis	1
1-Jun-11	E	Hydric Hammock	1	Smilax bona-nox	7
1-Jun-11	E	Hydric Hammock	1	Rubus trivialis	1
1-Jun-11	E	Hydric Hammock	1	Celtis laevigata	1
1-Jun-11	E	Hydric Hammock	2	Smilax bona-nox	8
1-Jun-11	E	Hydric Hammock	2	Celtis laevigata	2
1-Jun-11	E	Hydric Hammock	3	Smilax bona-nox	12
1-Jun-11	E	Hydric Hammock	3	Carpinus caroliniana	2
1-Jun-11	E	Hydric Hammock	3	Persea palustris	3
1-Jun-11	E	Hydric Hammock	4	Smilax bona-nox	4

Santa Fe River June 2011 List all species for each habitat					
1-Jun-11	E	Hydric Hammock	4	Celtis laevigata	1
1-Jun-11	E	Hydric Hammock	4	Panicum commutatum	15
1-Jun-11	E	Hydric Hammock	4	Acer rubrum	1
1-Jun-11	E	Hydric Hammock	5	Celtis laevigata	1
1-Jun-11	E	Hydric Hammock	5	Smilax bona-nox	3
1-Jun-11	E	Hydric Hammock	5	Panicum commutatum	3
1-Jun-11	E	Hydric Hammock	5	Quercus laurifolia	1
1-Jun-11	E	Hydric Hammock	6	Liquidambar styraciflua	1
1-Jun-11	E	Hydric Hammock	6	Smilax bona-nox	3
1-Jun-11	E	Hydric Hammock	6	Celtis laevigata	1
1-Jun-11	F	Hardwood Swamp	1	Toxicodendron radicans	1
1-Jun-11	F	Hardwood Swamp	1	Polygonum punctatum	15
1-Jun-11	F	Hardwood Swamp	1	Crataegus viridis	1
1-Jun-11	F	Hardwood Swamp	1	Panicum commutatum	60
1-Jun-11	F	Hardwood Swamp	1	Ulmus americana	1
1-Jun-11	F	Hardwood Swamp	1	Dyschoriste humistrata	15
1-Jun-11	F	Hardwood Swamp	1	Diospyros virginiana	1
1-Jun-11	F	Hardwood Swamp	2	Melothria pendula	8
1-Jun-11	F	Hardwood Swamp	2	Crataegus viridis	1
1-Jun-11	F	Hardwood Swamp	2	Polygonum punctatum	2
1-Jun-11	F	Hardwood Swamp	2	Hydrocotyle verticillata	1
1-Jun-11	F	Hardwood Swamp	2	Dichondra carolinensis	1
1-Jun-11	F	Hardwood Swamp	2	Boehmeria cylindrica	4
1-Jun-11	F	Hardwood Swamp	2	Panicum commutatum	40
1-Jun-11	F	Hardwood Swamp	2	Acer rubrum	1
1-Jun-11	F	Hardwood Swamp	2	Carex louisianica	15
1-Jun-11	F	Hardwood Swamp	3	Boehmeria cylindrica	15
1-Jun-11	F	Hardwood Swamp	3	Celtis laevigata	1
1-Jun-11	F	Hardwood Swamp	3	Panicum commutatum	50
1-Jun-11	F	Hardwood Swamp	3	Acer rubrum	2
1-Jun-11	F	Hardwood Hammock	4	Panicum commutatum	50
1-Jun-11	F	Hardwood Hammock	4	Ampelopsis arborea	20
1-Jun-11	F	Hardwood Hammock	4	Dyschoriste humistrata	5
1-Jun-11	F	Hardwood Hammock	4	Dichondra carolinensis	3
1-Jun-11	F	Hardwood Hammock	5	Dyschoriste humistrata	30
1-Jun-11	F	Hardwood Hammock	5	Axonopus fissifolius	60
1-Jun-11	F	Hardwood Hammock	5	Celtis laevigata	1
1-Jun-11	F	Hardwood Hammock	5	Panicum commutatum	7
1-Jun-11	F	Hardwood Hammock	5	Rubus trivialis	5
2-Jun-11	J	Hydric Hammock	2	Chasmanthium laxum	45
2-Jun-11	J	Hydric Hammock	2	Smilax bona-nox	1

Santa Fe River June 2011 List all species for each habitat					
2-Jun-11	J	Hydric Hammock	3	Panicum commutatum	45
2-Jun-11	J	Hydric Hammock	3	Carpinus caroliniana	1
2-Jun-11	J	Hydric Hammock	4	Panicum commutatum	76
2-Jun-11	J	Hydric Hammock	4	Smilax bona-nox	2
2-Jun-11	J	Hydric Hammock	4	Oplismenus hirtellus	15
2-Jun-11	J	Hydric Hammock	4	Carpinus caroliniana	1
2-Jun-11	J	Hydric Hammock	4	Dichondra carolinensis	1
2-Jun-11	J	Hydric Hammock	4	Chasmanthium laxum	5
2-Jun-11	J	Hardwood-Cypress Hydric Hammock	5	Panicum commutatum	58
2-Jun-11	J	Hardwood-Cypress Hydric Hammock	5	Chasmanthium laxum	2
2-Jun-11	J	Hardwood-Cypress Hydric Hammock	6	Carex louisianica	1
2-Jun-11	J	Hardwood-Cypress Hydric Hammock	6	Carpinus caroliniana	1
2-Jun-11	J	Hardwood-Cypress Hydric Hammock	6	Panicum commutatum	94
2-Jun-11	J	Hardwood-Cypress Hydric Hammock	6	Chasmanthium laxum	4
2-Jun-11	J	Hardwood-Cypress Hydric Hammock	7	Carex louisianica	89
2-Jun-11	J	Hardwood-Cypress Hydric Hammock	7	Boehmeria cylindrica	5
2-Jun-11	J	Hardwood-Cypress Hydric Hammock	7	Panicum commutatum	5
2-Jun-11	J	Hardwood-Cypress Hydric Hammock	7	Polygonum punctatum	1
2-Jun-11	J	Hardwood-Cypress Hydric Hammock	8	Carex louisianica	77
2-Jun-11	J	Hardwood-Cypress Hydric Hammock	8	Boehmeria cylindrica	15
2-Jun-11	J	Hardwood-Cypress Hydric Hammock	8	Carpinus caroliniana	1
2-Jun-11	J	Hardwood-Cypress Hydric Hammock	8	Panicum commutatum	5
2-Jun-11	J	Hardwood-Cypress Hydric Hammock	8	Acer rubrum	1
2-Jun-11	J	Hardwood-Cypress Hydric Hammock	8	Polygonum punctatum	1
2-Jun-11	J	Cypress-Hardwood Hydric Hammock	9	Boehmeria cylindrica	15
2-Jun-11	J	Cypress-Hardwood Hydric Hammock	9	Carex louisianica	2
2-Jun-11	J	Cypress-Hardwood Hydric Hammock	9	Acer rubrum	2
2-Jun-11	J	Cypress-Hardwood Hydric Hammock	9	Hydrocotyle verticillata	10
2-Jun-11	J	Cypress-Hardwood Hydric Hammock	9	Panicum commutatum	77
2-Jun-11	J	Cypress-Hardwood Hydric Hammock	9	Polygonum punctatum	2
2-Jun-11	J	Cypress-Hardwood Hydric Hammock	9	Carex longii	5
2-Jun-11	J	Cypress-Hardwood Hydric Hammock	9	Carpinus caroliniana	1
2-Jun-11	J	Cypress-Hardwood Hydric Hammock	9	Toxicodendron radicans	1
2-Jun-11	J	Cypress-Hardwood Hydric Hammock	9	Dichondra carolinensis	3
2-Jun-11	J	Cypress-Hardwood Hydric Hammock	10	Panicum commutatum	10
2-Jun-11	J	Cypress-Hardwood Hydric Hammock	10	Carex longii	63
2-Jun-11	J	Cypress-Hardwood Hydric Hammock	10	Acer rubrum	2
2-Jun-11	J	Cypress-Hardwood Hydric Hammock	10	Hydrocotyle verticillata	15
2-Jun-11	J	Cypress-Hardwood Hydric Hammock	10	Boehmeria cylindrica	15
2-Jun-11	J	Cypress-Hardwood Hydric Hammock	10	Carpinus caroliniana	2
2-Jun-11	J	Cypress-Hardwood Hydric Hammock	10	Centella asiatica	3
2-Jun-11	J	Cypress-Hardwood Hydric Hammock	11	Rhynchospora miliacea	6
2-Jun-11	J	Cypress-Hardwood Hydric Hammock	11	Hydrocotyle verticillata	4
2-Jun-11	J	Cypress-Hardwood Hydric Hammock	11	Panicum commutatum	20
2-Jun-11	J	Cypress-Hardwood Hydric Hammock	11	Ulmus americana	1

Santa Fe River June 2011 List all species for each habitat					
2-Jun-11	J	Cypress-Hardwood Hydric Hammock	11	Carex longii	63
2-Jun-11	J	Cypress-Hardwood Hydric Hammock	11	Acer rubrum	2
2-Jun-11	J	Cypress-Hardwood Hydric Hammock	11	Boehmeria cylindrica	4
2-Jun-11	J	Cypress-Hardwood Hydric Hammock	11	Centella asiatica	1
2-Jun-11	J	Hardwood-Cypress Swamp	12	Hydrocotyle verticillata	25
2-Jun-11	J	Hardwood-Cypress Swamp	12	Carex longii	4
2-Jun-11	J	Hardwood-Cypress Swamp	12	Carex louisianica	2
2-Jun-11	J	Hardwood-Cypress Swamp	12	Proserpinaca pectinata	7
2-Jun-11	J	Hardwood-Cypress Swamp	12	Panicum commutatum	20
2-Jun-11	J	Hardwood-Cypress Swamp	12	Acer rubrum	1
2-Jun-11	J	Hardwood-Cypress Swamp	12	Boehmeria cylindrica	1
2-Jun-11	J	Hardwood-Cypress Swamp	12	Smilax bona-nox	1
2-Jun-11	J	Hardwood-Cypress Swamp	12	Fraxinus caroliniana	5
2-Jun-11	J	Hardwood-Cypress Swamp	13	Acer rubrum	3
2-Jun-11	J	Hardwood-Cypress Swamp	13	Boehmeria cylindrica	1
2-Jun-11	J	Hardwood-Cypress Swamp	13	Taxodium distichum	1
2-Jun-11	J	Hardwood-Cypress Swamp	13	Panicum commutatum	2
2-Jun-11	J	Hardwood-Cypress Swamp	13	Cornus foemina	1
2-Jun-11	J	Hardwood-Cypress Swamp	13	Toxicodendron radicans	3
2-Jun-11	J	Hardwood-Cypress Swamp	13	Ulmus americana	2
2-Jun-11	J	Hardwood-Cypress Swamp	13	Hydrocotyle verticillata	6
2-Jun-11	J	Hardwood-Cypress Swamp	13	Fraxinus caroliniana	3
2-Jun-11	J	Hardwood-Cypress Swamp	13	Samolus valerandi	1
2-Jun-11	J	Hardwood-Cypress Swamp	14	Rhynchospora corniculata	15
2-Jun-11	J	Hardwood-Cypress Swamp	14	Boehmeria cylindrica	1
2-Jun-11	J	Hardwood-Cypress Swamp	14	Samolus valerandi	6
2-Jun-11	J	Hardwood-Cypress Swamp	14	Ulmus americana	1
2-Jun-11	J	Hardwood-Cypress Swamp	14	Hydrocotyle verticillata	8
2-Jun-11	J	Hardwood-Cypress Swamp	14	Fraxinus caroliniana	6
2-Jun-11	J	Hardwood-Cypress Swamp	14	Carex longii	10
2-Jun-11	K	Hardwood Hydric Hammock	1	Carex louisianica	5
2-Jun-11	K	Hardwood Hydric Hammock	1	Ulmus americana	1
2-Jun-11	K	Hardwood Hydric Hammock	2	Hydrocotyle verticillata	2
2-Jun-11	K	Hardwood Hydric Hammock	2	Carex longii	2
2-Jun-11	K	Hardwood Hydric Hammock	2	Carpinus caroliniana	1
2-Jun-11	K	Hardwood Hydric Hammock	2	Panicum commutatum	4
2-Jun-11	K	Hardwood Hydric Hammock	2	Celtis laevigata	1
2-Jun-11	K	Hardwood Hydric Hammock	2	Liquidambar styraciflua	1
2-Jun-11	K	Hardwood-Cypress Hydric Hammock	3	Panicum commutatum	10
2-Jun-11	K	Hardwood-Cypress Hydric Hammock	3	Quercus michauxii	1
2-Jun-11	K	Hardwood-Cypress Hydric Hammock	3	Carex louisianica	75
2-Jun-11	K	Hardwood Hydric Hammock	4	Rubus trivialis	1

Santa Fe River June 2011 List all species for each habitat					
2-Jun-11	K	Hardwood Hydric Hammock	4	Chasmanthium laxum	80
2-Jun-11	K	Hardwood Hydric Hammock	4	Celtis laevigata	1
2-Jun-11	K	Hardwood Hydric Hammock	4	Vitis rotundifolia	3
2-Jun-11	K	Hardwood Hydric Hammock	4	Panicum commutatum	2
2-Jun-11	K	Hardwood Hydric Hammock	4	Smilax bona-nox	1
2-Jun-11	K	Hardwood Hydric Hammock	5	Panicum commutatum	50
2-Jun-11	K	Hardwood Hydric Hammock	5	Toxicodendron radicans	10
2-Jun-11	K	Hardwood Hydric Hammock	5	Smilax bona-nox	3
2-Jun-11	K	Hardwood Hydric Hammock	5	Celtis laevigata	1
2-Jun-11	K	Hardwood Hydric Hammock	5	Carex longii	5
2-Jun-11	K	Hardwood Hydric Hammock	5	Rubus trivialis	2
2-Jun-11	K	Hardwood Hydric Hammock	5	Oplismenus hirtellus	10
2-Jun-11	K	Hardwood Hydric Hammock	5	Carpinus caroliniana	1
2-Jun-11	K	Hardwood Hydric Hammock	5	Pinus glabra	1
2-Jun-11	K	Hardwood Hydric Hammock	6	Panicum commutatum	50
2-Jun-11	K	Hardwood Hydric Hammock	6	Carex longii	15
2-Jun-11	K	Hardwood Hydric Hammock	6	Crataegus marshallii	1
2-Jun-11	K	Hardwood Hydric Hammock	6	Toxicodendron radicans	1
2-Jun-11	K	Hardwood Hydric Hammock	6	Smilax bona-nox	1
2-Jun-11	K	Hardwood Hydric Hammock	6	Quercus laurifolia	1
2-Jun-11	K	Hardwood Hydric Hammock	6	Carpinus caroliniana	1
3-Jun-11	L	Herbaceous Floodplain	1	Samolus valerandi	41
3-Jun-11	L	Herbaceous Floodplain	1	Crinum americanum	2
3-Jun-11	L	Herbaceous Floodplain	1	Taxodium distichum	1
3-Jun-11	L	Herbaceous Floodplain	1	Ludwigia palustris	1
3-Jun-11	L	Herbaceous Floodplain	1	Carex louisianica	15
3-Jun-11	L	Herbaceous Floodplain	1	Eupatorium capillifolium	1
3-Jun-11	L	Herbaceous Floodplain	1	Axonopus fissifolius	1
3-Jun-11	L	Herbaceous Floodplain	1	Dyschoriste humistrata	1
3-Jun-11	L	Herbaceous Floodplain	1	Echinodorus cordifolius	1
3-Jun-11	L	Herbaceous Floodplain	1	Hydrocotyle verticillata	10
3-Jun-11	L	Herbaceous Floodplain	1	Quercus nigra	1
3-Jun-11	L	Herbaceous Floodplain	1	Alternanthera philoxeroides	3
3-Jun-11	L	Herbaceous Floodplain	1	Toxicodendron radicans	1
3-Jun-11	L	Herbaceous Floodplain	1	Liquidambar styraciflua	1
3-Jun-11	L	Cypress Swamp	2	Panicum commutatum	77
3-Jun-11	L	Cypress Swamp	2	Cinnamomum camphora	1
3-Jun-11	L	Cypress Swamp	2	Berchemia scandens	3
3-Jun-11	L	Cypress Swamp	2	Liquidambar styraciflua	1
3-Jun-11	L	Cypress Swamp	2	Smilax bona-nox	2

Santa Fe River June 2011 List all species for each habitat					
3-Jun-11	L	Cypress Swamp	2	Toxicodendron radicans	1
3-Jun-11	L	Cypress Swamp	3	Panicum commutatum	10
3-Jun-11	L	Cypress Swamp	3	Pinus glabra	1
3-Jun-11	L	Cypress Swamp	3	Toxicodendron radicans	1
3-Jun-11	L	Cypress Swamp	3	Ostrya virginiana	1
3-Jun-11	L	Hydric Hammock	4	Ostrya virginiana	1
3-Jun-11	L	Hydric Hammock	4	Pinus glabra	2
3-Jun-11	L	Hardwood Hydric Hammock	5	Crataegus marshallii	4
3-Jun-11	L	Hardwood Hydric Hammock	5	Carpinus caroliniana	1
3-Jun-11	L	Hardwood Hydric Hammock	5	Panicum commutatum	5
3-Jun-11	L	Hardwood Hydric Hammock	5	Scleria triglomerata	3
3-Jun-11	L	Hardwood Hydric Hammock	5	Chasmanthium laxum	20
3-Jun-11	L	Hardwood Hydric Hammock	5	Asclepias perennis	3
3-Jun-11	L	Hardwood Hydric Hammock	5	Liquidambar styraciflua	1
3-Jun-11	L	Hardwood Hydric Hammock	5	Pinus glabra	1
3-Jun-11	L	Hardwood Hydric Hammock	6	Chasmanthium laxum	55
3-Jun-11	L	Hardwood Hydric Hammock	6	Cyrilla racemiflora	2
3-Jun-11	L	Hardwood Hydric Hammock	6	Carpinus caroliniana	2
3-Jun-11	L	Hardwood Hydric Hammock	6	Panicum commutatum	12
3-Jun-11	L	Hardwood Hydric Hammock	6	Liquidambar styraciflua	1
3-Jun-11	L	Hardwood Hydric Hammock	6	Smilax bona-nox	1
3-Jun-11	L	Hardwood Hydric Hammock	6	Scleria triglomerata	13

Date	Transect	Habitat	Point	Species	Tree Cover	Shrub Cover
31-May-11	A	Cypress Swamp	1	Fraxinus caroliniana	40	0
			1	Taxodium distichum	30	0
			2	Fraxinus caroliniana	5	0
			2	Taxodium distichum	70	0
			3	Fraxinus caroliniana	5	0
			3	Ostrya virginiana	85	0
		Hydric Hammock	4	Quercus lyrata	50	0
			4	Taxodium distichum	25	0
			4	Fraxinus caroliniana	5	0
			4	Forestiera acuminata	20	0
		Upland Hammock	5	Quercus laurifolia	93	0
			5	Taxodium distichum	2	0
			5	Acer rubrum	2	0
			5	Ostrya virginiana	3	0
			5	Carpinus caroliniana	1	0
			6	Quercus laurifolia	50	0
			6	Acer rubrum	50	0
			6	Forestiera acuminata	0	1
3-Jun-11	B	Hardwood Hydric Hammock	1	Forestiera acuminata	25	0
			1	Quercus lyrata	30	0
			1	Carya aquatica	15	0
			1	Quercus laurifolia	30	0
			1	Sideroxylon reclinatum	0	2
		Pop Ash Swamp	2	Fraxinus caroliniana	40	0
			2	Forestiera acuminata	15	10
			2	Taxodium distichum	20	0
			2	Ulmus americana	20	0
			2	Cephalanthus occidentalis	5	5
			2	Sideroxylon reclinatum	2	0
			2	Gleditsia aquatica	1	0
		Pop Ash Swamp	3	Fraxinus caroliniana	85	10
			3	Ulmus americana	15	0
		Pop Ash Swamp	4	Fraxinus caroliniana	50	0
			4	Taxodium distichum	30	3
			4	Ulmus americana	20	0
			4	Cephalanthus occidentalis	0	4
		Pop Ash Swamp	5	Fraxinus caroliniana	45	0
			5	Gleditsia aquatica	15	0
			5	Cephalanthus occidentalis	5	0
			5	Taxodium distichum	35	0

Date	Transect	Habitat	Point	Species	Tree Cover	Shrub Cover
31-May-11	BC	Cypress Swamp	1	Ostrya virginiana	80	0
			1	Taxodium distichum	5	0
		Cypress Swamp	2	Fraxinus caroliniana	55	0
			2	Taxodium distichum	1	0
		Hardwood Swamp	3	Fraxinus caroliniana	35	0
			3	Carya aquatica	15	0
			3	Forestiera acuminata	0	45
		Hardwood Swamp	4	Taxodium distichum	20	0
			4	Forestiera acuminata	60	0
			4	Cephalanthus occidentalis	0	10
		Hardwood Swamp	5	Fraxinus caroliniana	20	0
			5	Forestiera acuminata	80	0
		Hardwood Swamp	6	Forestiera acuminata	95	0
			6	Cephalanthus occidentalis	5	0
		Hydric Hammock	7	Quercus lyrata	90	0
			7	Ostrya virginiana	10	0
			7	Fraxinus caroliniana	3	3
			7	Cephalanthus occidentalis	0	5
			7	Salix caroliniana	0	10
			7	Sideroxylon reclinatum	0	1
		Hydric Hammock	8	Quercus lyrata	73	0
			8	Ostrya virginiana	12	0
			8	Fraxinus caroliniana	5	0
			8	Cephalanthus occidentalis	0	1
		Hydric Hammock	9	Quercus virginiana	72	0
			9	Taxodium distichum	1	0
			9	Ostrya virginiana	7	0
			9	Sideroxylon reclinatum	0	1
		Hydric Hammock	10	Quercus virginiana	62	0
			10	Fraxinus caroliniana	3	0
			10	Acer rubrum	5	0
			10	Viburnum obovatum	0	4
3-Jun-11	C	Berm	1	Ulmus americana	15	0
			1	Forestiera acuminata	2	0
			1	Acer rubrum	20	0
			1	Ilex vomitoria	5	0
			1	Taxodium distichum	2	0
			1	Quercus laurifolia	56	0
			1	Crataegus viridis	0	3
		Privet Swamp	2	Forestiera acuminata	91	0
			2	Fraxinus caroliniana	3	0

Date	Transect	Habitat	Point	Species	Tree Cover	Shrub Cover
			2	Ulmus americana	3	0
			2	Quercus lyrata	3	0
		Privet Swamp	3	Ostrya virginiana	40	0
			3	Forestiera acuminata	2	0
			3	Quercus lyrata	15	0
			3	Fraxinus caroliniana	3	0
			3	Gleditsia aquatica	40	0
			3	Cephalanthus occidentalis	0	2
		Privet Swamp	4	Forestiera acuminata	78	0
			4	Fraxinus caroliniana	2	0
			4	Taxodium distichum	10	0
			4	Ulmus americana	10	0
			4	Quercus lyrata	2	0
		Hydric Hammock	5	Carpinus caroliniana	95	1
			5	Ulmus americana	5	0
			5	Diospyros virginiana	0	2
		Hydric Hammock	6	Carpinus caroliniana	93	4
			6	Quercus laurifolia	7	0
			6	Celtis laevigata	0	5
		Hydric Hammock	7	Ulmus americana	30	0
			7	Quercus laurifolia	45	0
			7	Carpinus caroliniana	10	0
		Hydric Hammock	8	Taxodium distichum	88	0
			8	Ostrya virginiana	5	2
			8	Liquidambar styraciflua	2	0
			8	Quercus laurifolia	2	0
			8	Ulmus americana	2	0
			8	Gleditsia aquatica	1	0
		Hydric Hammock	9	Quercus laurifolia	40	0
			9	Carpinus caroliniana	10	0
			9	Taxodium distichum	50	0
			9	Cephalanthus occidentalis	0	4
		Hydric Hammock	10	Gleditsia aquatica	2	0
			10	Carpinus caroliniana	25	2
			10	Quercus laurifolia	40	0
			10	Ulmus americana	33	0
		Hydric Hammock	11	Ulmus americana	15	0
			11	Quercus laurifolia	20	0
			11	Carpinus caroliniana	61	20
			11	Liquidambar styraciflua	4	0
1-Jun-11	CD	Hydric Hammock	1	Quercus laurifolia	90	0

Date	Transect	Habitat	Point	Species	Tree Cover	Shrub Cover
			1	Ulmus americana	5	0
			1	Carya aquatica	5	0
		Hydric Hammock	2	Carya aquatica	18	0
			2	Acer rubrum	70	0
			2	Quercus laurifolia	7	0
			2	Fraxinus caroliniana	1	2
			2	Gleditsia aquatica	4	0
			2	Sideroxylon reclinatum	0	1
		Hydric Hammock	3	Ulmus americana	10	0
			3	Fraxinus caroliniana	35	0
			3	Acer rubrum	2	0
			3	Carya aquatica	7	0
			3	Ilex decidua	3	0
			3	Gleditsia aquatica	3	0
			3	Sideroxylon reclinatum	0	2
		Privet Swamp	4	Forestiera acuminata	10	0
			4	Ulmus americana	85	0
			4	Quercus lyrata	5	0
1-Jun-11	D	Herbaceous Floodplain	1	Fraxinus caroliniana	2	0
			1	Carya aquatica	48	0
		Hydric Hammock	2	Quercus lyrata	73	0
			2	Acer rubrum	15	0
			2	Carya aquatica	2	0
			2	Fraxinus caroliniana	10	4
		Hydric Hammock	3	Ulmus americana	71	0
			3	Forestiera acuminata	10	5
			3	Fraxinus caroliniana	4	0
			3	Cephalanthus occidentalis	0	3
		Hydric Hammock	4	Carpinus caroliniana	5	0
			4	Taxodium distichum	2	0
			4	Ulmus americana	8	0
			4	Gleditsia aquatica	50	0
			4	Quercus laurifolia	35	0
1-Jun-11	E	Hydric Hammock	1	Liquidambar styraciflua	20	0
			1	Ulmus americana	20	0
			1	Carpinus caroliniana	10	20
			1	Quercus laurifolia	0	5
			1	Cornus foemina	0	10
		Hydric Hammock	2	Carpinus caroliniana	70	90
			2	Fraxinus caroliniana	5	0

Date	Transect	Habitat	Point	Species	Tree Cover	Shrub Cover
			2	Diospyros virginiana	0	5
			2	Liquidambar styraciflua	0	5
		Hydric Hammock	3	Carpinus caroliniana	55	10
			3	Quercus virginiana	3	0
			3	Liquidambar styraciflua	5	0
			3	Celtis laevigata	10	0
			3	Sideroxylon reclinatum	0	10
		Hydric Hammock	4	Liquidambar styraciflua	50	0
			4	Carpinus caroliniana	5	0
			4	Diospyros virginiana	30	0
		Hydric Hammock	5	Taxodium distichum	40	0
			5	Carya aquatica	40	0
			5	Carpinus caroliniana	15	0
			5	Celtis laevigata	5	0
		Hydric Hammock	6	Ulmus americana	80	0
			6	Taxodium distichum	10	0
			6	Carpinus caroliniana	5	0
			6	Ostrya virginiana	5	0
1-Jun-11	F	Hardwood Swamp	1	Taxodium distichum	25	0
			1	Carya aquatica	62	0
			1	Acer rubrum	5	0
			1	Ulmus americana	3	0
			1	Cephalanthus occidentalis	0	3
		Hardwood Swamp	2	Ulmus americana	50	0
			2	Carya aquatica	35	0
			2	Fraxinus caroliniana	15	0
			2	Ilex decidua	0	4
		Hardwood Swamp	3	Taxodium distichum	15	0
			3	Ulmus americana	15	0
			3	Fraxinus caroliniana	50	0
		Hardwood Hammock	4	Carpinus caroliniana	80	0
			4	Tilia americana	10	0
			4	Fraxinus caroliniana	10	0
		Hardwood Hammock	5	Carpinus caroliniana	95	0
			5	Crataegus viridis	0	7
			5	Crataegus marshallii	0	10
2-Jun-11	J	Hydric Hammock	2	Carya aquatica	10	0
			2	Carpinus caroliniana	70	0
			2	Quercus laurifolia	20	0
			2	Sabal minor	0	10
		Hydric Hammock	3	Carpinus caroliniana	15	0

Date	Transect	Habitat	Point	Species	Tree Cover	Shrub Cover
			3	Quercus laurifolia	40	0
			3	Carya glabra	25	0
			3	Sabal minor	0	30
		Hydric Hammock	4	Quercus laurifolia	40	0
			4	Carpinus caroliniana	15	0
			4	Taxodium distichum	25	0
			4	Carya aquatica	20	0
			4	Ulmus americana	5	0
		Hardwood-Cypress Hydric Hammock	5	Quercus lyrata	54	0
			5	Carpinus caroliniana	6	0
			5	Taxodium distichum	25	0
			5	Quercus laurifolia	15	0
		Hardwood-Cypress Hydric Hammock	6	Ulmus americana	4	0
			6	Carpinus caroliniana	4	0
			6	Quercus laurifolia	50	0
			6	Quercus lyrata	40	0
			6	Fraxinus caroliniana	2	0
		Hardwood-Cypress Hydric Hammock	7	Carya glabra	38	0
			7	Nyssa bilfora	10	0
			7	Taxodium distichum	2	0
			7	Carya aquatica	5	0
			7	Acer rubrum	15	0
			7	Quercus laurifolia	30	0
		Hardwood-Cypress Hydric Hammock	8	Fraxinus caroliniana	55	0
			8	Acer rubrum	5	0
			8	Ulmus americana	40	0
			8	Taxodium distichum	0	3
			8	Carpinus caroliniana	0	1
		Cypress-Hardwood Hydric Hammock	9	Taxodium distichum	35	0
			9	Ulmus americana	2	0
			9	Acer rubrum	40	0
			9	Carya glabra	3	0

Date	Transect	Habitat	Point	Species	Tree Cover	Shrub Cover
			9	Cephalanthus occidentalis	0	5
			9	Diospyros virginiana	0	3
		Cypress-Hardwood Hydric Hammock	10	Taxodium distichum	78	0
			10	Nyssa aquatica	20	0
			10	Acer rubrum	2	0
		Cypress-Hardwood Hydric Hammock	11	Nyssa aquatica	43	0
			11	Taxodium distichum	43	0
			11	Ulmus americana	4	1
		Hardwood-Cypress Swamp	12	Taxodium distichum	33	0
			12	Quercus laurifolia	10	0
			12	Acer rubrum	52	0
			12	Nyssa aquatica	5	0
		Hardwood-Cypress Swamp	13	Taxodium distichum	10	0
			13	Acer rubrum	5	0
			13	Quercus laurifolia	10	0
			13	Nyssa aquatica	75	0
		Hardwood-Cypress Swamp	14	Acer rubrum	25	0
			14	Quercus laurifolia	15	0
			14	Nyssa aquatica	5	0
2-Jun-11	K	Hardwood Hydric Hammock	1	Carya aquatica	25	0
			1	Acer rubrum	65	0
			1	Quercus michauxii	10	0
		Hardwood Hydric Hammock	2	Ulmus americana	38	0
			2	Carpinus caroliniana	7	0
			2	Taxodium distichum	65	0
			2	Fraxinus caroliniana	0	1
			2	Crataegus marshallii	0	1
			2	Sabal minor	0	3
		Hardwood Hydric Hammock	3	Cephalanthus occidentalis	2	0
			3	Taxodium distichum	35	0
			3	Liquidambar styraciflua	15	0
			3	Carpinus caroliniana	25	0
			3	Quercus laurifolia	25	0

Date	Transect	Habitat	Point	Species	Tree Cover	Shrub Cover
			3	Sabal minor	0	1
		Hardwood Hydric Hammock	4	Quercus virginiana	78	0
			4	Carpinus caroliniana	10	0
			4	Ulmus americana	2	0
			4	Quercus laurifolia	10	0
		Hardwood Hydric Hammock	5	Carpinus caroliniana	25	0
			5	Quercus virginiana	70	0
			5	Quercus laurifolia	5	0
			5	Pinus glabra	0	1
			5	Crataegus marshallii	0	20
		Hardwood Hydric Hammock	6	Carpinus caroliniana	20	0
			6	Quercus laurifolia	70	0
			6	Carya aquatica	10	0
			6	Pinus glabra	0	70
			6	Sabal minor	0	10
3-Jun-11	L	Herbaceous Floodplain	1	Ostrya virginiana	45	0
			1	Taxodium distichum	55	0
			1	Cephalanthus occidentalis	0	5
		Cypress Swamp	2	Taxodium distichum	20	0
			2	Carya aquatica	10	0
			2	Fraxinus caroliniana	10	10
			2	Acer rubrum	30	0
			2	Quercus lyrata	30	0
			2	Cornus foemina	0	2
		Cypress Swamp	3	Fraxinus caroliniana	20	0
			3	Quercus lyrata	15	0
			3	Acer rubrum	5	0
			3	Carya aquatica	55	0
			3	Cephalanthus occidentalis	5	3
		Hydric Hammock	4	Pinus glabra	4	0
			4	Carya aquatica	17	0
			4	Quercus laurifolia	40	0
			4	Cephalanthus occidentalis	5	4
			4	Quercus virginiana	7	0
			4	Ostrya virginiana	17	0
		Hardwood Hydric Hammock	5	Quercus nigra	10	0

Date	Transect	Habitat	Point	Species	Tree Cover	Shrub Cover
			5	Quercus virginiana	61	0
			5	Quercus laurifolia	15	0
			5	Nyssa bilfora	4	0
			5	Carpinus caroliniana	3	0
			5	Liquidambar styraciflua	7	0
			5	Vaccinium corymbosum	0	10
			5	Cyrilla racemiflora	0	2
			5	Pinus glabra	0	7
			5	Sabal minor	0	3
		Hardwood Hydric Hammock	6	Quercus laurifolia	20	0
			6	Quercus nigra	10	0
			6	Quercus virginiana	66	0
			6	Carpinus caroliniana	2	0
			6	Nyssa bilfora	1	0
			6	Ostrya virginiana	1	0
			6	Vaccinium corymbosum	0	7
			6	Pinus glabra	0	5
			6	Hypericum galioides	0	2
			6	Ilex vomitoria	0	2

Appendix E: Technical note. Additional Tables and Graphs

Appendix E provides the tables and graphs called out in the draft Scope of Work from the District. Many of these have been submitted previously or are included in the main report.

Table 1a. Transect Length (feet) and GPS Locations of Selected Floodplain Features along the Santa Fe River.

Transect	Beginning		Ending		Length	Edge of Water		Top of Bank		Landward Extent of Wetland		Hydrological Indicator(s)	
	Latitude	Longitude	Latitude	Longitude		Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
A	29.89009	-82.87649	29.89063	-82.87884	768	29.89000	-82.87645	29.89009	-82.87649	29.89055	-82.87848	29.89020	-82.87666
												29.89034	-82.87673
												29.89030	-82.87682
												29.89032	-82.87693
												29.89040	-82.87752
												29.89039	-82.87754
												29.89042	-82.87795
B	29.89866	-82.86767	29.89962	-82.86870	477	29.89871	-82.86717	29.89880	-82.86721	29.89958	-82.86866	29.89882	-82.86781
												29.89880	-82.86788
												29.89877	-82.86785
												29.89925	-82.86826
												29.89927	-82.86825
												29.89917	-82.86839
												29.89927	-82.86843
												29.89933	-82.86836
												29.89935	-82.86839
C	29.91330	-82.84071	29.91352	-82.84292	704	29.91325	-82.84061	29.91330	-82.84071	29.91351	-82.84281	none	
CD	29.93257	-82.79738	29.93181	-82.79720	281	29.93266	-82.79792	29.93256	-82.79786	29.93182	-82.79720	none	
D	29.93359	-82.79023	29.93311	-82.79060	211	29.93537	-82.79147	29.93521	-82.79147	29.93325	-82.79050	none	
E (up)	29.88894	-82.75305	29.88902	-82.75375	222	29.88857	-82.75297	29.88859	-82.75236	29.88902	-82.75375	none	
E (down)	29.89124	-82.75296	29.89194	-82.75329	279	29.88857	-82.75297	29.88859	-82.75236	29.89194	-82.75329	29.89188	-82.75324
												29.89198	-82.75331
												29.89186	-82.75324
F	29.85604	-82.73249	29.85427	-82.73286	654	29.85604	-82.73249	29.85604	-82.73249	29.85427	-82.73286	29.85589	-82.73276
												29.85588	-82.73271
J	29.85454	-82.60371	29.85210	-82.59950	1605	29.85457	-82.60374	29.85454	-82.60371	29.85210	-82.59949	29.85217	-82.59964
												29.85221	-82.59974
												29.85225	-82.59970
K	29.85874	-82.60004	29.85818	-82.59946	271	29.85876	-82.60008	29.85874	-82.60004	29.85818	-82.59947	29.85874	-82.60004
L	29.86307	-82.59219	29.86365	-82.59127	360	29.86322	-82.59218	29.86321	-82.59214	29.86365	-82.59127	29.86307	-82.59219

Table 1b. Transect Length (feet) and GPS Locations of Selected Floodplain Features along the Ichetucknee River

Transect	Beginning		Ending		Length	Edge of Water		Top of Bank		Landward Extent of Wetland		Hydrological Indicator(s)	
	Latitude	Longitude	Latitude	Longitude		Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
AA (down)	29.95632	-82.78114	29.95661	-82.78140	134	29.95656	-82.78136	Not surveyed	Not surveyed	29.95661	-82.78141	29.95656	-82.78130
												29.95648	-82.78125
												29.95650	-82.78125
AA (up)	29.95754	-82.77978	29.95724	-82.77908	250	29.95754	-82.77978	Not surveyed		29.95724	-82.77908	29.95755	-82.77977
												29.95753	-82.77978
												29.95754	-82.77974
												29.95749	-82.77964
												29.95749	-82.77963
												29.95749	-82.77961
												29.95743	-82.77948
												29.95744	-82.77947
												29.95745	-82.77945
												29.95746	-82.77931
												29.95747	-82.77928
												29.95747	-82.77928
BB (west)	29.97084	-82.76056	29.97061	-82.76069	92	29.97084	-82.76054	Not surveyed		29.97068	-82.76065	29.97072	-82.76062
												29.97071	-82.76063
												29.97070	-82.76061
BB (east)	29.97050	-82.75962	29.97045	-82.75948	67	29.97057	-82.75965	29.97055	-82.75957	29.97045	-82.75947	29.97051	-82.75964
												29.97052	-82.75963
												29.97052	-82.75964
												29.97051	-82.75965
CC (west)	29.97701	-82.75963	29.976627	-82.759241	186	29.97701	-82.75964	Not surveyed		29.97667	-82.75928	29.97666	-82.75928
												29.97670	-82.75928
												29.97669	-82.75925
CC (east)	29.97727	-82.75892	29.97741	-82.75856	126	29.97727	-82.75892	Not surveyed		29.97740	-82.75861	none	

Table 2a. Length (feet) and GPS Locations for Soil Mapping Units for Transect A along the Santa Fe River.								
	Fluvaquents, Meggett-Bigbee Complex				Bigbee-Garcon-Meggett Complex			
	Minimum Extent		Maximum Extent		Minimum Extent		Maximum Extent	
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
GPS	29.89008	-82.87649	29.89052	-82.87839	29.89052	-82.87839	29.89062	-82.87884
Length	621				147			

Tables 2b. Length (feet) and GPS Locations for Soil Mapping Units for Transect B along the Santa Fe River.								
	Fluvaquents, Meggett-Bigbee Complex				Bigbee-Garcon-Meggett Complex			
	Minimum Extent		Maximum Extent		Minimum Extent		Maximum Extent	
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
GPS	29.89865	-82.86768	29.89935	-82.86842	29.89935	-82.86842	29.89961	-82.86870
Length	345				132			

Tables 2c. Length (feet) and GPS Locations for Soil Mapping Units for Transect C along the Santa Fe River.								
	Fluvaquents, Meggett-Bigbee Complex				Alpin Fine Sand			
	Minimum Extent		Maximum Extent		Minimum Extent		Maximum Extent	
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
GPS	29.91330	-82.84072	29.91343	-82.84206	29.91343	-82.84206	29.91352	-82.84292
Length	428				276			

Tables 2d. Length (feet) and GPS Locations for Soil Mapping Units for Transect CD along the Santa Fe River.				
	Fluvaquents			
	Minimum Extent		Maximum Extent	
	Latitude	Longitude	Latitude	Longitude
GPS	29.93257	-82.79738	29.93181	-82.79720
Length	281			

Tables 2e. Length (feet) and GPS Locations for Soil Mapping Units for Transect D along the Santa Fe River.								
	Fluvaquents				Otela-Penney fine Sands			
	Minimum Extent		Maximum Extent		Minimum Extent		Maximum Extent	
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
GPS	29.93362	-82.79021	29.93313	-82.79058	29.93313	-82.79058	29.93311	-82.79060
Length	201				10			

Tables 2f. Length (feet) and GPS Locations for Soil Mapping Units for Transect E (upstream) along the Santa Fe River.				
	Fluvaquents			
	Minimum Extent		Maximum Extent	
	Latitude	Longitude	Latitude	Longitude
GPS	29.88894	-82.75305	29.88902	-82.75375
Length	222			

Tables 2g. Length (feet) and GPS Locations for Soil Mapping Units for Transect E (downstream) along the Santa Fe River.				
	Fluvaquents			
	Minimum Extent		Maximum Extent	
	Latitude	Longitude	Latitude	Longitude
GPS	29.89124	-82.75296	29.89194	-82.75329
Length	279			

Tables 2h. Length (feet) and GPS Locations for Soil Mapping Units for Transect F along the Santa Fe River.				
	Fluvaquents			
	Minimum Extent		Maximum Extent	
	Latitude	Longitude	Latitude	Longitude
GPS	29.85604	-82.73249	29.85427	-82.73286
Length	654			

Tables 2i. Length (feet) and GPS Locations for Soil Mapping Units for Transect J along the Santa Fe River.				
	Oleno Clay			
	Minimum Extent		Maximum Extent	
	Latitude	Longitude	Latitude	Longitude
GPS	29.85454	-82.60372	29.85210	-82.59950
Length	1,605			

Tables 2j. Length (feet) and GPS Locations for Soil Mapping Units for Transect K along the Santa Fe River.				
	Tavares Sand			
	Minimum Extent		Maximum Extent	
	Latitude	Longitude	Latitude	Longitude
GPS	29.85874	-82.60004	29.85818	-82.59946
Length	271			

Tables 2k. Length (feet) and GPS Locations for Soil Mapping Units for Transect L. along the Santa Fe River.				
	Oleno Clay			
	Minimum Extent		Maximum Extent	
	Latitude	Longitude	Latitude	Longitude
GPS	29.86307	-82.59219	29.86365	-82.59127
Length	360			

Tables 2l. Length (feet) and GPS Locations for Soil Mapping Units for Transect AA (downstream) along the Ichetucknee River.				
	Bigbee-Garcon-Megget Complex			
	Minimum Extent		Maximum Extent	
	Latitude	Longitude	Latitude	Longitude
GPS	29.95624	-82.78107	29.95661	-82.78141
Length	134			

Tables 2m. Length (feet) and GPS Locations for Soil Mapping Units for Transect AA (upstream) along the Ichetucknee River.				
	Plummer Fine Sand			
	Minimum Extent		Maximum Extent	
	Latitude	Longitude	Latitude	Longitude
GPS	29.95754	-82.77978	29.95729	-82.77903
Length	250			

Tables 2n. Length (feet) and GPS Locations for Soil Mapping Units for Transect BB (west side) along the Ichetucknee River.				
	Blanton Fine Sand			
	Minimum Extent		Minimum Extent	
	Latitude	Latitude	Latitude	Latitude
GPS	29.97084	29.97084	29.97084	29.97084
Length	92			

Tables 2o. Length (feet) and GPS Locations for Soil Mapping Units for Transect BB (east side) along the Ichetucknee River.								
	Plummer Fine Sand				Bonneau Fine Sand			
	Minimum Extent		Maximum Extent		Minimum Extent		Maximum Extent	
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
GPS	29.97057	-82.7597	29.97047	-82.759491	29.97047	-82.7595	29.97043	-82.759424
Length	43				24			

Tables 2p. Length (feet) and GPS Locations for Soil Mapping Units for Transect CC (west side) along the Ichetucknee River.				
	Blanton Fine Sand			
	Minimum Extent		Minimum Extent	
	Latitude	Latitude	Latitude	Latitude
GPS	29.97701	-82.7596	29.97668	-82.759249
Length	186			

Tables 2q. Length (feet) and GPS Locations for Soil Mapping Units for Transect CC (east side) along the Ichetucknee River.								
	Plummer Fine Sand				Bonneau Fine Sand			
	Minimum Extent		Maximum Extent		Minimum Extent		Maximum Extent	
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
GPS	29.97727	-82.7589	29.97736	-82.758693	29.97736	-82.7587	29.97741	-82.758559
Length	80				46			

Tables 3a. Length (feet) and GPS Locations for Vegetation Class for Transect A along the Santa Fe River.								
	Cypress Swamp				Hydric Hardwood Hammock			
	Minimum Extent		Maximum Extent		Minimum Extent		Maximum Extent	
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
GPS	29.89009	-82.87649	29.89042	-82.87793	29.89042	-82.87793	29.89055	-82.87848
Length	469				180			

Tables 3b. Length (feet) and GPS Locations for Vegetation Class for Transect B along the Santa Fe River.								
	Hydric Hardwood Hammock				Hardwood Swamp			
	Minimum Extent		Maximum Extent		Minimum Extent		Maximum Extent	
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
GPS	29.89866	-82.86767	29.89928	-82.86834	29.89928	-82.86834	29.89958	-82.86866
Length	307				150			

Tables 3c. Length (feet) and GPS Locations for Vegetation Class for Transect C along the Santa Fe River.												
	River bank				Hardwood Swamp				Hydric Hardwood Hammock			
	Minimum Extent		Maximum Extent		Minimum Extent		Maximum Extent		Minimum Extent		Maximum Extent	
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
GPS	29.91331	-82.84071	29.91332	-82.84090	29.91332	-82.84090	29.91340	-82.84165	29.91340	-82.84165	29.91351	-82.84281
Length	59				240				369			

Tables 3d. Length (feet) and GPS Locations for Vegetation Class for Transect CD along the Santa Fe River.								
	Hydric Hardwood Hammock				Hardwood Swamp			
	Minimum Extent		Maximum Extent		Minimum Extent		Maximum Extent	
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
GPS	29.93257	-82.797379	29.932028	-82.797252	29.932028	-82.79725	29.931815	-82.7972
Length	201				80			

Tables 3e. Length (feet) and GPS Locations for Vegetation Class for Transect D along the Santa Fe River.				
	Hydric Hardwood Hammock			
	Minimum Extent		Maximum Extent	
	Latitude	Longitude	Latitude	Longitude
GPS	29.93354	-82.79027	29.93325	-82.79050
Length	130			

Tables 3f. Length (feet) and GPS Locations for Vegetation Class for Transect E (upstream) along the Santa Fe River.				
	Hydric Hardwood Hammock			
	Minimum Extent		Maximum Extent	
	Latitude	Longitude	Latitude	Longitude
GPS	29.88894	-82.75305	29.88902	-82.75375
Length	222			

Tables 3g. Length (feet) and GPS Locations for Vegetation Class for Transect E (downstream) along the Santa Fe River.				
	Hydric Hardwood Hammock			
	Minimum Extent		Maximum Extent	
	Latitude	Longitude	Latitude	Longitude
GPS	29.89124	-82.75296	29.89194	-82.75329
Length	279			

Tables 3h. Length (feet) and GPS Locations for Vegetation Class for Transect F along the Santa Fe River.								
	Hardwood Swamp				Mesic Hardwood Hammock			
	Minimum Extent		Maximum Extent		Minimum Extent		Maximum Extent	
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
GPS	29.85604	-82.73250	29.85457	-82.73280	29.85457	-82.73280	29.85427	-82.73286
Length	544				110			

Tables 3i. Length (feet) and GPS Locations for Vegetation Class for Transect J along the Santa Fe River.												
	River bank				Hydric Hardwood Hammock				Hardwood Cypress			
	Minimum Extent		Maximum Extent		Minimum Extent		Maximum Extent		Minimum Extent		Maximum Extent	
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
GPS	29.85454	-82.60372	29.85431	-82.60332	29.85431	-82.60332	29.85409	-82.60295	29.85409	-82.60295	29.85210	-82.59949
Length	152				140				1,313			

Tables 3j. Length (feet) and GPS Locations for Vegetation Class for Transect K along the Santa Fe River.												
	River bank				Hardwood Cypress				Hydric Hardwood Hammock			
	Minimum Extent		Maximum Extent		Minimum Extent		Maximum Extent		Minimum Extent		Maximum Extent	
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
GPS	29.85874	-82.60004	29.85866	-82.59995	29.85866	-82.59995	29.85849	-82.59978	29.85849	-82.59978	29.85818	-82.59947
Length	41				80				150			

Tables 3k. Length (feet) and GPS Locations for Vegetation Class for Transect L along the Santa Fe River.								
	Cypress Swamp				Hydric Hardwood Hammock			
	Minimum Extent		Maximum Extent		Minimum Extent		Maximum Extent	
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
GPS	29.86307	-82.59218	29.86333	-82.59178	29.86333	-82.59178	29.86365	-82.59127
Length	160				200			

Tables 3l. Length (feet) and GPS Locations for Vegetation Class for Transect AA (downstream) along the Ichetucknee River.				
	Cypress Swamp			
	Minimum Extent		Maximum Extent	
	Latitude	Longitude	Latitude	Longitude
GPS	29.95632	-82.78115	29.95661	-82.78141
Length	134			

Tables 3m. Length (feet) and GPS Locations for Vegetation Class for Transect AA (upstream) along the Ichetucknee River.								
	Cypress Popash Swamp				Mesic Hardwood Hammock			
	Minimum Extent		Maximum Extent		Minimum Extent		Maximum Extent	
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
GPS	29.95754	-82.77979	29.95727	-82.77916	29.95727	-82.77916	29.95724	-82.77908
Length	220				30			

Tables 3n. Length (feet) and GPS Locations for Vegetation Class for Transect BB (west side) along the Ichetucknee River.				
	Cypress Swamp			
	Minimum Extent		Maximum Extent	
	Latitude	Longitude	Latitude	Longitude
GPS	29.97084	-82.76057	29.97068	-82.76065
Length	62			

Tables 3o. Length (feet) and GPS Locations for Vegetation Class for Transect BB (east side) along the Ichetucknee River.				
	Hardwood Swamp			
	Minimum Extent		Maximum Extent	
	Latitude	Longitude	Latitude	Longitude
GPS	29.97050	-82.75962	29.97045	-82.75947
Length	50			

Tables 3p. Length (feet) and GPS Locations for Vegetation Class for Transect CC (west side) along the Ichetucknee River.				
	Hardwood Swamp			
	Minimum Extent		Maximum Extent	
	Latitude	Longitude	Latitude	Longitude
GPS	29.97701	-82.75963	29.97667	-82.75928
Length	167			

Tables 3q. Length (feet) and GPS Locations for Vegetation Class for Transect CC (east side) along the Ichetucknee River.				
	Bay Swamp			
	Minimum Extent		Maximum Extent	
	Latitude	Longitude	Latitude	Longitude
GPS	29.97727	-82.75892	29.97740	-82.75861
Length	109			

Table 4a. Summary of Elevation Parameters along the Santa Fe River Transects.							
Transect	**Transect Distance**	**Transect Maximum Elevation**	**Transect Minimum Elevation**	**Channel Minimum Elevation**	**Top of Bank Elevation**	**Edge of Water Elevation**	**Hydrologic Indicator (Mean Elevation)**
A	768	19.87	7.34	-8.56	11.07	4.22	18.61
B	477	14.41	8.87	-8.99	13.80	4.20	13.55
C	704	24.70	11.48	-5.20	16.43	7.17	none
CD	281	18.36	12.76	-1.40	14.99	6.13	None
D	211	23.77	10.50	-0.53	6.69	7.86	none
E (downstream)	279	20.59	13.57	surveyed upstream	not surveyed	not surveyed	24.59
E (upstream)	222	22.19	13.58	3.41	not surveyed	14.40	none
F	654	23.70	19.21	12.62	21.65	18.33	23.53
J	1,605	36.07	31.69	27.27	35.62	30.02	35.15
K	271	38.96	33.51	25.82	34.61	30.08	none
L	360	38.94	32.93	25.34	33.92	30.73	none

Table 4b. Summary of Elevation Parameters along the Ichetucknee River Transects.							
Transect	**Transect Distance**	**Transect Maximum Elevation**	**Transect Minimum Elevation**	**Channel Minimum Elevation**	**Top of Bank Elevation**	**Edge of Water Elevation**	**Hydrologic Indicator (Mean Elevation)**
AA (downstream)	134	21.41	15.27	surveyed upstream	not surveyed	not surveyed	19.43
AA (upstream)	250	25.86	13.37	4.96	not surveyed	13.37	18.73
BB (west side)	92	23.77	19.15	surveyed east side	not surveyed	19.15	21.81
BB (east side)	67	30.43	10.93	13.85	25.75	18.97	20.31
CC (west side)	186	26.94	20.25	16.40	no point	20.25	22.56
CC (east side)	126	32.01	20.80	16.40	no point	20.25	none

Table 5. Vegetation Class Classification Cross-walk

Vegetation Class	Cowardin (NWI)	FLUCCS	FNAI	SCS	FFWCC	Ecosystems of Florida	GAP
Cypress Swamp	Forested needle-leaved deciduous FO2	6210 - Cypress	Floodplain swamp or Strand swamp	17 - Cypress swamp	12 - Cypress swamp	Cypress strands / Cypress swamps	Cypress Forest Compositional Group
Hydric Hardwood Hammock	Forested broad-leaved deciduous FO1	6170 - Mixed wetland hardwoods	Hydric hammock or Bottomland forest	12 - Wetland hardwood hammock	13 - Hardwood swamp	Mixed hardwood swamps	Swamp Forest Ecological Complex
Hardwood Swamp	Forested broad-leaved deciduous FO1	6170 - Mixed wetland hardwoods	Hydric hammock or Bottomland forest	12 - Wetland hardwood hammock	13 - Hardwood swamp	Mixed hardwood swamps	Swamp Forest Ecological Complex
Mesic Hardwood Hammock	Not applicable	4200 – Upland hardwood forest	Upland hardwood forest	11 - Upland hardwood hammocks	Hardwood hammocks and forests	Hydric hammocks	Swamp Forest Ecological Complex
Hardwood Cypress	Forested needle-leaved deciduous FO2	6210 - Cypress	Floodplain swamp or Strand swamp	17 - Cypress swamp	12 - Cypress swamp	Cypress strands / Cypress swamps	Swamp Forest Ecological Complex
Cypress Popash Swamp	Forested needle-leaved deciduous FO2	6210 - Cypress	Floodplain swamp or Strand swamp	17 - Cypress swamp	12 - Cypress swamp	Cypress strands / Cypress swamps	Swamp Forest Ecological Complex
Bay Swamp	Forested broad-leaved evergreen FO3 and/or Forested deciduous FO6	Bay swamp - 6110	Baygall	22 - Shrub bog / bay swamp	14 - Bay swamp	Bay swamps	Bay/Gum/Cypress Ecological Complex

Tables 6a. Number, Elevation, and Distance from Edge of Water for Each Vegetation Class along the Santa Fe River (soils index not presented since it is an index and not a number).						
	Cypress Swamp	Hydric Hardwood Hammock	Hardwood Swamp	Mesic Hardwood Hammock	River Bank	Hardwood Cypress
Sample Size (number)	7	32	10	2	3	12
Elevation (NAVD88)	22.54	21.99	16.78	21.81	30.28	32.39
Distance from Edge of Water	0	149	184	544	0	181

Tables 6b. Number, Elevation, and Distance from Edge of Water for Each Vegetation Class along the Ichetucknee River River (soils index not presented since it is an index and not a number).					
	Cypress Popash Swamp	Mesic Hardwood Hammock	Cypress Swamp	Hardwood Swamp	Bay Swamp
Sample Size (number)	5	1	5	5	3
Elevation (NAVD88)	17.66	22.82	18.18	18.61	23.82
Distance from Edge of Water	0	220	0	0	0

Table 7a. Mean Elevation Ratio and Number of Transects for each Vegetation Class along the Santa Fe River.		
Vegetation Class	**Mean Ratio (linear ft of community divided by change in elevation)**	**Number of Transects**
Cypress Swamp	271.95	2
Hydric Hardwood Hammock	109.88	9
Hardwood Swamp	143.58	4
Mesic Hardwood Hammock	45.25	1
River Bank	574.88	3
Hardwood Cypress	297.23	2

Table 7b. Mean Elevation Ratio and Number of Transects for each Vegetation Class along the Ichetucknee River.		
Vegetation Class	**Mean Ratio (linear ft of community divided by change in elevation)**	**Number of Transects**
Cypress Popash Swamp	31.39	1
Mesic Hardwood Hammock	6.15	1
Cypress Swamp	68.53	2
Hardwood Swamp	62.73	2
Bay Swamp	11.08	1

Table 8a. Summary of Floodplain Wetland Tree Canopy Composition over all Vegetation Classes along the Santa Fe River.							
Species	**DEP Status**	**N**	**Total Basal Area**	**Ave Basal Area per Tree**	**Maximum DBH**	**Relative Dominance Based on Basal Area**	**Relative Dominance Based on Abundance**
Carya aquatica	OBL	15	54,682.90	364.60	36.90	0.19	0.05
Cephalanthus occidentalis	OBL	11	371.54	8.65	5.20	0.00	0.04
Fraxinus caroliniana	OBL	48	24,063.63	90.31	44.20	0.08	0.16
Gleditsia aquatica	OBL	2	58.28	8.30	3.30	0.00	0.01
Nyssa aquatica	OBL	4	12,846.45	546.25	37.10	0.04	0.01
Nyssa sylvatica var. *biflora*	OBL	3	3,181.10	220.54	24.60	0.01	0.01
Quercus lyrata	OBL	10	8,315.77	258.03	28.70	0.03	0.03
Taxodium distichum	OBL	32	108,433.23	494.84	41.50	0.38	0.11
Acer rubrum	FACW	17	13,814.95	148.92	26.50	0.05	0.06
Carpinus caroliniana	FACW	56	7,142.59	31.46	28.50	0.02	0.18
Celtis laevigata	FACW	2	349.36	12.60	4.20	0.00	0.01
Crataegus marshallii	FACW	3	429.33	10.88	4.30	0.00	0.01
Forestiera acuminata	FACW	32	867.01	6.02	5.80	0.00	0.11
Ilex decidua	FACW	1	3.19	1.54	1.40	0.00	0.00
Liquidambar styraciflua	FACW	8	2,375.63	29.12	10.60	0.01	0.03
Pinus glabra	FACW	1	371.60	179.08	15.10	0.00	0.00
Quercus laurifolia	FACW	18	20,217.75	274.40	43.50	0.07	0.06
Quercus nigra	FACW	3	2,598.35	150.07	23.60	0.01	0.01
Tilia americana	FACW	1	1,172.52	66.48	9.20	0.00	0.00
Ulmus americana	FACW	20	11,756.39	130.89	39.20	0.04	0.07
Diospyros virginiana	FAC	1	169.70	9.62	3.50	0.00	0.00
Ilex vomitoria	FAC	1	155.34	6.61	2.90	0.00	0.00
Ostrya virginiana		12	5,875.24	67.87	15.60	0.02	0.04
Quercus virginiana		2	8,180.09	463.77	24.30	0.03	0.01

Shading indicates that DEP has not assigned a status. N is the number of trees measured.

Table 8b. Summary of Floodplain Wetland Tree Canopy Composition over all Vegetation Classes along the Ichetucknee River.							
Species	**DEP Status**	**N**	**Total Basal Area**	**Ave Basal Area per Tree**	**Maximum DBH**	**Relative Dominance Based on Basal Area**	**Relative Dominance Based on Abundance**
Cephalanthus occidentalis	OBL	12	733.96	3.48	3.50	0.01	0.17
Fraxinus caroliniana	OBL	15	16,935.03	66.53	22.80	0.16	0.21
Ilex cassine	OBL	5	615.33	6.94	4.90	0.01	0.07
Persea palustris	OBL	3	10,582.93	132.56	19.10	0.10	0.04
Taxodium distichum	OBL	17	49,821.80	180.63	26.50	0.48	0.24
Acer rubrum	FACW	6	8,705.41	79.35	21.40	0.08	0.08
Carpinus caroliniana	FACW	3	8,679.46	36.24	8.40	0.08	0.04
Celtis laevigata	FACW	1	142.69	8.04	3.20	0.00	0.01
Quercus laurifolia	FACW	1	632.26	23.76	5.50	0.01	0.01
Tilia americana	FACW	1	20.07	1.13	1.20	0.00	0.01
Ulmus americana	FACW	4	3,471.00	48.91	12.20	0.03	0.06
Myrica cerifera	FAC	2	107.57	3.03	2.40	0.00	0.03
Carya glabra		2	2,654.25	69.84	13.20	0.03	0.03

Shading indicates that DEP has not assigned a status. N is the number of trees measured.

Tables 9a. Summary of Floodplain Wetland Tree Canopy for Cypress Swamp along the Santa Fe River.						
Species	**N**	**Total Basal Area**	**Ave Basal Area per Tree**	**Maximum DBH**	**Relative Dominance Based on Basal Area**	**Largest BA**
Acer rubrum	1	551.55	551.55	26.50	0.05	551.55
Carpinus caroliniana						
Carya aquatica	1	138.93	138.93	13.30	0.01	138.93
Celtis laevigata						
Cephalanthus occidentalis	1	2.54	2.54	1.80	0.00	2.54
Crataegus marshallii						
Diospyros virginiana						
Forestiera acuminata	3	15.41	5.14	3.30	0.00	8.55
Fraxinus caroliniana	11	246.33	22.39	10.50	0.02	86.59
Gleditsia aquatica						
Ilex decidua						
Ilex vomitoria						
Liquidambar styraciflua						
Nyssa aquatica						
Nyssa sylvatica var. *biflora*						
Ostrya virginiana	4	441.49	110.37	15.60	0.04	441.49
Pinus glabra						
Quercus laurifolia						
Quercus lyrata	1	65.04	65.04	9.10	0.01	65.04
Quercus nigra						
Quercus virginiana						
Taxodium distichum	12	8,849.41	737.45	39.50	0.86	1,225.42
Tilia americana						
Ulmus americana						

Shading indicates species absence.

Tables 9b. Summary of Floodplain Wetland Tree Canopy for Hardwood Swamp along the Santa Fe River.

Species	N	Total Basal Area	Ave Basal Area per Tree	Maximum DBH	Relative Dominance Based on Basal Area	Largest BA
Acer rubrum	1	24.63	24.63	5.60	0.01	24.63
Carpinus caroliniana						
Carya aquatica	2	1,438.92	719.46	32.80	0.29	844.96
Celtis laevigata						
Cephalanthus occidentalis	3	37.02	12.34	5.20	0.01	21.24
Crataegus marshallii						
Diospyros virginiana						
Forestiera acuminata	19	125.30	6.59	5.80	0.03	26.42
Fraxinus caroliniana	20	2,217.23	110.86	30.80	0.45	745.06
Gleditsia aquatica	1	8.04	8.04	3.20	0.00	8.04
Ilex decidua						
Ilex vomitoria						
Liquidambar styraciflua						
Nyssa aquatica						
Nyssa sylvatica var. *biflora*						
Ostrya virginiana	2	186.77	93.38	15.20	0.04	181.46
Pinus glabra						
Quercus laurifolia	1	32.17	32.17	6.40	0.01	32.17
Quercus lyrata						
Quercus nigra						
Quercus virginiana						
Taxodium distichum	4	777.43	194.36	22.00	0.16	380.13
Tilia americana						
Ulmus americana	3	70.21	23.40	7.10	0.01	39.59

Shading indicates species absence.

Tables 9c. Summary of Floodplain Wetland Tree Canopy for Hydric Hardwood Hammock along the Santa Fe River.

Species	N	Total Basal Area	Ave Basal Area per Tree	Maximum DBH	Relative Dominance Based on Basal Area	Largest BA
Acer rubrum	4	626.73	156.68	26.20	0.05	539.13
Carpinus caroliniana	47	1,533.34	32.62	28.50	0.13	637.94
Carya aquatica	6	1,213.58	202.26	23.70	0.10	441.15
Celtis laevigata	1	11.34	11.34	3.80	0.00	11.34
Cephalanthus occidentalis	5	42.81	8.56	4.50	0.00	15.90
Crataegus marshallii	1	4.91	4.91	2.50	0.00	4.91
Diospyros virginiana						
Forestiera acuminata	10	51.88	5.19	4.50	0.00	15.90
Fraxinus caroliniana	7	82.64	11.81	7.00	0.01	38.48
Gleditsia aquatica	1	8.55	8.55	3.30	0.00	8.55
Ilex decidua	1	1.54	1.54	1.40	0.00	1.54
Ilex vomitoria						
Liquidambar styraciflua	7	144.69	20.67	7.40	0.01	43.01
Nyssa aquatica						
Nyssa sylvatica var. *biflora*	2	186.34	93.17	14.10	0.02	156.15
Ostrya virginiana	5	129.46	25.89	6.60	0.01	34.21
Pinus glabra	1	179.08	179.08	15.10	0.02	179.08
Quercus laurifolia	13	4,406.60	338.97	43.50	0.38	1,486.17
Quercus lyrata	7	1,836.19	262.31	26.20	0.16	539.13
Quercus nigra	2	12.76	6.38	3.50	0.00	9.62
Quercus virginiana						
Taxodium distichum	6	163.37	27.23	26.10	0.01	535.02
Tilia americana						
Ulmus americana	10	1,018.65	101.86	26.50	0.09	551.55

Shading indicates species absence.

Tables 9d. Summary of Floodplain Wetland Tree Canopy for River Bank along the Santa Fe River.						
Species	**N**	**Total Basal Area**	**Ave Basal Area per Tree**	**Maximum DBH**	**Relative Dominance Based on Basal Area**	**Largest BA**
Acer rubrum	4	626.73	156.68	26.20	0.05	539.13
Carpinus caroliniana	47	1,533.34	32.62	28.50	0.13	637.94
Carya aquatica	6	1,213.58	202.26	23.70	0.10	441.15
Celtis laevigata	1	11.34	11.34	3.80	0.00	11.34
Cephalanthus occidentalis	5	42.81	8.56	4.50	0.00	15.90
Crataegus marshallii	1	4.91	4.91	2.50	0.00	4.91
Diospyros virginiana						
Forestiera acuminata	10	51.88	5.19	4.50	0.00	15.90
Fraxinus caroliniana	7	82.64	11.81	7.00	0.01	38.48
Gleditsia aquatica	1	8.55	8.55	3.30	0.00	8.55
Ilex decidua	1	1.54	1.54	1.40	0.00	1.54
Ilex vomitoria						
Liquidambar styraciflua	7	144.69	20.67	7.40	0.01	43.01
Nyssa aquatica						
Nyssa sylvatica var. *biflora*	2	186.34	93.17	14.10	0.02	156.15
Ostrya virginiana	5	129.46	25.89	6.60	0.01	34.21
Pinus glabra	1	179.08	179.08	15.10	0.02	179.08
Quercus laurifolia	13	4,406.60	338.97	43.50	0.38	1,486.17
Quercus lyrata	7	1,836.19	262.31	26.20	0.16	539.13
Quercus nigra	2	12.76	6.38	3.50	0.00	9.62
Quercus virginiana						
Taxodium distichum	6	163.37	27.23	26.10	0.01	535.02
Tilia americana						
Ulmus americana	10	1,018.65	101.86	26.50	0.09	551.55

Shading indicates species absence.

Tables 9e. Summary of Floodplain Wetland Tree Canopy for Hardwood Cypress along the Santa Fe River.						
Species	**N**	**Total Basal Area**	**Ave Basal Area per Tree**	**Maximum DBH**	**Relative Dominance Based on Basal Area**	**Largest BA**
Acer rubrum	11	1,328.76	120.80	18.20	0.09	260.16
Carpinus caroliniana	1	20.43	20.43	5.10	0.00	20.43
Carya aquatica	2	1,089.04	544.52	36.90	0.08	1,089.04
Celtis laevigata						
Cephalanthus occidentalis	2	12.76	6.38	2.90	0.00	6.61
Crataegus marshallii	1	13.20	13.20	4.10	0.00	13.20
Diospyros virginiana						
Forestiera acuminata						
Fraxinus caroliniana	8	1,775.18	221.90	44.20	0.12	1,534.39
Gleditsia aquatica						
Ilex decidua						
Ilex vomitoria						
Liquidambar styraciflua						
Nyssa aquatica	4	2,184.99	546.25	37.10	0.15	1,081.03
Nyssa sylvatica var. *biflora*	1	475.29	475.29	24.60	0.03	475.29
Ostrya virginiana						
Pinus glabra						
Quercus laurifolia						
Quercus lyrata	1	646.93	646.93	28.70	0.05	646.93
Quercus nigra	1	437.44	437.44	23.60	0.03	437.44
Quercus virginiana						
Taxodium distichum	10	4,778.80	477.88	41.50	0.33	1,352.66
Tilia americana						
Ulmus americana	6	1,503.33	250.56	39.20	0.11	1,206.88

Shading indicates species absence.

Tables 9f. Summary of Floodplain Wetland Tree Canopy for Mesic Hardwood Hammock along the Santa Fe River.						
Species	**N**	**Total Basal Area**	**Ave Basal Area per Tree**	**Maximum DBH**	**Relative Dominance Based on Basal Area**	**Largest BA**
Acer rubrum						
Carpinus caroliniana	7	178.78	25.54	8.40	0.17	55.42
Carya aquatica						
Celtis laevigata						
Cephalanthus occidentalis						
Crataegus marshallii						
Diospyros virginiana	1	9.62	9.62	3.50	0.01	9.62
Forestiera acuminata						
Fraxinus caroliniana	2	13.42	6.71	3.50	0.01	9.62
Gleditsia aquatica						
Ilex decidua						
Ilex vomitoria						
Liquidambar styraciflua						
Nyssa aquatica						
Nyssa sylvatica var. *biflora*						
Ostrya virginiana	1	56.75	56.75	8.50	0.05	56.75
Pinus glabra						
Quercus laurifolia	2	247.01	123.50	16.50	0.23	213.83
Quercus lyrata						
Quercus nigra						
Quercus virginiana	1	463.77	463.77	24.30	0.44	463.77
Taxodium distichum						
Tilia americana	1	66.48	66.48	9.20	0.06	66.48
Ulmus americana	1	25.52	25.52	5.70	0.02	25.52

Shading indicates species absence.

Tables 9g. Summary of Floodplain Wetland Tree Canopy for Bay Swamp along the Ichetucknee River.						
Species	**N**	**Total Basal Area**	**Ave Basal Area per Tree**	**Maximum DBH**	**Relative Dominance Based on Basal Area**	**Largest BA**
Acer rubrum						
Carpinus caroliniana						
Carya glabra						
Celtis laevigata						
Cephalanthus occidentalis	4	9.83	2.46	2.40	0.02	4.52
Fraxinus caroliniana	4	74.32	18.58	6.20	0.15	30.19
Ilex cassine						
Myrica cerifera						
Persea palustris	3	397.67	132.56	19.10	0.79	286.52
Quercus laurifolia	1	23.76	23.76	5.50	0.05	23.76
Taxodium distichum						
Tilia americana						
Ulmus americana						

Shading indicates species absence.

Tables 9h. Summary of Floodplain Wetland Tree Canopy for Cypress Popash Swamp along the Ichetucknee River.						
Species	**N**	**Total Basal Area**	**Ave Basal Area per Tree**	**Maximum DBH**	**Relative Dominance Based on Basal Area**	**Largest BA**
Acer rubrum	5	116.44	23.29	10.50	0.11	86.59
Carpinus caroliniana						
Carya glabra						
Celtis laevigata						
Cephalanthus occidentalis	1	1.77	1.77	1.50	0.00	1.77
Fraxinus caroliniana	5	282.47	56.49	18.00	0.27	254.47
Ilex cassine						
Myrica cerifera						
Persea palustris						
Quercus laurifolia						
Taxodium distichum	5	637.40	127.48	25.50	0.61	510.71
Tilia americana						
Ulmus americana						

Shading indicates species absence.

Tables 9i. Summary of Floodplain Wetland Tree Canopy for Cypress Swamp along the Ichetucknee River.						
Species	**N**	**Total Basal Area**	**Ave Basal Area per Tree**	**Maximum DBH**	**Relative Dominance Based on Basal Area**	**Largest BA**
Acer rubrum						
Carpinus caroliniana						
Carya glabra						
Celtis laevigata						
Cephalanthus occidentalis	7	30.12	4.30	3.50	0.01	9.62
Fraxinus caroliniana	4	637.16	159.29	22.80	0.25	408.28
Ilex cassine						
Myrica cerifera						
Persea palustris						
Quercus laurifolia						
Taxodium distichum	11	1,881.72	171.07	24.50	0.74	471.44
Tilia americana						
Ulmus americana						

Shading indicates species absence.

Tables 9j. Summary of Floodplain Wetland Tree Canopy for Hardwood Swamp along the Ichetucknee River.						
Species	**N**	**Total Basal Area**	**Ave Basal Area per Tree**	**Maximum DBH**	**Relative Dominance Based on Basal Area**	**Largest BA**
Acer rubrum	1	359.68	359.68	21.40	0.28	359.68
Carpinus caroliniana						
Carya glabra	1	136.85	136.85	13.20	0.11	136.85
Celtis laevigata	1	8.04	8.04	3.20	0.01	8.04
Cephalanthus occidentalis						
Fraxinus caroliniana	2	3.97	1.98	1.90	0.00	2.84
Ilex cassine	5	34.68	6.94	4.90	0.03	18.86
Myrica cerifera	2	6.06	3.03	2.40	0.00	4.52
Persea palustris						
Quercus laurifolia						
Taxodium distichum	1	551.55	551.55	26.50	0.43	551.55
Tilia americana	1	1.13	1.13	1.20	0.00	1.13
Ulmus americana	4	195.64	48.91	12.20	0.15	116.90

Shading indicates species absence.

Tables 9k. Summary of Floodplain Wetland Tree Canopy for Mesic Hardwood Hammock along the Ichetucknee River.						
Species	**N**	**Total Basal Area**	**Ave Basal Area per Tree**	**Maximum DBH**	**Relative Dominance Based on Basal Area**	**Largest BA**
Acer rubrum						
Carpinus caroliniana	3	108.72	36.24	8.40	0.97	55.42
Carya glabra	1	2.84	2.84	1.90	0.03	2.84
Celtis laevigata						
Cephalanthus occidentalis						
Fraxinus caroliniana						
Ilex cassine						
Myrica cerifera						
Persea palustris						
Quercus laurifolia						
Taxodium distichum						
Tilia americana						
Ulmus americana						

Shading indicates species absence.

Table 10a. Wetland Plant Community Classifications and Prevalence across all Transects along the Santa Fe River.				
Vegetation Class	**Cowardin (NWI)**	**FLUCCS**	**FNAI**	**No. Points**
Cypress Swamp	Forested needle-leaved deciduous FO2	6210 - Cypress	Floodplain swamp or Strand swamp	7
Hydric Hardwood Hammock	Forested broad-leaved deciduous FO1	6170 - Mixed wetland hardwoods	Hydric hammock or Bottomland forest	32
Hardwood Swamp	Forested broad-leaved deciduous FO1	6170 - Mixed wetland hardwoods	Hydric hammock or Bottomland forest	10
Mesic Hardwood Hammock	Not applicable	4200 - Upland hardwood forest	Upland hardwood forest	2
Hardwood Cypress	Forested needle-leaved deciduous FO2	6210 - Cypress	Floodplain swamp or Strand swamp	12

Table 10b. Wetland Plant Community Classifications and Prevalence across all Transects along the Ichetucknee River.				
Vegetation Class	**Cowardin (NWI)**	**FLUCCS**	**FNAI**	**No. Points**
Cypress Popash Swamp	Forested needle-leaved deciduous FO2	6210 - Cypress	Floodplain swamp or Strand swamp	5
Mesic Hardwood Hammock	Not applicable	4200 - Upland hardwood forest	Upland hardwood forest	1
Cypress Swamp	Forested needle-leaved deciduous FO2	6210 - Cypress	Floodplain swamp or Strand swamp	5
Hardwood Swamp	Forested broad-leaved deciduous FO1	6170 - Mixed wetland hardwoods	Hydric hammock or Bottomland forest	5
Bay Swamp	FO3 and/or FO6	Bay swamp - 6110	Baygall	3

Table 11a. Percent Occurrence of the Dominant Vegetation Classes by Transect along the Santa Fe River.							
Transect	**Total Length**	**Cypress Swamp**	**Hydric Hardwood Hammock**	**Hardwood Swamp**	**Mesic Hardwood Hammock**	**River Bank**	**Hardwood Cypress**
A	768	61.1	23.4				
B	477		64.4	31.4			
C	704		52.4	34.1		8.4	
CD	281		71.5	28.5			
D	211		61.6				
E (both segments)	501		100.0				
F	654			83.2	16.8		
J	1605					9.5	81.8
K	271		55.4			15.1	29.5
L	360	44.4	55.6				
Total Sampling Points		7	32	10	2	3	12
% Occurrence across all Transects		10.8	34.9	17.4	1.9	4.3	23.9
% Occurrence across Transects in which Vegetation Class Occurred		55.8	57.0	47.9	16.8	9.8	74.2

Shading indicates absence of vegetation class.

Table 11b. Percent Occurrence of the Dominant Vegetation Classes by Transect along the Ichetucknee River.						
Transect	**Total Length**	**Cypress Popash Swamp**	**Cypress Swamp**	**Hardwood Swamp**	**Mesic Hardwood Hammock**	**Bay Swamp**
AA (upstream)	250	88.0			12.0	
AA (downstream)	134		100.0			
BB (west side)	92		67.4			
BB (east side)	67			74.6		
CC (west side)	186			89.8		
CC (east side)	126					86.5
Total Sampling Points		5	5	5	1	3
% Occurrence across all Transects		25.7	22.9	25.4	3.5	12.7
% Occurrence across Transects in which Vegetation Class Occurred		88.0	87.0	86.0	12.0	86.0

Shading indicates absence of vegetation class.

Table 12a. Number of Plant Species Encountered by Vegetation Class along the Santa Fe River.							
	N	Cypress Swamp	Hydric Hardwood Hammock	Hardwood Swamp	Mesic Hardwood Hammock	River Bank	Hardwood Cypress
Trees	25	7	22	10	7	9	14
Shrubs	23	3	19	5	3	2	8
Vines	12	8	9	5	3	1	3

Table 12b. Number of Plant Species Encountered by Vegetation Class along the Ichetucknee River.						
	N	Cypress Popash Swamp	Mesic Hardwood Hammock	Cypress Swamp	Hardwood Swamp	Bay Swamp
Trees	17	4	2	6	11	7
Shrubs	16	9	2	5	4	9
Vines	11	3	4	4	7	3

Table 13a. Frequency of Non-hydric, Hydric, and Hydric Soils with Muck within each Vegetation Class along the Santa Fe River.						
Vegetation Class	N	Non-hydric	Hydric	Hydric with Muck	Texture	Average Depth to Seasonal High
Cypress Swamp	9	1	8	0	Loamy/ clayey	1.56
Hydric Hardwood Hammock	30	2	28	1	Loamy/ clayey	3.32
Hardwood Swamp	14	0	14	0	Loamy/ clayey	0.00
Mesic Hardwood Hammock	4	4	0	0	Sandy and loamy/clayey	9.75
River Bank	3	0	3	0	Sandy	5.00
Hardwood Cypress	12	0	12	0	Loamy/ clayey	0.42

Table 13b. Frequency of Non-hydric, Hydric, and Hydric Soils with Muck within each Vegetation Class along the Ichetucknee River.						
Vegetation Class	N	Non-hydric	Hydric	Hydric with Muck	Texture	Average Depth to Seasonal High
Cypress Popash Swamp	4	0	4	1	Loamy/ clayey	0.00
Mesic Hardwood Hammock	1	1	0	0	Loamy/ clayey	7.00
Cypress Swamp	6	0	6	0	Loamy/ clayey	0.00
Hardwood Swamp	5	0	5	2	Loamy/ clayey	0.00
Bay Swamp	3	0	3	0	Sandy	0.00

Table 14a. Average Elevations of Soils within each Transect along the Santa Fe River.						
Transect	**Non-hydric**	**N**	**Hydric**	**N**	**Hydric with Muck**	**N**
A	16.94	3	8.86	3		0
B	14.23	1	10.12	5		0
C	18.75	1	15.74	9		0
CD		0	13.12	4		0
D		0	14.28	4	14.44	1
E		0	21.30	6		0
F	22.41	2	20.84	3		0
J		0	32.57	11		0
K		0	34.16	5		0
L	38.69	1	35.28	6		0

Shading indicates absence of soil type.

Table 14b. Average Elevations of Soils within each Transect along the Ichetucknee River.						
Transect	**Non-hydric**	**N**	**Hydric**	**N**	**Hydric with Muck**	**N**
AA	21.41	1	16.19	7	15.77	1
BB	19.11	1	20.16	5	19.78	4
CC	31.05	2	21.72	4	21.68	1

Shading indicates absence of soil type.

Table 15. Mean Elevations of Hydrologic Indicators for each Transect along the Santa Fe and Ichetucknee Rivers.					
Transect	**Cypress Buttress**	**Cypress Knee**	**Stain Line**	**Wetland Edge**	**Difference in Elevation of Wetland Edge and Hydrologic Indicator**
A	18.61			16.87	-1.74
B	13.55			13.53	-0.02
C				23.92	
CD				20.32	
D				17.76	
E (downstream)	24.59			21.04	-3.55
E (upstream)				21.55	
F	24.03			23.53	-.50
J	35.15			31.65	-3.50
K				36.67	
L				38.69	
AA (downstream)			19.43	21.41	1.98
AA (upstream)		18.73		25.25	6.52
BB (west side)		21.81		19.66	-2.15
BB (east side)			20.31	24.95	4.64
CC (west side)			22.56	26.94	4.38
CC (east side)				32.01	

Shading indicates absence of hydrologic indicator.

Table 16a. Summary of Significant Variables from Discriminant Factor Analysis for Vegetation Classes along the Santa Fe River.

Wilks' Lambda= 0.0446; F=9.61; DF=25; p<0.0001

Variable	R-Square	F Value	Pr>F
Elevation relative to channel	0.5463	12.76	<0.0001
Elevation relative to EOW	0.5576	13.36	<0.0001
Soils (hydric or not)	0.3462	5.61	0.0003
Depth to SHS	0.5307	11.99	<0.0001
Elevation NAVD89	0.4238	7.79	<0.0001

Table 16b. Summary of Significant Variables from Discriminant Factor Analysis for Vegetation Classes along the Ichetucknee River.

Wilks' Lambda= 0.0000; F=∞; DF=12; p<0.0001

Variable	R-Square	F Value	Pr>F
Elevation relative to channel	0.71	9.60	0.0016
Elevation relative to EOW	0.74	11.50	0.0008
Soils (hydric or not)	NA	NA	NA
Depth to SHS	1.0	∞	<0.0001
Elevation NAVD89	0.82	17.65	0.0001

Table 17a. Results of DFA Analysis for Classification and Misclassification of Vegetation Classes along the Ichetucknee River.							
	Percent and number of communities correctly identified and incorrectly identified						
"From" class	"To" class						
Vegetation Class	**Cypress swamp**	**Hardwood cypress swamp**	**Hardwood swamp**	**Marsh**	**Hydric Hardwood Hammock**	**Mesic Hardwood Hammock**	**Total Classifications**
Cypress swamp	28.57 (2)	28.57 (2)	28.57 (2)	14.29 (1)			100 (7)
Hardwood cypress swamp		100 (12)					100 (12)
Hardwood swamp		10 (1)	60 (6)	20 (2)	10 (1)		100 (10)
Marsh				100 (1)			100 (1)
Hydric hardwood hammock	3.70 (1)	7.41 (2)	7.41 (2)		81.48 (22)		100 (27)
Mesic hardwood hammock						100 (2)	100 (2)
Total Classifications	5.08 (3)	32.2 (19)	18.64 (11)	5.08 (3)	35.59 (21)	3.39 (2)	100 (59)

Table 17b. Results of DFA Analysis for Classification and Misclassification of Vegetation Classes along the Santa Fe River.					
	Percent and number of communities correctly identified and incorrectly identified				
"From"	**"To"**				
Vegetation Class	**Cypress popash swamp**	**Cypress swamp**	**Hardwood swamp**	**Hydric hardwood hammock**	**Total classifications**
Cypress popash swamp	100 (4)				100 (4)
Cypress swamp	40 (2)	60 (3)			100 (5)
Hardwood swamp			100 (6)		100 (6)
Hydric hardwood hammock				100 (1)	100 (1)
Total classifications	37.5 (6)	18.75 (3)	37.5 (6)	6.25 (1)	100 (16)

Wilks' Lambda= 0.0000; F=∞; DF=12; p<0.0001

Variable	R-Square	F Value	Pr>F
Elevation relative to channel	0.71	9.60	0.0016
Elevation relative to EOW	0.74	11.50	0.0008
Soils (hydric or not)	NA	NA	NA
Depth to SHS	1.0	∞	<0.0001
Elevation NAVD89	0.82	17.65	0.0001

Additional Tables

Table 18a. Mean values for environmental parameters used in DFA for the Santa Fe River.					
Vegetation Class	**Elevation (feet) relative to channel bottom**	**Elevation (feet) relative to EOW**	**Hydric soils (present or not)**	**Depth to SHS**	**Elevation NAVD88**
Cypress Swamp (N=7)	14.51	4.89	0.9	2.0	20.48
Hardwood Cypress (N=12)	5.45	2.35	1.0	0.4	32.39
Hardwood swamp (N=10)	14.46	4.32	1.0	0.0	13.85
Hydric Hardwood Hammock (N=27)	17.96	8.90	0.9	3.8	20.83
Marsh (N=1)	10.60	8.29	1.0	0.0	10.07
Mesic Hardwood Hammock (N=2)	9.80	4.08	0.0	12.0	22.41

Table 18b. Mean values for environmental parameters used in DFA for the Santa Fe River					
Vegetation Class	**Elevation relative to channel bottom**	**Elevation relative to EOW**	**Hydric soils (present or not)**	**Depth to SHS**	**Elevation NAVD88**
Cypress Popash Swamp (N=4)	10.80	2.39	1	0	15.76
Cypress Swamp (N=5)	7.52	1.09	1	0	17.82
Hardwood Swamp (N=6)	6.05	1.75	1	0	21.60
Hydric Hardwood Hammock (N=1)	14.31	5.9	1	7	19.27

Table 19a. IVs for Tree Species, by Vegetation Class, along the Santa Fe River.										
Species	**DEP Status**	**Bay Swamp***	**Cypress Popash Swamp***	**Cypress Swamp**	**Hardwood Swamp**	**Hydric Hardwood Hammock**	**River Bank**	**Hardwood Cypress Swamp**	**Mesic Hardwood Hammock**	**Total IV**
Carya aquatica	OBL			9.29	36.40	19.62	136.72	17.51		219.54
Cephalanthus occidentalis	OBL			7.97	13.25	7.50		7.11		35.83
Fraxinus caroliniana	OBL			64.74	112.94	11.60		43.40	23.76	256.45
Gleditsia aquatica	OBL				5.52	1.96				7.48
Nyssa aquatica	OBL							32.22		32.22
Nyssa sylvatica var. *biflora*	OBL					4.08		8.27		12.35
Quercus lyrata	OBL			8.57	6.01	27.50		9.48		51.56
Taxodium distichum	OBL			146.12	33.67	21.29		74.33		275.41
Acer rubrum	FACW			13.29	5.86	10.12		52.23		81.50
Carpinus caroliniana	FACW					69.68	22.28	5.08	90.59	187.64
Celtis laevigata	FACW					1.99	21.52			23.50
Crataegus marshallii	FACW					1.94	21.55	5.03		28.52
Forestiera acuminata	FACW			18.97	61.48	14.73				95.18
Ilex decidua	FACW					1.91				1.91
Liquidambar styraciflua	FACW					10.92	25.19			36.11
Pinus glabra	FACW					3.28				3.28
Quercus laurifolia	FACW					55.29	51.59		45.77	152.66
Quercus nigra	FACW					3.89		8.01		11.90
Tilia americana	FACW								22.51	22.51
Ulmus americana	FACW				13.93	23.38		37.32	18.65	93.28
Diospyros virginiana	FAC								17.16	17.16
Ilex vomitoria	FAC						21.16			21.16
Ostrya virginiana	None			31.05	10.94	9.33			21.60	72.91
Quercus virginiana	None								59.95	59.95

Shading indicates absence of species. * Indicates absence of vegetation class.

Species	DEP Status	Bay Swamp	Cypress Popash Swamp	Cypress Swamp	Hardwood Swamp	Hydric Hardwood Hammock	River Bank	Hardwood Cypress Swamp*	Mesic Hardwood Hammock*	Total IV
Cephalanthus occidentalis	OBL	60.28	14.75	63.00			60.28			138.03
Fraxinus caroliniana	OBL	73.03	91.79	63.18	24.75		73.03			252.76
Ilex cassine	OBL				50.45					50.45
Persea palustris	OBL	141.16					141.16			141.16
Taxodium distichum	OBL		117.65	173.82	54.73					346.20
Acer rubrum	FACW		75.80		39.94					115.74
Carpinus caroliniana	FACW					222.46				300.00
Celtis laevigata	FACW				12.84					12.84
Quercus laurifolia	FACW	25.53					25.53			25.53
Tilia americana	FACW				12.31					12.31
Ulmus americana	FACW				57.30					57.30
Myrica cerifera	FAC				24.91					24.91
Carya glabra					22.77	77.54				22.77

Table 19b. Summary of Floodplain Wetland Tree Canopy Composition over all Vegetation Classes along the Ichetucknee River.

Shading indicates absence of species. * Indicates absence of vegetation class.

Required Figures.

No graphs for Ichetucknee transect CC due to inadequate number of data points

Figures 1- 15.

One figure for each transect where elevation is on the dependent axis and flooded wetland perimeter on the independent axis. These are floodplain wetted perimeter graphs. These graphs are included in Appendix B of the main report.

Figures 16 – 30.

One figure for each transect where elevation is on the dependent axis and distance from center of channel is on the independent axis. These figures are elevation profiles for each transect showing extents of vegetation classes. These graphs are provided in Appendix A of the main report.

Figures 31 – 45.

One figure for each transect where elevation is on the dependent axis and distance from center of channel is on the independent axis. These figures are elevation profiles for each transect showing extents of soil mapping units.

Figure 31. Extent of Soil Mapping Units along Transect A along the Santa Fe River.

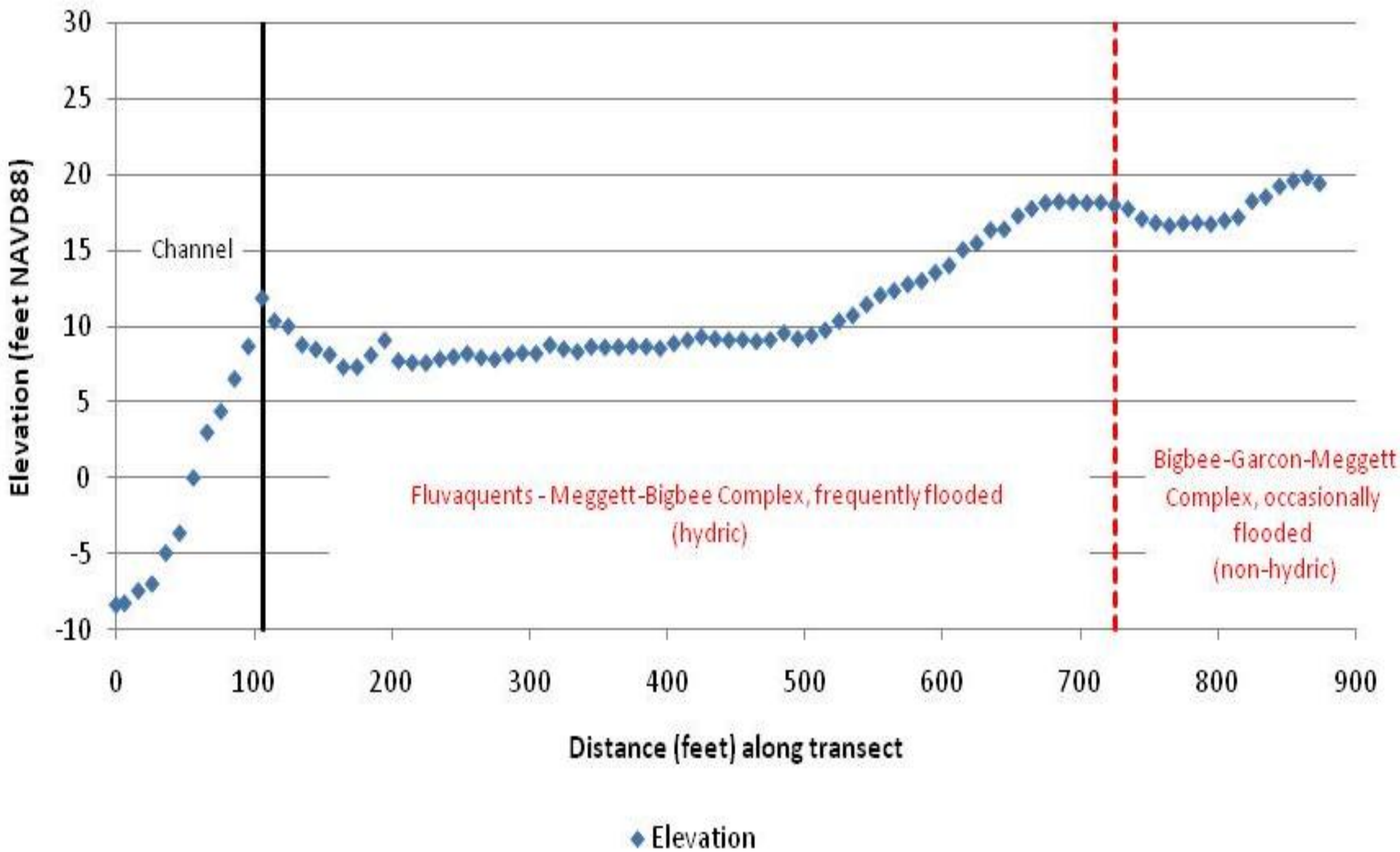


Figure 32. Extent of Soil Mapping Units along Transect B along the Santa Fe River.

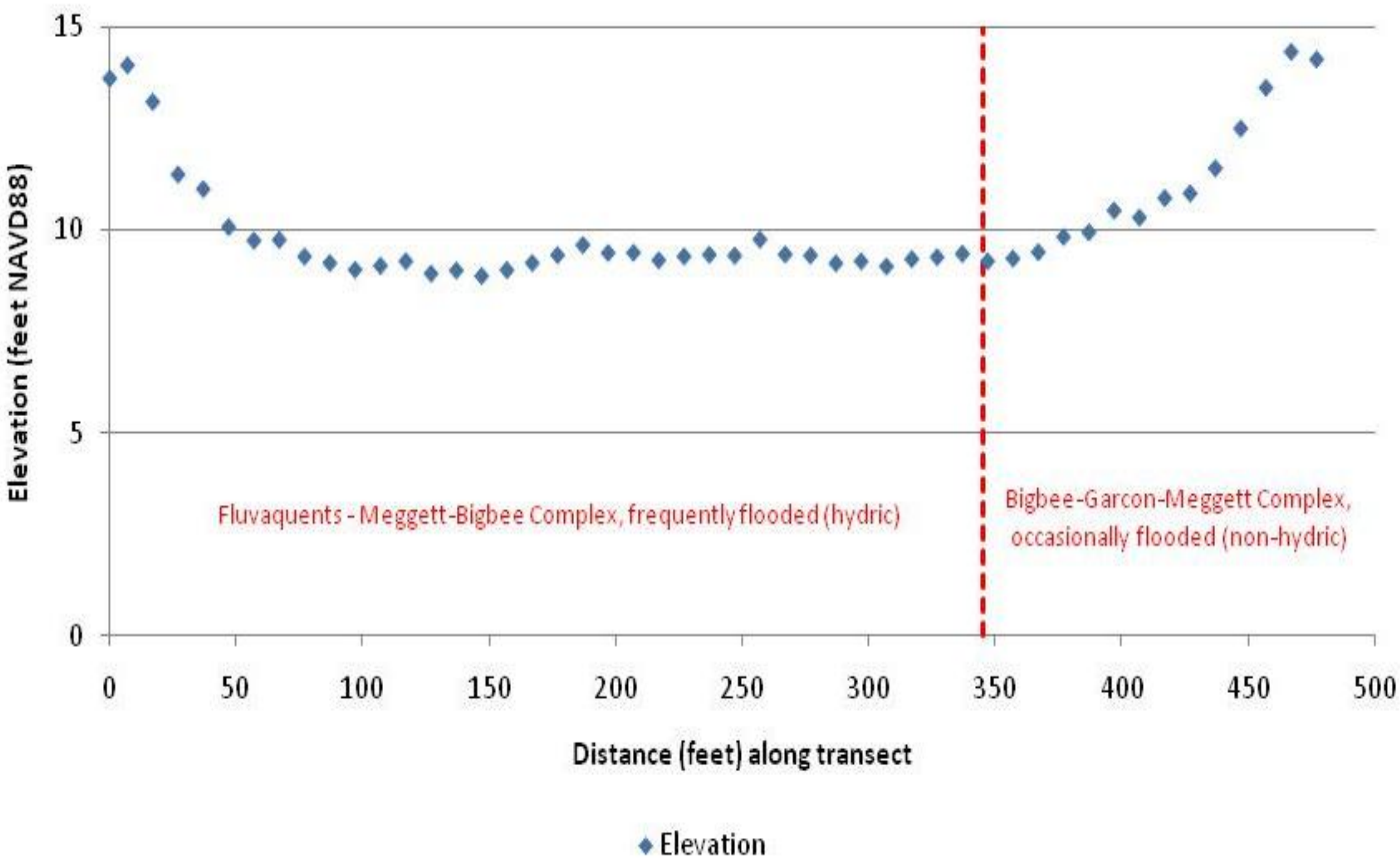


Figure 33. Extent of Soil Mapping Units along Transect C along the Santa Fe River.

Figure 34. Extent of Soil Mapping Units along Transect CD along the Santa Fe River.

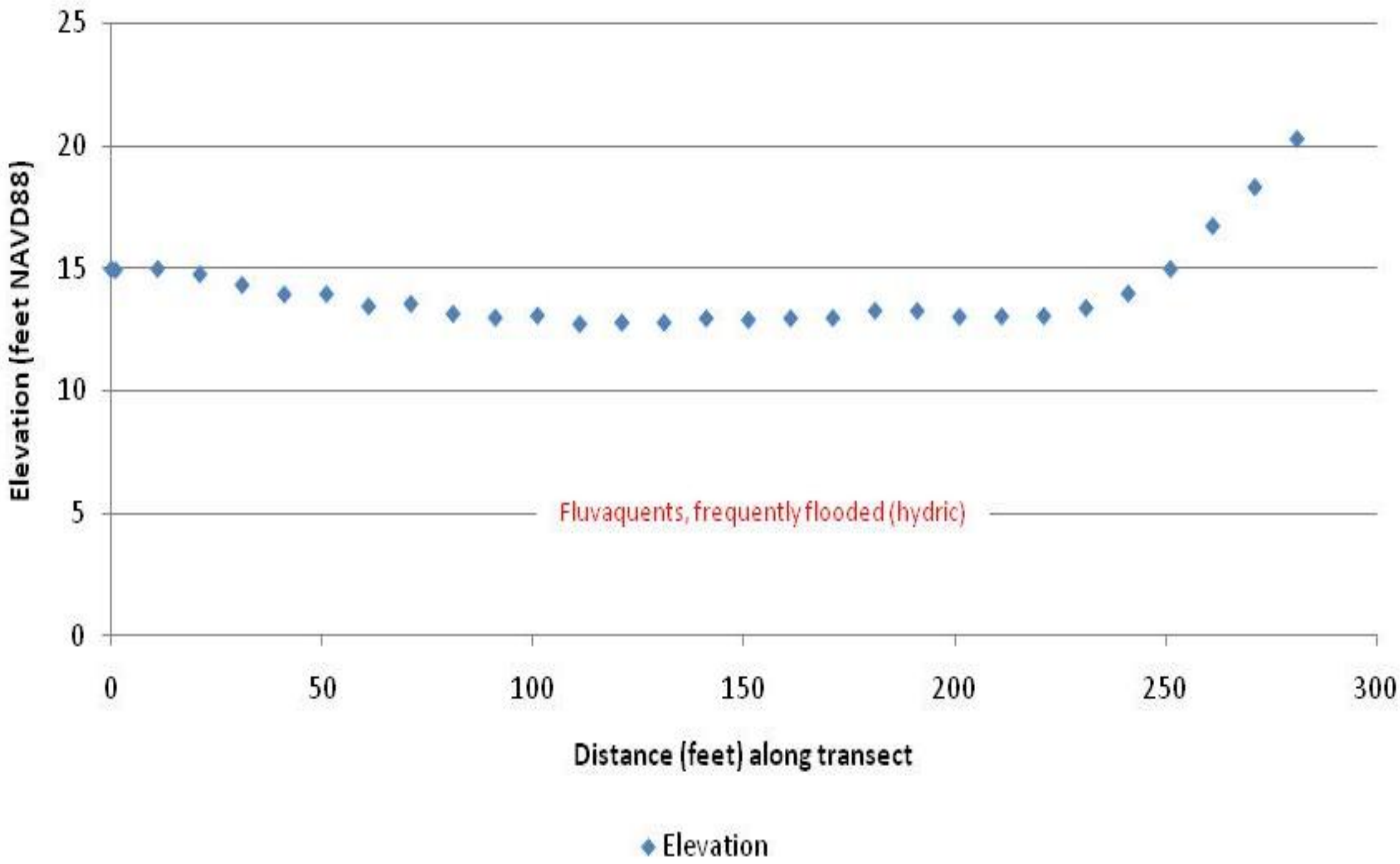


Figure 35. Extent of Soil Mapping Units along Transect D along the Santa Fe River.

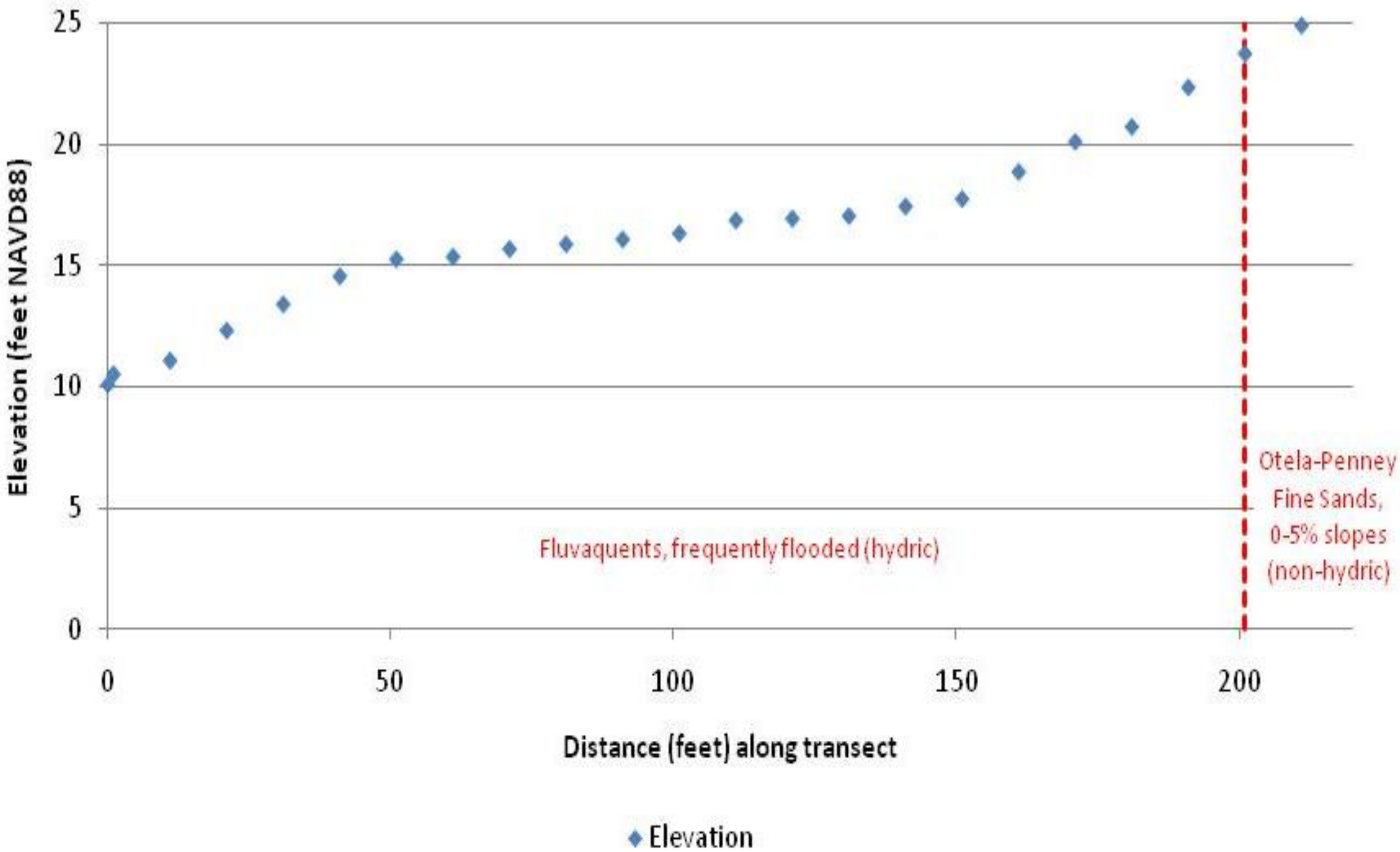


Figure 36. Extent of Soil Mapping Units along Transect E (downstream) along the Santa Fe River.

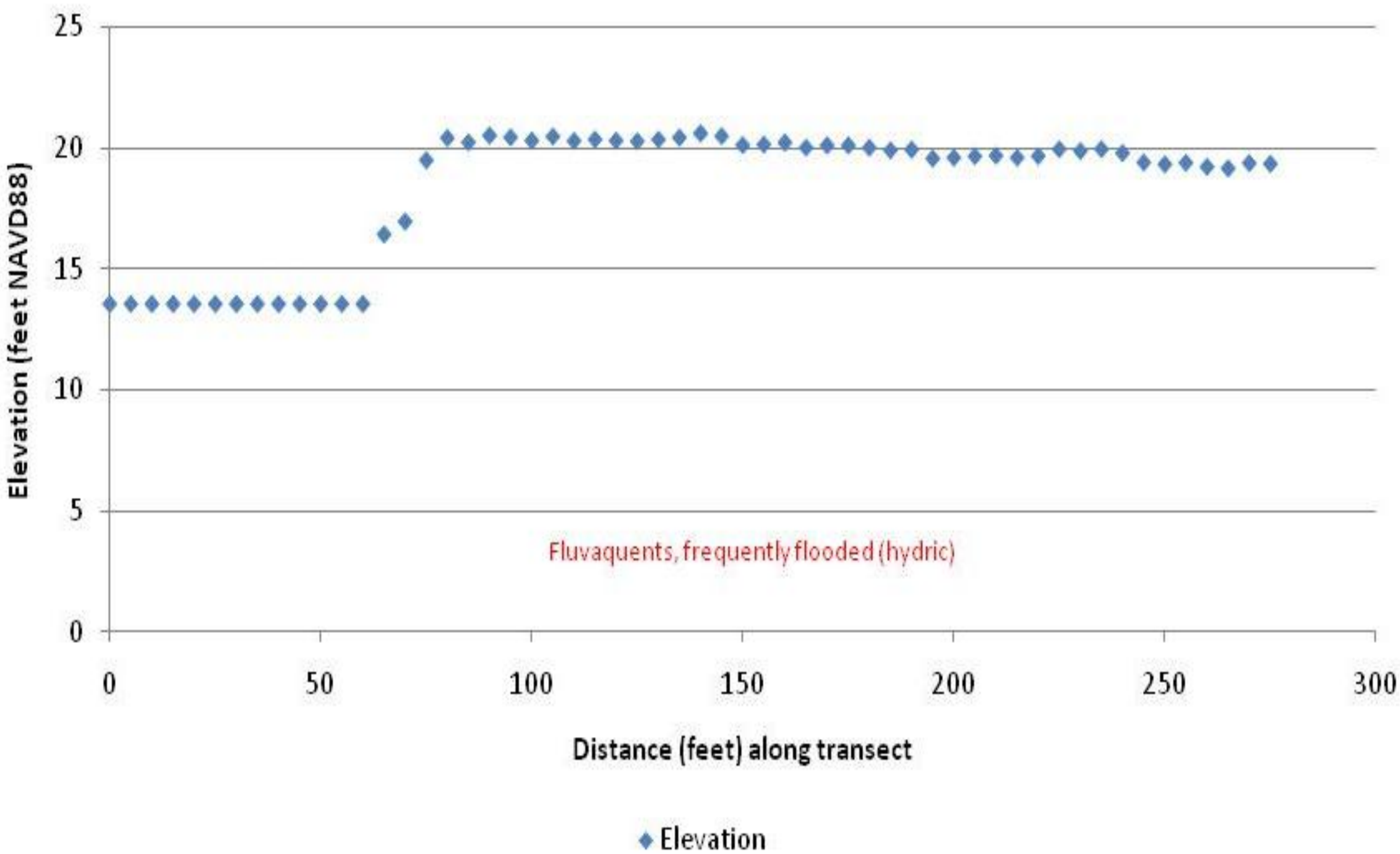


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Figure 37. Extent of Soil Mapping Units along Transect E (upstream) along the Santa Fe River.

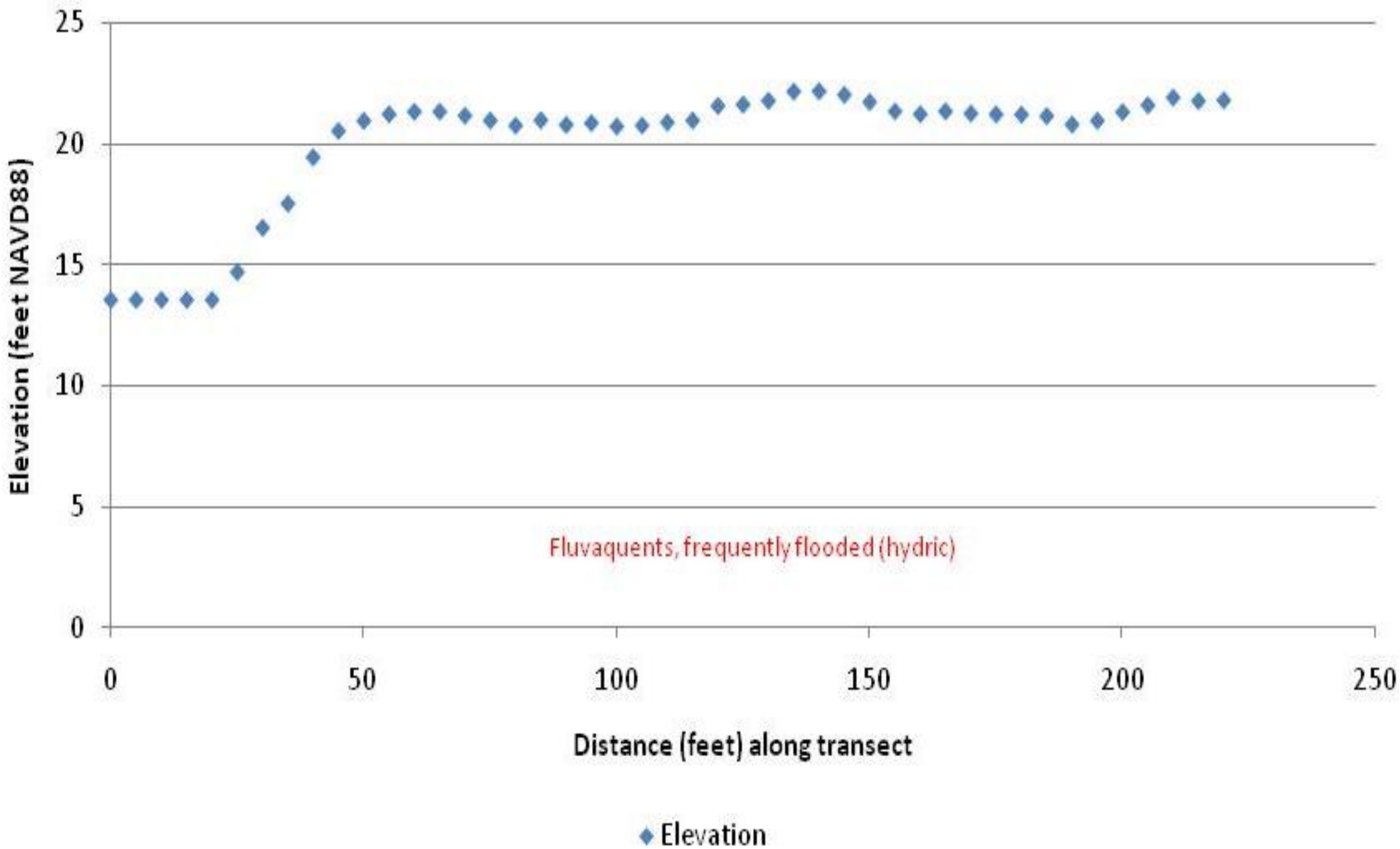


Figure 38. Extent of Soil Mapping Units along Transect F along the Santa Fe River.

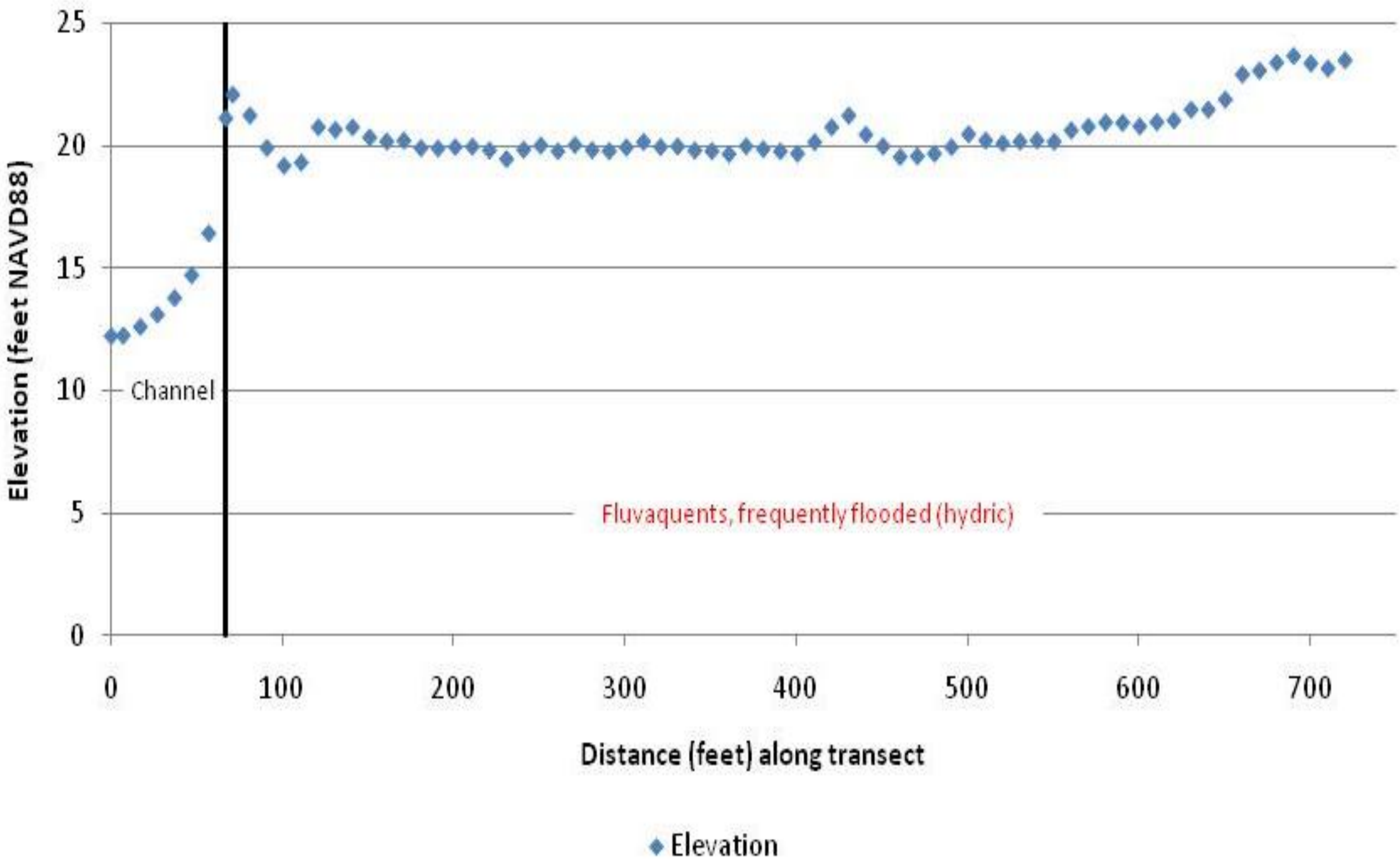


Figure 39. Extent of Soil Mapping Units along Transect J along the Santa Fe River.

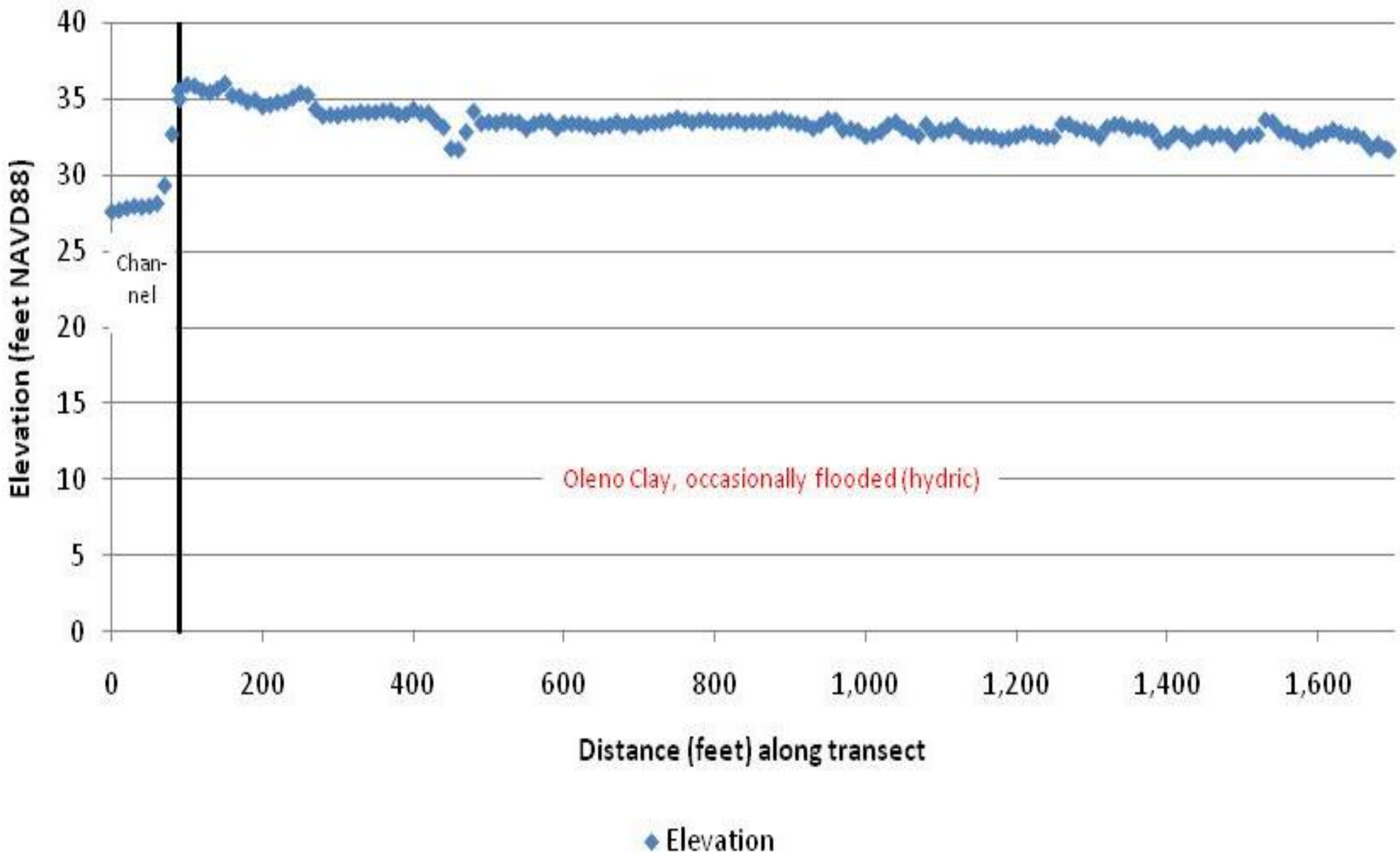


Figure 40. Extent of Soil Mapping Units along Transect K along the Santa Fe River.

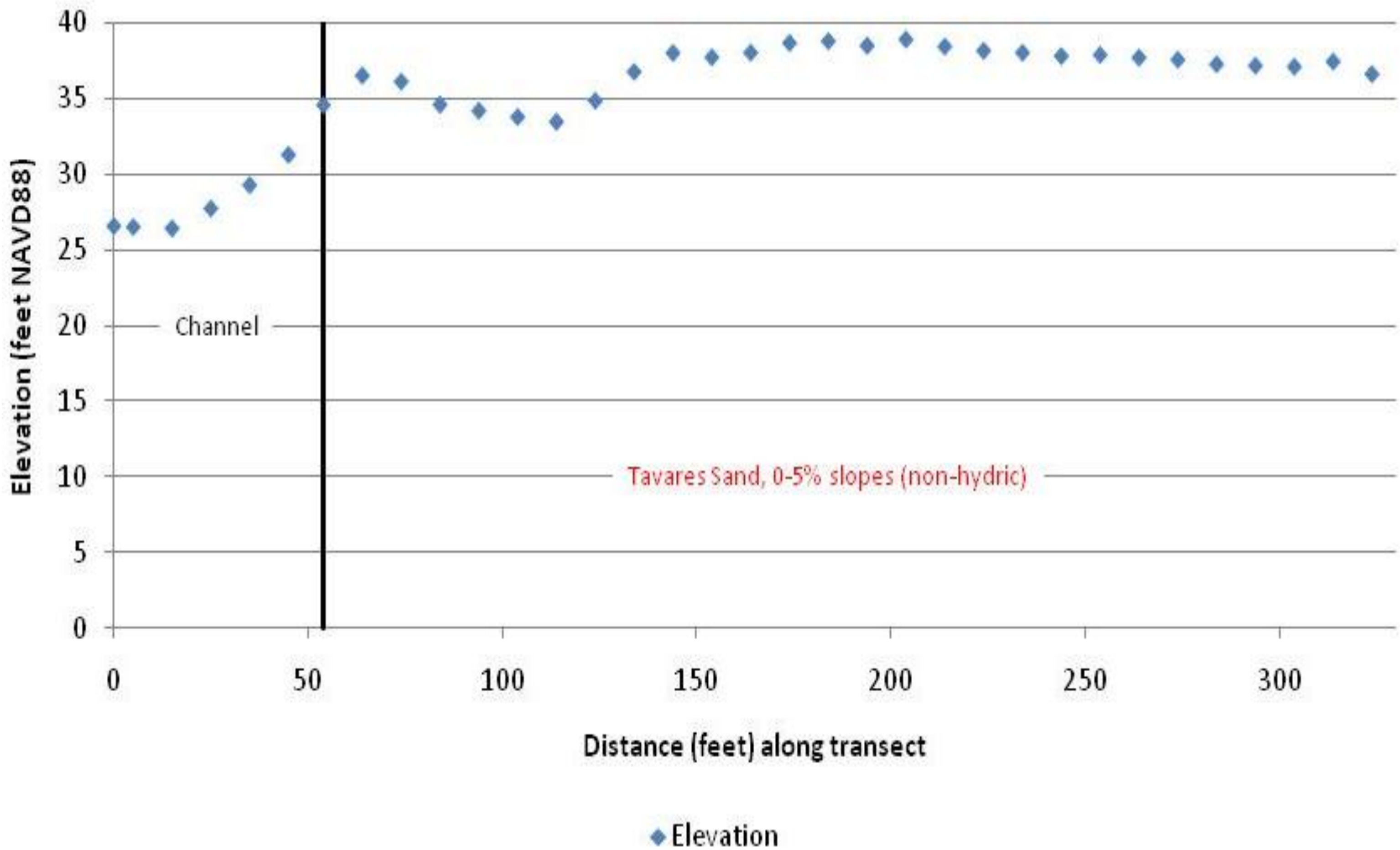


Figure 41. Extent of Soil Mapping Units along Transect L along the Santa Fe River.

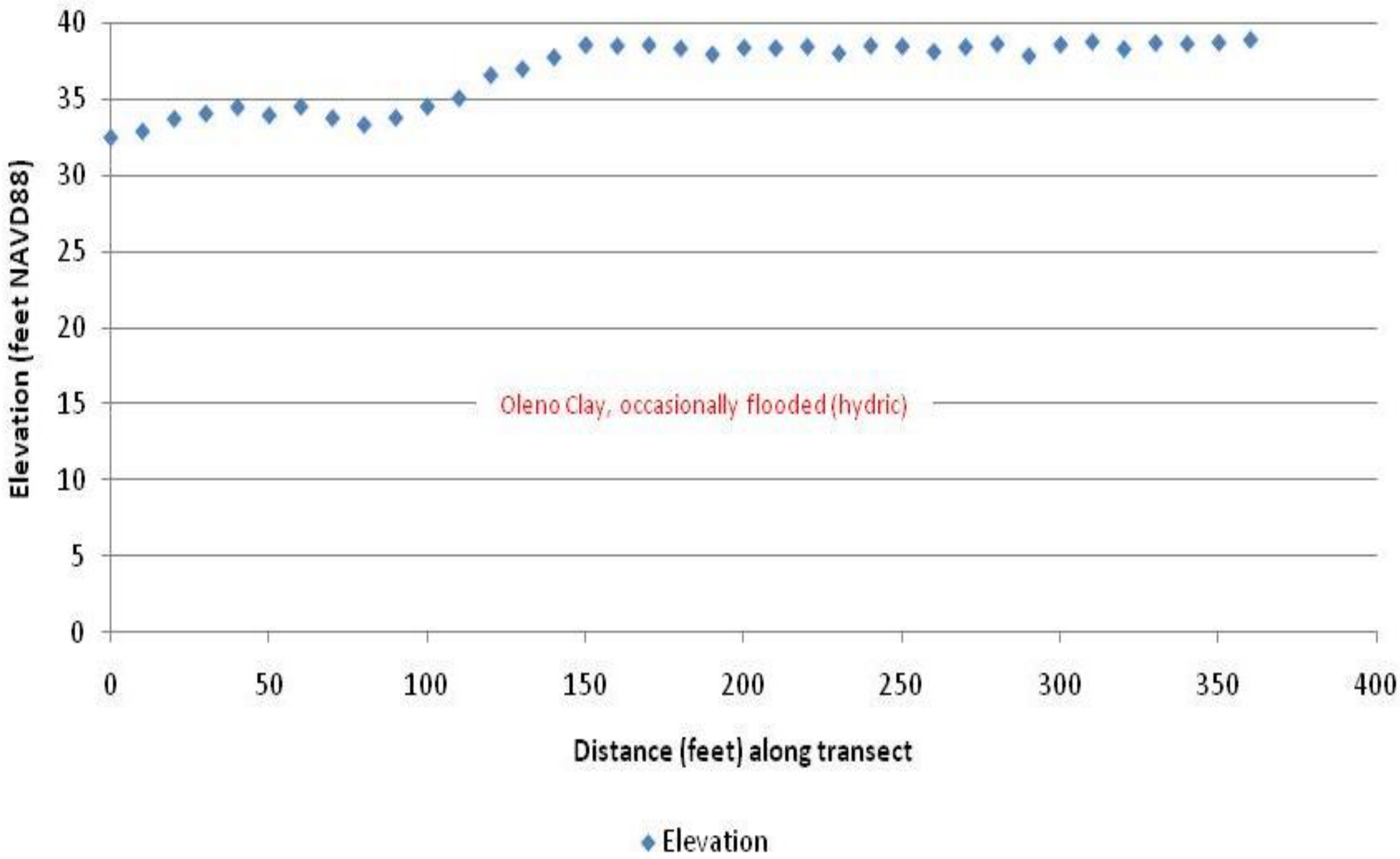


Figure 42. Extent of Soil Mapping Units along Transect AA (downstream) along the Ichetucknee River.

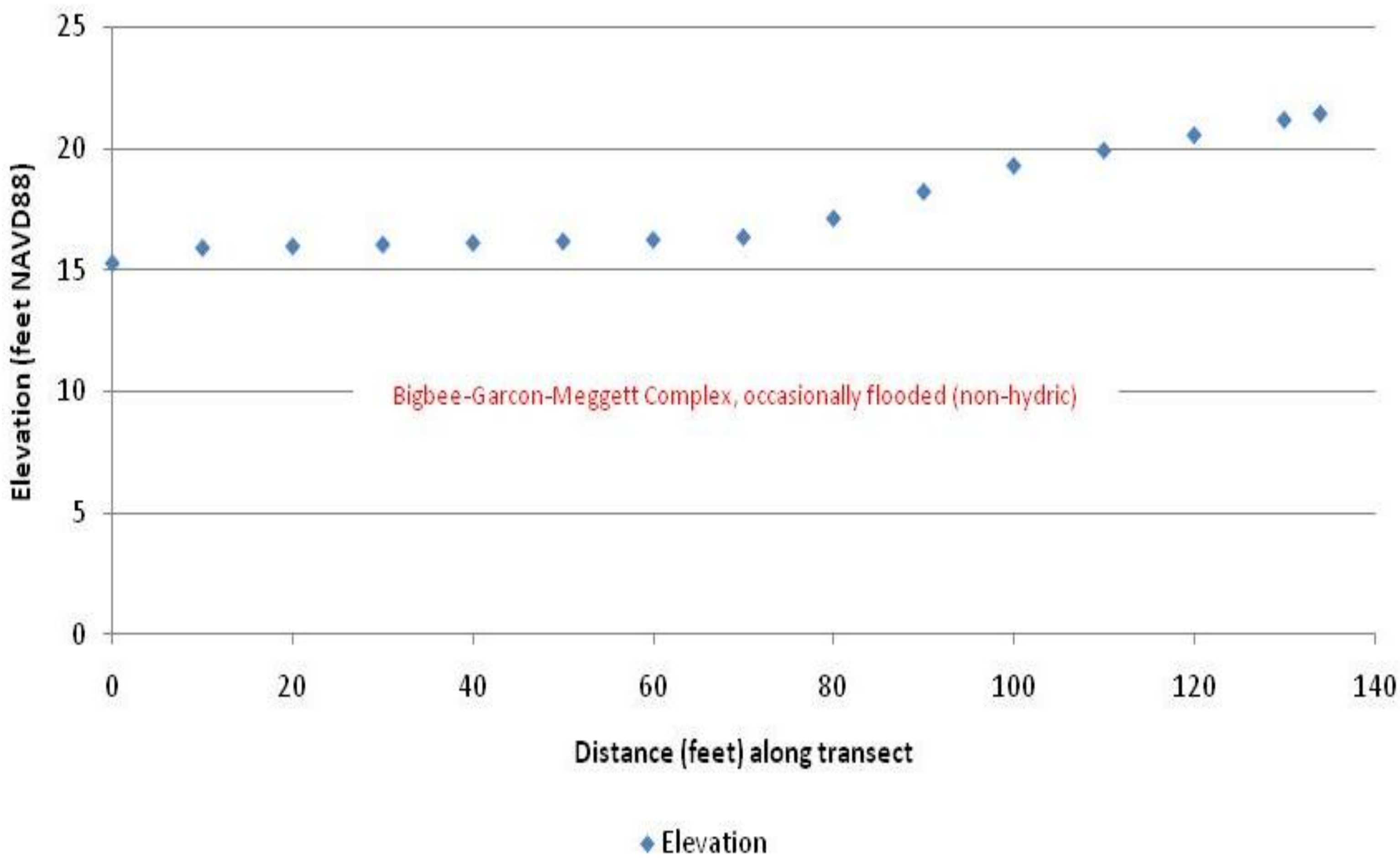


Figure 43. Extent of Soil Mapping Units along Transect AA (upstream) along the Ichetucknee River.

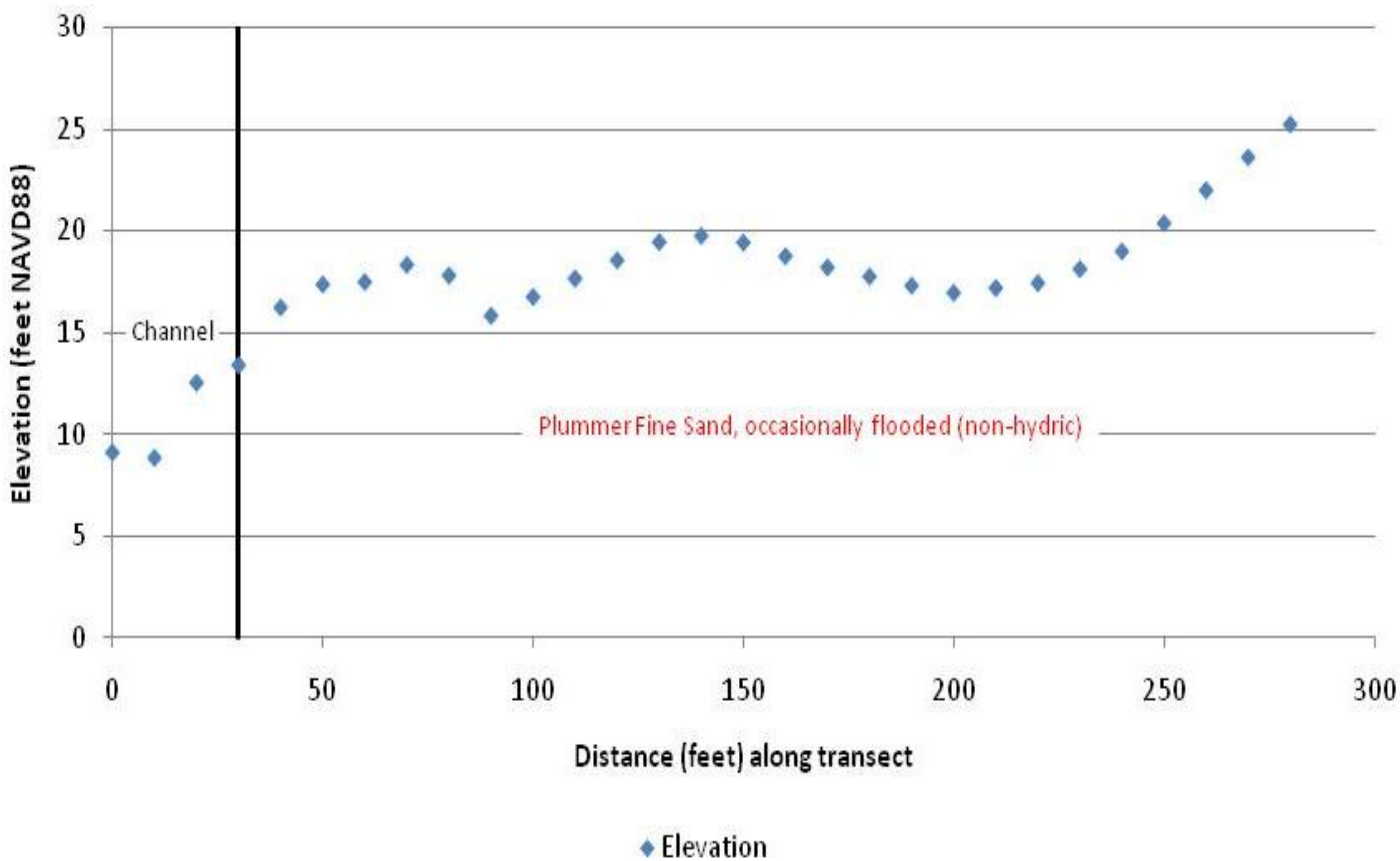


Figure 44. Extent of Soil Mapping Units along Transect BB (west side) along the Ichetucknee River.

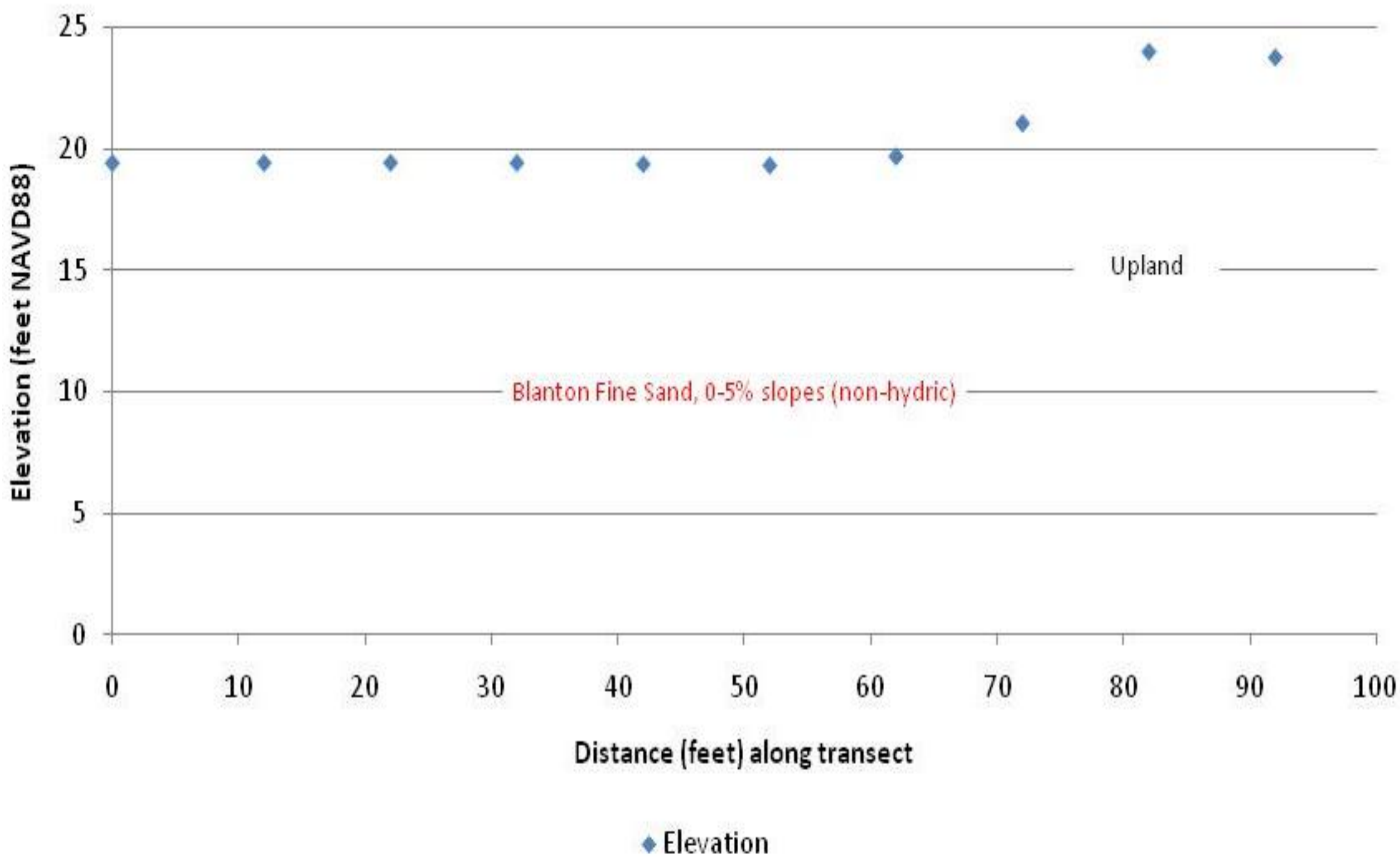
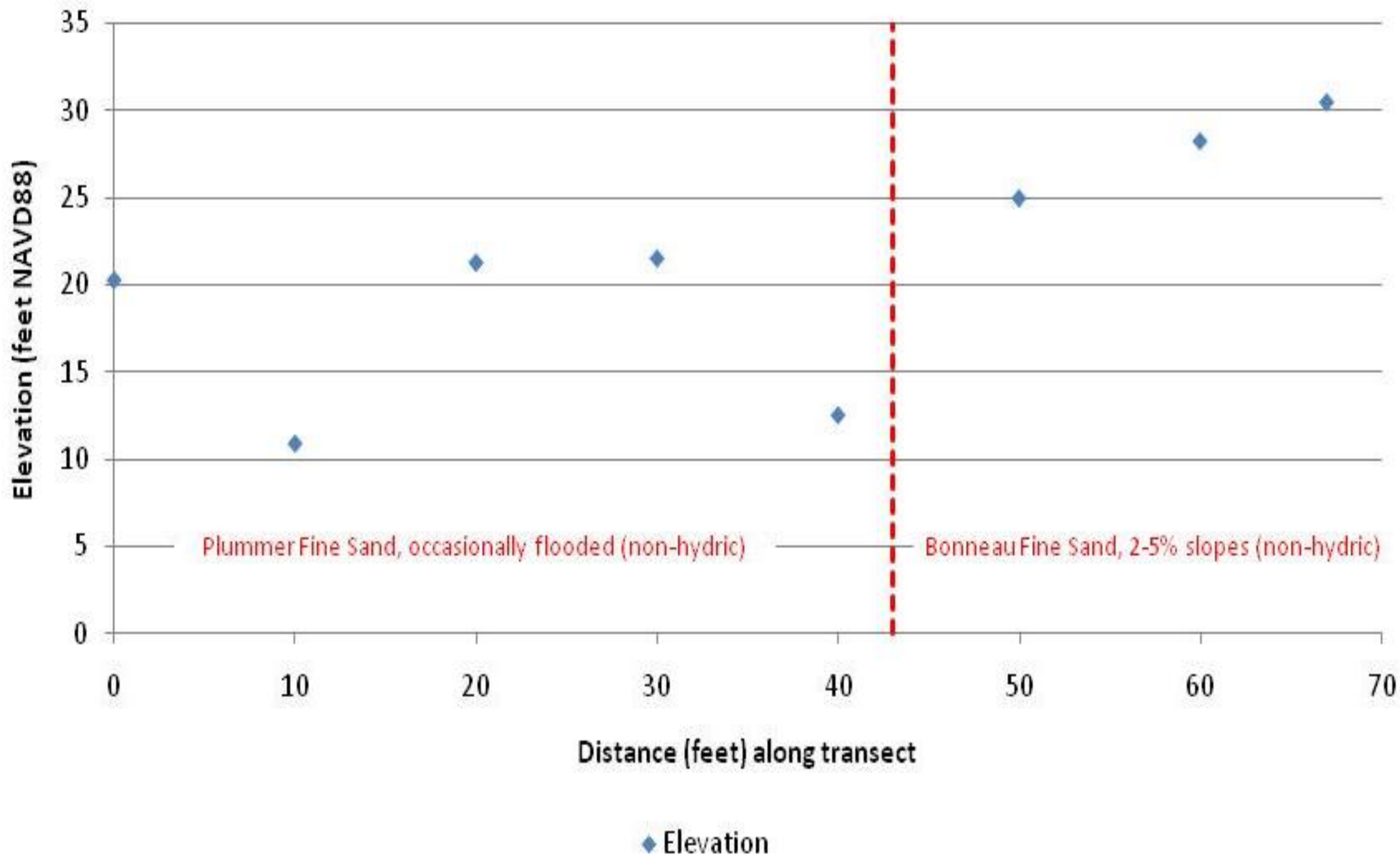


Figure 45. Extent of Soil Mapping Units along Transect BB (east side) along the Ichetucknee River.



Figures 46 – 60.

One figure for each transect where elevation is on the dependent axis and distance from center of channel is on the independent axis. These figures are elevation profiles for each transect showing extents of both vegetation classes and soil mapping units on the same figure.

Figure 46. Extent of Vegetation Classes and Soil Mapping Units along Transect A along the Santa Fe River.

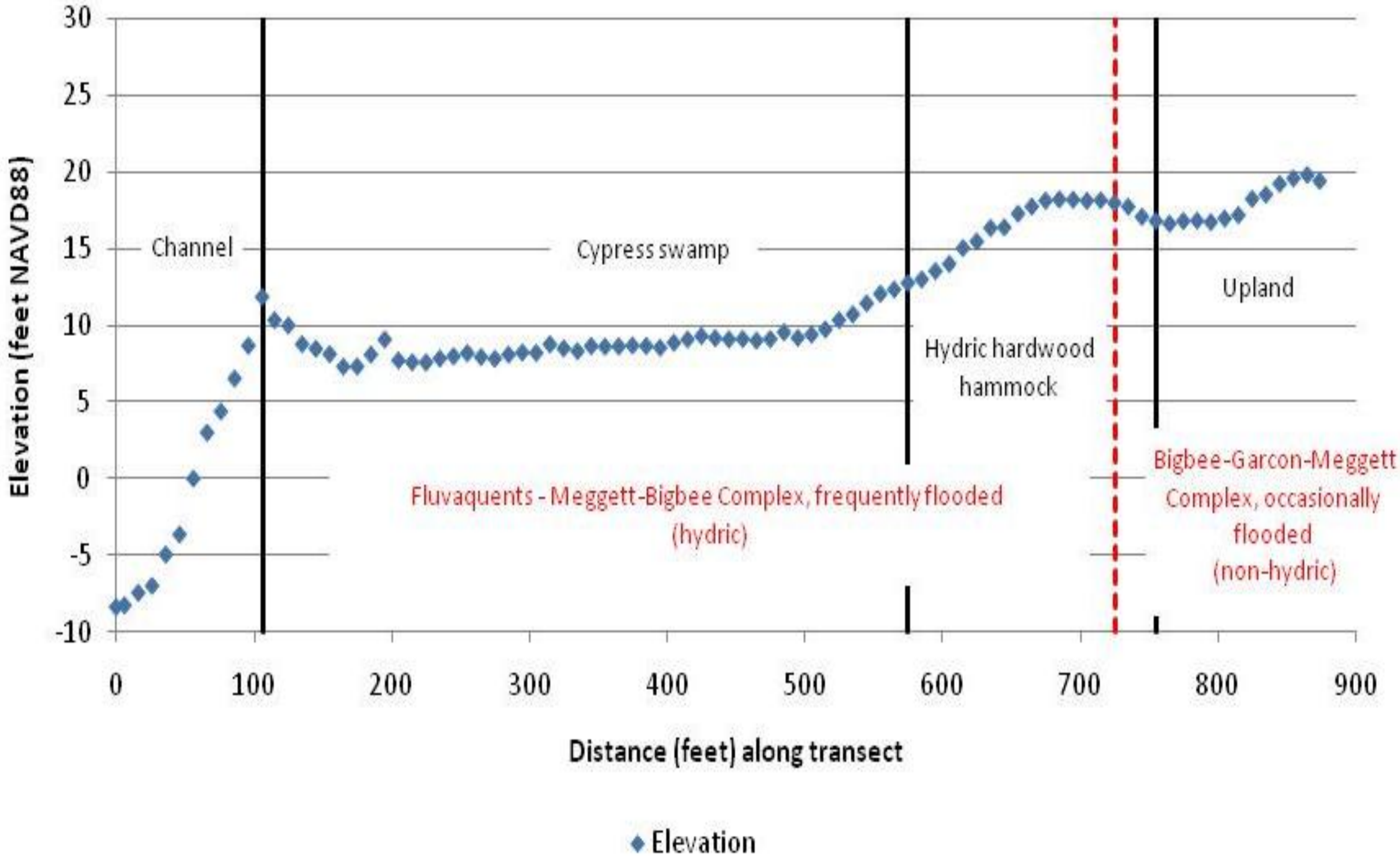


Figure 47. Extent of Vegetation Classes and Soil Mapping Units along Transect B along the Santa Fe River.

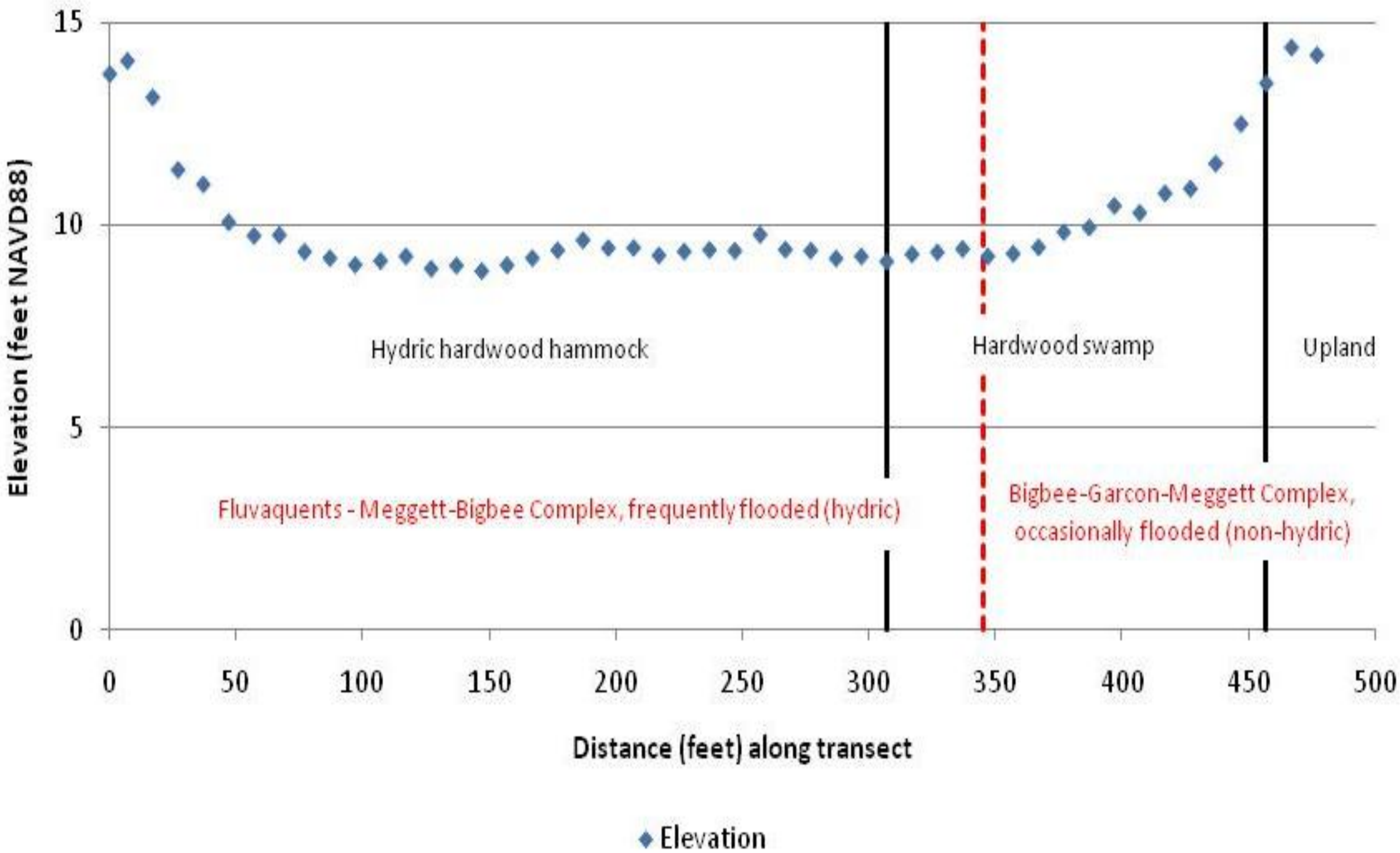


Figure 48. Extent of Vegetation Classes and Soil Mapping Units along Transect C along the Santa Fe River.

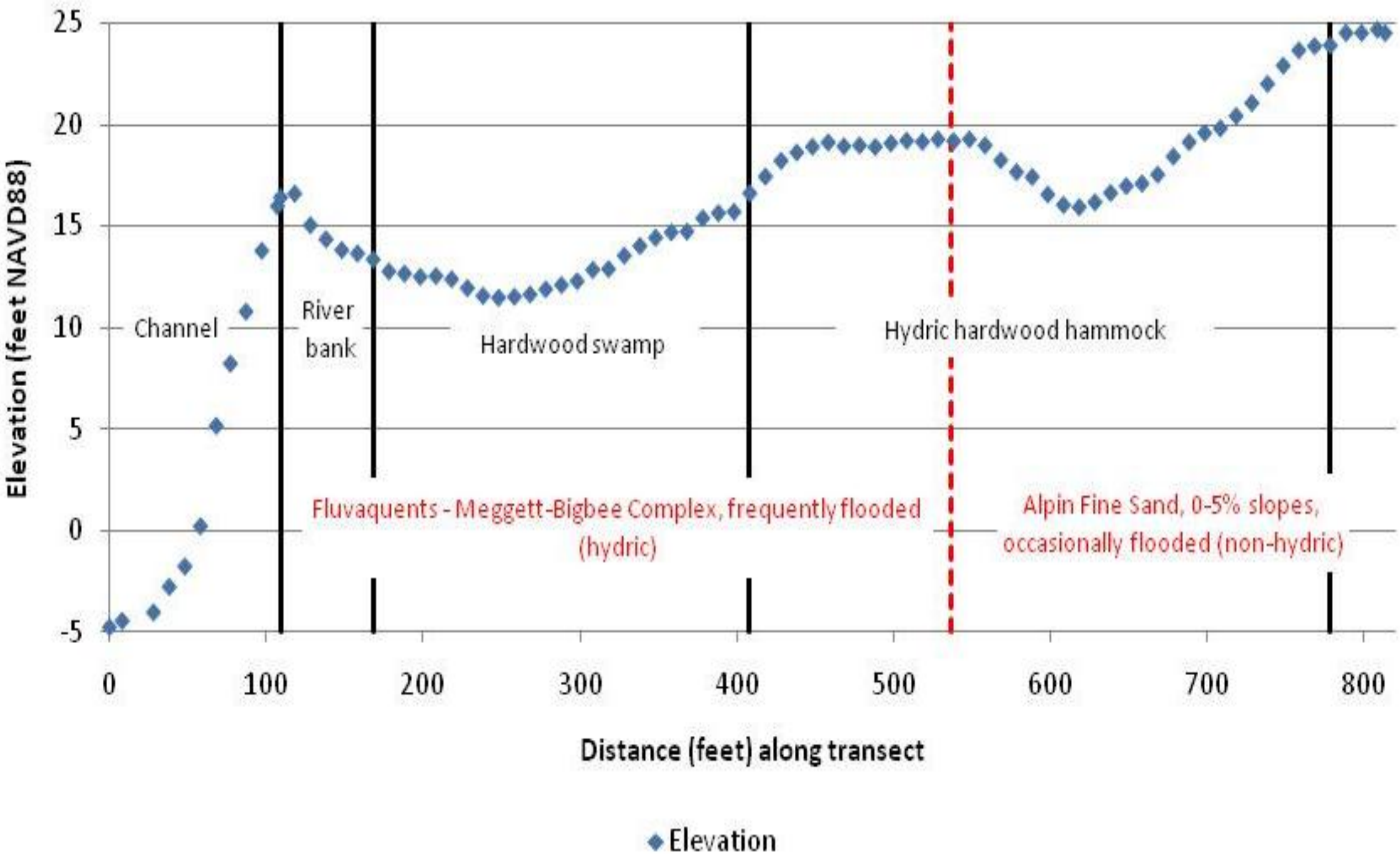


Figure 49. Extent of Vegetation Classes and Soil Mapping Units along Transect CD along the Santa Fe River.

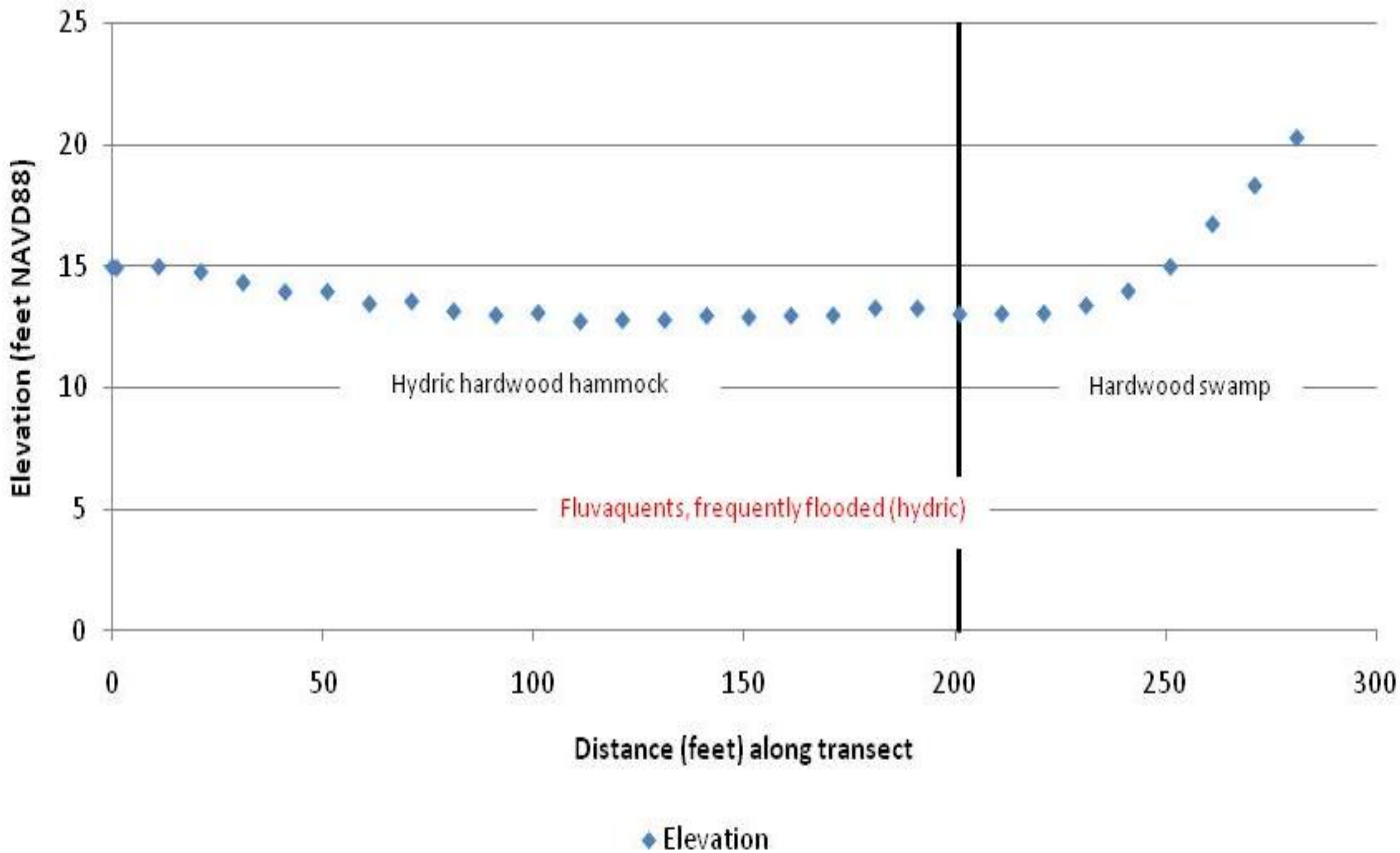


Figure 50. Extent of Vegetation Classes and Soil Mapping Units along Transect D along the Santa Fe River.

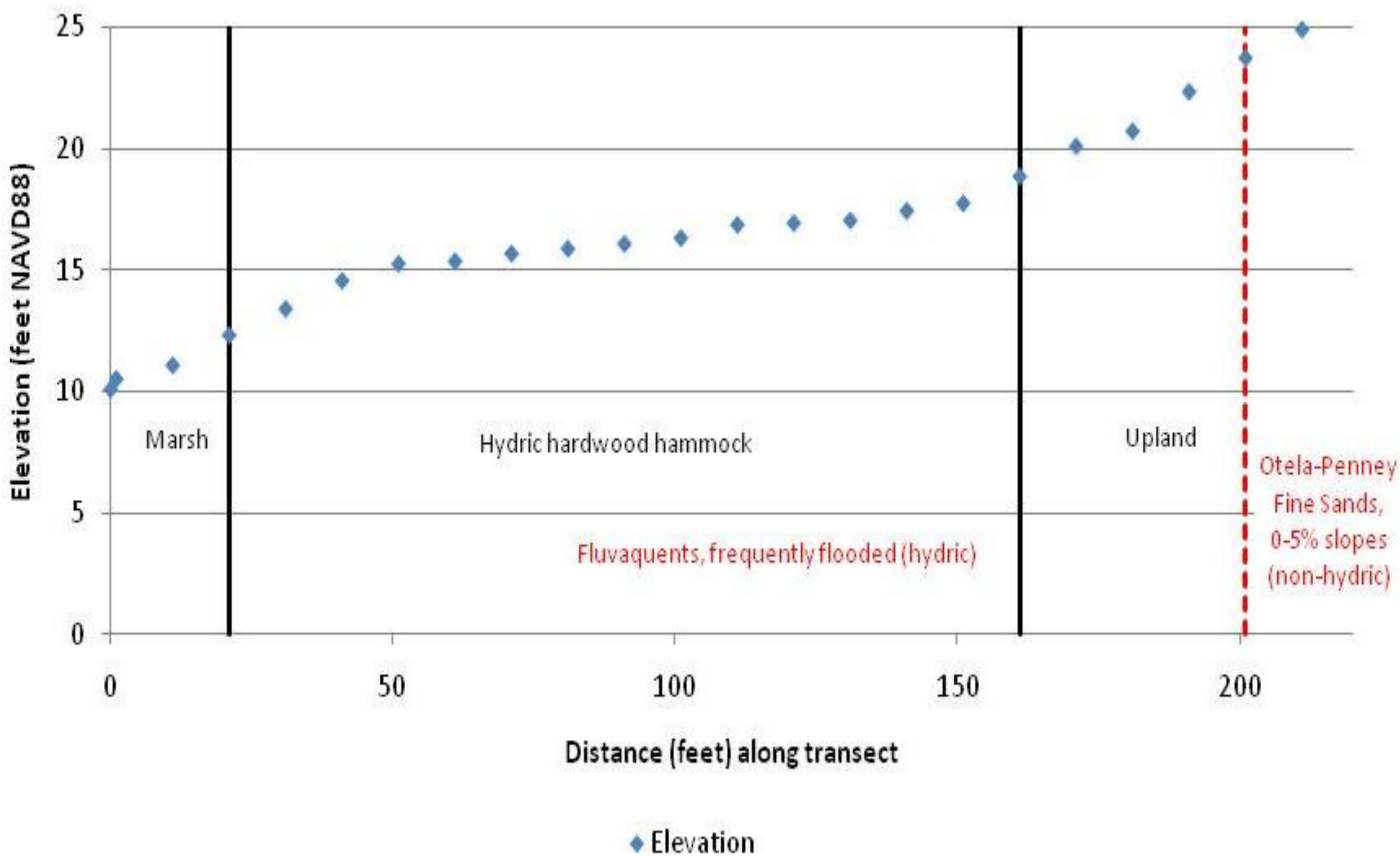


Figure 51. Extent of Vegetation Classes and Soil Mapping Units along Transect E (downstream) along the Santa Fe River.

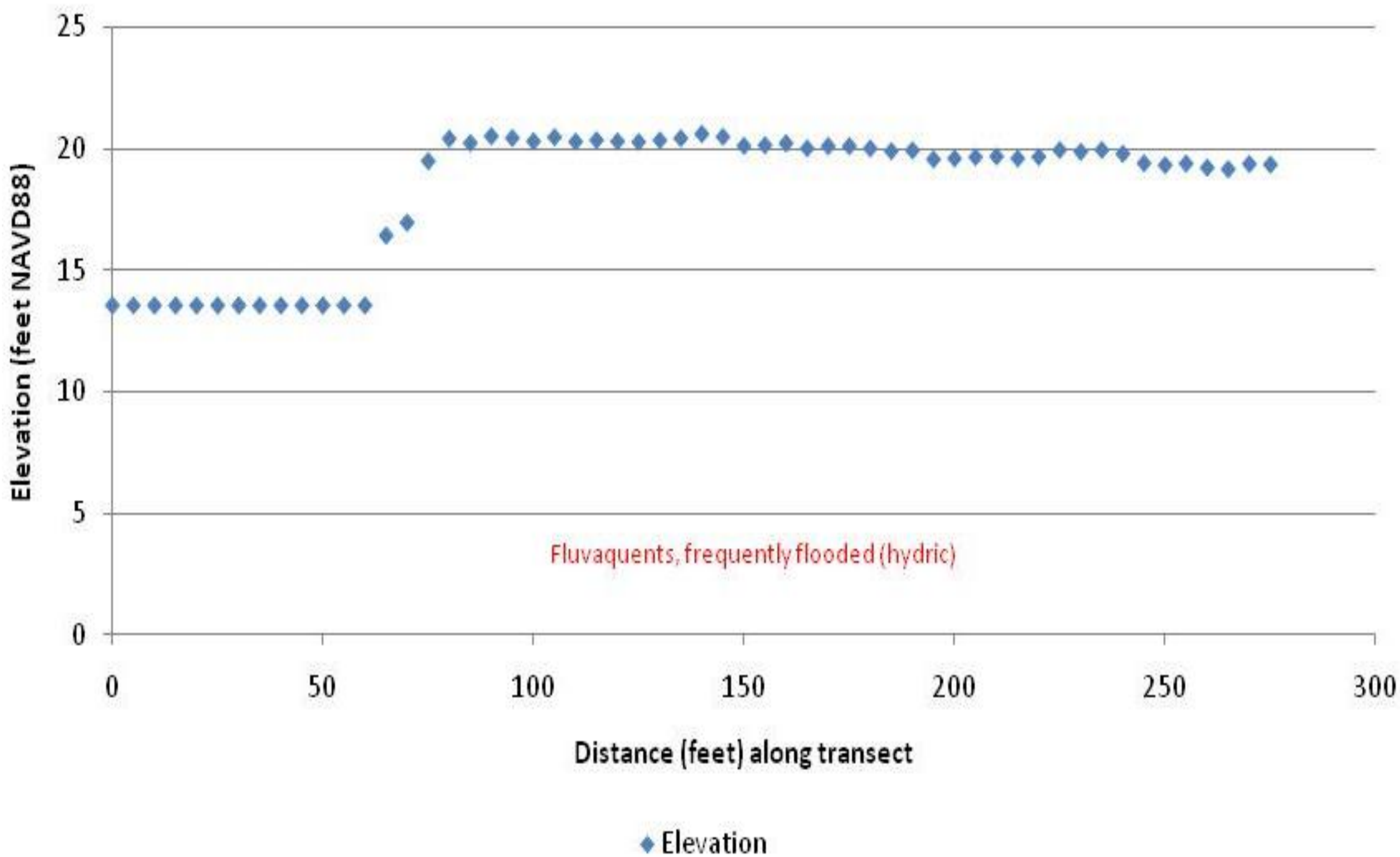


Figure 52. Extent of Vegetation Classes and Soil Mapping Units along Transect E (upstream) along the Santa Fe River.

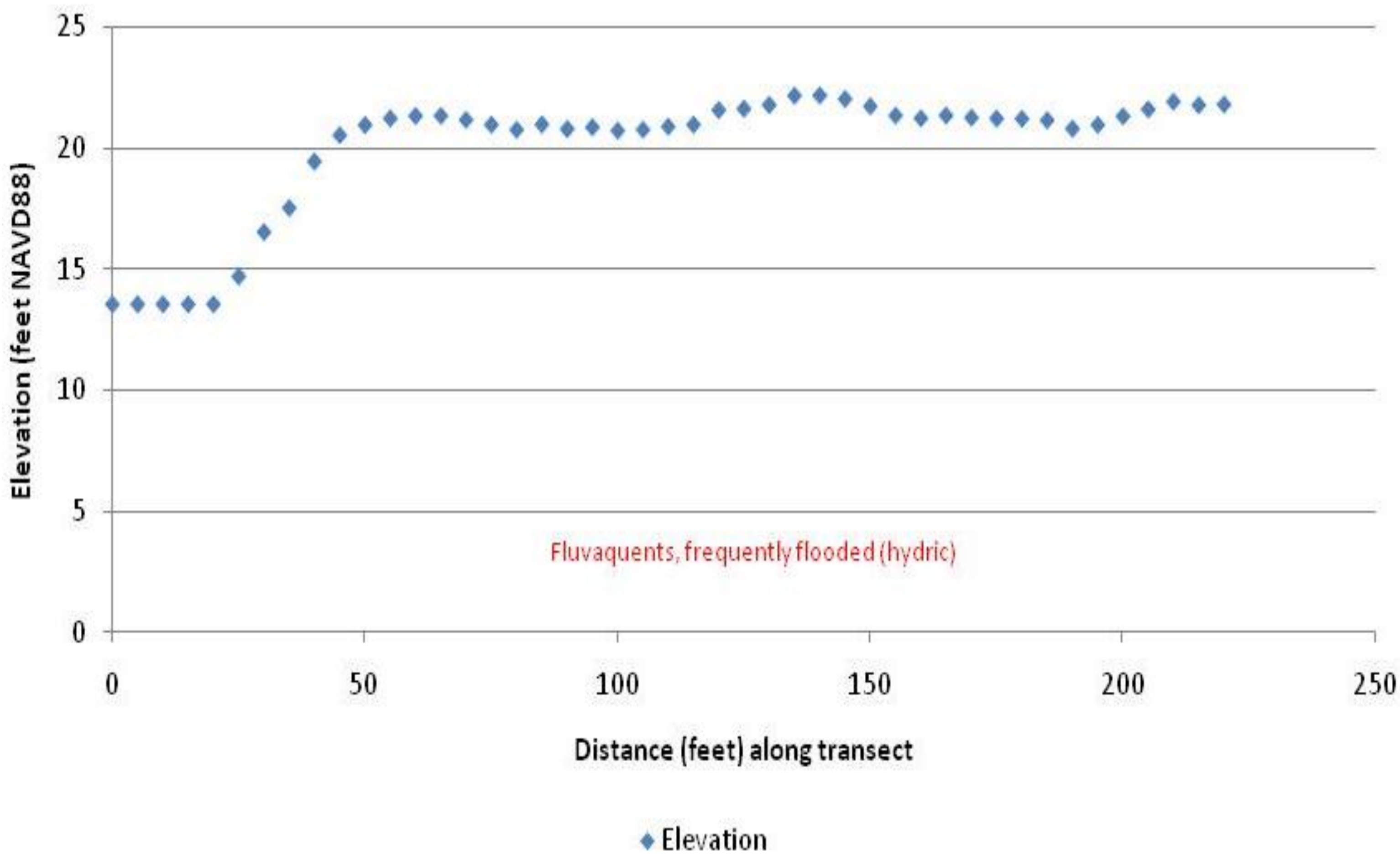


Figure 53. Extent of Vegetation Classes and Soil Mapping Units along Transect F along the Santa Fe River.

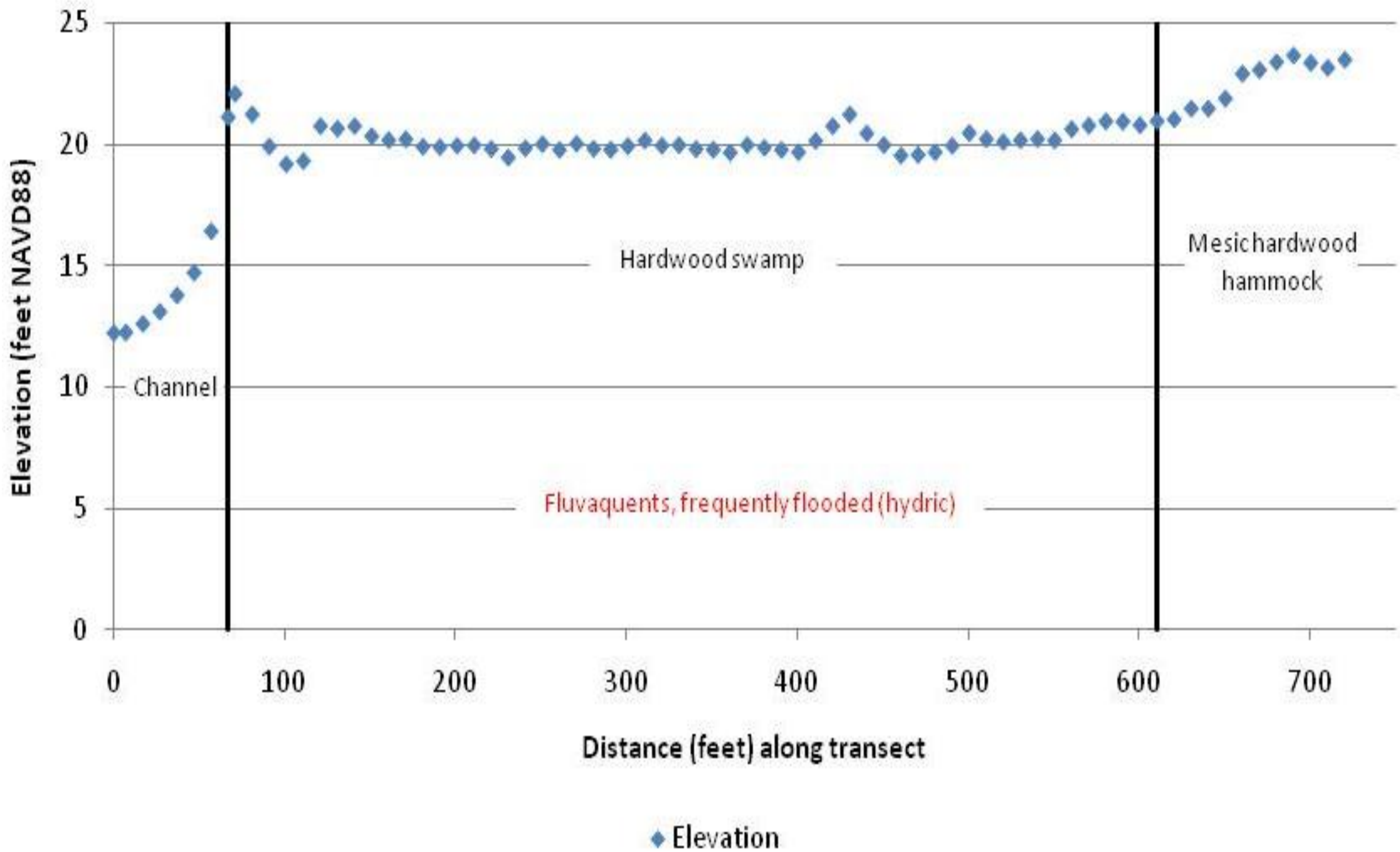


Figure 54. Extent of Vegetation Classes and Soil Mapping Units along Transect J along the Santa Fe River.

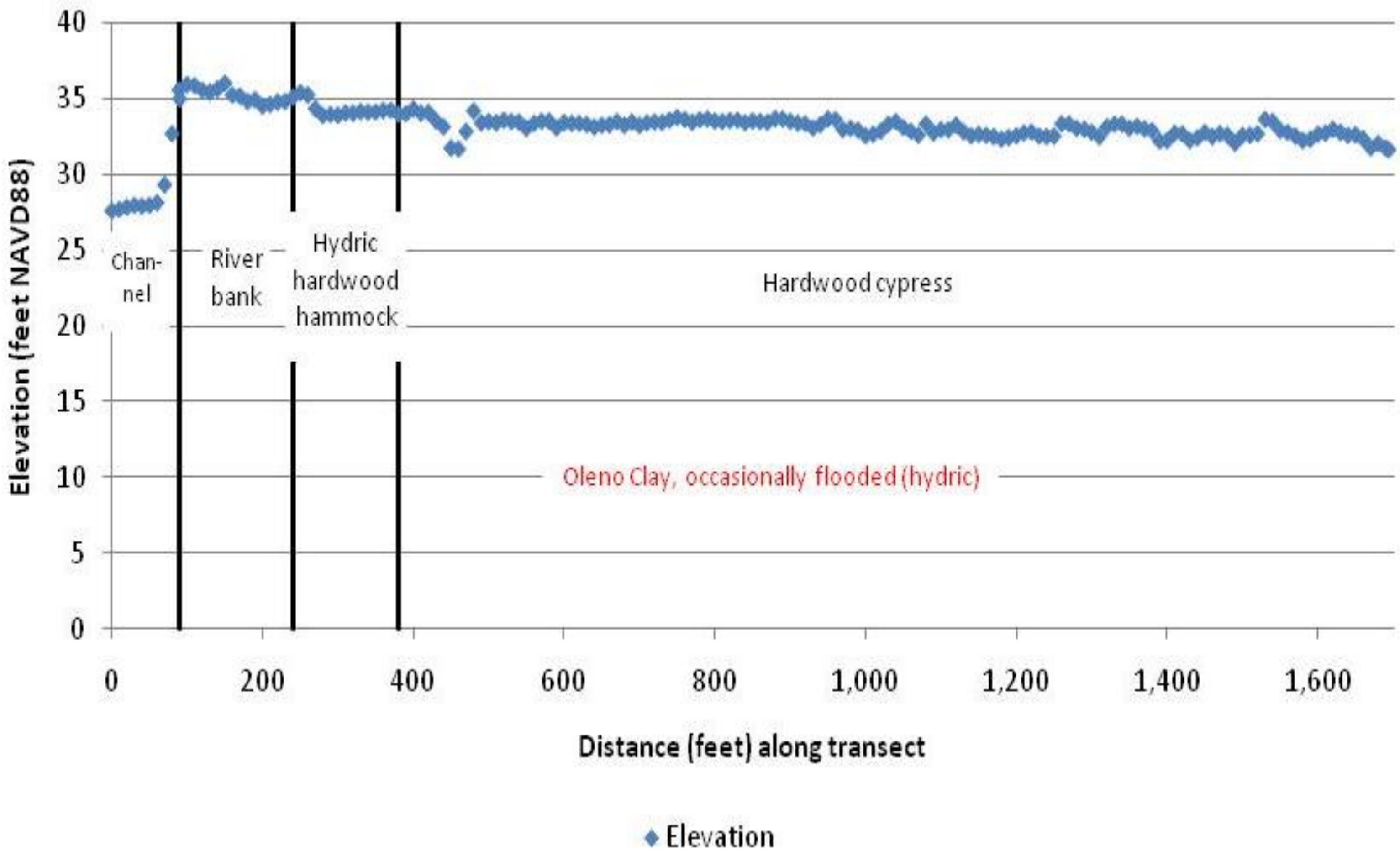


Figure 55. Extent of Vegetation Classes and Soil Mapping Units along Transect K along the Santa Fe River.

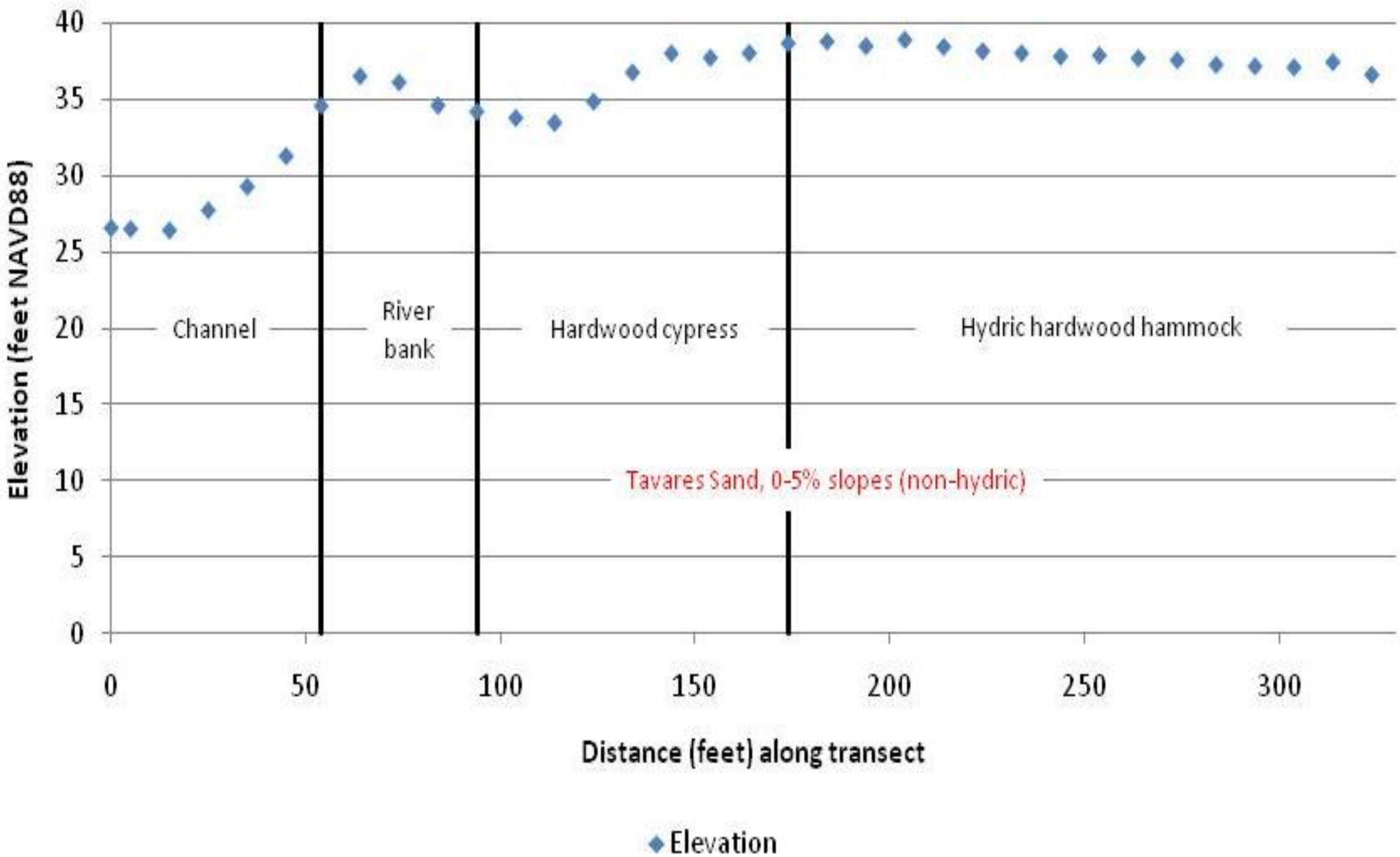


Figure 56. Extent of Vegetation Classes and Soil Mapping Units along Transect L along the Santa Fe River.

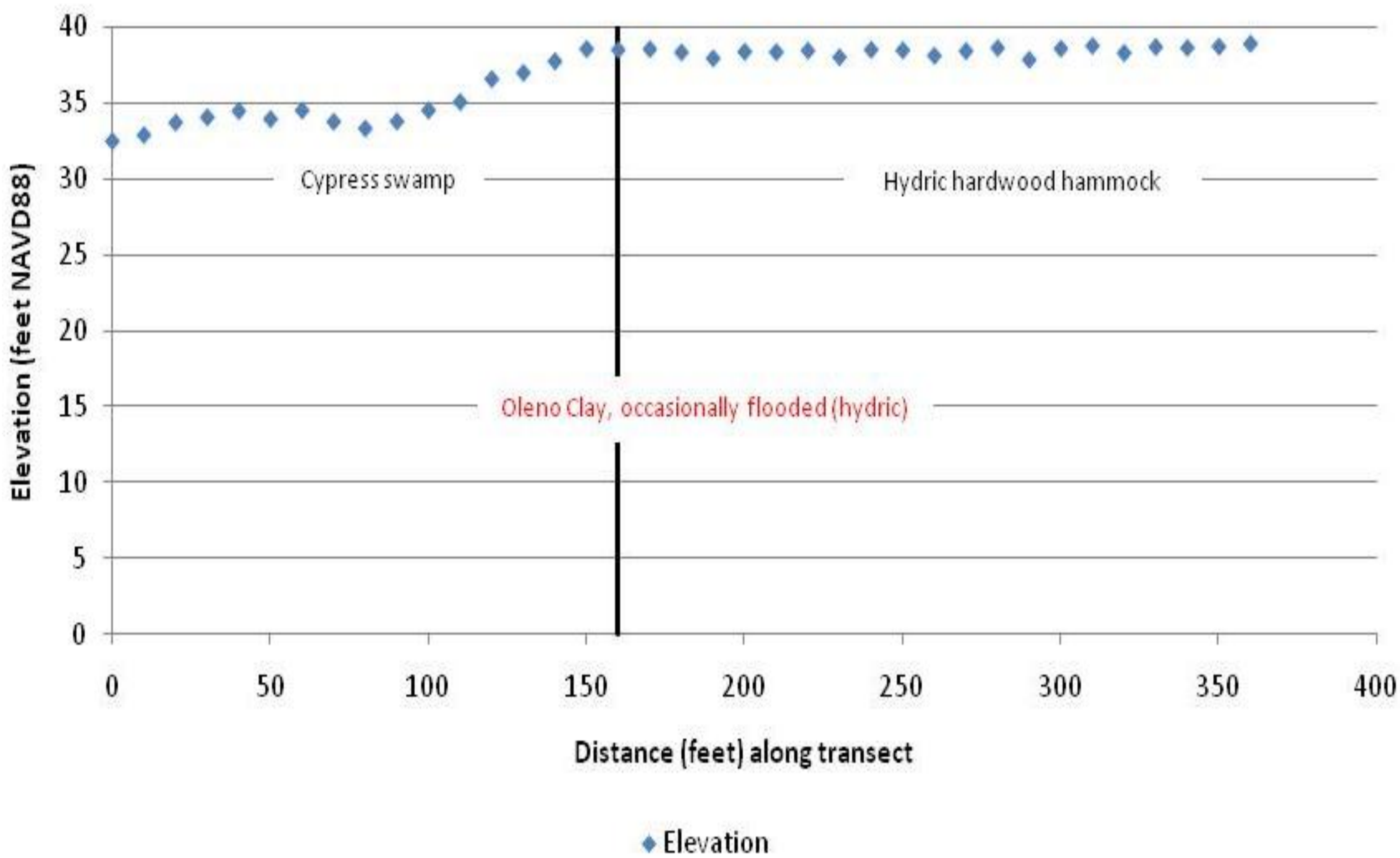


Figure 57. Extent of Vegetation Classes and Soil Mapping Units along Transect AA (downstream) along the Ichetucknee River.

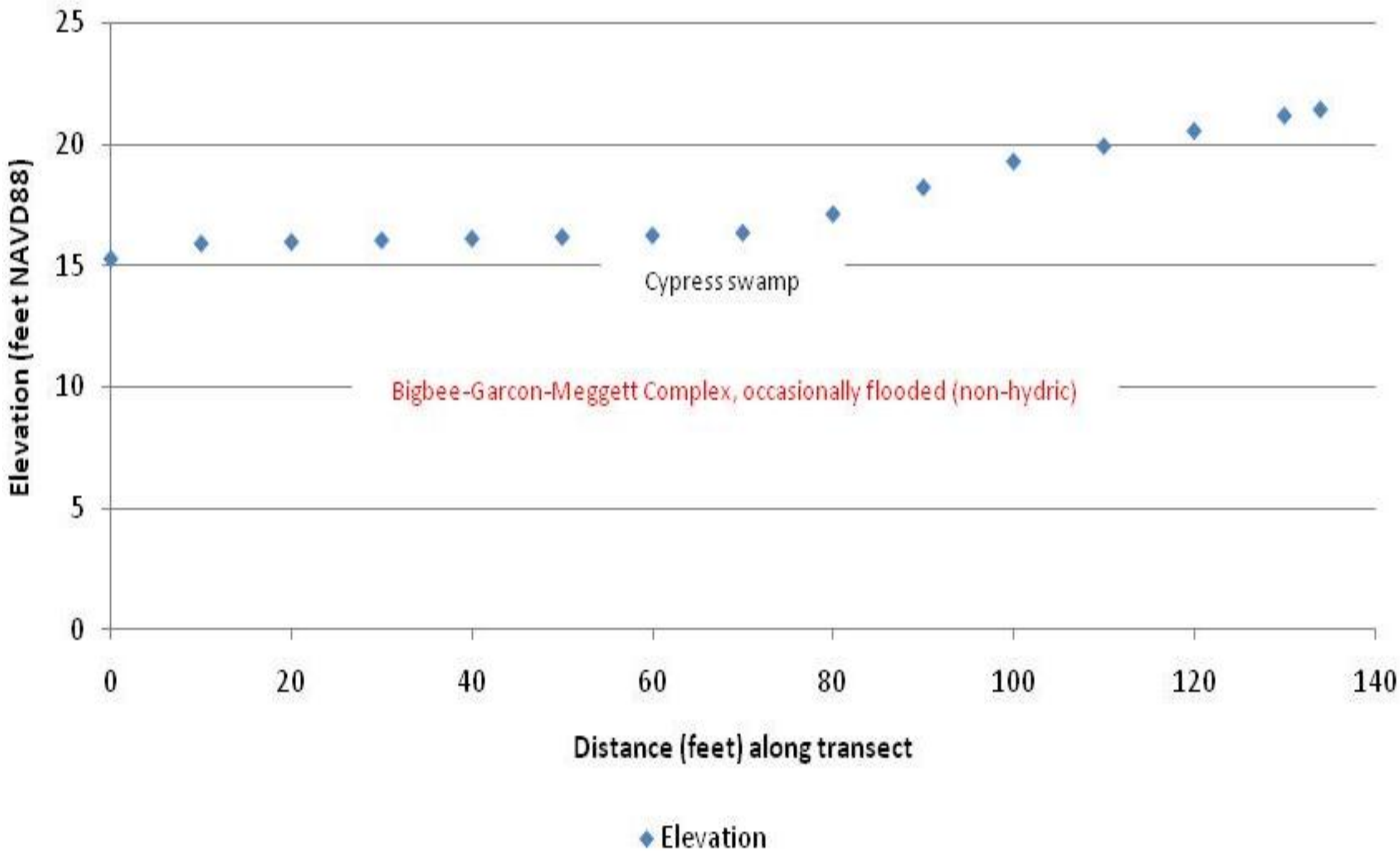


Figure 58. Extent of Vegetation Classes and Soil Mapping Units along Transect AA (upstream) along the Ichetucknee River.

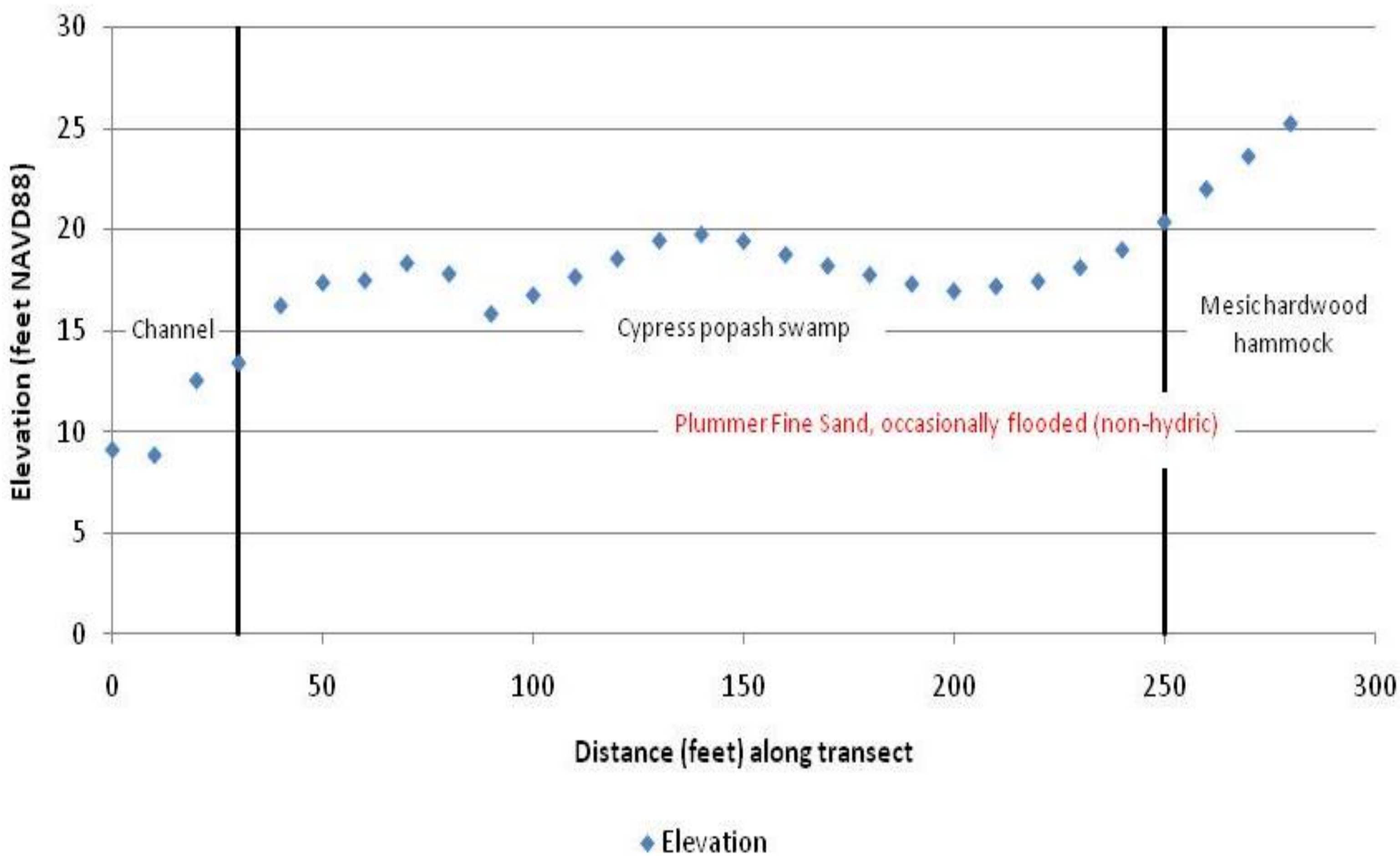


Figure 59. Extent of Vegetation Classes and Soil Mapping Units along Transect BB (west side) along the Ichetucknee River.

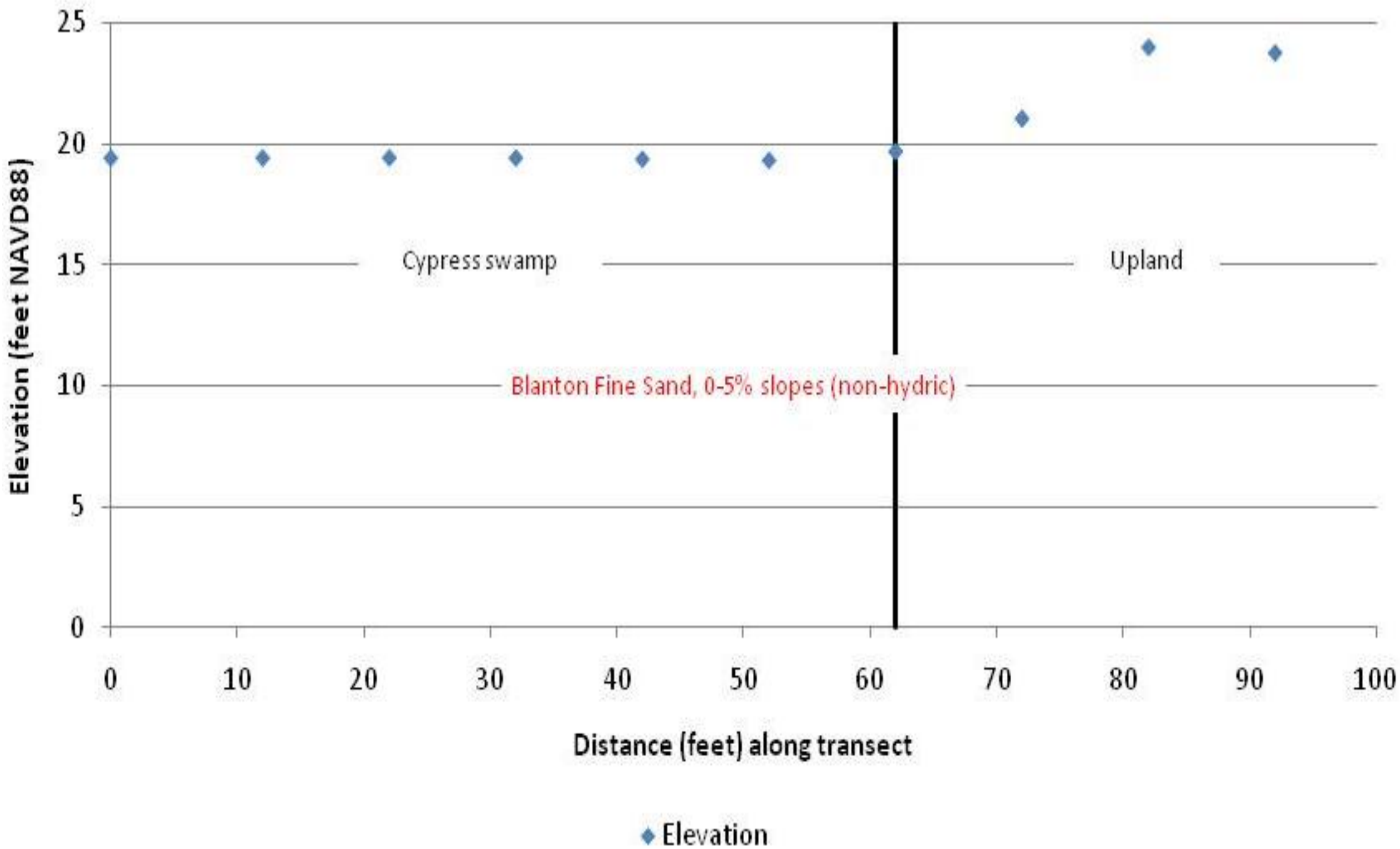
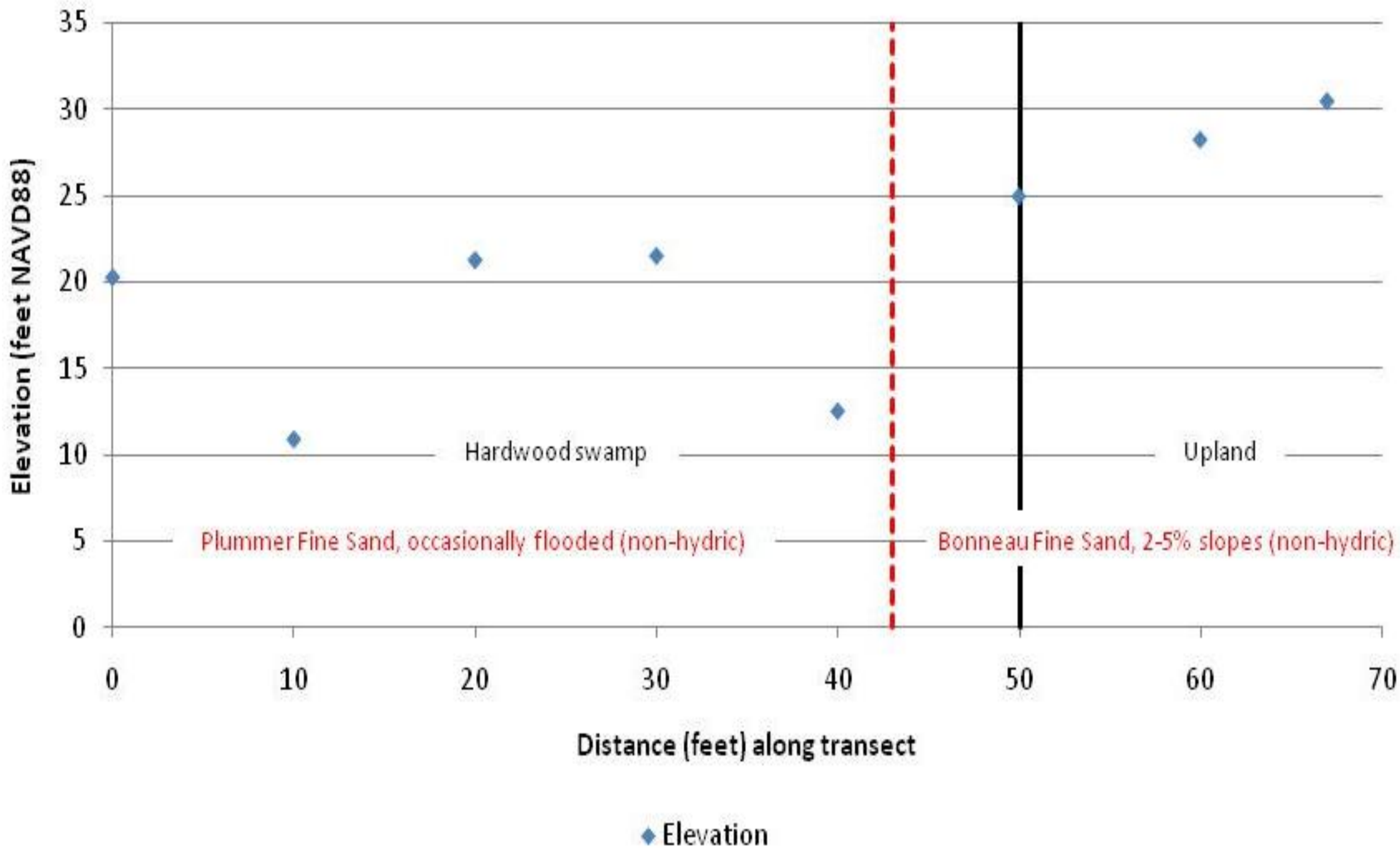


Figure 60. Extent of Vegetation Classes and Soil Mapping Units along Transect BB (east side) along the Ichetucknee River.



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