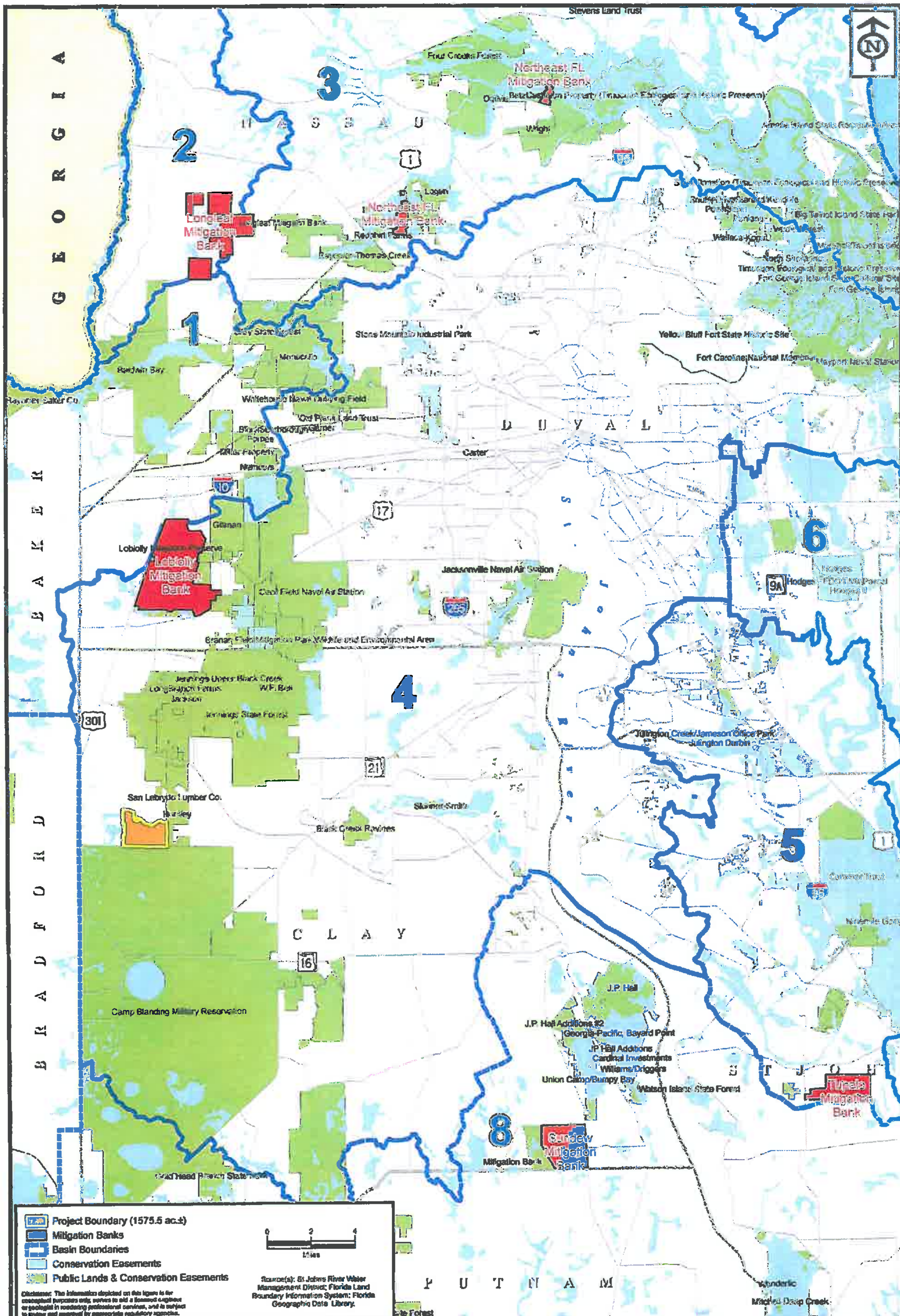

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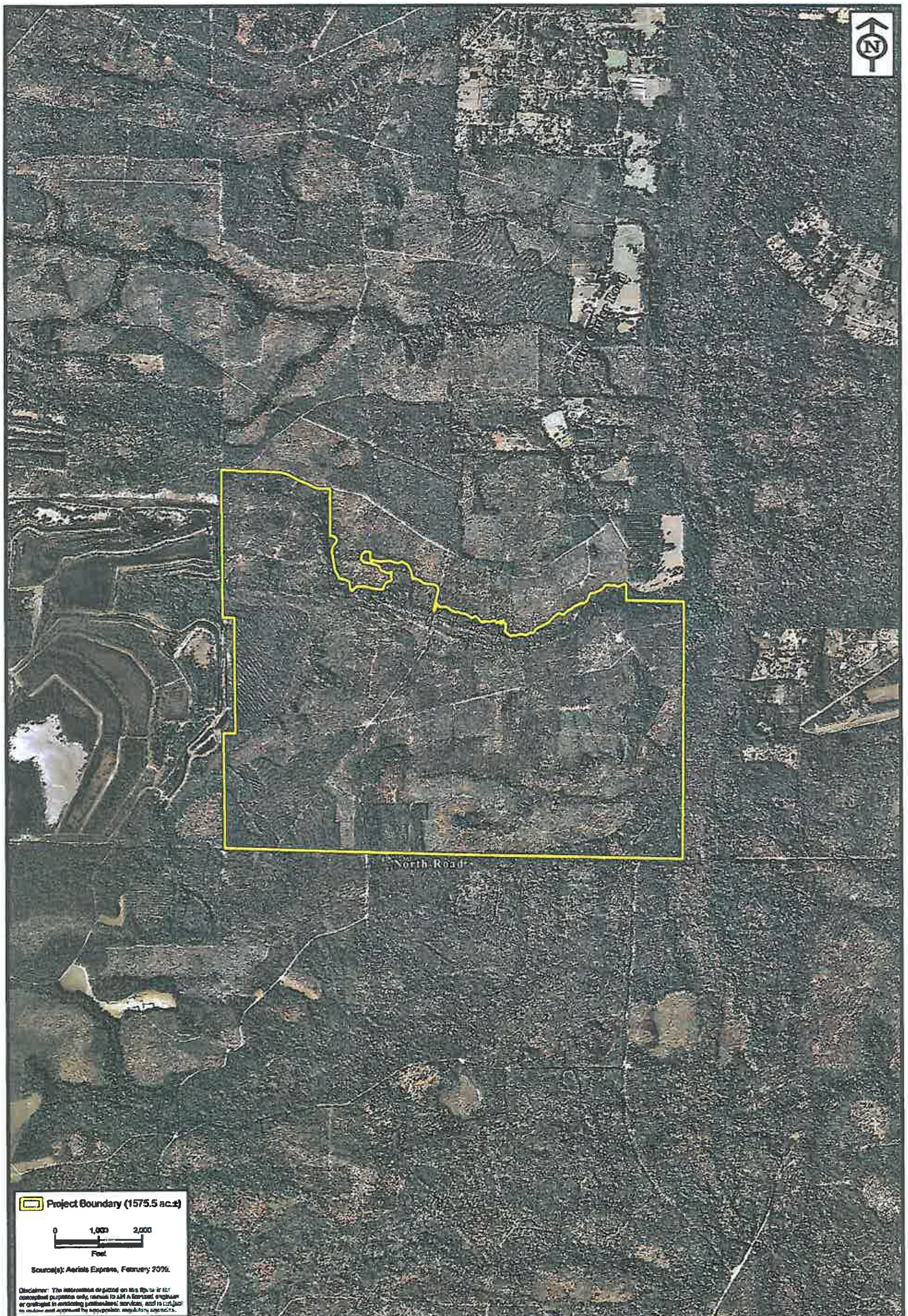
Project Location
Highlands Ranch Mitigation Bank
Clay County, Florida

Project:	EJ07352.05
Date:	Oct. 2009
Drwn/Chkd:	PG/JRN
Figure:	1



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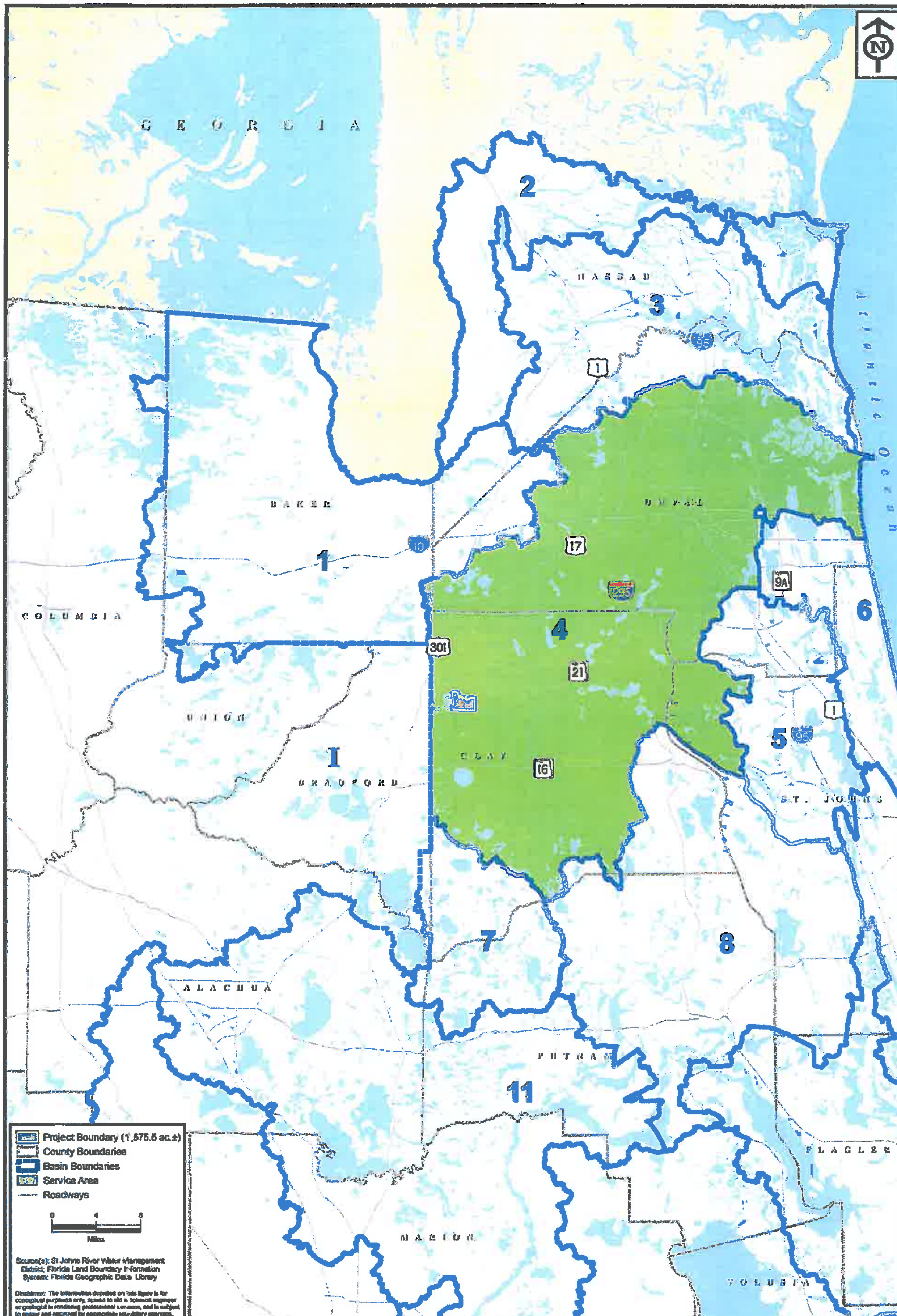
2009 Aerial Photograph

Highlands Ranch Mitigation Bank

Clay County, Florida

Project:	EJ07352.05
Date:	Oct. 2009
Drwn/Chkd:	PG/JRN
Figure:	2



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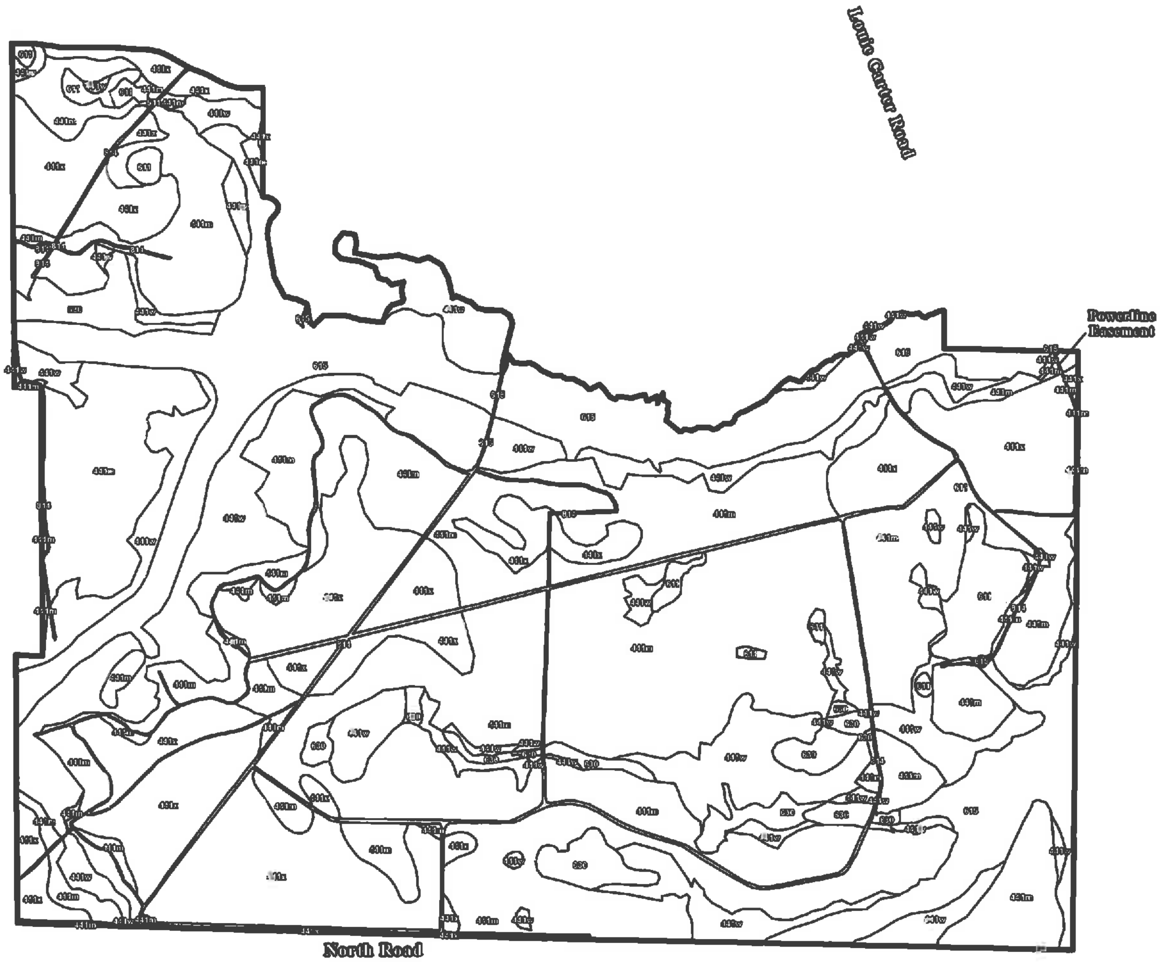
Service Area

Highlands Ranch Mitigation Bank

Clay County, Florida

Project:	EJ07352.05
Date:	Oct. 2009
Drwn/Chkd:	PG/JRN
Figure:	3



- Project Boundary (1575.49 ac.±)
- 441m, Mesic Pine Plantation (699.21 ac.±)
- 441w, Wet Pine Plantation (260.30 ac.±)
- 441x, Xeric Pine Plantation (291.69 ac.±)
- 611, Bay Swamps (29.85 ac.±)
- 615, Stream and Lake Swamps (Bottomland) (211.43 ac.±)
- 630, Wetland Forested Mixed (50.41 ac.±)
- 814, Trail Road (32.60 ac.±)
- Powerline Easement

0 600 1,200
Feet

Source(s): Florida Land Use, Cover and Forms Classification System (FDOT).

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Existing Site Conditions

Highlands Ranch Mitigation Bank

Clay County, Florida

Project:	EJ07352.05
Date:	Oct. 2011
Drwn/Chkd:	JRN/BAA
Figure:	4

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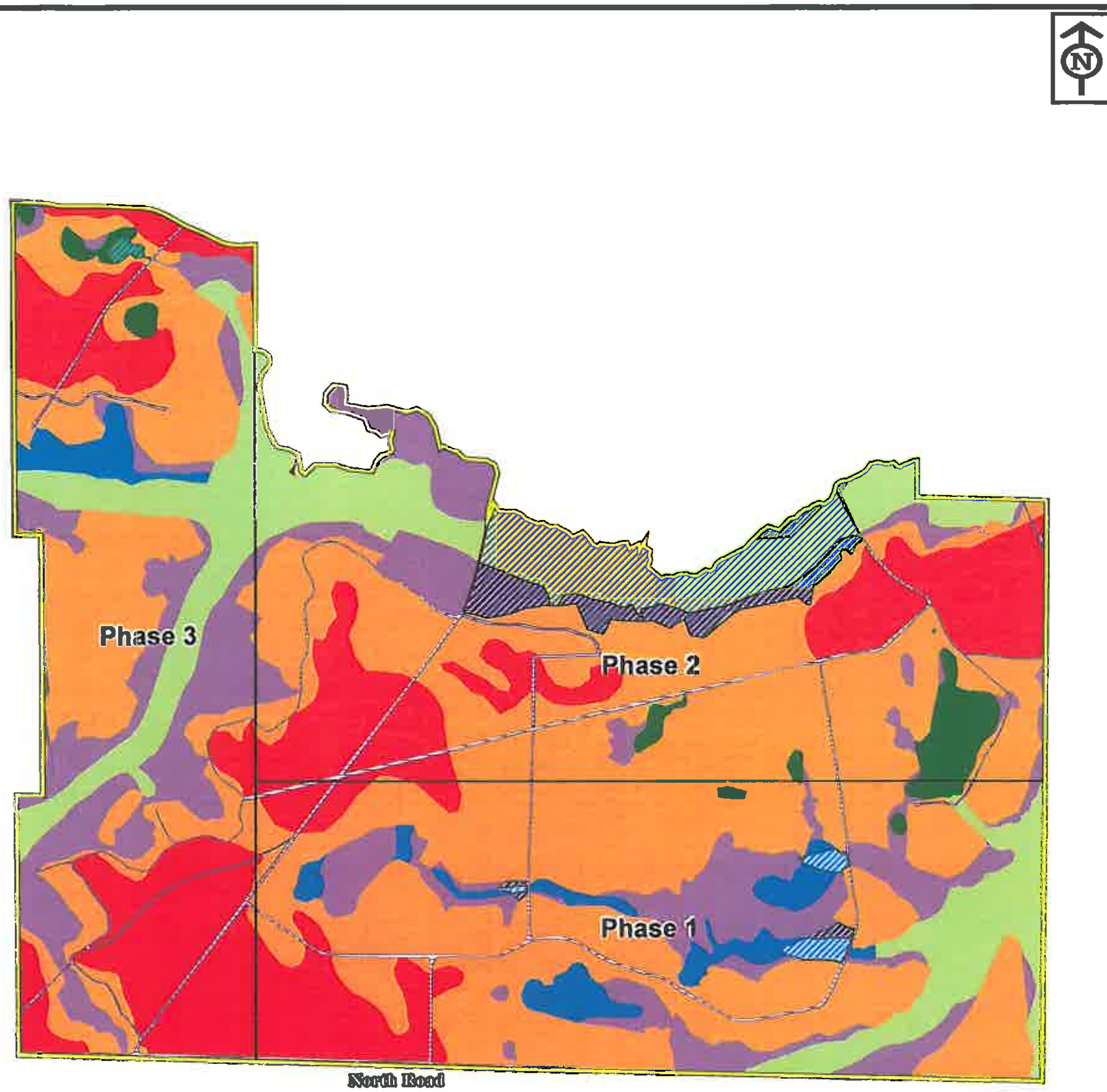

Project Boundary (1,575.5 ac.±)
Phase Boundary

Phase 1
- U1, Upland Restoration of Longleaf Pine/Xeric Oak (441x) (52.12 ac.±)
- U2, Upland Restoration of Mesic Pine Flatwoods (441m) (305.13 ac.±)
- W1, Vegetative Enhancement of Wet Pine Flatwoods (441w) (91.55 ac.±)
- W2, Vegetative and Hydrologic Enhancement of Wet Pine Flatwoods (441w) (1.65 ac.±)
- W3, Wetland Preservation of Bay Swamps (611) (3.70 ac.±)
- W5, Wetland Preservation of Stream and Lake Swamps (615) (52.88 ac.±)
- W7, Vegetative Enhancement of Wetland Forested Mixed (630) (31.58 ac.±)
- W8, Vegetative and Hydrologic Enhancement of Wetland Forested Mixed (630) (5.24 ac.±)
- Trail Road, Electrical Easement and Structures (10.70 ac.±)

Phase 2
- U1, Upland Restoration of Longleaf Pine/Xeric Oak (441x) (111.32 ac.±)
- U2, Upland Restoration of Mesic Pine Flatwoods (441m) (234.46 ac.±)
- W1, Vegetative Enhancement of Wet Pine Flatwoods (441w) (51.83 ac.±)
- W2, Vegetative and Hydrologic Enhancement of Wet Pine Flatwoods (441w) (20.75 ac.±)
- W3, Wetland Preservation of Bay Swamps (611) (18.25 ac.±)
- W5, Wetland Preservation of Stream and Lake Swamps (615) (50.79 ac.±)
- W6, Hydrologic Enhancement of Stream and Lake Swamps (615) (46.69 ac.±)
- W9, Trail Road Restoration (615) (0.58 ac.±)
- Trail Road, Electrical Easement and Structures (12.75 ac.±)

Phase 3
- U1, Upland Restoration of Longleaf Pine/Xeric Oak (441x) (128.25 ac.±)
- U2, Upland Restoration of Mesic Pine Flatwoods (441m) (159.62 ac.±)
- W1, Vegetative Enhancement of Wet Pine Flatwoods (441w) (94.52 ac.±)
- W3, Wetland Preservation of Bay Swamps (611) (6.33 ac.±)
- W4, Hydrologic Enhancement of Bay Swamps (611) (1.57 ac.±)
- W5, Wetland Preservation of Stream and Lake Swamps (615) (60.51 ac.±)
- W7, Vegetative Enhancement of Wetland Forested Mixed (630) (13.59 ac.±)
- Trail Road, Electrical Easement and Structures (9.15 ac.±)

0 600 1,200
Feet

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Proposed Phases

Highlands Ranch Mitigation Bank

Clay County, Florida

Project:	EJ07352.05
Date:	Nov. 2011
Drwn/Chkd:	JRN/BAA
Figure:	5

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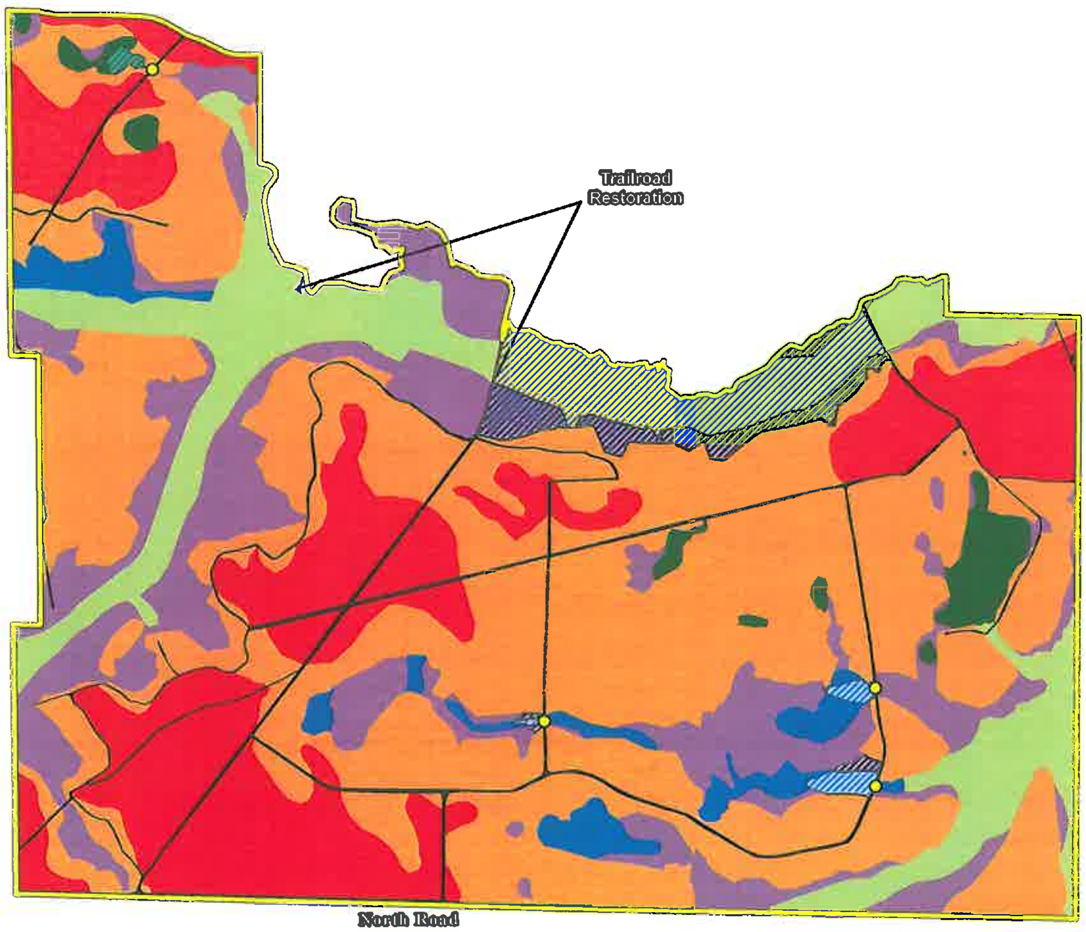

- Project Boundary (1575.5 ac.±)
- Culverts
- U1, Upland Restoration of Longleaf Pine/Xeric Oak (441x) (291.69 ac.±)
- U2, Upland Restoration of Mesic Pine Flatwoods (441m) (699.21 ac.±)
- W1, Vegetative Enhancement of Wet Pine Flatwoods (441w) (237.90 ac.±)
- W2, Vegetative and Hydrologic Enhancement of Wet Pine Flatwoods (441w) (22.40 ac.±)
- W3, Wetland Preservation of Bay Swamps (611) (28.28 ac.±)
- W4, Hydrologic Enhancement of Bay Swamps (611) (1.57 ac.±)
- W5, Wetland Preservation of Stream and Lake Swamps (615) (164.16 ac.±)
- W6, Hydrologic Enhancement of Stream and Lake Swamps (615) (46.69 ac.±)
- W7, Vegetative Enhancement of Wetland Forested Mixed (630) (45.17 ac.±)
- W8, Vegetative and Hydrologic Enhancement of Wetland Forested Mixed (630) (5.24 ac.±)
- W9, Trail Road Restoration (0.58 ac.±)
- Trail Road, Electrical Easement and Structures (32.60 ac.±)

0 600 1,200
Feet

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Proposed Site Conditions

Highlands Ranch Mitigation Bank

Clay County, Florida

Project:	EJ07352.05
Date:	Nov. 2011
Drwn/Chkd:	JRN/BAA
Figure:	6

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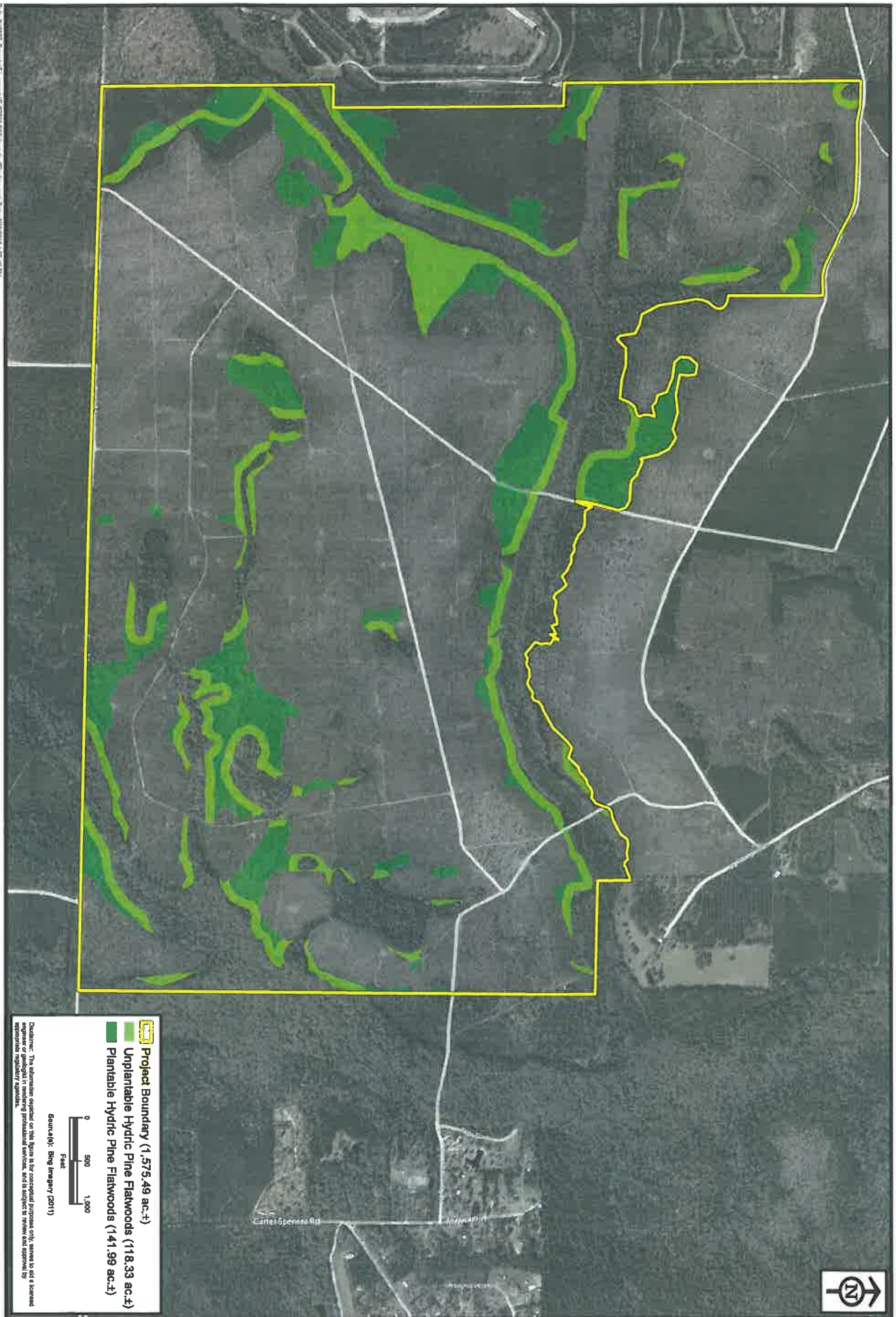

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Longleaf Planting Areas - Hydric Pine Flatwoods

Highlands Ranch Mitigation Bank

Clay County, Florida

Project:	EJ07352.09
Date:	Jul. 2012
Drwn/Chkd:	JRN/BAA
Figure:	1

Attachment 1

Executive Summary
Highlands Mitigation Bank
Hydrologic Improvement Analysis
Clay County, Florida

The Highlands Mitigation Bank is located in Clay County, east of US-301, west of CR-218, north of North Road, and south of Louie Carter Road. The Highlands Mitigation Bank is approximately 1,575 +/- acres and is primarily pine flat woods with several wetland systems located in each of the 6 separate drainage basins. The site has significant topographical relief across the project boundary falling approximately 90 feet in the northeasterly direction towards Boggy Branch Creek. Boggy Branch is the direct outfall for the subject property. Boggy Branch is a significant tributary of the North Fork of Black Creek. Published FEMA flood elevations are available for the intersection of Boggy Branch and North Fork creeks.

Highlands Mitigation Bank has 6 separate and distinct drainage basins. While the boundary for Highlands Mitigation Bank is approximately 1,575 +/- acres, the offsite contributory area adds a significant amount of acreage draining through the project boundary. The total area included (offsite + onsite) for this drainage analysis totals 4,874 +/-. Individual basin acreages are listed below.

Each drainage basin has an active wetland system defined within it. Several of these wetland systems cross from one basin to another through a wetland crossing. These crossings are generally areas of concentrated storm water discharges in which drainage is being controlled and facilitated with bridge and culvert crossings. Each wetland crossing has been identified with the phonetic alphabet (Alpha, Bravo, Charlie, Delta, and Echo). The purpose of this hydrologic analysis is to demonstrate that modifications to each of the wetland crossings will provide a measurable hydrologic benefit to the wetland contained within the basin. Measurable hydrologic benefit in this analysis was determined by comparing the pre-improvement and post-improvement changes in upstream water surface elevations and comparing the pre-improvement and post-improvement changes in flooded areas associated with any increase in upstream flood depth.

Data was collected to determine the extent of each drainage basin, stage area relationship of each basin and wetland system, and the wetland crossing data. The data available at the time of this analysis was limited to USGS Quadrangle Maps, Infrared Aerial Photography, FEMA Flood Maps and Studies, LIDAR Data, and publicly available GIS data. The data collected from the publicly available maps and data was then used to setup a drainage model with ICPR.

Highlands Mitigation Bank
Basin & Wetland Crossing Summary

Basin No.	Associated Wetland	Wetland Crossing	Acerage
1	Wet 1	*Alpha*	409.5
2	Wet 2	*Bravo*	1331.5
3	Wet 3	*Charlie*	186.4
4	Wet 4	*Delta & Echo*	220.3
5	Wet 5	-	2405.5
6	Wet 6	-	321.2
Total			***4874.4***

Basin #1 (Basin 1; Wetland 1; Wetland Crossing "Alpha")

Pre-Improvement Conditions

Basin #1 is approximately 409.5 acres in size. Basin 1 has a large offsite contributory area, and is predominantly pine flat woods with a defined wetland located within the interpreted storm water discharge path. Storm water runoff travels within the Wetland 1 system. The storm water in Wetland #1 crosses from Basin 1 into Basin 2 at wetland crossing "Alpha". Alpha Crossing is a small wooden bridge, the physical geometry of the bridge crossing and adjacent trail road predominantly control the upstream wetland water surface elevation. Due to the large contributory drainage area, a peaking factor of 256 was used commensurate of the existing land cover, time of concentration path, and flow of storm water through wetland systems. Basin #1 contributes storm water runoff to Wetland #1. Wetland #1 is established as a stage-area node; elevation and area data was obtained from Quad maps. With the existing bridge crossing established as the link between the Wetland #1 node to Wetland #2 node, the 25year-24hour design storm was run and water surface elevations recorded for comparison with post-improvement conditions.

Post-Improvement Conditions

The proposed improvements to Wetland Crossing Alpha have been designed to increase the water surface elevation in the Wetland 1. With an increase in water surface elevation, the corresponding increase in flood area was also measured. Upstream flooding is contained onsite and does not contribute to any detrimental offsite flooding problems. The proposed improvements to Alpha Crossing are to remove the existing bridge crossing, install a control structure with associated culverts, and raise the elevation of the trail road. These proposed changes were then modeled with the 25year-24hour design storm. Results were recorded and compared with the pre-improvement conditions.

Basin #2 (Basin 2; Wetland 2; Wetland Crossing "Bravo")

Pre-Improvement Conditions

Basin #2 is approximately 1331.5 acres in size. Basin 2 has a large offsite contributory area, and is predominantly pine flat woods with a defined wetland located within the interpreted storm water discharge path. Storm water runoff travels within the Wetland 2 system. The storm water in Wetland #2 crosses from Basin 2 into Basin 6 at wetland crossing "Bravo". Bravo Crossing is a large wooden bridge; the physical geometry of the bridge crossing and adjacent trail road predominantly control the upstream wetland water surface elevation. Due to the large contributory drainage area, a peaking factor of 256 was used commensurate of the existing land cover, time of concentration path, and flow of storm water through wetland systems. Basin #2 contributes storm water runoff to Wetland #2. Wetland #2 is established as a stage-area node; elevation and area data was obtained from Quad maps. With the existing bridge crossing established as the link between the Wetland #2 node to Wetland #6 node, the 25year-24hour design storm was run and water surface elevations recorded for comparison with post-improvement conditions.

Post-Improvement Conditions

The proposed improvements to Wetland Crossing Bravo have been designed to decrease the water surface elevation in the Wetland 2, and allow a more unrestricted flow of storm water between Basins 2 and 6. The intent of changes to crossing Bravo are to provide increased down stream storm water discharges, improving the downstream wetland hydraulic function of Wetland 6. The proposed improvements to Bravo Crossing are to remove the existing bridge crossing and lower the elevation of the adjacent trail road. These proposed changes were then modeled with the 25year-24hour design storm. Results were recorded and compared with the pre-improvement conditions.

Basin #3 (Basin 3; Wetland 3; Wetland Crossing "Charlie")

Pre-Improvement Conditions

Basin #3 is approximately 186.4 acres in size. Basin 3 is totally internal to the project boundaries of the Highlands Mitigation Bank, and is predominantly pine flat woods with a defined-wetland located within the interpreted storm water discharge path. Storm water runoff travels within the Wetland 3 system. The storm water in Wetland #3 crosses from Basin 3 into Basin 4 at wetland crossing "Charlie". Charlie Crossing is dual culvert crossing; the physical geometry of the culvert crossing and adjacent trail road predominantly control the upstream wetland water surface elevation. Due to the large contributory drainage area, a peaking factor of 256 was used commensurate of the existing land cover, time of concentration path, and flow of storm water through wetland systems. Basin #3 contributes storm water runoff to Wetland #3. Wetland #3 is established as a stage-area node; elevation and area data was obtained from Quad maps. With the existing bridge crossing established as the link between the Wetland #3 node to Wetland #4 node, the 25year-24hour design storm was run and water surface elevations recorded for comparison with post-improvement conditions.

Post-Improvement Conditions

The proposed improvements to Wetland Crossing Alpha have been designed to increase the water surface elevation in the Wetland 3. With an increase in water surface elevation, the corresponding increase in flood area was also measured. Upstream flooding is contained onsite and does not contribute to any detrimental offsite flooding problems. The proposed improvements to Charlie Crossing are to remove the existing culverts, install a control structure with associated new culverts, and raise the elevation of the trail road. These proposed changed were then modeled with the 25year-24hour design storm. Results were recorded and compared with the pre-improvement conditions

Basin #4 (Basin 4; Wetland 4; Wetland Crossing "Delta and Echo")

Pre-Improvement Conditions

Basin #4 is approximately 220.3 acres in size. Basin 3 is totally internal to the project boundaries of the Highlands Mitigation Bank, and is predominantly pine flat woods with a defined wetland located within the interpreted storm water discharge path. Storm water runoff travels within the Wetland 4 system. The storm water in Wetland #4 crosses from Basin 4 into Basin 5 at two wetland crossings named "Delta" and "Echo". Both Delta and Echo Crossings are small wooden

bridges; the physical geometry of the bridge crossing and adjacent trail road predominantly control the upstream wetland water surface elevation. Due to the large contributory drainage area, a peaking factor of 256 was used commensurate of the existing land cover, time of concentration path, and flow of storm water through wetland systems. Basin #4 contributes storm water runoff to Wetland #4. Wetland #4 is established as a stage-area node; elevation and area data was obtained from Quad maps. With the existing bridge crossings established as the link between the Wetland #4 node to Wetland #5 node, the 25year-24hour design storm was run and water surface elevations recorded for comparison with post-improvement conditions.

Post-Improvement Conditions

The proposed improvements to Wetland Crossing Delta and Echo have been designed to increase the water surface elevation in the Wetland 4. With an increase in water surface elevation, the corresponding increase in flood area was also measured. Upstream flooding is contained onsite and does not contribute to any detrimental offsite flooding problems. The proposed improvements to the Delta and Echo Crossings are to remove the existing bridge crossing, install a control structure with associated culverts, and raise the elevation of the trail road. These proposed changes were then modeled with the 25year-24hour design storm. Results were recorded and compared with the pre-improvement conditions.

Basin #5 & Basin #6 (Basin 5; Wetland 5; Basin 6; Wetland 6)

Pre-Improvement Conditions

Basin #5 is approximately 2,405.5 acres in size. Basin 5 has a large offsite contributory area, and is predominantly pine flat woods with a defined wetland located within the interpreted storm water discharge path. Storm water runoff travels within the Wetland 5 system. Due to the large contributory drainage area, a peaking factor of 256 was used commensurate of the existing land cover, time of concentration path, and flow of storm water through wetland systems. Basin #5 contributes storm water runoff to Wetland #5. Wetland #5 is established as a stage-area node; elevation and area data was obtained from Quad maps. The 25year-24hour design storm was run and water surface elevations recorded for comparison with post-improvement conditions.

Basin #6 is approximately 321.2 acres in size. Basin 6 has a large offsite contributory area, and is predominantly pine flat woods with a defined wetland located within the interpreted storm water discharge path. Storm water runoff travels within the Wetland 6 system. Due to the large contributory drainage area, a peaking factor of 256 was used commensurate of the existing land cover, time of concentration path, and flow of storm water through wetland systems. Basin #5 contributes storm water runoff to Wetland #6. Wetland #6 is established as a stage-area node; elevation and area data was obtained from Quad maps. The 25year-24hour design storm was run and water surface elevations recorded for comparison with post-improvement conditions.

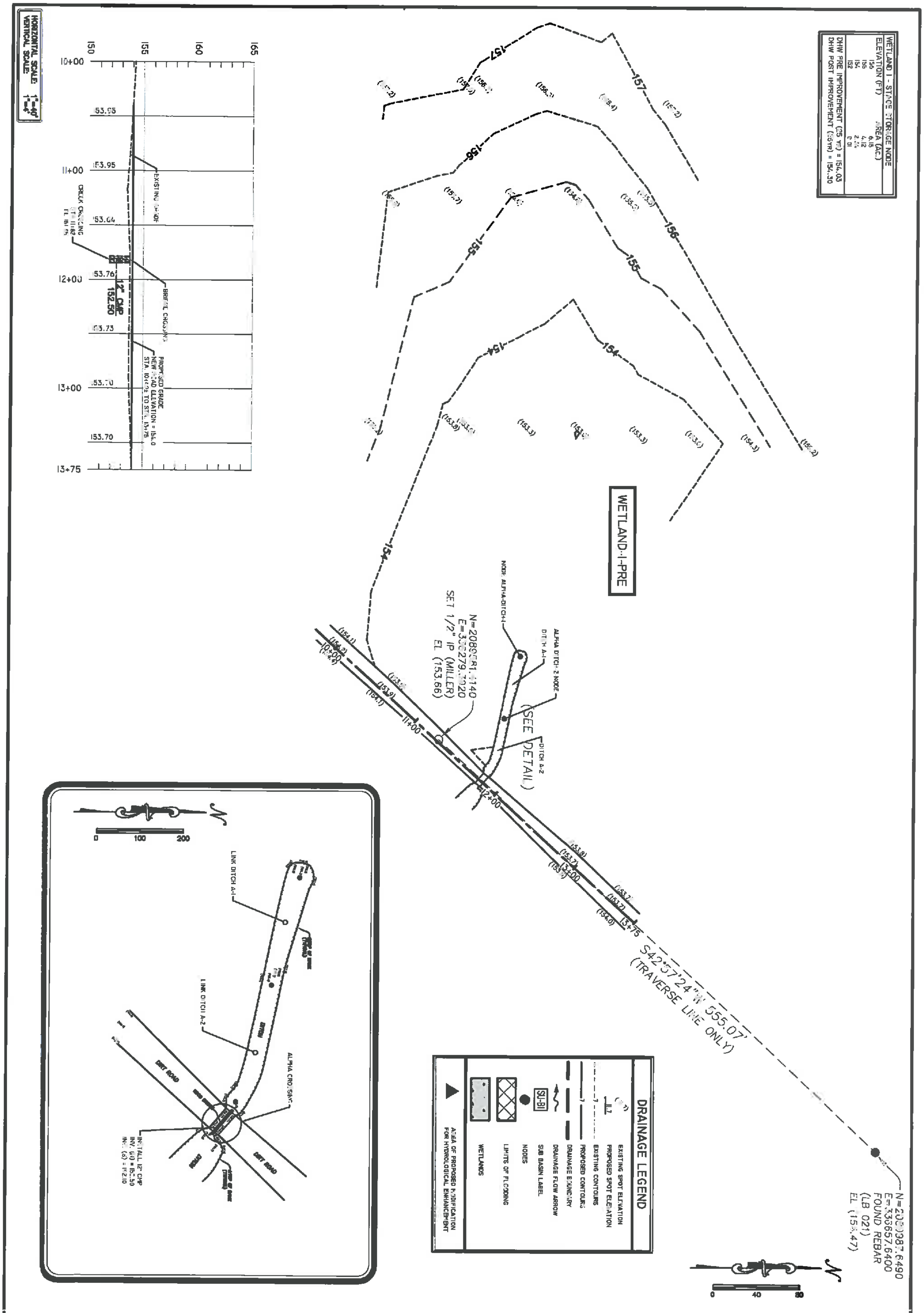
Post-Improvement Conditions

Wetland #5 and Wetland #6 are downstream nodes into which Wetlands #1, #2, #3, and #4 ultimately discharge into. There are no physical improvements proposed to these basins or wetland systems.

Pre / Post-Development Comparison Summary

		Pre-Development		Post-Development	
Critical Nodes	Node Description	Max Stage (ft) 25yr24hr	Max Flow (cfs) 25yr24hr	Max Stage (ft) 25yr24hr	Max Flow (cfs) 25yr24hr
Basin 1 - "ALPHA"					
WETLAND-1-PRE	Stage Storage Node for Wetland 1	154.04	58.93	154.33	26.33
ALPHA-DITCH-1	Wetland 1 Ditch Node	153.72	25.23	154.21	26.33
ALPHA-DITCH-2	Wetland 1 Ditch Node	153.29	25.21	154.11	26.33
Basin 2 - "BRAVO"					
WETLAND-2-PRE	Stage Storage Node for Wetland 2	107.97	1074.29	107.86	1992.89
NODE B12	First Upstream Node from WET-2-PRE	114.23	1067.06	114.23	1067.14
Basin 3 - "CHARLIE"					
NODE C1-PRE	Wetland 3 Upstream Node	160.89	72.60	160.89	78.59
NODE C2-PRE	Wetland 3 Upstream Node	146.39	110.63	146.39	110.63
WETLAND-3-PRE	Stage Storage Node for Wetalnd 3	131.29	177.45	131.98	152.04
Basin 4 - "DELTA/ECHO"					
NODE-WETLAND-4-D-PRE	Stage Storage Node for Sub Area 4D	94.77	163.25	95.23	234.64
NODE-WETLAND-4-E-PRE	Stage Storage Node for Sub Area 4E	96.99	99.69	97.14	119.83
Basin-6					
NODE-WET6-UPSTREAM	Immediate Downstream Node from Basin 2	107.92	1066.48	107.85	1076.58
NODE-WET6-DOWNSTREAM	Downstream Node from Wet6-Upstream	95.39	1057.03	95.84	1060.25

				100yr24hr	25yr24hr	10yr24hr	MeanAnnual24hr
Basin 1 - "ALPHA"							
	WETLAND-1-PRE	Stage Storage Node for Wetland 1	*PRE*	154.05	154.04	153.93	153.61
			POST	154.36	154.33	154.14	154.03
	ALPHA-DITCH-1	Wetland 1 Ditch Node	*PRE*	153.73	153.73	153.61	153.30
			POST	154.22	154.21	154.10	154.02
	ALPHA-DITCH-2	Wetland 1 Ditch Node	*PRE*	153.30	153.30	153.12	152.65
			POST	154.11	154.11	154.07	154.02
Basin 2 - "BRAVO"							
	WETLAND-2-PRE	Stage Storage Node for Wetland 2	*PRE*	108.18	107.97	107.29	107.01
			POST	108.06	107.86	106.41	105.01
	NODE B12	First Upstream Node from WET-2-PRE	*PRE*	114.35	114.23	113.34	112.52
			POST	114.35	114.23	113.34	112.52
Basin 3 - "CHARLIE"							
	NODE C1-PRE	Wetland 3 Upstream Node	*PRE*	160.92	160.89	160.70	160.53
			POST	160.92	160.89	160.70	160.53
	NODE C2-PRE	Wetland 3 Upstream Node	*PRE*	146.44	146.39	146.06	145.76
			POST	146.44	146.39	146.06	145.76
	WETLAND-3-PRE	Stage Storage Node for Wetalnd 3	*PRE*	131.35	131.29	130.91	130.56
			POST	131.99	131.98	131.89	131.80
Basin 4 - "DELTA/ECHO"							
	NODE-WETLAND-4-D-PRE	Stage Storage Node for Sub Area 4D	*PRE*	94.87	94.77	93.67	92.74
			POST	95.25	95.23	95.13	95.02
	NODE-WETLAND-4-E-PRE	Stage Storage Node for Sub Area 4E	*PRE*	97.08	96.99	96.39	95.88
			POST	97.17	97.14	96.93	96.69
Basin-6							
	NODE-WET6-UPSTREAM	Immediate Downstream Node from Basin 2	*PRE*	108.14	107.92	106.41	105.00
			POST	108.05	107.85	106.40	105.00
	NODE-WET6-DOWNSTREAM	Downstream Node from Wet6-Upstream	*PRE*	95.57	95.39	94.12	93.00
			POST	96.10	95.84	94.13	92.98



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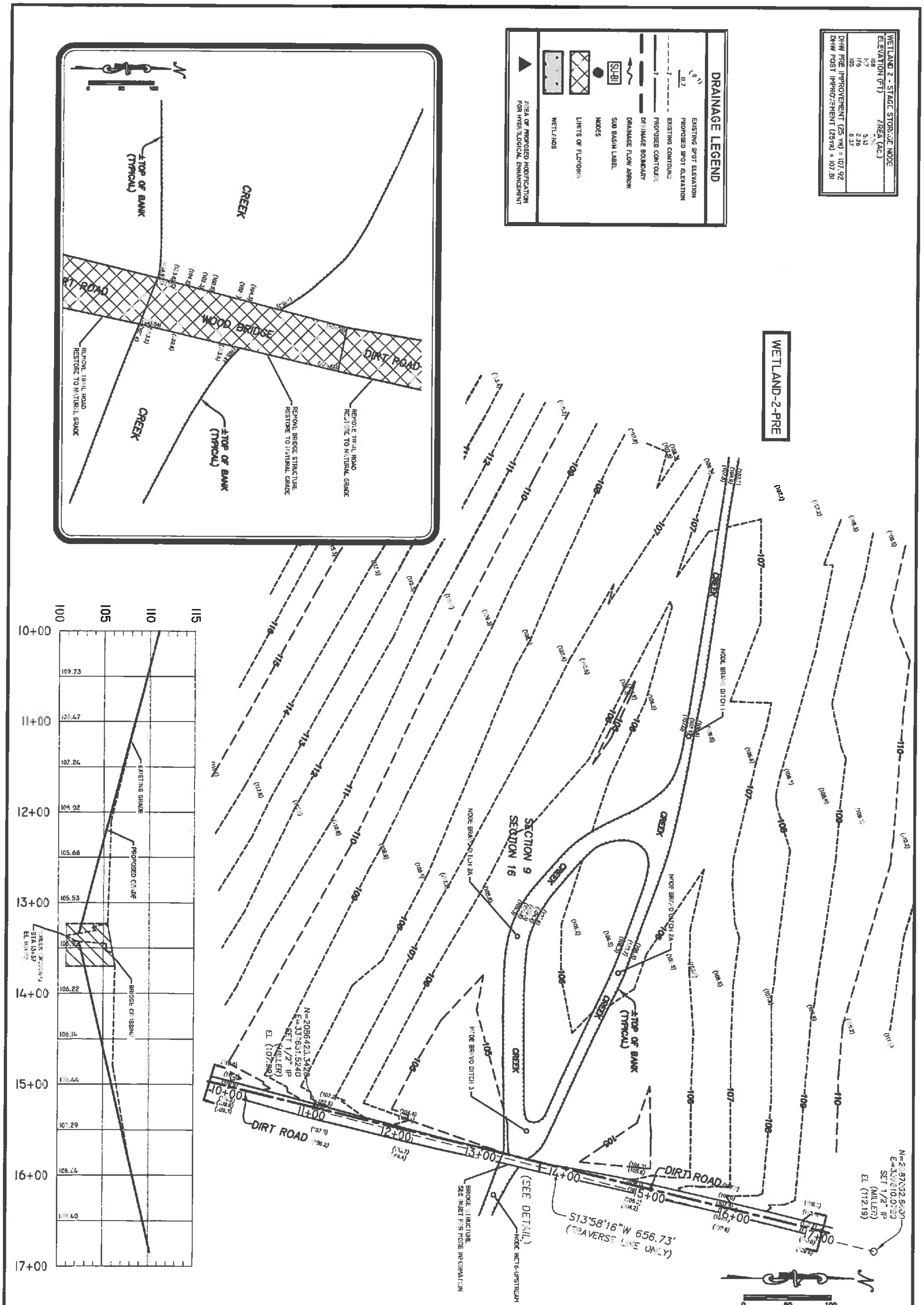
HIGHLANDS MITIGATION BANK
FOR
CRP/HLV HIGHLANDS RANCH, LLC
9803 OLD ST. AUGUSTINE RD, SUITE I
JACKSONVILLE, FL 32257

PROPOSED CROSSING (ALPHA) PLAN AND PROFILE

DATE: June 15, 2009

ERIC J. ALMOND, P.E.
FL# 59246

8

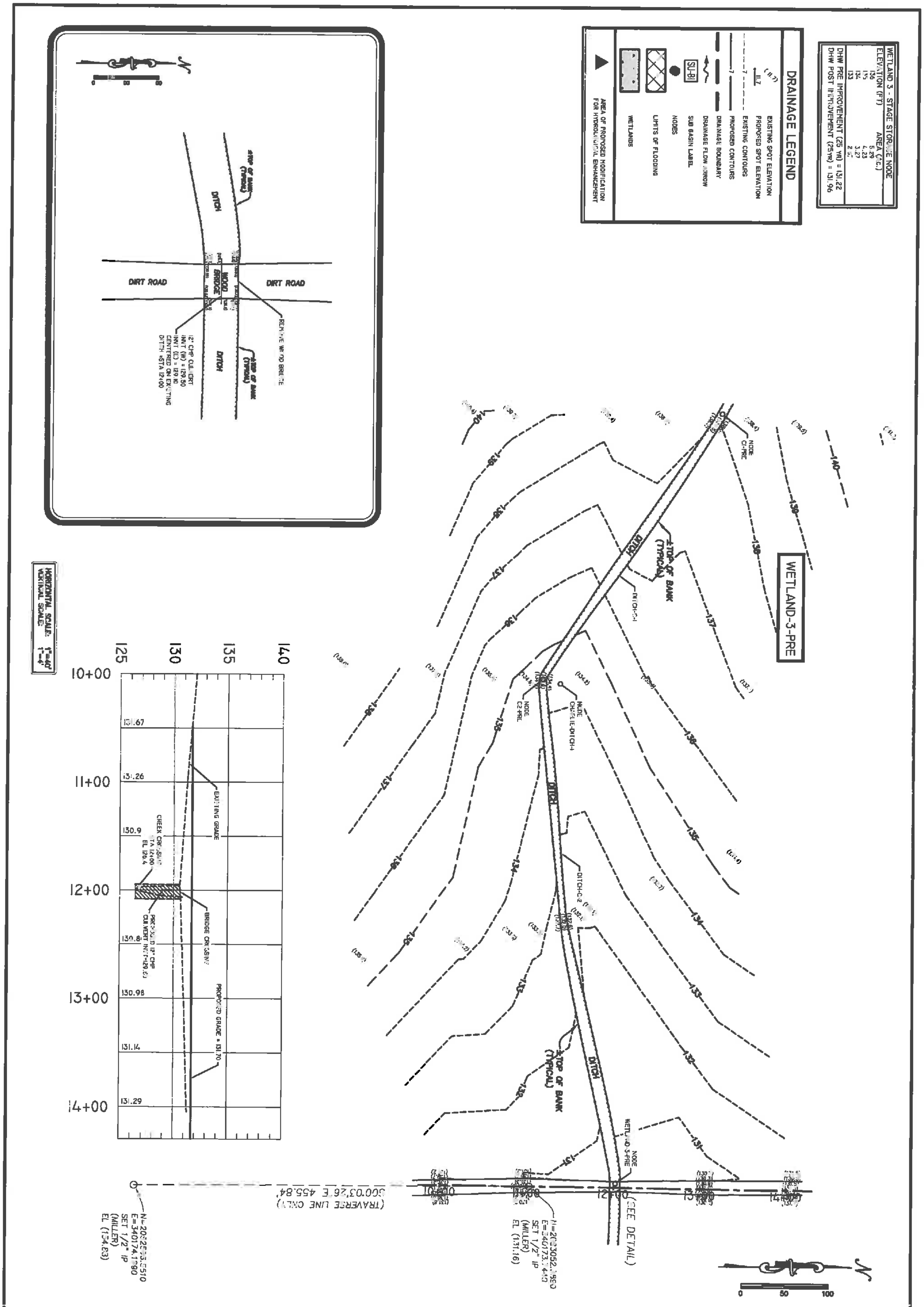


9	ALMOND ENGINEERING, P.A. 3609 HENDRICKS AVENUE JACKSONVILLE, FL 32207 (904) 306-0162 PHONE (904) 306-2185 FAX	HIGHLANDS MITIGATION BANK FOR CRP/HLV HIGHLANDS RANCH, LLC 9803 OLD ST. AUGUSTINE RD, SUITE I JACKSONVILLE, FL 32257	PROPOSED CROSSING (BRAVO) PLAN AND PROFILE

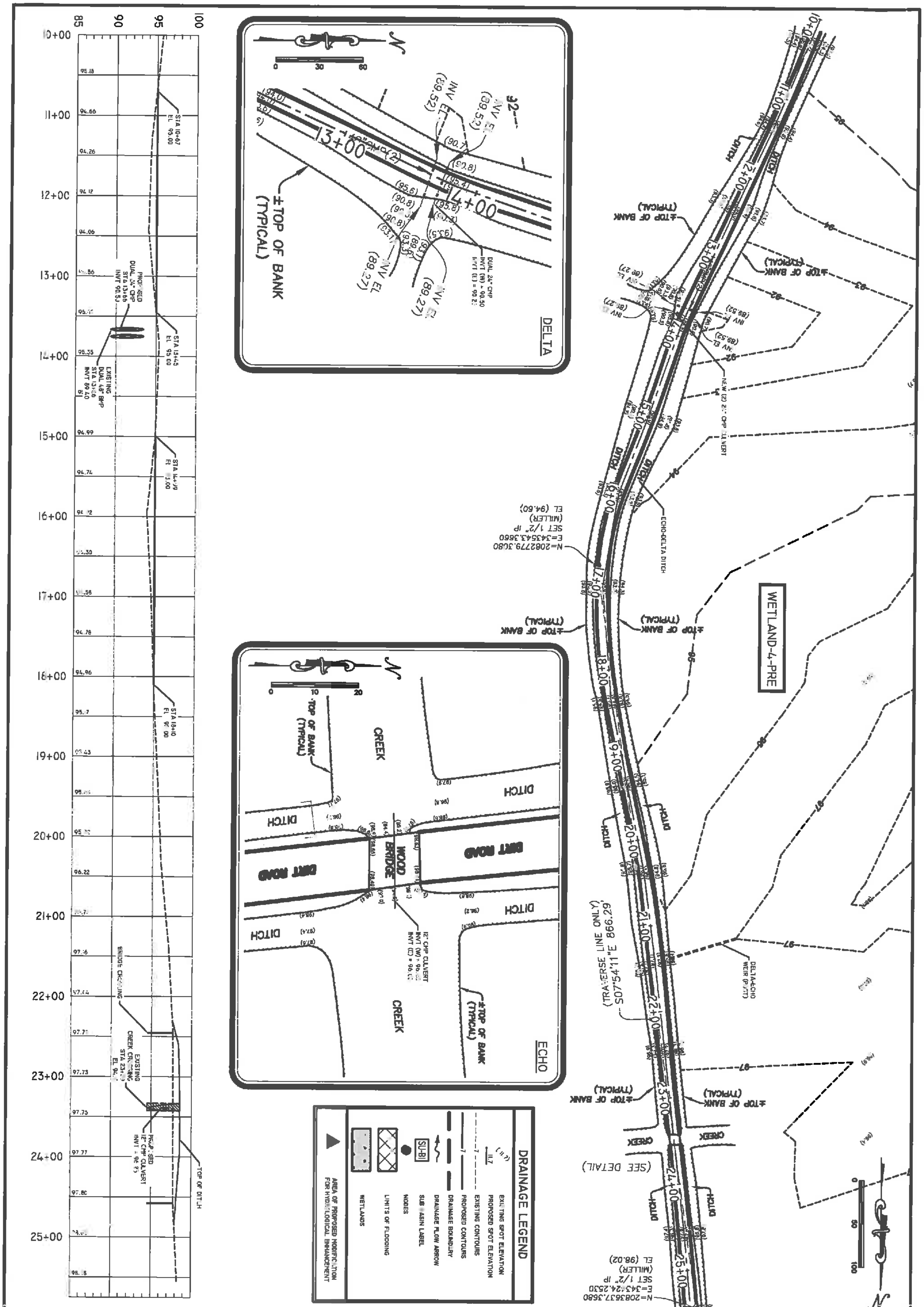
JOB NO.: AE09-25
DESIGN: EJA
DRAWN: DCJ
CHECKED: EJA
DATE: June 15, 2009

Date | Revision

ERIC J. ALMOND, P.E.
FL# 59246



10	ALMOND ENGINEERING, P.A. 3609 HENDRICKS AVENUE JACKSONVILLE, FL 32207 (904) 306-0162 PHONE (904) 306-2185 FAX	HIGHLANDS MITIGATION BANK FOR CRP/HLV HIGHLANDS RANCH, LLC 9803 OLD ST. AUGUSTINE RD, SUITE I JACKSONVILLE, FL 32257	PROPOSED CROSSING (CHARLIE) PLAN AND PROFILE	ERIC J. ALMOND, P.E. FL# 59246



11	ALMOND ENGINEERING, P.A. 3609 HENDRICKS AVENUE JACKSONVILLE, FL 32207 (904) 306-0162 PHONE (904) 306-2185 FAX	HIGHLANDS MITIGATION BANK FOR CRP/HLV HIGHLANDS RANCH, LLC 9803 OLD ST. AUGUSTINE RD, SUITE JACKSONVILLE, FL 32257	PROPOSED CROSSING (DELTA-ECHO) PLAN AND PROFILE	JOB NO.: AE08-25 DESIGN: EJA DRAWN: DCJ CHECKED: EJA DATE: June 18, 2008

Date	Revision

ERIC J. ALMOND, P.E.
FL# 59246

ATTACHMENT 2 – TARGET COMMUNITIES (5 4 12)

The target condition of HRMB is one that will be similar to historic native communities of this site and would be maintained in perpetuity. The majority of the site consists of uplands that will be restored from the current silviculture setting to Longleaf Pine/Xeric Oak Sandhills and Mesic Flatwoods. These upland systems grade down to Hydric Pine Flatwoods, Baygall, Mixed Hardwood/Bottomland Forest, and the Floodplain swamps of Boggy Branch and Tiger Branch.

General descriptions of these anticipated native target communities are provided below, based on Florida Natural Areas Inventory's *Guide to the natural communities of Florida*, 2010 edition and FLUCCS (1999). These descriptions may be further refined, as revealed by site-specific restoration activities, or as otherwise supported by scientific documentation.

Longleaf Pine/Xeric Oak Sandhill

Sandhill is characterized by widely spaced pine trees with a sparse midstory of deciduous oaks and a moderate to dense groundcover of grasses, herbs, and low shrubs. Sandhill occurs on the rolling topography and deep sands of the Southeastern U.S. Coastal Plain. Typical associations or indicator species are longleaf pine (*Pinus palustris*), turkey oak (*Quercus laevis*), and wiregrass (*Aristida stricta* var. *beyrichiana*).

The midstory trees and low shrubs can be sparse to dense, depending on fire history, and may include turkey oak, bluejack oak (*Q. incana*), sand live oak (*Q. geminata*), sand post oak (*Q. margaretta*), saw palmetto (*Serenoa repens*), sparkleberry (*Vaccinium arboreum*), dwarf huckleberry (*Gaylussacia dumosa*), pricklypear (*Opuntia humifusa*), and gopher apple (*Licania michauxii*). Earleaf greenbrier (*Smilax auriculata*) is the most common woody vine that occurs in sandhill.

The greatest plant diversity within sandhill is in the herbaceous groundcover. Dominant grasses, in addition to wiregrass, include other three-awns (*Aristida* spp.), pineywoods dropseed (*Sporobolus junceus*), lopsided indiangrass (*Sorghastrum secundum*), and several species of bluestems (*Andropogon* spp). Bracken fern (*Pteridium aquilinum*) can be common. Typical forbs include dogtongue wild buckwheat (*Eriogonum tomentosum*) and such Aster family taxa as narrowleaf silkgrass (*Pityopsis graminifolia*), gayfeathers and blazing stars (*Liatris* spp.), coastalplain honeycomb-head (*Balduina angustifolia*), sweet goldenrod (*Solidago odora*), and soft green eyes (*Berlandiera pumila*). Legumes also make up an important component of the sandhill groundcover. Typical species include sidebeak pencil flower (*Stylosanthes biflora*), sensitive brier (*Mimosa quadrivalvis* var. *angustata*), summer farewell (*Dalea pinnata*), milkpeas (*Galactia* spp.), snoutbeans (*Rhynchosia* spp.), spurred butterfly pea (*Centrosema virginianum*), and Atlantic pigeon-wing (*Clitoria mariana*). Other plant species may include queensdelight (*Stillingia sylvatica*) pinewoods milkweed (*Asclepias humistrata*),toothache-grass (*Ctenium floridanum*), scrub stylisma (*Stylisma abdita*), giant orchid (*Pteroglossaspis ecristata*), and variable-leaf crownbeard (*Verbesina heterophylla*).

Sandhill can provide important habitat for rare animals such as gopher frog (*Rana capito*), gopher tortoise (*Gopherus polyphemus*), and eastern indigo snake (*Drymarchon couperi*). The gopher tortoise is an especially important keystone species in sandhills.

Sandhill occurs on crests and slopes of rolling hills and ridges with steep or gentle topography. Soils are deep, marine-deposited, often yellowish sands that are well-drained and relatively infertile. Sandhill is important for aquifer recharge because the porous sands allow water to percolate rapidly with little runoff and minimal evaporation. The deep, sandy soils and a lack of near surface hardpan or water table contribute to a xeric environment. Sandhill requires growing season fires to maintain open structure.

Sandhill was historically widespread on well-drained sands throughout the Southeastern U.S. Coastal Plain and was once a major part of an extensive mosaic of longleaf pine-dominated natural communities.

Fire is a dominant environmental factor in sandhill ecology. Frequency, intensity, and season are important fire characteristics that influence community structure and species composition. Frequent low-intensity fires in the growing season reduce hardwood competition and perpetuate pines and grasses. The herbaceous and faunal species diversity in sandhill increases with application of prescribed fires in areas where fire had long been excluded. The natural or historic frequency of fire in sandhill is every 1-3 years. Frequent fires reduce ground litter and prevent hardwood and shrub encroachment into the midstory, thereby allowing ample sunlight to reach the forest floor. This is essential for the regeneration and maintenance of longleaf pines, as well as the native grasses, herbs, and low shrubs that characterize sandhill communities.

Mesic Flatwoods

Mesic flatwoods are characterized by an open canopy of tall pines and a dense, low ground layer of low shrubs, grasses, and forbs. Longleaf pine (*Pinus palustris*) is the principal canopy tree in northern and Central Florida. Currently, slash pine is more common than longleaf pine in mesic flatwoods of northern Florida, typically as a result of invasion by or planting of slash pine after logging of longleaf pine followed by a long period of fire exclusion. At the time of final credit release as outlined in the permit, the community type will be characterized by a combination of longleaf pine and slash pine. With re-establishment of a natural fire regime, longleaf pine will continue to regenerate and the site will transition into a longleaf pine dominant community.

Characteristic low shrubs include saw palmetto (*Serenoa repens*), gallberry (*Ilex glabra*), coastalplain staggerbush (*Lyonia fruticosa*), and fetterbush (*Lyonia lucida*). Rhizomatous dwarf shrubs, usually less than two feet tall, are common and include dwarf live oak (*Quercus minima*), runner oak (*Q. elliottii*), shiny blueberry (*Vaccinium myrsinites*), Darrow's blueberry (*V. darrowii*), and dwarf huckleberry (*Gaylussacia dumosa*).

The herbaceous layer is predominantly grasses, including wiregrass (*Aristida stricta* var. *beyrichiana*), dropseeds (*Sporobolus curtissii, S. floridanus*), panicgrasses (*Dichanthelium* spp.), pine-woods bluestem (*Andropogon arctatus*) and broomsedges (*Andropogon* spp.) that provide fine fuel source, plus a large number of showy forbs, including tarflower (*Bejaria racemosa*) Canby's wild indigo (*Baptisia calycosa*), variable-leaf crownbeard (*Verbesina heterophylla*), many-flowered grass-pink (*Calopogon multiflorus*) and milkwort (*Polygala* sp.).

Mesic flatwoods are the most widespread natural community in Florida, covering the flat sandy terraces left behind by former high stands of sea level during the Plio-Pleistocene. Soils are acidic, nutrient-poor fine sands with upper layers darkened by organic matter. Leon, Vero, and Smyrna fine sands are common examples. The soils are alternately droughty during dry periods and saturated, or even inundated, after heavy rains.

Mesic flatwoods can provide habitat for a suite of species including the frosted flatwoods salamander (*Ambystoma cingulatum*), reticulated flatwoods salamander (*A. bishopi*), eastern diamondback rattlesnake (*Crotalus adamanteus*), Bachman's sparrow (*Aimophila aestivalis*), Sherman's fox squirrel (*Sciurus niger shermani*), and Florida black bear (*Ursus americanus floridanus*).

Mesic flatwoods require frequent fire; all of its constituent plant species recover rapidly from fire and several species require fire to reproduce. Longleaf pines have thick bark to protect them from fire and their seeds need the mineral soil and open sunlight that fire provides to germinate; they form a grass stage for several years after germination that is resistant to fire. Wiregrass requires fire to flower, along with a number of other characteristic herbs, including, but not limited to, whitetop aster (*Oclemena reticulata*), many-flowered grass-pink, and crowpoison (*Stenanthium densum*). The flatwoods salamander prefers a grassy border around its breeding ponds which is maintained against encroaching shrubs by frequent fire.

Direct evidence for the natural fire return interval and season in mesic flatwoods comes from a study of fire scars on cross sections of old longleaf pine stumps in mesic flatwoods near the Gulf coast west of Apalachicola. The natural or historic frequency of fire in mesic flatwoods is 1-3 years. Growing season fires (April to mid-August) are known to be necessary for flowering and seed set in wiregrass.

<u>Hydric or Wet Flatwoods</u>

Hydric flatwoods are pine forests with a sparse or absent midstory and a dense groundcover of hydrophytic grasses, herbs, and low shrubs.

The pine canopy typically consists of a combination of longleaf pine (*Pinus palustris*) and slash pine (*P. elliottii*) or pond pine (*P. serotina).* The subcanopy, if present, consists of scattered sweetbay (*Magnolia virginiana*), swamp bay (*Persea palustris*), loblolly bay (*Gordonia lasianthus*), and pond cypress (*Taxodium ascendens*).

Shrubs include large gallberry (*Ilex coriacea*), fetterbush (*Lyonia lucida*), titi, black titi (*Cliftonia monophylla*), sweet pepperbush (*Clethra alnifolia*), red chokeberry (*Photinia pyrifolia*), dahoon (*Ilex cassine*), and/or wax myrtle (*Myrica cerifera*). Saw palmetto (*Serenoa repens*) and gallberry (*I. glabra*), species also found in mesic flatwoods sites, may be present.

Herbs include wiregrass (*Aristida stricta var. beyrichiana*), blue maindencane *(Amphicarpum muhlenbergianum)* and/or hydrophytic species such as toothache grass (*Ctenium aromaticum*) and cutover muhly (*Muhlenbergia capillaries var trichopodes*), in addition to yellow-eyed grass (*Xyris sp.*), Carolina redroot (*Lachnanthes caroliana*), beaksedges (*Rhynchospora chapmanii, R. latifolia, R.*

compressa), vanillaleaf (*Carphephorus odoratissimus* var. *odoratissimus*), milkwort (*Polygala* sp.), and pitcherplants (*Sarracenia* spp.).. Other species may include purple honeycomb-head (*Balduina atropurpurea*), Bartram's ixia (*Calydorea coelestina*), hartwrightia (*Hartwrightia floridana*), lake-side sunflower (*Helianthus carnosus*), cutthroat grass (*Panicum abscissum*), St. John's blackeyed susan (*Rudbeckia nitida*) and white-flowered wild petunia (*Ruellia noctiflora*). The relative density of herbs and shrubs varies greatly in this habitat.

Wet flatwoods often occur in the ecotones between mesic flatwoods and shrub bogs, wet prairies, dome swamps, strand swamps or floodplains. Wet flatwoods also occur in broad, low flatlands, often in a mosaic with these communities.

Hydric flatwoods can provide habitat for include suite including three species of flatwoods salamanders, and Florida black bear (*Ursus americanus floridanus*) .

The variations of vegetation structure and composition of wet flatwoods in Florida likely reflect variations in soil characteristics, hydrology and fire. The general historic fire frequency in pinelands across the southeastern U.S. coastal plain is estimated to be every 1-3 years. This interval is frequent enough to maintain grassy wet flatwoods and inhibit invasion by shrubs and is consistent with management of longleaf pine systems. Wet flatwoods that are shrubbier and dominated by slash pine or pond pine may have had longer fire return intervals, or perhaps a few periods of longer intervals, on the order of 5-7 years. Shrubs tend to dominate where fire has been absent for a long period or where cool season fires predominate; herbs are more abundant in locations that are frequently burned.

Fires at too long intervals (5-10 years) can lead to an increase in woody species cover and decline in grasses and forb cover. It is uncertain whether increased fire frequency alone is adequate to restore areas heavily invaded by shrubs and trees as a result of lack of fire Many factors other than frequency of fire, such as season of fire, pre- and post-fire soil moistures, groundwater levels, weather, and plant size or age at the time of fire, can greatly influence vegetation responses to fire. Fire in the growing season can reduce the stature of woody vegetation, particularly hardwoods, prevent increases in shrub densities (although it may not reduce stem densities), and promote flowering of herbaceous groundcover

Baygall/bay swamp

Baygall is an evergreen forested wetland of bay species situated at the base of a slope or in a depression. Loblolly bay (*Gordonia lasianthus*), sweetbay (*Magnolia virginiana*), and/or swamp bay (*Persea palustris*) form an open to dense tree canopy and are also dominant in the understory along with fetterbush (*Lyonia lucida*), large gallberry (*Ilex coriacea*), dahoon (*I. cassine*), myrtle dahoon (*I. cassine* var. *myrtifolia*), titi (*Cyrilla racemiflora*), black titi (*Cliftonia monophylla*), wax myrtle (*Myrica cerifera*), coastal doghobble (*Leucothoe axillaris*), swamp doghobble (*L. racemosa*), red maple (*Acer rubrum*), and/or Virginia willow (*Itea virginica*).

Composition can vary regionally. Loblolly pine (*Pinus taeda*), slash pine (*P. elliottii*), and/or pond pine (*P. serotina*) are often found in the canopy, as well as sweetgum (*Liquidambar styraciflua*). Wetter baygalls may also contain swamp tupelo (*Nyssa sylvatica* var. *biflora*) and/or pond cypress (*Taxodium ascendens*). The canopy and understory do not generally form distinct

strata but may appear as a dense, tall thicket. Vines, especially laurel greenbrier (*Smilax laurifolia*), coral greenbrier (*S. walteri*), and muscadine (*Vitis rotundifolia*), may be abundant and contribute to the often impenetrable nature of the understory. Herbs are absent or few, and typically consist of ferns such as cinnamon fern (*Osmunda cinnamomea*), netted chain fern (*Woodwardia areolata*), and Virginia chain fern (*W. virginica*). Sphagnum mosses (*Sphagnum* spp.) are common.

Baygall typically develops on wet soils at the bases of slopes, edges of floodplains, in depressions, and in stagnant drainages. The soils are generally composed of peat with an acidic pH (3.5 - 4.5). Seepage from uplands, rainfall, and/or capillary action from adjacent wetlands maintains a saturated peat substrate. While baygalls are not generally influenced by flowing water, they are often drained by small blackwater streams.

Baygall forests are important habitat for Florida black bear (*Ursus americanus floridanus*) and provide cover for their dens.

Baygall occurs throughout mainland Florida and much of the southeastern coastal plain. The largest examples occur near the Georgia border in the Pinhook Swamp area south of Okefenokee Swamp.

Several pine species can withstand hydric soil conditions (loblolly pine, pond pine, slash pine), and the occurrence of these pines in baygall is apparently part of the natural variation. Many baygall species common in the northern peninsula and Panhandle reach their southern limits in the central peninsula (titi, black titi, coastal doghobble, and swamp doghobble).

The dominant baygall species are fire-intolerant, and a mature canopy indicates the lack of destructive fire for many years. Although the saturated soils and humid conditions within baygalls typically inhibit fire, droughts may create conditions that allow them to burn catastrophically. These fires not only destroy the canopy, but also may ignite the deep peat layers that can smolder for weeks, or even months. This occurs perhaps only a few times each century in the deepest baygalls.

Where the peat layer is destroyed, the lower soil level may collect open water that can be re-colonized by marsh or cypress/tupelo swamp vegetation. If the root systems are not killed, bay species will readily re-sprout and form a shrub thicket. Baygall that has burned recently may be shrubby, but will have a large component of re-sprouting bay trees and burned tree stumps. Peat areas with more frequent fires develop shrub bog vegetation rather than baygall. Thus, certain vegetation types (baygall, basin swamp, shrub bog, and open water) in the Okefenokee Swamp have been described as a "moving mosaic" of vegetation determined by fire history and hydrology.

As with other wetlands, baygall communities are best managed with a landscape level focus on maintaining high quality adjacent natural uplands and upland-wetland ecotones. When possible, fires from adjacent communities should be allowed to extinguish naturally at the edges of the baygall to prevent encroachment of bay species into other communities and to maintain open, grassy wetland/upland ecotones. The maintenance or restoration of natural

hydrology is critical to wetland communities. Artificial drainage of baygalls creates an opportunity for catastrophic peat fires.

Invasive exotic plants are a concern in all natural communities of Florida. Old world climbing fern (*Lygodium microphyllum*) has been documented in baygall communities.

Historically, many areas that were a mosaic of flatwoods, wet prairies, bay swamps, and shrub bogs were converted to pine plantation, and these communities may be difficult to distinguish after such disturbance. Timber harvest and fire exclusion can encourage the replacement of other natural community types by baygall. For example, examination of historic aerial photography suggests that logging of cypress swamps led to a shift in vegetation to baygall. Medium-depth depressions with evidence of pond cypress logging in north Florida show a pattern of increased loblolly bay and swamp tupelo dominance. Baygall may also be generated by the removal of pine trees in wet flatwoods; shading from the remaining shrub layer may inhibit pine regeneration but does not limit bay species growth. This process is further promoted by fire exclusion.

Bottomland Forest/Wetland Forest Mixed

Bottomland forest is a deciduous, or mixed deciduous/evergreen, closed-canopy forest on terraces and levees within riverine floodplains and in shallow depressions. Found in situations intermediate between swamps (which are flooded most of the time) and uplands, the canopy may be quite diverse with both deciduous and evergreen hydrophytic to mesophytic trees.

Dominant tree species include sweetgum (*Liquidambar styraciflua*), spruce pine (*Pinus glabra*), loblolly pine (*Pinus taeda*), sweetbay (*Magnolia virginiana*), swamp laurel oak (*Quercus laurifolia*), water oak (*Q. nigra*), live oak (*Q. virginiana*), swamp chestnut oak (*Q. michauxii*), and sugarberry (*Celtis laevigata*). More flood tolerant species that are often present include American elm (*Ulmus americana*) and red maple (*Acer rubrum*), as well as occasional swamp tupelo (*Nyssa sylvatica* var. *biflora*) and bald cypress (*Taxodium distichum*). Evergreen bay species such as loblolly bay (*Gordonia lasianthus*), and sweetbay are often mixed in the canopy and understory in acidic or seepage systems. Smaller trees and shrubs often include American hornbeam (*Carpinus caroliniana*), swamp dogwood (*Cornus foemina*), possumhaw (*Ilex decidua*), dahoon (*I. cassine*), dwarf palmetto (*Sabal minor*), swamp bay (*Persea palustris*), wax myrtle (*Myrica cerifera*), and highbush blueberry (*Vaccinium corymbosum*).

The understory is either dense shrubs with little ground cover, or open, with few shrubs and a groundcover of ferns, such as cinnamon fern (*Osmunda cinnamomea*) and royal fern (*Osmunda regalis*), herbs, and grasses. In the drier forests of this type, American holly (*Ilex opaca*), Gulf Sebastian bush (*Sebastiania fruticosa*), and sparkleberry (*Vaccinium arboreum*) may be frequent.

Ground cover is also variable in composition and abundance, often with species overlap between herbs suited to either mesic or hydric conditions. Characteristic species include witchgrasses (*Dichanthelium* spp.), slender woodoats (*Chasmanthium laxum*), and sedges (*Carex* spp.) and may also include sweet shrub *(Calycanthus floridus)*, ciliate-leaf tickseed *(Coreopsis integrifolia)*, Indian cucumber-root *(Medeola virginiana)*, little club-spurred orgina *(Platanthera clavellata)* and buckthorn *(Sideroxlyon lycoides)*.

Bottomland forest/wetland forest mixed can provide habitat for a suite of animals including four-toed salamander (*Hemidactylium scutatum*), copperhead (*Agkistrodon contortrix*), yellow-crowned night-heron (*Nyctanassa violacea*), black-crowned night-heron (*Nycticorax nycticorax*), Louisiana waterthrush (*Seiurus motacilla*), Rafinesque's big-eared bat (*Corynorhinus rafinesquii*), big brown bat (*Eptesicus fuscus*), southeastern bat (*Myotis austroriparius*), gray bat (*Myotis grisescens*), northern long-eared myotis (*Myotis septentrionalis*), southeastern weasel (*Mustela frenata olivacea*), Florida long-tailed weasel (*Mustela frenata peninsulae*), and Florida black bear (*Ursus americanus floridanus*).

Bottomland forest, while not as prone to prolonged growing season inundations as alluvial forest, is nevertheless influenced by high water tables and peak seasonal flooding as well as irregular high flood events. Variations in seedling establishment are often caused not only by flooding regimes, but also by windthrows and treefall gaps that allow for the establishment of shade intolerant species.

Organic debris from bottomland forests is an important nutrient source for downstream ecosystems. Although annual floods do not always inundate bottomland forest, large scale patterns of high water pulses are critical in providing nutrients flushed from higher terraces of the floodplain into the receiving waters.

Fire is not a significant factor in bottomland forest, and is primarily limited to individual trees affected by lightning strikes.

Nearly all bottomland forests have suffered from timbering operations, which frequently leave long-lasting scars from soil disturbance. In addition to clearcutting, some bottomland forests have been converted to pine plantations, usually with severe effects on species composition and leaving exposed topsoil that would normally have been bound by tree roots. Clearcutting of bottomland forest often leads to a second growth canopy dominated by loblolly pine and sweetgum. Sweetgum is often favored by disturbance due to its ability to sprout following damage to the tree.

<u>Floodplain Swamp/Stream or Lake Swamp</u>

Floodplain swamp is a closed-canopy forest of hydrophytic trees occurring on frequently or permanently flooded hydric soils adjacent to stream and river channels and in depressions and oxbows within floodplains. Trees are often buttressed, and the understory and groundcover are sparse. Floodplain swamp can often occur within a complex mixture of communities including alluvial forest, bottomland forest, and baygall. This produces a variable assemblage of canopy and subcanopy species, with less flood tolerant trees and shrubs found on small hummocks and ridges within the swamp.

The canopy is commonly bald cypress (*Taxodium distichum*)with water tupelo (*Nyssa aquatica*), swamp tupelo (*N. sylvatica* var. *biflora*), or ogeechee tupelo (*N. ogeche*). The "knees" arising from the root systems of cypress are common features in floodplain swamp. Other canopy trees capable of withstanding frequent inundation may be present but rarely dominant, including

water hickory (*Carya aquatica*), overcup oak (*Quercus lyrata*), red maple (*Acer rubrum*), green ash (*Fraxinus pennsylvanica*), American elm (*Ulmus americana*), and swamp laurel oak (*Q. laurifolia*).

Shrubs and smaller trees such as Carolina ash (*Fraxinus caroliniana*), planer tree (*Planera aquatica*), black willow (*Salix nigra*), titi (*Cyrilla racemiflora*), Virginia willow (*Itea virginica*), common buttonbush (*Cephalanthus occidentalis*), cabbage palm (*Sabal palmetto*), and dahoon (*Ilex cassine*) may be present.

A groundcover of flood tolerant ferns and herbs are found in some floodplain swamps, including lizard's tail (*Saururus cernuus*), false nettle (*Boehmeria cylindrica*), creeping primrosewillow (*Ludwigia repens*), savannah panicum (*Phanopyrum gymnocarpon*), royal fern (*Osmunda regalis* var. *spectabilis*), dotted smartweed (*Polygonum punctatum*), climbing aster (*Symphyotrichum carolinianum*), and string lily (*Crinum americanum*). Eastern poison ivy (*Toxicodendron radicans*) is a frequent vine.

Floodplain swamp is located within floodplains of any permanently moving stream or river. It ranges from narrow strips of cypress along primary and secondary streams to expansive stands along large rivers to tidally influenced freshwater swamps near river mouths. Often, floodplain swamps immediately border the stream or river channel. In many cases, however, floodplain swamps are isolated from the main channel by riverbank levees and restricted to oxbows, overflow channels, old stream beds, and expansive flats commonly called backswamps. Soils are variable mixtures of alluvial and organic materials, sometimes with layers of sand in the subsoil. Inundation is seasonal and usually prolonged, restricting the growth of most shrubs and herbs and leaving most of the ground surface open or thinly mantled with leaf litter.

Floodplain swamp can provide habitat for a suite of a aquatic and terrestrial animals including blackbanded sunfish (*Enneacanthus chaetodon*), lowland topminnow (*Fundulus blairae*), cypress minnow (*Hybognathus hayi*), eastern mudminnow (*Umbra pygmaea*), one-toed amphiuma (*Amphiuma pholeter*), American alligator (*Alligator mississippiensis*), spotted turtle (*Clemmys guttata*), limpkin (*Aramus guarauna*), swallow-tailed kite (*Elanoides forficatus*), wood stork (*Mycteria americana*), yellow-crowned night-heron (*Nyctanassa violacea*), black-crowned night-heron (*Nycticorax nycticorax*), Rafinesque's big-eared bat (*Corynorhinus rafinesquii*), big brown bat (*Eptesicus fuscus*), southeastern bat (*Myotis austroriparius*), gray bat (*Myotis grisescens*), northern long-eared myotis (*Myotis septentrionalis*), southeastern weasel (*Mustela frenata olivacea*), Florida long-tailed weasel (*Mustela frenata peninsulae*), and Florida black bear (*Ursus americanus floridanus*).

Floods redistribute detrital accumulations to other portions of the floodplain or into the main river channel. This rich organic debris is essential to the functional integrity of downriver ecosystems, providing a vital source of nutrients. Floodplain swamp may also act as a nutrient sink or transformer depending on local conditions.

The topography of alluvial forest and floodplain swamp, particularly in larger alluvial river systems, is a result of a seasonal flooding pattern which builds levees and point bars, creates scour channels and depressions, and introduces flowing water into backswamps. Old channels and levees left behind by the changing meander of the river itself become part of the complex

mosaic. The oxbows and backswamps created by meander processes are important breeding grounds for fish when high water connects them to the river.

Floodplain swamp is usually too wet to support fire; however, large cypress trees are somewhat fire-resistant, and thus infrequent fires during very dry conditions may contribute to cypress dominance. Fires may greatly damage the understory.

Floodplain swamp communities provide important wildlife habitat, contribute to flood attenuation, and help protect the overall water quality of streams and rivers. The natural hydroperiods of swamps promote their high productivity, and drainage of these systems may greatly reduce biomass.

Vegetation composition change due to drying conditions in the floodplain can be detected first in swamps even if the remainder of the floodplain is virtually unchanged. A net increase in flooding or permanent water may also have an adverse affect on cypress and tupelo growth, as these species require some dry periods in order for seedlings to attain the size necessary to withstand flooding.

ATTACHMENT 3 - UMAM SUMMARY

Highlands Ranch Mitigation Bank - UMAM Assessment

ASSESSMENT AREA	MITIGATION CATEGORY	AREA (ACRES)	SCORE						Current Condition or w/o pres	WITH MITIGATION	DELTA	TIME LAG	P FACTOR	RISK	RFG	CREDIT
			LOCATION AND LANDSCAPE SUPPORT		WATER ENVIRONMENT		COMMUNITY STRUCTURE									
			current condition or w/o pres	With Mitigation	current condition or w/o pres	With Mitigation	current condition or w/o pres	With Mitigation								
U1	Sandhill restoration	291.69	5	7			4	7	0.45	0.70	0.25	1.00		1.00	0.25	**72.92**
U2	Mesic Flatwoods restoration	699.21	5	8			4	8	0.45	0.80	0.35	1.00		1.00	0.35	**244.72**
W 1,2	Hydric pine flatwoods restoration	260.30	6	8	8	8	4	8	0.60	0.80	0.20	1.00		1.00	0.20	**52.06**
W 3	Bay preservation	28.28	5	7	6	8	4	8	0.50	0.77	0.27	1.00	0.70	1.00	0.19	**5.28**
W 4	Bay enhance	1.57	6	8	8	8	5	8	0.63	0.80	0.17	1.00		1.00	0.17	**0.26**
W 5	Floodplain preservation	164.16	5	8	6	8	4	8	0.50	0.80	0.30	1.00	0.70	1.00	0.21	**34.47**
W6	Floodplain enhance	46.69	6	8	8	8	6	8	0.67	0.80	0.13	1.00		1.00	0.13	**6.23**
W 7,8	Bottomland enhance	50.41	6	8	8	8	5	8	0.63	0.80	0.17	1.00		1.00	0.17	**8.40**
trail road	Flooplain restoration*	0.58	0	8	0	8	0	8	0.00	0.80	0.80	1.00		1.00	0.80	**0.46**
remaining area	in holdings (easement, hunt camp)	32.60							0.00	0.00	0.00	1.00		1.00	0.00	**0.00**
	TOTALS	**1575.49**														**424.81**

* - not expected to meet the release criteria or these scores at the same time as the rest of the bank

			Phase 1		Phase 2		Phase 3			
			Acres	Credits	Acres	Credits	Acres	Credits		
U1	Sandhill restoration	291.69	52.12	13.03	111.32	27.83	128.25	32.06	291.69	
U2	Mesic Flatwoods restoration	699.21	305.13	106.80	234.46	82.06	159.62	55.87	699.21	
W 1,2	Hydric pine flatwoods restoration	260.30	93.20	18.64	72.58	14.52	94.52	18.90	260.30	
W 3	Bay preservation	28.28	3.70	0.69	18.25	3.41	6.33	1.18	28.28	
W 4	Bay enhance	1.57	0.00	0.00	0.00	0.00	1.57	0.26	1.57	
W 5	Floodplain preservation	164.16	52.86	11.10	50.79	10.67	60.51	12.71	164.16	
W6	Floodplain enhance	46.69	0.00	0.00	46.69	6.23	0.00	0.00	46.69	
W 7,8	Bottomland enhance	50.41	36.53	6.09	0.00	0.00	13.88	2.31	50.41	
trail road	Flooplain restoration*	0.58	0.00	0.00	0.58	0.46	0.00	0.00	0.58	1575.49
	TOTAL	*1542.89*	*543.54*	*156.35*	*534.67*	*145.17*	*464.68*	*123.30*	424.81	

CE, et al	*(total)*	***23.45***	***21.78***	***18.49***	***63.72***	**15%**
	flatwoods	11.44	10.63	9.02	31.09	
	fw forested	12.01	11.15	9.47	32.63	
Interim I	*(total)*	***39.09***	***36.29***	***30.82***	***106.20***	25%
	flatwoods	19.08	17.71	15.04	51.83	
	fw forested	20.01	18.58	15.78	54.37	
Interim II-A	*(total)*	***9.38***	***8.71***	***7.40***	***25.49***	6%
	flatwoods	4.58	4.25	3.61	12.44	
	fw forested	4.80	4.46	3.79	13.05	
Interim II-B	*(total)*	***3.13***	***2.90***	***2.47***	***8.50***	2%
	flatwoods	1.53	1.42	1.21	4.16	
	fw forested	1.60	1.48	1.26	4.34	
Interim III	*(total)*	***32.83***	***30.49***	***25.89***	***89.21***	21%
	flatwoods	16.02	14.88	12.63	43.53	
	fw forested	16.81	15.61	13.26	45.68	
Interim IV	*(total)*	***28.14***	***26.13***	***22.19***	***76.46***	**18%**
	flatwoods	13.73	12.75	10.83	37.31	
	fw forested	14.41	13.38	11.36	39.15	
Final	*(total)*	***12.51***	***11.61***	***9.86***	***33.98***	**8%**
	flatwoods	6.10	5.67	4.81	16.58	
	fw forested	6.41	5.94	5.05	17.40	
final bank	(total)	***7.82***	***7.26***	***6.16***	***21.24***	5%
		3.82	3.54	3.01	10.37	
		4.00	3.72	3.15	10.87	
Total:		*156.35*	*145.17*	*123.28*	*424.80*	**100%**

Flatwoods	207.3	207.31
Forested	217.51	217.49
	424.81	424.80

ATTACHMENT 4
Highlands Ranch Mitigation Bank
File No.: 10-308703-001
LEDGER

Freshwater Forested Wetlands
Phase 1 = 80.05 total potential credits
Phase 2 = 74.33 total potential credits
Phase 3 = 63.13 total potential credits
Total = **217.51 potential credits**

Release Modification/ Impact Permit No.	Permit Date	Issuing Agency	Ledger Modification Date	Credits Added	Credits Used	Balance

Hydric Pine Flatwoods/Wet Prairie
Phase 1 = 76.30 total potential credits
Phase 2 = 70.83 total potential credits
Phase 3 = 60.17 total potential credits
Total = **207.30 potential credits**

Release Modification/ Impact Permit No.	Permit Date	Issuing Agency	Ledger Modification Date	Credits Added	Credits Used	Balance