

**ExxonMobil Environmental Services  
Company**

**Cove Restoration Planting Plan**

Mayflower Pipeline Incident Response  
Mayflower, Arkansas

January 2015



A handwritten signature in black ink that reads "Joseph Shisler".

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## **Cove Restoration Planting Plan**

Mayflower Pipeline Incident  
Response  
Mayflower, Arkansas

Prepared for:  
ExxonMobil Environmental Services  
Company

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## **1. Introduction**

ARCADIS U.S., Inc. (ARCADIS) prepared this Cove Restoration Planting Plan (CRPP) for ExxonMobil Environmental Services Company (EMES) on behalf of ExxonMobil Pipeline Company (EMPCo) for the Mayflower Pipeline Incident Response located in Mayflower, Arkansas (site; Figure 1). In April 2013, the U.S. Army Corps of Engineers (USACE) issued a Nationwide Permit 38 Cleanup of Toxic and Hazardous Waste (NWP 38) to EMPCo (Permit No. 2013-00129) for the cleanup of a crude oil release on March 29, 2013.

Initial response actions in 2013 and sheen mitigation actions in the fall of 2014 temporarily disturbed portions of the site. These response actions included vegetation removal in the marsh between Interstate 40 and Highway 89 (herein referred to as “the cove”). This plan outlines the proposed restoration activities for the cove and the subsequent monitoring requirements.

A Stream and Wetland Compensatory Restoration Plan (ARCADIS 2014b) was submitted to the USACE in June 2014 and proposed the level of stream and wetland mitigation to meet the compensatory mitigation rule outlined by the U.S. federal government. The Stream and Wetland Compensatory Restoration Plan included an overview of the proposed on-site restoration. Arkansas Game and Fish Commission (AGFC; 2014) and the Arkansas Natural Heritage Commission (ANHC; 2014) provided comments to EMES on the proposed on-site restoration and these letters are included in Appendix A. Through discussions between EMES and the USACE, the USACE indicated that the Stream and Wetland Compensatory Restoration Plan will address the NWP 38 requirements and that the AGFC and ANHC comments should be incorporated into a detailed planting plan for the site. This CRPP addresses the AGFC and ANHC comments and provides detailed planting plan associated with the proposed level of mitigation.

## **2. Project Description**

On March 29, 2013, a breach in a pipeline operated by EMPCo (the 20-inch Pegasus Pipeline) released crude oil in Mayflower, Arkansas (Figure 1). The crude oil was identified as Wabasca heavy crude oil (herein referred to as “crude oil”). An emergency response action was implemented immediately to mitigate the release, and a substantial amount of the crude oil was removed. Wetland, riparian and upland habitats of the cove were disturbed during the 2013 initial response action and 2014 mitigation activities.

Response action cleanup activities affected approximately 17.1 acres of forested wetlands and approximately 1,300 linear feet of an unnamed stream (referred to as the Inlet Channel) in the cove. Sheen mitigation actions described in the Mitigation Action Plan (ARCADIS 2014a) were completed in November 2014. The remedial action objective was to mitigate surface water sheens related to crude oil from the Pegasus Pipeline, to the extent technologically feasible. The completed mitigation actions in three areas of the cove are summarized below (areas are shown on Figure 2):

- *Inlet Channel.* Targeted removal of sheen-bearing sediment along the bottom of the main channel between Interstate 40 and the Open Water Area. Removal depths varied from 6 to 18 inches. Approximately 750-800 cubic yards of sediment were removed from along approximately 1,300 feet of the Inlet Channel. Excavation areas with depths greater than 6 inches were backfilled with clean material.
- *Open Water Area.* A thin-layer reactive cap was placed over approximately 4.5 acres in the open marsh and water area located between the Inlet Channel and the Heavily Vegetated Area. The reactive cap consisted of an approximate 3- to 6-inch layer of clean sand mixed with organoclay placed directly over the sediment surface. Organoclay is an effective sorptive medium for petroleum hydrocarbons and sheens.
- *Heavily Vegetated Area.* The Heavily Vegetated Area is located downstream of the Open Water Area, extends east, and includes several natural channels. Targeted in-situ amendment in the Heavily Vegetated Area consisted of organoclay placed directly over the sediment, limiting disturbance to the existing vegetation. This vegetation was preserved during the response activities because of its habitat value and the relatively light degree of oiling that occurred in this area.

These activities completed in the Inlet Channel and Heavily Vegetated Area were followed by cap installation in the Open Water Area in November 2014.

### **3. Wetland Delineation and Assessment**

The outline of disturbed wetlands is shown on Figure 2. This CRPP focuses on restoring the disturbed Inlet Channel and forested wetlands in the cove. The following sections discuss the cove hydrology, the wetland delineation performed in April 2014, and the supplemental wetland assessment performed in September 2014.

#### **3.1 Cove Hydrology**

Lake Conway hydrology is the controlling factor for the wetlands habitat in the cove as well as other habitats surrounding the lake. The AGFC began impounding Palarm Creek in 1948 to create the state-owned recreational fishing lake known as Lake Conway (AGFC 2013). From April 15 through November 15, the water surface elevation in Lake Conway is controlled by the dam elevation, which is at approximately 262.87 feet (NAVD88). During winter, November 16 through April 14, the lake level is lowered to an elevation of 261.87 feet (NAVD88) for flood control purposes. Due to the controlling effect of the cove outlet culverts (invert elevation of 262.2 feet [NAVD88]), normal seasonal water levels in the cove are 262.2 feet (NAVD88) during winter (or possibly lower) and 262.87 feet (NAVD88) during summer, as controlled by the Lake Conway dam.

As a result of the seasonal flooding of Lake Conway, portions of the cove are periodically inundated. As shown on the National Wetland Inventory Map (Figure 3), this results in the creation of two vegetation communities:

- Palustrine Forested Broad-Leaved Deciduous (PFO1Ah) with a temporary non-tidal water regime that has been diked/impounded
- Palustrine Scrub-Shrub Broad-leaved Deciduous (PSS1Fh) with a semi-permanent non-tidal regime that has been diked/impounded

### **3.2 Wetland Delineation**

Wetlands in the cove were delineated by Conestoga-Rovers & Associates in April 2014, and documented in a memorandum provided in the Stream and Wetland Compensatory Restoration Plan (ARCADIS 2014b). The delineation was conducted using the following U.S. Army Corps of Engineers (USACE) guidance:

- Wetlands Delineation Manual (USACE 1987)
- Eastern Mountains and Piedmont Regional Supplement (USACE 2012)
- Regulatory Guidance Letter 08-02 (USACE 2008)

The wetlands delineation classified the 17.1 acres of disturbed wetlands as 8.8 acres as Palustrine Forested Wetland – Broad-leaved Deciduous (PFO1) and 8.3 acres as Palustrine Scrub-Shrub Wetland – Broad-leaved Deciduous (PSS1). A summary figure is provided Appendix B.

### **3.3 Wetland Assessment**

In September 2014, ARCADIS conducted a supplemental wetland assessment to evaluate current site conditions, sample reference wetland areas around Lake Conway, and develop a restoration planting plan for the cove. The assessment was performed in response to correspondence from the AGFC and ANHC to EMES (Appendix A) that requested similar wetlands in the area of high natural quality be used as reference areas to determine the most appropriate species to plant for the site restoration.

Three nearby wetlands (Figure 4) were assessed to determine which plant species would be proposed in the CRPP. The Hydrogeomorphic Approach, as outlined in “A Regional Guidebook for Conducting Functional Assessments of Forested Wetlands in the Arkansas Valley Region of Arkansas” (USACE 2008b), was used for the assessment, with the following modification. In place of detailed transects recommended in the Hydrogeomorphic Approach, forested wetland habitats around Lake Conway were sampled. This

modification allowed for an efficient assessment of the existing wetland communities affected by the Lake Conway hydrology.

The surveys conducted in three reference areas are summarized in the following sections. Appendix C provides the U.S. Department of Agriculture (USDA) Soil Survey data for each of the three reference areas (2013). Table 1 provides the plant species observed.

#### 3.3.1 Forested Wetland Reference Area A

Reference Area A is a late successional forested wetland representing a typical undisturbed system for the cove. It is part of the forested wetland areas associated with Palarm Creek in the northeast portion of Lake Conway and is classified as Fringe Forested Wetlands.

The community located in and adjacent to standing water in the drainage swales of Reference Area A was dominated by a bald cypress (*Taxodium distichum*) and water tupelo (*Nyssa aquatica*). The upper edge was dominated by the sweet gum (*Liquidambar styraciflua*) and red maple (*Acer rubrum*) community. There was an absence of a dense shrub and herbaceous community due to the closed tree canopy. The sampling plots in Reference Area A are shown in Figure 5.

#### 3.3.2 Forested Wetland Reference Area B

Reference Area B is an undisturbed young forested wetland, representative of an early successional wetland forest as would be present in the cove. It lies southeast of Lake Conway. This forested wetland consists of a dense stand of small diameter-at-breast height sweet gum trees with little to no shrub community as a result of the closed canopy. Two plots were sampled in Reference Area B (Figure 6).

#### 3.3.3 Forested Wetland Reference Area C

Reference Area C is a mature forest on the fringe of Lake Conway. It is representative of emergent hydrological regimes such as the edges of the cove. Two plots were sampled in this area, along the eastern shore of Lake Conway (Figure 7). In this area, Wetland Fringe and Forested Wetland habitats were observed. Their vegetation community was dominated by bald cypress trees. These were growing in 6 inches of water, with water marks on the trunks approximately 12 inches above the water line, indicating the range of water levels these habitats experience.

### 3.4 Project Area Current Conditions

In September 2014, an assessment was conducted in the cove to document current conditions. Plant species presence and abundance, hydrology and habitat descriptions were recorded. A number of trees remain within

the disturbed area of the cove. For each of these individual trees, the species was identified, it was located with a global positioning system device, and its diameter at breast height was measured and recorded (Figure 8; Table 1). The trees in the upland forest edge (i.e., undisturbed areas) around the cove were not surveyed. Soil survey data from USDA shows that the cove exhibits similar soils to the reference areas (Appendix C).

The following plant communities, habitats, and conditions were observed in the cove:

- The higher elevations of the cove are dominated by the beggar ticks (*Bidens frondosa*) and water pepper (*Polygonum hydropiper*) community. This community has naturally colonized the area during 2014 and it is expected to be replaced by other species in subsequent years as the plant community matures. This dense herbaceous community provides important organic matter for the soils and traps waterborne seeds for colonization.
- Wetland swales are located throughout the cove. The majority of on-site swales have established new vegetation through waterborne seed deposition and are dominated by a mixture of spikerushes (*Eleocharis spp.*), Virginia buttonweed (*Diodia virginiana*), ditch stonecrop (*Penthorum sedoides*), soft rush (*Juncus effusus*), and beaksedge (*Rhynchospora corniculata*). In September 2014, the swales were retaining water, which is assumed to be at the same elevation as the water level in Lake Conway.
- The Inlet Channel was undergoing remediation at the time of the assessment and was largely devoid of vegetation due to the removal of sediments and placement of clean backfill.

Several wetland communities have developed over the last two growing seasons in the cove from natural seed deposition and the seed bank. It is expected that existing trees in the disturbed area and along the upland forest edge will also function as a seed source for natural recruitment of tree species in the cove.

#### **4. Restoration Objectives and Planting Plan**

This CRPP describes the methods that will be used to restore areas temporarily disturbed during the response action and sheen mitigation activities.

##### **4.1 Objectives**

The objectives of the restoration include:

- Restore the Inlet Channel in accordance with the Little Rock District Stream Method (Little Rock Method) (USACE Little Rock District 2011).

- Revegetate riparian and wetland habitats temporarily disturbed by cleanup activities and the sheen mitigation activities. Use the wetlands assessment to verify the species for planting.
- Provide slope stability and erosion control through revegetation and restoration activities.
- Use local obtained native plants (as available) to match local vegetation dormancy periods, fruiting, leafing out, and hardiness.
- Develop a monitoring program to measure restoration success and report results.

#### **4.2 Planting Plan for Disturbed Wetlands**

The cove wetlands contain three distinct hydrologic zones and associated plant communities: Upper Edge Forested Wetland habitat, Wetland Fringe habitat, and Forested Wetland habitat (Figure 9). The three reference wetland areas associated with Lake Conway were evaluated in order to find examples of each type of habitat with the respective hydrology to aid the restoration planning. The reference wetlands are driven by Lake Conway hydrology, as are the wetland habitats in the cove.

Figure 10 shows a conceptual drawing of a cross-section of the proposed planting plan across the range of habitats as well as the species recommended for each hydrological condition. The approximate locations of these habitats are shown on Figure 11. Based on current site conditions and the assessment of other hydrologically comparable forested wetlands associated with Lake Conway, the planned restoration of the cove is as follows:

- *Upper Edge Forested Habitat (3.2 acres)*. The cleared, higher elevations of the cove currently dominated by beggar ticks (*Bidens frondosa*)/water pepper (*Polygonum hydropiper*) community and associated with the Upper Edge Forested Wetland habitats of Lake Conway will be planted with bare root seedlings of sweet gum, red maple and persimmon. The area will be seeded with riparian herbaceous seed mix (NC Piedmont Riparian Mix, ERNMX-307; Table 2) to reduce erosion and stabilize slopes until the seedlings establish root systems.
- *Forested Wetland Habitat (8.4 acres)*. In both the Reference Areas and the cove, a collection of tree species were identified in those areas of the forested wetlands that occurred in areas with seasonal flooding. These species included: overcup oak (*Quercus lyrata*), willow oak (*Quercus phellos*), silver maple (*Acer saccharinum*), and river birch (*Betula nigra*). Bare root seedlings of these species will be planted in the Forested Wetland habitat of the cove in areas of appropriate hydrology. A combination of the Riparian and Wet Meadow seed mixes (NC Piedmont Riparian Mix [ERNMX-307] and NC Piedmont FACW Mix [ERNMX-308]; Table 2) will be applied to the Forested Wetland habitat.

- *Forested Wetland Fringe Habitat (5.5 acres).* The lower elevations of the cove wetlands will be planted with bare root seedlings of bald cypress and water tupelo trees. Historical Lake Conway water elevations will be used to estimate average hydrologic conditions and select seedling placement within the cove. Wetland swales provide ideal hydrology for the development of cypress/water tupelo communities as observed in Reference Area C. A native wet meadow seed mix (NC Piedmont FACW Mix, ERNMX-308; Table 2) will be applied in the saturated soils of the Fringe Forested Wetland habitat to provide species diversity with modifications.

The reactive cap was placed in October through November 2014 and portions of the cap cover the three habitat types within the cove. The Site Planting Plan (Figure 11) shows the location and hydrology of the cap and the proposed plant communities to be restored. In these areas with the reactive cap, special measures will be taken to not compromise the cap's integrity with restoration activities. Areas of the cap that can be reached from adjacent uncapped areas will be planted with seedlings and seeded with a Wetland mixes (Obligate Wetland Mix, ERNMX-131; Table 2) will be applied to accessible edges of the cap. For the remainder of the area, methods of access will be used that prevent damage to the cap:

- A shallow-draft small boat (e.g., jon-boat with electric motor) to access submerged areas of the cap
- The use of boards/mats to walk out on the cap and plant seedlings.

The seedling frequency will be reduced and the planting techniques may also be modified as necessary. For example, mesh bags may be filled with seeds and weighted with rocks and placed in the open waters to hold the seeds to bottom until roots develop. Other ways to plant seeds or seedlings will be evaluated as necessary in the field for their efficacy and safety in application.

#### **4.3 Planting Plan for the Inlet Channel**

The Inlet Channel (1,300 linear feet) will be restored in accordance with the Little Rock Method (USACE Little Rock District 2011). Figure 12 shows a conceptual drawing of the restoration plan for the Inlet Channel. These restoration activities include installing root wads, biologs, and live stakes and planting bare root seedlings to armor stream banks, establish a riparian buffer, and create a diverse habitat structure for fish, reptiles, and amphibians (Figure 12).

#### **4.4 Seed and Plant Types**

Table 2 shows the proposed seed mixes. The seed mixture have been modified as requested by the agencies in accordance with correspondence from AGFC and ANHC to EMES (Appendix A).



Existing trees, shrubs, and herbaceous species in the cove, as well as plant communities upstream of the cove, are important seed sources for revegetation of the cove, as evidenced by the naturally recruited black willow (*Salix nigra*), water willow (*Decodon verticillatus*), and buttonbush (*Cephalanthus occidentalis*) are already abundant in the cove. Given their natural recruitment, these species will not be included in the initial restoration planting.

#### **4.5 Planting Density**

Trees and shrubs will be planted at sufficient density to account for natural competition and mortality among seedlings. The target planting density will be approximately 10 percent greater than observed for seedlings and young trees in reference areas. The plant stem density in the early successional forested system in Reference Area B was approximately 890 stems per acre and the bare root seedlings on site will be planted at a rate of up to 1000 stems per acre. In the areas with the reactive cap, the planting frequency will be reduced to approximately 500 stems per acre to reduce the impact on the reactive cap.

#### **4.6 Schedule**

Planting activities are scheduled to begin in March 2015 to maximize time in the first growing season and help establish the plant community. The restoration activities are anticipated to take 2 to 3 weeks to complete.

### **5. Adaptive Management and Monitoring Program**

Monitoring and adaptive management of the restoration will be conducted, as needed, to ensure the wetland plant communities and habitats are reestablished in the cove after completion of the initial restoration and planting activities. During the initial planting activities in spring 2015, permanent photograph locations will be established to document the success of restoration efforts during the monitoring period. At least one permanent photograph location will be established for each habitat type. Photographs will be taken at each location for pre-planting conditions, post-planting conditions, and subsequent monitoring events.

In late summer/fall 2015 and spring 2016, site visits will be conducted to monitor and photo-document planting success (e.g., new growth on trees, sprouting vegetation) and the overall condition of the habitat (e.g., channel structure, the presence of invasive species). The results of these monitoring events will be submitted to the USACE and subsequent adaptive management requirements will be discussed in cooperation with the USACE.



## 6. References

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## Tables

**Table 1**  
**Species Observed During Wetland Assessment (September 2014)**

**Cove Restoration Planting Plan**  
**ExxonMobil Environmental Services Company**  
**Mayflower Pipeline Incident Response, Mayflower, Arkansas**

Common Name	Scientific Name	Cove	Reference Area A	Reference Area B	Reference Area C
American elm	<i>Ulmus americana</i>	X	X		
Arrowwood viburnum	<i>Viburnum dentatum</i>		X		
Asiatic dayflower	<i>Commelina communis</i>	X	X		X
Bald cypress	<i>Taxodium distichum</i>		X		X
Bamboo vine	<i>Smilax laurifolia</i>			X	
Barnyard grass	<i>Echinochloa crusgalli</i>	X			
Beak rush	<i>Rhynchospora spp.</i>	X			
Beggar ticks	<i>Bidens frondosa</i>	X		X	
Black gum	<i>Nyssa silvatica</i>		X		X
Black willow	<i>Salix nigra</i>	X			
Blackberry	<i>Rubus allegheniensis</i>	X			
Blackjack oak	<i>Quercus marilandica</i>	X			
Blue lobelia	<i>Lobelia siphilitica</i>			X	
Blue mist flower	<i>Conoclinium coelestinum</i>	X	X	X	
Buttonbush	<i>Cephalanthus occidentalis</i>	X	X		X
Camphorweed	<i>Pluchea camphorata</i>	X			
Cardinal flower	<i>Lobelia cardinalis</i>	X	X		
Catbriar	<i>Smilax rotundifolia</i>		X	X	X
Clear weed	<i>Pilea pumila</i>		X		
Climbing boneset	<i>Mikania scandens</i>	X			
Common Nettle	<i>Urtica dioica</i>	X	X		
Common Persimmon	<i>Diospyros virginiana</i>	X			
Ditch stonecrop	<i>Penthorum sedoides</i>	X			
Duck potato	<i>Sagittaria latifolia</i>		X		
Eastern red cedar	<i>Juniperus virginiana</i>		X		
Elderberry	<i>Sambucus canadensis</i>		X		
Fall panicum	<i>Panicum dichotomiflorum</i>	X			
Giant ragweed	<i>Ambrosia trifida</i>		X		
Green ash	<i>Fraxinus pennsylvanica</i>	X			
Indian grass	<i>Sorghastrum nutans</i>				X
Japanese Honeysuckle	<i>Lonicera japonica</i>		X		
Japanese stilt grass	<i>Microstegium vimineum</i>		X	X	
Jewelweed	<i>Impatiens capensis</i>		X		
Late goldenrod	<i>Solidago gigantea</i>	X		X	
Lizard's tail	<i>Saururus cernuus</i>		X		
Millet	<i>Pennisetum glaucum</i>	X			
Monkey flower	<i>Mimulus ringens</i>	X			
Musclewood	<i>Carpus caroliniana</i>			X	
Northern sea oats	<i>Chasmanthium latifolium</i>	X	X		
Overcup oak	<i>Quercus lyrata</i>	X	X		
Pignut Hickory	<i>Carya glabra</i>	X	X		X

**Table 1**  
**Species Observed During Wetland Assessment (September 2014)**

**Cove Restoration Planting Plan**  
**ExxonMobil Environmental Services Company**  
**Mayflower Pipeline Incident Response, Mayflower, Arkansas**

Common Name	Scientific Name	Cove	Reference Area A	Reference Area B	Reference Area C
Pin Oak	<i>Quercus palustris</i>		X		
Poison ivy	<i>Toxicodendron radicans</i>		X	X	
Red Maple	<i>Acer rubrum</i>	X	X	X	X
Rice cut grass	<i>Leersia oryzoides</i>	X			
River birch	<i>Betula nigra</i>		X		
Sassafras	<i>Sassafras albidum</i>				X
Sensitive fern	<i>Onoclea sensibilis</i>		X		
Silver Maple	<i>Acer saccharinum</i>	X	X		
Small white aster	<i>Aster vimineus</i>	X	X		
Soft rush	<i>Juncus effusus</i>	X			
Spike rush	<i>Eleocharis spp.</i>	X			X
St. John's wort	<i>Hypericum perforatum</i>				X
Swamp Rose Mallow	<i>Hibiscus moscheutos</i>	X			
Sweet gum	<i>Liquidambar styraciflua</i>	X	X	X	X
Tall blue lettuce	<i>Lactuca biennis</i>	X			
Trumpet vine	<i>Campsis radicans</i>		X		X
Unknown sedge	<i>Carex spp</i>		X		X
Upland boneset	<i>Eupatorium sessilifolium</i>	X		X	X
Virginia buttonweed	<i>Diodia virginiana</i>	X			
Virginia creeper	<i>Parthenocissus quincuefolia</i>			X	
Virginia dayflower	<i>Commelina virginica</i>	X	X		
Water horehound	<i>Lycopus americanus</i>	X	X		
Water oak	<i>Quercus nigra</i>	X	X		X
Water pepper	<i>Polygonum hydropiper</i>	X	X		
Water purslane	<i>Ludwigia palustris</i>	X			
Water tupelo	<i>Nyssa aquatica</i>	X	X		X
Willow oak	<i>Quercus phellos</i>		X	X	X
Yellow nut sedge	<i>Cyperus esculentus</i>	X			

**Table 2**  
**Proposed Seed Mixes**

**Cove Restoration Planting Plan**  
**ExxonMobil Environmental Services Company**  
**Mayflower Pipeline Incident Response, Mayflower, Arkansas**

<b>Riparian Seed Mix</b>	
<b>Common Name</b>	<b>Scientific Name/Ecotype</b>
<b>NC Piedmont Riparian Mix, ERNMX-307</b>	
Redtop Panicgrass	<i>Panicum rigidulum</i> ( <i>P. stipitatum</i> ), Coastal Plain NC Ecotype
Virginia Wildrye	<i>Elymus virginicus</i> , 'Suther'-NC Ecotype
River Oats	<i>Chasmanthium latifolium</i> ( <i>Uniola latifolia</i> ), Coastal Plain NC Ecotype
Beaked Panicgrass	<i>Panicum anceps</i> , SC Ecotype
Indiangrass	<i>Sorghastrum nutans</i> , NC Ecotype
Winter Bentgrass	<i>Agrostis hyemalis</i> , Piedmont NC Ecotype
Mistflower	<i>Eupatorium coelestinum</i> ( <i>Conoclinium c.</i> ), VA Ecotype
Leathery Rush	<i>Juncus coriaceus</i> , Coastal Plain NC Ecotype

<b>Wet Meadow and Wetland Seed Mix</b>	
<b>Common Name</b>	<b>Scientific Name/Ecotype</b>
<b>NC Piedmont FACW Mix, ERNMX-308</b>	
Redtop Panicgrass	<i>Panicum rigidulum</i> ( <i>P. stipitatum</i> ), Coastal Plain NC Ecotype
Beaked Panicgrass	<i>Panicum anceps</i> , SC Ecotype
Virginia Wildrye	<i>Elymus virginicus</i> , 'Suther'-NC Ecotype
Lurid (Shallow) Sedge	<i>Carex lurida</i> , NC Ecotype
Hop Sedge	<i>Carex lupulina</i> , Coastal Plain NC Ecotype
Squarrose Sedge	<i>Carex squarrosa</i> , VA Ecotype
Soft Rush	<i>Juncus effusus</i> , Coastal Plain NC Ecotype
Lizard's Tail	<i>Saururus cernuus</i> , NC Ecotype
Woolgrass	<i>Scirpus cyperinus</i> , Coastal Plain NC Ecotype
Mistflower	<i>Eupatorium coelestinum</i> ( <i>Conoclinium c.</i> ), VA Ecotype
Showy Tickseed Sunflower	<i>Bidens aristosa</i> , Coastal Plain NC Ecotype
Path Rush	<i>Juncus tenuis</i> , NC Ecotype
Green Bulrush	<i>Scirpus atrovirens</i> , 'Suther'-NC Ecotype

Note:

1. New York ironweed (*Vernonia noveboracensis*), and crimson-eyed rosemallow (*Hibiscus moscheutos*) are part of the standard seed mix, but will be excluded from the seed mix for this site.

**Table 2**  
**Proposed Seed Mixes**

**Cove Restoration Planting Plan**  
**ExxonMobil Environmental Services Company**  
**Mayflower Pipeline Incident Response, Mayflower, Arkansas**

<b>Obligate Wetland Seed Mix</b>	
<b>Common Name</b>	<b>Scientific Name, Ecotype</b>
<b><i>Obligate Wetland Mix, ERNMX-131</i></b>	
Fox Sedge	<i>Carex vulpinoidea</i> , PA Ecotype
Lurid (Shallow) Sedge	<i>Carex lurida</i> , PA Ecotype
Hop Sedge	<i>Carex lupulina</i> , PA Ecotype
Green Bulrush	<i>Scirpus atrovirens</i> , PA Ecotype
Eastern Bur Reed	<i>Sparganium americanum</i>
Blue Vervain	<i>Verbena hastata</i> , PA Ecotype
Soft Rush	<i>Juncus effusus</i> , PA Ecotype
Boneset	<i>Eupatorium perfoliatum</i> , PA Ecotype
Joe Pye Weed	<i>Eupatorium fistulosum</i> , PA Ecotype
Fringed (Nodding) Sedge	<i>Carex crinita</i> , PA Ecotype
Swamp Milkweed	<i>Asclepias incarnata</i> , PA Ecotype
Square Stemmed Monkeyflower	<i>Mimulus ringens</i> , PA Ecotype
Softstem Bulrush	<i>Scirpus validus</i> , PA Ecotype
Swamp (Narrowleaf) Sunflower	<i>Helianthus angustifolius</i> , Coastal Plain NC Ecotype
Woolgrass	<i>Scirpus cyperinus</i> , PA Ecotype
Roughleaf Goldenrod	<i>Solidago patula</i> , PA Ecotype
Nodding Bur Marigold	<i>Bidens cernua</i> , PA Ecotype

Note:

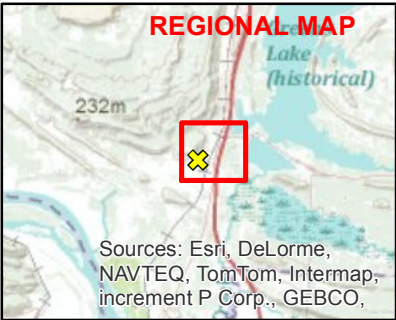
1. Blueflag (*Iris versicolor*) , Giant Bur Reed (*Sparganium eurycarpum*) , and Rattlesnake Grass (*Glyceria canadensis*) are part of the standard seed mix, but will be excluded from the seed mix for this site.

## Figures





- LEGEND**
- ✕ Source Point
  - - - Drainage Path
  - Approximate Limit of Work



**MAYFLOWER PIPELINE INCIDENT RESPONSE  
EXXONMOBIL ENVIRONMENTAL SERVICES COMPANY  
COVE RESTORATION PLANTING PLAN**

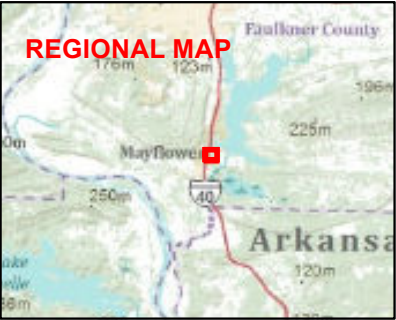
**SITE LOCATION MAP**



**FIGURE  
1**

**Map Date: 1/19/2015**

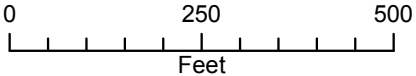




**Legend**

- Drainage Path
- Approximate Water's Edge
- Approximate Limit of Work
- Areas with Heavy Vegetation
- Disturbed Wetlands Outline

NOTES:  
1. The Heavily Vegetated Area shown in this plan was digitized based on the February 2014 aerial photo that was acquired via Google Enterprise Geo Master License.  
2. The water's edge changes based on season and recent rainfall. The approximate water's edge is based on conditions during the pre-design study in April 2014.



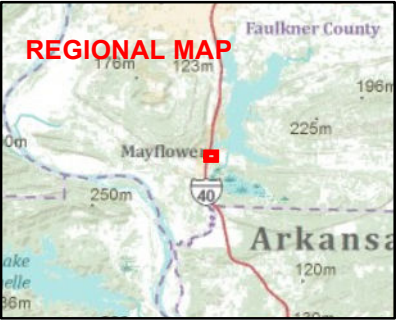
MAYFLOWER PIPELINE INCIDENT RESPONSE  
EXXONMOBIL ENVIRONMENTAL SERVICES COMPANY  
COVE RESTORATION PLANTING PLAN

**SITE PLAN**



Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community  
IMAGE: FEB 2014; Google Earth

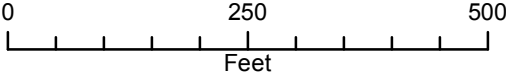




**Legend**

- Drainage Path
  - Approximate Water's Edge
  - Approximate Limit of Work
- Wetlands**
- Freshwater Forested/Shrub Wetland
  - Cove

NOTE:  
1. NATIONAL WETLAND INVENTORY DATA DOWNLOADED FROM THE U.S. FISH & WILDLIFE SERVICE AT: <http://www.fws.gov/wetlands/Data/index.html>



MAYFLOWER PIPELINE INCIDENT RESPONSE  
EXXONMOBIL ENVIRONMENTAL SERVICES COMPANY  
COVE RESTORATION PLANTING PLAN

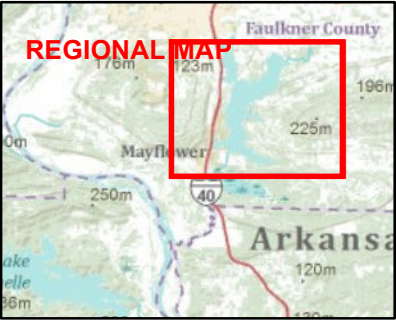
SITE NATIONAL WETLAND  
INVENTORY MAP

ARCADIS

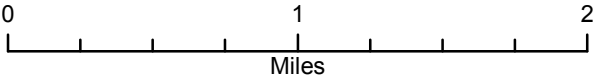
FIGURE  
3

Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community  
IMAGE: FEB 2014; Google Earth





**Legend**  
 Forested Wetland Assessment Areas

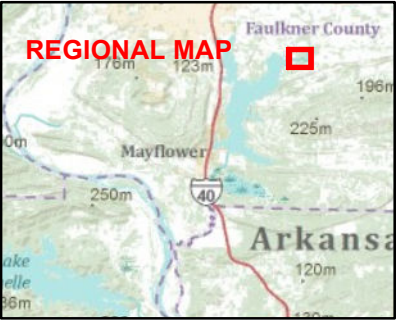


MAYFLOWER PIPELINE INCIDENT RESPONSE  
EXXONMOBIL ENVIRONMENTAL SERVICES COMPANY  
COVE RESTORATION PLANTING PLAN

2014 WETLAND ASSESSMENT OVERVIEW

FIGURE  
4

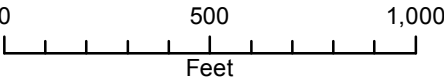




Legend

- Wetland Assessment Area Plot and Transect Center

NOTE:  
1. ALL LOCATIONS ARE APPROXIMATE. INDIVIDUAL POINTS WERE SURVEYED USING A TRIMBLE GeoXH HANDHELD GLOBAL POSITIONING SYSTEM (GPS) EQUIPPED WITH REAL-TIME CORRECTION. THE GPS DATA SET WAS CORRECTED USING A REFERENCE POSITION FROM BASE PROVIDER LITTLE ROCK (ARLR).



MAYFLOWER PIPELINE INCIDENT RESPONSE  
EXXONMOBIL ENVIRONMENTAL SERVICES COMPANY  
COVE RESTORATION PLANTING PLAN

FORESTED WETLAND  
REFERENCE AREA A


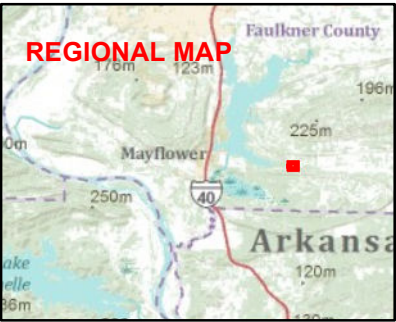
 **ARCADIS**

FIGURE  
5

Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community  
Copyright:© 2013 Esri, DeLorme, NAVTEQ, TomTom  
Source: Esri, DigitalGlobe, GeoEye, I-cubed, USDA, USGS, AEX,

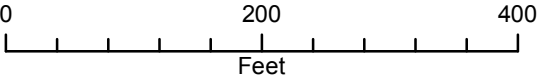




Legend


- Wetland Assessment Area Plot and Transect Center

NOTE:  
1. ALL LOCATIONS ARE APPROXIMATE. INDIVIDUAL POINTS WERE SURVEYED USING A TRIMBLE GeoXH HANDHELD GLOBAL POSITIONING SYSTEM (GPS) EQUIPPED WITH REAL-TIME CORRECTION. THE GPS DATA SET WAS CORRECTED USING A REFERENCE POSITION FROM BASE PROVIDER LITTLE ROCK (ARLR).



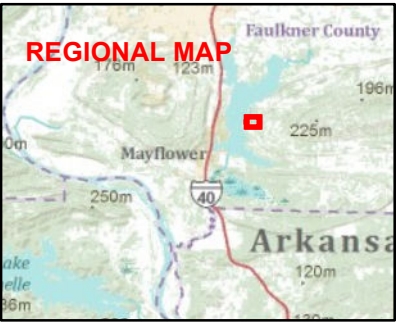
MAYFLOWER PIPELINE INCIDENT RESPONSE  
EXXONMOBIL ENVIRONMENTAL SERVICES COMPANY  
COVE RESTORATION PLANTING PLAN

FORESTED WETLAND  
REFERENCE AREA B

 **FIGURE 6**

Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community  
Copyright © 2013 Esri, DeLorme, NAVTEQ, TomTom  
Source: Esri, DigitalGlobe, GeoEye, I-cubed, USDA, USGS, AEX,

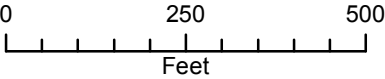




Legend

- Wetland Assessment Area Plot and Transect Center

NOTE:  
1. ALL LOCATIONS ARE APPROXIMATE. INDIVIDUAL POINTS WERE SURVEYED USING A TRIMBLE GeoXH HANDHELD GLOBAL POSITIONING SYSTEM (GPS) EQUIPPED WITH REAL-TIME CORRECTION. THE GPS DATA SET WAS CORRECTED USING A REFERENCE POSITION FROM BASE PROVIDER LITTLE ROCK (ARLR).



MAYFLOWER PIPELINE INCIDENT RESPONSE  
EXXONMOBIL ENVIRONMENTAL SERVICES COMPANY  
COVE RESTORATION PLANTING PLAN

FORESTED WETLAND  
REFERENCE AREA C


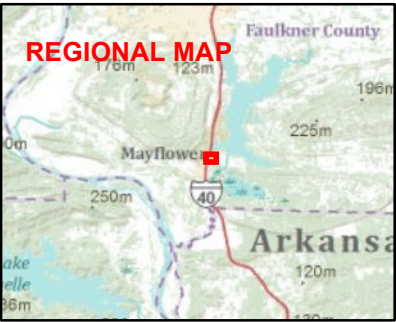
 **ARCADIS**

FIGURE  
7

Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community  
Copyright:© 2013 Esri, DeLorme, NAVTEQ, TomTom  
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX,





**Legend**

- Existing Forested Wetlands
- Existing Vegetated Wetlands
- Disturbed Wetlands

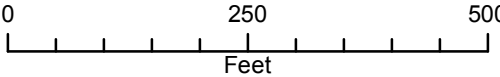
**Tree Code**

- AE - American Elm
- BO - Blackjack Oak
- BW - Black Willow
- GA - Green Ash
- OO - Overcup Oak
- PH - Pignut Hickory
- PS - Persimmon
- RM - Red Maple
- SG - Sweet Gum
- SM - Silver Maple
- SN - Snag
- WL - Willow Oak
- WO - Water Oak
- WT - Water Tupelo

**DBH**

- 4 - 9
- 9 - 14
- 14 - 20
- 20 - 28
- 28 - 38
- Wetland Assessment Area Plot and Transect Center

NOTES:  
1. ALL LOCATIONS ARE APPROXIMATE. INDIVIDUAL POINTS WERE SURVEYED USING A TRIMBLE GeoXH HANDHELD GLOBAL POSITIONING SYSTEM (GPS) EQUIPPED WITH REAL-TIME CORRECTION. THE GPS DATA SET WAS CORRECTED USING A REFERENCE POSITION FROM BASE PROVIDER LITTLE ROCK (ARLR).  
2. DBH IS THE DIAMETER AT BREAST HEIGHT MEASURED IN INCHES.

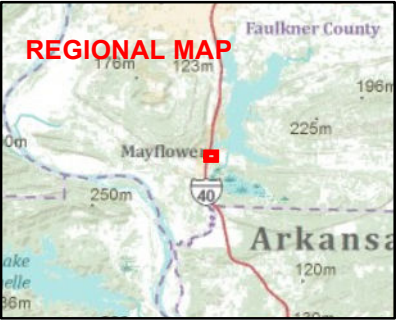
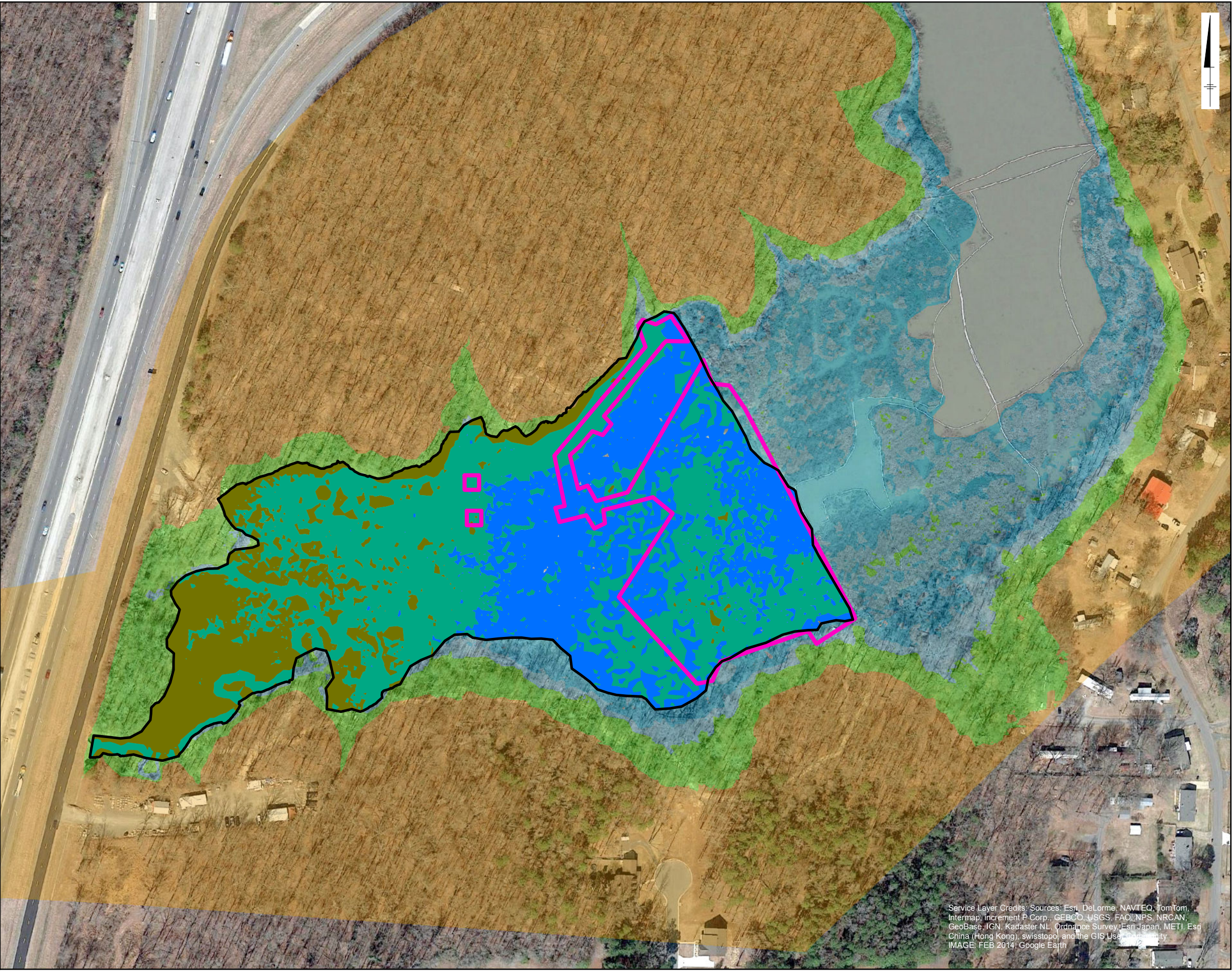


MAYFLOWER PIPELINE INCIDENT RESPONSE  
EXXONMOBIL ENVIRONMENTAL SERVICES COMPANY  
COVE RESTORATION PLANTING PLAN

PROJECT AREA FORESTED WETLAND







**Legend**

Reactive Cap Extent

**Cove Topography (feet)**

- < 262.99
- Forested Wetland Fringe Habitat  
263 - 263.99
- Forested Wetland Habitat  
264 - 264.99
- Upper Edge Forested Habitat  
265 - 267.99
- > 268.00

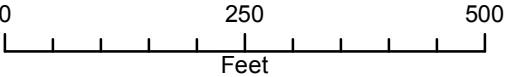
**Disturbed Wetlands Outline (17.1 acres)**



**Disturbed Wetlands**

- 5.5 acres of Disturbed Forested Wetland Fringe Habitat
- 8.4 acres of Disturbed Forested Wetland Habitat
- 3.2 acres of Disturbed Upper Edge Forested Habitat

NOTES:  
1. SURVEY DATA COLLECTED DURING FIELD ACTIVITIES INTERPOLATED BY THE INVERSE DISTANCE WEIGHTING (IDW) METHOD USING AN OPTIMIZED POWER TERM TO DEVELOP A DIGITAL ELEVATION MODEL (DEM) FOR THE AREA SHOWN.  
2. HYDROLOGIC CONDITIONS SHOWN ARE BASED ON LAKE CONWAY MEAN WATER ELEVATIONS CALCULATED USING DATA RECORDED IN NATIONAL GEODETIC VERTICAL DATUM (NGVD) 29 FROM FEBRUARY 18, 2008 THROUGH JULY 10, 2013.  
3. TOPOGRAPHY AND PLANTING PLAN IN AREA OF REACTIVE CAP SUBJECT TO CHANGE.



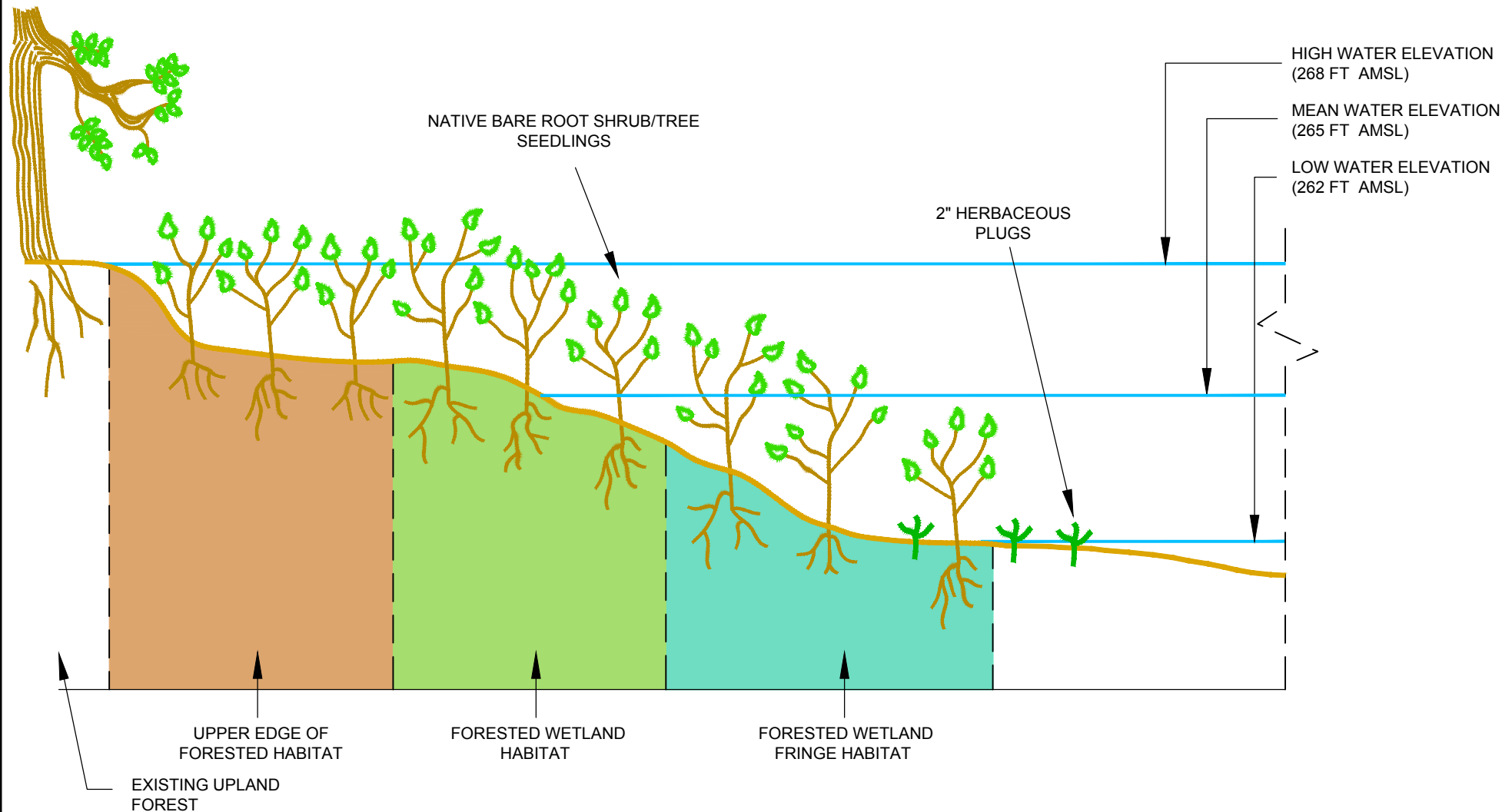
MAYFLOWER PIPELINE INCIDENT RESPONSE  
EXXONMOBIL ENVIRONMENTAL SERVICES COMPANY  
COVE RESTORATION PLANTING PLAN

**SITE HYDROLOGIC CONDITIONS**

FIGURE  
9



CITY:CRANBURY,NJ DIV:GROUP:ENV:CAD DB:T:DATTO LD: P/C: PM:M:JONES TMM:JONES LYRON: "OFF=REF" G:\ENV:CAD\CRANBURY\ACT\18080602\140100025\B0080602N01.dwg LAYOUT: 10 SAVED: 1/19/2015 10:17 AM ACADVER: 18.1S (LMS TECH) PAGES: 10 PLOTTED: 1/19/2015 10:19 AM BY: MEYER, JULIE



BARE ROOT SEEDLING NOTES:

1. SELECTED SHRUB AND TREE SEEDLING SPECIES BASED ON OBSERVATIONS OF HIGH-VALUE FORESTED WETLAND SYSTEMS ASSOCIATED WITH UNDISTURBED PORTIONS OF LAKE CONWAY CONDUCTED DURING THE SEPTEMBER 2014 WETLAND ASSESSMENT. SPECIES AND THE LOCATION THAT THEY WERE OBSERVED CAN BE FOUND IN TABLE 1.
2. 2" NATIVE HERBACEOUS PLUGS WILL BE PLANTED AS NEEDED IN THE "FORESTED WETLAND FRINGE HABITAT".
3. DURING THE SEPTEMBER 2014 WETLAND ASSESSMENT THE FOLLOWING SPECIES WERE OBSERVED TO BE NATURALLY RECOLONIZING THE PROJECT AREA: BLACK WILLOW, BUTTONBUSH, WATER WILLOW. NO BARE ROOT SEEDLINGS OF THESE SPECIES WILL BE PLANTED DURING THE INITIAL RESTORATION EFFORTS.
4. SHRUB AND TREE SEEDLING SPECIES AND HERBACEOUS PLUGS WILL BE PLANTED AS AVAILABLE.
5. LOCATIONS OF THE FEATURES SHOWN HAVE BEEN APPROXIMATED. ACTUAL PLANT PLACEMENT WILL BE SELECTED BY AN ECOLOGIST IN THE FIELD.
6. RESTORATION PLANTING WILL TARGET A DENSITY OF 1,000 SEEDLINGS PER ACRE.

SEED MIX NOTES:

1. NATIVE SEED MIXES WILL BE APPLIED THROUGHOUT THE PROJECT AREA IN ADDITION TO THE PLANTED TREES AND SHRUBS. THE SPECIES INCLUDED IN THE SEED MIXES ARE LISTED IN TABLE 2.
2. RIPARIAN SEED MIX (NC Piedmont Riparian Mix, ERNMX-307) WILL BE APPLIED TO THE "UPPER EDGE FORESTED HABITAT" AND "FORESTED WETLAND HABITAT" AREAS.
3. WET MEADOW AND WETLAND SEED MIX (NC Piedmont FACW Mix, ERNMX-308) WILL BE APPLIED TO THE "FORESTED WETLAND FRINGE HABITAT" AND "FORESTED WETLAND HABITAT" AREAS.
4. OBLIGATE SEED MIX (OBL Wetland Mix, ERNMX-131) WILL BE APPLIED TO THE WETTER LOCATIONS OF THE "FORESTED WETLAND FRINGE HABITAT" AND "FORESTED WETLAND HABITAT."
5. THE SEEDING RATE WILL BE APPROXIMATELY 5 POUNDS PER ACRE.

ABBREVIATIONS:

STRATUM "T" IS TREE  
STRATUM "S" IS SHRUB  
STRATUM "H" IS HERBACEOUS  
FT AMSL - FEET ABOVE MEAN SEA LEVEL

Upper Edge Forested Habitat		
Scientific Name	Common Name	Stratum
<i>Acer negundo</i>	Box elder	T
<i>Acer rubrum</i>	Red maple	T
<i>Diospyros virginiana</i>	Persimmon	T
<i>Liquidambar styraciflua</i>	Sweetgum	T
<i>Nyssa sylvatica</i>	Black gum	T
<i>Quercus pallustris</i>	Pin oak	T
<i>Quercus phellos</i>	Willow oak	T

Forested Wetland Habitat		
Scientific Name	Common Name	Stratum
<i>Acer negundo</i>	Box elder	T
<i>Acer rubrum</i>	Red maple	T
<i>Acer saccharinum</i>	Silver maple	T
<i>Betula nigra</i>	River birch	T
<i>Celtis laevigata</i>	Sugarberry	T
<i>Nyssa sylvatica</i>	Black gum	T
<i>Quercus lyrata</i>	Overcup oak	T
<i>Quercus nigra</i>	Water oak	T
<i>Quercus phellos</i>	Willow oak	T
<i>Ulmus americana</i>	American elm	T
<i>Cornus foemina</i>	Stiff dogwood	S
<i>Decodon verticillatus</i>	Water willow	S
<i>Forestiera acuminata</i>	Swamp privet	S
<i>Ilex decidua</i>	Deciduous holly	S
<i>Planera aquatic</i>	Water elm	S

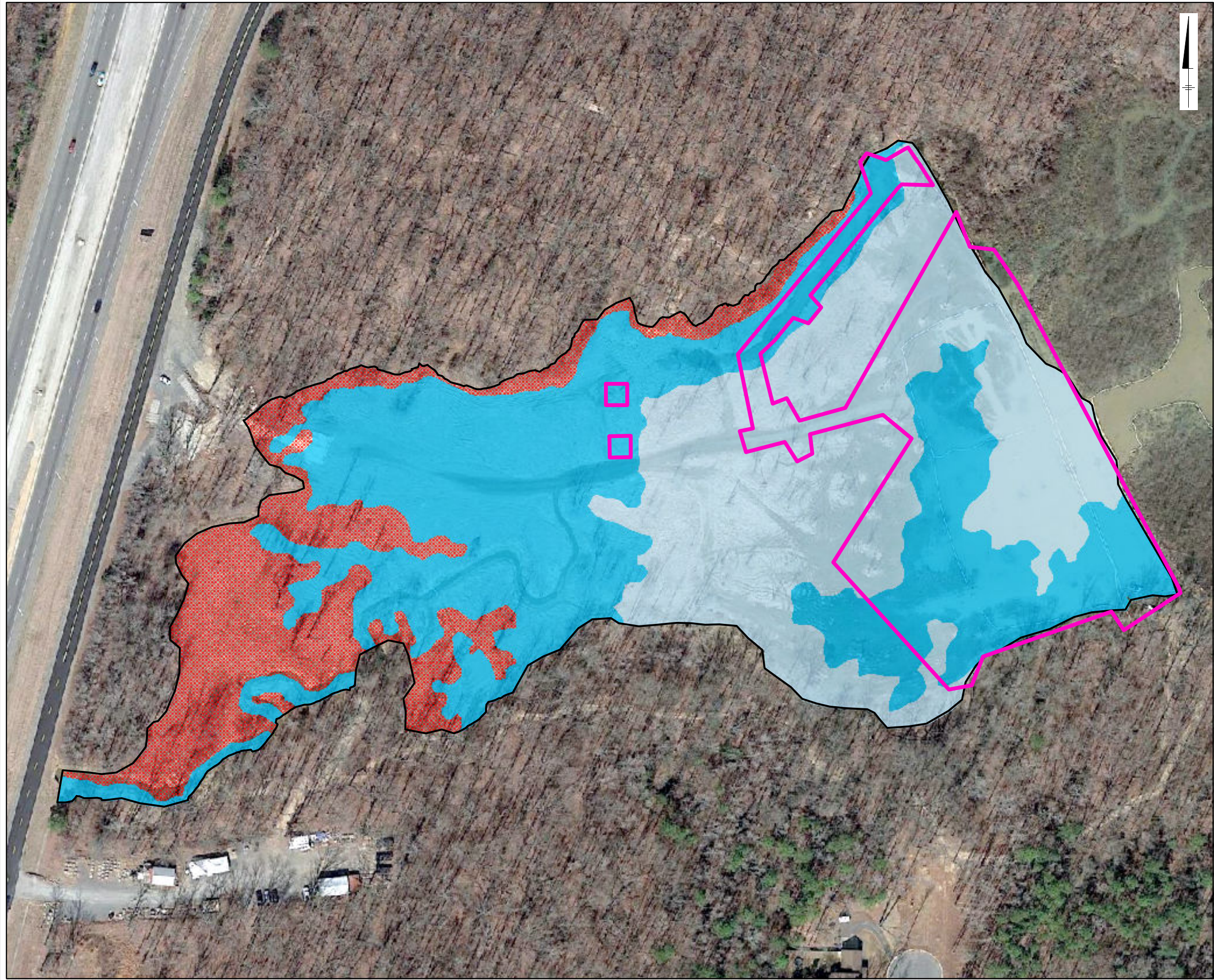
Forested Wetland Fringe Habitat		
Scientific Name	Common Name	Stratum
<i>Nyssa aquatica</i>	Water tupelo	T
<i>Quercus nigra</i>	Water oak	T
<i>Taxodium distichum</i>	Bald cypress	T
<i>Salix nigra</i>	Black willow	T
<i>Cephalanthus occidentalis</i>	Buttonbush	S
<i>Sambucus canadensis</i>	Common elderberry	S
<i>Nuphar lutea</i>	Spatterdock	H
<i>Nymphaea odorata</i>	Fragrant water lily	H
<i>Pontederia cordata</i>	Pickersweed	H
<i>Sagittaria latifolia</i>	Common arrowhead	H
<i>Schoenoplectus pungens</i>	Common three	H
<i>Schoenoplectus tabernaemontani</i>	Softstem bulrush	H

MAYFLOWER PIPELINE INCIDENT RESPONSE  
EXXONMOBIL ENVIRONMENTAL SERVICES COMPANY  
COVE PLANTING PLAN





PLANTING PLAN DETAILS



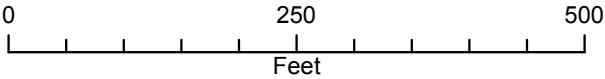




**Legend**

-  Reactive Cap Extent
-  Upper Edge Forested Habitat
-  Forested Wetland Habitat
-  Forested Wetland Fringe Habitat

NOTES:  
1. REFER TO FIGURE 10 FOR PLANTING PLAN DETAILS.  
2. SOME TOPOGRAPHIC FEATURES HAVE BEEN GENERALIZED FOR THE PURPOSE OF THIS PLAN. APPROPRIATE PLANT PLACEMENT IN SITE MICROTOPOGRAPHY WILL BE SELECTED BY AN ECOLOGIST IN THE FIELD.



MAYFLOWER PIPELINE INCIDENT RESPONSE  
EXXONMOBIL ENVIRONMENTAL SERVICES COMPANY  
COVE RESTORATION PLANTING PLAN

SITE PLANTING PLAN VIEW


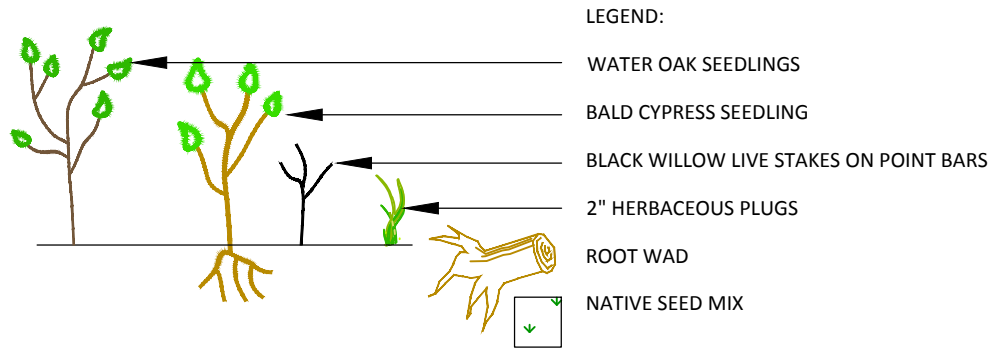
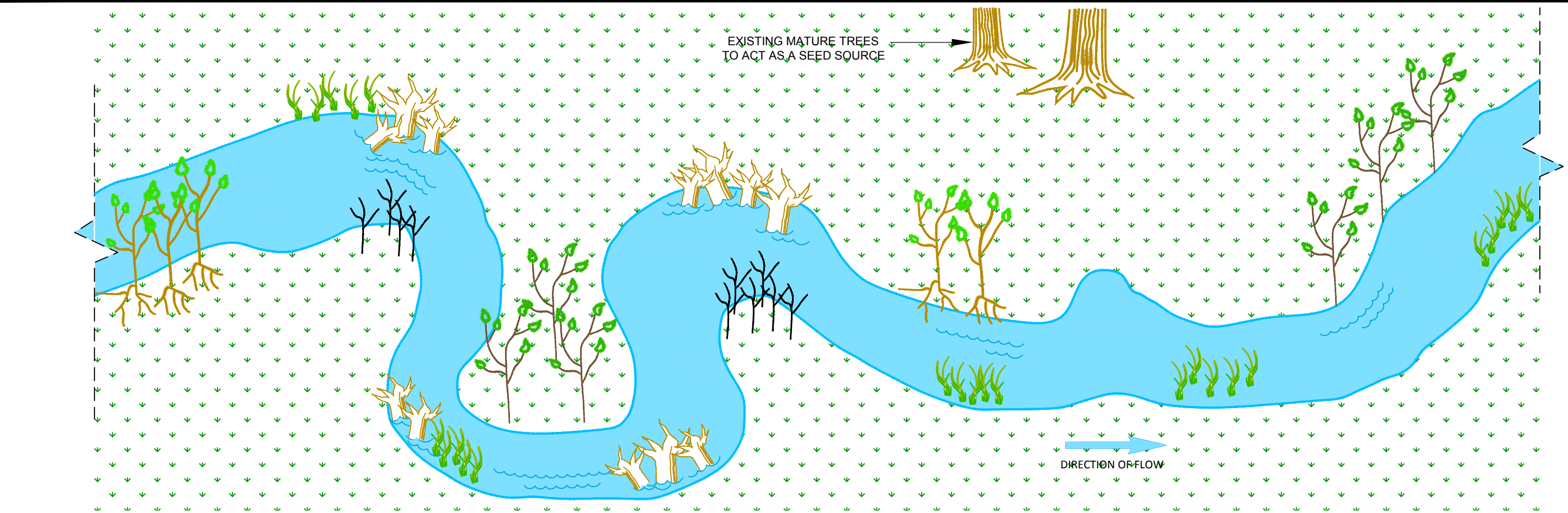
 **ARCADIS**

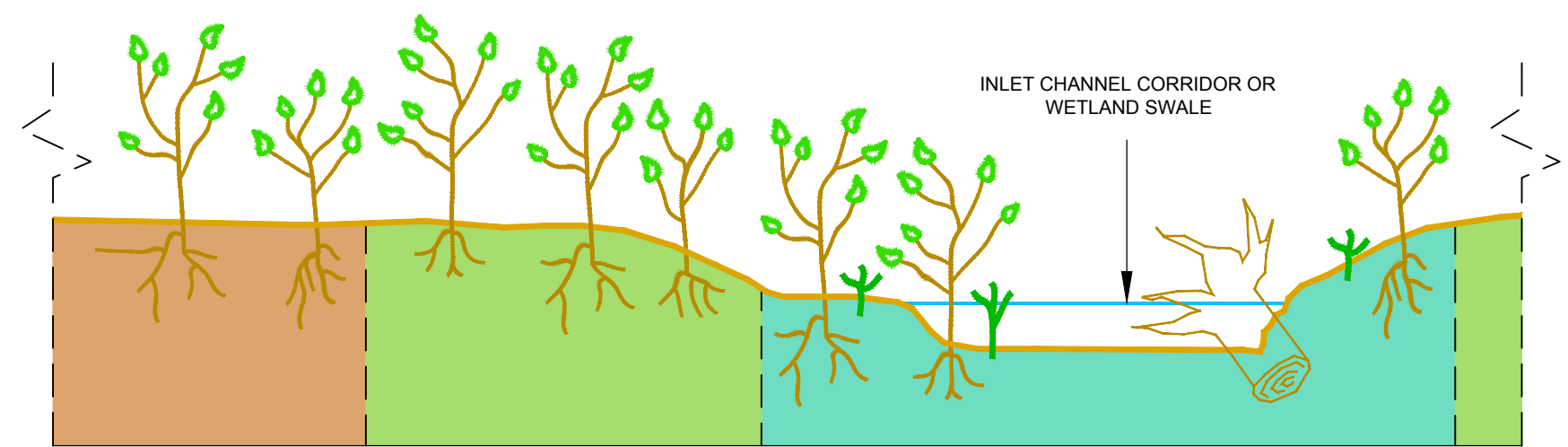
FIGURE  
**11**



CITY:CRANBURY,NJ DIV:GROUP:ENV:CAD DB:T:FAUTO LD: P:IC: PM:M:JONES TMM:JONES LYRON:"OFF=REF"  
G:\ENV:CAD\CRANBURY\ACT\B0086002\1401000250\B0086002N02.dwg LAYOUT: 12 SAVED: 12/19/2014 12:21 PM ACADVER: 18.1S (LMS TECH) PAGES: 12 PLOTSETUP: --- PLOTSTYLETABLE: PLT:FULL.CTB PLOTTED: 1/19/2016 10:25 AM BY: MEYER, JULIE  
XREFS: IMAGES: PROJECTNAME: ---



- NOTES:
1. SELECTED SHRUB AND TREE SEEDLING SPECIES BASED ON OBSERVATIONS OF HIGH VALUE FORESTED WETLAND SYSTEMS ASSOCIATED WITH UNDISTURBED PORTIONS OF LAKE CONWAY CONDUCTED DURING THE SEPTEMBER 2014 WETLAND ASSESSMENT. SPECIES AND THE LOCATION THAT THEY WERE OBSERVED CAN BE FOUND IN TABLE 1.
  2. NATIVE SEED MIXES WILL BE APPLIED THROUGHOUT THE RIPARIAN AREA IN ADDITION TO THE PLANTED TREES AND SHRUBS. THE SPECIES INCLUDED IN THE SEED MIXES ARE LISTED IN TABLE 2. RIPARIAN SEED MIX (NC PIEDMONT RIPARIAN MIX, ERNMX-307) WILL BE APPLIED TO THE INLET CHANNEL BANKS AND ADJACENT FLOODPLAIN. WET MEADOW AND WETLAND SEED MIX (NC PIEDMONT FACW MIX, ERNMX-308) WILL BE APPLIED TO PORTIONS OF THE INLET CHANNEL CORRIDOR EXHIBITING APPROPRIATE HYDROLOGIC CONDITIONS.
  3. 2" NATIVE HERBACEOUS PLUGS WILL BE PLANTED AS NEEDED IN THE INLET CHANNEL CORRIDOR. NATIVE SPECIES WILL BE PLANTED AS AVAILABLE.
  4. BLACK WILLOW LIVE STAKES FROM EXISTING TREES ONSITE WILL BE USED TO REVEGETATE THE INLET CHANNEL CORRIDOR.
  5. SHRUB AND TREE SEEDLING SPECIES WILL BE PLANTED AS AVAILABLE.
  6. LOCATIONS OF THE FEATURES SHOWN HAVE BEEN APPROXIMATED. ACTUAL PLANT PLACEMENT WILL BE SELECTED BY AN ECOLOGIST IN THE FIELD.
  7. ROOT WADS WILL BE PLACED THROUGHOUT THE CORRIDOR TO PROVIDE WILDLIFE HABITAT AND ARMOR INLET CHANNEL BANKS.



CROSS SECTION VIEW

MAYFLOWER PIPELINE INCIDENT RESPONSE EXXONMOBIL ENVIRONMENTAL SERVICES COMPANY COVE PLANTING PLAN	
INLET CHANNEL RESTORATION PLAN	
	FIGURE 12



## **Appendix A**

Letter Correspondence



Mike Knoedl  
Director  
Mike Armstrong  
Deputy Director

Keeping the Natural State natural.

## Arkansas Game and Fish Commission

Ricky Chastain  
Deputy Director  
Jeff Crow  
Deputy Director

July 15, 2014

Mr. Michael Sixsmith  
ExxonMobil Environmental Services Company  
13401 North Freeway  
Houston, TX 77060

Dear Mr. Sixsmith:

An integrated team of Arkansas Game and Fish Commission staff has reviewed the Draft Stream and Wetland Compensatory Restoration Plan prepared by ARCADIS U.S., Inc. and submitted on behalf of ExxonMobil as requested by the U.S. Army Corp of Engineers under a Nationwide Permit 38 to determine the level of stream and wetland mitigation required to meet the compensatory mitigation rule outlined by the US federal government. The plan proposes to conduct on-site restoration by planting and reseeding 17.1 acres of wetlands and 1,300 linear feet of the inlet channel. The treatment of 17.1 acres of wetlands includes 8.8 acres of wetlands that will be restored to palustrine forested wetlands and 8.3 acres of wetlands that will be restored to palustrine scrub-shrub wetlands. The Arkansas Game and Fish Commission staff is providing the following comments on the draft restoration plan, and specifically the proposed re-vegetation portion of the plan.

- While the species lists included in the Proposed Bareroot Plants for Forested Habitat (PF01) and Proposed Bareroot Plants for Emergent Habitat (PSS1) may suggest some generic restoration composition, similar wetlands in the area of high natural quality and diversity should be used as a more precise reference to determine the most appropriate species to plant in the restored areas.
- Specifically in the restored forested wetlands site, the Arkansas Game and Fish Commission requests to be consulted in the development of a more detailed restoration map and planting guide. The previously developed topographic survey of Dawson Cove should be used, in collaboration with the AGFC, to develop a planting guide based on site elevation to determine which species, or assemblage of species, should be planted to mimic natural transitional wetland forests.
- All plants and seedlings used for re-vegetation should be secured from local genotypes.
- Restoration activities for the woody plantings (planting seedlings) and the herbaceous plants (seeding) should be timed to promote the optimal survival of the two plantings. Ideally, tree seedlings would be planted in the late fall/winter while dormant and the herbaceous species would be planted in the spring to allow for a full growing season during establishment.
- Several of the emergent wetland species proposed for use are not appropriate for this site:

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*The Arkansas Game and Fish Commission's mission is to conserve and enhance Arkansas's fish and wildlife and their habitats while promoting sustainable use, public understanding and support.*

- *Acorus americanus* is a northern species and not native to Arkansas. No *Acorus* species should be used in the restoration plantings.
- *Iris versicolor* (Harlequin blueflag iris) is not native to Arkansas. *Iris virginica* would be an acceptable replacement for this site.
- *Schoenoplectus acutus* (hardstem bullrush) is a rare species in the Arkansas and is not known to occur in this region. The use of this species on this site is not appropriate.
- *Vernonia noveboracensis* (New York ironweed) is an eastern species and is not native to Arkansas. *Vernonia gigantea* is a common wetland species in central Arkansas and would be a suitable alternative.
- *Hibiscus moscheutos* (crimson-eyed rosemallow) is not native to Arkansas. *H. lasiocarpus* is present in Arkansas and *H. laevis* is known from this region and may be an appropriate alternative.

The Arkansas Game and Fish Commission appreciates the opportunity to provide constructive comments regarding the Draft Stream and Wetland Compensatory Restoration Plan. The Commission would welcome any opportunity to further collaborate in finalizing this restoration plan.

Sincerely,



Ricky Chastain  
Deputy Director

CC: Jim Ellis, Corps of Engineers, Little Rock District  
Jennifer Sheehan, Arkansas Game and Fish Commission  
Lindsey Lewis, U. S. Fish and Wildlife Service



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Date: July 10, 2014

Subject: Stream and Wetland Compensatory Restoration Plan  
Mayflower, Arkansas Oil Spill

ANHC No.: P-CORP-14-010

Mr. Mike Sixsmith

ExxonMobil Environmental Services Company

13401 North Freeway

Houston, TX 77060

Dear Mr. Sixsmith:

Staff members of the Arkansas Natural Heritage Commission have reviewed the Stream and Wetland Compensatory Restoration Plan prepared by ARCADIS U.S., Inc. for ExxonMobil Environmental Services Company on behalf of ExxonMobil Pipeline Company for the Mayflower Pipeline Incident Response in Mayflower, Arkansas. The purpose of the plan was to determine the level of wetlands/stream mitigation required to meet the federal rules on compensatory mitigation. The plan proposes to conduct on-site restoration by planting and reseeding 17.1 acres of wetlands and 1,300 linear feet of the inlet channel.

The restoration plan identifies 8.8 acres of wetlands that will be restored to palustrine forested wetlands and 8.3 acres that will be restored to palustrine scrub-shrub wetlands. It is proposed that the forested wetlands will be planted with bareroot seedlings from a list of 21 species and seeded with North Carolina Piedmont Riparian Mix and North Carolina Piedmont FACW Mix. The scrub-shrub wetlands will be planted with bareroot seedlings from a list of 13 species. We have the following comments on the proposed revegetation:

- Ideally, similar wetlands in the area of high natural quality should be used as reference areas to determine the most appropriate species to plant in the restoration site.
- Plants and seeds used for revegetation should be secured from local genotypes.
- The woody plants proposed for use (listed in Table 1 of the plan) appear appropriate to this region of the state and are probably present around Lake Conway in suitable habitat.
- Several of the emergent wetland species proposed for use are not appropriate for this site:
  - *Acorus americanus* (sweet flag) is a northern species and not native to Arkansas. No *Acorus* species should be used as this genus is not native to the state.
  - *Iris versicolor* (Harlequin blueflag iris) is not native to Arkansas. *Iris virginica* would be the native iris in wetlands in this part of Arkansas.
  - *Schoenoplectus acutus* (hardstem bullrush) is a rare species in the state and is not known from this region. Although

- we support planting native species, rare species should only be planted within their documented range and, because they may have genetic distinctiveness, only local genotypes should be used.
- Several of the species in the Piedmont FACW Mix are not appropriate for this area:
  - *Vernonia noveboracensis* (New York ironweed). This is an eastern species, not native to Arkansas. The common *Vernonia* species in central Arkansas are *V. baldwinii*, *V. gigantea*, and *V. missurica*. Of these, *V. gigantea* is the most frequently encountered in wetlands.
  - *Hibiscus moscheutos* (crimsoneyed rosemallow) is not native to Arkansas. *H. lasiocarpus* is present in Arkansas (once considered a variety of *H. moscheutos* but now considered distinct - different from what is in Virginia). *H. laevis* is known from the region and might be appropriate.

Your attention to these concerns is appreciated.

Sincerely,

A handwritten signature in black ink that reads "Cindy Osborne". The script is cursive and fluid, with the first name "Cindy" and last name "Osborne" clearly legible.

Cindy Osborne

Data Manager/Environmental Review Coordinator

CC: Jim Ellis, Corps of Engineers, Little Rock District  
Jen Sheehan, Arkansas Game and Fish Commission  
Lindsey Lewis, U.S. Fish and Wildlife Service





## **Appendix B**

Wetland Delineation Summary

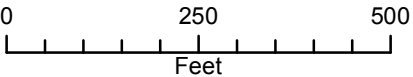




Legend

- Wetland Delineation Points
- Drainage Path
- Approximate Waters Edge
- Existing Forested Wetlands (4.4 acres)
- Existing Vegetated Wetlands (10.3 acres)
- Disturbed Wetlands (17.1 acres)

Notes:  
1. Conastoga-Rovers & Associates conducted a wetland delineation in April 2014 using the methodology outlined in the 1987 USACE Wetland Delineation Manual, including the Atlantic and Gulf Coast Regional Supplement, and Regulatory Guidance Letter 08-02.  
2. The vegetated area shown in this plan was digitized based on the February 2014 aerial photo that was acquired via Google Enterprise Geo Master License  
3. The water's edge changes based on season and recent rainfall. The approximate water's edge is based on conditions during the pre-design study in April 2014.  
4. Vegetation was not cleared from the areas labeled "Existing Forested Wetland" and "Existing Vegetated".



MAYFLOWER PIPELINE INCIDENT RESPONSE  
EXXONMOBIL ENVIRONMENTAL SERVICES COMPANY  
WETLAND DELINEATION

WETLAND DELINEATION

FIGURE  
1





## **Appendix C**

USDA Soil Survey



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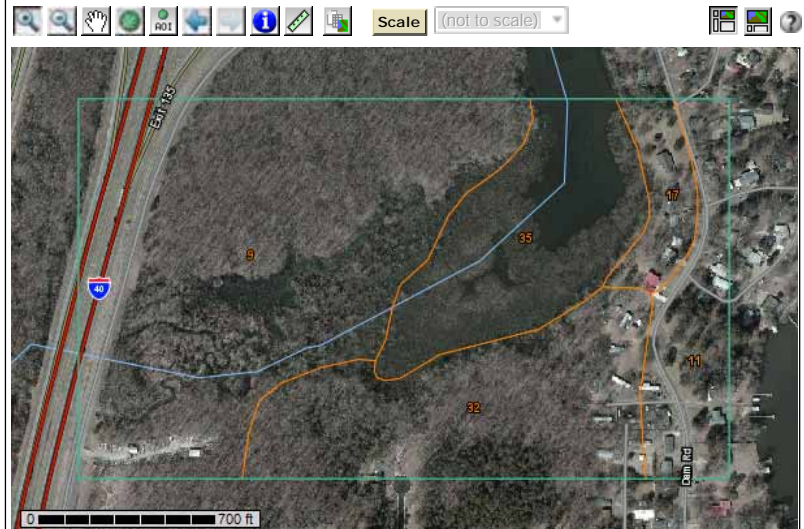
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Map Unit Legend

Faulkner County, Arkansas (AR045)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
9	Leadvale silt loam, 3 to 8 percent slopes	43.1	48.2%
11	Linker fine sandy loam, 3 to 8 percent slopes	8.6	9.7%
17	Mountainburg gravelly fine sandy loam, 3 to 8 percent slopes	3.7	4.2%
32	Taft silt loam, 0 to 2 percent slopes	19.0	21.2%
35	Water	14.9	16.7%
Totals for Area of Interest		89.3	100.0%

Soil Map



**Warning: Soil Map may not be valid at this scale.**

You have zoomed in beyond the scale at which the soil map for this area is intended to be used. Mapping of soils is done at a particular scale. The soil surveys that comprise your AOI were mapped at 1:20,000. The design of map units and the level of detail shown in the resulting soil map are dependent on that map scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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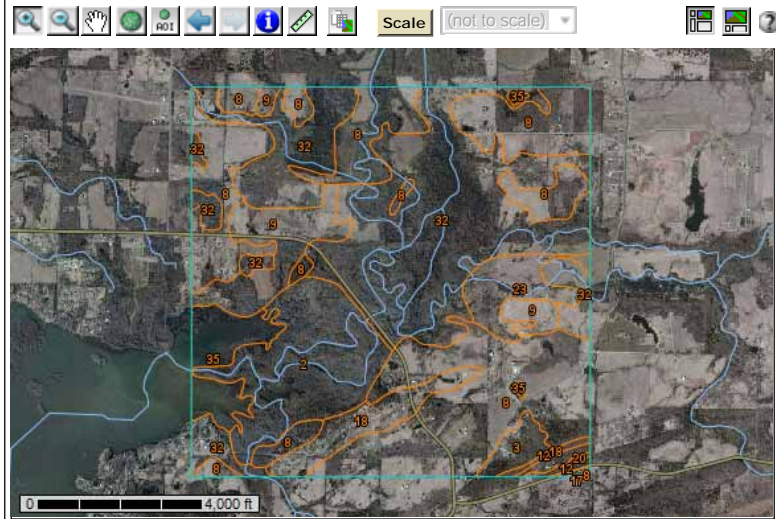
Search

Map Unit Legend

## Faulkner County, Arkansas (AR045)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
2	Amy soils, frequently flooded	242.1	11.3%
3	Enders gravelly fine sandy loam, 3 to 8 percent slopes	31.9	1.5%
8	Leadvale silt loam, 1 to 3 percent slopes	733.6	34.3%
9	Leadvale silt loam, 3 to 8 percent slopes	137.5	6.4%
12	Linker fine sandy loam, 8 to 12 percent slopes	13.1	0.6%
17	Mountainburg gravelly fine sandy loam, 3 to 8 percent slopes	2.9	0.1%
18	Mountainburg gravelly fine sandy loam, 8 to 12 percent slopes	86.1	4.0%
20	Mountainburg very stony fine sandy loam, 12 to 40 percent slopes	1.6	0.1%
23	Ouachita silt loam, occasionally flooded	75.6	3.5%
32	Taft silt loam, 0 to 2 percent slopes	722.7	33.8%
35	Water	89.3	4.2%
Totals for Area of Interest		2,136.4	100.0%

Soil Map

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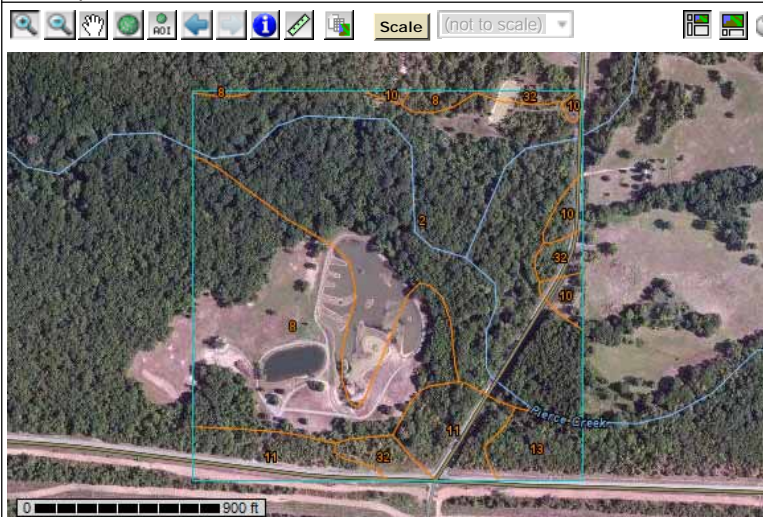
Search

Map Unit Legend

## Faulkner County, Arkansas (AR045)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
2	Amy soils, frequently flooded	41.6	49.9%
8	Leadvale silt loam, 1 to 3 percent slopes	24.8	29.8%
10	Linker fine sandy loam, 1 to 3 percent slopes	2.1	2.6%
11	Linker fine sandy loam, 3 to 8 percent slopes	8.7	10.4%
13	Linker-Mountainburg association, 8 to 12 percent slopes	3.2	3.8%
32	Taft silt loam, 0 to 2 percent slopes	2.9	3.5%
Totals for Area of Interest		83.4	100.0%

Soil Map

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Map Unit Legend

## Faulkner County, Arkansas (AR045)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
5	Enders gravelly fine sandy loam, 12 to 45 percent slopes	2.3	1.0%
8	Leadvale silt loam, 1 to 3 percent slopes	89.6	41.2%
11	Linker fine sandy loam, 3 to 8 percent slopes	9.6	4.4%
18	Mountainburg gravelly fine sandy loam, 8 to 12 percent slopes	1.5	0.7%
20	Mountainburg very stony fine sandy loam, 12 to 40 percent slopes	46.6	21.4%
35	Water	67.9	31.2%
Totals for Area of Interest		217.5	100.0%

Soil Map

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