City Of Fayetteville, Arkansas
Woolsey Wet Prairie Abbreviated Monitoring Report
And 2013 Adaptive Management Strategy

Fayetteville
ARKANSAS

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Environmental Consulting Operations
ECO, INC.
"Integrating ECOnomy and ECOlogy"

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1.0 – Introduction and Project Overview

The City of Fayetteville, Arkansas' Wastewater System Improvement Project (WSIP) was designed to improve the City's sewer collection system, upgrade the Paul Noland Wastewater Treatment Plant (WWTP), and construct a new (Westside) WWTP. The project's primary purpose was to implement corrective actions to eliminate/reduce odor and overflow problems associated with the Noland Plant and collection system, and to provide wastewater treatment to areas currently outside the treatment area while reducing the total hydraulic loading to the system. The WSIP involved discharges of fill into "waters of the U.S." within the Illinois River Watershed (within the Arkansas River Basin) and the Beaver Reservoir Watershed (within the White River Basin) therefore permitting under Section 404 of the Clean Water Act was required.

1.1 – Individual Section 404 Permit No. 14207

On March 10, 2005, the City of Fayetteville received Individual Section 404 Permit No. 14207 from the U.S. Army Corps of Engineers, Little Rock District (Corps) for the portion of the WSIP in the Illinois River Watershed (west side) that involved 36 stream crossings and 15 wetland crossings during construction of the new Westside WWTP, sewer lines, and road improvements. The permit required wetland compensatory mitigation due to the permanent alteration of 9.56 acres of wetlands. As part of the terms and conditions included in the Section 404 permit, five annual reports on the status of the mitigation site must be submitted to the Corps. The first annual wetland monitoring report was due December 31st after the first growing year, and each year thereafter, for a total of five years. The first Monitoring Year was 2007 and the fifth annual monitoring report was completed in December 2011.

Upon completion of the intensive monitoring activities required by the Corps, ECO, Inc. commenced with abbreviated monitoring activities in 2012. The Corps monitoring requirements included an evaluation concerning the achievement of performance standards at the 47 monitoring stations. It is well documented that Woolsey Wet Prairie has more than met the required performance standards. Consequently, the abbreviated monitoring strategy focuses on where adaptive management activities are needed on a cell-by-cell basis in lieu of the 47 monitoring stations.

1.2 – Mitigation Site Concept & Team

The 43.65-acre wetland mitigation site is located immediately to the north of the Westside WWTP that became operational on June 1, 2008. A site aerial photograph is shown in Figure 1. McGoodwin, Williams, and Yates Consulting Engineers, Inc. of Fayetteville designed hydrological features and Environmental Consulting Operations, Inc. of Benton has done ecological feature design, site management, and monitoring. Brasfield and Gorrie General Contractors completed construction of earthen berms and water level control structures. Operation of hydrological controls, mowing, staff gauge and monitoring well data, and herbicide applications are managed through Operations Management International, Inc. (OMI) a subsidiary of the CH2M Hill Companies, Ltd that also manages and maintains the City's wastewater utility system. OMI subcontracts herbicide applications to Ozark Ecological Restoration, Inc. (OERI). Prescribed burns are contracted by the City of Fayetteville through an informal bidding process. ECO, Inc. oversees environmental regulatory compliance and conducts annual monitoring and site adaptive management strategy development at Woolsey Wet Prairie.

Modifications to the existing hydrology at the mitigation site were achieved via the construction of low elevation perimeter earthen berms designed to provide a mechanism for water retention. Water level control structures with stop logs were constructed within the berms in order to provide the ability to both hold and release water, as needed. Construction of the earthen berms resulted in two cells (W-1 and W-2) within the West Mitigation Site, and five cells (E-1 through E-5) within the East Mitigation Site. The mitigation site has been named "Woolsey Wet Prairie Sanctuary" in honor of Samuel Gilbert Woolsey, whose family settled the property in 1830.

2.0 – Mitigation Site Monitoring Activities

Monitoring activities completed to date include:

- **2002-2005 Pre-Mitigation Baseline Site Characterization**
- **October 2006**
- **May 2007**
- **November 2007**
- **June 2008**
- **October 2008**
- **July 2009**
- **November 2009**
- **July 2010**
- **October/November 2010**
- **June 2011**
- **November 2011**
- **June 2012**
- **November 2012**

The following sections describe observations for each wetland cell during the 2012 growing season. An aerial photograph of the wetland cells is shown in Figure 1, and 2012 observations are indicated on a cell-by-cell basis in Figures 2-8.

Figure 1 Woolsey Wet Prairie Site Aerial Photograph

2.1 – Wetland Cell E-1

Rare Species
Two rare plants, opaque prairie sedge (*Carex opaca*) and Arkansas sedge (*Carex arkansana*) occur in Cell E-1. Both are uncommon in this cell and are scattered in low areas.

Invasive Species
Four invasive species were observed in this cell in 2012 that need management. Tall fescue (*Schedonorus arundinaceus*) was observed to be persisting in two areas near the northwest corner of the cell, callery pear (*Pyrus calleryana*) was seen at a single site near the southeast corner of the cell, and sericea lespedeza (*Lespedeza cuneata*) is thinly scattered throughout the cell. Dallis grass (*Paspalum dilatatum*) occurs at scattered locations along the edge of the berm and is spreading out into the cell from there.

Species Richness
A total of 112 plant species were observed in 2012 in Cell E-1, of which 108 are native species and 4 are non-native or invasive species.

2.2 – Wetland Cell E-2

Rare Species
Three rare plants: opaque prairie sedge (*Carex opaca*), Arkansas sedge (*Carex arkansana*), and Wolf's spikerush (*Eleocharis wolfii*) occur in Cell E-2. The Carex species are uncommon in this cell and are scattered in low areas. Wolf's spikerush was observed in a single location in this cell in a swale at the edge of an open marsh.

Invasive Species
Five invasive species were observed in this cell in 2012 that need management. Bush honeysuckle (*Lonicera maackii*) was observed for the first time at Woolsey Prairie, growing among several elm trees just inside the berm immediately north of the pond (in Cell E-4). Sericea lespedeza (*Lespedeza cuneata*) and Queen Anne's lace (*Daucus carota*) are thinly scattered throughout the cell. Dallis grass (*Paspalum dilatatum*) occurs at scattered locations along the edge of the berm and is spreading out into the cell from there. Johnson grass (*Sorghum halepense*) was observed at one site near the western edge of the cell.

Species Richness
A total of 108 plant species were observed in 2012 in Cell E-2, of which 103 are native species and 5 are non-native or invasive species.

2.3 – Wetland Cell E-3

Rare Species
Two rare plants, opaque prairie sedge (*Carex opaca*) and Arkansas sedge (*Carex arkansana*) occur in Cell E-3. Both are uncommon in this cell and are scattered in low areas.

Invasive Species
Five invasive species were observed in this cell in 2012 that need management. Sericea lespedeza (*Lespedeza cuneata*) is thinly scattered throughout the cell. Dallis grass (*Paspalum dilatatum*) occurs at scattered locations along the edge of the berm, especially near the northeast corner of the cell, and is spreading out into the cell from there. A large patch of yellow foxtail (*Setaria pumila*) was observed along the edge of the berm near the northeast edge of the cell. A patch of multiflora rose (*Rosa multiflora*) occurs near the southeast and northwest corners of the cell, and callery pear (*Pyrus calleryana*) occurs near the southeast corner and west edge of the cell.

Species Richness
A total of 105 plant species were observed in 2012 in Cell E-3, of which 100 are native species and 5 are non-native or invasive species.

2.4 – Wetland Cell E-4

Rare Species
Five rare plants occur in Cell E-4. In June of 2012 a single individual of pink milkwort (*Polygala incarnata*) was found for the first time at Woolsey Prairie on a mound on the western edge of this cell. Four rare sedges also occur in this cell. Opaque prairie sedge (*Carex opaca*) and Arkansas sedge (*Carex arkansana*) are uncommon in this cell and are scattered in low areas. Tall horned beaksedge (*Rhynchospora macrostachya*) and Wolf's spikerush (*Eleocharis wolfii*) occur scattered at the edge of open marshes.

Invasive Species
Ten invasive species were observed in this cell in 2012 that need management. Chinese privet (*Ligustrum sinense*) was found for the first time at Woolsey Prairie in an elm thicket on the east side of the pond in this cell. A non-native blackberry (*Rubus pascuus*) occurs in several large patches in this cell and callery pear (*Pyrus calleryana*) occurs as several scattered individuals. Patches of Japanese honeysuckle (*Lonicera japonica*) occur in clumps of woody vegetation in two areas. Sericea lespedeza (*Lespedeza cuneata*) occurs in two areas. Dallis grass (*Paspalum dilatatum*) and Bermuda grass (*Cynodon dactylon*) occur at scattered locations along the edge of the berm and are spreading out into the cell from there. A patch of multiflora rose (*Rosa multiflora*) occurs near the east edge of the cell. Johnson grass (*Sorghum halepense*) occurs along the berm on the west side of the cell, and Queen Anne's lace (*Daucus carota*) is scattered in the cell.

Species Richness
A total of 154 plant species were observed in 2012 in Cell E-4, of which 144 are native species and 10 are non-native or invasive species.

2.5 – Wetland Cell E-5

Rare Species
Four rare plants occur in Cell E-5. Opaque prairie sedge (*Carex opaca*) and Arkansas sedge (*Carex arkansana*) are uncommon in this cell and are scattered in low areas. Tall horned beaksedge (*Rhynchospora macrostachya*) and Wolf's spikerush (*Eleocharis wolfii*) occur scattered at the edge of open marshes.

Invasive Species
Five invasive species were observed in this cell in 2012 that need management. Sericea lespedeza (*Lespedeza cuneata*) is thinly scattered throughout the cell. Dallis grass (*Paspalum dilatatum*) occurs at scattered locations along the edge of the berm and is spreading out into the cell from there. Callery pear (*Pyrus calleryana*) occurs as scattered individuals at several sites in this cell. Black willow (*Salix nigra*) and green ash (*Fraxinus pennsylvanica*), both native species, are becoming dense in this cell, especially at the south end.

Species Richness
A total of 129 plant species were observed in 2012 in Cell E-5, of which 124 are native species and of 5 are non-native or invasive species.

2.6 – Wetland Cell W-1

Rare Species
Six rare plants occur in Cell W-1. In 2012, a single clump of pointed sedge (*Carex scoparia*) was observed in this cell. This is the first time this rare species has been seen at Woolsey Prairie. Opaque prairie sedge (*Carex opaca*) and Arkansas sedge (*Carex arkansana*) are uncommon in this cell and are scattered in low areas. Tall horned beaksedge (*Rhynchospora macrostachya*) and Wolf's spikerush (*Eleocharis wolfii*) occur scattered at the edge of open marshes. A few individuals of hammock sedge (*Carex fissa*) occur in a single swale in this cell.

Invasive Species
Eleven invasive species were observed in this cell in 2012 that need management. A non-native blackberry (*Rubus pascuus*) occurs in three large patches at the south end of this cell and callery pear (*Pyrus calleryana*) occurs as scattered individuals. Tall fescue (*Schedonorus arundinaceus*) occurs as a few scattered individuals throughout the cell. Dense stands of yellow foxtail (*Setaria pumila*) and Italian foxtail (*Setaria italica*) occur in the northwest corner of the cell. Sericea lespedeza (*Lespedeza cuneata*) and curly dock (*Rumex crispus*) are scattered in the cell. Dallis grass (*Paspalum dilatatum*) and Bermuda grass (*Cynodon dactylon*) occur at scattered locations along the edge of the berm and are spreading out into the cell from there. Johnson grass (*Sorghum halepense*) occurs on a few of the mounds. Black willow (*Salix nigra*), a native species, is becoming thick, with many individuals becoming large, thoughout this cell.

Species Richness
A total of 125 plant species were observed in 2012 in Cell W-1, of which 114 are native species and 11 are non-native or invasive species.

2.7 – Wetland Cell W-2

Rare Species
Six rare plants occur in Cell W-2. Opaque prairie sedge (*Carex opaca*) and Arkansas sedge (*Carex arkansana*) are fairly common in this cell and are scattered in low areas, especially in the southern half of the cell. Tall horned beaksedge (*Rhynchospora macrostachya*) and Wolf's spikerush (*Eleocharis wolfii*) occur scattered at the edge of open marshes. A large population of hammock sedge (*Carex fissa*) occurs in the southern half of this cell and three large colonies of woolly sedge (Carex pellita) occur in the eastern half of this cell.

Invasive Species
Five invasive species were observed in this cell in 2012 that need management. Tall fescue (*Schedonorus arundinaceus*) has persisted as small but dense patches in several areas of this cell. A non-native blackberry (*Rubus pascuus*) occurs in scattered patches. Sericea lespedeza (*Lespedeza cuneata*) occurs as scattered individuals, mostly in the northern half of this cell. Yellow foxtail (*Setaria pumila*) and Johnson grass (*Sorghum halepense*) occur scattered along the edge of the berm around this cell, with Johnson grass also occurring on a few of the mounds.

Species Richness
A total of 153 plant species were observed in 2012 in Cell W-2, of which 148 are native species and 5 are non-native or invasive species.

Table 1 – 2012 Wetland Cell Observation Summary

Cells	Non-Native Invasives	Rare Plant Species	New Plant Species	Species Richness
E-1	Tall Fescue Callery Pear Sericea Lespedeza Dallis Grass	Opaque Prairie Sedge Arkansas Sedge		112
E-2	Bush Honeysuckle Sericea Lespedeza Queen Anne's Lace Dallis Grass Johnson Grass	Opaque Prairie Sedge Arkansas Sedge Wolf's Spikerush		108
E-3	Sericea Lespedeza Dallis Grass Yellow Foxtail Multiflora Rose Callery Pear	Opaque Prairie Sedge Arkansas Sedge		105
E-4	Chinese Privet Non-Native Blackberry Callery Pear Japanese Honeysuckle Sericea Lespideza Dallis Grass Bermuda Grass Multiflora Rose Johnson Grass Queen Anne's Lace	Pink Milkwort Tall Horned Beaksedge Opaque Prairie Sedge Arkansas Sedge Wolf's Spikerush	Pink Milkwort	154
E-5	Black Willow Green Ash Callery Pear Sericea Lespideza Dallis Grass	Tall Horned Beaksedge Opaque Prairie Sedge Arkansas Sedge Wolf's Spikerush		129
W-1	Tall Fescue Callery Pear Sericea Lespedeza Dallis Grass Non-Native Blackberry Italian Foxtail Yellow Foxtail Curly DockBermuda Grass Johnson Grass Black Willow	Pointed Sedge Hammock Sedge Tall Horned Beaksedge Opaque Prairie Sedge Arkansas Sedge Wolf's Spikerush	Pointed Sedge	125
W-2	Yellow Foxtail Johnson Grass Tall Fescue Sericea Lespedeza Non-Native Blackberry	Woolley Sedge Hammock Sedge Tall Horned Beaksedge Opaque Prairie Sedge Arkansas Sedge Wolf's Spikerush		153

Figure 2 Wetland Cell E-1

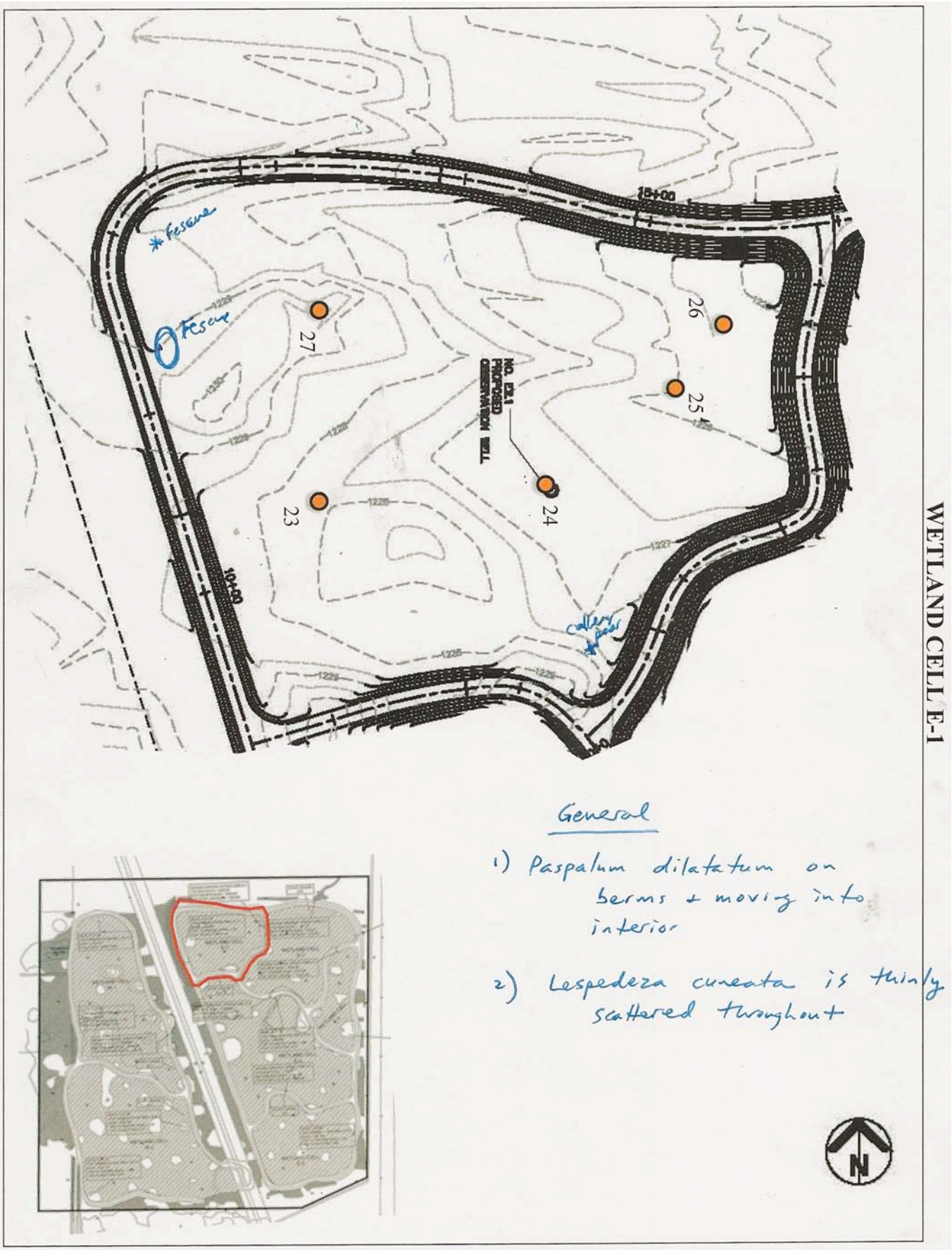


Figure 3 Wetland Cell E-2

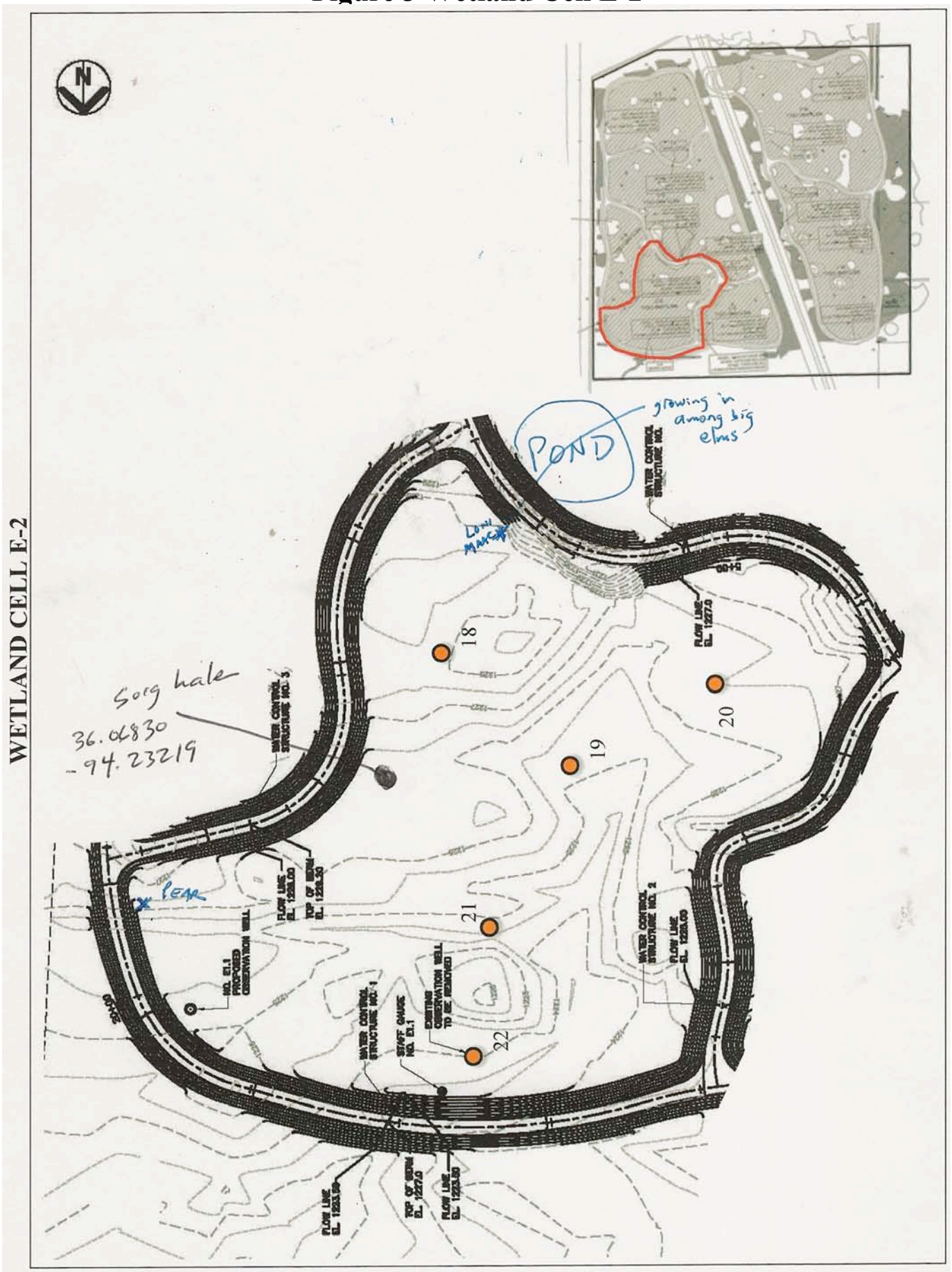


Figure 4 Wetland Cell E-3

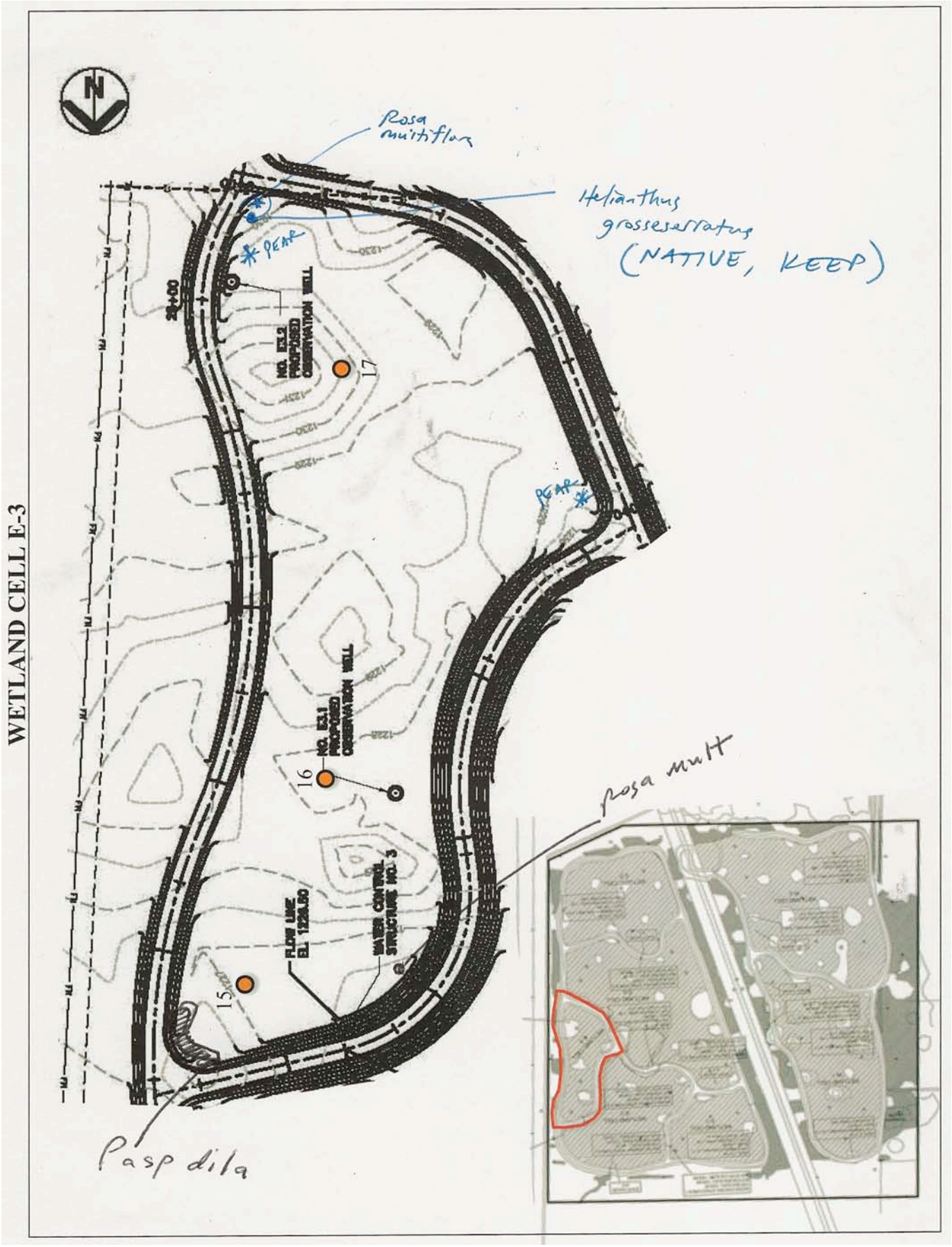


Figure 5 Wetland Cell E-4

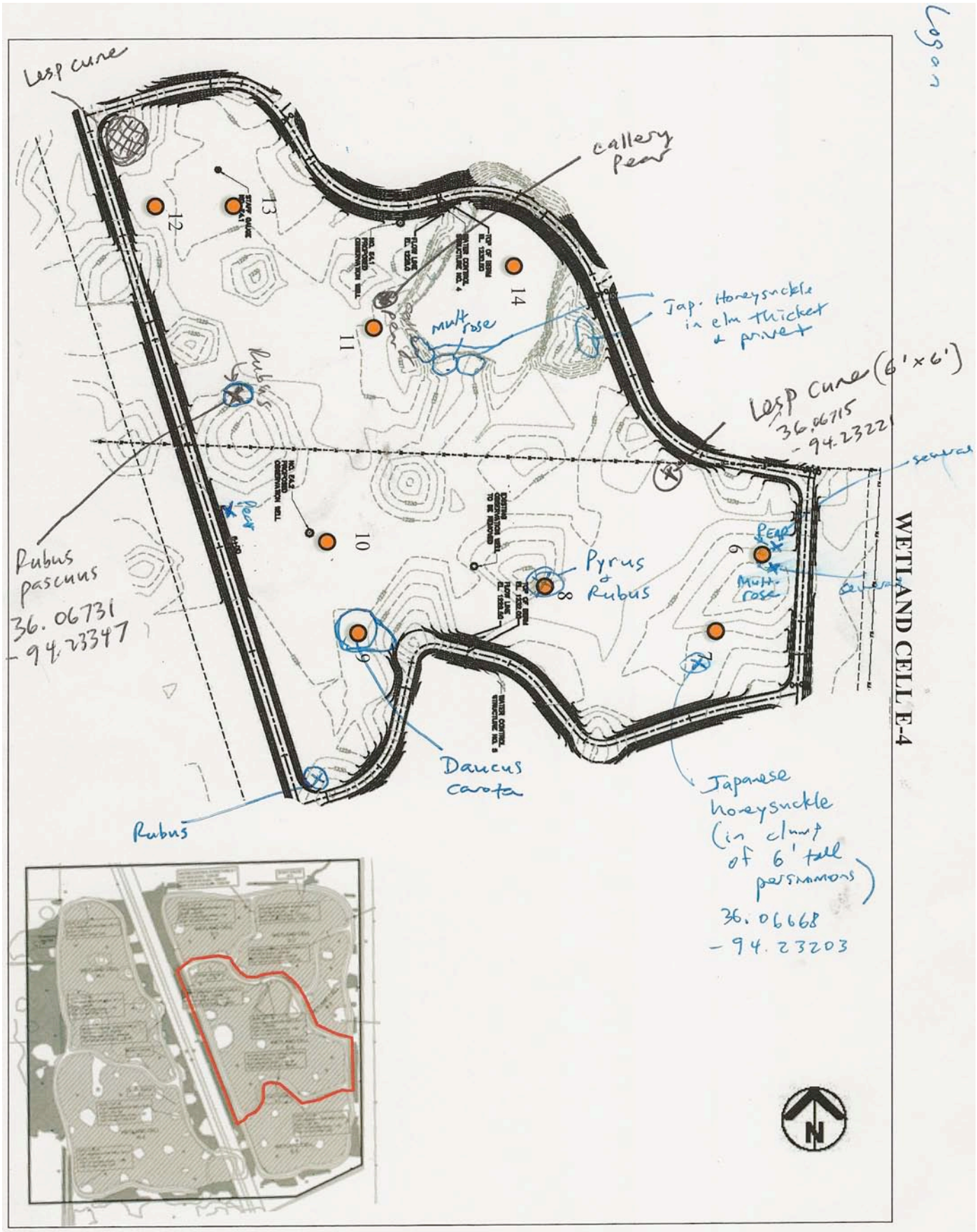


Figure 6 Wetland Cell E-5

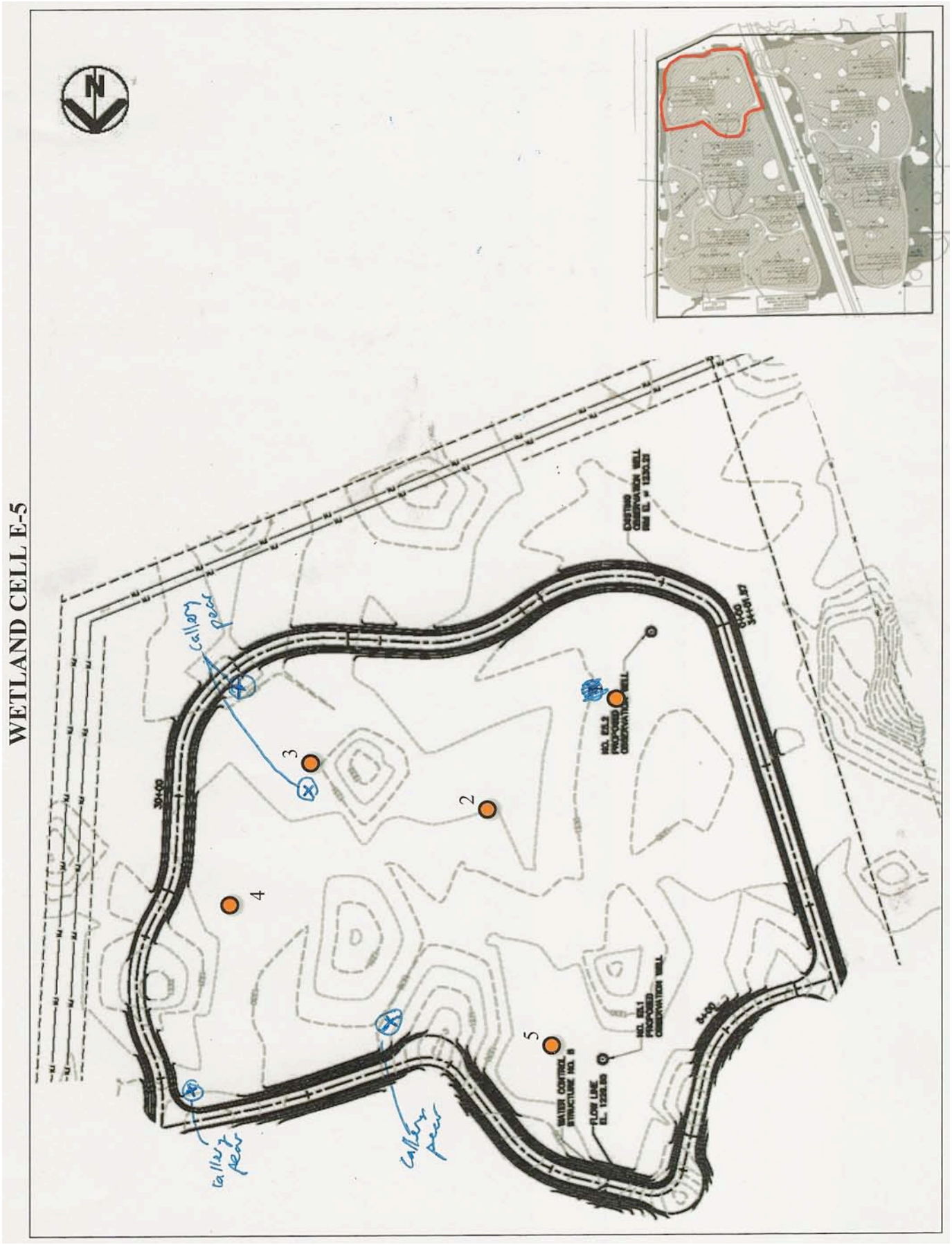


Figure 7 Wetland Cell W-1

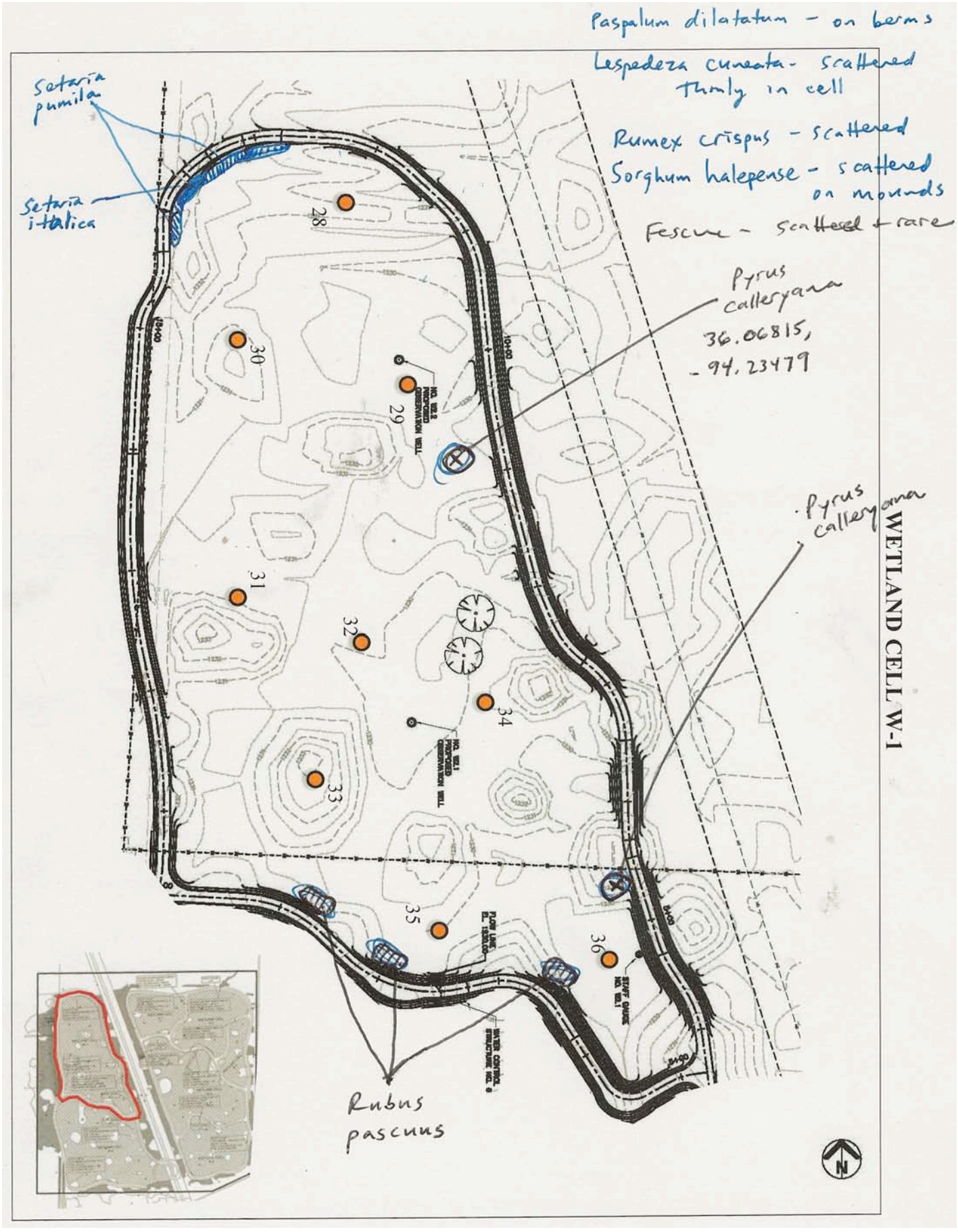
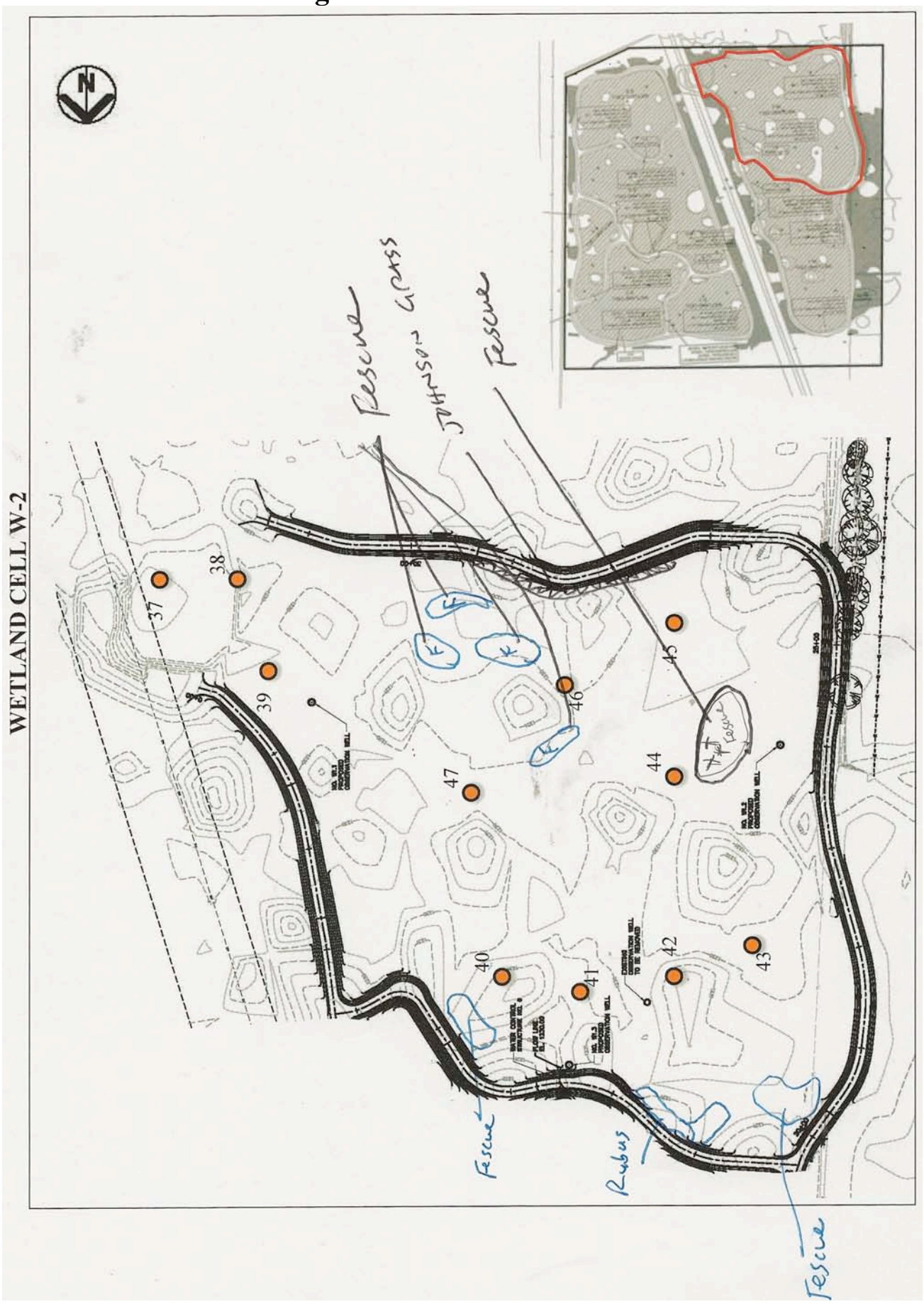


Figure 8 Wetland Cell W-2



2.8 – Rare Species at Woolsey Wet Prairie Sanctuary

Nine plant species tracked as elements of conservation concern (rare species) by the Arkansas Natural Heritage Commission, were found to naturally occur at the mitigation site. The rare plants include sedges (family Cyperaceae) and pink milkwort (family Polygalacea), and are characteristic of unplowed tallgrass wet prairie remnants.

Polygala incarnata (pink milkwort) – **G5S1 –** Pink Milkwort a slender annual forb found only in wet-mesic tall grass prairie habitats. This plant has a wetland indicator status of FAC-. At Woolsey Wet Prairie, this plant is found on a mound at the western edge of Cell E-4.

Carex scoparia (pointed sedge) – **G5T5S1S2** – This uncommon sedge can be found in many types of wetland habitat, and in generally wet places from meadows to irrigation ditches. It is very adaptable to varying soil types and hydrologic conditions. This sedge has a wetland indicator status of FACW. At Woolsey Wet Prairie, it occurs in one small clump in Cell W-1.

Carex arkansana **(Arkansas sedge) – G4S1 –** This uncommon sedge is known in Arkansas from wet prairie remnants, hydric oak flatwoods, and similar open wetland habitats (ANHC, 2007). While it has no wetland indicator status code in the USDA Plants Database, it is listed by Yatskievych (1999) as occurring primarily in bottomland prairies and moist depressions of upland prairies. At Woolsey Wet Prairie it is scattered in wetter areas of the prairie.

Carex opaca **(opaque prairie sedge) – G4S2S3 –** This rare sedge is primarily associated with unplowed, wet tallgrass prairie remnants in Arkansas (ANHC, 2007). While it has no wetland indicator status code in the USDA Plants Database, it is listed by Yatskievych (1999) as rimarily occurring in "bottomland prairies, moist depressions of upland prairies, and margins of fens." At Woolsey Wet Prairie it is scattered in wetter areas of the prairie.

Carex fissa **var.** ***fissa*** **(a sedge) – G3G4S1 –** Prior to its discovery at Woolsey Wet Prairie, this rare sedge was known in Arkansas from only two sites in Saline and Lonoke Counties where is occurs in disturbed prairie-associated wetlands and wet hardwood flatwoods (ANHC, 2007). At Woolsey Wet Prairie, it occurs in small numbers in two naturally occurring prairie swales in Cells W-1 and W-2.

Carex pellita **(a sedge) – G5S1 –** Prior to its collection at Woolsey Wet Prairie, this species was known to be extant at a single Arkansas locality, in a fen in Marion County. At Woolsey Wet Prairie it is uncommon in one open water plot and locally common in one marsh plot. It is apparently increasing at the site based on observations in 2007- 2011.

Eleocharis wolfii **(Wolf's spikerush) – G3G4S2 –** This wetland sedge occurs in Arkansas primarily in wet areas in unplowed tallgrass prairie remnants but can persist in wet, open areas in landscapes that were formerly dominated by prairie vegetation (ANHC, 2007). At Woolsey Wet Prairie it is locally common in several naturally occurring swales and is now expanding around at least two of the marsh plots.

Rhynchospora macrostachya **(tall horned beaksedge) – G4S1 -** Prior to its collection at Woolsey Wet Prairie, this species was known from Arkansas only from historical collections. At Woolsey Wet Prairie it was known from two natural prairie swales prior to construction of the berms, but is now increasing in marsh areas at the site. In the fall of 2006, ECO, Inc. gathered seeds and successfully propagated over 50 specimens during the 2007 growing season that were transplanted into marsh areas at the mitigation site during 2008. A 90 percent survival rate was observed, and transplanted specimens produced large seed heads by the end of the 2008 growing season. During the 2009 growing season, it was observed that much of the beaksedge failed to return. The suspected cause for this is believed to be related to hydrology and the appearance of dense stands of large macrophytes (i.e. *Ludwigia spp., Persicaria spp., Typha spp*.) that were released due to reduction in tall fescue density and due to hydrological changes at the site. This species typically grows in wet areas of shallow inundation where water levels fluctuate. Tall horned beaksedge requires conservation of habitat and protection of the hydrology, including maintenance of cyclical drawdown regime and water table. No drawdowns were performed during the 2009 growing season and an abundance of standing water prevailed at the site. This lack of fluctuating water levels is likely responsible for reduced densities. It was observed that the high densities returned during the 2010 and 2011growing seasons after excessive droughts followed by excessive rain events restored naturally occurring water level fluctuations.

Scleria pauciflora **(fewflower nutrush) – G5S3 –** This sedge is known in Arkansas from unplowed tallgrass prairies, saline barrens, and open pine flatwoods (ANHC, 2007). At Woolsey Wet Prairie it occurs in areas that support other characteristic prairie vegetation.

SOURCES:

ANHC (Arkansas Natural Heritage Commission). 2007. Database of Elements of Conservation Concern. Arkansas Natural Heritage Commission. Little Rock, AR.

Yatskievych, G. 1999. Steyermark's Flora of Missouri. Vol. 1. Revised Edition. Missouri Dept. of Conservation & Missouri Botanical Garden Press. St. Louis, MO. 991 pp.

3.0 Site Adaptive Management Activities

The "adaptive management" approach has been utilized to manage site vegetation and hydrology. Adaptive management is a structured, iterative process of optimal decision making in the face of uncertainty, with the objective to reduce uncertainty over time via system monitoring. Adaptive management is often characterized as "learning by doing" in a decision-making process whereby any given selection of a vegetation management tools is done after observing the results of the previous vegetation management tool.

Among the adaptive management tools used for vegetation management at Woolsey Wet Prairie are:

- **Hand cutting/cut stump herbicide application of woody plants**
- **Mowing to prevent undesirable plant species from forming seed heads**
- **Hand pulling of undesirable plant species**
- **Herbicide applications**
- **Prescribed burning**
- **Water level control**

Use of mowing, prescribed burning, and herbicide applications for control of non-native and invasive plant species have become commonly accepted practices among ecological restoration professionals. Implementation of "adaptive management" techniques that were previously prohibited at wetland mitigation sites are now not only condoned, but actually encouraged, by both the Corps and EPA.

With regard to ecological restoration projects, each site has its own unique characteristics such as soil chemistry, hydrology, and dormant seeds within the relict seed bank. This creates a scenario whereby the observed results from the implementation of site management tools can be somewhat unpredictable. The timing of implementation of each management tool can also be a very critical factor in the results that are produced. A historical list of adaptive management activities at Woolsey Wet Prairie is shown in Table 2.

Table 2 – Woolsey Wet Prairie Adaptive Management Activities

Date	Activity
May 2006	Discontinuation of decades of cattle grazing and haying operations
May - July 2006	Construction on of earthen berms for hydrological modification
October 2006	Spot spray Bermuda, Johnson grass, honey locust, sericea lespedeza, elm with Triclopyr
March 2007	Installation of water level control structures
April 27, 2007	Mow to height of 10-12 " to prevent tall fescue seed head development
February 29, 2008	Prescribed burn
March 27, 2008	Plant tree saplings in forested wetland cells and at outfall structure
March 27-April 5, 2008	Boom spray fescue with Sulfosulfuron
June 13, 2008	Plant approximately 10 Rattlesnake Master (*Eryngium yuccifolium) plants*
June 25, 2008	Plant approximately 50 tallhorned beaksedge (*Rhynchospora macrostachya)*
November 14, 2008	Boom spray tall fescue with Sulfosulfuron
February 19, 2009	Prescribed burn
March 25, 2009	Boom spray fescue with Glyphosate
March 29, 2009	Spot spray Johnsongrass with Sethoxydim
June – October 2009	Weekly spot spraying of invasive woody vegetation with Triclopyr
November 19-24, 2009	Wetland cell drawdown in preparation for prescribed burn
December 16, 2009	Prescribed burn
December 17, 2009	Reset stop logs in water level control structures to restore water levels in wetland cells
March 23 2010	Wetland cell drawdown in preparation for herbicide application
April 9-12, 2010	Boom spray with Clethodim.
June 2, 2010	Mow berms
June 10-15. 2010	Adjacent (west and north) fescue fields hayed before tall fescue goes to seed
June 18-22, 2010	Mow berm sides and site perimeter to primarily keep Queen Anne's Lace from going to seed
May – October 2010	Weekly spot spraying of invasive woody vegetation with Triclopyr
March 18, 2011	Prescribed burn
April 15, 2011	Spray tall fescue in Cell W-2 with Clethodim
May 17, 2011	Spray sericea lespedeza on berms with 2-4-D
May 19, 2011	Spray fire line with Glyphosate
May-June 2011	Spray sericea lespedeza on berms with Triclopyr on 3-4 week rotation
June 15-18, 2011	Mow tall fescue and Queen Anne's Lace around perimeter of mitigation site prior to formation of seed heads
June 16-17, 2011	Hand pull Queen Anne's Lace and curly dock on entire mitigation site
June-September 2011	Monthly spot spraying of selected woody vegetation with Triclopyr
June-November 2011	Hand cut selected black willow, honey locust, persimmon and green ash
December 2011	Spot spray tall fescue with Clethodim
March 13, 2012	Prescribed burn
June-September 2012	Monthly spot spraying of selected woody vegetation with Triclopyr
June-November 2012	Hand cut selected black willow, honey locust, persimmon and green ash
December 2012	Spot spray tall fescue with Clethodim

3.1 – Prescribed Burning

Prescribed burning is a widely accepted vegetation management tool for ecological restoration projects and is routinely conducted in Arkansas by the Arkansas Forestry Commission, the Nature Conservancy, and the Arkansas Natural Heritage Commission at natural areas. To date, prescribed burns have been conducted at Woolsey Wet Prairie on February 29, 2008; February 19, 2009; December 16, 2009; March 18, 2011; and March 13, 2012.

A multitude of studies have shown that the anthropogenic suppression of fire has been responsible for the eradication of many native plant communities nationwide. Historically, Native Americans intentionally set fires for various reasons, one of which was for habitat enhancement for attraction of large migrating mammals such as bison and elk. For ecological restoration, fire has become recognized as a valuable vegetation management tool that can be used to enhance community diversity. It has also been documented that prescribed burning should be done at a variety of seasons throughout the year instead of the same time each year. Fire removes much of the surface layer of decaying vegetation "thatch" that covers the ground. Many native plant species require sunlight to germinate, while others actually require fire to germinate. Prescribed burning is commonly used to increase native plant species richness.

Burning at Woolsey Wet Prairie has been avoided during May through August when the majority of songbirds are nesting, and/or waterfowl are rearing their young. Prescribed burns aide in preventing woody encroachment and maintain the wet prairie habitat, depending upon the time of year of the burn, and the site hydrology at the time of the burn. The volunteer tree growth has primarily occurred in the wetter areas where inundation protects trees from fire.

3.2 – Herbicide Applications

Herbicides have been applied for control of tall fescue and other non-native invasive species. Tall fescue is extremely competitive and capable of forming monocultures in former native grasslands. It is estimated that approximately 4 million of the 5.4 million acres of pasturelands in Arkansas are dominated by tall fescue. It contains a toxic alkaloid that is detrimental to bobwhite quail, white-tailed deer, songbirds, wild turkey, and other wildlife. Tall fescue has a wetland indicator status of FAC- and is capable of dominating wet meadow areas, significantly reducing native plant species richness. Tall fescue is a cool season grass and actively begins photosynthesis very early in the growing season. It goes dormant during hot dry weather and actively grows in the fall even after several killing frosts. This provides an advantage in vegetation management since the fescue can be sprayed at a time when native plant species are dormant. As observed soon after the February 29, 2008, February 19, 2009, March 18, 2011, and March 13, 2012 prescribed burns, tall fescue was the first plant species to become active after completion of the prescribed burn. It was apparent that three to four weeks after these burns would be a critical time to apply herbicides on the fescue.

3.3 – Mowing and Hand Cutting

The mowing is aimed toward invasive species such as tall fescue, Johnson grass, ragweed, and sericea lespedeza. When necessary, stands of these species are mowed to a height of 10-12 inches as they begin to mature, but before they form seed heads. This is intended to prevent the dispersal of additional seeds from invasive species. Currently, most areas at the mitigation site remain too wet to mow. However, periodic mowing will be continued in a 50-foot perimeter around the mitigation site and on the earthen berms, as necessary.

Management activities targeted woody vegetation in some areas with both mechanical and chemical control, which contributed to the decline in several species. One non-native invasive woody species, callery pear (*Pyrus calleryana*) was encountered frequently but has largely been controlled on the site.

In 2012, selected black willows were hand cut and the stumps were treated with Triclopyr. The cut trees were stacked into brush piles that will provide winter habitat for migrating sing birds. The brush piles will likely burn during the planned prescribed burn in March-April of 2013.

3.4 – Hydrological Controls

Two drawdown events have taken place since the 2008-2009 period when all wetland cells were inundated during the majority of the year. The first such event occurred during November 19-24, 2009 in preparation for a prescribed burn. The second drawdown occurred on March 23, 2010 in preparation for herbicide boom spraying. The drawdowns coupled with a very dry 2010, 2011, and 2012 is believed to have been the cause for the emergence of dense stands of pale smartweed (*Persicaria lapathifolia*) during the 2010 – 2011 growing seasons. However, Wetland Cell W-2, which cannot be drained since it has no water level control structure, became very dry like the other cells. Therefore, it is speculated that the lack of previously observed variations in water depth and degree of soil saturation would have occurred anyway due to drought conditions.

Although pale smartweed is a native species that provides value to wildlife, both as food and as cover, it did appear to reduce the diversity of sedges, rushes, and emergent aquatic plants in certain areas. The management of Woolsey Wet Prairie is aimed at promoting biodiversity, and avoidance of near monoculture conditions, even with native species. Such a situation has the potential to adversely affect species richness. Species richness can be affected directly by local environmental conditions that determine the pool of species physiologically capable of living at any given site; and indirectly through biomass, which can affect competitive exclusion. Thus, there is a correlation between productivity (above ground biomass) and species richness. In essence, there is a mechanism whereby favorable environmental conditions that lead to increased accumulation in biomass of any given species can lead to competitive exclusion of other species. Therefore, declines in biodiversity can often be observed when vegetation surpasses normal productivity. It is apparent that this mechanism was in place to a degree during the 2010 growing season with the dense stands of pale smartweed. This did not adversely affect the wetland mitigation success, or wetland credits generated; however, preventative measures became necessary to avoid a monoculture situation.

The application of herbicides to reduce the density of pale smartweed was not a feasible management alternative because it actively grows during the warm season when many desirable plant species are thriving. It also covered significant wet meadow areas that had previously been inundated during 2008-2009. It would require a broadleaf-specific herbicide such as 2,4-D to control it. The need for repeated applications was anticipated, due to the density of growth, thereby making it difficult to achieve good herbicide coverage on all plants within a given stand. Consequently, there was a risk of damage to nearby desirable species.

Management of hydrology was selected as the primary tool to control the smartweed since it prefers moist soil in poorly drained areas with abundant organic matter. It is somewhat weedy, and can be aggressive when favorable conditions exist. It tolerates occasional flooding, but typically grows at the edge of flooded areas. It does not grow as well in standing water with depths of one foot or more. Therefore, restoring water retention to previous levels of inundation and soil saturation was anticipated to reduce the density of smartweed and allow other species to grow. This is to be achieved via discontinuation of drawdowns, which has been implemented since 2011.

4.0 – Planned Adaptive Management Activities for 2013

4.1 – Hydrology Management

Currently, all stop logs at water level control structures are set for maximum water retention in the wetland cells. They will be maintained at these settings in order to restore and maintain optimal inundation. This will allow for standing water in areas of dense smartweed growth as an effort to continue the reduction in smartweed density observed in 2012. The presence of smartweed is not necessarily a bad thing; however, it has grown so dense in some locations during 2011 that a reduction in mud flat habitat that is attractive to the many species of shorebirds has been observed. It is one of the management goals to restore a portion of the mudflat habitat via control of smartweed through management of hydrology. Therefore, a return of some of the mudflats as well as denser growth of sedges and rushes should be observed in 2013.

Drawdowns are not planned in the near future, since the tall fescue is largely under control and herbicide applications with the large boom sprayer should not be necessary. Similarly, it has been observed that a prescribed burn can be achieved without a drawdown.

Management of hydrology is an important tool in vegetation community diversity optimization because plant zonation occurs along water depth and soil saturation gradients. Consequently, variations in water depth and degree of soil saturation lead to variations in species composition. The timing and frequency of flooding and drawdowns are also among the most important filters in species assemblages. Inundation causes physical disturbances, removal of litter, transport of sediments and nutrient availability and an increased dispersal of seeds.

In summary, for management of hydrology, the major emphasis will be to recreate natural hydrological regimes in a manner to limit productivity of any single species from becoming excessively high, while at the same time, enriching biodiversity. The strategy for management of hydrology has not only included considerations for the volume of water retained, but also the time of the year water is retained. It is vital to retain water during the growing season in order to maintain areas of soil saturation and/or inundation to support desirable wetland vegetation.

4.2 – Prescribed Burning

The season of the year at which a prescribed burn is conducted has a great influence over the vegetation community (Table 3). This knowledge can be used as a management tool to achieve desired effects.

With the objective of increasing encouraging native warm season grasses (NWSG) and suppressing hardwood sprouts, a prescribed burn will be conducted during the mid-March to mid-April 2013 time frame. Ideally, this will occur during the transition from the Late Dormant to Dormancy Break periods. At that time, most of the warm season species will still be dormant and there will be adequate fuel from the vegetation killed by winter cold weather. A burn during this time should:

- **Reduce the density of smartweed and woody seedlings**
- **Set back cool season invasives such as tall fescue**
- **Favor NWSGs**
- **Be outside the bird breeding season**

An important consideration for prescribed burning of uplands versus wetlands as restoration tools lies in the fact that some wetland sedges and native wetland grasses are C3 cool-season plants, that can be disadvantaged as much as their exotic competitors by a mid- to late-spring burn. Given that a drawdown will not be done in preparation for the burn, as was done previously, areas supporting C3 cool season plants should be wet enough to prevent encroachment of fire. Woolsey Wet Prairie is a mesic (saturated soils and shallow inundation) prairie that has a tendency to be dominated by forbs. The species composition can be shifted toward grasses that historically dominated prairies in northwest Arkansas via yearly spring burns.

Prairie burning reduces mulch cover, increases the number of reproductive grass shoots, and results in a more rapid phenological development of young plants and an increase in flower production. Removal of the litter allows soil temperatures to warm more rapidly, giving the NWSG an earlier emergence thereby providing a competitive edge against cool season invasives. The cumulative effects of fire seem to be important in controlling invasion by nonnative species due to the increased productivity of dominant native C4 grasses under a regime of frequent fire rather than to direct negative impacts of fire on nonnative species. Although total forb yields may usually be reduced more by Dormancy Break spring burns than fall burns, forb composition will very likely be increased by burning when plants are dormant. Otherwise, young, actively growing forbs may be severely harmed by fire.

Table 3 – Effects of Season of Prescribed Burn

Season of Burn	Effect	Timing Indicators
Early Dormant (Late Fall: Oct-Nov)	Encourages forbs. Suppresses NWSG *Note: Never burn newly established Native Warm Season Grasses (NWSG) at this time*	After the first frost. Native grasses have ceased growing for the year. Above-ground stems have turned any variation of brown, gold, red, or yellow only within the last few weeks or month. Broken stems may be slightly green inside. Hardwoods are losing their leaves.
Mid-Dormant (Winter: Dec-Jan)	Encourages NWSG and forbs. Minimal impact on hardwood sprouts	Above-ground stems are dry and, when broken, are dry within their core. Hardwoods are dormant and have lost their leaves.
Late Dormant (Late Winter/Early Spring: Feb –Mar)	Encourages NWSG	Above-ground stems are dry hardwood buds have not yet swollen or may have just begun to swell.
Dormancy Break (Spring: April-May)	Encourages most NWSG species while suppressing cool-season grasses and hardwood sprouts; favors dominant tall grasses over forbs and woody species.	Hardwood buds are swollen, and a few have leafed out. Check the base of grass crowns for emerging shoots of new growth up to 1 inch in height. Many times these can be found just below the soil's surface.
Growing Season (Summer: June - July)	Suppresses NWSG and encourages forbs	NWSG seed stems are elongated, plant is blooming and/or seed heads have formed.
Late Growing Season (Late Summer/Early Fall: Aug-Sept)	Stresses NWSG and encourages forbs. Provides the best hardwood sprout control.	Late summer, early fall. Seed has set. Stems are just beginning to change color or have turned but are still green inside when broken. Hardwood leaves are changing color.

4.3 – Herbicide Applications

It is anticipated that future herbicide applications can be accomplished with backpack sprayers and/or ATV mounted spray equipment. Most of the fescue has been significantly reduced, with the exception of Wetland Cell W-2 (southwestern-most cell). Access with the boom sprayer has been limited due to the fact a drawdown of Cell W-2 cannot be achieved because it has no water level control structure. Consequently, Cell W-2 has a few areas where dense stands of fescue persist.

Soon after the 2013 prescribed burn, Clethodim will be applied to the remaining tall fescue via backpack sprayers and/or ATV mounted spray equipment. Excellent results on eradication of fescue with very minimal harm to non-target plant species, including sedges and rushes, have been observed when herbicides are applied while native warm season species are dormant.

4.4 – 2013 Adaptive Management Scheduling

A general schedule for 2013 is shown in Table 4. Site conditions will be observed and changes will be made to scheduling, as necessary.

Table 4 – 2013 Woolsey Wet Prairie Adaptive Management Tentative Schedule

General Timeframe	Activity
January	**Prescribed burn informal bid process; establishment of fire line**
February	**Hand cut larger black willows on edges of earthen berms**
Mid-March to Mid-April	**Prescribed burn**
Mid April	**Spray tall fescue before native plants come out of dormancy**
Early June	**Mow berms (OMI)**
Mid June	**Adjacent (west and north) fescue fields to be hayed before tall fescue goes to seed**
Mid to Late June	**Mow berm sides and site perimeter to primarily keep Queen Anne's Lace from going to seed (OMI)**
May – October	**Weekly spot spraying of invasive woody vegetation and hand cutting of selected woody vegetation (OERI)**
November – December	**Spray stands of tall fescue**

5.0 – Conclusion

The success of Woolsey Wet Prairie Sanctuary has been well noted in local media coverage via newspapers, periodicals, and television programs. In addition to achieving above and beyond the required wetland compensatory mitigation requirements, it has provided passive recreation and educational value for the public and academia.

Woolsey Wet Prairie has won awards and special recognitions for the City of Fayetteville, including:

April 2009 - Arkansas Environmental Stewardship Award (ENVY Award) Finalist presented by Arkansas Department of Environmental Quality

August 2009 - Governor's Conservation Awards - Corporate Conservationist of the Year presented by Arkansas Wildlife Federation in (the first and only time this award has been presented to a city since the inception of the AWF in 1936)

November 2009 - Golden Paddle Award presented by Illinois River Watershed Partnership

February 2011 - designation as a Certified Wildlife Habitat by the National Wildlife Federation

October 2011 – Special recognition in the America in Bloom National Turf and Groundcover Award

The Woolsey Wet Prairie Sanctuary is part of the original prairie of Prairie Township, Fayetteville, Arkansas that extended all the way to the Prairie Grove and Lincoln areas in Washington County. Conversion of an estimated 100,000 acres of prairie habitat to

production of wheat in northwest Arkansas in the late 1800's and early 1900's was the beginning of the decimation of prairie habitat.

With more than twice the credits needed for compensatory mitigation, the Little Rock District Corps of Engineers has given verbal approval to sell surplus credits to infrastructure improvement projects needing wetland credits. Expansion of Woolsey Wet Prairie to include an additional 70 acres as a Mitigation Bank is also being planned, and the topic has been discussed by the City of Fayetteville Water and Sewer and Environmental Action Committees. The timing of this expansion will be largely driven by economic conditions and the need for wetland credits in the area.

Federal Guidance on the Use of the Transportation Equity Act (TEA-21) established a "Preference for Mitigation Banking to fulfill Mitigation Requirements under Section 404 of the Clean Water Act – July 11, 2003." Furthermore, as published in the Federal Register on April 10, 2008, the 40 CFR 230 Compensatory Mitigation For Losses of Aquatic Resources: Final Rule established a preference for mitigation bank credits over permittee-sponsored mitigation due to findings that banks involves less risk of failure because they must undergo a multi-resource agency review process. They also provide lower costs for the consumer of wetland permits and are more stable, support more diversity, and contribute more to larger ecosystem relationships than small onsite mitigation projects.

Additional information and periodic updates will be posted at the Woolsey Wet Prairie Sanctuary Website at: http://ecoarkansas.com/WoolseyMain.html

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6.0 – Appendices

Appendix I
Woolsey Wet Prairie
Master Plant Species List

MASTER PLANT LIST FOR WOOLSEY WET PRAIRIE - updated November 2012 - 396 taxa

SCIENTIFIC NAME	WETLAND INDICATOR STATUS	CODE	COMMON NAME	FAMILY	STRATA	SOURCE CODE
Abutilon theophrastii *	*FACU-*	ABUT THEO	pie-maker	MALVACEAE	herb	5
Acalypha gracilens	*no data*	ACAL GRAC	copperleaf	EUPHORBIACEAE	herb	5
Acalypha virginica	*FACU-*	ACAL VIRG	Virginia copperleaf	EUPHORBIACEAE	herb	3
Acer negundo	*FACW*	ACER NEGU	boxelder	ACERACEAE	tree/sapling	5
Acer saccharinum	*FACW*	ACER SACC	silver maple	ACERACEAE	tree/sapling	9
Achillea millefolium	*FACU*	ACHI MILL	yarrow	ASTERACEAE	herb	12
Agalinis fasciculata	*FAC*	AGAL FASC	gerardia	SCROPHULARIACEAE	herb	6
Agrostis gigantea *	*FACW*	AGRO GIGA	redtop	POACEAE	herb	3
Agrostis hyemalis	*FAC*	AGRO HYEM	ticklegrass	POACEAE	herb	5
Ailanthus altissima *	*NI*	AILA ALTI	tree-of-heaven	SIMAROUBACEAE	tree/sapling	10
Allium vineale *	*FACU-*	ALLI VINE	field garlic	ALLIACEAE	herb	3
Amaranthus cf. viridis *	*NO*	AMAR VIRI	pigweed	AMARANTHACEAE	herb	4
Amaranthus spinosus	*FACU*	AMAR SPIN	spiny pigweed	AMARANTHACEAE	herb	3
Ambrosia artemisiifolia	*FACU*	AMBR ARTE	common ragweed	ASTERACEAE	herb	3
Ambrosia bidentata	*no data*	AMBR BIDE	lanceleaf ragweed	ASTERACEAE	herb	3
Ambrosia trifida	*FAC*	AMBR TRIF	giant ragweed	ASTERACEAE	herb	3
Ammannia X coccinea	*FACW+*	AMMA COCC	toothcup	LYTHRACEAE	herb	3
Ampelopsis cordata	*FAC+*	AMPE CORD	heartleaf ampelopsis	VITACEAE	woody vine	10
Andropogon gerardii	*FAC*	ANDR GERA	big bluestem	POACEAE	herb	3
Andropogon glomeratus	*FACW+*	ANDR GLOM	bushy bluestem	POACEAE	herb	11
Andropogon virginicus	*FAC-*	ANDR VIRG	broomsedge bluestem	POACEAE	herb	3
Apios americana	*FACW*	APIO AMER	groundnut	FABACEAE	herb	3
Apocynum cannabinum	*FAC-*	APOC CANN	Indian hemp	APOCYNACEAE	herb	3
Aristida dichotoma	*FACU*	ARIS DICH	churchmouse three-awn	POACEAE	herb	8
Aristida oligantha	*no data*	ARIS OLIG	three-awn	POACEAE	herb	8
Asclepias amplexicaulis	*no data*	ASCL AMPL	curly milkweed	ASCLEPIADACEAE	herb	3
Asclepias longifolia ssp. hirtella	*UPL*	ASCL HIRT	longleaf milkweed	ASCLEPIADACEAE	herb	3
Asclepias viridis	*no data*	ASCL VIRI	spider milkweed	ASCLEPIADACEAE	herb	3
Baptisia alba var. macrophylla	*no data*	BAPT ALBA	white false indigo	FABACEAE	herb	3
Baptisia bracteata var. leucophaea	*no data*	BAPT BRAC	cream false indigo	FABACEAE	herb	1
Barbarea vulgaris *	*FAC*	BARB VULG	yellow rocket	BRASSICACEAE	herb	5
Bidens aristosa	*FACW*	BIDE ARIS	tickseed sunflower	ASTERACEAE	herb	8
Bidens frondosa	*FACW*	BIDE FRON	tickseed sunflower	ASTERACEAE	herb	13
Boltonia asteroides	*FACW*	BOLT ASTE	false aster	ASTERACEAE	herb	3
Boltonia diffusa	*FAC*	BOLT DIFF	doll's daisy	ASTERACEAE	herb	8
Brassica rapa *	*no data*	BRAS RAPA	turnip	BRASSICACEAE	herb	5
Bromus catharticus *	*no data*	BROM CATH	rescue grass	POACEAE	herb	5
Bromus hordeaceus *	*no data*	BROM HORD	soft chess	POACEAE	herb	5
Bromus inermis *	*no data*	BROM INER	smooth broome	POACEAE	herb	5
Bromus racemosus *	*no data*	BROM RACE	bald brome	POACEAE	herb	5

*Bromus tectorum **	*no data*	BROM TECT	cheatgrass	POACEAE	herb	5
Callitriche heterophylla	*OBL*	CALL HETE	water starwort	CALLITRICHACEAE	herb	5
Campsis radicans	*FAC*	CAMP RADI	trumpet creeper	BIGNONIACEAE	herb	10
*Capsella bursa-pastoris **	*FACU+*	CAPS BURS	shepherd's purse	BRASSICACEAE	herb	5
Cardamine parviflora var. arenicola	*FACU*	CARD PARV AREN	small-flowered bittercress	BRASSICACEAE	herb	5
*Carduus nutans **	*no data*	CARD NUTA	nodding thistle	ASTERACEAE	herb	4
Carex annectens	*FACW*	CARX ANNE	a sedge	CYPERACEAE	herb	5
Carex arkansana	*no data*	CARX ARKA	Arkansas sedge	CYPERACEAE	herb	5
Carex austrina	*no data*	CARX AUST	a sedge	CYPERACEAE	herb	5
Carex brevior	*OBL*	CARX BREV	a sedge	CYPERACEAE	herb	5
Carex bushii	*FACW*	CARX BUSH	Bush's sedge	CYPERACEAE	herb	5
Carex complanata	*FAC+*	CARX COMP	a sedge	CYPERACEAE	herb	5
Carex festucacea	*FACW*	CARX FEST	a sedge	CYPERACEAE	herb	5
Carex fissa	*FACW+*	CARX FISS	hammock sedge	CYPERACEAE	herb	5
Carex flaccosperma	*FAC+*	CARX FLAC	a sedge	CYPERACEAE	herb	9
Carex frankii	*OBL*	CARX FRAN	Frank's sedge	CYPERACEAE	herb	5
Carex glaucodea	*no data*	CARX GLAU	blue sedge	CYPERACEAE	herb	15
Carex granularis	*FACW*	CARX GRAN	granular sedge	CYPERACEAE	herb	5
Carex hirsutella	*no data*	CARX HIRS	a sedge	CYPERACEAE	herb	5
Carex leavenworthii	*no data*	CARX LEAV	Leavenworth's sedge	CYPERACEAE	herb	5
Carex meadii	*FAC*	CARX MEAD	Mead's sedge	CYPERACEAE	herb	7
Carex oklahomensis	*OBL*	CARX OKLA	Oklahoma sedge	CYPERACEAE	herb	3
Carex opaca	*no data*	CARX OPAC	opaque prairie sedge	CYPERACEAE	herb	5
Carex pellita	*OBL*	CARX PELL	woolly sedge	CYPERACEAE	herb	5
Carex retroflexa	*no data*	CARX RETR	a sedge	CYPERACEAE	herb	5
Carex scoparia	*FACW*	CARX SCOP	pointed sedge	CYPERACEAE	herb	16
Carex shortiana	*FACW*	CARX SHOR	Short's sedge	CYPERACEAE	herb	14
Carex vulpinoidea	*OBL*	CARX VULP	foxtail sedge	CYPERACEAE	herb	3
Catalpa bignonioides	*FAC-*	CATA BIGN	catalpa	BIGNONIACEAE	tree/sapling	3
Celtis occidentalis	*FACU*	CELT OCCI	hackberry	CELTIDACEAE	tree/sapling	8
Cephalanthus occidentalis	*OBL*	CEPH OCCI	buttonbush	RUBIACEAE	shrub	3
*Cerastium pumilum **	*no data*	CERA PUMI	chickweed	CARYOPHYLLACEAE	herb	4
Ceratophyllum demersum	*OBL*	CERA DEME	coontail	CERATOPHYLLACEAE	herb	10
Chamaesyce maculata	*no data*	CHAM MACU	spotted spurge	EUPHORBIACEAE	herb	3
Chamaesyce nutans	*FACU*	CHAM NUTA	spurge	EUPHORBIACEAE	herb	8
Chenopodium album	*FAC-*	CHEN ALBU	lamb's quarters	CHENOPODIACEAE	herb	3
Cicuta maculata	*OBL*	CICU MACU	water hemlock	APIACEAE	herb	5
*Cirsium vulgare **	*FAC*	CIRS VULG	common thistle	ASTERACEAE	herb	8
*Conium maculatum **	*FACW*	CONI MACU	poison hemlock	APIACEAE	herb	7
Conyza canadensis	*FACU*	CONY CANA	horseweed	ASTERACEAE	herb	3
Coreopsis grandiflora	*no data*	CORE GRAN	tickseed	ASTERACEAE	herb	5
Cornus drummondii	*FAC*	CORN DRUM	rough-leaved dogwood	CORNACEAE	shrub	3
Corydalis crystallina	*no data*	CORY CRYS	mealy fumewort	FUMARIACEAE	herb	5
Crataegus crus-galli	*FAC-*	CRAT CRUS	cockspur hawthorn	ROSACEAE	shrub	3
Crataegus mollis	*FAC*	CRAT MOLL	hairy hawthorn	ROSACEAE	herb	8
Crotalaria sagittalis	*no data*	CROT SAGI	rattlebox	FABACEAE	herb	12
Croton capitatus	*no data*	CROT CAPI	goatweed	EUPHORBIACEAE	herb	3
Croton glandulosus var. septentrionalis	*no data*	CROT GLAN SEPT	tropic croton	EUPHORBIACEAE	herb	3

Croton monanthogynus	*no data*	CROT MONA	prairie tea	EUPHORBIACEAE	herb	8
Croton willdenowii	*no data*	CROT WILD	rushfoil	EUPHORBIACEAE	herb	3
Cruciata pedemontana *	*no data*	CRUC PEDE	yellow-flowered bedstraw	RUBIACEAE	herb	5
Cuscuta campestris	*no data*	CUSC CAMP	field dodder	CONVOLVULACEAE	herb	12
Cynodon dactylon *	*FACU*	CYNO DACT	Bermuda grass	POACEAE	herb	3
Cyperus acuminatus	*OBL*	CYPE ACUM	tapertip flatsedge	CYPERACEAE	herb	6
Cyperus echinatus	*FAC*	CYPE ECHI	globe flatsedge	CYPERACEAE	herb	3
Cyperus erythrorhizos	*OBL*	CYPE ERYT	redroot flatsedge	CYPERACEAE	herb	11
Cyperus esculentus	*FAC*	CYPE ESCU	yellow nutsedge	CYPERACEAE	herb	3
Cyperus flavescens	*OBL*	CYPE FLAV	yellow flatsedge	CYPERACEAE	herb	3
Cyperus lupulinus	*no data*	CYPE LUPU	flatsedge	CYPERACEAE	herb	4
Cyperus odoratus	*FACW*	CYPE ODOR	rusty flatsedge	CYPERACEAE	herb	6
Cyperus pseudovegetus	*FACW*	CYPE PSEU	marsh flatsedge	CYPERACEAE	herb	3
Cyperus strigosus	*FACW*	CYPE STRI	false nutsedge	CYPERACEAE	herb	1
Dactylis glomerata *	*FACU*	DACT GLOM	orchard grass	POACEAE	herb	3
Datura stramonium *	*no data*	DATU STRA	Jimson weed	SOLANACEAE	herb	5
Daucus carota *	*no data*	DAUC CARO	Queen Anne's lace	APIACEAE	herb	3
Desmodium canescens/illinoense	*no data*	DESM SP	tick-trefoil	FABACEAE	herb	12
Desmodium nuttallii	*no data*	DESM NUTT	tick-trefoil	FABACEAE	herb	8
Desmodium obtusum	*no data*	DESM OBTU	tick-trefoil	FABACEAE	herb	8
Desmodium paniculatum	*FACU*	DESM PANI	tick-trefoil	FABACEAE	herb	3
Desmodium sessilifolium	*no data*	DESM SESS	sessile-leaf tick-trefoil	FABACEAE	herb	16
Dichanthelium aciculare	*FACU*	DICH ACIC	slimleaf rosettegrass	POACEAE	herb	3
Dichanthelium acuminatum	*FAC*	DICH ACUM	pointed rosettegrass	POACEAE	herb	3
Dichanthelium clandestinum	*FACW*	DICH CLAN	deer-tongue rosettegrass	POACEAE	herb	8
Dichanthelium commutatum	*FAC*	DICH COMM	variable rosettegrass	POACEAE	herb	11
Dichanthelium dichotomum	*FAC*	DICH DICH	rosettegrass	POACEAE	herb	3
Dichanthelium oligosanthes var. scribnerianum	*FACU*	DICH OLIG SCRI	Scribner's rosettegrass	POACEAE	herb	5
Dichanthelium scoparium	*FACW*	DICH SCOP	velvet rosettegrass	POACEAE	herb	3
Dichanthelium sphaerocarpon	*FACU*	DICH SPHA	rosettegrass	POACEAE	herb	5
Digitaria ciliaris *	*FAC*	DIGI CILI	southern crabgrass	POACEAE	herb	4
Digitaria ischaemum *	*UPL*	DIGI ISHA	smooth crabgrass	POACEAE	herb	3
Diodia teres	*FACU-*	DIOD TERE	poorjoe	RUBIACEAE	herb	3
Diodia virginiana	*FACW*	DIOD VIRG	Virginia buttonweed	RUBIACEAE	herb	3
Diospyros virginiana	*FAC*	DIOS VIRG	persimmon	EBENACEAE	tree/sapling	3
Dysphania ambrosioides *	*FACU*	DYSP AMBR	wormseed	CHENOPODIACEAE	herb	3
Echinochloa colona *	*FACW*	ECHI COLO	jungle rice	POACEAE	herb	3
Echinochloa crus-galli *	*FACW-*	ECHI CRUS	barnyard grass	POACEAE	herb	1
Echinochloa muricata	*FAC*	ECHI MURI	barnyard grass	POACEAE	herb	3
Eclipta prostrata	*FACW-*	ECLI PROS	yerba de tajo	ASTERACEAE	herb	1
Eleocharis acicularis	*OBL*	ELEO ACIC	least spikerush	CYPERACEAE	herb	5
Eleocharis lanceolata	*FACW*	ELEO LANC	spikerush	CYPERACEAE	herb	3
Eleocharis macrostachya	*OBL*	ELEO MACR	pale spikerush	CYPERACEAE	herb	16
Eleocharis obtusa	*OBL*	ELEO OBTU	blunt spikerush	CYPERACEAE	herb	3
Eleocharis palustris	*OBL*	ELEO PALU	common spikerush	CYPERACEAE	herb	3
Eleocharis quadrangulata	*OBL*	ELEO QUAD	squarestem spikerush	CYPERACEAE	herb	9
Eleocharis tenuis var. verrucosa	*FACW*	ELEO TENU VERR	slender spikerush	CYPERACEAE	herb	5
Eleocharis wolfii	*OBL*	ELEO WOLF	Wolf's spikerush	CYPERACEAE	herb	5

*Eleusine indica **	*FACU*	ELEU INDI	India goosegrass	POACEAE	herb	3
Elymus glabrifloris	*no data*	ELYM GLAB	wild rye	POACEAE	herb	3
Eragrostis spectabilis	*FACU*	ERAG SPEC	purple lovegrass	POACEAE	herb	3
Eragrostis intermedia	*no data*	ERAG INTE	lovegrass	POACEAE	herb	8
Erechtites hieraciifolia	*FAC-*	EREC HIER	fireweed	ASTERACEAE	herb	8
Erigeron annuus	*FACU*	ERIG ANNU	fleabane	ASTERACEAE	herb	3
Erigeron strigosus	*FAC*	ERIG STRI	daisy fleabane	ASTERACEAE	herb	5
Eryngium yuccifolium +	*FAC*	ERYN YUCC	rattlensnake master	APIACEAE	herb	10
Eupatorium perfoliatum	*FACW+*	EUPA PERF	clasping boneset	ASTERACEAE	herb	3
Eupatorium serotinum	*FAC*	EUPA SERO	late boneset	ASTERACEAE	herb	1
Festuca rubra	*FACU+*	FEST RUBR	red fescue	POACEAE	herb	2
Fimbristylis annua	*FACW*	FIMB ANNU	annual fimbry	CYPERACEAE	herb	9
Fimbristylis puberula	*OBL*	FIMB PUBE	hairy fimbry	CYPERACEAE	herb	5
Fraxinus pennsylvanica	*FACW*	FRAX PENN	green ash	OLEACEAE	tree/sapling	3
Galactia regularis	*no data*	GALA REGU	milk pea	FABACEAE	herb	3
Galium obtusum	*FACW-*	GALI OBTU	bluntleaf bedstraw	RUBIACEAE	herb	7
Galium pilosum	*no data*	GALI PILO	hairy bedstraw	RUBIACEAE	herb	4
Gamochaeta purpurea	*UPL*	GAMO PURP	purple cudweed	ASTERACEAE	herb	5
Gaura longiflora	*no data*	GAUR LONG	gaura	ONAGRACEAE	herb	8
Geranium carolinianum	*no data*	GERA CARO	Carolina cranesbill	GERANIACEAE	herb	5
*Geranium dissectum **	*no data*	GERA DISS	cutleaf cranesbill	GERANIACEAE	herb	5
*Geranium molle **	*no data*	GERA MOLL	dovesfoot cranesbill	GERANIACEAE	g	4
Glandularia canadensis	*no data*	GLAN CANA	rose vervain	VERBENACEAE	herb	3
Gleditsia triacanthos	*FAC-*	GLED TRIA	honey locust	FABACEAE	tree/sapling	3
Glyceria septentrionalis	*OBL*	GLYC SEPT	mannagrass	POACEAE	herb	3
Gratiola neglecta	*OBL*	GRAT NEGL	hedge-hyssop	SCROPHULARIACEAE	herb	9
Gratiola virginiana	*OBL*	GRAT VIRG	hedge-hyssop	SCROPHULARIACEAE	herb	3
Helenium amarum	*FACU-*	HELE AMAR	bitterweed	ASTERACEAE	herb	3
Helenium flexuosum	*FACW*	HELE FLEX	purple-headed sneezeweed	ASTERACEAE	herb	1
Helenium autumnale	*FACW*	HELE AUTU	fall sneezeweed	ASTERACEAE	herb	8
Helianthus grosseserratus	*FAC+*	HELI GROS	sawtooth sunflower	ASTERACEAE	herb	3
Helianthus mollis	*no data*	HELI MOLL	ashy sunflower	ASTERACEAE	herb	3
Hibiscus moscheutos ssp. lasiocarpos	*OBL*	HIBI MOSC LASI	rose mallow	MALVACEAE	herb	3
Hieracium gronovii	*UPL*	HIER GRON	hawkweed	ASTERACEAE	herb	2
*Hordeum pusillum **	*FACU*	HORD PUSI	little barley	POACEAE	herb	5
Hypericum drummondii	*FACU*	HYPE DRUM	nits-and-lice	CLUSIACEAE	herb	8
Hypericum gymnanthum	*FACW*	HYPE GYMN	clasping St. John's wort	CLUSIACEAE	herb	10
Hypericum hypericoides var. multicaule	*FAC*	HYPE HYPE MULT	creeping St. Andrew's cross	CLUSIACEAE	shrub	3
Hypericum mutilum	*FACW*	HYPE MUTI	dwarf St. John's wort	CLUSIACEAE	herb	9
Hypericum punctatum	*FAC*	HYPE PUNC	dotted St. John's wort	CLUSIACEAE	herb	8
Ipomoea lacunosa	*FAC+*	IPOM LACU	whitestar morning glory	CONVOLVULACEAE	herb	10
Ipomoea pandurata	*FACU*	IPOM PAND	wild potato vine	CONVOLVULACEAE	herb	5
Isolepis carinata	*FACW+*	ISOL CARI	bulrush	CYPERACEAE	herb	5
Juncus anthelatus	*no data*	JUNC ANTH	rush	JUNCACEAE	herb	3
Juncus biflorus	*FACW*	JUNC BIFL	rush	JUNCACEAE	herb	3
Juncus brachycarpus	*FACW*	JUNC BRAC	rush	JUNCACEAE	herb	9
Juncus diffusissimus	*FACW*	JUNC DIFF	spreading rush	JUNCACEAE	herb	10

Juncus effusus	*FACW+*	JUNC EFFU	soft rush	JUNCACEAE	herb	3
Juncus interior	*FACU*	JUNC INTE	inland rush	JUNCACEAE	herb	5
Juncus marginatus	*FACW*	JUNC MARG	rush	JUNCACEAE	herb	8
Juncus secundus	*FAC*	JUNC SECU	rush	JUNCACEAE	herb	4
Juncus validus	*FACW+*	JUNC VALI	rush	JUNCACEAE	herb	5
Juniperus virginiana	*FACU-*	JUNI VIRG	eastern redcedar	CUPRESSACEAE	tree/sapling	8
Krigia dandelion	*FACU*	KRIG DAND	potato dandelion	ASTERACEAE	herb	7
*Kummerowia stipulacea **	*FACU-*	KUMM STIP	Korean bushclover	FABACEAE	herb	3
*Kummerowia striata **	*FACU*	KUMM STRI	Japanese bushclover	FABACEAE	herb	3
Lactuca canadensis	*FACU-*	LACT CANA	Canada wild lettuce	ASTERACEAE	herb	16
*Lactuca serriola **	*FAC*	LACT SERR	prickly wild lettuce	ASTERACEAE	herb	3
Leersia oryzoides	*OBL*	LEER ORYZ	rice cutgrass	POACEAE	herb	2
Leersia virginica	*FACW*	LEER VIRG	Virginia cutgrass	POACEAE	herb	8
Lemna minuta	*OBL*	LEMN MINU	duckweed	LEMNACEAE	herb	5
Lepidium virginicum	*FACU*	LEPI VIRG	Virginia peppergrass	BRASSICACEAE	herb	3
*Lespedeza cuneata **	*NI*	LESP CUNE	sericea lespedeza	FABACEAE	herb	3
Leucospora multifida	*OBL*	LEUC MULT	leucospora	SCROPHULARIACEAE	herb	5
*Ligustrum sinense **	*FAC*	LIGU SINE	Chinese privet	OLEACEAE	shrub	17
Lindernia anagallidea	*OBL*	LIND ANAG	false pimpernel	SCROPHULARIACEAE	herb	10
Lobelia siphilitica	*OBL*	LOBE SIPH	big blue lobelia	CAMPANULACEAE	herb	8
Lobelia spicata	*FAC*	LOBE SPIC	spike lobelia	CAMPANULACEAE	herb	5
*Lolium perenne **	*FACU*	LOLI PERE	ryegrass	POACEAE	herb	5
*Lonicera japonica **	*FAC-*	LONI JAPO	Japanese honeysuckle	CAPRIFOLIACEAE	woody vine	3
*Lonicera maackii **	*no data*	LONI MAAC	bush honeysuckle	CAPRIFOLIACEAE	shrub	17
Lonicera sempervirens	*FAC*	LONI SEMP	trumpet honeysuckle	CAPRIFOLIACEAE	woody vine	5
Ludwigia alternifolia	*OBL*	LUDW ALTE	seedbox	ONAGRACEAE	herb	8
Ludwigia palustris	*OBL*	LUDW PALU	creeping seedbox	ONAGRACEAE	herb	3
Ludwigia peploides ssp. glabrescens	*OBL*	LUDW PEPL GLAB	floating primrose-willow	ONAGRACEAE	herb	3
Luzula echinata	*FAC*	LUZU ECHI	wood rush	JUNCACEAE	herb	10
Lycopus americanus	*OBL*	LYCO AMER	American water horehound	LAMIACEAE	herb	8
Lythrum alatum	*FACW+*	LYTH ALAT	winged loosestrife	LYTHRACEAE	herb	5
*Maclura pomifera **	*FACU*	MACL POMI	bois d'arc	MORACEAE	tree/sapling	3
Mecardonia acuminata	*FACW*	MECA ACUM	purple axilflower	SCROPHULARIACEAE	herb	3
*Medicago sp. **	*no data*	MEDI SP.	medic	FABACEAE	herb	16
*Melilotus albus **	*FACU-*	MELI ALBU	white sweetclover	FABACEAE	herb	3
*Melilotus officinalis **	*FACU-*	MELI OFFI	yellow sweetclover	FABACEAE	herb	16
Melothria pendula	*FACW-*	MELO PEND	dwarf cucumber vine	CUCURBITACEAE	herb	10
Mimosa quadrivalvis var. nuttallii	*no data*	MIMO QUAD NUTT	sensitive brier	FABACEAE	herb	3
Mollugo verticillata	*FAC*	MOLL VERT	green carpetweed	MOLLUGINACEAE	herb	10
Morus rubra	*FAC*	MORU RUBR	red mulberry	MORACEAE	herb	8
Muhlenbergia schreberi	*FAC*	MUHL SCHR	nimblewill	POACEAE	herb	8
Myriophyllum sp.	*OBL*	MYRI SP	water milfoil	HALORAGACEAE	herb	9
Nothoscordum bivalve	*FAC*	NOTH BIVA	crow poison	ALLIACEAE	herb	7
Nuttallanthus texanus	*no data*	NUTT TEXA	blue toadflax	SCROPHULARIACEAE	herb	5
Oenothera biennis	*FACU*	OENO BIEN	evening-primrose	ONAGRACEAE	herb	7
Oenothera laciniata	*FACU*	OENO LACI	cutleaf evening-primrose	ONAGRACEAE	herb	5
Orbexilum pedunculatum var. pedunculatum	*FACU*	ORBE PEDU	Sampson's snakeroot	FABACEAE	herb	5
Oxalis dillenii	*no data*	OXAL DILL	yellow wood sorrel	OXALIDACEAE	herb	3

Oxalis violacea	*no data*	OXAL VIOL	violet woodsorrel	OXALIDACEAE	herb	5
Panicum anceps	*FAC-*	PANI ANCE	beaked panicgrass	POACEAE	herb	3
Panicum capillare	*FAC*	PANI CAPI	witchgrass	POACEAE	herb	8
Panicum dichotomiflorum	*FACW*	PANI DICH	fall panicgrass	POACEAE	herb	3
Panicum rigidulum	*FACW*	PANI RIGI	rigid panicgrass	POACEAE	herb	5
Panicum virgatum	*FAC+*	PANI VIRG	switchgrass	POACEAE	herb	3
*Paspalum dilatatum **	*FAC+*	PASP DILA	Dallisgrass	POACEAE	herb	3
Paspalum floridanum	*FACW-*	PASP FLOR	Florida crowngrass	POACEAE	herb	3
Paspalum laeve	*FACW-*	PASP LAEV	field paspalum	POACEAE	herb	3
*Paspalum notatum **	*FACU+*	PASP NOTA	Bahia grass	POACEAE	herb	10
Paspalum pubiflorum	*FACW*	PASP PUBI	hairyseed crowngrass	POACEAE	herb	10
Paspalum setaceum	*FAC*	PASP SETA	thin crowngrass	POACEAE	herb	4
Passiflora incarnata	*no data*	PASS INCA	passion flower	PASSIFLORACEAE	herb	3
Penstemon digitalis	*FAC*	PENS DIGI	foxglove beard-tongue	SCROPHULARIACEAE	herb	5
Penstemon tubaeflorus	*no data*	PENS TUBA	whitewand beard-tongue	SCROPHULARIACEAE	herb	3
*Persicaria hydropiper **	*OBL*	PERS HYDROPIPER	water pepper	POLYGONACEAE	herb	6
Persicaria hydropiperoides	*OBL*	PERS HYDROPIPEROIDES	wild water pepper	POLYGONACEAE	herb	3
Persicaria lapathifolia	*FACW*	PERS LAPA	pale smartweed	POLYGONACEAE	herb	3
*Persicaria longiseta **	*no data*	PERS LONG	pink smartweed	POLYGONACEAE	herb	8
*Persicaria maculosa **	*FACW*	PERS MACU	lady's-thumb	POLYGONACEAE	herb	6
Persicaria pensylvanica	*FACW*	PERS PENS	Pennsylvania smartweed	POLYGONACEAE	herb	3
Persicaria punctata	*FACW+*	PERS PUNC	dotted smartweed	POLYGONACEAE	herb	2
Physalis angulata	*FAC*	PHYS ANGU	smooth groundcherry	SOLANACEAE	herb	8
Physalis heterophylla	*no data*	PHYS HETE	clammy groundcherry	SOLANACEAE	herb	10
Physalis longifolia	*no data*	PHYS LONG	longleaf groundcherry	SOLANACEAE	herb	10
Physalis pumila	*no data*	PHYS PUMI	prairie groundcherry	SOLANACEAE	herb	3
Physostegia angustifolia	*FACW*	PHYS ANGU	false dragonhead	LAMIACEAE	herb	3
Phytolacca americana	*FACU+*	PHYT AMER	pokeweed	PHYTOLACACEAE	herb	3
Plantago aristata	*no data*	PLAN ARIS	bracted plantain	PLANTAGINACEAE	herb	3
*Plantago lanceolata **	*FAC*	PLAN LANC	English plantain	PLANTAGINACEAE	herb	3
*Plantago rugelii **	*FAC*	PLAN RUGE	blackseed plantain	PLANTAGINACEAE	herb	2
Plantago virginica	*FACU-*	PLAN VIRG	Virginia plantain	PLANTAGINACEAE	herb	5
Platanus occidentalis	*FACW-*	PLAT OCCI	American sycamore	PLATANACEAE	tree/sapling	12
*Poa annua **	*FAC*	POA ANNU	annual bluegrass	POACEAE	herb	5
*Poa compressa **	*FACU-*	POA COMP	Canada bluegrass	POACEAE	herb	3
*Poa pratensis **	*FACU+*	POA PRAT	Kentucky bluegrass	POACEAE	herb	5
Polygala incarnata	*FAC-*	POLY INCA	pink milkwort	POLYGALACEAE	herb	16
Polygala sanguinea	*FAC-*	POLY SANG	purple milkwort	POLYGALACEAE	herb	10
*Polygonum aviculare **	*FAC-*	POLY AVIC	knotweed	POLYGONACEAE	herb	3
Polygonum erectum	*FACU*	POLY EREC	erect knotweed	POLYGONACEAE	herb	10
Populus deltoides	*FAC+*	POPU DELT	eastern cottonwood	SALICACEAE	tree/sapling	10
Potamogeton diversifolius	*OBL*	POTA DIVE	pondweed	POTAMOGETONACEAE	herb	5
Potamogeton nodosus	*OBL*	POTA NODO	pondweed	POTAMOGETONACEAE	herb	1
Potamogeton pusillus	*OBL*	POTA PUSI	narrowleaf pondweed	POTAMOGETONACEAE	herb	11
*Potentilla recta **	*no data*	POTE RECT	rough-fruited cinquefoil	ROSACEAE	herb	5
Potentilla simplex	*FACU*	POTE SIMP	cinquefoil	ROSACEAE	herb	5
Proserpinaca palustris	*OBL*	PROS PALU	mermaid weed	HALORAGACEAE	herb	1

Prunella vulgaris ssp. lanceolata	*FAC-*	PRUN VULG	heal-all	LAMIACEAE	herb	4
Prunus serotina	*FACU*	PRUN SERO	black cherry	ROSACEAE	tree/sapling	3
Pycnanthemum pilosum	*UPL*	PYCN PILO	hairy mountain mint	LAMIACEAE	herb	7
Pycnanthemum tenuifolium	*FAC-*	PYCN TENU	slender mountain mint	LAMIACEAE	herb	3
Pycnanthemum pilosum X P. tenuifolium	*no data*	PYCN PILO X TENU	hybrid mountain mint	LAMIACEAE	herb	13
Pyrrhopappus carolinianus	*no data*	PYRR CARO	false dandelion	ASTERACEAE	herb	12
*Pyrus calleryana **	*no data*	PYRU CALL	callery pear	ROSACEAE	tree/sapling	3
Quercus +	-	QUER SP.	oak	FAGACEAE	tree/sapling	10
*Ranunculus bulbosus**	*FAC+*	RANU BULB	bulbous buttercup	RANUNCULACEAE	herb	1
Ranunculus laxicaulis	*OBL*	RANU LAXI	water plantain spearwort	RANUNCULACEAE	herb	5
*Ranunculus parviflorus **	*FAC*	RANU PARV	smallflower crowfoot	RANUNCULACEAE	herb	5
*Ranunculus sardous **	*FAC+*	RANU SARD	hairy buttercup	RANUNCULACEAE	herb	3
Rhexia mariana	*FACW+*	RHEX MARI	meadow beauty	MELASTOMATACEAE	herb	10
Rhus copallinum	*NI*	RHUS COPA	winged sumac	ANACARDIACEAE	shrub	10
Rhus glabra	*no data*	RHUS GLAB	smooth sumac	ANACARDIACEAE	shrub	10
Rhynchospora harveyi	*OBL*	RHYN HARV	Harvey's beaksedge	CYPERACEAE	herb	5
Rhynchospora macrostachya	*OBL*	RHYN MACR	tall horned beaksedge	CYPERACEAE	herb	1
Rhynchospora recognita	*FACW*	RHYN RECO	beaksedge	CYPERACEAE	herb	14
Rorippa palustris ssp. fernaldiana	*OBL*	RORI PALU FERN	Fernald's yellowcress	BRASSICACEAE	herb	12
Rosa carolina	*FACU*	ROSA CARO	Carolina rose	ROSACEAE	shrub	3
*Rosa multiflora **	*UPL*	ROSA MULT	multiflora rose	ROSACEAE	shrub	3
Rosa setigera	*FACU*	ROSA SETI	prairie rose	ROSACEAE	shrub	3
Rotala ramosior	*OBL*	ROTA RAMO	toothcup	LYTHRACEAE	herb	3
Rubus argutus	*FACU+*	RUBU ARGU	highbush blackberry	ROSACEAE	shrub	4
*Rubus pascuus **	*UPL*	RUBU PASC	Himalayan blackberry	ROSACEAE	shrub	5
Rubus flagellaris	*UPL*	RUBU FLAG	northern dewberry	ROSACEAE	herb	3
Rudbeckia hirta	*FACU*	RUDB HIRT	black-eyed Susan	ASTERACEAE	herb	3
Rudbeckia subtomentosa	*FAC+*	RUDB SUBT	sweet coneflower	ASTERACEAE	herb	3
Ruellia humilis var. humilis	*FACU*	RUEL HUMI	hairy wild petunia	ACANTHACEAE	herb	3
*Rumex acetosella **	*FACU+*	RUME ACET	red sorrel	POLYGONACEAE	herb	5
Rumex altissimus	*FACW*	RUME ALTI	pale dock	POLYGONACEAE	herb	4
*Rumex crispus **	*FAC*	RUME CRIS	curly dock	POLYGONACEAE	herb	3
Sabatia angularis	*FAC*	SABA ANGU	winged rosepink	GENTIANACEAE	herb	5
Sabatia campestris	*FACU*	SABA CAMP	prairie rosepink	GENTIANACEAE	herb	7
Sagittaria montevidensis	*OBL*	SAGI MONT	duck potato	ALISMATACEAE	herb	3
Salix nigra	*OBL*	SALI NIGR	black willow	SALICACEAE	tree/sapling	3
*Salsola tragus **	*FACU*	SALS TRAG	Russian thistle	CHENOPODIACEAE	herb	11
Salvia lyrata	*FAC-*	SALV LYRA	cancerweed	LAMIACEAE	herb	3
Sassafras albidum	*FACU*	SASS ALBI	sassafras	LAURACEAE	tree/sapling	3
*Schedonorus arundinaceus **	*FAC-*	SCHE ARUN	tall fescue	POACEAE	herb	3
Schizachyrium scoparium	*FACU*	SCHI SCOP	little bluestem	POACEAE	herb	3
Schoenoplectus tabernaemontani	*OBL*	SCHO TABE	softstem bulrush	CYPERACEAE	herb	9
Scirpus georgianus	*OBL*	SCIR GEOR	Georgia bulrush	CYPERACEAE	herb	3
Scirpus pendulus	*OBL*	SCIR PEND	drooping bulrush	CYPERACEAE	herb	5
Scleria ciliata	*FAC*	SCLE CILI	fringed nutrush	CYPERACEAE	herb	12
Scleria pauciflora var. caroliniana	*FAC+*	SCLE PAUC	fewflower nutrush	CYPERACEAE	herb	5
*Setaria faberi **	*UPL*	SETA FABE	Chinese foxtail	POACEAE	herb	3
*Setaria italica **	*FACU*	SETA ITAL	Italian foxtail	POACEAE	herb	14

Setaria parviflora	*FAC*	SETA PARV	knotroot bristlegrass	POACEAE	herb	3
Setaria pumila ssp. pumila *	*FAC*	SETA PUMI	yellow foxtail	POACEAE	herb	3
Sherardia arvensis *	*no data*	SHER ARVE	field madder	RUBIACEAE	herb	5
Sida spinosa *	*FACU*	SIDA SPIN	prickly sida	MALVACEAE	herb	3
Sideroxylon lanuginosum	*FACU*	SIDE LANU	chittum wood	SAPOTACEAE	tree/sapling	3
Silphium laciniatum	*no data*	SILP LACI	compass plant	ASTERACEAE	herb	7
Sisymbrium officinale *	*no data*	SISY OFFI	hedge mustard	BRASSICACEAE	herb	5
Sisyrinchium angustifolium	*FAC*	SISY ANGU	blue-eyed grass	IRIDACEAE	herb	7
Sisyrinchium atlanticum	*FACW-*	SISY ATLA	blue-eyed grass	IRIDACEAE	herb	5
Smilax bona-nox	*FAC*	SMIL BONA	bull greenbrier	SMILACACEAE	woody vine	3
Solanum carolinense	*FACU*	SOLA CARO	Carolina horsenettle	SOLANACEAE	herb	3
Solanum physalifolium *	*no data*	SOLA PHYS	hairy nightshade	SOLANACEAE	herb	6
Solidago altissima	*FACU*	SOLI CANA	tall goldenrod	ASTERACEAE	herb	3
Solidago gigantea	*FACW*	SOLI GIGA	giant goldenrod	ASTERACEAE	herb	16
Solidago rugosa	*FAC*	SOLI RUGO	wrinkleleaf goldenrod	ASTERACEAE	herb	13
Sonchus asper *	*FAC+*	SONC ASPE	spiny sowthistle	ASTERACEAE	herb	10
Sorghastrum nutans	*FACU*	SORG NUTA	Indiangrass	POACEAE	herb	3
Sorghum bicolor *	*FACU*	SORG BICO	sorghum	POACEAE	herb	15
Sorghum halepense *	*FACU*	SORG HALE	Johnson grass	POACEAE	herb	3
Sphenopholis obtusata	*FAC+*	SPHE OBTU	prairie wedgescale	POACEAE	herb	3
Spiranthes cernua	*FACW*	SPIR CERN	nodding ladies'-tresses	ORCHIDACEAE	herb	4
Spiranthes vernalis	*FACW-*	SPIR VERN	spring ladies'-tresses	ORCHIDACEAE	herb	10
Spirodella polyrhiza	*OBL*	SPIR POLY	giant duckweed	LEMNACEAE	herb	5
Sporobolus compositus var. compositus	*UPL*	SPOR COMP	rough dropseed	POACEAE	herb	4
Sporobolus vaginiflorus	*UPL*	SPOR VAGI	dropseed	POACEAE	herb	8
Steinchisma hians	*OBL*	STEI HIAN	gaping panicgrass	POACEAE	herb	1
Stellaria media *	*FACU*	STEL MEDI	common chickweed	CARYOPHYLLACEAE	herb	5
Strophostyles leiosperma	*no data*	STRO LEIO	wild bean	FABACEAE	herb	8
Strophostyles helvola	*FAC*	STRO HELV	amberique-bean	FABACEAE	herb	3
Stylosanthes biflora	*no data*	STYL BIFL	pencil flower	FABACEAE	herb	7
Symphoricarpos orbiculatus	*FAC-*	SYMP ORBI	coralberry	CAPRIFOLIACEAE	shrub	3
Symphyotrichum dumosum	*FAC*	SYMP DUMO	aster	ASTERACEAE	herb	1
Symphyotrichum ericoides	*UPL*	SYMP ERIC	heath aster	ASTERACEAE	herb	3
Symphyotrichum lanceolatum	*NI*	SYMP LANC	tall white ater	ASTERACEAE	herb	5
Symphyotrichum patens	*no data*	SYMP PATE	spreading aster	ASTERACEAE	herb	4
Symphyotrichum pilosum	*FAC-*	SYMP PILO	white heath aster	ASTERACEAE	herb	3
Taraxacum officinale	*FACU*	TARA OFFI	common dandelion	ASTERACEAE	herb	3
Teucrium canadense	*FACW-*	TEUC CANA	germander	LAMIACEAE	herb	10
Torilis arvensis *	*no data*	TORI ARVE	hedge parsley	APIACEAE	herb	3
Toxicodendron radicans	*FAC*	TOXI RADI	poison ivy	ANACARDIACEAE	woody vine	3
Trachelospermum difforme	*FACW*	TRAC DIFF	climbing dogbane	APOCYNACEAE	woody vine	5
Tragia ramosa	*no data*	TRAG RAMO	noseburn	EUPHORBIACEAE	herb	5
Tridens flavus var. flavus	*FACU*	TRID FLAV	purpletop tridens	POACEAE	herb	1
Tridens strictus	*FACW*	TRID STRI	longspike tridens	POACEAE	herb	1
Tridens X oklahomensis	*no data*	TRID OKLA	Oklahoma purpletop	POACEAE	herb	11
Trifolium campestre *	*no data*	TRIF CAMP	hop clover	FABACEAE	herb	5
Trifolium dubium *	*FACU-*	TRIF DUBI	low hop clover	FABACEAE	herb	5
Trifolium pratense *	*FACU-*	TRIF PRAT	red clover	FABACEAE	herb	3

Trifolium repens *	*FACU*	TRIF REPE	white clover	FABACEAE	herb	2
Triodanis perfoliata	*FACU+*	TRIO PERF	Venus' looking glass	CAMPANULACEAE	herb	5
Typha angustifolia *	*OBL*	TYPH ANGU	narrowleaf cattail	TYPHACEAE	herb	7
Typha domingiensis	*OBL*	TYPH DOMI	southern cattail	TYPHACEAE	herb	3
Typha latifolia	*OBL*	TYPH LATI	broadleaf cattail	TYPHACEAE	herb	14
Ulmus alata	*FACU+*	ULMU ALAT	winged elm	ULMACEAE	tree/sapling	3
Ulmus americana	*FACW*	ULMU AMER	American elm	ULMACEAE	tree/sapling	3
Valerianella radiata	*FAC*	VALE RADI	cornsalad	VALERIANACEAE	herb	5
Verbascum thapsus *	*no data*	VERB THAP	woolly mullein	SCROPHULARIACEAE	herb	11
Verbena bracteata	*FACU-*	VERB BRAC	bigbract vervain	VERBENACEAE	herb	16
Verbena hastata	*FAC*	VERB HAST	blue vervain	VERBENACEAE	herb	3
Verbena simplex	*OBL*	VERB SIMP	vervain	VERBENACEAE	herb	5
Verbena urticifolia	*FAC+*	VERB URTI	white vervain	VERBENACEAE	herb	5
Vernonia arkansana	*FAC*	VERN ARKA	Arkansas ironweed	ASTERACEAE	herb	10
Vernonia baldwinii	*UPL*	VERN BALD	Baldwin's ironweed	ASTERACEAE	herb	8
Vernonia missurica	*FAC+*	VERN MISS	Missouri ironweed	ASTERACEAE	herb	3
Veronica arvensis *	*NI*	VERO ARVE	corn speedwell	SCROPHULARIACEAE	herb	5
Veronica peregrina	*FAC+*	VERO PERS	necklace weed	SCROPHULARIACEAE	herb	5
Vicia sativa *	*FACU*	VICI SATI	common vetch	FABACEAE	herb	5
Vitis vulpina	*FAC+*	VITI VULP	fox grape	VITACEAE	woody vine	3
Wolffia brasiliensis	*OBL*	WOLF BRAS	wolffia	LEMNACEAE	herb	11
Xanthium strumarium	*FAC*	XANT STRU	cocklebur	ASTERACEAE	herb	6

Species in bold type are tracked by the Arkansas Natural Heritage Commission (n = 8)

*** = nonnative species (83/396 = 21.0% of total)**

+ = native species intentionally introduced to site (n = 2)

STRATA:

tree = ≥ 5 in dbh and ≥ 20 ft tall

sapling = 0.4 to < 5 in dbh and ≥ 20 ft. tall

shrub = usually 3 to 20 ft tall; multi-stemmed brushy shrubs, small trees, and saplings

woody vine = vines that are woody

herb = graminoids, forbs, ferns, fern allies, herbaceous vines, tree seedlings

SOURCE CODES:

1 = Chris Reid, site inventory, 17 August 2001 (west side)

2 = Bruce Shackleford, plot data

3 = Theo Witsell, site inventory, 1 August 2006

4 = Theo Witsell, Fall 2006 monitoring & inventory

5 = Theo Witsell, June 2007 monitoring & inventory

6 = Theo Witsell, October 2007 monitoring & inventory

7 = Theo Witsell, May/June 2008 monitoring & inventory

8 = Theo Witsell, September 2008 inventory

9 = Theo Witsell, November 2008 monitoring & inventory

10 = Theo Witsell, July 2009 monitoring & inventory

11 = Theo Witsell, October/November 2009 monitoring & inventory

12 = Theo Witsell, July 2010 monitoring & inventory					
13 = Theo Witsell, October/November 2010 monitoring & inventory					
14 = Theo Witsell, July 2011 monitoring & inventory					
15 = Theo Witsell, November 2011 monitoring & inventory					
16 = Theo Witsell, June 2012 monitoring & inventory					
17 = Theo Witsell, November 2012 monitoring & inventory					
Scientific Nomenclature according to Checklist of the Vascular Plants of Arkansas					
Arkansas Vascular Flora Committee. 2006.					