Angelina & Neches River Authority

Mitigation Plan
Lake Columbia

Regional Water Supply Reservoir Project

U.S. Army Corps of Engineers Project Number 198700524

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1.0 Introduction

The purpose of this mitigation plan (the "Plan") is to identify and describe in detail the mitigation measures proposed by the Angelina and Neches River Authority (ANRA) to compensate for the impacts to aquatic resources related to the Lake Columbia project. The Lake Columbia project site is depicted in Figure 1. This Plan was prepared in accordance with the guidelines established by the U.S. Army Corps of Engineers (USACE) and published in the following documents:

- Clean Water Act (CWA), Section 404
- Compensatory Mitigation for Losses of Aquatic Resources; Final Rule (33 Code of Federal Regulations, Parts 325 and 332 and 40 CFR Part 230, as published in the Federal Register, Vol. 73, No. 70, April 10, 2008) (the "Mitigation Rule")
- Mitigation Guidelines, Regulatory Program, Fort Worth District U.S. Army Corps of Engineers, Draft – December 24, 2003

In addition, the plan was developed in consultation with the Texas Commission on Environmental Quality, Texas Parks and Wildlife Department and Texas Water Development Board during a series of meetings. The plan was subsequently submitted to the USACE and other federal resource agencies for review and comment. The plan conforms to the outline for mitigation plans as prescribed in the Mitigation Rule, 40 CFR Chapter I, Subpart J, § 230.94(c)(2)-(14).

2.0 Mitigation Objectives

The goal of ANRA's proposed mitigation Plan is to replace and/or restore aquatic functions and services in waters of the U.S. that are expected to be lost due to the development of Lake Columbia. In keeping with federal wetlands policy, this mitigation goal includes no overall net loss of wetland functions and services within the Neches River watershed. To that end, ANRA has developed its proposed compensatory mitigation plan based on the conservatively high wetland functional capacity values estimated for the impact site by the USACE's environmental impact statement (EIS) contractor using the Hydrogeomorphic Interim model. Detailed descriptions of the

impacts of the proposed project to waters of the U.S. were described in the *Lake Columbia Regional Water Supply Reservoir Project Draft Environmental Impact Statement*, prepared by the USACE and published (*Date of new DEIS to be inserted here*), and they are outlined in applicable sections of this Plan.

2.1 Mitigation Sequencing

2.1.1 Impact Avoidance and Minimization

This mitigation plan was conceived to compensate for the estimated unavoidable impacts to waters of the U.S. due to development of the proposed Lake Columbia. As described in the environmental impact statement for the project (USACE, *Date of new DEIS to be inserted here*), ANRA has followed the USACE required sequencing process whereby impacts to waters of the U.S. were avoided to the extent practicable while addressing the purpose and need for the project, impacts that could not be avoided were minimized to the extent practicable, and finally mitigation actions were identified in this Plan to compensate for the remaining unavoidable but minimized impacts to waters of the U.S.

ANRA has avoided impacts to waters of the U.S. by evaluating alternatives that would be commensurate with the projected water needs of its service area. Such analysis was described in the Lake Eastex Regional Water Supply Planning Study conducted for ANRA by Lockwood, Andrews & Newnam, Inc. (LAN, 1991). The report summarizes ANRA's consideration of the proposed Ponta Reservoir which would be located on the Angelina River west of the city of Nacogdoches. The proposed reservoir would have a storage capacity of 810,000 acre feet, more than four times the capacity of proposed Lake Columbia, and it would yield 300,000 acre feet per year which is three and a half times greater than the firm yield of Lake Columbia. In addition, the Ponta Reservoir would inundate the entire 6,784 acre USFWS designated Priority 1 Bottomland Hardwood site near the confluence of Mud Creek and the Angelina River. As noted by LAN (1991), the Ponta Reservoir project was rejected by ANRA in favor of a project with less environmental impact and more in line with the local water needs.

ANRA proposes the following measures to <u>minimize</u> direct and indirect impacts of the proposed project on the aquatic environment.

a. **Land and Flowage Easement Acquisitions.** ANRA will purchase land around Lake Columbia up to elevation 318 feet NGVD and prohibit unpermitted development within this area. This would avoid indirect impacts to 1,029 acres of land contiguous with the conservation pool. In addition, flowage easements would be purchased for land from 318 ft NGVD up to elevation 326 ft NGVD. Approximately 3,350 acres would be included. Development restrictions would minimize the secondary impacts of development along the shoreline and in the vicinity of the reservoir to avert flood damage to habitable structures. Permitted activities are described in detail in Appendix B, Lake Columbia Water Quality Regulations which were approved by ANRA in August 2007. Following receipt of a 404 permit, the ANRA Board of Directors would develop and adopt permit criteria to implement the Water Quality Regulations. ANRA has not calculated specific functional credit units for this area or claimed any preservation credits. However, these restrictions would minimize water quality and secondary development impacts.

b. **Water Quality Regulations.** ANRA adopted the *Lake Columbia Water Quality Regulations* (WQR) on August 7, 2007 (Appendix B). These regulations apply to the lake itself and to an area immediately surrounding the lake shore known as the "No Discharge Zone" (NDZ). The NDZ is defined by the regulation as "the land located horizontally 2,000 feet from the 315 feet [NGVD] elevation. The NDZ as well as the 318 foot and 326 foot NGVD contours are depicted in Figure 2. The NDZ encompasses approximately 15,500 acres, and it includes approximately 35 miles of intermittent stream channels and 10 miles of perennial stream channels.

ANRA's WQR specifically prohibits the following activities:

1) Construction and installation of pipelines and utility lines within the lake.
2) Construction or enlargement of existing hazardous or municipal solid waste facilities within the Lake Columbia watershed (except for such facilities owned, operated, or within the incorporated

limits of Tyler, Jacksonville, New Summerfield, Troup, Whitehouse, and Bullard).

3) Petroleum storage tanks greater than 100 gallons within the NDZ.
4) Onsite sewerage facilities (OSSF) in the NDZ on lots: less than 0.75 acre if connected to a public water supply; less than 1.25 acres if not connected to public water supply; which can be served practicably by a sewage collection system. (NOTE: All OSSFs in the NDZ must be permitted by ANRA.)
5) Human-induced erosion.
6) Construction of any structure that would decrease the storage capacity of the lake, be a source of contamination, or significantly impact aquatic or terrestrial habitat.
7) Modification of the shoreline (up to the 100-year flood elevation, 322.59 feet NGVD) without prior written consent of ANRA.

In addition, ANRA's regulations require the following specific measures to protect water quality in Lake Columbia:

1) Forestry best management practices (BMPs) for all forestry activities within the NDZ. (Section 4 of the WQRs makes the Best Management Practices established by the Texas Forest Service mandatory for all forestry operations within the No Discharge Zone. The BMPs are applicable to all property regardless of acreage. Part Three of the BMPs specifically addresses forestry operations in wetlands. One of the principal procedures to protect wetlands is the establishment of Streamside Management Zones (SMZs) which should be at least 50 feet in width near perennial streams. The BMPs do not allow for clear cutting in the SMZs and require at least a minimum of 50% of original crown cover or 50 square feet of basal area per acre to be maintained).
2) OSSFs must be designed by a P.E. or registered professional sanitarian.
3) OSSF plan approval by ANRA prior to construction.

4) ANRA approval of plans to construction piers, docks and other water front facilities. At least 60 % of the shoreline within 50 feet of 315 ft. msl (conservation pool elevation) is required to be maintained in a natural condition.

2.1.2 Analysis of Alternative Mitigation Approaches

ANRA first proposed its multi-faceted mitigation approach for the Lake Columbia project in its Section 404 permit application to the USACE Fort Worth District on October 31, 2000. That proposed approach encompassed both permittee-responsible mitigation, which was the regulatory preference at that time, and purchase of mitigation bank credits and payment of in-lieu fee.

ANRA further refined its compensatory mitigation strategy in the 2003 Lake Eastex [Columbia] Planning Studies Report (FNI, 2003). The components of that strategy, which included on-site, near-site, and off-site permittee-responsible activities, were published in the USACE Joint Public Notice issued on September 5, 2003.

More recently, the USACE issued its Mitigation Rule which essentially reversed the USACE preference for implementing mitigation by making the purchase of mitigation bank credits and in-lieu fee payment methods as preferred over permittee-responsible mitigation. Also during the period between submittal of the Lake Columbia 404 permit application and publication of the Mitigation Rule, the USACE approved a number of mitigation banks in East Texas that could potentially provide opportunities to compensate for the loss of waters of the U.S. Meanwhile, prior to publication of the Mitigation Rule, ANRA had already made tentative commitments to secure off-site, threatened private lands associated with the Big Thicket National Preserve (BTNP) that could be restored or preserved to compensate for some of the loss of wetlands and streams at the Lake Columbia site.

After publication of the Mitigation Rule, ANRA evaluated the alternative of purchasing mitigation bank credits to compensate for all or a portion of the impacts to waters of the U.S. at the Lake Columbia site.

Results of that evaluation indicated the following:

- No single mitigation bank would have enough credits to offset the wetlands impacts as identified by the desktop Hydrogeomorphic Methodology (HGM) study conducted by the USACE and its EIS contractor on Lake Columbia. Consequently, compensatory mitigation through bank credit purchase would be geographically fragmented.
- A proposal from a mitigation bank brokerage company proposed stacking credits from nine mitigation banks from East Texas, only two of which are currently permitted, to address ANRA's compensatory mitigation need. Lake Columbia lies within the primary service area of only two of the banks, while the remaining seven banks are outside of the Neches River basin. Credit purchase requirements increase for projects outside of the primary service area of a bank. The number of credits currently available would not meet ANRA's need, and there is no certainty that additional banks would be approved and enough additional credits of the appropriate type made available to compensate for the impacts of Lake Columbia. Thus, additional mitigation actions would be required.
- The largest bank within close proximity to the Lake Columbia site, Pineywoods Mitigation Bank, has a total land area of approximately 19,000 acres (nearly two times the area of the lake Columbia project). Based on our preliminary review, the bank would not have enough credits to meet the mitigation needs of Lake Columbia.

Large on-channel reservoir projects in general, because of their size and location and the typically large area of aquatic resources impacts, may require more complex (i.e., multi-faceted) mitigation approaches than other types of non- water dependent development projects. After reviewing the practicability of satisfying Lake Columbia mitigation requirements solely through purchase of mitigation bank credits (in-lieu fee compensation is not an available mitigation strategy for the project area), ANRA concluded that continuing its efforts to mitigate through a multi-faceted permittee-responsible approach would keep the mitigation activities within the Neches River basin

where the impacts would occur, and it would be more cost effective than pursuing mitigation primarily through credit purchase. ANRA would employ mitigation bank credit purchase as a supplemental mitigation strategy, if needed, to fulfill mitigation requirements.

Recognizing the USACE mandate and desirability of compensating for impacts as close to the impact source as practicable, ANRA proposes to mitigate the adverse effects of the Lake Columbia project on aquatic resources in a stepwise fashion by first identifying and implementing mitigation measures on-site, followed next by near-site (two sites within Mud Creek floodplain downstream of dam to confluence with Angelina River) mitigation actions, and finally by off-site actions in the vicinity of the Big Thicket National Preserve (BTNP), a federally-protected resource recognized internationally for its unique ecological importance, as well as at the Neches River National Wildlife Refuge (NRNWR) site, which is a newly designated federal wildlife refuge approximately 18 miles southwest of the Lake Columbia site.

In the event that additional mitigation credit is still needed after implementing mitigation measures on-site, near-site, and off-site near BTNP and NRNWR, ANRA will also seek other off-site lands within the Neches River watershed as well as the purchase of mitigation bank credits if necessary to offset the losses of aquatic habitat. ANRA's proposed on-site, near-site, and off-site approach to achieve the no-net-loss goal affords flexibility among these mitigation locations to allow for land availability at the time the mitigation plan is implemented. It is ANRA's intent to mitigate as much of the impacts as practicable either at or near the reservoir site. In this context, "practicable" is defined as "available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes" (40 CFR 230.3(q)). In addition, ANRA's goal is to acquire mitigation properties (fee simple or easement) by willing buyer/willing seller agreements. However, if necessary to fulfill its compensatory mitigation requirements, ANRA will exercise its power of eminent domain to acquire mitigation land in the absence of readily identifiable willing sellers.

2.2 Impact Site

Lake Columbia will have a surface area of 10,133 acres and is situated in the Pineywoods vegetation area in East Texas. The area is typified by pine and mixed pine/hardwood forest and is dissected with bottomland hardwood forest associated with rivers, streams, swamps, and reservoirs. There are areas of pasture land and some areas of crop cultivation. Early timber harvesting principally involved cutting large trees. Subsequently, clear cutting practices have dominated timber harvesting and have resulted in replanting of pine stands producing even-aged monotypic communities which are generally referred to as pine plantations. Timberlands which have been converted to pasture use are dominated by coastal Bermuda grass (*Cynodon dactylon*) and bahia grass (*Paspalum notatum*). Mud Creek, the stream on which the dam will be located, is a tributary of the Angelina River which is a tributary of the Neches River. Mud Creek, at the dam site, is flanked by a broad fluvial floodplain with a stream bed elevation of 265 ft. NGVD. Regional topography is generally rolling to hilly with broad, flat floodplains.

A total of 5,746.5 acres of waters of the U. S., including wetlands, were delineated in the Permit Area (Table 2.1). The Permit Area includes the footprint of the conservation pool of the reservoir below elevation 315 NGVD and the limits of construction in the vicinity of the dam. The location and boundaries of waters of the U.S. at the site were delineated by Freese and Nichols, Inc. (FNI) as described in the Joint Public Notice of 404 permit application issued by the USACE and the Texas Commission on environmental Quality on September 4, 2003.

Table 2.1 Waters of The US Within the Permit Area

Water of the U.S. Classification	Area (acres)
Forested Wetlands	3,689
Shrub-scrub Wetlands	144
Herbaceous Wetlands	1,518
Intermittent Streams (204,864 linear feet)	47
Perennial Streams (370,128 linear feet)	255
Open Water	63
Hillside Bog	0.5
New Channel (14,256 linear feet)	30
TOTAL	5,746.5

3.0 Mitigation Site Selection

As noted in Table 2.1, the aquatic resources impacted by Lake Columbia consist of wetlands, streams, and open water. ANRA proposes to mitigate the impacts of the proposed Lake Columbia on waters of the U.S. by implementing mitigation activities at the following locations, which will be selected in consultation with the resource agencies and subject to USACE approval:

1. On-site, at the reservoir site: Within the reservoir itself or land immediately surrounding the reservoir
2. Near-site: Land connected immediately downstream as well as the U.S. Fish and Wildlife Service (USFWS) designated Priority 1 Bottomland Hardwood site at the confluence of Mud Creek and the Angelina River.
3. Off-site: Land that is not on-site or near-site, including the following:
   a. Land adjacent to the BTNP that meets the following criteria:
      i. Is in imminent danger of disturbance or has high potential for residential, commercial, industrial, or other intensive use, including timber harvesting, that would be detrimental to BTNP property.
      ii. Is undeveloped and exhibits high quality habitat or aquatic ecosystem functions based on a Habitat Evaluation Procedure (HEP) or Hydrogeomorphic (HGM) assessment.
   b. Land within the proclamation boundary of the NRNWR.

c. Other land suitable for wetland restoration or preservation that is within the Mud Creek or Neches River watersheds.

d. Mitigation bank credit purchase.

ANRA has received a financial commitment from the Texas Water Development Board (TWDB) which will provide funding for the purchase of land. However, funds for land acquisition will not be released until the 404 permit is issued. ANRA will commence consultation efforts with the resource agencies, consistent with Section 5.2.1 of this document, to acquire land for mitigation in the prioritized areas upon receipt of the 404 permit.

4.0 Site Protection

Mitigation Lands acquired by ANRA to compensate for impacts of the reservoir project will be protected in perpetuity from modification by establishing USACE approved conservation easements upon those properties. Such lands may be transferred in fee title to appropriate federal or state agencies or other USACE approved entity for management in perpetuity upon USACE approval.

In 2003, the Texas Legislature enacted Senate Bill 1362 which, among other things, gave ANRA the legal authority to adopt rules throughout the Lake Columbia watershed and around the Lake Columbia site to protect it from sources of pollution and other activities necessary to protect the water quality of the reservoir. ANRA subsequently adopted the WQR for Lake Columbia (Appendix B). ANRA has the authority under current law to enforce its WQR. Texas Water Code Section 49.216 further authorizes ANRA to contract for or employ peace officers to enforce its rules.

One of the important features of the WQR is the control over land development within the fringe areas of the reservoir. As provided in Section 6.01 of the WQR: "The general rules are that nothing can be constructed in this zone which will decrease the storage capacity of the lake, be a source of contamination, or significantly impact aquatic or terrestrial habitat." Section 6.02 restricts the construction of piers, docks, and other waterfront facilities in the Construction Regulated Zone and provides for prior approval and licensing by ANRA on a case by case basis. Before a property owner can subdivide

shoreline property, the owner must prepare and submit to ANRA a "Shoreline Habitat Plan." At least 60 % of the shoreline within 50 feet of 315 ft. msl elevation is required to be maintained in a natural condition. In considering shoreline modification, ANRA specifically will consider those areas identified as wetland fringe in the Mitigation Plan.

Mitigation land that is acquired by ANRA which is adjacent or proximate to the BTNP or within the NRNWR boundary will be conveyed to the United States of America or appropriate state agency to be made part of these public trust lands. Todd Brindle, Park Superintendent, has advised ANRA that the National Park Service has the legal authority to accept donated land. Such conveyance will be made after it has been determined by ANRA that the restoration or other action to benefit lands has been successful.

5.0 Baseline Information

Baseline conditions for both the Lake Columbia impact site and the proposed mitigation sites are described in the following sections.

5.1 Lake Columbia Impact Site

The proposed reservoir would be located on Mud Creek, a tributary to the Angelina River, and would extend into Smith and Cherokee Counties (Figure 1). The proposed dam site would be located approximately three miles downstream (south) of U.S. Highway 79 in Cherokee County, approximately at **Universal Transverse Mercator (UTM)** coordinates 297304.242 East and 3535573.434 North (Zone 15) on the Troup West, Tecula, Griffin, Jacksonville East, and new Summerfield 7.5-minute USGS quadrangle map in the USGS Hydrologic Unit 12020004.

The location and distribution of waters of the U.S. within the Lake Columbia footprint are shown in Figures 3a through 3g. The total area of affected waters of the U.S. is 5,746.5 acres (Table 2.1).

5.1.1 Assessment Methods

Wetland functions within the footprint of Lake Columbia were assessed by the USACE's EIS contractor using a desktop approach to the modified, rapid Hydrogeomorphic Methodology (HGM) model known as *HGM Interim*. The

methodology has been employed commonly by the Fort Worth District USACE in recent years, especially to evaluate the functional uplift potential of mitigation bank sites. For the Lake Columbia site, two models were selected by the USACE: *Riverine Herbaceous/Shrub HGM Interim* and *Riverine Forested HGM Interim*. Each of these models is used to evaluate the capacity of either riverine herbaceous/shrub-scrub or riverine forested wetlands to perform three wetland functions, as follows:

- Temporary storage and detention of surface water
- Maintain Plant and animal community
- Removal and sequestration of elements and compounds

The model yields a dimensionless functional capacity index (FCI) value ranging between 0 and 1.0 for each function, with 1.0 indicating perfect functional capacity and 0 indicating no capacity or value for that wetland function. The FCI is used to calculate functional capacity units (FCU) by multiplying the FCI value by the number of acres of wetland type (i.e., forested, shrub-scrub, or herbaceous wetland). The FCU values represent the units of functional impacts at the reservoir site, and they represent the units of mitigation credit that must be achieved at the mitigation site or that must be purchased from a mitigation bank in order to balance or compensate for project impacts. A detailed discussion of the method and the desktop HGM analysis conducted for the Lake Columbia site is presented in the Draft EIS. ANRA has developed its proposed compensatory mitigation plan based on the conservatively high wetland functional capacity values (FCIs for forested wetlands functions ranged from 0.83 to 0.98) estimated for the impact site by the USACE's environmental impact statement (EIS) contractor using the Hydrogeomorphic Interim model.

5.1.2 Existing Hydrology

Mud Creek, on which the proposed Lake Columbia would be located, is a tributary of the Angelina River and has a total drainage area of approximately 554 square miles. There is one streamflow gaging station on Mud Creek, USGS No. 08034500 (Mud Creek near Jacksonville). The gaging record extends from 1939 to 1979 and 2001 to present. The drainage area of Mud Creek and its tributaries above this gage covers 376 square miles. The average mean daily flow for 1940 through 1979 was 258 cubic feet per

second (cfs), and the median was 74 cfs. The minimum mean daily flow is 0 cfs and the maximum is 22,700 cfs. The proposed dam site would be located immediately upstream of the Coon Creek confluence and the drainage area at this point is approximately 384 square miles.

5.1.3 Existing Vegetation

The location and distribution of vegetative cover types within the Lake Columbia Reservoir site are depicted in Figures 4a through 4g. Following are descriptions of the typical species that occur within each cover type.

Herbaceous Wetland

Herbaceous wetlands within the Permit Area are dominated by wetland obligates such as rushes, sedges, smartweed, and lizard's tail (*Saururus cernuus*) (FNI, 2003). Common forbs include goldenrod and morning glory (*Ipomoea* sp.). Native grasses such as switch grass (*Panicum virgatum*) and bluestems (*Andropogon* sp.) are common.

Shrub Wetland

Shrub wetlands within the Permit Area are wetlands in successional transition between herbaceous wetlands and forested wetlands (FNI, 2003). Dominant shrubs include eastern false-willow (*Baccharis halimilifolia*), deciduous holly (*Ilex decidua*), and buttonbush (*Cephalanthus occidentalis*). Trees include overcup oak (*Quercus lyrata*), willow oak (*Q. phellos*), loblolly pine (*Pinus taeda*), and red maple (*Acer rubrum*). Vines include green briar (*Smilax* spp.), wisteria (*Wisteria* spp.), blackberry (*Rubus* spp.), and pepper vine (*Ampelopsis arborea*). Soft rush (*Juncus effusus*), American snowbell (*Styrax americana*), lizard's tail, sedges (e.g., *Carex* spp., *Cyperus* spp.), and smartweed (*Polygonum* spp.) dominated the herbaceous species present.

Bottomland Hardwood Forest (Deciduous Forested Wetland)

Bottomland hardwood forest in the proposed Lake Columbia project area is associated with the Mud Creek floodplain (FNI, 2003). Dominant trees include willow oak, overcup oak, American elm (*Ulmus americana*), sweet gum (*Liquidambar styraciflua*), sugar hackberry (*Celtis laevigata*), and water oak (*Q. nigra).* Dominant plants in the shrub strata are often small trees, such as those listed above, and may also

include water tupelo (*Nyssa aquatica*), deciduous holly (*Ilex decidua*), and American beautyberry (*Callicarpa americana*). Common vines in the bottomland hardwood forest include green briar (*Smilax* spp.), poison ivy (*Toxicodendron radicans*), trumpet creeper (*Campsis radicans*), and Japanese honeysuckle (*Lonicera japonica*), while common herbaceous plants include lizard's tail, sedges, goldenrod (*Solidago* spp.), and smartweed.

Riverine

Emergent, floating, and submergent aquatic vegetation is noticeably absent from the Mud Creek channel (FNI, 2003). Vegetation overhanging the stream channel typically includes herbs and grasses such as sedges, smartweed, and Indian sea-oats (*Chasmanthium latifolia*). Common tree and shrub species include planer-tree (*Planera aquatica),* water oak, swamp privet (*Forestiera acuminata*), and water tupelo (*Nyssa aquatica*).

Upland Forest (Deciduous Upland Forest)

Upland forests in the Permit Area are typically mixed hardwood/pine stands with thick sub-canopies of young trees, shrubs, and vines (FNI, 2003). Dominant tree species include water oak, post oak (*Quercus stellata*), southern red oak (*Quercus falcata*), loblolly pine, short leaf pine (*Pinus echinata*), sweet gum, winged elm (*Ulmus alata*), and eastern red cedar (*Juniperus virginiana*). Common shrub and vine species include common persimmon (*Diospyros virginiana*), American beautyberry, blackberry, Japanese honeysuckle, and green briar. Common herbs include joe-pye weed (*Eupatorium* sp.), corn salad (*Valerianella* sp.), sweet clover (*Melilotus* spp.), and dock (*Rumex* sp.).

Shrubland

Shrubland in the Permit Area represents a midpoint in the successional transition from pasture to forest (FNI, 2003). Most of the shrub stratum is made up of small trees (e.g., elms, oaks, sweet gum, and pines). Actual shrub species include eastern false-willow (*Baccharis halimilifolia*), sumac (*Rhus coriaria),* Mexican plum (*Prunus mexicana*), and rusty black-haw (*Viburnum rufidulum*). Common vines include blackberry, honeysuckle, and grape (*Vitis* sp.), and common herbaceous species include sedges, corn salad, rabbit tobacco (*Evax verna*), and sweet clover.

Grassland

Grassland within the Permit Area is generally represented by upland improved Bermuda grass (*Cynodon dactylon*) pastures that have typically followed from forest clearing (FNI, 2003). Common forbs include nettles (*Solanum* sp.), yankeeweed (*Eupatorium compostifolium*), corn salad, and goldenrod.

5.1.4 Existing Soils

Soils within the proposed footprint of Lake Columbia are presented in Table 5.1. Descriptions of the soil series are available online from the following:

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Official Soil Series Descriptions [Online WWW]. Available URL: "http://soils.usda.gov/technical/classification/osd/index.html" [Accessed 10 February 2008]. USDA-NRCS, Lincoln, NE.

Table 5.1 Soils in the Proposed Lake Columbia Footprint

Area (ac.)	Percent of Footprint Area	Description	Geomorphology	Prime Farmland	Erodibility	Drainage
4,289	40.38	Mantachie clay loam	floodplains		Not highly erodible	Somewhat poorly drained
1,703	16.03	Iuka fine sandy loam	floodplains		Not highly erodible	Moderately well drained
1,667	15.70	Marietta clay loam	floodplains		Not highly erodible	Moderately well drained
317	2.98	Bienville loamy fine sand, nearly level	stream terraces		Not highly erodible	Somewhat excessively drained
308	2.90	Sacul fine sandy loam, strongly sloping	interfluves		Highly erodible	Moderately well drained
298	2.80	Mantachie fine sandy loam	floodplains		Not highly erodible	Somewhat poorly drained
221	2.08	Bowie fine sandy loam, sloping	interfluves		Potentially highly erodible	Well drained
220	2.08	Bienville loamy fine sand	stream terraces		Not highly erodible	Somewhat excessively drained
204	1.92	Sacul fine sandy loam, sloping	interfluves		Potentially highly erodible	Moderately well drained
196	1.84	Mantachie loam, frequently flooded	floodplains		Not highly erodible	Somewhat poorly drained
114	1.07	Ochlockonee loamy fine sand	floodplains		Not highly erodible	Well drained
102	0.96	Sacul fine sandy loam, gently sloping	interfluves		Potentially highly erodible	Moderately well drained
95	0.89	Bowie fine sandy loam, gently sloping	interfluves	X	Potentially highly erodible	Well drained
89	0.83	Bienville loamy fine sand, sloping	stream terraces		Potentially highly erodible	Somewhat excessively drained
76	0.72	Sacul fine sandy loam, sloping, eroded	interfluves		Potentially highly erodible	Moderately well drained
63	0.60	Cuthbert fine sandy loam, strongly sloping	interfluves		Highly erodible	Well drained

Area (ac.)	Percent of Footprint Area	Description	Geomorphology	Prime Farmland	Erodibility	Drainage
53	0.50	Percilla soils	depressions on interfluves		Not highly erodible	Poorly drained
53	0.50	Hannahatchee fine sandy loam	floodplains		Not highly erodible	Well drained
45	0.43	Betis loamy fine sand, sloping	interfluves		Potentially highly erodible	Somewhat excessively drained
44	0.42	Lilbert loamy fine sand, sloping	interfluves		Potentially highly erodible	Well drained
39	0.37	Darco loamy fine sand, strongly sloping	interfluves		Highly erodible	Somewhat excessively drained
38	0.36	Darco loamy fine sand, sloping	interfluves		Potentially highly erodible	Somewhat excessively drained
38	0.36	Nacogdoches fine sandy loam, sloping, eroded	interfluves		Potentially highly erodible	Well drained
38	0.36	Trawick fine sandy loam, strongly sloping, eroded	interfluves		Highly erodible	Well drained
34	0.32	Angelina	floodplains		Not highly erodible	Very poorly drained
34	0.32	Sacul fine sandy loam, strongly sloping, eroded	interfluves		Highly erodible	Moderately well drained
32	0.30	Darco loamy fine sand, strongly sloping	interfluves		Highly erodible	Somewhat excessively drained
28	0.27	Elrose fine sandy loam, strongly sloping	interfluves		Highly erodible	Well drained
26	0.25	Elrose fine sandy loam, sloping	interfluves		Potentially highly erodible	Well drained
26	0.24	Woodtell fine sandy loam, gently sloping	interfluves		Potentially highly erodible	Well drained
26	0.24	Briley loamy fine sand, sloping	interfluves		Potentially highly erodible	Well drained
19	0.18	Alazan fine sandy loam, level	stream terraces	X	Not highly erodible	Moderately well drained
16	0.15	Tenaha loamy fine sand, strongly sloping	interfluves		Highly erodible	Well drained
15	0.14	Water				

Area (ac.)	Percent of Footprint Area	Description	Geomorphology	Prime Farmland	Erodibility	Drainage
11	0.10	Woodtell fine sandy loam, sloping	interfluves		Highly erodible	Well drained
6	0.06	Briley loamy fine sand, gently sloping	interfluves		Not highly erodible	Well drained
6	0.06	Elrose fine sandy loam, gently sloping	interfluves	X	Potentially highly erodible	Well drained
6	0.05	Ruston fine sandy loam, sloping	interfluves	X	Potentially highly erodible	Well drained
5	0.05	Bub-Trawick complex	interfluves		Highly erodible	Well drained
4	0.03	Owentown loamy fine sand, occasionally flooded	floodplains	X	Not highly erodible	Moderately well drained
2	0.02	Woodtell fine sandy loam, sloping, eroded	interfluves		Highly erodible	Well drained
2	0.02	Darco loamy fine sand, nearly level	interfluves		Not highly erodible	Somewhat excessively drained
2	0.02	Darco loamy fine sand, strongly sloping	interfluves		Highly erodible	Somewhat excessively drained
2	0.02	Lilbert loamy fine sand, gently sloping	interfluves		Not highly erodible	Well drained
2	0.02	Alazan fine sandy loam, sloping	stream terraces	X	Potentially highly erodible	Moderately well drained
2	0.02	Ruston fine sandy loam, gently sloping	interfluves	X	Potentially highly erodible	Well drained
1	0.01	Darco loamy fine sand, 1 to 6 percent slopes	interfluves		Potentially highly erodible	Somewhat excessively drained
1	0.01	LaCerda clay loam, sloping	interfluves		Potentially highly erodible	Moderately well drained
1	0.01	Gallime fine sandy loam, 1 to 5 percent slopes	stream terraces	X	Potentially highly erodible	Well drained
1	0.01	Bowie fine sandy loam, sloping, eroded	interfluves		Potentially highly erodible	Well drained

Source: NRCS, 2007

5.1.5 Existing Wildlife Usage

The following descriptions are based on the interagency HEP study conducted at the Lake Columbia site (FNI, 2003).

Bottomland Hardwood Forest (Deciduous Forested Wetlands)

This habitat type is situated along slopes and lowlands bordering Mud Creek and its tributaries. Cover is young to mature hardwood forest with many mast and fruit producing species. Understory and ground cover habitat structure are usually limited due to the dense overstory. The highly variable hydrologic regime of this habitat ranging from mesic to hydric, along with it being frequently associated with aquatic habitats, provides excellent habitat diversity. Characteristic fauna of bottomland hardwoods are white-tailed deer, (*Odocoileus virginianus*), fox squirrel (*Sciurus niger*), gray squirrel (*Sciurus carolinensis*), swamp rabbit (*Sylvilagus aquaticus*), raccoon (*Procyon lotor*), beaver (*Castor canadensis*), three-toed box turtle (*Terrapene Carolina*), western cottonmouth (*Agkistrodon piscivorus*), ground skink (*Leiolopisma laterale*), green anole (*Anolis carolinensis*), fence lizard (*Sceloporus undulates*), green tree frog (*Hyla cinera*), gray tree frog (*Hyla chrysoscelis*), gulf coast toad (*Bufo valiceps*), barred owl (*Strix varia*), hairy woodpecker (*Dendrocopos villosus*), downy woodpecker (*Dendrocopos pubescens*), wood thrush, (*Hylocichla mustelina*), and wood duck (*Aix sponsa*). Signs of white-tailed deer, bobcats (*Lynx rufus*), and raccoons are common in the bottomlands of the Permit Area, and common avian species include pileated woodpecker (*Dryocopus pileatus*), eastern-tufted titmouse (*Parus bicolor*), wood duck, Carolina wren (*Thryothorus ludovicianus*), red shouldered hawk (*Buteo lineatus*), and yellow-crowned night heron (*Nycticroax violaceus*).

Herbaceous Wetlands

Herbaceous wetlands (hydric habitats) typically exhibit a relatively high species diversity and habitat structure. These areas may also be associated with aquatic habitats (ponds and streams), thus increasing habitat diversity. Typical wildlife inhabiting herbaceous wetland areas include raccoon, beaver, cricket frog (*Acris crepitans*), spring peeper (*Hyla crucifer*), Strecker's chorus frog (*Pseudacris streckeri*), southern leopard frog (*Rana utricularia*), green anole, western cottonmouth, water snake (*Nerodia erythrogaster*), great blue heron (*Ardea herodias*), snowy egret (*Leucophoyx thula*), and red-winged blackbird (*Agelaius phoeniceus*). Marsh wrens

(*Cistothorus palustris*), common yellow throats (*Geothlypis trichas*), and turkey (*Meleagris galopavo*), along with beaver and a variety of frogs, can be found within the herbaceous wetlands of the Permit Area (FNI, 2003).

Shrub-Scrub Wetlands

Shrub-scrub wetlands are in successional transition between herbaceous wetlands and bottomland hardwood forests. Shrub-scrub wetlands can also be associated with aquatic habitats (ponds and streams), thus increasing habitat diversity. Characteristic wildlife included those occurring in both herbaceous wetlands and bottomland hardwood forests. A variety of songbirds, including yellow-breasted chat (*Icteria virens*), along with evidence of beaver activity have been observed in shrub-scrub wetlands within the Permit Area (FNI, 2003).

Riparian

Characteristic wildlife associated with streams and ponds are raccoon, opossum (*Didelphis virginiana*), beaver, cricket frog, bullfrog (*Rana catesbeana*), southern leopard frog, red-eared turtle (*Chyrsemys* sp.), snapping turtle (*Chelydra serpentina*), diamond-backed water snake (*Nerodia rhombifera*), western cottonmouth, mallard (*Anas platyrhynchos*), wood duck, great blue heron, and green heron (*Butorides virescens*) (FNI, 2003).

Grassland

Characteristic wildlife of the grassland habitat are nine-banded armadillo (*Dasypus novemcinctus*), eastern cottontail (*Sylvilagus floridanus*), hispid cotton rat (*Sigmodon hispidus*), long-tailed harvest mouse (*Reithrodontomys fulvescens*), plains pocket gopher (*Geomys bursarius*), six-lined racerunner (*Cnemidophorus sexlinatus*), racer (*Coluber constrictor*), painted bunting (*Passerina ciris*), lark sparrow (*Chondestes grammacus*), eastern meadowlark (*Sturnella ma*gna), mockingbird (*Mimus polyglottos*), scissor-tailed flycatcher (*Muscivora forfic*), mourning dove (*Zenaidura macroura),* bobwhite quail (*Colinus virginianus*), red tailed hawk (*Buteo lineatus*), and turkey vulture (*Cathartes aura*) (FNI, 2003).

Streams and Ponds

Fish collected in the Mud Creek watershed are shown in Table 5.2. Fish in ponds in the project area are those that would be stocked by landowners and would likely be channel catfish, largemouth bass, bluegill and various baitfish species.

Table 5.2 Fish Species Collected from Mud Creek and Tributaries

Scientific Name	Common Name	Fish Collected (# of Individuals)					
		Mud Creek SH 110	West Mud Creek	Mud Creek U.S. 79	Keys Creek	Ragsdale Creek	
						1	2
Petromyzontidae	Lampreys						
Ichthyomyzon gagei	southern brook lamprey				1		
Lepisosteidae	Gars						
Lepisosteus occulatus	spotted gar	1		6			
Amiidae	Bowfins						
Amia calva	bowfin			1			
Clupeidae	Herrings						
Dorosoma cepedianum	gizzard shad		1				
Esocidae	Pikes						
Esox americanus	redfin pickerel	3			1		
Cyprinidae	Carps and Minnows						
Cyprinella lutrensis	Red shiner			1			
C. venusta	blacktail shiner	8	3	2	17		
Hybopsis amnis	pallid shiner			12			
Lythrurus fumeus	ribbon shiner		2	10	53		4
L. umbratilis	redfin shiner		2				
Notropis atherinoides	emerald shiner	20					
N. atrocaudalis	blackspot shiner		3	1	17	34	63
N. texanus	weed shiner	126		3	5		
Opsopoeodus emiliae	pugnose minnow			17	1		
Phenacobius mirabilis	suckermouth minnow				1		
Pimephales vigilax	bullhead minnow	1		7	24		
Semotilus atromaculatus	creek chub					33	23
Catostomidae	Suckers						
Erimyzon sucetta	lake chubsucker						1
Minytrema melanops	spotted sucker			6			
Moxostoma poecilurum	blacktail redhorse			9			
Ictaluridae	North American Catfishes						
Amierus natalis	yellow bullhead	1	2		2	15	8
Ictalurus punctatus	channel catfish			3			
Noturus nocturnus	freckled madtom				17		
Aphredoderidae	Pirate Perches						
Aphredoderus sayanus	pirate perch	8					
Fundulidae	Topminnows						

Scientific Name	Common Name	Fish Collected (# of Individuals)					
		Mud Creek SH 110	West Mud Creek	Mud Creek U.S. 79	Keys Creek	Ragsdale Creek	
						1	2
Fundulus notatus	blackstripe topminnow	8	2	3	14	33	24
Poeciliidae	Livebearers						
Gambusia affinis	western mosquitofish	2	71	28	13	47	62
Centrarchidae	Sunfishes						
Lepomis cyanellus	green sunfish		20			7	
L. gulosus	warmouth	12		1	4	2	
L. macrochirus	bluegill	19	3	3	8	3	
L. megalotis	longear sunfish	56	7	12	61	10	14
L. microlophus	redear sunfish			1			
L. punctatus	spotted sunfish	5			2		
Micropterus punctulatus	spotted bass	2		1			
M. salmoides	largemouth bass	6	4	4	2	1	
Pomoxis annularis	white crappie			3			
P. nigromaculatus	black crappie	3					
Percidae	Perches						
Etheostoma asprigene	mud darter	19			2		
E. chlorosoma	bluntnose darter	1		3	1		
E. gracile	slough darter	14					
E. whipplei	redfin darter						1
Percina sciera	dusky darter	2			12		
Sciaenidae	Drums and Croakers						
Aplodinotus grunniens	freshwater drum			2			
	Total Number	317	120	139	258	185	200
	Total Species	21	12	24	21	10	9

List compiled from TNRCC, 1996 and 1999.

Nomenclature according to Nelson et al., 2004.

Upland Forest (Deciduous Upland Forest)

Characteristic wildlife of the upland hardwood forest habitat type are white-tailed deer, fox squirrel, raccoon, white-footed mouse (*Peromyscus leucopus*), eastern cottontail, three-toed box turtle, green anole, Texas rat snake (*Elaphe obsoleta*), downy woodpecker, red-bellied woodpecker (*Centurus carolinus*), cardinal (*Richmondena cardinalis*), Carolina chickadee (*Parus carolinensis*), Carolina wren (*Thryothorus ludovicianus*), mourning dove, black and white warbler (*Mniotilta varia*), pine warbler (*Dendroica pinus*), and blue jay (*Cyanocitta*

cristata). Eastern bluebirds (*Sialia sialis*), pine warblers, tufted-titmouse (*Baeolophus bicolor*), broad-headed and five-lined skinks (*Eumeces laticeps* and *E. faciatus*, respectively), gray tree frogs (*Hyla* sp.), and armadillos (*Dasypus novemcinctus*) have been observed in upland forests within the Permit Area (FNI, 2003).

Shrub-Scrub Upland

Wildlife species inhabiting shrub-scrub uplands include white-tailed deer, raccoon, opossum, eastern cottontail, coyote (*Canis latrans*), six-lined racerunner, green anole, racer, and copperhead (*Akistrodon contortrix*). Bird species observed in this habitat type within the Permit Area included indigo bunting (*Passerina cyanea*), blue grosbeak (*Guiraca caerulea*), red-tailed hawk, cardinal, mourning dove, eastern kingbird (*Tyrannus tyrannus*), and common crow (*Corvus brachyrhynchos*) (FNI, 2003).

5.2 Mitigation Sites

ANRA proposes to mitigate the impacts of the proposed Lake Columbia project on waters of the U.S. onsite, near site, and off-site. Mitigation sites generally were selected based on proximity to the reservoir site, location within the Neches River basin, potential for ongoing human disturbances such as logging and land development from which mitigation might provide protection, and landscape position that would enhance the probability of achieving mitigation success criteria.

Onsite mitigation for which ANRA proposes compensatory mitigation credit would include the creation of 1,195 acres of herbaceous (emergent) fringe wetlands and 8,938 acres of open water as depicted in Figure 5A. A typical cross-sectional view of the wetland fringe area relative to shoreline zones protected under the WQRs is presented in Figure 5B. Other less tangible, but nonetheless important mitigation benefits would be provided by water quality protection measures imposed by the Lake Columbia WQR and flood easement restrictions surrounding the proposed reservoir (Figure 2).

Near site and off-site mitigation would be provided through the acquisition of large blocks of land within the Mud Creek floodplain downstream of the proposed reservoir and in the USFWS designated Priority 1 Bottomland Hardwood area, near the BTNP, and within the NRNWR site. ANRA has targeted these areas as potential mitigation sites based on their

location within the Neches River basin, adjacency to Mud Creek or the Neches River, and ecological and societal value. The conditional assessment of the proposed mitigation sites, described in the following sections, was based on geographic information system analysis of publicly available remote sensing data, including Texas Parks and Wildlife Department land cover mapping data, USGS National Hydrography Dataset, and USDA hydric soils mapping data.

5.2.1 Interagency Site Selection Process

The boundaries of each mitigation site would be determined based on ANRA and interagency field review of the mitigation sufficiency of these areas, including functional assessment, prior to completion of reservoir construction. The process for the interagency review and site selection is shown in Figure 11 and described, as follows.

ANRA has identified blocks of land in this plan as potential mitigation sites. Upon issuance of a 404 permit, ANRA would invite state and federal resource agencies to participate in planning meetings for site visits to the proposed mitigation sites. The purpose of the meetings would be to prepare for site visits by reaching consensus on field data forms and logistics for field data collection and other relevant items. The specific functional assessment methods to be used will be decided during USACE-led EIS cooperating agency meetings.

Following planning meetings, the resource agencies would be invited to participate in field visits led by ANRA to perform functional assessments and characterize baseline conditions of the proposed mitigation sites. These assessments would provide data necessary for ANRA to draft detailed mitigation site plans that would be presented to the USACE and other resource agencies for concurrence. These plans would include proposed restoration and enhancement measures, as applicable, and they would present the calculation of credit value for existing and future conditions (i.e., the ecological uplift) at each site. When the USACE and other resource agencies approve a mitigation site plan, the uplift credits would be subtracted from the required number of credits to offset project impacts. As illustrated by the flow chart loop in Figure 11, the cycle of conducting functional assessments on proposed mitigation tracts, preparing site plans for resource agency concurrence, and calculating the uplift value for mitigation tracts would continue until the calculations indicate that project impacts would be offset by the proposed mitigation sites.

The resource agencies would be notified of the implementation and monitoring schedule for each mitigation site. ANRA would invite the agencies to observe or participate in implementation and monitoring activities to the extent each agency desires to do so.

5.2.2 Mud Creek Site Below Lake Columbia

This near-site mitigation area consists of 1,869 acres of bottomland habitat adjacent to Mud Creek immediately downstream of the Lake Columbia dam site (Figure 6a). The majority of the soils within this area are mapped as hydric (Figure 6b). There are 13,429 linear feet of intermittent streams and 111,245 linear feet of perennial streams embedded within the area based on NHD mapping data. The area of wetland cover types, based on TPWD mapping data, are as follows:

Acres	Type
18	Bottomland Seasonally Flooded Hardwood Forest
580	Bottomland Baldcypress Swamp
179	Small Stream and Riparian Temporarily Flooded Hardwood Forest
125	Small Stream and Riparian Wet Prairie
93	Bottomland Wet Prairie
88	Bottomland Temporarily Flooded Hardwood Forest
73	Bottomland Herbaceous Wetland
43	Bottomland Deciduous Successional Shrubland
4	Bottomland Temporarily Flooded Mixed Pine / Hardwood Forest
2	Small Stream and Riparian Baldcypress Swamp
2	Small Stream and Riparian Temporarily Flooded Mixed Forest

Based on the current desktop analysis of available data, this tract would afford mitigation credit by preservation of existing streams and bottomland hardwood forested wetland habitat. If site conditions are observed at the time of interagency field visits, the use of restoration or enhancement measures for streams or wetlands would be considered for this tract.

5.2.3 Mud Creek Priority 1 Bottomland Hardwood Site

This near-site mitigation area consists of 4,471 acres of bottomland habitat along Mud Creek just upstream of its confluence with the Angelina River (Figure 7a). This site was designated by the U.S. Fish and Wildlife Service in 1984 as priority bottomland hardwood preservation area. The majority of the soils within this area are mapped as hydric (Figure 7b), and there are 85,884 linear feet of intermittent streams and 97,544 linear feet of perennial

streams embedded within the area based on NHD mapping data. The area of wetland cover types, based on TPWD mapping data, are as follows:

Acres	Type
2403	Bottomland Seasonally Flooded Hardwood Forest
1225	Bottomland Baldcypress Swamp
268	Small Stream and Riparian Temporarily Flooded Hardwood Forest
179	Small Stream and Riparian Wet Prairie
110	Bottomland Herbaceous Wetland
53	Bottomland Temporarily Flooded Hardwood Forest
28	Small Stream and Riparian Seasonally Flooded Hardwood Forest
11	Small Stream and Riparian Deciduous Successional Shrubland
4	Small Stream and Riparian Baldcypress Swamp
3	Small Stream and Riparian Temporarily Flooded Mixed Forest

Review of the aerial map presented in Figures 7a and 7b, nearly half of the forested area was clearcut in the recent past. Thus, for planning purposes, ANRA estimates that one-half of the target area (i.e., 2,235.5 acres) would afford mitigation credit by preservation and the other half would provide mitigation credit by restoring bottomland hardwood forest and protecting embedded streams.

5.2.4 Big Thicket National Preserve Mitigation Site

This off-site mitigation area consists of 4,232 acres of privately owned bottomland habitat along the Neches River adjacent to the existing Big Thicket National Preserve (Figure 8a). The majority of the soils within this area are mapped as hydric (Figure 8b). There are 7,033 linear feet of intermittent streams and 24,383 linear feet of perennial streams embedded within the area based on NHD mapping data. The area of wetland cover types, based on TPWD mapping data, are as follows:

Acres	Type
3096	Bottomland Seasonally Flooded Hardwood Forest
586	Bottomland Temporarily Flooded Hardwood Forest
51	Bottomland Deciduous Successional Shrubland
0.4	Bottomland Baldcypress Swamp
10	Bottomland Wet Prairie
4	Bottomland Temporarily Flooded Mixed Pine / Hardwood Forest
17	Hardwood Flatwoods

This site would afford mitigation credit by preservation of existing stream and wetland habitat.

5.2.5 Neches River National Wildlife Refuge Site

This off-site mitigation area consists of 1,023 acres of privately owned bottomland habitat along the Neches River within the boundary of the newly designated Neches River National Wildlife Refuge (Figure 9a). The majority of the soils within this area are mapped as hydric (Figure 9b). There are 3,006 linear feet of intermittent streams and 32,296 linear feet of perennial streams embedded within the area based on NHD mapping data. The area of wetland cover types, based on TPWD mapping data, are as follows:

Acres	Type
779	Bottomland Seasonally Flooded Hardwood Forest
73	Bottomland Baldcypress Swamp
50	Small Stream and Riparian Temporarily Flooded Hardwood Forest
46	Bottomland Herbaceous Wetland
16	Bottomland Temporarily Flooded Hardwood Forest

This site would afford mitigation credit by preservation of existing stream and wetland habitat.

6.0 Determination of Compensatory Mitigation Credits

ANRA proposes to compensate for the loss of functions of waters of the U.S. due to the development of the proposed Lake Columbia by on-site, near-site, and off-site mitigation measures. The location of Lake Columbia and the proposed mitigation sites within the Neches River basin is depicted in Figure 10. If ANRA was unable to compensate for the impacts of Lake Columbia to waters of the U.S. through preservation, restoration, or other permittee-responsible action, ANRA would purchase mitigation bank credits to supplement its permittee responsible mitigation activities in order to achieve no net loss of functions of waters of the U.S.

6.1 Onsite Mitigation Credit Determination

ANRA proposes compensatory mitigation credit for two types of water bodies onsite, including fringe wetlands and open water. The rationale for credit determination for these water types follows.

6.1.1 Onsite Fringe Wetland Credit Determination

As described in the DEIS, the USACE and its EIS contractor conducted a field evaluation of fringe wetland development in several representative East Texas reservoirs and estimated that 1,195 acres of fringe wetlands would develop in certain shallow (i.e., 4-foot deep or less), gently sloping portions of the Lake Columbia (USACE, *Date of new DEIS to be inserted here*). The expected location and distribution of these wetlands are depicted in Figure 5A. A typical cross-sectional view of the expected wetland fringe area relative to shoreline zones protected under the WQRs is presented in Figure 5B. ANRA estimates that the establishment of 1,195 acres of fringe wetlands in Lake Columbia would for compensate for lost functions of 1,195 acres of the 1,518 acres of herbaceous wetlands (Table 2.1) inundated by the proposed reservoir. This would leave 323 acres of herbaceous wetland impacts to be addressed by other mitigation methods, such as preservation or restoration of similar habitat near site or off site. These wetlands would temporarily detain runoff (flood) waters from overland flow when the reservoir level is lower that the wetland elevation; they would provide for the maintenance of plant and animal communities by sheltering and providing forage for aquatic and amphibious species (fish, frogs, snakes, salamanders, insects, etc.); and they would sequester nutrients and other compounds and elements within the cellular structure of the aquatic macrophytes and organisms that utilize such plants as substrate or host. The fringe wetlands would be protected by ANRA through fee title purchase and adoption of conservation easements in the No Discharge Zone adjacent to the fringe wetland areas. They would also be protected under the authority of ANRA's Water Quality Regulations (WQRs), as described under the *Site Protection* section of this Mitigation Plan. ANRA would adopt enforceable WQR permit criteria following approval of a 404 permit for Lake Columbia. The WQRs offer protection of the fringe wetland areas in several ways, including the following:

- Human-induced erosion is prohibited under the No Discharge Zone clause, which states that adjacent landowners are required to abate erosion on their properties that is due to anything other than natural causes.
- The Construction Regulated Zone (between elevations 315 feet NGVD and 330 feet NGVD) clause prohibits building any structure that would decrease the lake's

storage capacity, contribute pollutants, or significantly impact aquatic or terrestrial habitat (e.g., fringe wetlands).

- ANRA would adopt WQR permit criteria in accordance with the Construction Regulated Zone clause that would prohibit issuance of a license for construction of piers, boat docks, and other water front facilities in the designated fringe wetland mitigation areas.
- In accordance with the Land Development clause which requires at least 60% of the lake shore to remain undeveloped/natural, ANRA would set aside the designated fringe wetland mitigation areas as undeveloped/natural shoreline areas during development of WQR permit criteria.

6.1.2 Onsite Open Water Credit Determination

The proposed Lake Columbia will have a surface area of 10,133 acres. Subtracting 1,195 acres of expected fringe wetlands, the total area of open water to be created in the lake is 8,926 acres of open water. It is expected that this area will compensate fully for the inundation of 63 acres of open water (Table 2.1) within the reservoir footprint.

6.2 Near-Site and Off-Site Mitigation Credit Determination

6.2.1 Wetlands Mitigation Credit Determination

The U.S. Army Corps of Engineers' mitigation sufficiency calculator (USACE, *http://el.erdc.usace.army.mil/wetlands/calc/HGMMit**Sufficiency**(xl).xls*) was used to identify the approximate number of acres necessary to compensate for wetlands impacts in addition to onsite mitigation. The results are presented in Table 6.1. It should be noted that these calculations are based on readily available remote sensing data. Actual field data will be collected by ANRA and participating resource agencies at each proposed mitigation site as described elsewhere in this plan in order to estimate the compensatory value of each site.

Table 6.1 Generalized Mitigation Sufficiency Analysis for Use with any HGM Calculators

Project Name: Lake Columbia **Alternative:** Forested wetlands

Impact Site

Functions[2]	Weight[3] ☑	A Pre-Project 3689.00 ha			B Post-Project 0.00 ha			Net Loss 3689.00 ha		
		FCI	Adj FCI	Adj FCUs	FCI	Adj FCI	Adj FCUs	FCI	Adj FCI	Adj FCUs
1 Temp. storage and detention surface water	1	0.96	0.32	1180.48	0.00	0.00	0.00	-0.96	-0.32	-1180.48
2 Maintenance of plant and animal communities	1	0.98	0.33	1205.07	0.00	0.00	0.00	-0.98	-0.33	-1205.07
3 Removal/sequestration of elements/compounds	1	0.83	0.28	1020.62	0.00	0.00	0.00	-0.83	-0.28	-1020.62
4										
5										
6										
7										
TOTALS		2.77	0.92	3406.18	0.00	0.00	0.00	-2.77	-0.92	**-3406.18**

Mitigation Site Year Analyzed: 10

Functions	Weight ☑	C Pre-Project 9000.00 ha			D Post-Project 9000.00 ha			Net Gain 0.00 ha		
		FCI	Adj FCI	Adj FCUs	FCI	Adj FCI	Adj FCUs	FCI	Adj FCI	Adj FCUs
1 Temp. storage and detention surface water	1	0.20	0.07	600.00	0.60	0.20	1800.00	0.40	0.13	1200.00
2 Main. Of plant and animal communities	1	0.20	0.07	600.00	0.60	0.20	1800.00	0.40	0.13	1200.00
3 Removal/sequestration of elements/compounds	1	0.20	0.07	600.00	0.60	0.20	1800.00	0.40	0.13	1200.00
4										
5										
6										
7										
TOTALS		0.60	0.20	1800.00	1.80	0.60	5400.00	1.20	0.40	**3600.00**

Impact and Mitigation Net Adjusted FCUs as of Year 10:	**193.82**

1. Enter data into yellow cells. Others will be calculated.
2. Enter the names of the functions used in the HGM Guidebook and Calculator for your area. Those for the Wet Pine Flats of the Gulf Coastal Plain are shown. Up to 7 functions may be analyzed. Functions not being assessed should be left blank in all cells.
3. If desired, the functions may be weighted and averaged. To assign weights, check Weight box and enter weights for each function. If you set all weights to 1, the total adjusted FCI will be a straight average of the FCIs. Weights for the mitigation and impact sites should be the same.

Based on the three functions represented in the HGM analysis conducted by the USACE and its EIS contractor, assuming an arbitrary functional uplift of 0.40 over a 10-year period, ANRA would need approximately 9,000 acres of mitigation land to compensate for the loss of 3,406 FCUs in forested wetlands inundated by Lake Columbia.

ANRA's rationale to estimate the amount of mitigation credit (FCUs) potentially available in the four proposed mitigation sites is illustrated in Table 6.2.

Table 6.2 Lake Columbia Wetland Mitigation

Mitigation Site	Location	Acres	Mitigation Ratio	FCI (Baseline)	FCUs (baseline)	FCI (after 10 yrs)	FCU (Credits)
1	Mud Creek Downstream of Dam (preservation)	1,869	1/10	0.90	1,682	0.95	178
2a	Priority 1 BLH (preservation)	2,235.5	1/2	0.90	2,012	0.95	1,062
2b	Priority 1 BLH (restoration)	2,235.5	1	0.20	447	0.60	894
3	Big Thicket National Preserve (preservation)	4,232	1/2	0.90	3,809	0.95	2,010
4	Neches River National Wildlife Refuge (preservation)	1,023	1/2	0.90	921	0.95	486
	Total	**11,595**				**Total**	**4,630**

This example analysis indicates that the combined 11,595 acres of prospective mitigation lands could yield as many as 4,630 FCUs. This conclusion is based on the following assumptions:

- There is high quality (FCI = 0.90) forested wetlands suitable for preservation at each site.
- Approximately half of the area (2,235.5 acres) at the Priority 1 Bottomland Hardwood site is clearcut with FCI = 0.20 and would be restored to forested wetlands with FCI = 0.60 in 10 years.
- Forested wetland preservation areas would have baseline FCI = 0.90.
- Over a ten year period, the preserved forested wetland areas would have a functional uplift of 0.05 FCI, raising their value to FCI = 0.95.
- Preserved forested wetlands at the Mud Creek site below the dam would receive a mitigation credit ratio of 10:1 (10 acres/FCUs preserved compensates for 1 acre/FCU impacted).
- All other preserved forested wetlands would receive a mitigation ratio of 2:1, in recognition of the high ecological and societal value (USFWS Priority 1 BLH site, Big Thicket Nat'l Preserve, and Upper Neches River Wildlife Refuge).
- Restored forested wetlands would receive a mitigation ratio of 1:1.

Mitigation for herbaceous wetlands not compensated by the reservoir fringe wetlands and shrub wetlands could also be accomplished at the selected areas described above. Approximately 323 acres of herbaceous wetland (in addition to the 1,195 acres mitigated onsite) and 144 acres of shrub wetland would need to be mitigated. Based on the TPWD cover type mapping there appears to be adequate opportunities for restoration, enhancement or preservation. Mitigation plans for these would be developed after detailed interagency studies are conducted at the four mitigation areas previously described.

6.2.2 Stream Mitigation Credit Determination

Streams embedded within the preserved and restored mitigation sites would be protected by the conservation easements executed by ANRA for each site and by fee title transfer to a federal or, state agency, or other USACE approved entity. Streams in these areas would be protected in perpetuity from the impacts that they are currently subject to due to sedimentation resulting from periodic logging or clearing for other purposes. Such activities also typically involve temporary stream crossing that result in direct and indirect impacts, including potential long-term stream bank erosion at the crossing sites that can persist for years if the temporary crossing sites are not restored properly. Streams embedded within the mitigation sites would benefit from the perpetual protection of their adjacent riparian floodplain zones. Streams are dynamic and tend to heal themselves if given time and protection from disturbances (vegetation clearing, expansion of impervious surfaces, etc.) within their watersheds. Thus, perpetual preservation of streams within these mitigation areas over time is expected to result in restoration of stream functions.

The length of streams in the four mitigation sites, based on the National Hydrographic Dataset, were measured and compared to the impacted stream length at the Lake Columbia site. The results are presented in Table 6.3 and indicate that there would be an overall surplus of 398,617 linear feet of stream within the four mitigation sites that could be protected by preservation compared to the length impacted at the Lake Columbia site. Streams identified from NHD mapping would be verified during interagency field visits to the mitigation sites.

Table 6.3 Lake Columbia Stream Mitigation

Mitigation Component		Acres	Intermittent Streams (ft)	Perennial Streams (ft)
1	Mud Creek Downstream of Dam (preservation)	1,869	13,429	111,245
2	Priority 1 BLH (preservation)	4,471	85,884	97,544
3	Big Thicket National Preserve (preservation)	4,232	7,033	247,383
4	Neches River National Wildlife Refuge (preservation)	1,023	3,006	32,296
		Total Stream Mitigation (preservation)	109,352	488,468
		Impacted Streams (ft)	204,864	370,128
		Net Gain/Loss	(95,512)	118,340

7.0 Mitigation Work Plan

ANRA will develop a mitigation work plan for each mitigation site following the process identified in Figures 11 and 12. Generally, this will involve ANRA identifying specific blocks of land for review followed by solicitation of interagency involvement in field-based functional assessments of the mitigation quality. The result of this process will be the acquisition of suitable property and acreages adequate to compensate for the lost functions of waters of the U.S. at the Lake Columbia site. For wetland restoration lands, this process will culminate in a USACE and cooperating agency approved mitigation work plan. The plan will prescribe site preparation, planting, and monitoring activities necessary to achieve compensatory mitigation goals for that property.

8.0 Maintenance Plan

Once mitigation is implemented, the mitigation land will be monitored as provided in the *Monitoring Requirements* and *Performance Standards* sections of this plan. In addition to corrective action as may be required, maintenance of the property will include:

- Protection from encroachment by neighboring landowners;
- Protection from timber thefts;
- Maintaining boundary markings;

- Providing for usages which do not interfere with the achieving and maintaining wetland functions;
- Replacing vegetation planted as needed to achieve survival goals;
- Controlling invasive species; and
- Taking such other action as may be necessary under the Adaptive Management Plan.

The cost of the maintenance will be included in the cost for operating and maintaining Lake Columbia Reservoir which the Participants will be obligated to pay.

9.0 Performance Standards

Performance standards to be used in this plan will conform to the USACE guidance in effect at the time this plan was developed. If mitigation site evaluations indicate that ecological uplift goals would not be met at the end of 10 years, appropriate steps would be implemented to achieve success.

9.1 Target Values

Vegetation characteristics indices of the highest function values (e.g., FCIs if HGM is the assessment tool) will be used as indicators of the effectiveness of mitigation site success. A goal of the mitigation plan(s) would be to offer plant species diversities that provide benefits to wildlife throughout the year. Hickories and oaks are good mast producers, but they only provide food value in the fall. Other tree species would also include elm, maple or other species that seed in the spring, and fruit trees like plum, cherry or mulberry that produce during the summer. The same applies to the herbaceous species, the *Carex* spp. bloom and fruit in the spring, *Cyperus* spp. bloom and fruit in the fall. Considering the oak species, the white oak group drops acorns in the fall that were fertilized in the spring. The acorns from the red oak group take 2 years to mature and drop. If a rainy period occurs during the oak bloom, the white oak acorn crop will be poor in the fall, but the red oaks will drop the acorns that were fertilized the previous spring. So, planting a mixture of red and white oaks would increase the likelihood that there will be reliable source of acorns on the mitigation site every year. There would be a focus on planting the more desirable large or heavy seeded species and expect to see the lighter seeded

easily dispersed species to come in on their own. A list of candidate species provided by the USACE for the Pineywoods Region is included in Appendix C.

The planting rates for trees would depend on the type of planting stock. If seedlings are preferred, they would be planted at a minimum rate of 435 bare-rooted seedlings per acre during the winter dormant season. If containerized or balled and burlap saplings are the preferred planting stock, they would be planted at a minimum rate of 110 trees per acre or other rate approved by the USACE. The preferred time to plant these would also be during the winter when the trees are dormant, but containerized or balled and burlap stock could be planted at other times of year, if necessary. Performance goals would also be met by desirable (native) volunteer species.

9.2 Vegetative Cover Survival Goals

Tree and shrub planting survival in the wetland restoration sites will be monitored annually in September and October for years 1 through 5 after the site restoration is completed and then at years 7 and 10. The overall goal will be to have a functioning early-successional stage forested wetland established at the end of 10 years. The 10-year goal is based on growth and yield models for southern hardwoods (McTague et al., 2006). For a moderate quality site (site index =50 based on 25 years base age) a mixed southern hardwood site should have trees with a mean height of approximately 25 feet at the end of 10 years. Part of the monitoring would be to document tree height, stem density, basal area, shrub and tree canopy cover. These survival goals will be used as indicators of the relative success of planting and any discrepancies will be addressed as part of the Adaptive Management Plan as described in Section 12. Performance goals would also be met by desirable (native) volunteer species.

9.3 Functions Goals

In addition to the survival goals, the primary goal of the overall compensatory mitigation plan is to restore and/or create a functioning forested wetland that will ***replace the lost functions and services*** of those lost by the proposed Lake Columbia Project.

At years 5 and 10, the HGM Interim model variables used for the Lake Columbia HGM Interim baseline would be sampled, calculated and compared to the mitigation sites baseline to document success. If after 10 years the mitigation site(s) have achieved net gain/loss of zero or

greater, the plan will be considered a success and mitigation implementation will be deemed complete. Wildlife use of the mitigation site will be documented (quantitatively if practicable) during monitoring events.

10.0 Monitoring Requirements

A detailed monitoring plan will be developed for each mitigation tract. ANRA will be responsible for retaining a qualified staff or entity to conduct monitoring at mitigation sites at years 1 through 5 and years 7 and 10 following implementation of planting. Monitoring will be conducted by evaluating plant survival rates based 5-percent surveys of mitigation tracts using 0.1-acre plots. The HGM model or other functional assessment tool as agreed upon by ANRA, the USACE, and the cooperating agencies will be used to monitor the mitigation tracts. Monitoring reports shall be prepared in letter format and will include maps, data, and photographs necessary to allow the USACE to evaluate the performance and success of mitigation efforts.

11.0 Long-Term Management Plan

Mitigation land owned by ANRA will be monitored on a periodic basis by making visual observations after year 10 to insure that the land has continued to develop in accordance with the applicable desired mitigation condition.

The East Texas area is subject to a number of events which could be detrimental to the mitigation lands including hurricanes, floods, wildfires, tornados, and other similar types of occurrences. The impacts from these events may require corrective actions in order to maintain or obtain the appropriate functions. Any corrective action taken will be consistent with this Mitigation Plan. Any proposed action which will result in a modification of a mitigation site will be submitted to the Corps for its prior approval. Corrective actions consistent with the Texas Forest Service BMPs will not require prior approval.

The cost of the maintenance shall be included in the operation and maintenance budget for Lake Columbia. In the contracts between ANRA and the Participants, the Participants will be obligated to pay the annual operating and maintenance expenses.

Long term management may also require prescribed burns of forest lands, control of invasive species, and maintenance of topographic features to control hydrology. Likewise, cost

of insuring compliance with conservation restrictions will be a part of the operation and maintenance expense payable by the Participants.

Upon a determination that a mitigation tract meets the compensatory mitigation requirements, such land may be conveyed to a federal or state agency, or other USACE approved entity. Once the mitigation land has been transferred, the receiving entity will provide for the long term management. For other mitigation land, the long term costs will be included in the operation and management budget of Lake Columbia which will be an obligation of the Lake Participants.

12.0 Adaptive Management Plan

The following elements will be monitored and evaluated during monitoring events to determine whether any corrective action needs to be implemented as determined by the USACE, cooperating agencies, and ANRA.

12.1 Hydrology

If baseline hydrological conditions or modified conditions created as part of the mitigation plan are not supporting the conditions needed for a functioning forested wetland, then the problem will be assessed using hydrological/hydraulic modeling, on-the-ground surveys, etc. to provide solutions. The creation of beaver dams or other natural events modifying hydrology will not be considered a problem unless the event is detrimental to the overall functioning of the site.

12.2 Topography

Any topographical modifications made as part of the mitigation plan will be monitored for effectiveness. If there is evidence that features created (ponds, swales berm/hummocks, etc.) are not "working," attempts to modify them will be made to the extent practicable without damaging the other features of the site.

12.3 Biology – Plant and Animal Communities

The functioning of the site will be monitored using HGM Interim or other appropriate assessment tool as determined by the USACE, cooperating agencies, and ANRA. If a site is not performing as expected, then sampling results using the accepted assessment tool can be used to

identify variables that need to be improved. This will be the basis of any additional habitat treatments such as additional planting, selectively cutting trees, modifying topography, etc.

12.4 Invasive Species

The presence of invasive species is unwanted and control plans will be developed and implemented in accordance with accepted invasive species management practices. During the monitoring period, ANRA will coordinate with appropriate state and federal agencies to identify and implement invasive species control measures and the level of control that might be needed. For example, the Texas Parks and Wildlife Department may be called upon to assist with education and outreach opportunities to inform the public about invasive species and methods for control.

13.0 Financial Assurance

The funds to carry out this Mitigation Plan will come from the proceeds of bonds which will be issued only after ANRA has entered into contracts with the State of Texas, cities, water supply corporations, industries, and other entities for the sale and purchase of water from Lake Columbia. The money to purchase mitigation land and/or easements will be borrowed as part of the funding for reservoir site acquisition. ANRA will use the funds and revenues from these sources to implement (i.e., acquire land, conduct functional assessment, draft site plans, prepare sites and plant) the mitigation plan. In addition, proceeds from the sale of water and any other revenues from lake operations will be used to conduct post-mitigation plan implementation activities, such as success monitoring, remedial planting, invasive species control, etc.

ANRA and the Texas Water Development Board (TWDB) entered into a Master Agreement under which the Board became a co-owner of the project with ANRA. Under the agreement, the Board is obligated to deliver to ANRA $52,785,000 for the acquisition of the land and the easements for the reservoir site and the mitigation land. There is an additional $9,500,000 allocated for surveying, appraisal, title and site assessments.

14.0 References

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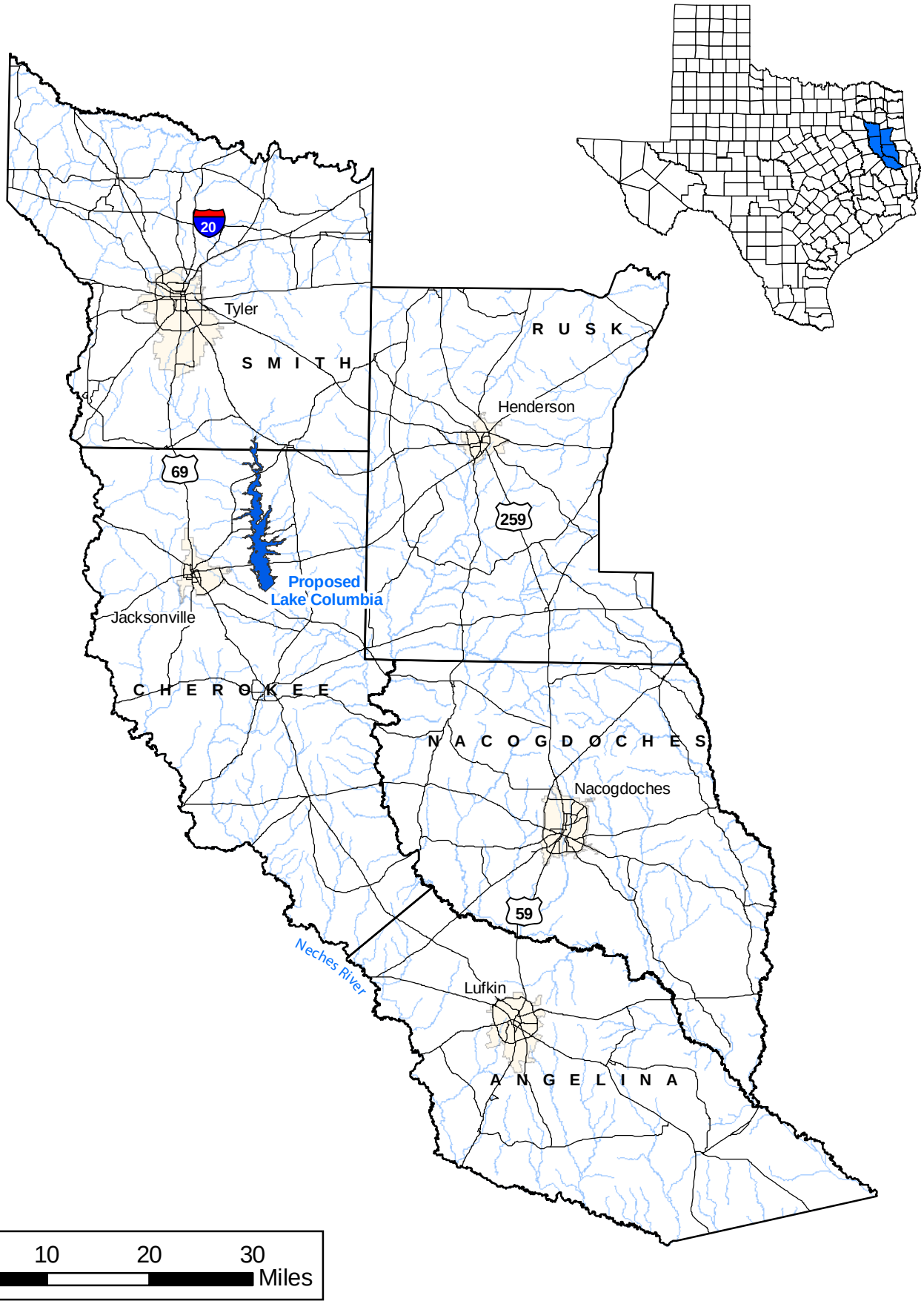
APPENDIX A

Maps and Figures



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Location Map

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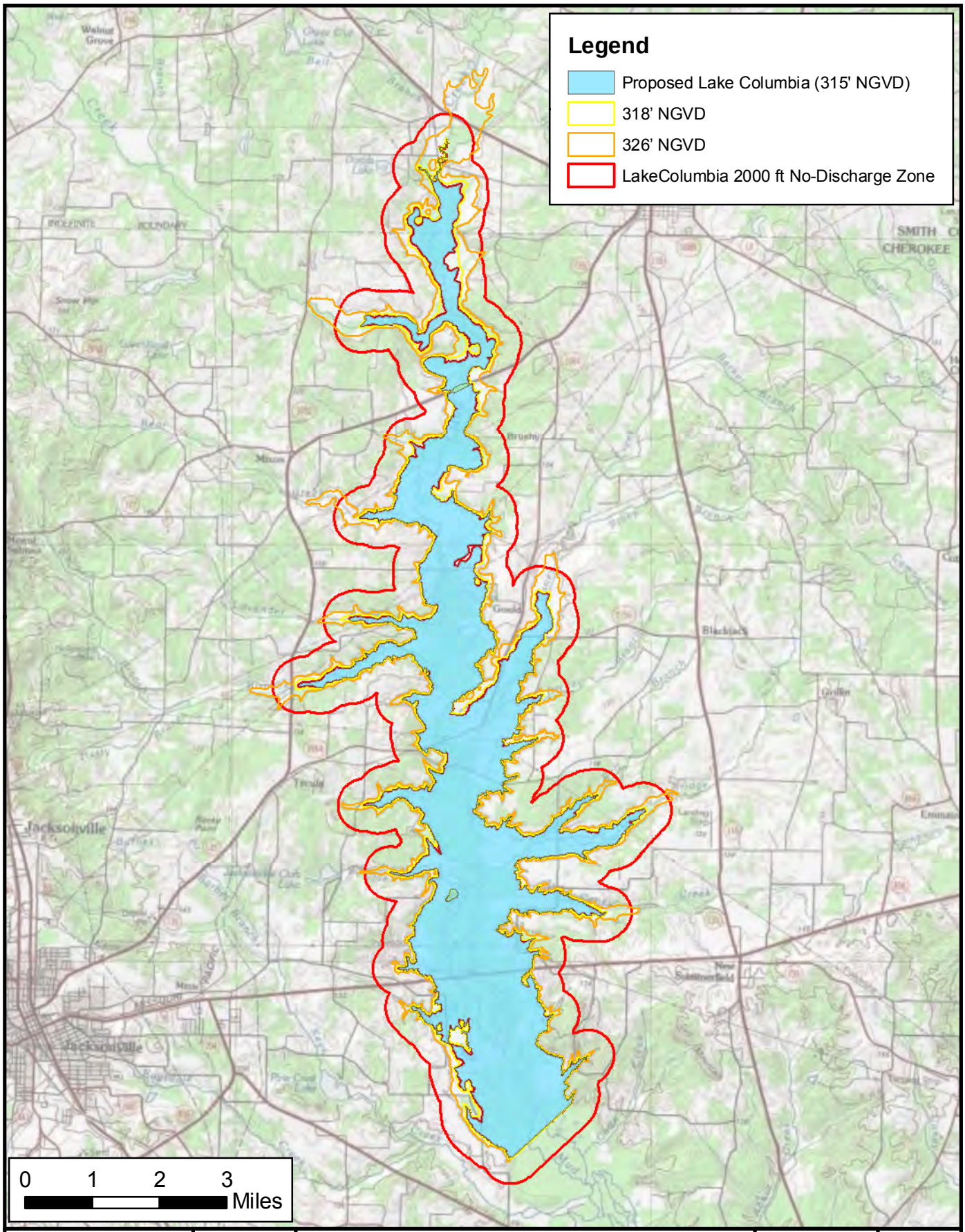

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No Discharge Zone

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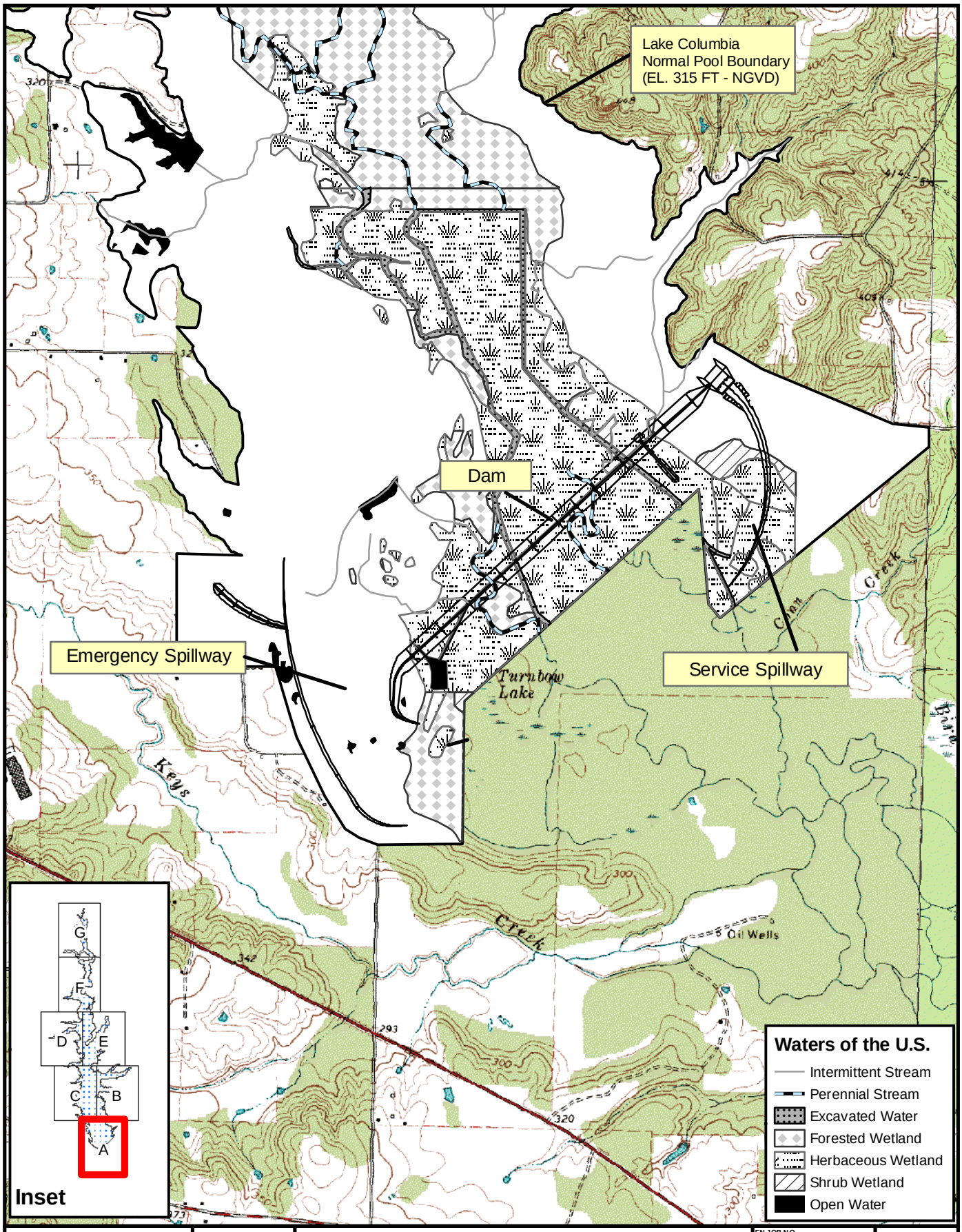

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Waters of the U.S. Within the Normal Pool

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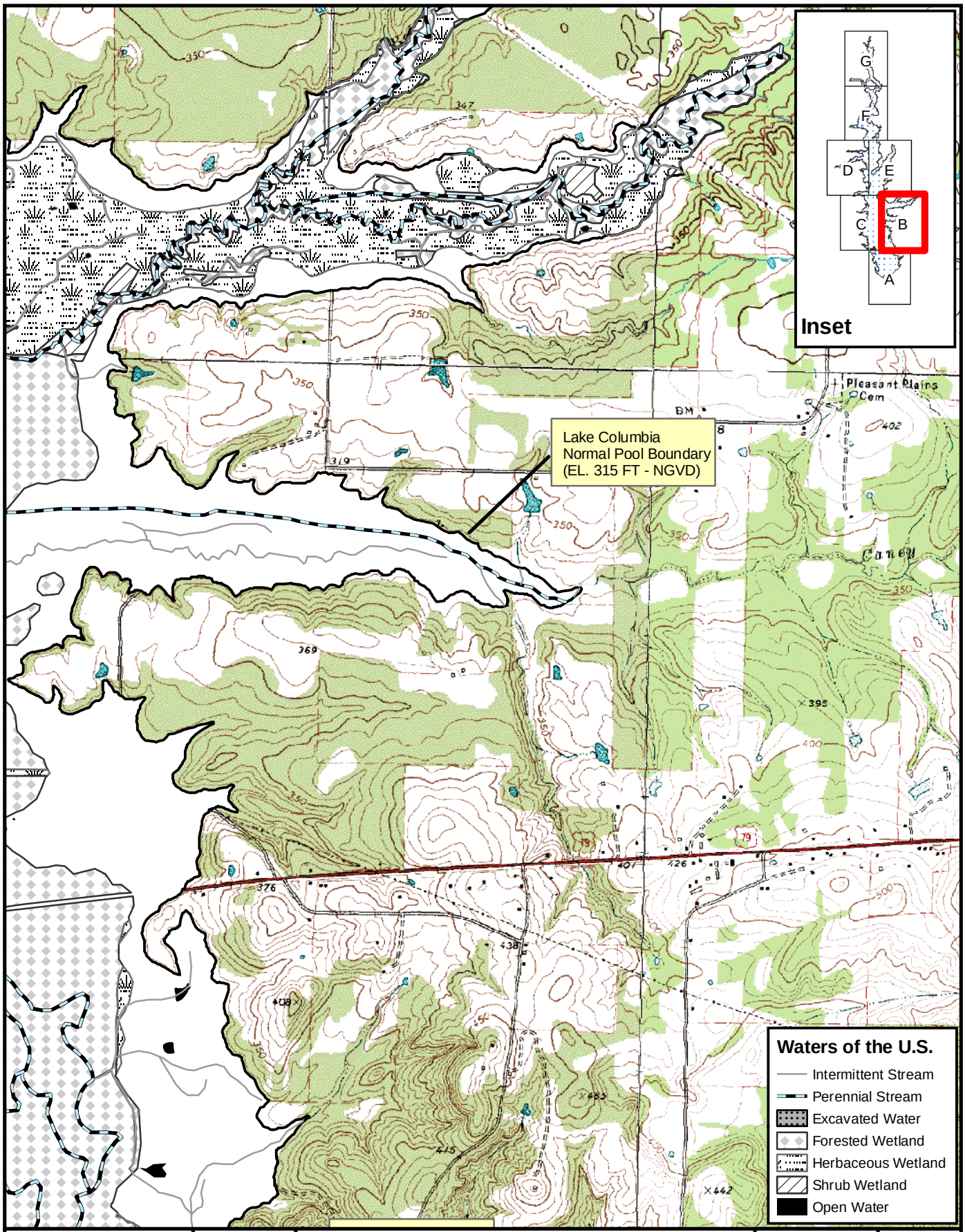

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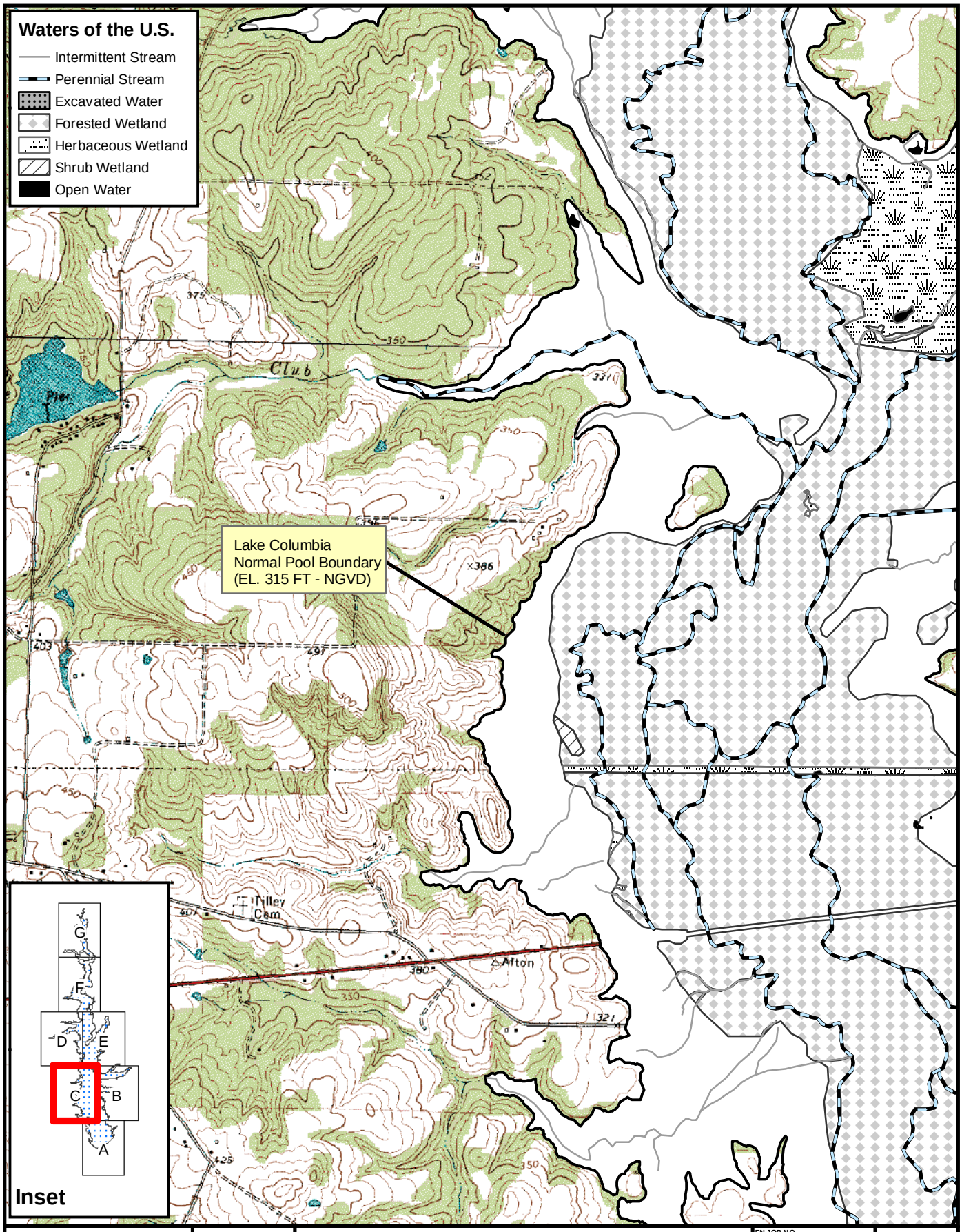

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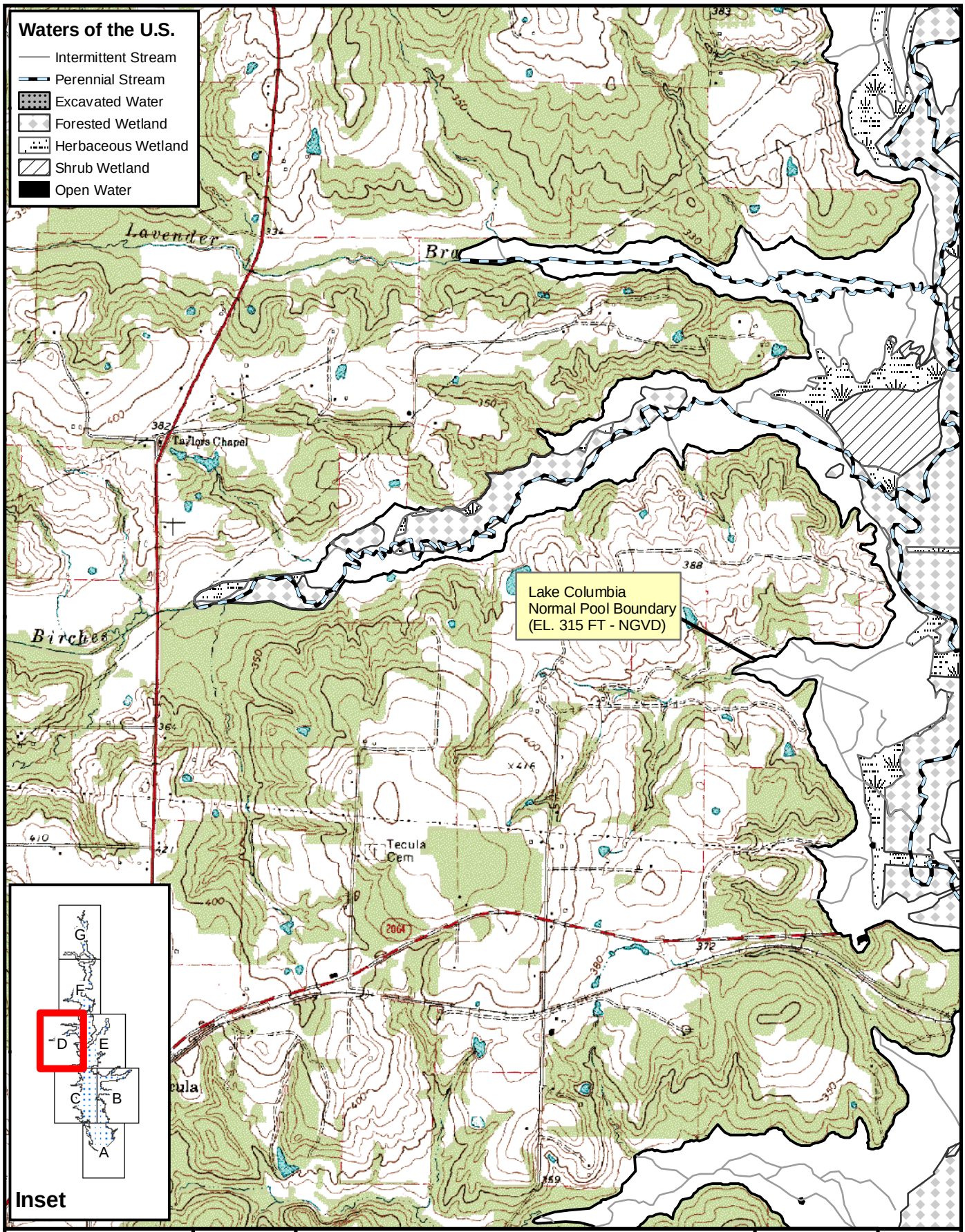

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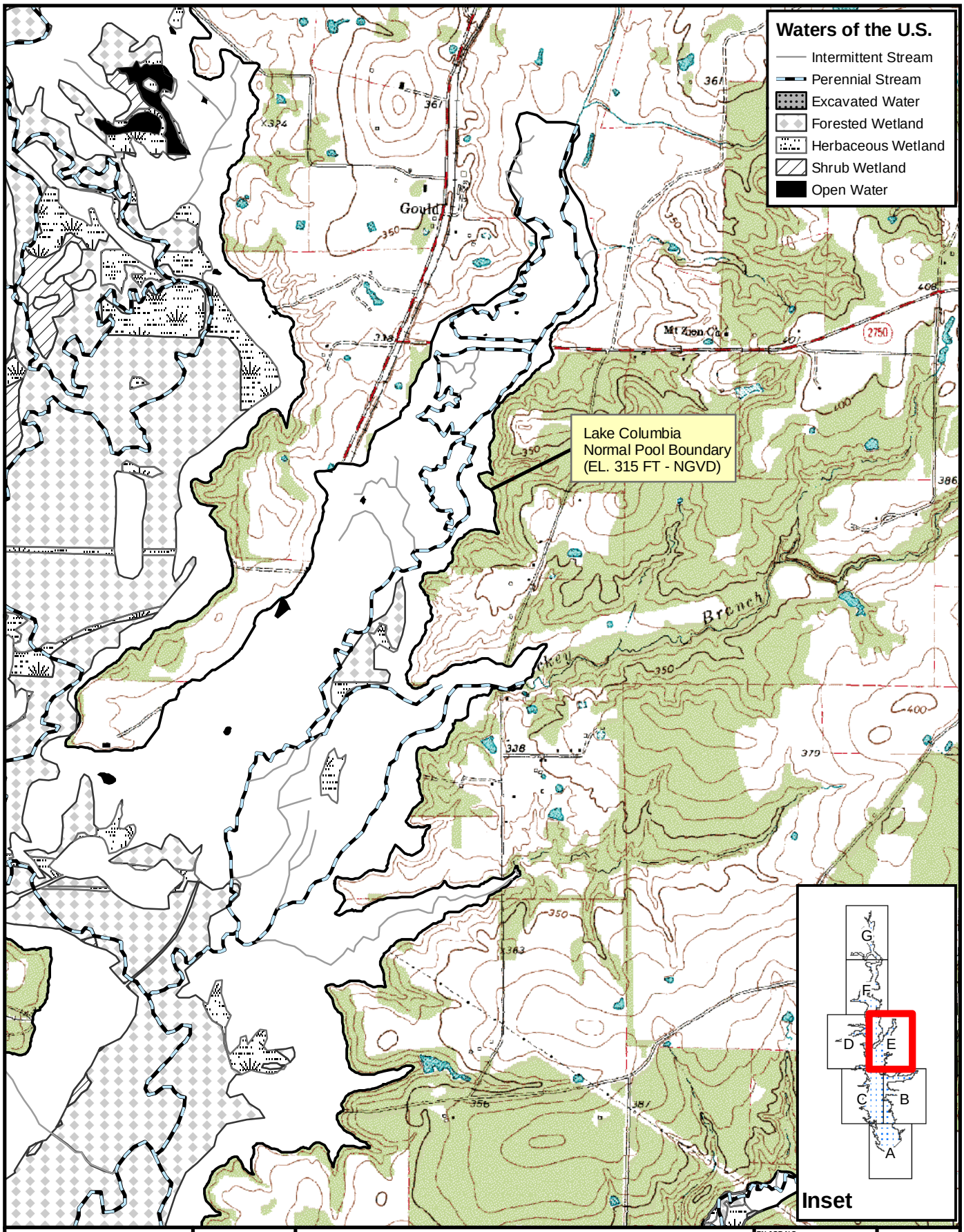

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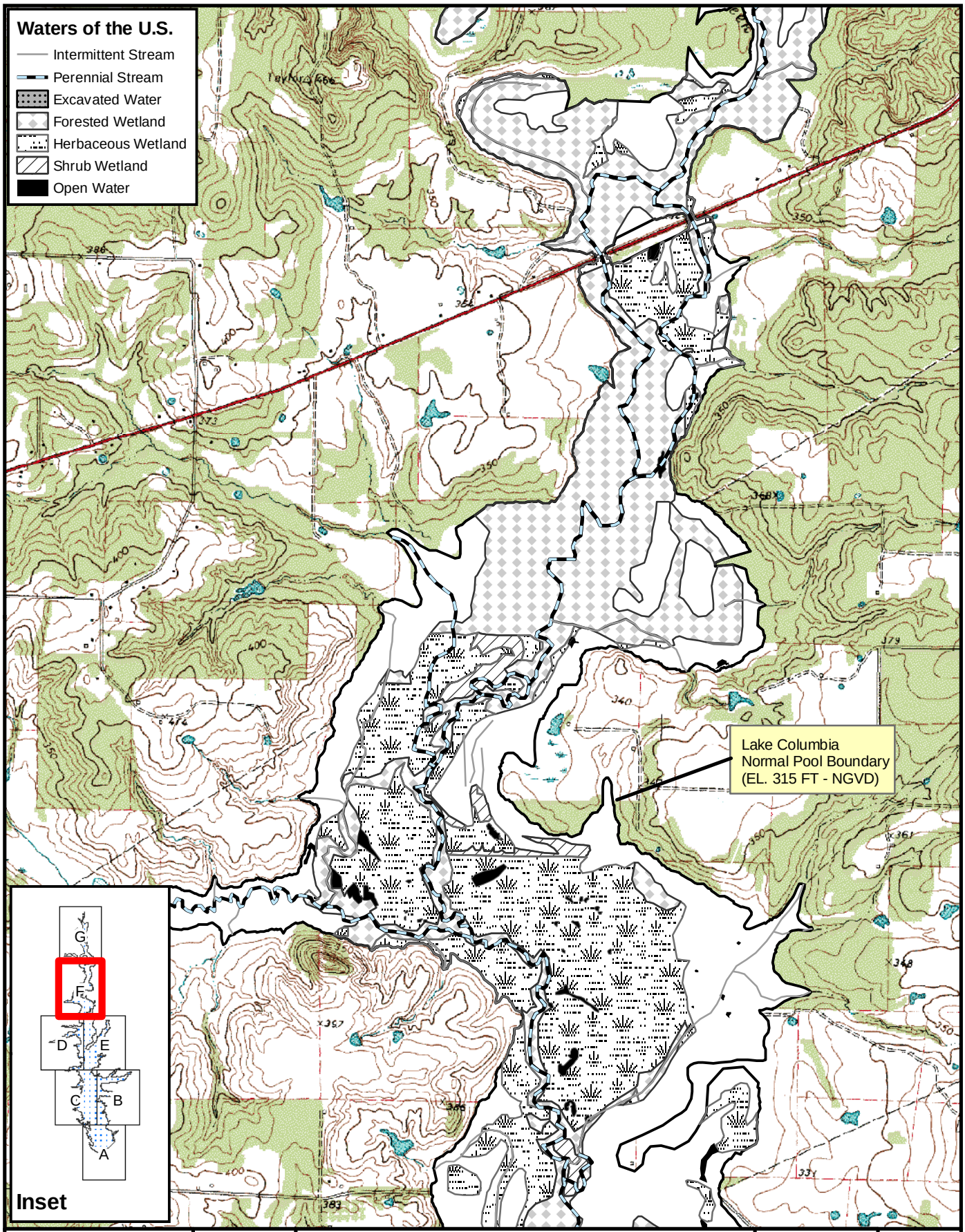

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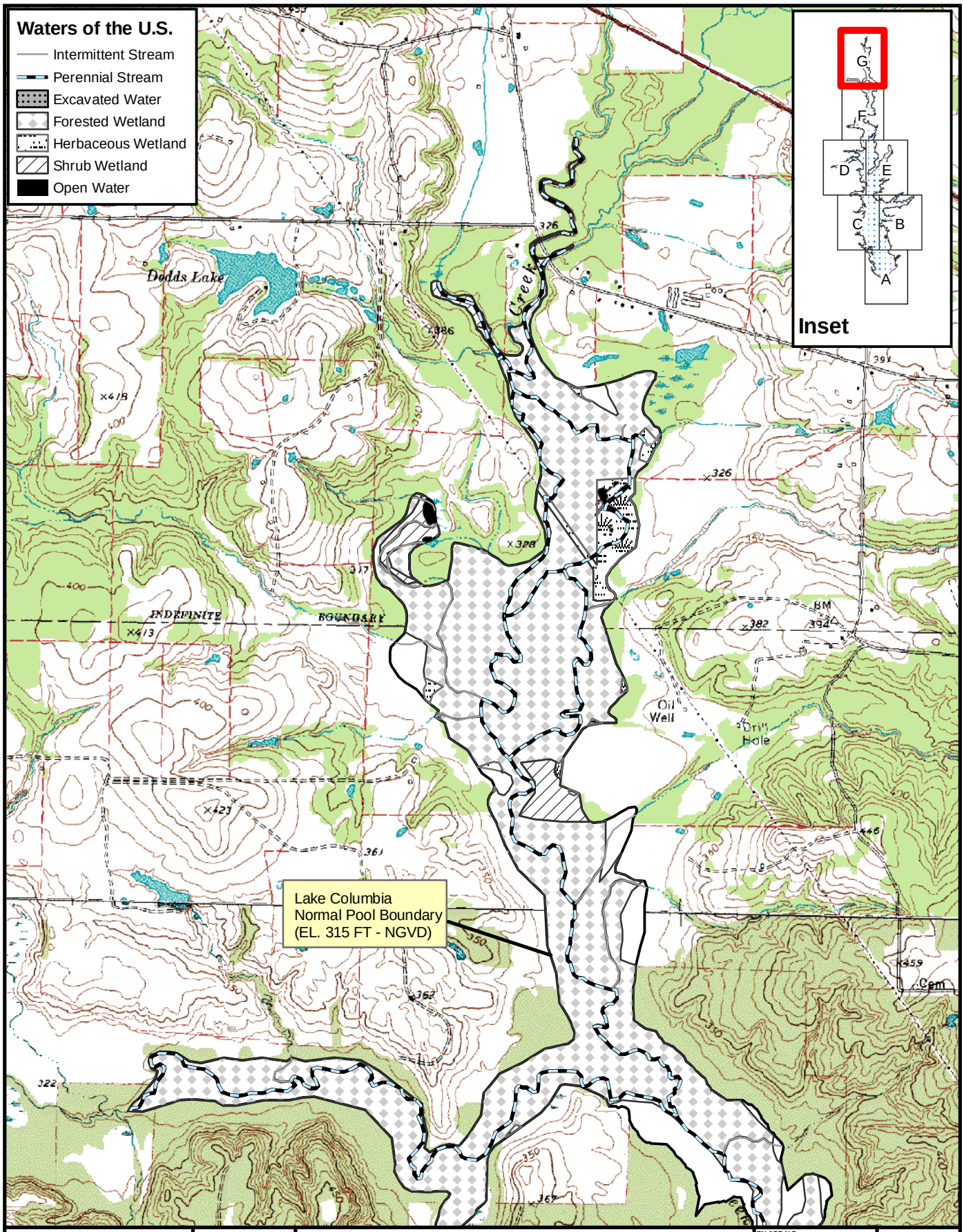

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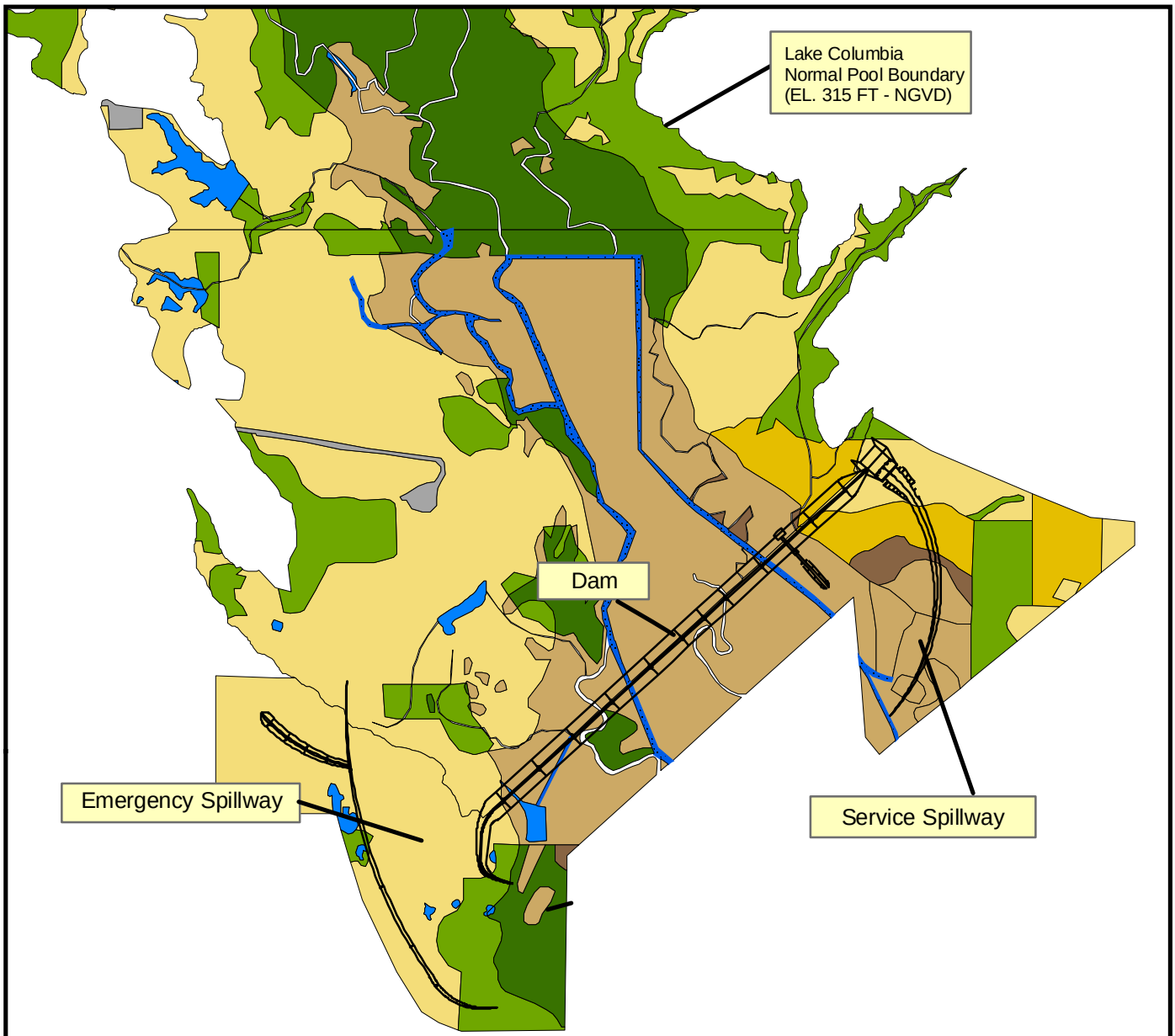
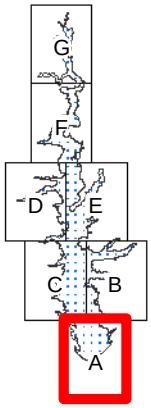


Legend

- Intermittent Stream
- Perennial Stream
- Forested Wetland
- Upland Forest
- Highways/Railroads
- Herbaceous Wetland
- Herbaceous Upland
- Shrub Wetland
- Shrub Upland
- Open Water
- Excavated Water
- Urban



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Cover Types Within the Normal Pool

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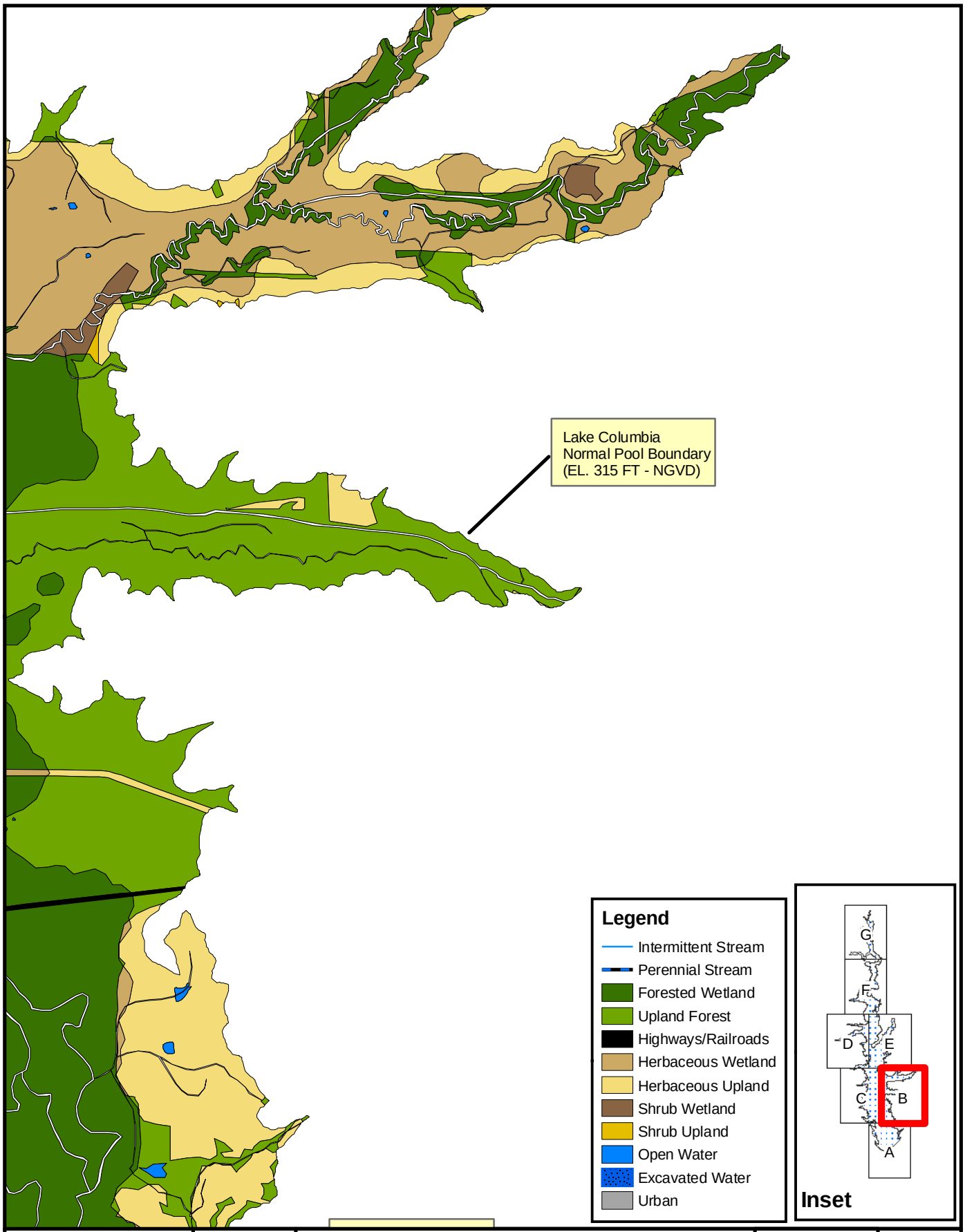

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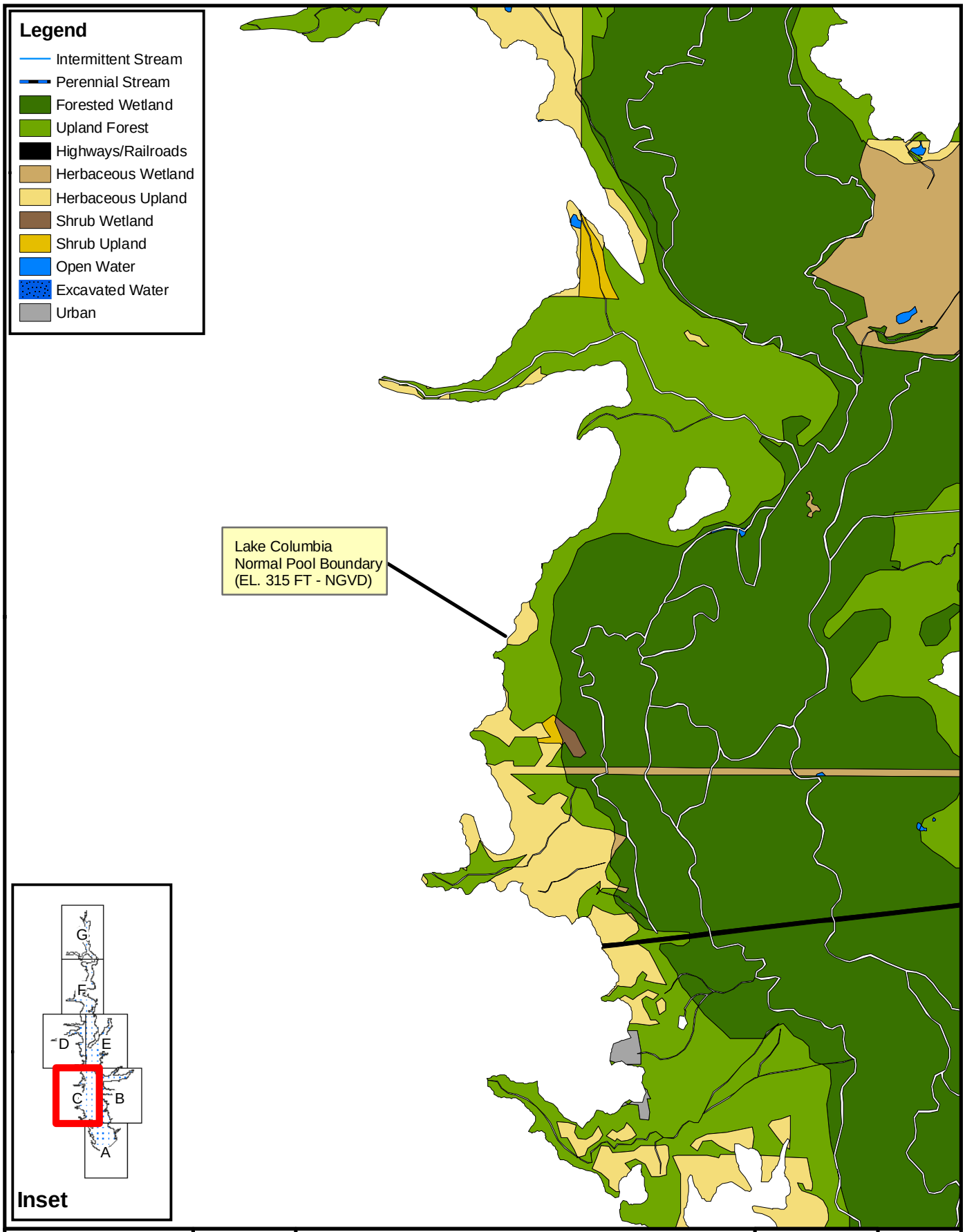

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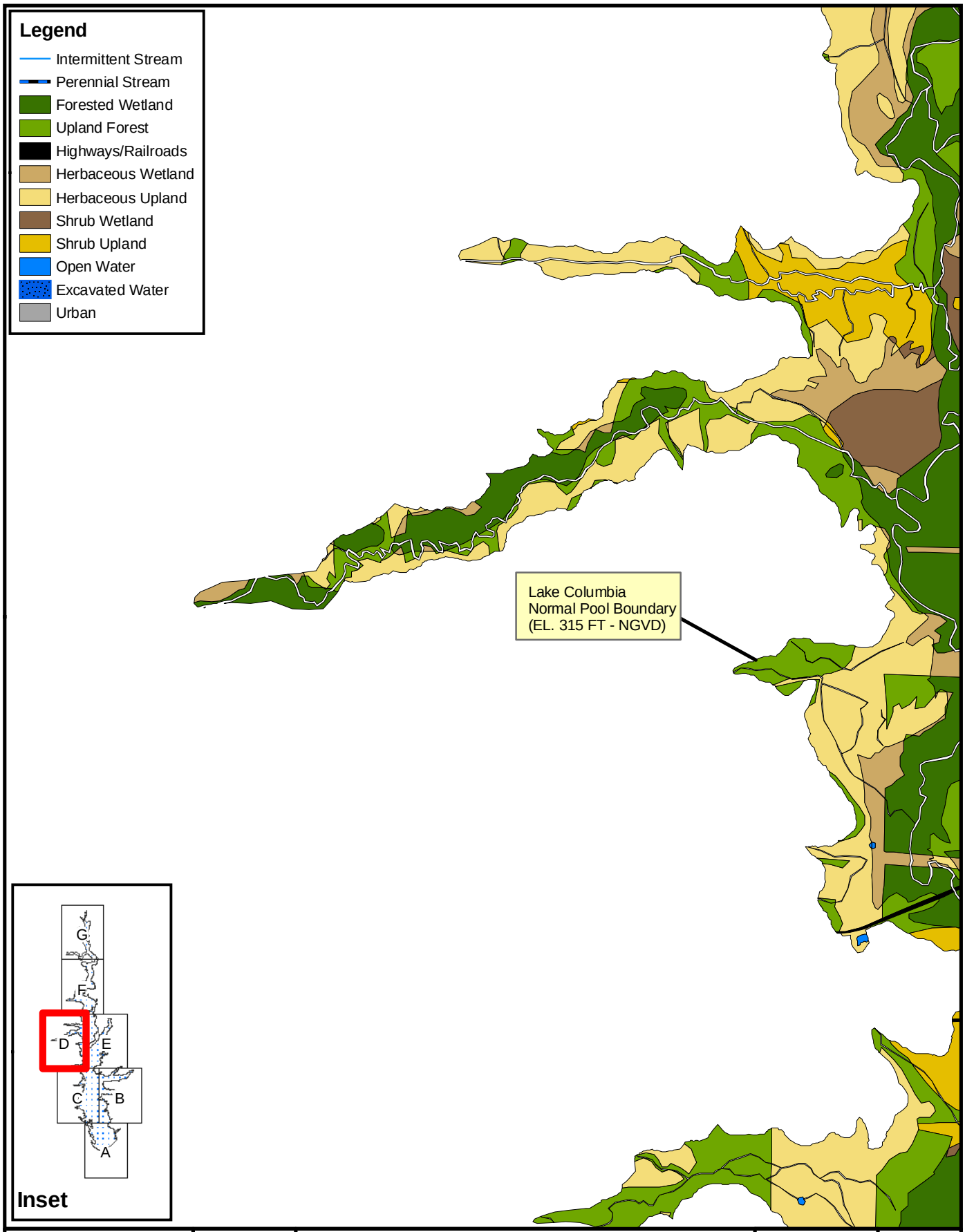

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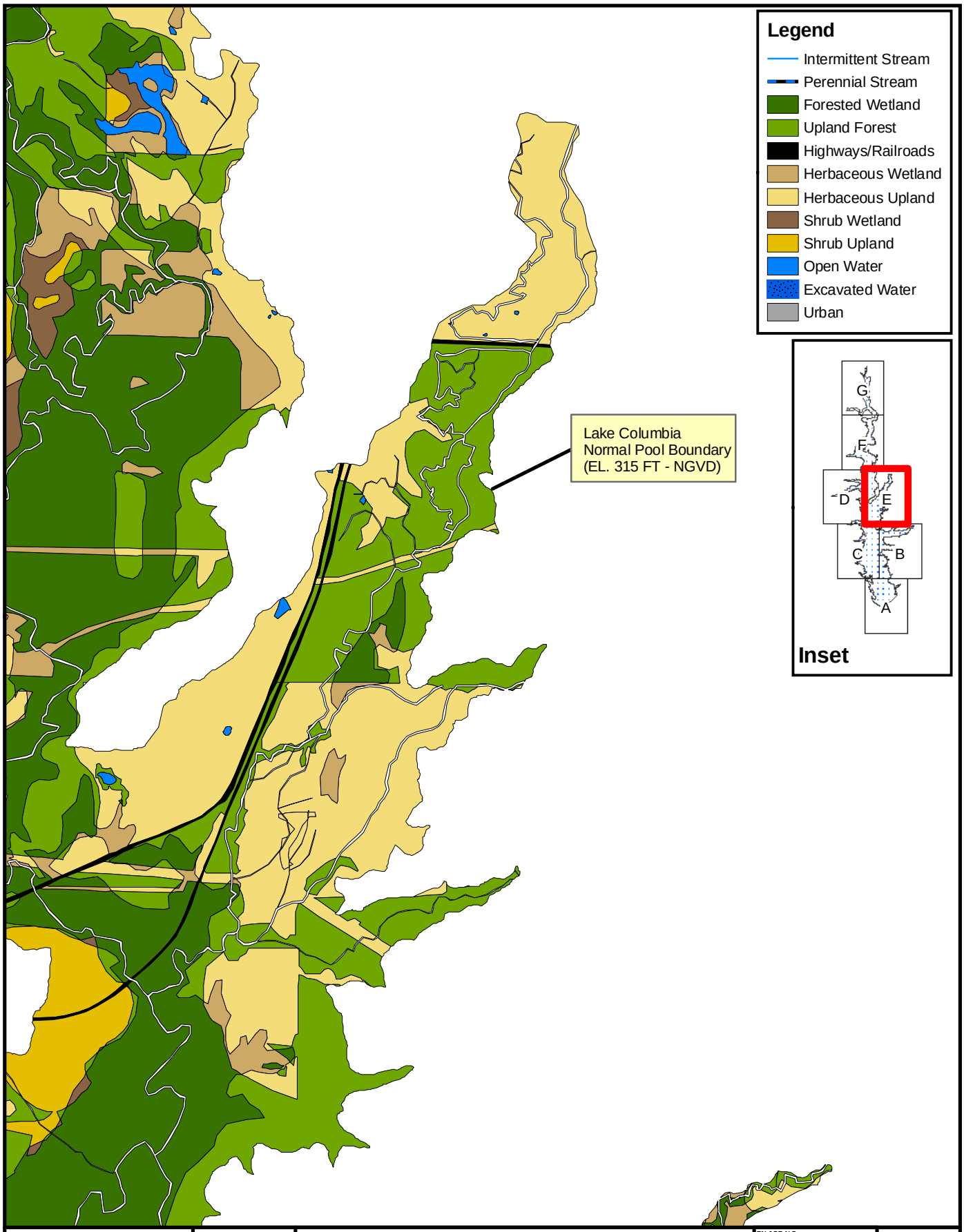

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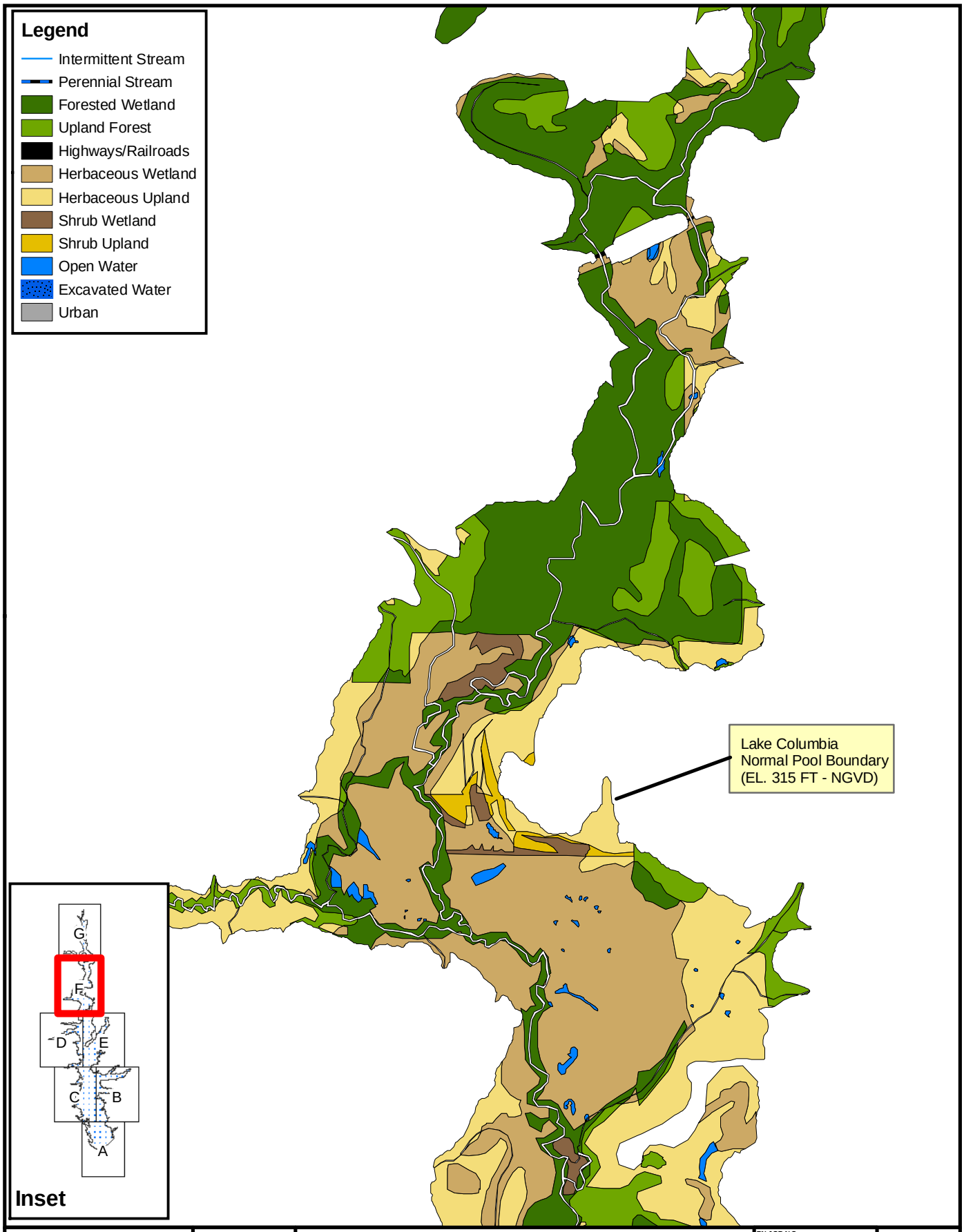

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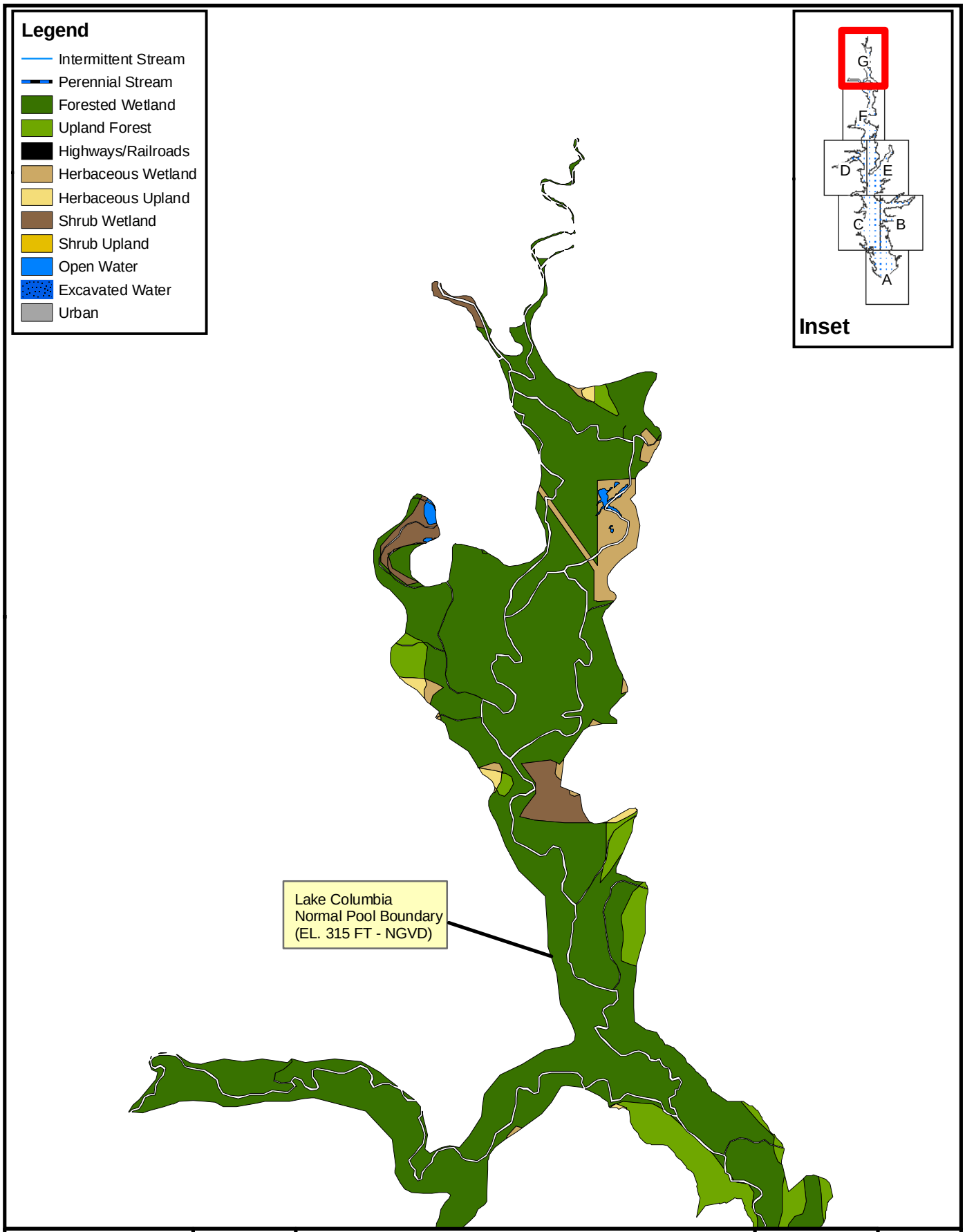
W E
S

Angelina and Neches River Authority
Lake Columbia Mitigation Plan

Cover Types Within the Normal Pool

FN JOB NO	ANR00164
FILE	Figure4(Covertypes).mxd
DATE	May 2011
SCALE	1:24,000
DESIGNED	SPW
DRAFTED	BME

4f
FIGURE



Freese and Nichols
4055 International Plaza, Suite 200
Fort Worth, TX 76109 - 4895
Phone - (817) 735 - 7300

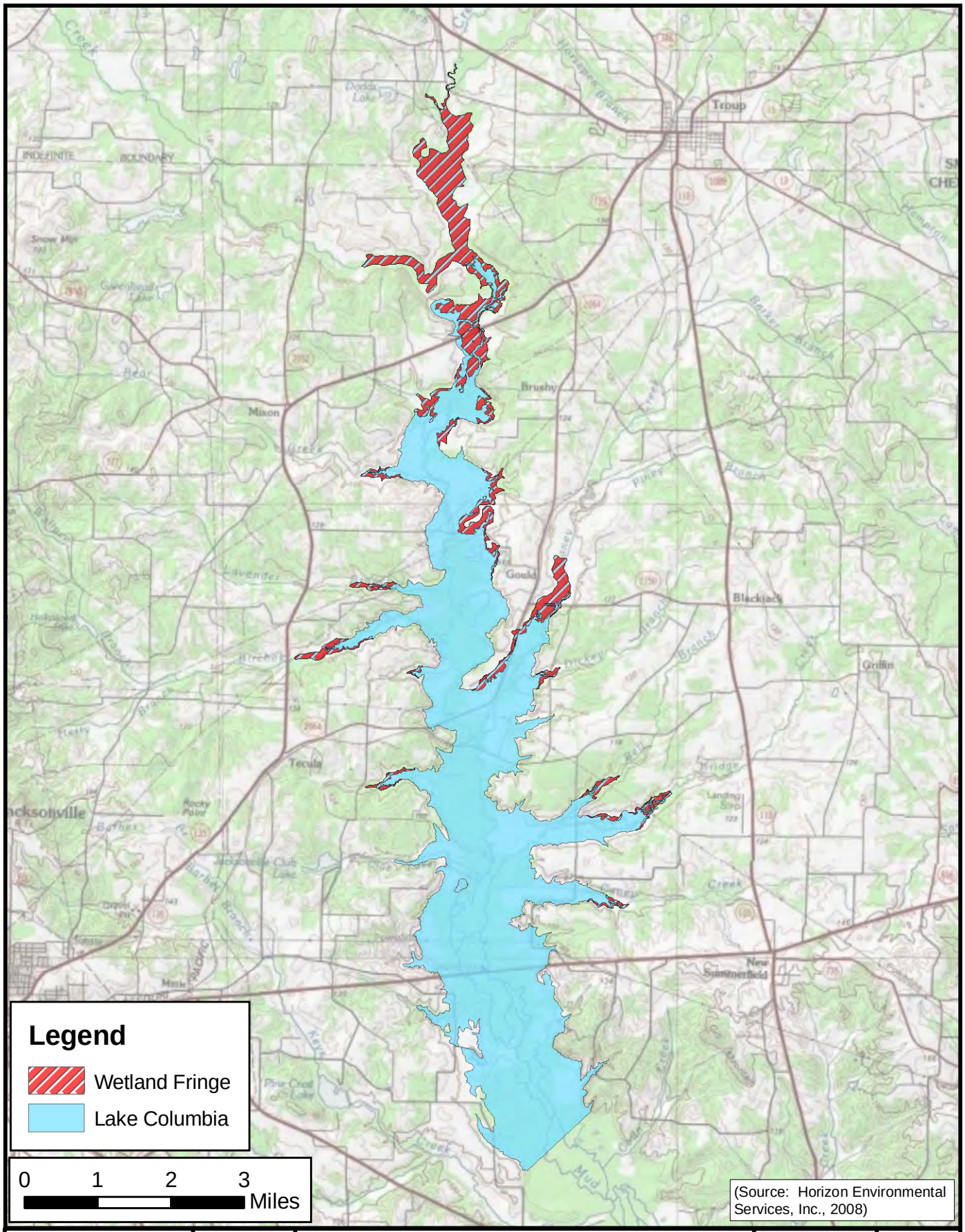
N
W E
S

Angelina and Neches River Authority
Lake Columbia Mitigation Plan

Cover Types Within the Normal Pool

FN JOB NO	ANR00164
FILE	Figure4(Covertypes).mxd
DATE	May 2011
SCALE	1:24,000
DESIGNED	SPW
DRAFTED	BME

4g
FIGURE



Freese and Nichols
4055 International Plaza, Suite 200
Fort Worth, TX 76109 - 4895
Phone - (817) 735 - 7300

N
W E
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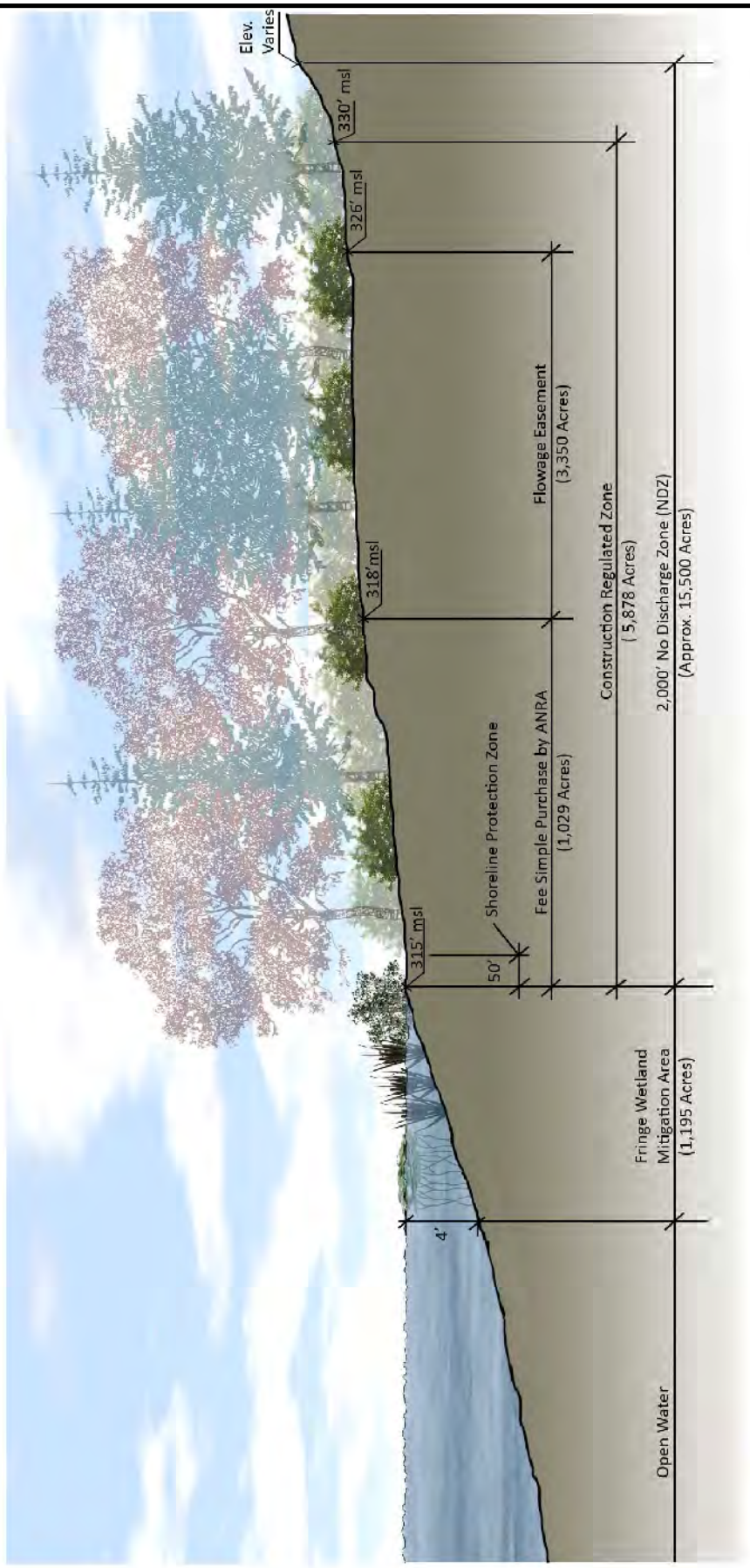
Angelina and Neches River Authority
Lake Columbia Mitigation Plan

Wetland Fringe Areas

FN JOB NO	ANR00164
FILE	Figure5A.mxd
DATE	May 2011
SCALE	1:115,000
DESIGNED	SPW
DRAFTED	BME

5a
FIGURE



Freese and Nichols
4055 International Plaza, Suite 200
Fort Worth, TX 76109 - 4895
Phone - (817) 735 - 7300

Angelina and Neches River Authority
Lake Columbia Mitigation Plan

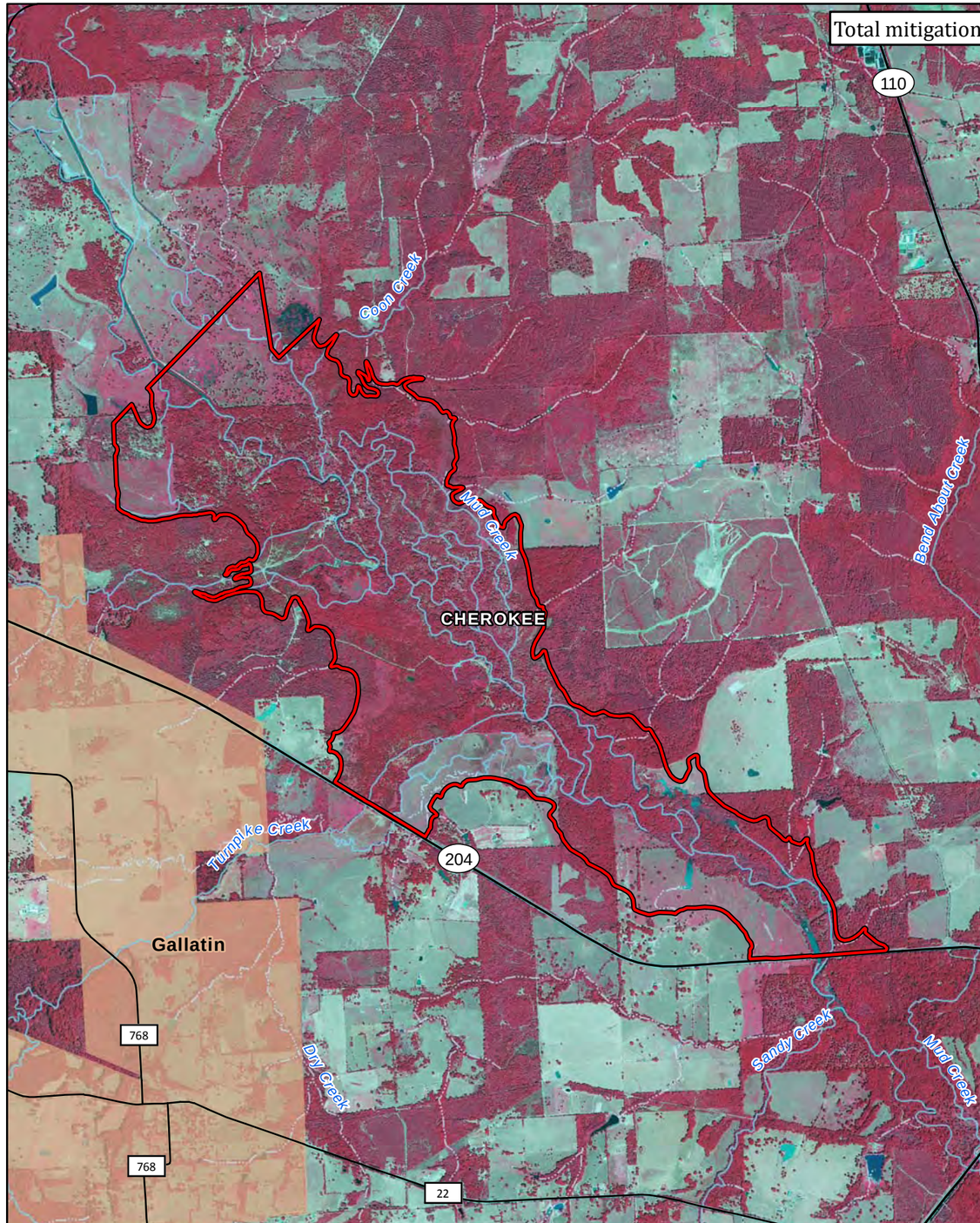
Typical Cross-Section View of Fringe Wetlands and ANRA's Water Quality Regulations Protection Zones

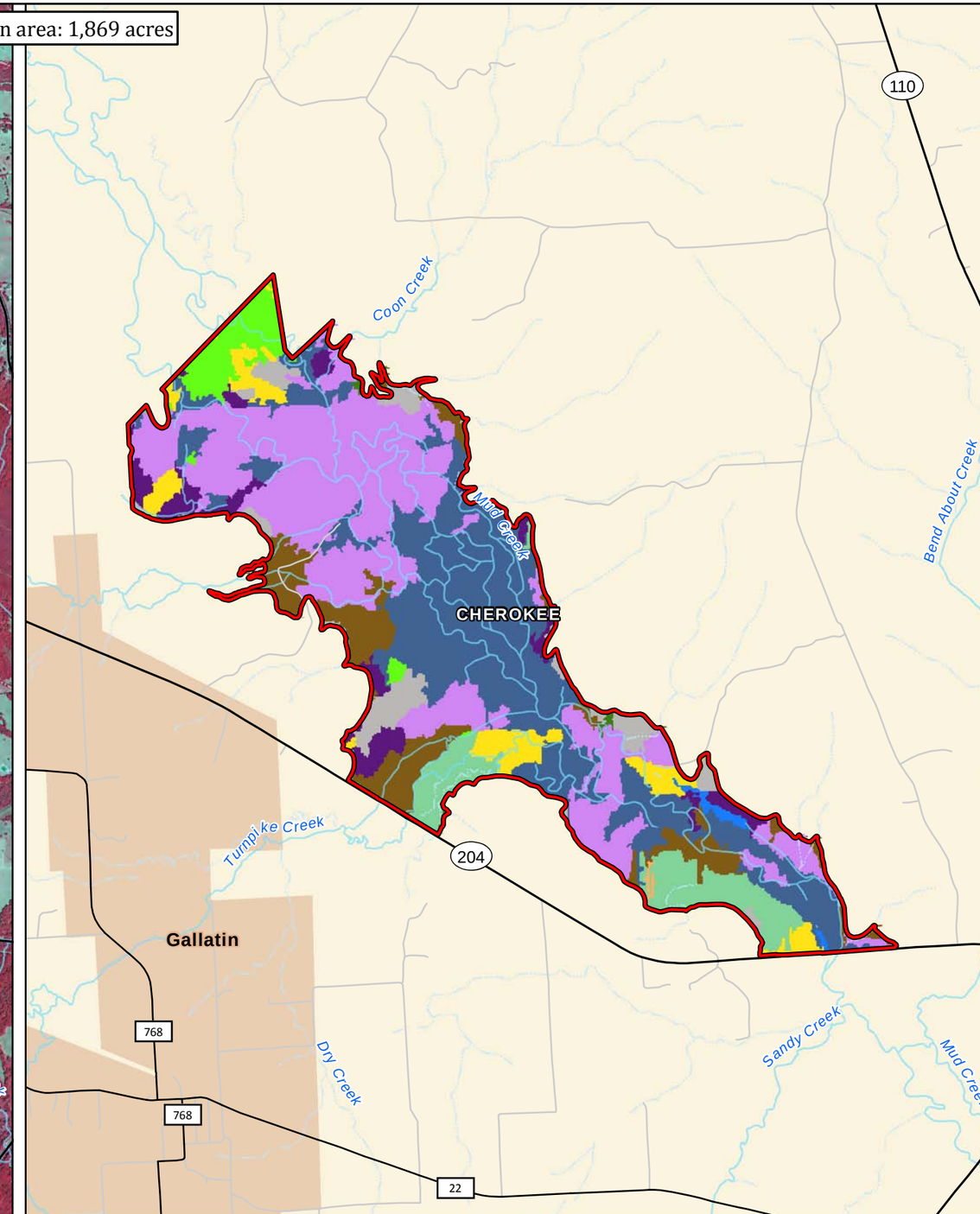
FN JOB NO	ANR00164
FILE	Figure5B.mxd
DATE	November 2009
SCALE	Not to Scale
DESIGNED	SPW
DRAFTED	BME

5b

FIGURE

Total mitigation area: 1,869 acres





Mitigation Boundary

Other

Bottomland Temporarily Flooded Mixed Pine / Hardwood Forest

Bottomland Temporarily Flooded Hardwood Forest

Bottomland Herbaceous Wetland

Bottomland Seasonally Flooded Hardwood Forest

Bottomland Wet Prairie

Bottomland Baldcypress Swamp

Small Stream and Riparian Temporarily Flooded Mixed Forest

Small Stream and Riparian Temporarily Flooded Hardwood Forest

Small Stream and Riparian Wet Prairie

Small Stream and Riparian Baldcypress Swamp

Open Water

1:36,000

0 3,000 6,000 Feet

N

FN PROJECT NO. ANR01289

DATE CREATED May 2011

DATUM & COORDINATE SYSTEM NAD83 State Plane (feet) Texas Central

FILE NAME MudCreek_BD_Cover_Types.mxd

PREPARED BY SSJ

ANGELINA AND NECHES RIVER AUTHORITY

Lake Columbia Proposed Mitigation Area

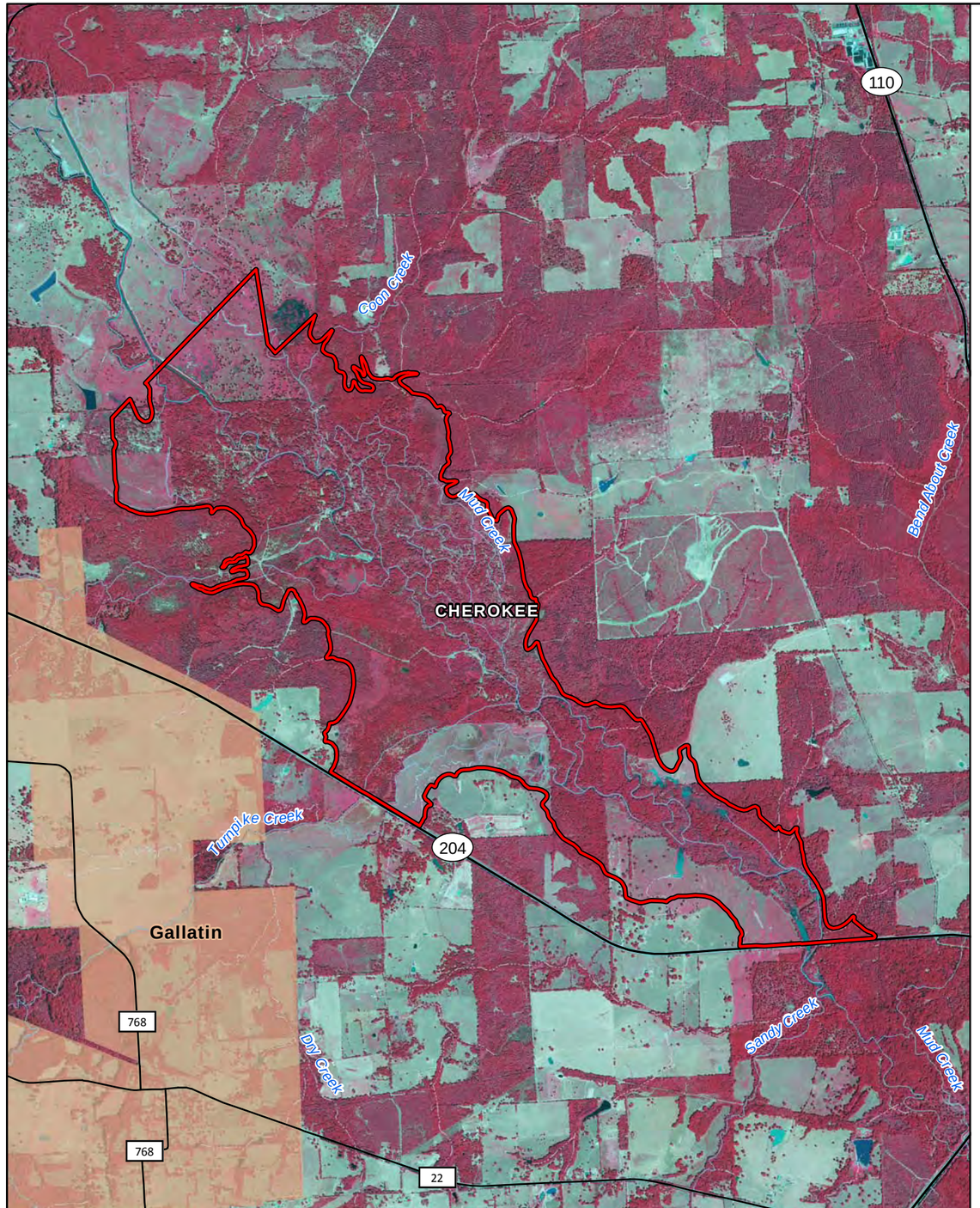
Mud Creek Site Below Dam - Cover Types

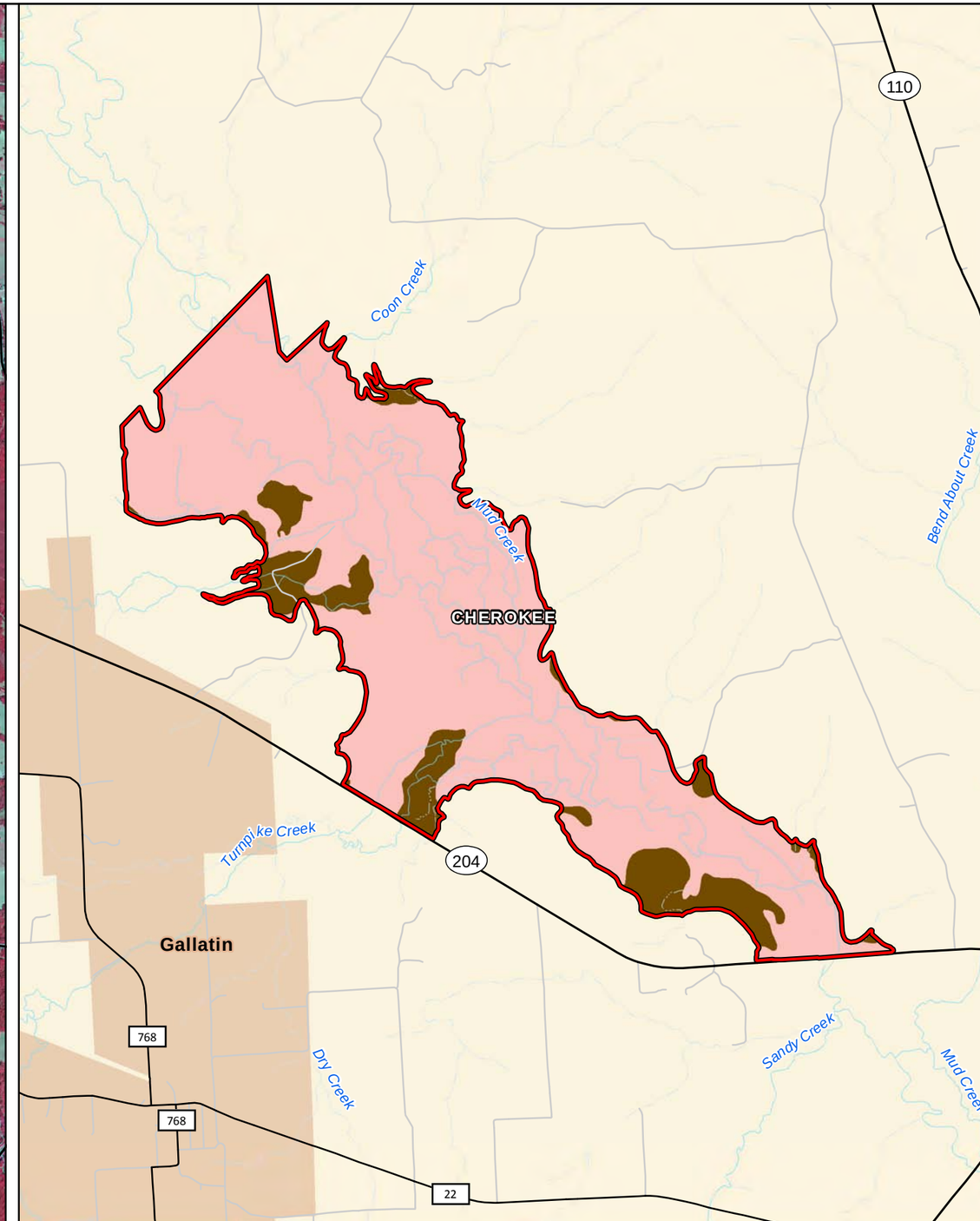
FREESE AND NICHOLS, INC
10814 JOLLYVILLE ROAD
BUILDING 4, SUITE 100
AUSTIN, TX 78759
PHONE: 512.617.3100

FIGURE

6a

Updated: Tuesday, May 17, 2011 Updated By: SSJ File: H:\ENVIRONMENTAL\FINAL_EXHIBITS\MudCreek_BD_Cover_Types.mxd





FN PROJECT NO. ANR01289
DATE CREATED May 2011
DATUM & COORDINATE SYSTEM NAD83 State Plane (feet) Texas Central
FILE NAME MudCreek_BD_Soils.mxd
PREPARED BY SSJ

ANGELINA AND NECHES RIVER AUTHORITY

Lake Columbia Proposed Mitigation Area

Mud Creek Site Below Dam - Soils

FREESE AND NICHOLS, INC
10814 JOLLYVILLE ROAD
BUILDING 4, SUITE 100
AUSTIN, TX 78759
PHONE: 512.617.3100

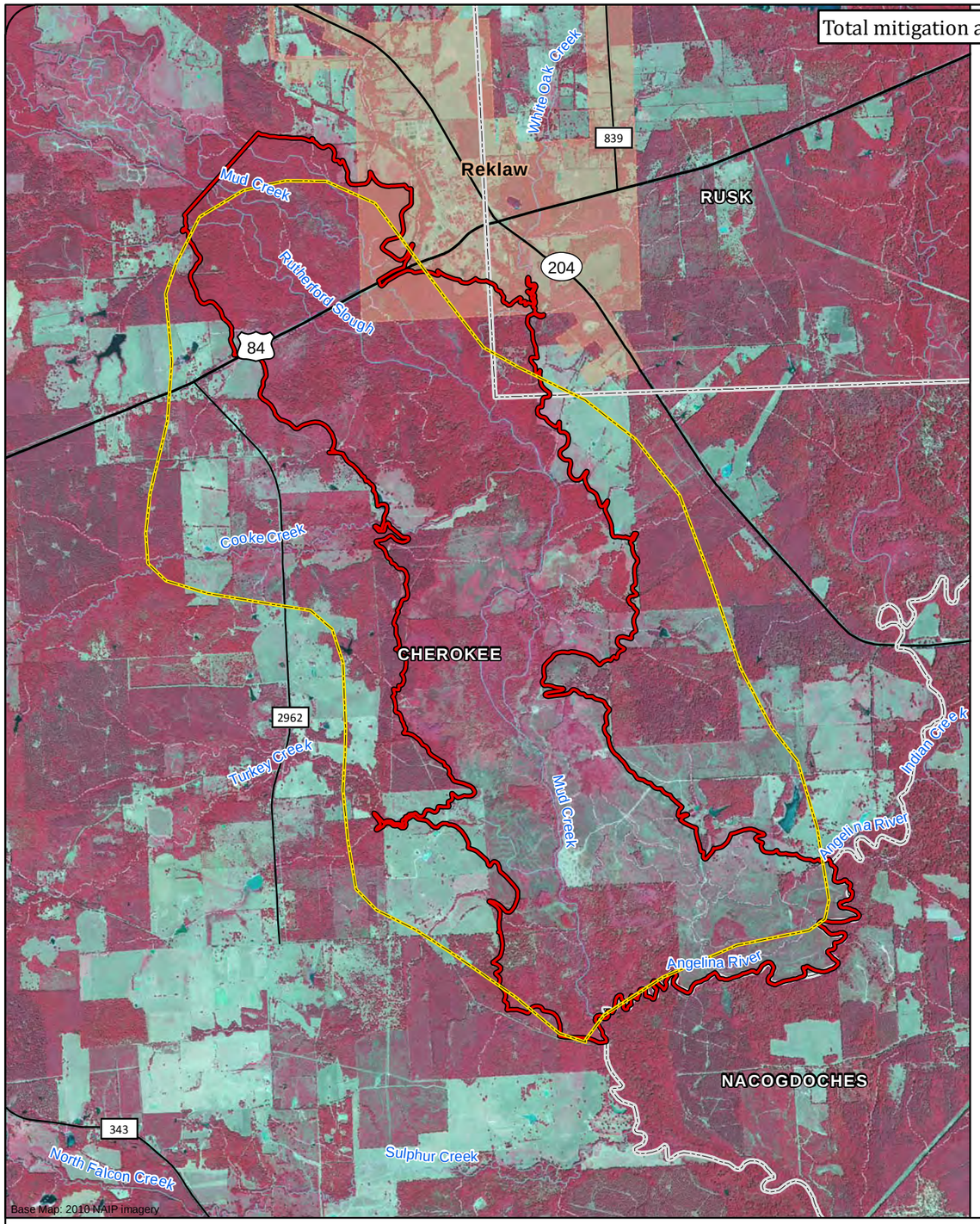
Mitigation Boundary
County Boundary
Not Hydric Soils
Partially Hydric Soils

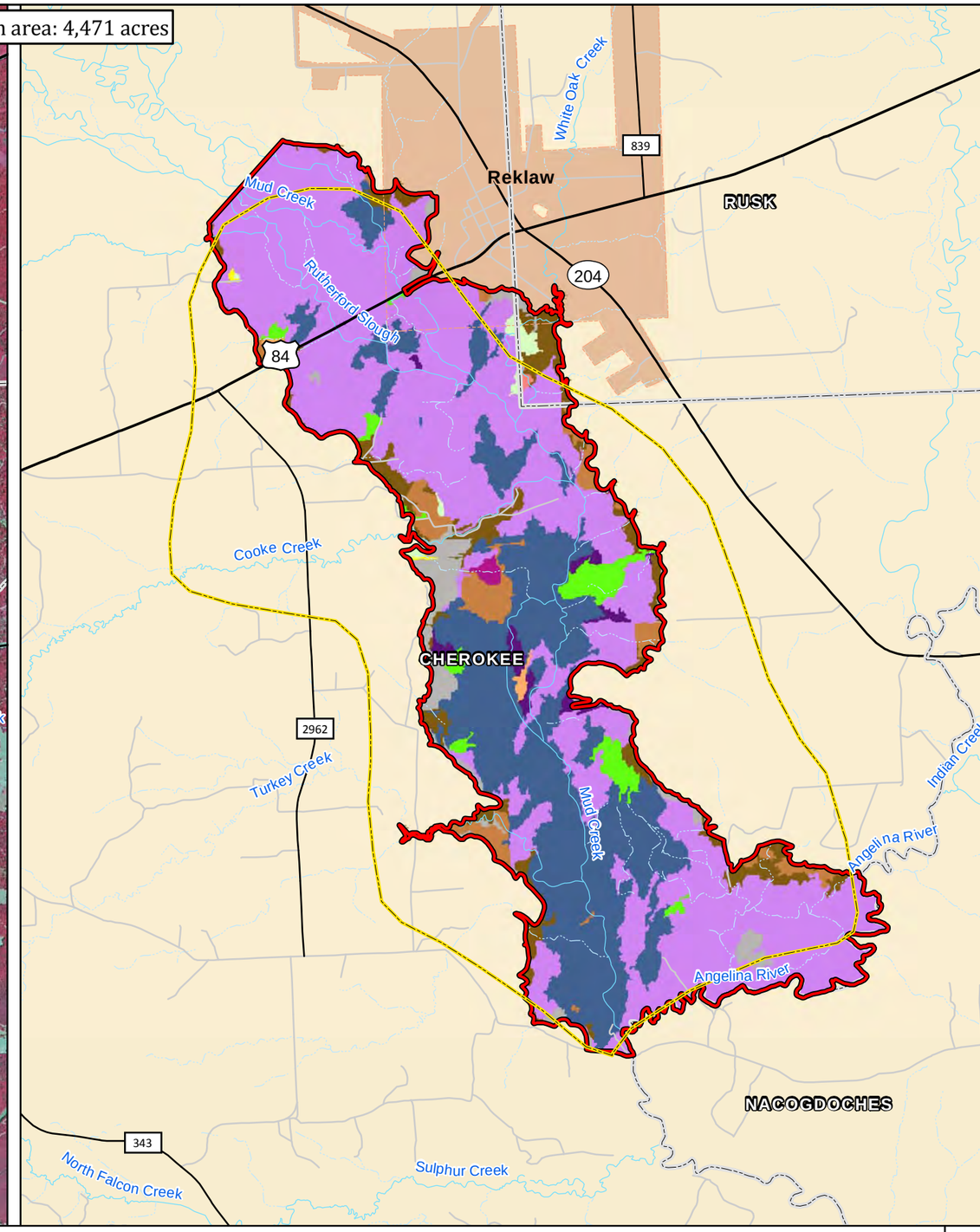
1:36,000
0 3,000 6,000 Feet

N

FIGURE
6b

Updated: Tuesday, May 17, 2011 Updated By: SSJ File: H:\ENVIRONMENTAL\FINAL_EXHIBITS\MudCreek_BD_Soils.mxd





Mitigation Area
County Boundary
Priority Bottomland Hardwood Area
Other
Bottomland Temporarily Flooded Hardwood Forest
Bottomland Deciduous Successional Shrubland
Bottomland Herbaceous Wetland
Bottomland Seasonally Flooded Hardwood Forest
Bottomland Baldcypress Swamp
Small Stream & Riparian Temporarily Flooded Mixed Forest
Small Stream & Riparian Temporarily Flooded Hardwood Forest
Small Stream & Riparian Deciduous Successional Shrubland
Small Stream & Riparian Seasonally Flooded Hardwood Forest
Small Stream & Riparian Wet Prairie
Small Stream & Riparian Baldcypress Swamp

1:48,000
0 4,000 8,000 Feet

N

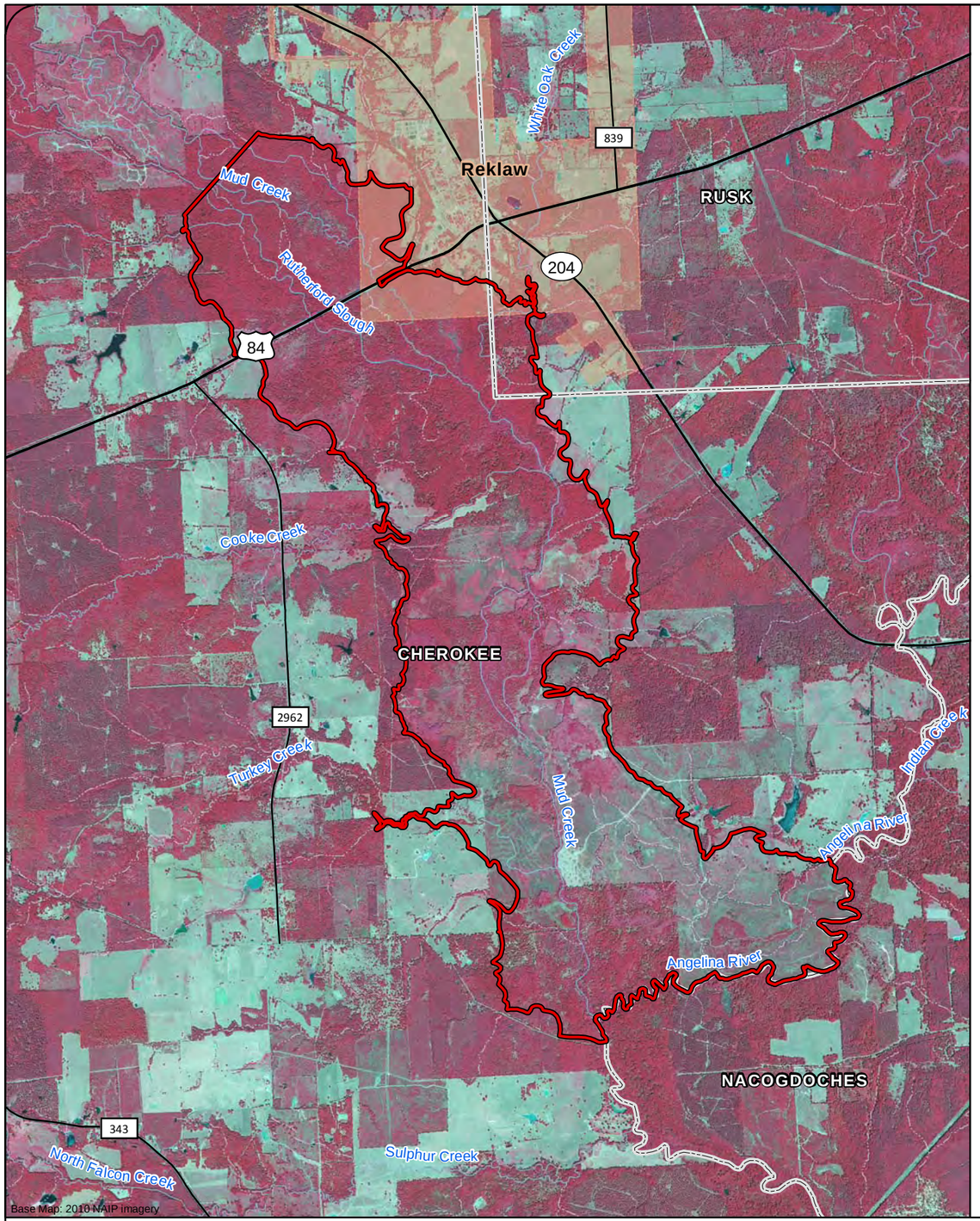
FN PROJECT NO. ANR01289
DATE CREATED May 2011
DATUM & COORDINATE SYSTEM NAD83 State Plane (feet) Texas Central
FILE NAME MudCreek_Pri1_Cover_Types.mxd
PREPARED BY SSJ

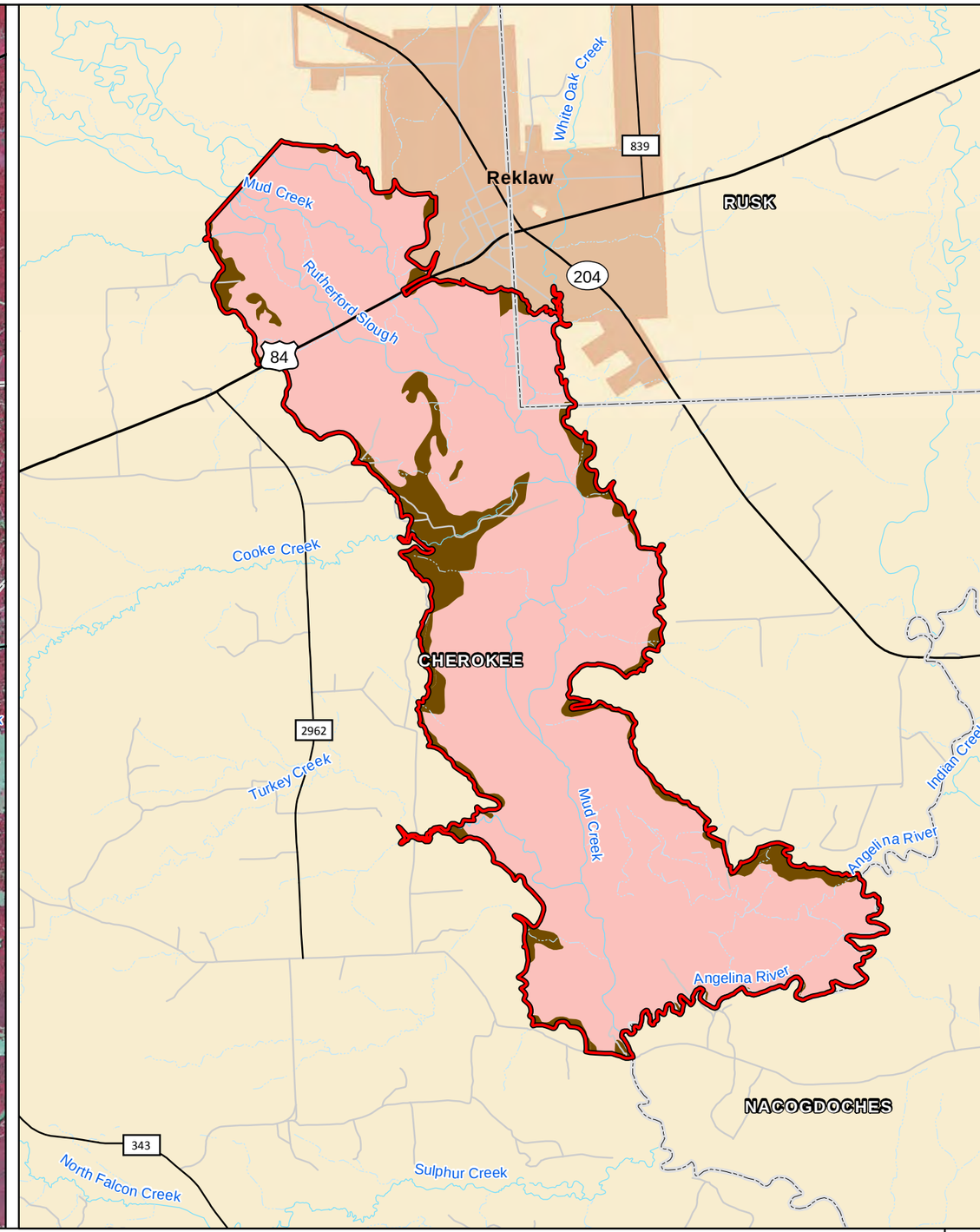
ANGELINA AND NECHES RIVER AUTHORITY

Lake Columbia Proposed Mitigation Area
Mud Creek Priority 1 Bottomland Hardwood Site - Cover Types

FREESE AND NICHOLS, INC.
10814 JOLLYVILLE ROAD
BUILDING 4, SUITE 100
AUSTIN, TX 78759
PHONE: 512.617.3100

FIGURE
7a





FN PROJECT NO. ANR01289
DATE CREATED May 2011
DATUM & COORDINATE SYSTEM NAD83 State Plane (feet) Texas Central
FILE NAME MudCreek_Pri1_Soils.mxd
PREPARED BY SSJ

ANGELINA AND NECHES RIVER AUTHORITY

Lake Columbia Proposed Mitigation Area

Mud Creek Priority 1 Bottomland Hardwood Site - Soils

FREESE AND NICHOLS, INC.
10814 JOLLYVILLE ROAD
BUILDING 4, SUITE 100
AUSTIN, TX 78759
PHONE: 512.617.3100

Mitigation Area
County Boundary
Not Hydric Soils
Partially Hydric Soils

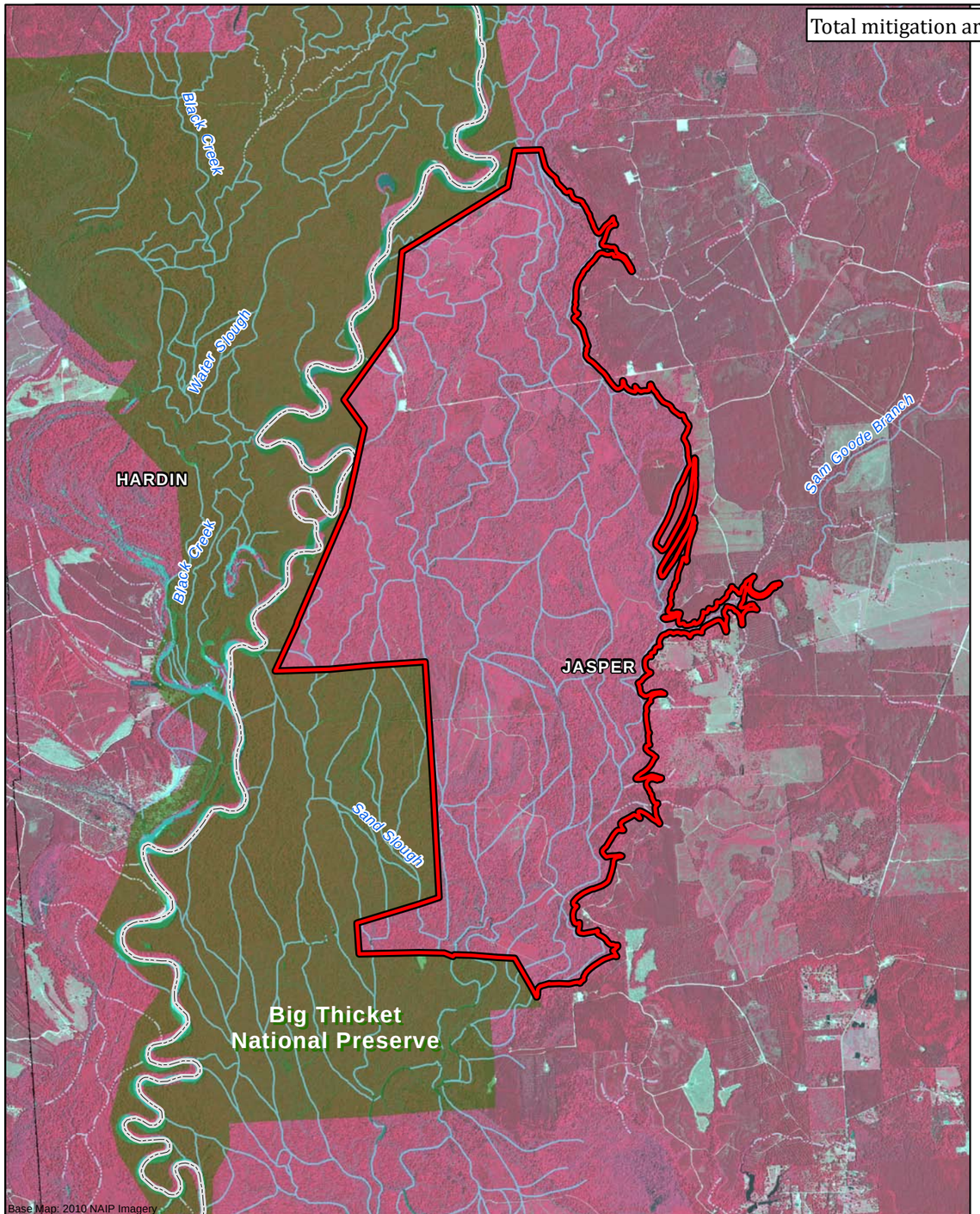
1:48,000
0 4,000 8,000 Feet

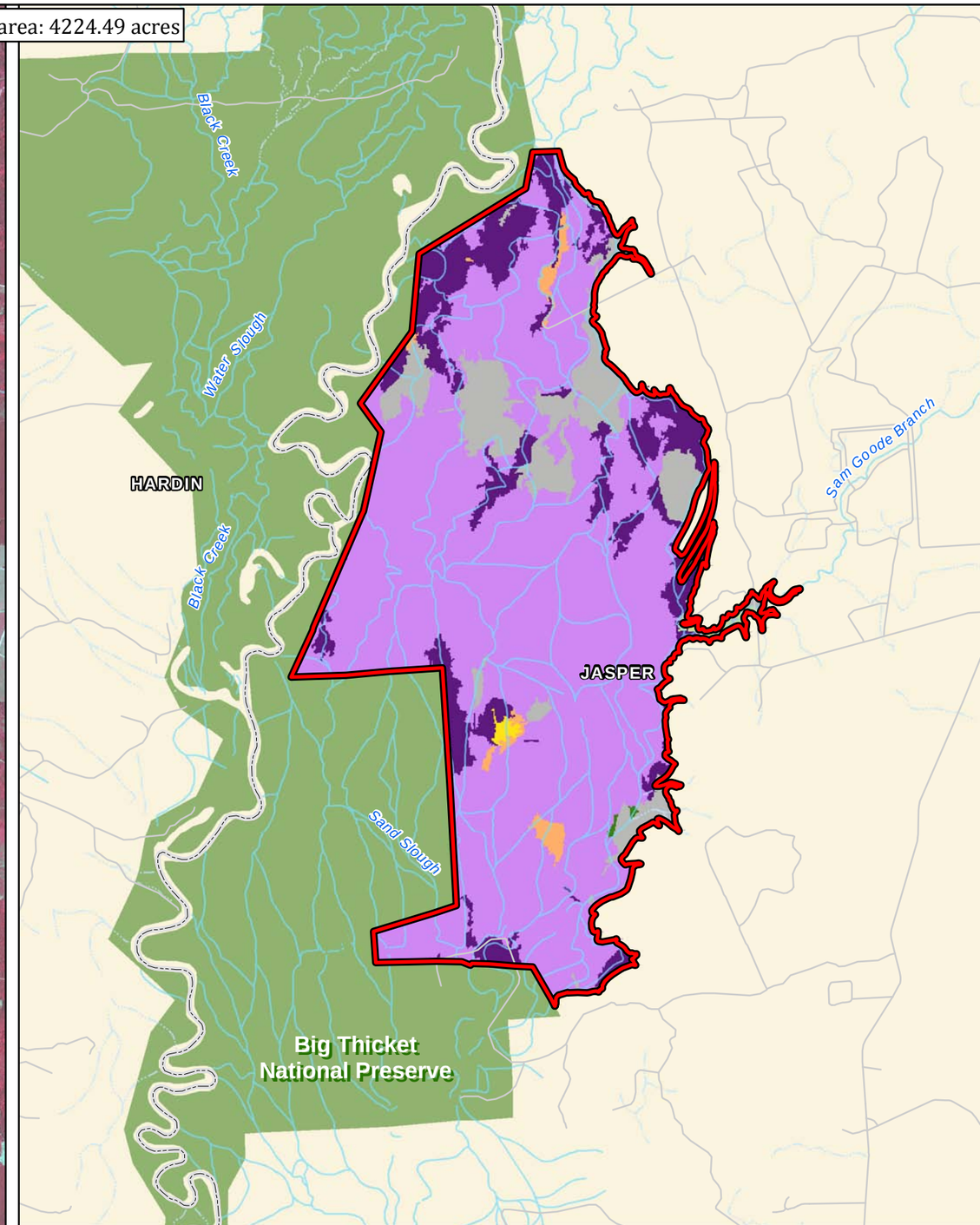
N

FIGURE
7b

Updated: Friday May 13, 2011 Updated By: SSJ File: H:\ENVIRONMENTAL\FINAL_EXHIBITS\MudCreek_Pri1_Soils.mxd

Total mitigation area: 4224.49 acres





Mitigation Boundary
County Boundary
Other
Bottomland Temporarily Flooded Mixed Pine/Hardwood Forest
Bottomland Temporarily Flooded Hardwood Forest
Bottomland Deciduous Successional Shrubland
Bottomland Herbaceous Wetland
Bottomland Seasonally Flooded Hardwood Forest
Bottomland Wet Prairie
Bottomland Baldcypress Swamp
Small Stream and Riparian Temporarily Flooded Hardwood Forest
Wet Hardwood Flatwoods
Hardwood Flatwoods
Open Water

1:48,000
0 4,000 8,000 Feet

N

FN PROJECT NO. ANR01289
DATE CREATED May 2011
DATUM & COORDINATE SYSTEM NAD83 State Plane (feet) Texas Central
FILE NAME BigThicket_Cover_Types.mxd
PREPARED BY SSJ

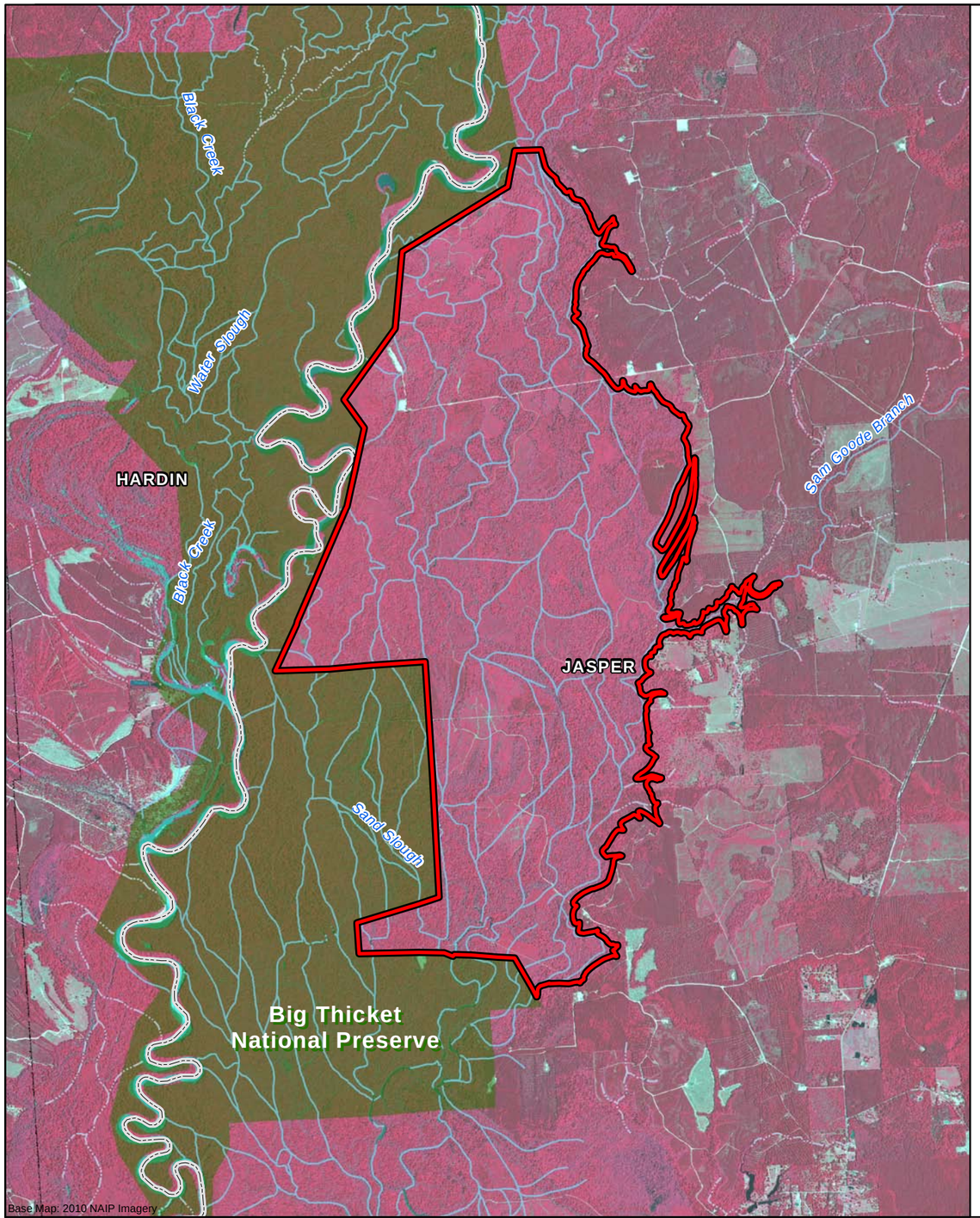
ANGELINA AND NECHES RIVER AUTHORITY

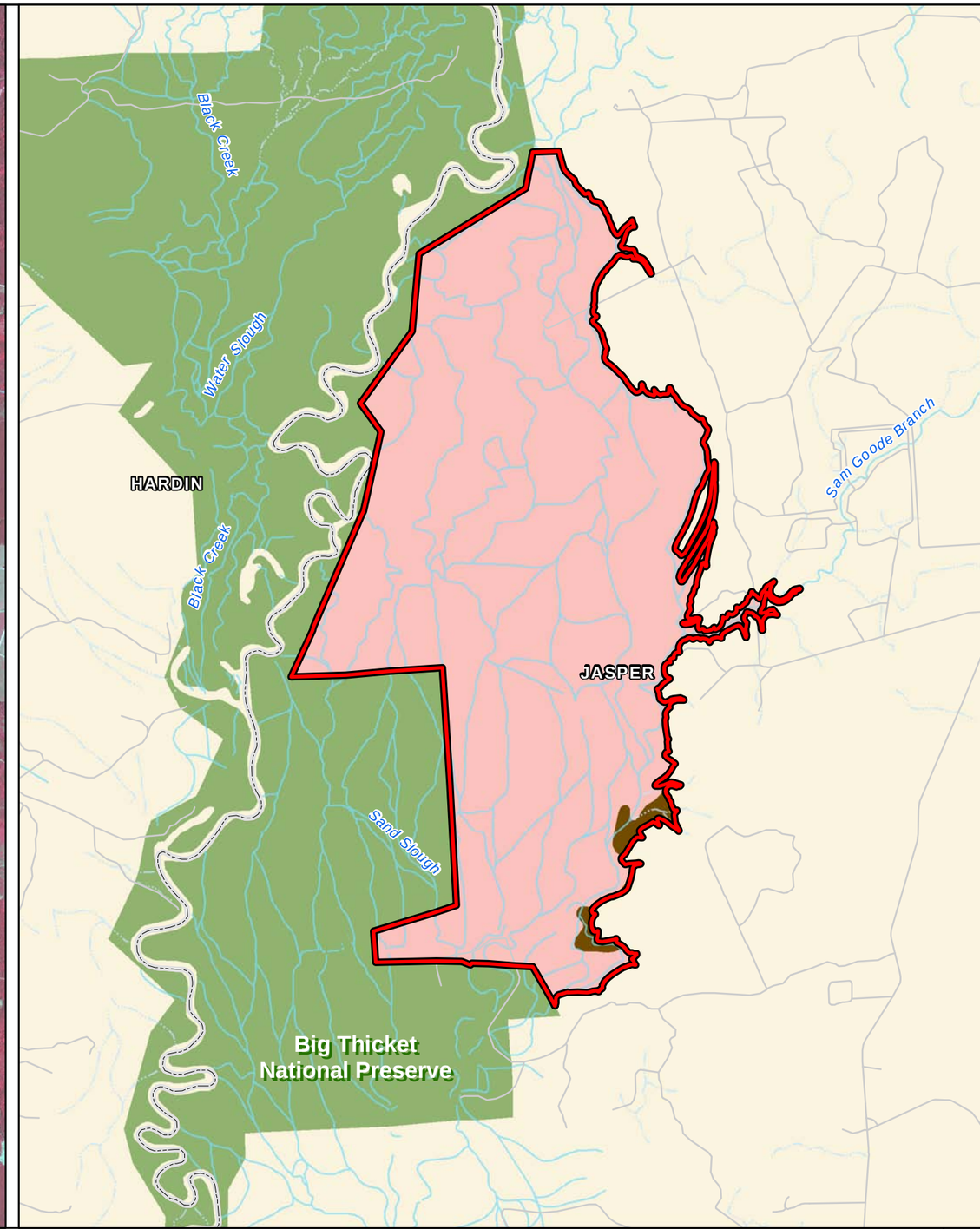
Lake Columbia Proposed Mitigation Area

Big Thicket - Cover Types

FREESE AND NICHOLS, INC.
10814 JOLLYVILLE ROAD
BUILDING 4, SUITE 100
AUSTIN, TX 78759
PHONE: 512.617.3100

FIGURE
8a





FN PROJECT NO. ANR01289
DATE CREATED May 2011
DATUM & COORDINATE SYSTEM NAD83 State Plane (feet) Texas Central
FILE NAME BigThicket_Soils.mxd
PREPARED BY SSJ

ANGELINA AND NECHES RIVER AUTHORITY

Lake Columbia Proposed Mitigation Area

Big Thicket - Soils

FREESE AND NICHOLS, INC.
10814 JOLLYVILLE ROAD
BUILDING 4, SUITE 100
AUSTIN, TX 78759
PHONE: 512.617.3100

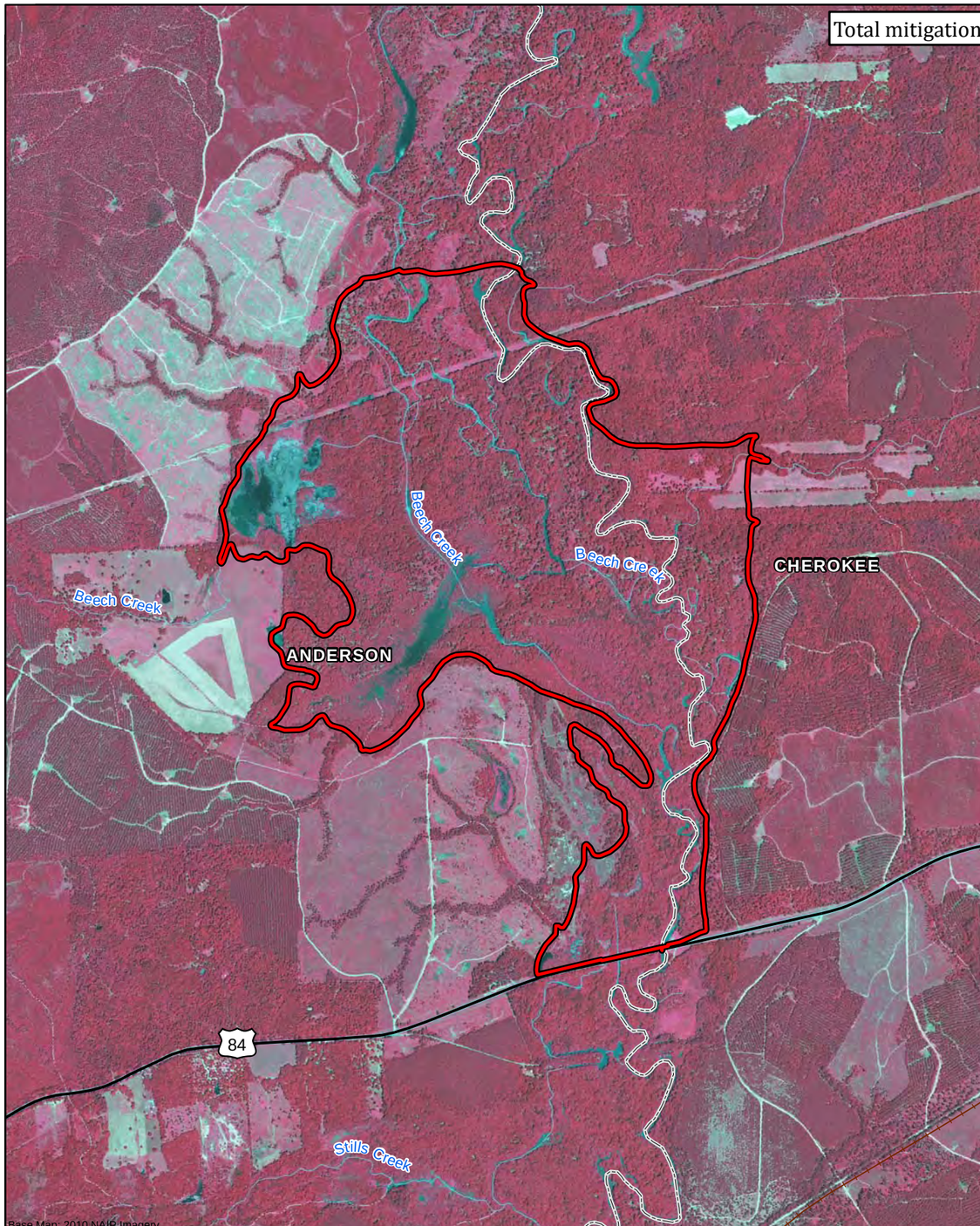
Mitigation Boundary
County Boundary
Not Hydric Soils
Partially Hydric Soils

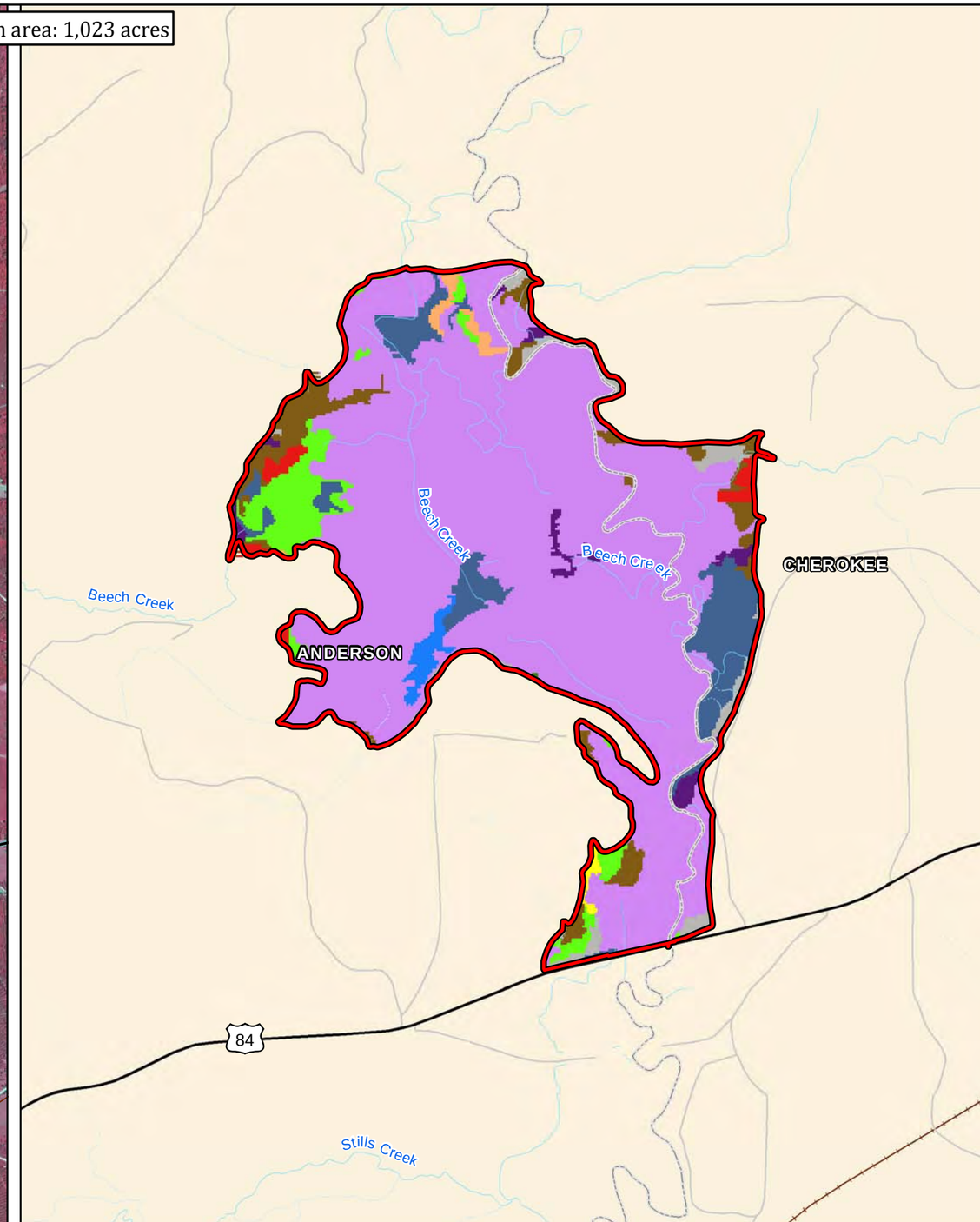
1:48,000
0 4,000 8,000 Feet

N

FIGURE
8b

Updated: Tuesday, May 17, 2011 Updated By: SSJ File: H:\ENVIRONMENTAL\FINAL_EXHIBITS\BigThicket_North_Soils.mxd





Mitigation Boundary
County Boundary
Other
Bottomland Temporarily Flooded Mixed Pine/Hardwood Forest
Bottomland Temporarily Flooded Hardwood Forest
Bottomland Deciduous Successional Shrubland
Bottomland Herbaceous Wetland
Bottomland Seasonally Flooded Hardwood Forest
Bottomland Baldcypress Swamp
Small Stream and Riparian Temporarily Flooded Hardwood Forest
Small Stream and Riparian Deciduous Successional Shrubland
Small Stream and Riparian Wet Prairie
Open Water

1:24,000
0 2,000 4,000 Feet

N

FN PROJECT NO. ANR01289
DATE CREATED May 2011
DATUM & COORDINATE SYSTEM NAD83 State Plane (feet) Texas Central
FILE NAME UpperNeches_Cover_Types.mxd
PREPARED BY SSJ

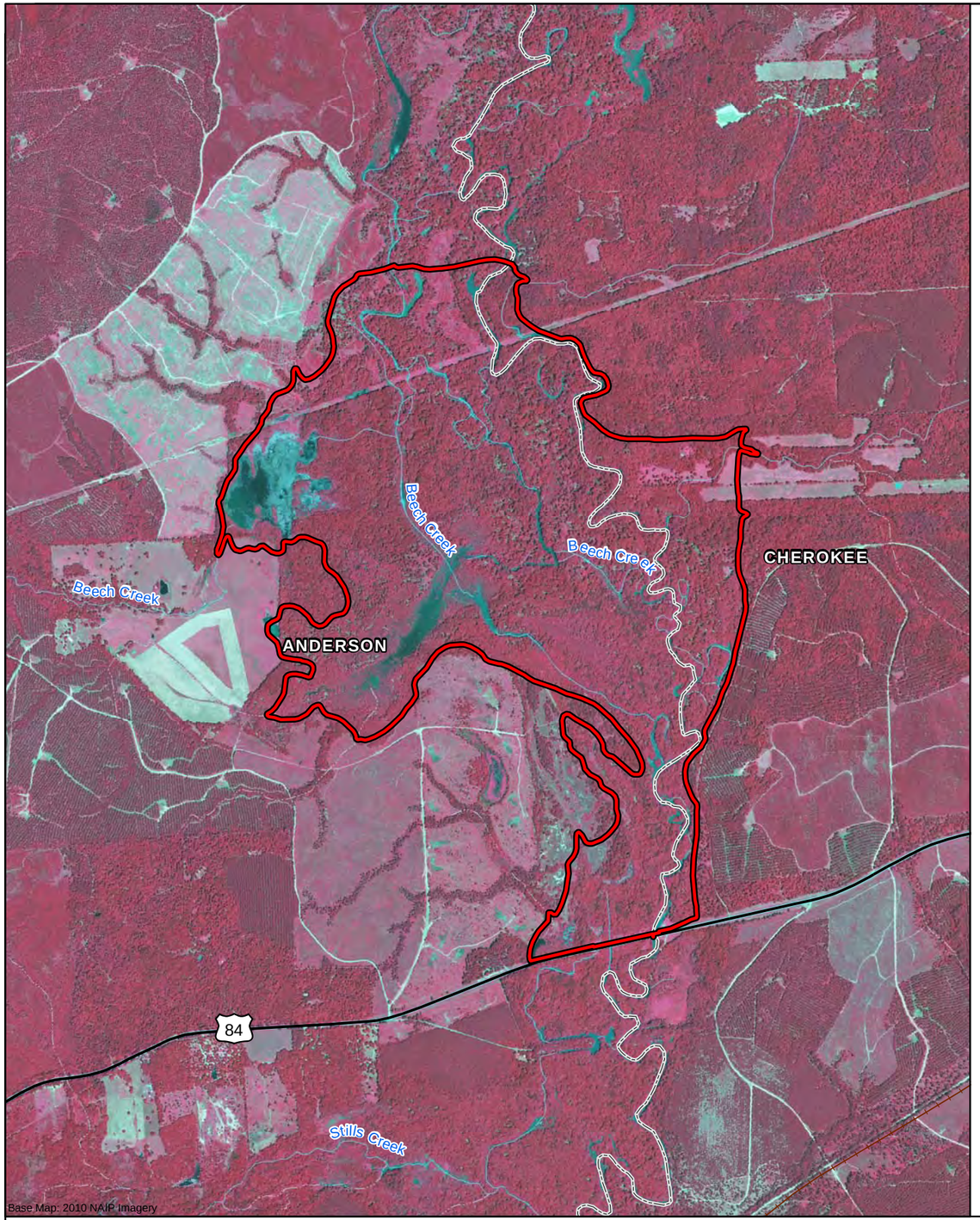
ANGELINA AND NECHES RIVER AUTHORITY

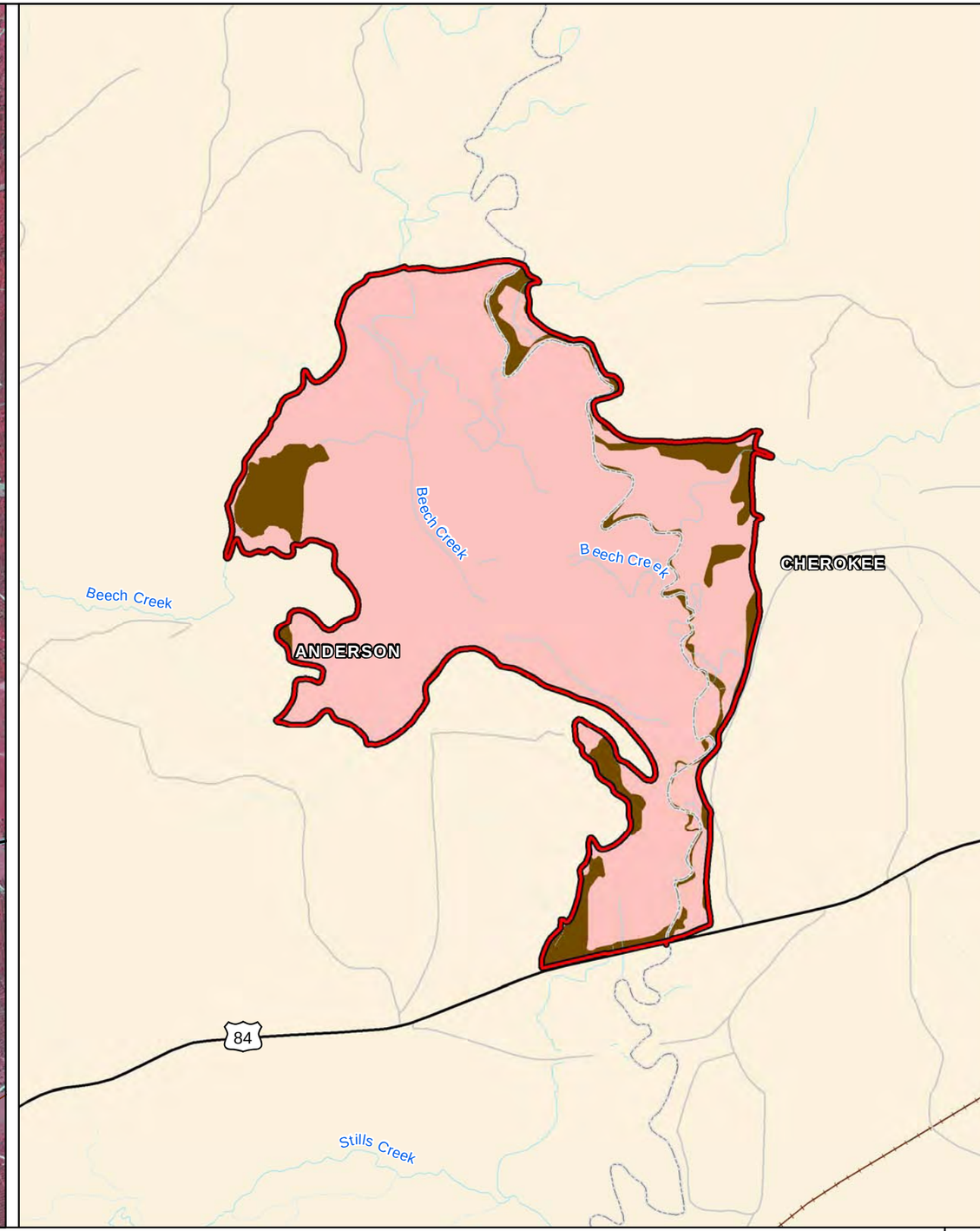
Lake Columbia Proposed Mitigation Area

Upper Neches Site - Cover Types

FREESE AND NICHOLS, INC.
10814 JOLLYVILLE ROAD
BUILDING 2, SUITE 100
AUSTIN, TX 78759
PHONE: 512.617.3100

FIGURE
9a





Mitigation Boundary

County Boundary

Not Hydric Soils

Partially Hydric Soils

1:24,000

0 2,000 4,000 Feet

N

FN PROJECT NO. ANR01289

DATE CREATED May 2011

DATUM & COORDINATE SYSTEM NAD83 State Plane (feet) Texas Central

FILE NAME UpperNeches_Soils.mxd

PREPARED BY SSJ

ANGELINA AND NECHES RIVER AUTHORITY

Lake Columbia Proposed Mitigation Area

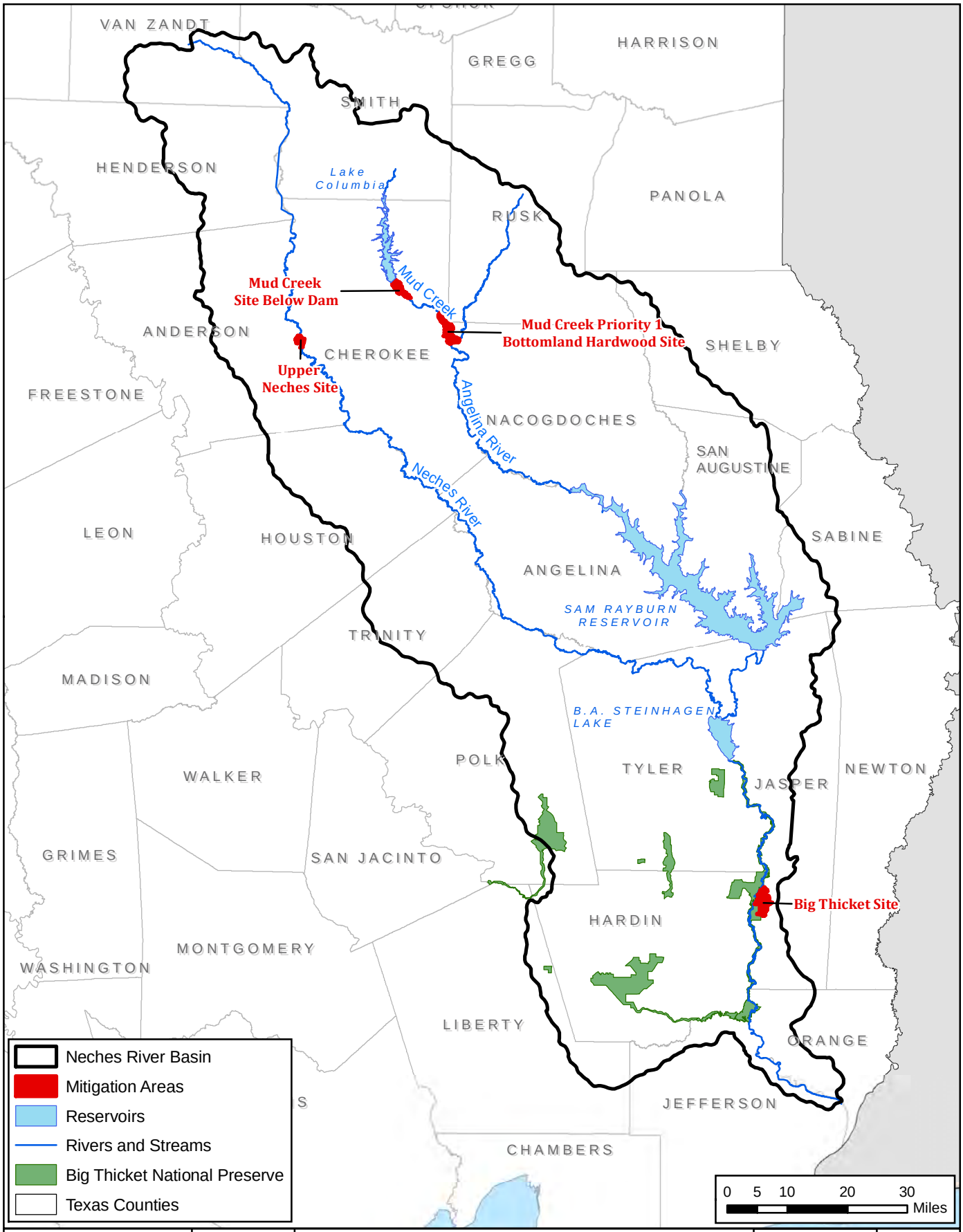
Upper Neches Site - Soils

FREESE AND NICHOLS, INC.
10814 JOLLYVILLE ROAD
BUILDING 4, SUITE 100
AUSTIN, TX 78759
PHONE: 512.617.3100

FIGURE

9b

Updated: Tuesday, May 17, 2011 Updated By: SSJ File: H:\ENVIRONMENTAL\FINAL_EXHIBITS\UpperNeches_Soils.mxd



Freese and Nichols
4055 International Plaza, Suite 200
Fort Worth, TX 76109 - 4895
Phone - (817) 735 - 7300

N
W E
S

Angelina and Neches River Authority
Lake Columbia Mitigation Plan

Location of Big Thicket National Preserve

FN JOB NO	ANR01289
FILE	NechesBasin.mxd
DATE	May 2011
SCALE	1:500,000
DESIGNED	SPW
DRAFTED	SSJ

FIGURE 10

ANRA Lake Columbia Mitigation Work Plan Process

January 21, 2011

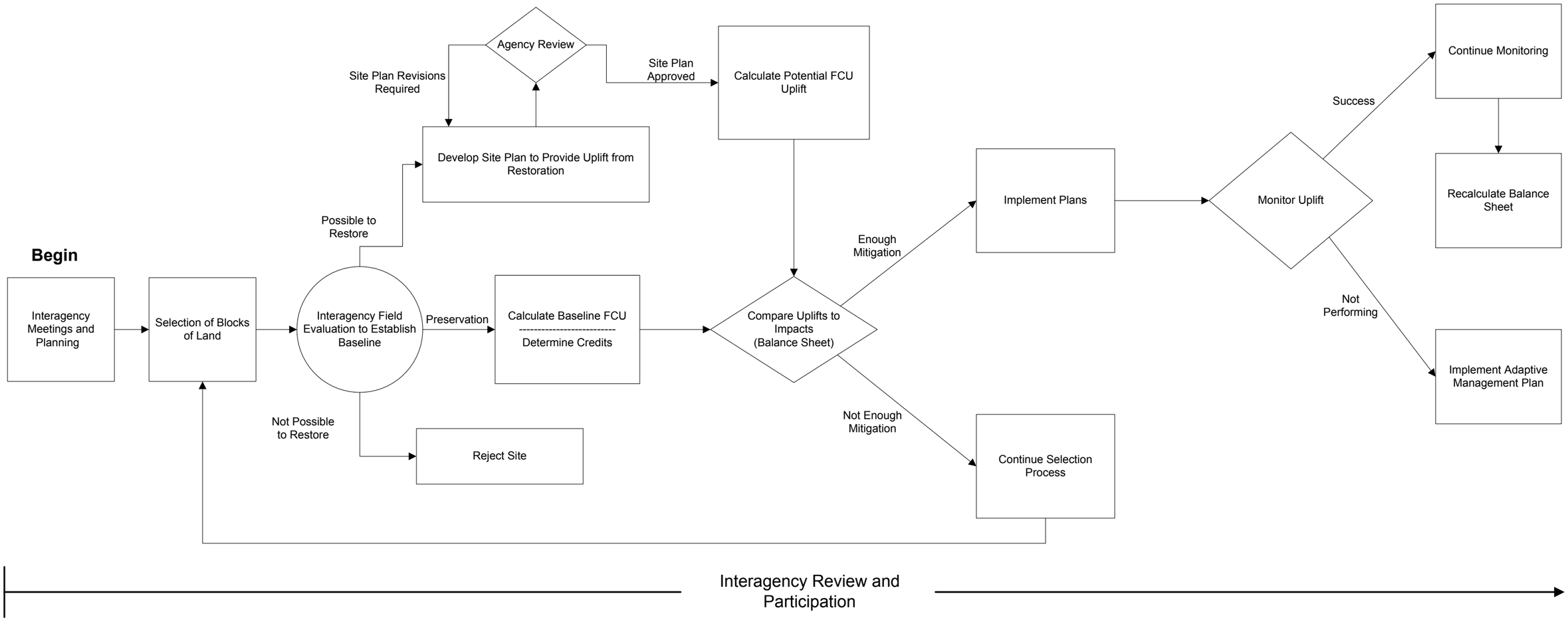


Figure 11

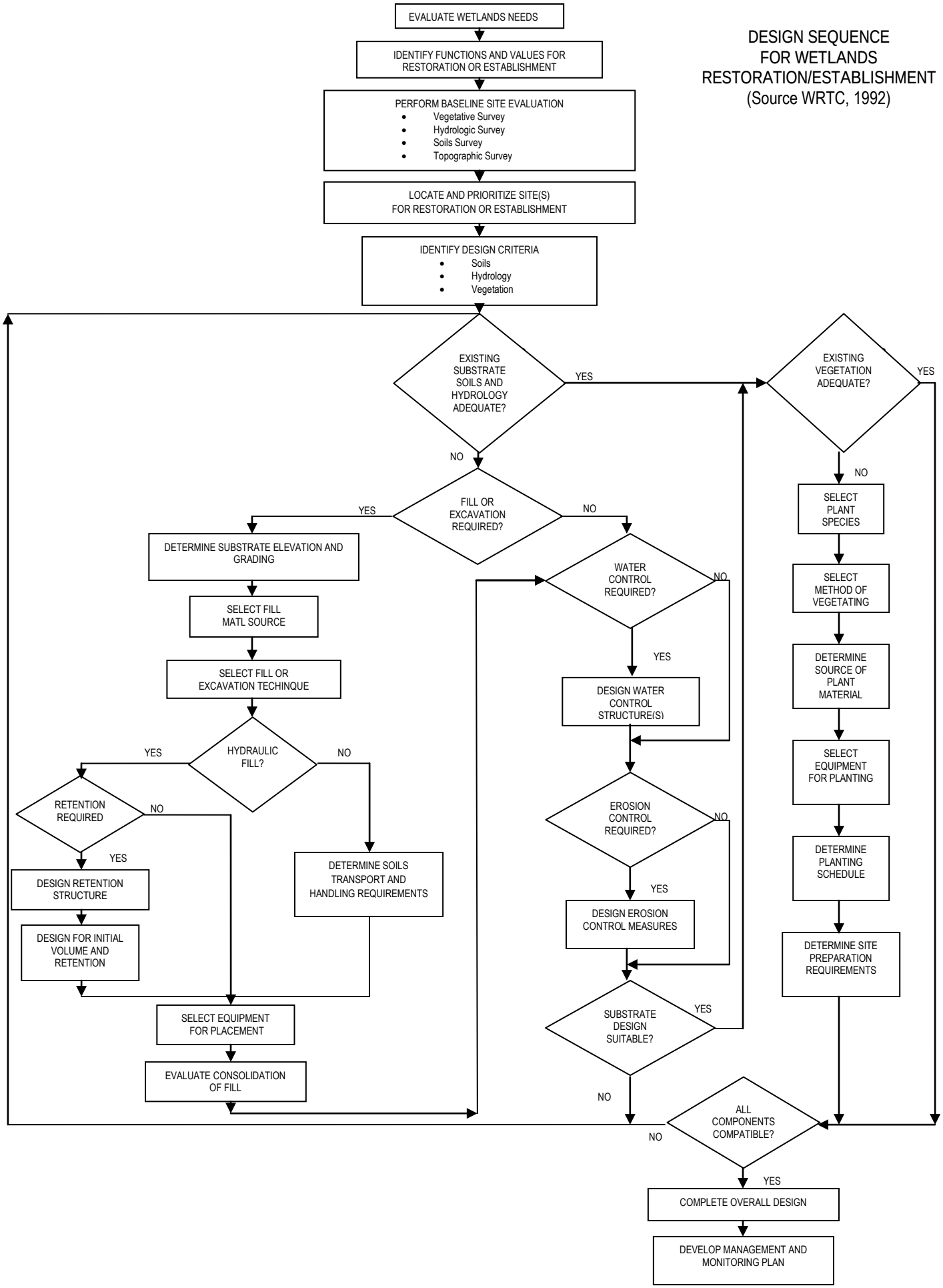


Figure 12 Flowchart illustrating design sequence for wetlands restoration and establishment projects

APPENDIX B

Lake Columbia
Water Quality Regulations

LAKE COLUMBIA WATER QUALITY REGULATIONS

(Approved 8/7/2007 by ANRA Board of Directors)

The State of Texas has conferred on the Angelina and Neches River Authority ("ANRA") the authority and responsibility to develop and maintain Lake Columbia so that the quality of water flowing into, stored, and diverted from it will be of the highest quality. This authority and responsibility is derived from Senate Bill 1362 (78th Leg. Ch. 1230), Texas Water Code Chapter 26, Texas Special Local Districts Code Chapter 8501, Texas Constitution Article 16, Section 59, and other laws. After public notice and hearing, ANRA has adopted the regulations set out below, which it may amend from time to time, in order to protect water quality while at the same time provide for the use and enjoyment of Lake Columbia.

SECTION 1

Definitions. The following definitions are used in these Regulations unless another meaning is specifically stated. All locations are in relation to the shores of Lake Columbia.

1.01 "MSL" means an elevation with reference to mean sea level.

1.02 "Construction Regulated Zone" means land located at or above 315 feet MSL and below 330 MSL and in the locations shown on the attachments labeled "Construction Limits."

1.03 "No Discharge Zone" means the land located horizontally 2000 feet from the 315 feet MSL elevation.

1.04 "100 Year Flood Level" means 323.4 feet MSL.

1.05 "On-site Sewage Facility" ("OSSF") means a system defined in Texas Health and Safety Code Sec 366.

1.06 "Effective Date or Effective Dates" means the day or days established in an Order adopted by ANRA after which compliance with these Regulations will be required. The Order, as may be amended, will be recorded in the Real Property Records of both Smith and Cherokee Counties.

1.07 "Forestry BMPs" mean the Best Management Practices established, from time to time, by the Texas Forest Service

1.08 "Lake Columbia Watershed" means all land draining into Lake Columbia.

1.09 "Lake Columbia" means the reservoir project authorized by Permit to Appropriate State Water Number 4228 (Application No. 4537) held by ANRA.

1.10 "Large or Significant Development" means a development that ANRA believes may have a direct water quality impact on Lake Columbia.

1.11 "Nonpoint Source Pollution" ("NPS") means pollution that is caused by or attributable to diffused sources such as land runoff, precipitation, or percolation.

1.12 "Best Management Practices" ("BMPs") mean those practices, including but not limited to Forestry BMPs, that prevent or control nonpoint source pollution.

1.13 “Pollution” has the same meaning as given in Texas Water Code Chapter 26, as amended.

1.14 “Lake Columbia Water Quality Regulations” mean these regulations adopted and as may be amended, by ANRA for the protection and preservation of the water in Lake Columbia.

1.15 “Shoreline Habitat Plan” means a plan that addresses the Shoreline and/or the Streamside Management Zone in the Forestry BMPs.

1.16 “Shoreline Habitat Zone” means the area along the Shoreline.

1.17 “Subdivided” means the division of land into two or more tracts which is not exempt under Texas Local Government Code Chapter 232.

1.18 “Subdivision” means land which has been subdivided.

1.19 “Shoreline” means the extended point where the plane of the surface of water stored in Lake Columbia touches land up to the 100-year Flood Level.

1.20 “Commission” means the Texas Commission on Environmental Quality or its successor or agency.

1.21 “Agricultural Activities” means all activities associated with the production of livestock or use of land for planting, growing, cultivation and harvesting crops, or participation in a wildlife management plan.

1.22 “Utility Line” means any wire, cable, pipe or any other type of conveyance for the transmission of gas, liquid, electronic signal, electricity, telephone service, cable television service or any other type of service whether public or private.

1.22 “Development” means all land modification activity, including the construction of buildings, roads, paved storage areas and parking lots. Development also includes, but is not limited to, any land disturbing construction activities or human-caused change of the land surface including clearing of vegetative cover, excavating, leveling, grading, contouring, mining and the deposit of refuse, waste, or fill. Care and maintenance of lawns, gardens and landscape vegetation, agricultural activities and activities subject to “Forestry BMPs” are not included within this definition.

SECTION 2
Pipelines and Utilities

The construction and installation of pipelines and utility lines in Lake Columbia is prohibited.

SECTION 3
Solid or Hazardous Waste Facilities

3.01 Construction of or enlargement of existing Hazardous or Municipal Solid Waste facilities including receiving and transfer facilities are prohibited within the Lake Columbia Watershed except for Municipal Solid Waste within the incorporated limits of the Cities of Tyler, Jacksonville, New Summerfield, Troup, Whitehouse, and Bullard or owned by or operated by one of said cities.

3.02 Petroleum storage tanks (“PST”) with a capacity greater than 100 gallons are prohibited in the No Discharge Zone without the approval of ANRA.

SECTION 4

Forestry Activities:

Forestry BMPs are mandatory for all forestry activities in the No Discharge Zone.

SECTION 5

No Discharge Zone.

5.01 After the Effective Date, OSSF are not allowed in the No Discharge Zone on: (1) a lot less than 0.75 acres in size if the improvements are connected to a public water supply; (2) a lot less than 1.25 acres that is not connected to a public water supply; or (3) on any lot which can practicably be served by a sewage collection and treatment system permitted by the Texas Commission on Environmental Quality (the"Commission") .

5.02 OSSF may be allowed in the No Discharge Zone, except as provided in 5.01 above, provided the OSSF has received a permit as provided below and it does not discharge pollution.

5.03 All On-Site Sewage Facilities must be designed by either a registered professional engineer or a registered professional sanitarian. Plans for an OSSF, along with all applicable fees and other information which may be required by ANRA, must be submitted to ANRA for its review and approval prior to beginning construction. Upon its review and approval, ANRA shall issue a permit to the property owner for the system. ANRA shall make available to the public the forms and design criteria for OSSF.

5.04 All OSSF permits shall remain subject to the continued jurisdiction of ANRA and shall be cancelable upon reasonable notice for failure to comply with applicable laws, regulations and requirements.

5.05 ANRA shall adopt application forms, design criteria, maintenance requirements, fee schedules, and other requirements from time to time which shall be incorporated by reference into these Regulations. The requirements may be more stringent and restrictive than those established by the Commission, Cherokee County or Smith County for OSSF.

5.06 Erosion is prohibited in the No Discharge Zone. Property owners are required to take action to prevent erosion from occurring on their property and to immediately abate any erosion on it. Property owners may be relieved of the duty to abate erosion occurring on their property if they can show to ANRA's satisfaction that the erosion is caused by natural forces.

SECTION 6

Construction Regulated Zone.

6.01 Owners of property adjacent to the Construction Regulated Zone ("Adjacent Owners") may be granted permission to use this Zone but are limited in what can be constructed on it. The general rules are that nothing can be constructed in this Zone which will decrease the storage capacity of the Lake, be a source of contamination, or significantly impact aquatic or terrestrial habitat.

6.02 Adjacent Owners may construct piers, docks, and other water front facilities in the Construction Regulated Zone after applying to and receiving from ANRA a license to do so. Each application will be

evaluated on a case by case basis consistent with applicable construction regulations.

SECTION 7
Land Development

7.01. Any person who proposes to subdivide land within the Construction Regulated Zone, except for land within the municipal limits or extraterritorial jurisdiction of the Cities of Tyler, Whitehouse, and Troup, must submit to ANRA the plat or plats required under the Subdivision Regulations of Smith County or Cherokee County.

7.02 In addition to the County Requirements, the Subdivider must provide a Non-point Source Pollution control plan for both the construction of any roads, utilities, parking lots, or other improvements associated with the development and any impervious cover that will remain on the property.

7.03 Any Shoreline property that is to be Subdivided must contain a Shoreline Habitat Plan that states how the Shoreline habitat will be maintain, restored and protected as well as means and methods of stabilizing the Shoreline to prevent erosion. At least sixty percent (60%) of all Shoreline within 50 feet of the 315 MSL Level must be maintained in a natural condition. No modification within the Shoreline as defined in these Regulations is permitted without prior written consent from ANRA. The purpose of the Shoreline Habitat Plan is to prevent sedimentation within the lake, prevent erosion along the shoreline, to filter and remove nutrients from runoff into the lake and to provide a productive wildlife habitat. Shoreline Habitat Plans shall be reviewed on a case by case basis as necessary, consistent with the purpose stated herein, and any such review shall be based upon the following considerations:

a. Slope, soil type and other characteristics within the area to be covered by the Shoreline Habitat Plan.
b. Exotic invasive species as identified by the Texas Parks and Wildlife Department or Commission, United States Fish and Wildlife, the Texas Department of Agriculture, the Texas Commission on Environmental Quality, any branch or part of the United States Department of Agriculture or the United States Environmental Protection Agency are prohibited.
c. Use of native species over non-native species.
d. Use of non-natural shoreline materials such as sea walls, bulkheads, rip rap and other hard shoreline materials will be considered on a case by case basis.
e. Any other factors peculiar to the site being considered and determined, by ANRA, to be relevant.

7.04 In determining whether Development is a “large or significant development” as defined by Rule 1.10 ANRA shall consider the following:

a. the size of the development;
b. the character of the development (residential, commercial, industrial, etc.);
c. the amount of impervious cover;

d. proximity to Lake Columbia and/or streams, rivers or creeks draining into Lake Columbia; and

e. other factors the ANRA considers relevant.

7.05 All Development within the No Discharge Zone equal to or greater than one (1) acre, must comply with TCEQ TPDES General Permit No. TXR150000. Development of less than one (1) acre must control run-off and sedimentation from the Development so as to prevent discharges that would cause or contribute to a violation of water quality standards or that would fail to protect and maintain all existing designated uses of Lake Columbia.

APPENDIX C

List of Candidate Trees for Planting at the Lake Columbia Mitigation Sites
(From USACE, Fort Worth District)

Http://Www.Swf.Usace.Army.Mil/Pubdata/Environ/Regulatory/Permitting/Plantdata/Index.Asp

Genus	Species	Common Name	R6 Ind	Food Value	Habit	Regions
Acer	negundo	BOX-ELDER	FACW-	Y	Native Tree	1
Acer	rubrum	MAPLE,RED	FAC	Y	Native Tree	1
Acer	rubrum d.	MAPLE,DRUMMOND RED	FACW	Y	Native Tree	1
Aesculus	glabra o.	BUCKEYE,OHIO	FAC-	Y	Native Tree	1
Aesculus	glabra t.	BUCKEYE,TEXAS	FACU-	Y	Native Tree	1
Aesculus	pavia	BUCKEYE,RED	FAC-	Y	Native Shrub/Tree	1
Alnus	serrulata	ALDER,BROOK-SIDE	OBL	Y	Native Tree	1
Amelanchier	arborea	SERVICE-BERRY,DOWNY	FACU	Y	Native Tree	1
Amorpha	fruticosa	INDIGO-BUSH,FALSE	FACW		Native Shrub	1
Amorpha	paniculata	INDIGO-BUSH,PANICLED	FACW		Native Shrub	1
Aralia	spinosa	CLUB,HERCULES	FAC		Native Tree	1
Aronia	arbutifolia	CHOKEBERRY,RED	FACW	Y	Native Shrub	1
Asimina	parviflora	PAWPAW,DWARF	FAC		Native Shrub/Tree	1
Asimina	triloba	PAWPAW,COMMON	FAC-		Native Tree	1
Baccharis	halimifolia	FALSE-WILLOW,EASTERN	FACW-		Native Shrub	1
Betula	nigra	BIRCH,RIVER	FACW		Native Tree	1
Carpinus	caroliniana	HORNBEAM,AMERICAN	FAC	Y	Native Tree	1
Carya	aquatica	HICKORY,WATER	OBL	Y	Native Tree	1
Carya	cordiformis	HICKORY,BITTER-NUT	FAC	Y	Native Tree	1
Carya	illinioensis	HICKORY,PECAN	FAC+	Y	Native Tree	1
Carya	myristiciformis	HICKORY,NUTMEG	FACW-	Y	Native Tree	1
Carya	ovata	HICKORY,SHAG-BARK	FACU+	Y	Native Tree	1
Catalpa	speciosa	CATALPA,NORTHERN	FAC-		Native Tree	1
Celtis	laevigata	SUGAR-BERRY	FAC	Y	Native Tree	1
Cephalanthus	occidentalis	BUTTONBUSH,COMMON	OBL	Y	Native Shrub	1
Clethra	alnifolia	PEPPER-BUSH,COAST	FACW		Native Shrub	1
Cornus	drummondii	DOGWOOD,ROUGH-LEAF	FAC	Y	Native Tree	1
Cornus	florida	DOGWOOD,FLOWERING	FACU	Y	Native Tree	1
Cornus	foemina	DOGWOOD,STIFF	FACW	Y	Native Shrub	1
Crataegus	berberifolia	HAWTHORN,BARBERRY-LEAF	FAC+	Y	Native Tree	1
Crataegus	brachyacantha	HAWTHORN,BLUEBERRY	FACW	Y	Native Tree	1
Crataegus	marshallii	HAWTHORN,PARSLEY	FAC-	Y	Native Shrub/Tree	1
Crataegus	mollis	HAWTHORN,DOWNY	FAC	Y	Native Tree	1
Crataegus	opaca	HAWTHORN,RIVER-FLAT	OBL	Y	Native Emergent Tree	1
Crataegus	spathulata	HAWTHORN,LITTLE-HIP	FAC+	Y	Native Shrub/Tree	1

Crataegus	viridis	HAWTHORN,GREEN	FAC	Y	Native Tree	1
Cyrilla	racemiflora	CYRILLA,SWAMP	FACW+		Native Tree	1
Dioclea	multiflora	CLUSTER-PEA,BOYKIN	FACU		Perennial Native Shrub	1
Diospyros	virginiana	PERSIMMON,COMMON	FAC	Y	Native Tree	1
Euonymus	americanus	STRAWBERRY-BUSH,AMERICAN	FACW		Native Shrub	1
Fagus	grandifolia	BEECH,AMERICAN	FACU	Y	Native Tree	1
Forestiera	acuminata	PRIVET,SWAMP	OBL	Y	Native Shrub/Tree	1
Fraxinus	americana	ASH,WHITE	FACU		Native Tree	1
Fraxinus	caroliniana	ASH,CAROLINA	OBL		Native Emergent	1
Fraxinus	pennsylvanica	ASH,GREEN	FACW-		Native Tree	1
Gleditsia	aquatica	WATER-LOCUST	OBL		Native Emergent	1
Gleditsia	triacanthos	HONEY-LOCUST	FAC		Native Tree/Shrub	1
Halesia	diptera	SILVER-BELL,TWO-WING	FAC+		Native Tree/Shrub	1
Hamamelis	virginiana	WITCH-HAZEL,AMERICAN	FAC-		Native Shrub/Tree	1
Hypericum	apocynifolium	ST. JOHN'S-WORT	OBL		Native Emergent Shrub	1
Hypericum	fasciculatum	ST. JOHN'S-WORT,SANDWEED	FACW+		Native Shrub	1
Hypericum	galioides	ST. JOHN'S-WORT,BEDSTRAW	OBL		Native Shrub	1
Hypericum	nudiflorum	ST. JOHN'S-WORT,PRETTY	FACW+		Native Shrub	1
Hypericum	prolificum	ST. JOHN'S-WORT,SHRUBBY	FACU		Native Shrub	1
Hypericum	sphaerocarpum	ST. JOHN'S-WORT,ROUND-FRUIT	FACU		Native Shrub	1
Ilex	cassine	HOLLY,DAHOON	FACW	Y	Native Tree	1
Ilex	decidua	HOLLY,DECIDUOUS	FACW-	Y	Native Tree	1
Ilex	glabra	INK-BERRY	FACW	Y	Native Shrub	1
Ilex	opaca	HOLLY,AMERICAN	FACU	Y	Native Tree/Shrub	1
Ilex	verticillata	WINTERBERRY,COMMON	OBL*	Y	Native Shrub/Tree	1
Ilex	vomitoria	YAUPON	FAC-	Y	Native Shrub/Tree	1
Juglans	nigra	WALNUT,BLACK	FACU	Y	Native Tree	1
Juniperus	virginiana	CEDAR,EASTERN RED	FACU-	Y	Native Tree	1
Lantana	horrida	SHRUB-VERBENA,COMMON	FAC-		Native Shrub	1
Leucothoe	racemosa	FETTER-BUSH	FACW		Native Shrub	1
Lindera	benzoin	SPICEBUSH,NORTHERN	FACW-	Y	Native Shrub/Tree	1
Liquidambar	styraciflua	GUM,SWEET	FAC	Y	Native Tree	1
Liriodendron	tulipifera	TREE,TULIP	FACU		Native Tree	1
Lonicera	japonica	HONEYSUCKLE,JAPANESE	FAC	Y	Native Shrub	1
Lyonia	ligustrina	MALEBERRY	FACW		Native Shrub	1
Lyonia	mariana	STAGGER-BUSH,PIEDMONT	FAC		Native Shrub	1

Magnolia	grandiflora	MAGNOLIA,LARGE-FLOWER	FAC-	Y	Native Tree	1
Magnolia	virginiana	MAGNOLIA,SWEETBAY	OBL	Y	Native Tree	1
Morus	rubra	MULBERRY,RED	FACU	Y	Native Tree	1
Myrica	cerifera	BAYBERRY,SOUTHERN	FAC	Y	Native Shrub/Tree	1
Myrica	heterophylla	BAYBERRY,EVERGREEN	FAC+	Y	Native Shrub	1
Nyssa	aquatica	WATER-TUPELO	OBL	Y	Native Tree	1
Nyssa	sylvatica b.	TUPELO,SWAMP	OBL	Y	Native Tree	1
Nyssa	sylvatica s.	GUM,BLACK	FAC	Y	Native Tree	1
Ostrya	virginiana	HOP-HORNBEAM,EASTERN	FACU+	Y	Native Tree	1
Persea	borbonia	BAY,RED	FACW		Native Tree	1
Pinus	palustris	PINE,LONG-LEAF	FAC-	Y	Native Tree	1
Pinus	taeda	PINE,LOBLOLLY	FAC-	Y	Native Tree	1
Planera	aquatica	PLANER-TREE	OBL		Native Emergent Tree	1
Platanus	occidentalis	SYCAMORE,AMERICAN	FAC+		Native Tree	1
Populus	deltoides	COTTON-WOOD,EASTERN	FAC		Native Tree	1
Prunus	serotina	CHERRY,BLACK	FACU	Y	Native Tree	1
Quercus	alba	OAK,WHITE	FACU+	Y	Native Tree	1
Quercus	falcata	OAK,CHERRY-BARK	FAC+	Y	Native Tree	1
Quercus	falcata	OAK,SOUTHERN RED	FACU	Y	Native Tree	1
Quercus	laurifolia	OAK,LAUREL	FACW	Y	Native Tree	1
Quercus	lyrata	OAK,OVERCUP	OBL	Y	Native Tree	1
Quercus	macrocarpa	OAK,BUR	FAC-	Y	Native Tree/Shrub	1
Quercus	michauxii	OAK,SWAMP CHESTNUT	FACW	Y	Native Tree	1
Quercus	muhlenbergii	OAK,CHINKAPIN	FAC*	Y	Native Tree	1
Quercus	nigra	OAK,WATER	FAC+	Y	Native Tree	1
Quercus	phellos	OAK,WILLOW	FACW	Y	Native Tree	1
Quercus	shumardii	OAK,SHUMARD	FAC	Y	Native Tree	1
Rhamnus	caroliniana	BUCKTHORN,CAROLINA	FACU-	Y	Native Shrub/Tree	1
Rhododendron	canescens	AZALEA,HOARY	FACW-		Native Shrub	1
Rhododendron	coryi	AZALEA,TEXAS BOG	FACW		Native Shrub	1
Rhododendron	oblongifolium	AZALEA,TEXAS	FACW+		Native Shrub	1
Rosa	carolina	ROSE,CAROLINA	FACU	Y	Native Shrub	1
Rubus	arvensis	BLACKBERRY,FIELD	FAC*	Y	Native Shrub	1
Rubus	louisianus	BLACKBERRY,LOUISIANA	FACW-	Y	Native Shrub	1
Sabal	minor	PALMETTO,DWARF	FACW	Y	Native Shrub/Tree	1
Salix	exigua	WILLOW,SANDBAR	FACW+		Native Shrub	1

Salix	humilis	WILLOW,TALL PRAIRIE	FACU		Native Shrub	1
Salix	nigra	WILLOW,BLACK	FACW+		Native Tree	1
Sambucus	canadensis	ELDER,AMERICAN	FAC+	Y	Native Shrub	1
Sapindus	saponaria	SOAPBERRY,WING-LEAF	FACU-		Native Tree	1
Sapium	sebiferum	TALLOW-TREE,CHINESE	FACU+		Introduced Tree	1
Sassafras	albidum	SASSAFRAS	FACU		Native Tree	1
Sebastiania	fruticosa	SEBASTIAN-BUSH,GULF	FAC		Native Shrub	1
Sesbania	drummondii	RATTLE-BUSH,DRUMMOND'S	FACW		Native Shrub	1
Sesbania	punicea	RATTLE-BUSH,PURPLE	FACW-		Introduced Shrub	1
Styrax	americana	SNOWBELL,AMERICAN	FACW-		Native Shrub/Tree	1
Symphoricarpos	orbiculatus	CORAL-BERRY	FACU*	Y	Native Shrub	1
Symplocos	tinctoria	HORSE-SUGAR	FAC+		Native Tree/Shrub	1
Tamarix	parviflora	TAMARISK,SMALL-FLOWER	FACW		Introduced Tree	1
Taxodium	distichum	CYPRESS,BALD	OBL		Native Emergent Tree	1
Tilia	americana	BASSWOOD,AMERICAN	FACU		Native Tree	1
Ulmus	alata	ELM,WINGED	FACU	Y	Native Tree	1
Ulmus	americana	ELM,AMERICAN	FAC	Y	Native Tree	1
Ulmus	crassifolia	ELM,CEDAR	FAC	Y	Native Tree	1
Ulmus	rubra	ELM,SLIPPERY	FAC	Y	Native Tree	1
Vaccinium	arboreum	FARKLEBERRY	FACU	Y	Native Shrub/Tree	1
Vaccinium	caesium	DEERBERRY	FACU	Y	Native Shrub	1
Vaccinium	corymbosum	BLUEBERRY,HIGHBUSH	FACW	Y	Native Shrub	1
Vaccinium	stamineum	DEERBERRY	FACU+	Y	Native Shrub	1
Verbena	scabra	VERVAIN,SANDPAPER	OBL		Perennial Native	1
Viburnum	dentatum	ARROW-WOOD	FAC	Y	Native Tree/Shrub	1
Viburnum	nudum	VIBURNUM,POSSUM-HAW	FACW+	Y	Native Shrub/Tree	1
Viburnum	prunifolium	BLACK-HAW	FACU+	Y	Native Shrub/Tree	1
Viburnum	rufidulum	BLACK-HAW,RUSTY	FACU-	Y	Native Tree/Shrub	1
Zanthoxylum	clava-herculis	HERCULES-CLUB	FAC-		Native Shrub/Tree	1