City of Fayetteville Staff Review Form

2020-1136

Legistar File ID

12/18/2020

City Council Meeting Date - Agenda Item Only
N/A for Non-Agenda Item

Garner Stoll	1/5/2021	CITY PLANNING (630)
Submitted By	**Submitted Date**	**Division / Department**

Action Recommendation:

ANX 2020-000001: Annexation (3435 E. ZION RD./BURGE, 100/139): Submitted by WATKINS LAW OFFICE for property located at 3435 E. ZION RD. The property is in the FAYETTEVILLE PLANNING AREA and contains approximately 59.00 acres. The request is to annex the property into the City Limits of Fayetteville with the zoning of R-A, RESIDENTIAL AGRICULTURE.

Budget Impact:

Account Number	Fund
Project Number	Project Title

Budgeted Item?	NA	Current Budget	$	-
		Funds Obligated	$	-
		Current Balance	$	-
Does item have a cost?	No	Item Cost		
Budget Adjustment Attached?	NA	Budget Adjustment		
		Remaining Budget	$	-

V20180321

Purchase Order Number: _____ **Previous Ordinance or Resolution #** _____

Change Order Number: _____ **Approval Date:** _____

Original Contract Number: _____

Comments:

CITY OF
FAYETTEVILLE
ARKANSAS

CITY COUNCIL MEMO

MEETING OF JANUARY 5, 2021

TO: Mayor; Fayetteville City Council

THRU: Susan Norton, Chief of Staff
Garner Stoll, Development Services Director
Jonathan Curth, Development Review Manager

FROM: Jessie Masters, Senior Planner

DATE: December 18, 2020

SUBJECT: **ANX 2020-000001: Annexation (3435 E. ZION RD./BURGE, 100/139):** Submitted by WATKINS LAW OFFICE for property located at 3435 E. ZION RD. The property is in the FAYETTEVILLE PLANNING AREA and contains approximately 59.00 acres. The request is to annex the property into the City Limits of Fayetteville with the zoning of R-A, RESIDENTIAL AGRICULTURE.

RECOMMENDATION:
The Planning Commission and City Planning staff recommend approval of a request to annex the subject property as described and shown in the attached Exhibits 'A' and 'B'.

BACKGROUND:
The subject property is in northeast Fayetteville on the south side of E. Zion Road, about .30 miles east of N. Crossover Road (or Highway 265). The property under consideration is the majority of a 62.2 acre parcel (001-15182-000), and the applicant intends to not include two portions of land that are adjacent to E. Zion Road, bringing the acreage under consideration to 59.00 acres. The property currently has a single-family dwelling, which county records indicate was built in 1947, and associated outbuildings for what has long been an agricultural use. Hilton Creek runs east and west through the site, and the area surrounding the creek is designated as a flood plain. The property is located within 1 mile from the Fayetteville city limits, and the westernmost portion of the property is adjacent to the current City limits; an associated rezoning has also been submitted by the property owners (PZD-2020-000002).

Request: The request is to annex the subject property into the City of Fayetteville. The applicant has stated that the annexation is needed so that the property can be developed. An order of annexation was signed by the Washington County Judge on July 10, 2020.

Land Use Plan Analysis: City Plan 2040's Future Land Use Map designates the properties within the proposed annexation as Residential Neighborhood Area and Natural Area. Residential Neighborhood Areas are primarily residential in nature and offer a wide variety of housing types of appropriate scale and context, encouraging traditional neighborhood development that incorporates low-intensity, non-residential uses on corners and along connecting corridors.

Natural Areas consist of lands with limited development potential, including stream and wildlife corridors and encouraging a development pattern that requires conservation and preservation.
In addition to the Future Land Use Plan, City Plan 2040 sets forth several guiding policies to consider an annexation proposal, which are attached in full to staff's report. These include the potential impacts on Fayetteville's boundaries, services, infrastructure, intergovernmental relations, property administration, and existing environmentally sensitive areas. Staff finds that while the proposed boundary is unusual, it does not create any islands, and begins to square off the existing City limits to the north. Further, the request is compatible with many of these policies, including that the proposed annexation will include environmentally-sensitive areas along Hilton Creek. Staff finds that leaving the land within Washington County does not prevent development from happening, but limits Fayetteville's control over how the land is developed. If the land is annexed into the City's limits, city ordinances such as tree preservation, streamside protection, and zoning enforcement would apply.

Current infrastructure availability to the site is minimal, and staff finds that E. Zion Road is underdeveloped, the site's only point of access, with an under-capacity one-lane bridge. That said, the Master Street Plan indicates a Neighborhood Link Street bisecting the property east and west to connect to N. Crossover Road, that opens up opportunities for development, access for fire and the extension of needed utilities such as water and sewer to the site. Further, the applicant intends to include an adjacent property that is already within the City limits in their development plan, making near-term access to proposed development through this corridor in the annexed portion much more feasible. Staff finds that much of the cost of infrastructure improvements needed would be borne by the developer, but future maintenance would likely be at the City's expense. The school system, Springdale Public Schools, did not comment on the proposal, and neither did the police department.

Despite its potential shortcomings, staff finds that the annexation request is overall of a benefit to the City, given the added development control, the proposed development form of the associated Planned Zoning District, and the ability to offer greater protections over an area of environmental concern with regards to the Hilton Creek floodplain and the Lake Fayetteville watershed.

DISCUSSION:
The item in question was in front of the Planning Commission four times. The item was first brought to Planning Commission on August 24, 2020, where it was tabled indefinitely. Commissioners needed to see a more robust plan for the area for clarity about the potential impact this request could have on the City. The applicant reconfigured an associated rezoning request through a PZD, or Planned Zoning District, re-notified the public, and brought the item with the associated PZD back to Planning Commission on November 9, 2020. Commissioners did not hear the annexation at that meeting, nor at the November 23, 3030 meeting, each time voting to table to the subsequent meeting as details of the associated PZD were worked out. Commissioners heard this annexation request in conjunction with the associated PZD at the December 14, 2020 meeting. Finding in favor on the balance of issues on the annexation itself, and finding the associated PZD appropriate (with added conditions as well as conditions recommended by staff), Commissioners voted to forward the annexation request with a vote of 7-1-0 with a recommendation of approval to City Council. Commissioner Garlock offered the

dissenting vote on the annexation, finding that any development that would occur without annexation likely would not contribute as much asphalt as is what is currently proposed with the associated PZD.

Public comment was received and provided to the Planning Commission ahead of each meeting and is included in full in staff's report. Public comment was heard on the annexation at the August 24, 2020 and at the December 14, 2020 Planning Commission meetings. Neighbors and residents expressed concerns with flooding in the area, water quality conditions to Lake Fayetteville, limited infrastructure availability for the influx of traffic, and general opposition to the proposal at large. City staff recommended adding a condition that a flood study be provided for the area in association with the PZD, and also reported that impacts from the development as far as drainage was concerned would have to meet all drainage standard criteria.

Ultimately, staff found and Commission agreed that many of the issues noted by the public would be best addressed through annexation, driving the recommendation of approval. Annexing the land will subject the property to the City of Fayetteville's Unified Development Code and the drainage, design, and tree preservation standards within.

BUDGET/STAFF IMPACT:
N/A

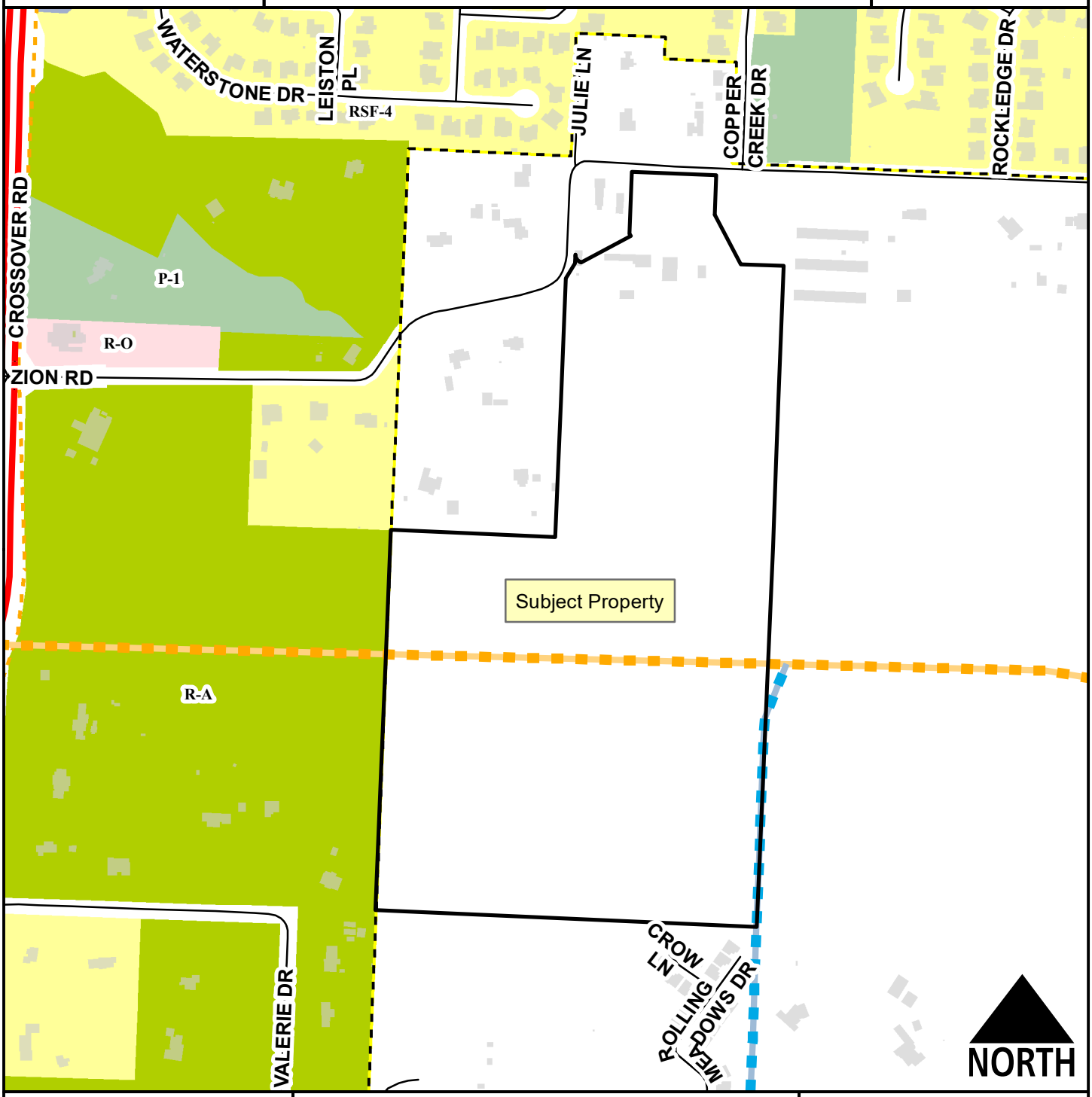
Attachments:
- Exhibit A
- Exhibit B
- Planning Commission Staff Report

ANX-2020-000001

Close Up View

BURGE

ANX-2020-000001
EXHIBIT 'A'



Legend

- Planning Area
- Fayetteville City Limits
- Trail (Proposed)
- Building Footprint

Feet

0 180 360 720 1,080 1,440

1 inch = 500 feet

- Residential-Agricultural
- RSF-4
- Residential-Office
- Neighborhood Services - Gen.
- P-1

ANX-2020-000001
EXHIBIT 'B'

SURVEY DESCRIPTION:

THE NORTHWEST QUARTER (NW 1/4) OF THE SOUTHEAST QUARTER (SE 1/4) AND PART OF THE SOUTHWEST QUARTER (SW 1/4) OF THE NORTHEAST QUARTER (NE 1/4), OF SECTION NINETEEN (19), TOWNSHIP SEVENTEEN (17) NORTH, RANGE TWENTY-NINE (29) WEST OF THE FIFTH PRINCIPAL MERIDIAN, WASHINGTON COUNTY, ARKANSAS AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT THE NORTHWEST CORNER OF THE NW 1/4 OF THE SE 1/4 OF SAID SECTION 19, SAID POINT BEING A FOUND 1/2 INCH REBAR; THENCE ALONG THE NORTH LINE OF SAID NW 1/4 OF THE SE 1/4, S87°29’54”E A DISTANCE OF 570.00 FEET TO A FOUND 1 INCH PIPE; THENCE LEAVING SAID NORTH LINE, N02°17’19”E A DISTANCE OF 894.88 FEET; THENCE N31°17”12”E A DISTANCE OF 61.88 FEET; THENCE N02°17’19”E A DISTANCE OF 30.12 FEET TO A POINT ON A NON-TANGENT CURVE; THENCE ALONG A CURVE TO THE LEFT HAVING A RADIUS OF 26.00 FEET, AN ARC LENGTH OF 32.86 FEET AND A CHORD BEARING & DISTANCE OF S33°54’56”E – 30.71 FEET; THENCE S70°07’11”E A DISTANCE OF 2.84 FEET; THENCE N62°13’43”E A DISTANCE OF 193.73 FEET; THENCE N27°46’17”W A DISTANCE OF 7.88 FEET; THENCE N02°13’43”E A DISTANCE OF 216.09 FEET; THENCE S87°36’11”E A DISTANCE OF 292.00 FEET; THENCE S02°13’43”W A DISTANCE OF 136.99 FEET; THENCE S27°46’17”E A DISTANCE OF 193.19 FEET; THENCE S87°46’17”E A DISTANCE OF 148.40 FEET TO THE EAST LINE OF SAID SW 1/4 OF THE NE 1/4; THENCE ALONG SAID EAST LINE, S02°13’43”W A DISTANCE OF 971.65 FEET TO THE NORTHEAST CORNER OF SAID NW 1/4 OF THE SE 1/4 AND A FOUND 1/2 INCH REBAR; THENCE ALONG THE EAST LINE OF SAID NW 1/4 OF THE SE 1/4, S02°23’57”W A DISTANCE OF 1316.65 FEET TO THE SOUTHEAST CORNER OF SAID NW 1/4 OF THE SE 1/4 AND A FOUND MONUMENT “ALAN REID”; THENCE ALONG THE SOUTH LINE OF SAID NW 1/4 OF THE SE 1/4, N87°30’23”W A DISTANCE OF 1320.05 FEET TO THE SOUTHWEST CORNER OF SAID NW 1/4 OF THE SE 1/4 AND A FOUND 1/2 INCH REBAR IN CONCRETE; THENCE LEAVING SAID SOUTH LINE AND ALONG THE WEST LINE OF SAID NW 1/4 OF THE SE 1/4, N02°17’05”E A DISTANCE OF 1316.84 FEET TO THE **POINT OF BEGINNING**, CONTAINING 59.00 ACRES, MORE OR LESS.

CITY OF
FAYETTEVILLE
ARKANSAS

PLANNING COMMISSION MEMO

TO: Fayetteville Planning Commission

THRU: Jonathan Curth, Development Review Manager

FROM: Jessie Masters, Senior Planner

MEETING DATE: December 14, 2020 Updated with PC hearing results from 12/14/2020

SUBJECT: **ANX 2020-000001: Annexation (3435 E. ZION RD./BURGE, 100/139):** Submitted by WATKINS LAW OFFICE, INC. for properties located SOUTH OF AND AT 3435 E. ZION RD. The properties are in the FAYETTEVILLE PLANNING AREA and contain approximately 59.00 acres. The request is to annex the properties into the City Limits of Fayetteville.

RECOMMENDATION:
Staff recommends forwarding **ANX 2020-000001** to the City Council with a recommendation of approval.

RECOMMENDED MOTION:
"I move to forward **ANX 2020-000001** to the City Council with a recommendation of approval."

August 24, 2020 Planning Commission Meeting:
This item was initially heard at the August 24, 2020 Planning Commission meeting, where it was tabled indefinitely by the Planning Commission. The commissioners expressed concerns about available infrastructure and public comment surrounding the one-lane bridge on E. Zion Road, and expressed a desire to see a more comprehensive plan for the area, such as through a PZD, or Planned Zoning District. The applicant has developed a PZD (RPZD-2020-000002) that incorporates an adjacent parcel that is currently located within the City limits, and following the provision of public notification, requests that the annexation be reconsidered in association with that request.

November 9, 2020 Planning Commission Meeting:
At the November 9, 2020 Planning Commission meeting, Commissioners voted to bring the item off the table to discuss. Commissioners then voted immediately to table the item to the subsequent Planning Commission meeting on November 23, 2020.

November 23, 2020 Planning Commission Meeting:
The applicant requested to table the item until the next Planning Commission meeting. Commissioners moved to suspend the rules and not hear public comment on the item, given the applicant's request, and voted to table the item to the December 14, 2020 Planning Commission meeting.

BACKGROUND:
The subject property is in northeast Fayetteville on the south side of E. Zion Road, about .30 miles east of N. Crossover Road (or Highway 265). The property under consideration is the majority of

a 62.2 acre parcel (001-15182-000), and the applicant intends to not include two portions of land that are adjacent to E. Zion Road, bringing the acreage under consideration to 59.00 acres. The property currently has a single-family dwelling, which county records indicate was built in 1947, and associated outbuildings for what has long been an agricultural use. Hilton Creek runs east and west through the site, and the area surrounding the creek is designated as a flood plain. The property is located within 1 mile from the Fayetteville city limits, and the westernmost portion of the property is adjacent to the current city limits; an associated rezoning has also been submitted by the property owners (PZD-2020-000002). Surrounding land uses and zoning is depicted in *Table 1.*

Table 1
Surrounding Land Use and Zoning

Direction	Land Use	Zoning
North	Single-Family Residential	Washington County: AG/SF Res 1, Agricultural Single-family Residential (1 units per acre)
South	Single-Family Residential/ Agricultural	Washington County: AG/SF Res 1, Agricultural Single-family Residential (1 units per acre)
East	Single-Family Residential/ Agricultural	Washington County: AG/SF Res 1, Agricultural Single-family Residential (1 units per acre)
West	Single-Family Residential/ Undeveloped	City of Fayetteville R-A, Residential-Agricultural; Washington County: AG/SF (Res 1, Agricultural Single-Family Residential (1 units per acre)

Request: The request is to annex the subject property into the City of Fayetteville. The applicant has stated that the annexation is needed so that the property can be developed. An order of annexation was signed by the Washington County Judge on July 10, 2020.

Public Comment: Staff has received many public inquiries regarding this request and its associated rezoning. Surrounding property owners have voiced concerns regarding limited infrastructure availability for an influx of traffic, reported flooding concerns from Hilton Creek and its associated floodplain, and expressed general opposition to the annexation and rezoning. Comments in full are provided with this report.

INFRASTRUCTURE:

Streets: The property has frontage to E. Zion Road. E. Zion Road is an unimproved, unclassified street with asphalt paving and open ditches. Any street improvements required in these areas would be determined at the time of development proposal, as well as any improvements or requirements for drainage. The Master Street Plan also indicates a planned Neighborhood Link Street running east and west through the property, which would ultimately connect the site to N. Crossover Road.

Water: Public water is available to this parcel through an existing 12-inch water main present along E. Zion Road.

Sewer: Sanitary Sewer is not available to the subject property. The subject parcel is currently outside the city limits and would need to be annexed and have sanitary sewer extended by the developer to provide access.

Drainage: Any additional improvements or requirements for drainage will be determined at time of development. Hydric soils appear to be present throughout most of the subject area. No portion of the property is within the Hillside-Hilltop Overlay District. The property is bisected by Hilton Creek, which is not currently part of the

Streamside Protection Zone, though a portion of the property appears to be in a Zone A floodplain.

Fire: Fire apparatus access and fire protection water supplies will be reviewed for compliance with the Arkansas Fire Prevention Code at the time of development. Station 5 located at 2979 N Crossover, protects this site. The property is located approximately 2.4 miles from the fire station with an anticipated drive time of approximately 5 minutes using existing streets. The anticipated response time would be approximately 7.2 minutes. Fire Department response time is calculated based on the drive time plus 1 minute for dispatch and 1.2 minutes for turn-out time. Within the City Limits, the Fayetteville Fire Department has a response time goal of 6 minutes for an engine and 8 minutes for a ladder truck. This property does not meet the fire department's response goal of 6 minutes for an engine, but does meet the 8 minute goal for a ladder truck.

Police: The Police Department did not express any concerns with this request.

CITY PLAN 2040 FUTURE LAND USE PLAN: City Plan 2040 Future Land Use Plan designates the property within the proposed rezone as **Residential Neighborhood Area** and **Natural Area.**

Residential Neighborhood Areas are primarily residential in nature and support a wide variety of housing types of appropriate scale and context: single-family, duplexes, rowhouses, multifamily and accessory dwelling units. Residential Neighborhood encourages highly connected, compact blocks with gridded street patterns and reduced building setbacks. It also encourages traditional neighborhood development that incorporates low-intensity non-residential uses intended to serve the surrounding neighborhoods, such as retail and offices, on corners and along connecting corridors. This designation recognizes existing conventional subdivision developments which may have large blocks with conventional setbacks and development patterns that respond to features of the natural environment. Building setbacks may vary depending on the context of the existing neighborhood.

Natural Areas consist of lands approximating or reverting to a wilderness conditions, including those with limited development potential due to topography, hydrology, vegetation or value as an environmental resource. These resources can include stream and wildlife corridors, as well as natural hubs and cores, many of which are identified in the generalized enduring green network. A Natural Area designation would encourage a development pattern that requires conservation and preservation, prevents degradation of these areas, and would utilize the principles of low impact development stormwater infrastructure for all developments. Natural Areas are prime candidates for conservation subdivision design and/or clustered development patterns.

CITY PLAN 2040 INFILL MATRIX: City Plan 2040's Infill Matrix indicates a score of 2-4 for this site, with a weighted score of 3.5 at the highest level. The following elements of the matrix contribute to the score:

- Near Park (Lake Fayetteville and David Lashley Park)
- Near Paved Trail (Lake Fayetteville, on-street bike lands on N. Crossover Road)
- Near Water Main (E. Zion Road)
- Appropriate Fire Department Response time (Station 5 located at 2979 N Crossover)*

- *Only portions of the site are covered in this response time. The Fire Department indicated an estimate of a 7.2 minute response time to reach the site.

FINDINGS OF THE STAFF

CITY PLAN 2040 (Res. 35-20)
12.3 Annexation Guiding Policies

Boundaries

12.3.5.a Annex existing islands and peninsulas and do not annex areas that create an island or peninsula

Finding: **The proposed annexation is a backwards L-shape, and creates an unusual boundary, leaving two portions of land immediately to the north and to the west left unincorporated. Though technically not creating an island since two small notches are remaining within the County of the property as a whole, the proposed new city limit boundaries could cause confusion for residents and inefficiencies for service providers because of the atypical configuration.**

12.3.5.b The proposed annexation area must be adjacent, or contiguous, to city limits.

Finding: **Approximately 1300 linear feet of the western-most boundary is completely adjacent to the corporate city limits. The property then jogs to the east and then north, connecting to Zion Road outside of the city limits.**

12.3.5.c Areas should either include or exclude entire subdivisions or neighborhoods, not divide.

Finding: **The proposed annexation is for an area containing no subdivisions, and is the majority of one 62.2 acre legal lot of record with one owner. It does not divide any subdivisions or neighborhoods.**

12.3.5.d Boundaries for annexed areas should follow natural corridors.

Finding: **The proposed annexation boundaries almost follow the property lines of the subject property, but leaves two small notches at the northeast and northwest corners of the property unincorporated into the city limits. The annexation boundary does not necessarily follow any natural, already existing corridors. The property is bisected by Hilton Creek, a designated natural area by the City Plan 2040 Future Land Use Map designation, and the only currently existing street frontage is along E. Zion Road, which is outside of the city limits. The property does not currently intersect with any streets within the City of Fayetteville. However, the Master Street Plan shows a future Neighborhood Link corridor running east and west through the entire property, and connecting N. Crossover Road (Highway 265) to Old Wire Road.**

12.3.5.e The provision of services should be concurrent with development.

Finding: **The property is adjacent to City water along E. Zion Road, but not City sewer. This property does not meet the fire department's response goal of 6 minutes for an engine, but does meet the anticipated goal of 8 minutes for a ladder truck. That said, should the associated PZD be approved, a proposed Neighborhood Link Street would connect this site to N. Crossover Road. Any services would need to be extended at the time of development.**

ENVIRONMENTALLY SENSITIVE AREAS

12.3.5.f Annex environmentally sensitive areas that could be impacted by development and utilize appropriate development regulations to protect those areas.

Finding: **The property is largely undeveloped except for a farm, single-family dwelling, and its accessory structures. No portion of the property is within the Hillside-Hilltop Overlay District, or Streamside Protection Zone, though approximately 30 acres of the site is within the Enduring Green Network, and approximately 3.5 acres of the site is within a floodplain surrounding Hilton Creek. If the property were to be annexed, a portion of the property would Several citizens have reported flooding events on their properties within the region of the requested annexation, which the city currently does not have any jurisdiction over since the property is outside of the city limits. By bringing the site into the City limits, further development will be subjected to the City's streamside protection standards.**

EMERGENCY AND PUBLIC SERVICES

12.3.5.g Public services must be able to be provided efficiently in newly annexed areas.

Finding: **Fire:** **The Fayetteville Fire Department response time to this location is approximately 7.2 minutes from the current closest station (2979 N Crossover). The Fire Department response time goal is six minutes for an engine and eight minutes for a ladder truck; this site is currently above the Fire Department's stated response goals.**

Police: **To date, the Fayetteville Police Department has not expressed any concerns with this request.**

12.3.5.h Annexed areas should receive the same level of service of areas already in the city limits.

Finding: **The subject property would receive the same services, including trash service, police protection, fire protection, sewer, water, recycling and yard waste pick-up, and zoning protection as nearby property within the City.**

12.3.5.i The ability to provide public services should be evaluated in terms of equipment, training of personnel, number of units, and response time.

Finding: **These factors were taken into consideration in the responses and recommendations included in this report.**

INFRASTRUCTURE AND UTILITIES

12.3.5.j Areas currently served by utilities and other public services should be annexed.

Finding: **The property in question is currently served by City of Fayetteville water, but not sewer. Additionally, extensions would need to be made to this property, likely at the property owner's expense at time of development.**

12.3.5.k Proposed annexation areas should not require the upgrading of utilities to meet the demands of development unless there is a threat to public safety.

Finding:

Engineering: **Engineering anticipates a need to upgrade utilities. Though public water is currently available to the site, extensions would need to be made upon any proposed development. Sanitary sewer is not currently available to this proposed property.**

Planning: **If developed under the zoning requirements of the concurrently-requested PZD, there will be a marked increase in both density and traffic. Staff finds that significant infrastructure improvements would likely need to be made to absorb the increase in density and traffic, including potential street improvements to Zion Road (which is currently not owned by the City of Fayetteville), redevelopment of a one-lane bridge on E. Zion Road, and bringing the proposed Neighborhood Link Street into compliance with the Master Street Plan. Staff does find that the most recent iteration of the PZD does indicate a desire to reduce the amount of development which fronts E. Zion Road, somewhat alleviating a concern about how much development that road could currently support. Much of the cost of this infrastructure improvement would initially be borne by the developer, but much of the maintenance would likely become the City's responsibility.**

12.3.5.l Phased annexation should be initiated by the City within active annexation areas based on planned service extensions or availability of services.

Finding: **Not applicable; the proposed annexation is not part of a phased annexation initiated by the City.**

INTERGOVERNMENTAL RELATIONS

12.3.5.m Promote long-range planning with adjacent jurisdictions.

Finding: **The extent of the proposed rezoning is not within or adjacent to the planning areas of other municipalities in Washington County. The property would require at least emergency access through Washington County, as E. Zion Road is currently divided between Fayetteville and Washington County right-of-way, and does not have a City of Fayetteville Master Street Plan designation.**

12.3.5.n Establish agreements to address regional concerns, such as water, stormwater, and sewer.

Finding: **Several citizens have reported stormwater and flooding concerns in the area; likely discussion would need to occur to discuss solutions for mitigating these issues, especially if this large portion of land is brought into the City of Fayetteville.**

ADMINISTRATION OF ANNEXATIONS

12.3.5.o Develop a land use plan for annexation initiated by the City.

Finding: **Not applicable; this annexation is not City-initiated. However, the property is included within the City's Future Land Use Plan and is primarily designated as a Residential Neighborhood Area.**

12.3.5.p Designate zoning districts for the property during the annexation process.

Finding: **Annexations are automatically zoned R-A, Residential Agricultural. The applicant has submitted a concurrent request to rezone a portion of the property to a Planned Zoning District (PZD-2020-000002) with proposed Planning Areas. The associated item will be heard at the same meeting. The applicant's request indicates that the portion of the property that is designated as a Natural Area is intended to stay downzoned to limit development potential in that area.**

12.3.5.q An annexation study should be completed on all annexation proposals.

Finding: **Planning staff has engaged with the Engineering Division along with the Water and Sewer, Fire, and Police Departments to review the proposed annexation. The request was studied to determine if facilities or services are available or needed in association with this request. Responses are included throughout this report.**

12.3.5.r Development proposals require a separate review from the annexation proposals.

Finding: **Future development of the subject property will be required to go through the development review process. No development proposal has been submitted, though a rezoning request as a PZD was submitted concurrently and will be heard at the same meeting.**

12.3.5.s Residents should be fully informed of annexation activities.

Finding: **Per §157.03 of the Unified Development Code, property owners and residents within 200 feet of the subject property are notified. Additionally, a legal advertisement has been submitted with the local newspaper prior to the Planning Commission meeting for which this item is scheduled. Signage was also posted on the site informing surrounding neighbors of the annexation proposal. Residents were also informed of the scheduled public meetings and how to participate.**

12.3.5.t Encourage larger annexations to create acceptable boundaries.

Finding: **Staff finds that this request is of a moderate size, totaling approximately 60 acres. The request would help fill in the City boundaries to the east; to the north of the proposed annexation, the City of Fayetteville boundary extends further to the east, and this annexation would begin to "square off" this boundary. Should City Council choose to annex this portion of land, there would be a few pieces of land that would remain in Washington County.**

12.3.5.u Conduct a fiscal impact assessment on large annexations.

Finding: **Given the moderate size of the proposed rezoning, a fiscal impact assessment was not conducted for the requested annexation. However, it should be noted that annexing land toward the northeastern extent of the City and developing it can pose financial challenges for the City to maintain the public infrastructure in a fiscally sustainable manner. The proposal to rezone the property in a manner that promotes urban form and higher densities toward property that fronts N. Crossover Road, and lower density towards the west and north and E. Zion Road frontage somewhat ameliorates this concern.**

RECOMMENDATION: Planning staff recommends forwarding ANX-2020-000001 to the City Council with a recommendation of approval.

PLANNING COMMISSION ACTION: **Required** **YES**

Date: **December 14, 2020** ❒ **Tabled** ☒ **Forwarded** with recommendation of approval ❒ **Denied**

Motion: Belden

Second: Canada

Vote: 7-1-0 (Commissioner Garlock dissenting vote)

BUDGET/STAFF IMPACT:
None

Attachments:

- City Plan 2040, Section 12.3: Annexation
- Request letter
- Order of Annexation
- Public Comment
- One Mile Map
- Close-up Map
- Current Land Use Map
- Future Land Use Map

12.3 Annexation

Annexation is the inclusion of previously unincorporated lands within the City limits. Annexation has benefits to the residents of the annexed area as well as to the City. The residents gain access to urban services, such as enhanced police and fire protection and have a voice in city government. The City gains the ability to control development and extend boundaries in a logical manner.

The purpose of this planning element is to take a more active approach toward annexations by identifying potential annexations areas and establishing annexation policies. The annexation policies will guide evaluation of future annexation proposals. The policies are designed to ensure that public services, infrastructure, and utility extension is properly addressed in order to manage growth. The potential annexation areas may become part of the City when these annexation polices are met.

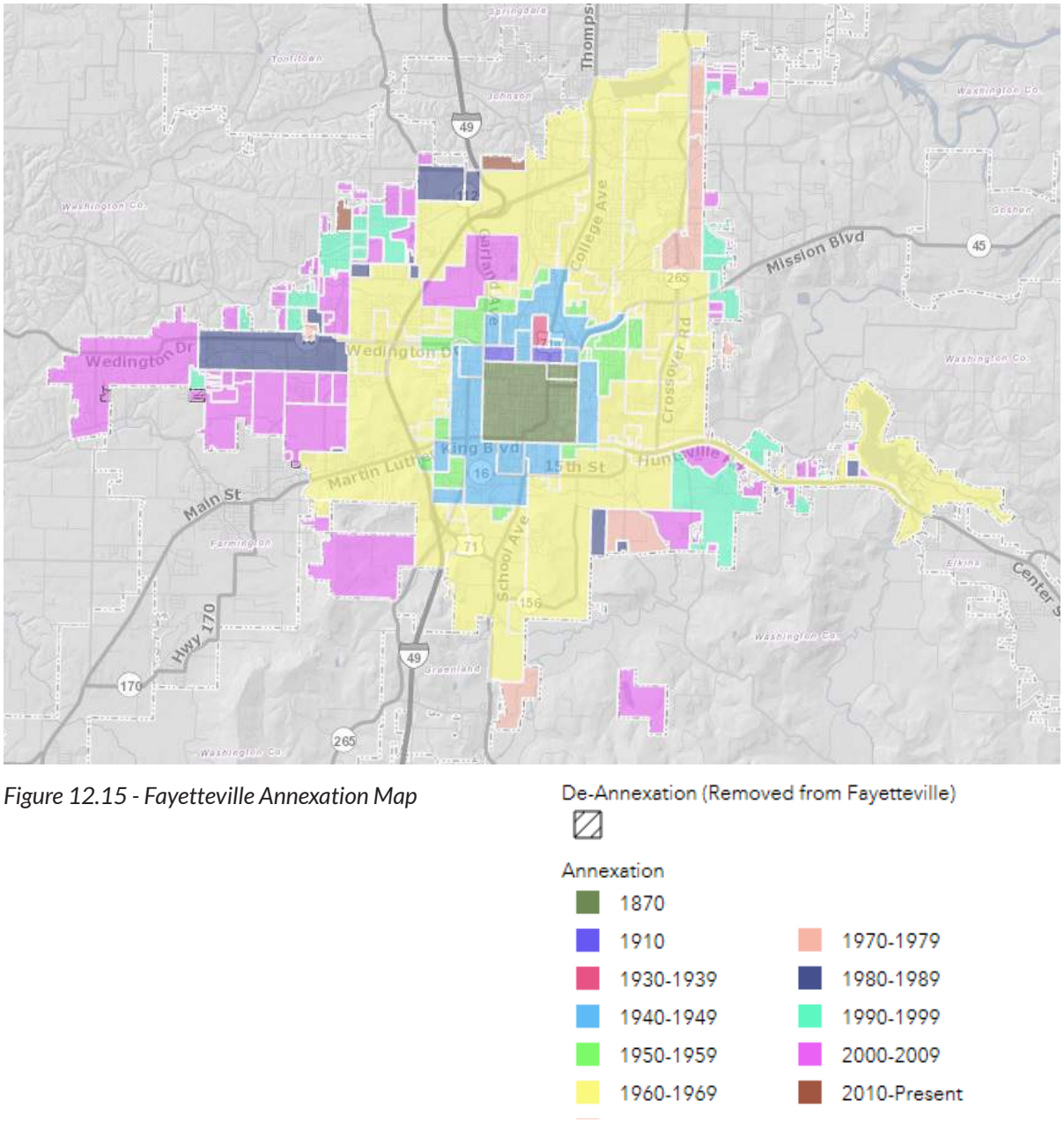


Figure 12.15 - Fayetteville Annexation Map

Annexation History and Trends

The original town was incorporated in 1870 with approximately 1,100 acres. Since incorporation, the City has made almost 200 annexations, totaling over 34,000 acres. Annexation activity was relatively slow until the 1940's, when over 2,500 acres were annexed within 19 annexations. During the 1950's, almost the same number of annexations took place, however, the total land area annexed was significantly smaller than in the 1940's. By the 1960's. annexation activity increased dramatically, with 42 annexations bringing over 18,000 acres into the city limits. Annexation numbers dropped in 1970 and stayed steady until the 1990's, when the number of annexations tripled from the 1980's. By 2000, the City contained 45 square miles and by 2018 the City contained approximately 55 square miles.

One indicator of the amount of developable land within the City is the number of people per acre. Prior to 1940 there were approximately 5.6 persons per acre. This era represents the time when Fayetteville was still relatively small and consisted primarily of what we would now consider the downtown and surrounding neighborhoods. By 1970, after numerous large annexations in the 1960's, the persons per acre had been reduced to 1.3. The City's population continued to increase dramatically through the 2000's when we maintained just over 2 people per acre from 2000-2010. An annexation referendum in October of 2006 for a large area along Wedington Drive on the west side of town brought in an additional 1,400 acres of low density land for eventual development.

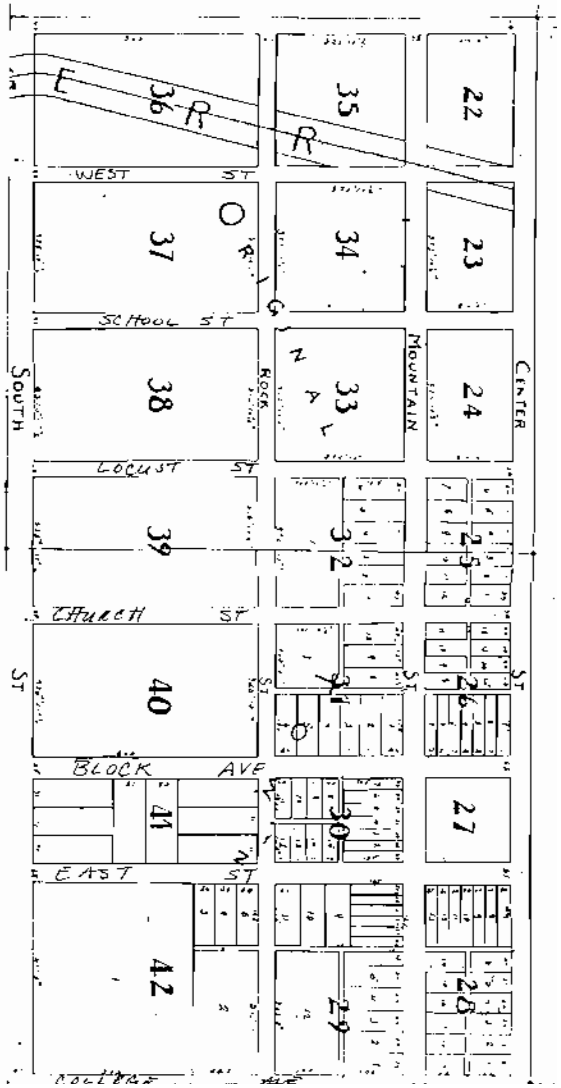


Figure 12.16 - Fayetteville Town Plat

State Statutes on Annexation

Title 14, Chapter 40 of the state statute discusses annexation. Annexations can be initiated by a municipality or by property owners.

A municipality can annex contiguous lands, lands surrounded by the municipality, unincorporated area that is completely bounded by two or more municipalities. If the municipality has the greater distance of city limits adjoining the area, and land contiguous and in adjacent counties to annex any contiguous lands, the governing body must adopt an ordinance, passed by two-thirds of the governing body and hold an election of the people. Those lands must meet one of the following criteria:

- Platted and held for sale or use as municipal lots;
- Whether platted or not, if the lands are held to be sold as suburban property;
- When the lands furnish the abode for a densely settled community or represent the actual growth of the municipality beyond its legal boundary;
- When the lands are needed for any proper municipal purposes such as for the extension of needed police regulation; or
- When they are valuable by reason of their adaptability for prospective municipal uses.

Contiguous lands must not be annexed if they meet either of the following criteria:

- Have a fair market value at the time of adoption of the ordinance of lands used only for agricultural or horticultural purposes and the highest and best use of the land is for agricultural or horticultural purposes; or
- Are lands upon which a new community is to be constructed with funds guaranteed in whole or in part by the federal government under Title IV of the Housing and Urban Development Act of 1968 or under Title VII of the Housing and Urban Development Act of 1970.

To annex land surrounded by a municipality, the governing body can propose an ordinance to annex the property. Again, the lands must meet the criteria listed above. A public hearing must be held within 60 days of the proposed ordinance, A majority of the governing body must approve the annexation for it to become effective.

Figure 12.17 - Great Seal of the State of Arkansas

Property owners in areas contiguous and adjacent to the municipality may request annexation. They can apply with a petition of the majority of land owners in the area, if the majority of the total number of owners own more than one-half of the acreage affected.

Potential Annexation Areas

The potential annexation areas should be identified by the City using the following criteria:

- Areas that are already urban in character.
- Areas that can be developed at urban densities.
- Immediate areas are those that are peninsulas or islands, where municipal services have already been extended.
- Vacant lands that are subject to development pressure.
- Areas where urban services are already provided.
- Areas where urban services are needed.

Annexation Guiding Policies

Boundaries

- Annex existing islands and peninsulas and do not annex areas that would create an island or peninsula.
- Proposed annexation area must be adjacent, or contiguous, to city limits.
- Areas should either include or exclude entire subdivisions or neighborhoods, not divide.
- Boundaries for annexed areas should follow natural corridors.
- The provision of services should be concurrent with development.

Environmentally Sensitive Areas

- Annex environmentally sensitive areas that could be impacted by development and utilize appropriate development regulations to protect those areas.

Emergency and Public Services

- Public services must be able to be provided efficiently in newly annexed areas.
- Annexed areas should receive the same level of service of areas already in the city limits.
- The ability to provide public services should be evaluated in terms of equipment, training of personnel, number of units and response time.

Infrastructure and Utilities

- Areas currently served by utilities and other public services should be annexed.
- Proposed annexation areas should not require the upgrading of utilities to meet the demands of development unless there is a threat to public safety.
- Phased annexation should be initiated by the City within the active annexation areas based on planned service extensions or availability of services.

Intergovernmental Relations

- Promote long-range planning with adjacent jurisdictions.
- Establish agreements to address regional concerns, such as water, stormwater and sewer.

Administration of Annexations

- Develop a land use plan for annexation initiated by the City.
- Designate zoning districts for property during the annexation process.
- An annexation study should be completed on all annexation proposals.
- Development proposals require a separate review from the annexation proposals.
- Residents should be fully informed of annexation activities.
- Encourage larger annexations to create acceptable boundaries.
- Conduct a fiscal impact assessment on large annexations.

WATKINS, BOYER, GRAY & CURRY, PLLC

ATTORNEYS AT LAW

WILLIAM P. WATKINS, III, P.A.
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WRITER'S DIRECT E-MAIL
wkellstrom@watkinslawoffice.com

DELYNN HALE, SECRETARY
AMY BENSON, PARALEGAL
WHITNEY DUCKER, OFFICE MANAGER

July 15, 2020

Fayetteville Planning Department
125 W. Mountain St.
Fayetteville, AR 72701

Re: Annexation of Parcel No. 001-15182-000 into the City of Fayetteville

Dear Planning Staff:

Our firm has been retained to assist with the annexation of certain lands into the City of Fayetteville. A survey depicting the lands that are proposed to be annexed has submitted along with this letter. The purpose of this letter is to address the consistency of the proposed annexation the Annexation Guiding Policies provided in City Plan 2030. This annexation is consistent with those guidelines.

The lands proposed to be annexed are contiguous to the Fayetteville city limits and will not create and islands or peninsulas. The property is contiguous to the City of Fayetteville along the majority of its Western boundary, and is located in the corner between lands annexed as the Stonewood Subdivision and lands annexed along N. Crossover Road. In this way, the proposed annexation is a natural extension of the Fayetteville city limits and follows the natural development corridor along Crossover Road.

Annexation of this land would not divide any existing neighborhoods. The proposed parcel for annexation is owned entirely by one individual. The entire parcel is undeveloped, and has served as the homestead for the residence located on the parcel for several years.

Public services can be efficiently provided to the proposed parcel, as it is within a reasonable distance from existing police and fire stations in Fayetteville. The parcel is approximately 1.85 miles from Fire Station #5, and approximately 2.5 miles from the Fayetteville Police Department Substation located on Shiloh. For comparison, the proposed parcel is roughly the same distance or closer to emergency services than Stonewood Subdivision, just North of the subject parcel.

The parcel proposed for annexation is currently served by Fayetteville Water, Sewer, Recycling and Trash Pickup services. The property is adjacent to a twelve inch (12") water main which runs along E. Zion Road. As for sewer, the property would be served through the sewer main running adjacent to N. Crossover Road, and will run through the adjacent parcel which has been proposed for rezoning concurrently with this request.

1106 WEST POPLAR STREET
ROGERS, AR 72756
PH: 479-636-2168
FX: 479-636-6098
WWW.WATKINSLAWOFFICE.COM

Lastly, the annexation will include a portion of an environmentally sensitive area–that area being a section of Hilton Creek. Although development plans have not been finalized, the applicant is requesting (through a concurrent rezoning request) that a portion of the parcel be zoned R-A for the purpose of preserving and protecting Hilton Creek.

Thank you for considering this annexation application. If you have any questions please contact me.

Sincerely,

WATKINS, BOYER,
GRAY & CURRY, PLLC

W. Kellstrom

Will A. Kellstrom

WK:
pc:

IN THE COUNTY COURT OF WASHINGTON COUNTY, ARKANSAS

IN THE MATTER OF ANNEXING TO THE CITY FAYETTEVILLE, ARKANSAS, CERTAIN TERRITORY CONTIGUOUS TO SAID CITY OF FAYETTEVILLE, ARKANSAS **CC NO. 2020-013**

ORDER CONCERNING ANNEXATION

On this regular day of a regular term of the County Court of Washington County, Arkansas, there is presented to the Court by Patricia Lynne Severino, as Trustee of the Robert Eugene Burge Irrevocable Trusted, dated December 20, 2012, the petition of the real estate owner desiring the annexation of territory to the City of Fayetteville, Arkansas, more particularly described therein. The court has received the verification of the county assessor and county clerk required by A.C.A § 14-40-609. This Court being fully advised of the facts and the law does hereby find as follows:

1. The Court finds that the petition and verifications are complete and accurate.
2. The Court further finds that no enclaves will be created by the annexation.
3. The Court finds that the petition contains a schedule of services.
4. The Court finds that the territory consists of lands that:
   a.. whether platted or not, are held to be sold as suburban property;
   b. represent the actual growth of the municipality beyond its legal boundary; and
   c. are needed for proper municipal purposes such as the extension of need police regulations.

Therefore, the Court hereby ORDERS that the petition and this Order be delivered to the City of Fayetteville, Arkansas.

DocuSigned by:
Joseph Wood
34F19462757444F...

JOSEPH K. WOOD, COUNTY JUDGE

DATED: Jul 10, 2020 | 3:30 PM CDT

DocuSigned by:
ABF7527CDFBB45C...

PETITION

Date: Nov 21, 2020

Re Requests: Annexation of 3435 E Zion Rd and Rezoning for Chandler Crossing PZD

To: Fayetteville Planning Commission

This petition is to request a prudent decision to deny the annexation of 3435 E Zion Road and the Chandler Crossing PZD, due to the following issues:

1. Traffic issues and safety concerns regarding school age children, traffic through neighboring subdivisions, blind curves, inferior county roads and connectivity points, and the deteriorating one lane bridge. Jurisdiction on who is responsible for the improvements to the road and one lane bridge. The proposed development would result in as many as 600+ vehicles.
2. The flooding, storm water run-off, and drainage from the subject property into Hilton Creek, which ends up in Lake Fayetteville. Water quality in the lake has been previously studied by a toxicologist and discussed at the previous planning commission meeting. There is potential for increased lake pollution by adding 267 housing units .
3. The proposed development would create suburban sprawl and not be compatible with the surrounding land or semi-rural neighborhoods. This is sprawl, not infill, which goes against two of the goals of the City of Fayetteville. The annexation also would create an island of county property surrounded by city property.
4. The proposed development would be in the Springdale School district, so a large part of tax millage would go to Springdale School System. Yet, Fayetteville would be responsible for paying for and maintenance of the project's infrastructure.
5. A large part of the subject property is located in Fayetteville's long range map of the Enduring Green Network. The City's stated goal is to protect existing natural areas from development and guarantee green space as the city grows. The proposed annexation and rezoning do not meet that goal.

We the undersigned request a denial to the annexation of 3435 E Zion Road and a denial to the proposed Chandler Crossing PZD. The care and future growth of our unique, quaint Fayetteville should lead us to focus on quality as a top priority rather than a disruption by quantity.

Signature	Printed Name	Address
Nancy Fuller	Nancy Fuller	4260 N. Hillside Terr. Fayetteville
Ray Fuller	Ray Fuller	4260 N. Hillside Ter. Fayetteville
[illegible]	IOANNIS TZANETAKIS	4101 N Hillside Terr, Fayetteville 72703
Cean Hevin	Cean Hevin	4101 N Hillside Ter. Fayetteville 72703

Signature	Printed Name	Address
Elaine Odle	Elaine Odle	4179 N. Hillside Terr.
Larry Odle	Larry Odle	Fayetteville, AR 72703
[illegible]	David Powell	4147 Hillside 72703
[illegible]	DAVID BEAM	4077 N. Hillsid 72703
Debbie McCaslin	Debbie McCaslin	3090 Valerie Dr 72703
Clyde McCaslin	Clyde McCaslin	3090 Valerie Dr 72703
[illegible]	CHRIS PATTERSON	4126 N. VALERIE DR 72703
Rebecca Patterson	Rebecca Patterson	4126 N Valerie Dr 72703
Chris Carlson	Chris Carlson	4084 N Valerie Dr 72703
Kristal Carlson	Kristal Carlson	4084 N. Valerie Dr 72703
M. LeRoy Duell	M. LeRoy Duell	4017 N. Valerie Dr 72703
Kim V. Duell	Kim V. Duell	4017 N. Valerie Dr. 72703
Cindy Hsu	Cindy Hsu	4030 N. Valerie Dr. 72703
Harry Chu	Harry Chu	4030 N. Valerie Dr. 72703
Tyler Orsek	Tyler Orsek	4017 N Valerie Dr. 72703
Sandra Bowman	Sandra Bowman	4121 N. Valerie Dr 72703
Darle Bowman	Darle Bowman	4121 N Valerie Dr 72703
Angela Lawson	Angela Lawson	4121 Valerie Dr. 72703
Linda Ferguson	Linda Ferguson	3258 E Valerie D. Fay 72703
Sue Mayes	Sue Mayes	3266 E Valerie Dr Fay 72703
Ben R Mayes	Ben R Mayes	3266 E. Valerie R Fay 72703
Veronica Jones	Veronica Jones	3061 E. Valerie Fay 72703
Mike Rieker	Mike Rieker	3061 E. Valerie Fay 72703
Kandy Johnson	Kandy Johnson	4131 N. Valerie Dr. Fay 72703
Stephen Johnson	Stephen Johnson	4131 N. Valerie Dr. Fay 72703
Rozan Powell	Rozan Powell	4147 N. Hillside Terr. Fay 72703
John Rollins	JOHN ROLLINS	4024 N. HILLSIDE TER, Fay 72703
Barbara D. Center	Barbara D. Center	4146 N. Valerie Dr Fay 72703
Larry D. Center	Larry D. Center	4146 N. Valerie Dr Fay 72703
Nicholas B. Anthony	Nicholas B. Anthony	3301 E. Zion Rd Fay 72764
Kimberly A Anthony	Kimberly A Anthony	3301 E Zion Rd. Fay 72764
Emma Graves	Emma Graves	3293 E. Zion Road Fay 72764
DENNIS GRAVES	DENNIS GRAVES	3293 E. ZION RD 72764
DAVID EDDINGTON	DAVID EDDINGTON	3274 E ZION RD 72764
Debra Eddington	Debra Eddington	3274 E Zion Rd 72764
Martha A. Robles	Martha A. Robles	3281 E. Zion Rd. 72764
Kathy Cooper	Kathy Cooper	3209 E. ZION 72764

Contact Person: Phone #:

Signature	Printed Name	Address
	JAMES COOPER	3209 E. ZION
Monetha Calvert	Monetha Calvert	3312 E. Zion Rd
Darryl Calvert	Darryl Calvert	3312 E. Zion Rd
Brian Dieterle	BRIAN Dieterle	3245 E. ZION
Joetta Kliewer	JOETTA Kliewer	3245 E. ZION
Kelly Stewart	Kelly Stewart	3306 E. Zion Rd
Jack Stewart Jr.	Jack Stewart	3306 E. Zion Rd
Kellie Robertson	Kellie Robertson	3397 E. Zion Rd
Joseph Robertson	Joseph Robertson	3397 E. Zion Rd.
Janice Chapman	Janice Chapman	3463 E. Zion Rd
Tom Lenbrook	Tom Lenbrook	3462 E. Zion Rd
	Kevin Starr	4652 Julie Lane
	Blanca Starr	4652 Julie Lane
Sarah Pinion	Sarah Pinion	3522 E Zion Rd
	Adam Pinion	3522 E Zion Rd.
Janet Boote	Janet Boote	4675 Copper Creek Dr.
Paul Partridge	Paul Partridge	4689 Copper Creek Dr.
Lisa Partridge	Lisa Partridge	4689 Copper Creek Dr
Debra Nasmundsted	Debra Nasmundsted	4701 Copper Creek Drive
Sandra Soderquist	Sandra Soderquist	4676 Copper Creek Dr
Sandy Bennett	Sandy Bennett	3834 E. Zion
Margaret Walker	Margaret Walker	3441 Peppermill Pl
Ila D Jones	Ila D Jones	4639 Rockledge Drive
Jessica Booth		3400 E Zion Road
Nick Booth		3400 E Zion Rd.
Michele Lang	Michele Lang	3322 E. Zion Rd
Roy Lang	Roy Lang	3322 E. Zion Rd.

Contact Person: Michele Lang

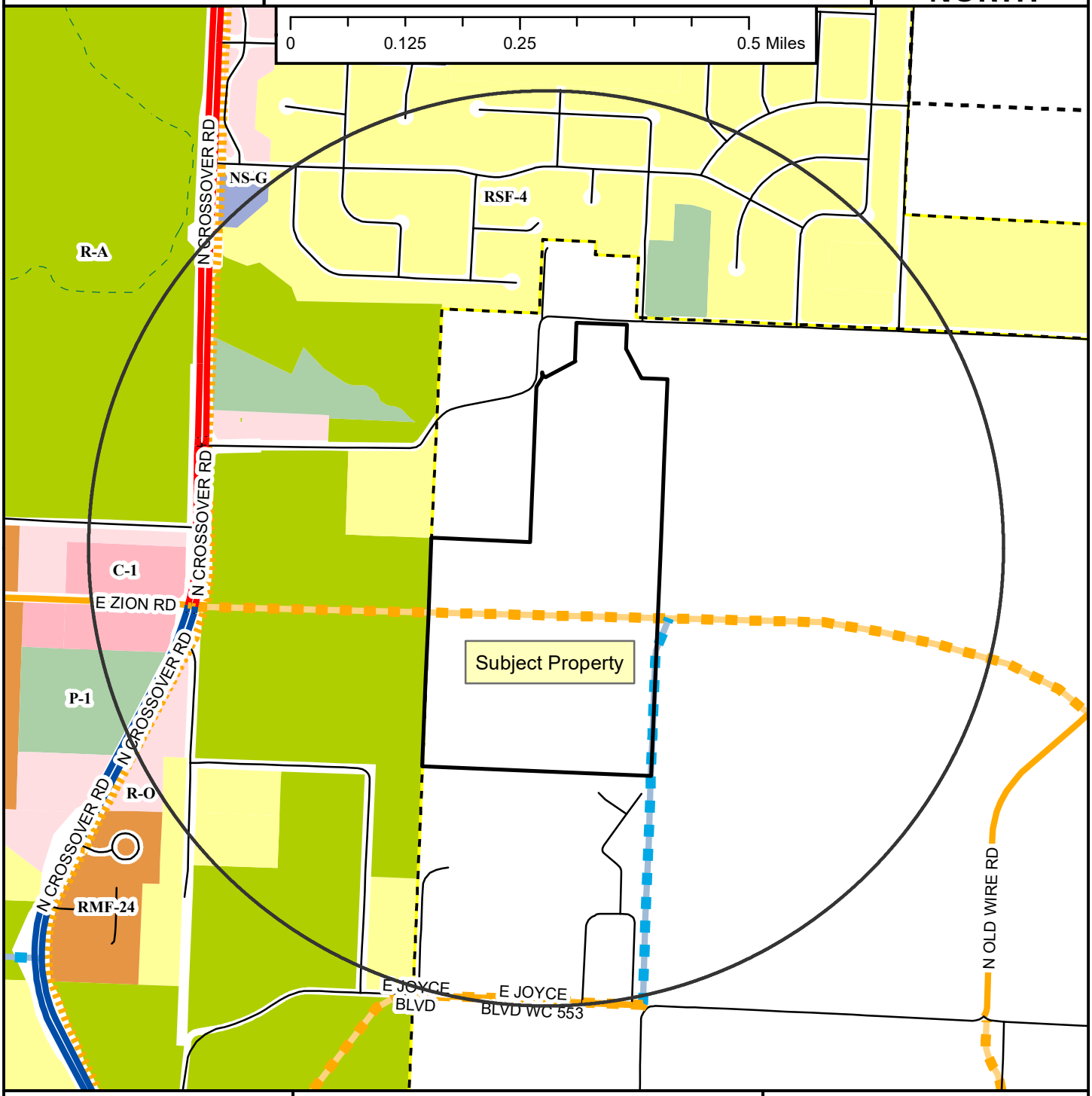
Phone #: 501-282-3350

ANX-2020-000001

One Mile View

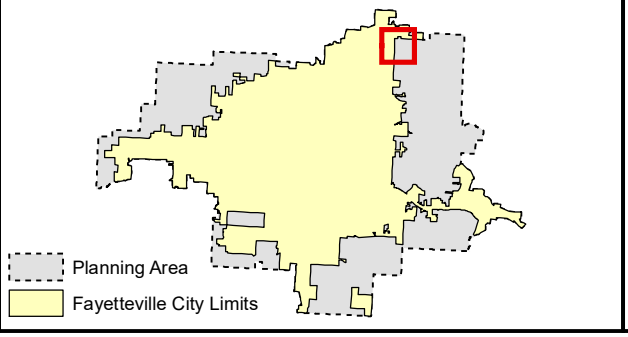
BURGE

NORTH



Legend

- Planning Area
- Fayetteville City Limits
- Trail (Proposed)



Zoning

RESIDENTIAL SINGLE-FAMILY
- NS-G
- RI-U
- RI-12
- NS-L
- Residential-Agricultural
- RSF-.5
- RSF-1
- RSF-2
- RSF-4
- RSF-7
- RSF-8
- RSF-18

RESIDENTIAL MULTI-FAMILY
- RMF-6
- RMF-12
- RMF-18
- RMF-24
- RMF-40

INDUSTRIAL
- I-1 Heavy Commercial and Light Industrial
- I-2 General Industrial

EXTRACTION
- E-1

COMMERCIAL
- Residential-Office
- C-1
- C-2
- C-3

FORM BASED DISTRICTS
- Downtown Core
- Urban Thoroughfare
- Main Street Center
- Downtown General
- Community Services
- Neighborhood Services
- Neighborhood Conservation

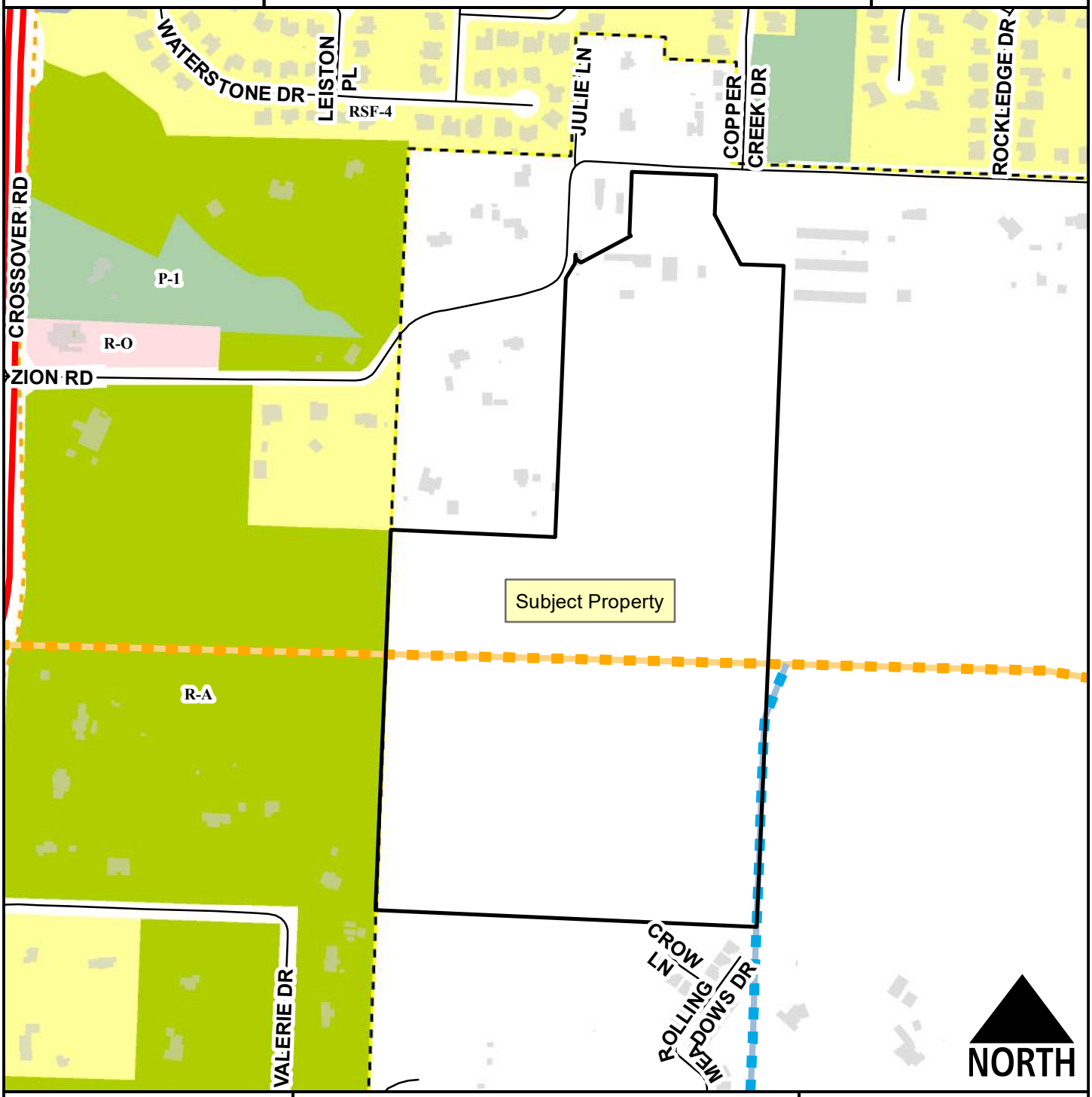
PLANNED ZONING DISTRICTS
- Commercial, Industrial, Residential

INSTITUTIONAL
- P-1

ANX-2020-000001

Close Up View

BURGE



Legend

- Planning Area
- Fayetteville City Limits
- Trail (Proposed)
- Building Footprint

Feet

0 180 360 720 1,080 1,440

1 inch = 500 feet

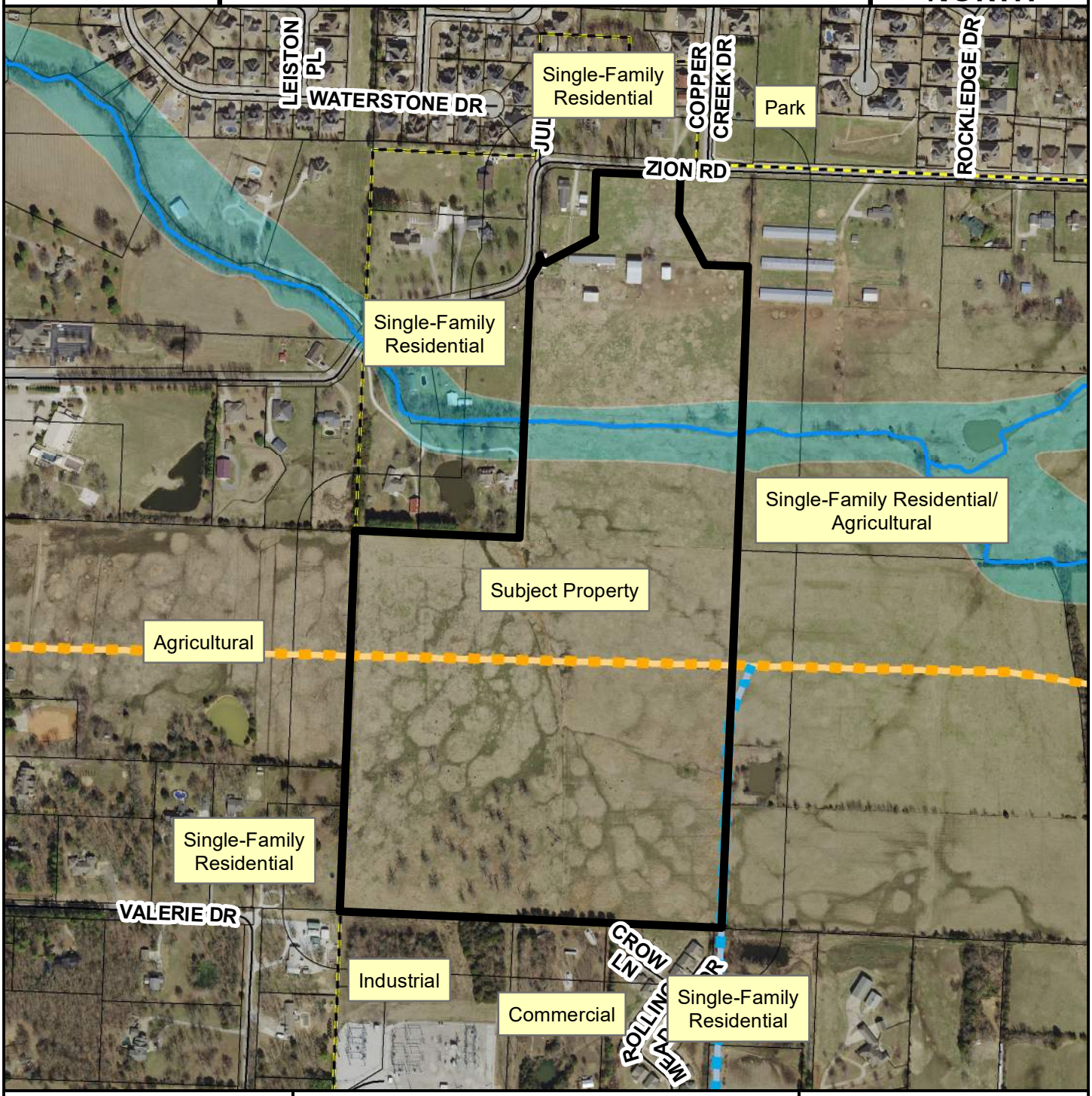
- Residential-Agricultural
- RSF-4
- Residential-Office
- Neighborhood Services - Gen.
- P-1

ANX-2020-1

Current Land Use

BURGE

NORTH



Planning Area

Fayetteville City Limits

Feet

0 180 360 720 1,080 1,440

1 inch = 500 feet

FEMA Flood Hazard Data

100-Year Floodplain

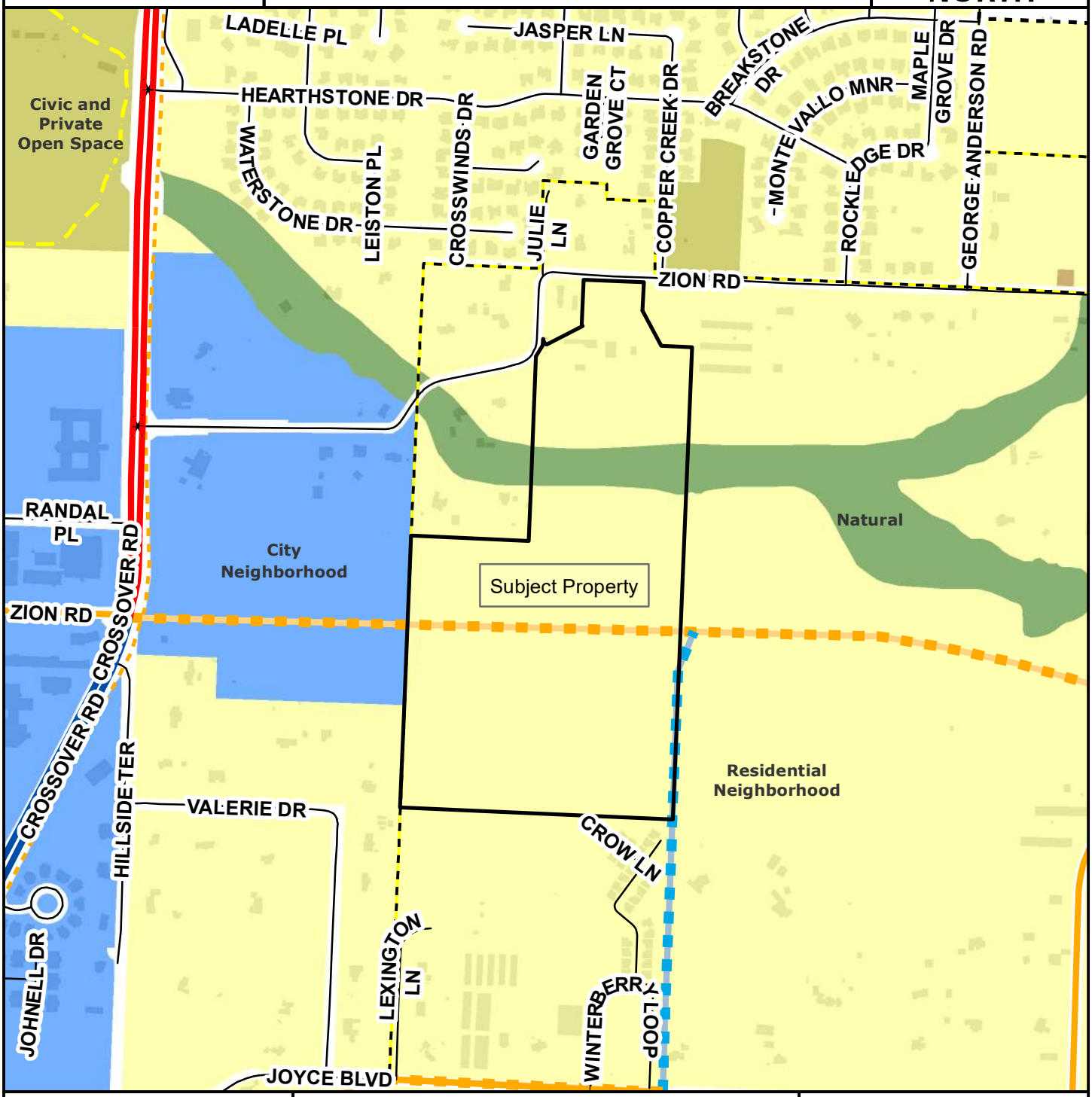
Floodway

ANX-2020-000001

Future Land Use

BURGE

NORTH



Legend

- Planning Area
- Fayetteville City Limits
- Shared Use Paved Trail
- Trail (Proposed)
- Building Footprint

Feet

0 255 510 1,020 1,530 2,040

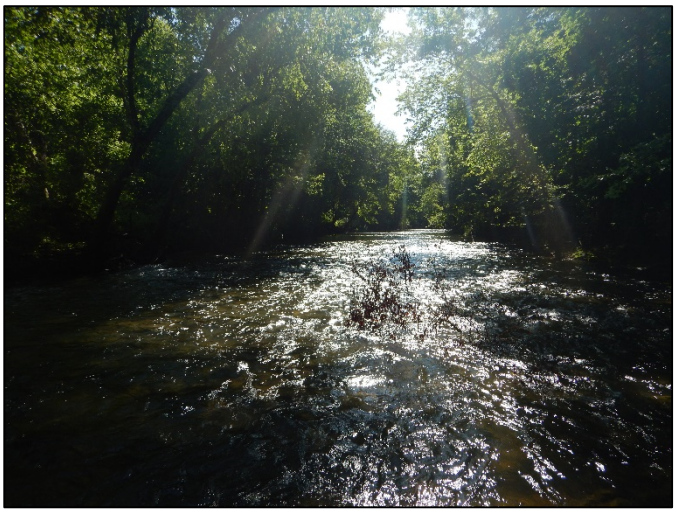
1 inch = 700 feet

- City Neighborhood
- Civic Institutional
- Civic and Private Open Space
- Industrial
- Natural
- Non-Municipal Government
- Residential Neighborhood
- Rural Residential
- Urban Center

Received from Jonathan
2/11/21

Clear Creek Assessment
Final Report



Submitted to the USDA Natural Resource Conservation Service

By the Watershed Conservation Resource Center

March 31, 2020

WATERSHED CONSERVATION
RESOURCE CENTER

Table of Figures and Tables

Clear Creek Assessment Project Partners
Watershed Conservation Resource Center (Lead)
City of Fayetteville
City of Springdale
USDA Natural Resources Conservation Service - State and Washington County Offices
Illinois River Watershed Partnership
Lake Fayetteville Watershed Partnership
Washington County Cooperative Extension Service
City of Johnson
City of Tontitown

Section 1. Introduction

Project Description

The USDA Natural Resource Conservation Service (NRCS) awarded the Watershed Conservation Resource Center (WCRC) a grant to conduct an inventory of the riparian and streambank conditions for 20 miles of Clear Creek and select tributaries. The inventory included the main stem of Clear Creek and the tributaries above the Lake Fayetteville dam and the Skull Creek tributary. A map of the entire project area is shown in Figure 1-1. The project objectives were to:

- Identify riparian areas and streambanks in need of restoration
- Identify stable sections of stream, wetland areas, springs, prairie, and other natural areas for potential protection and conservation
- Evaluate sediment and phosphorus loadings in the Lake Fayetteville watershed
- Provide assessment results to Cities, natural resource agencies, and local watershed and conservation based groups to help direct funding to high priority areas and to protect unique natural features
- Provide outreach to watershed residents

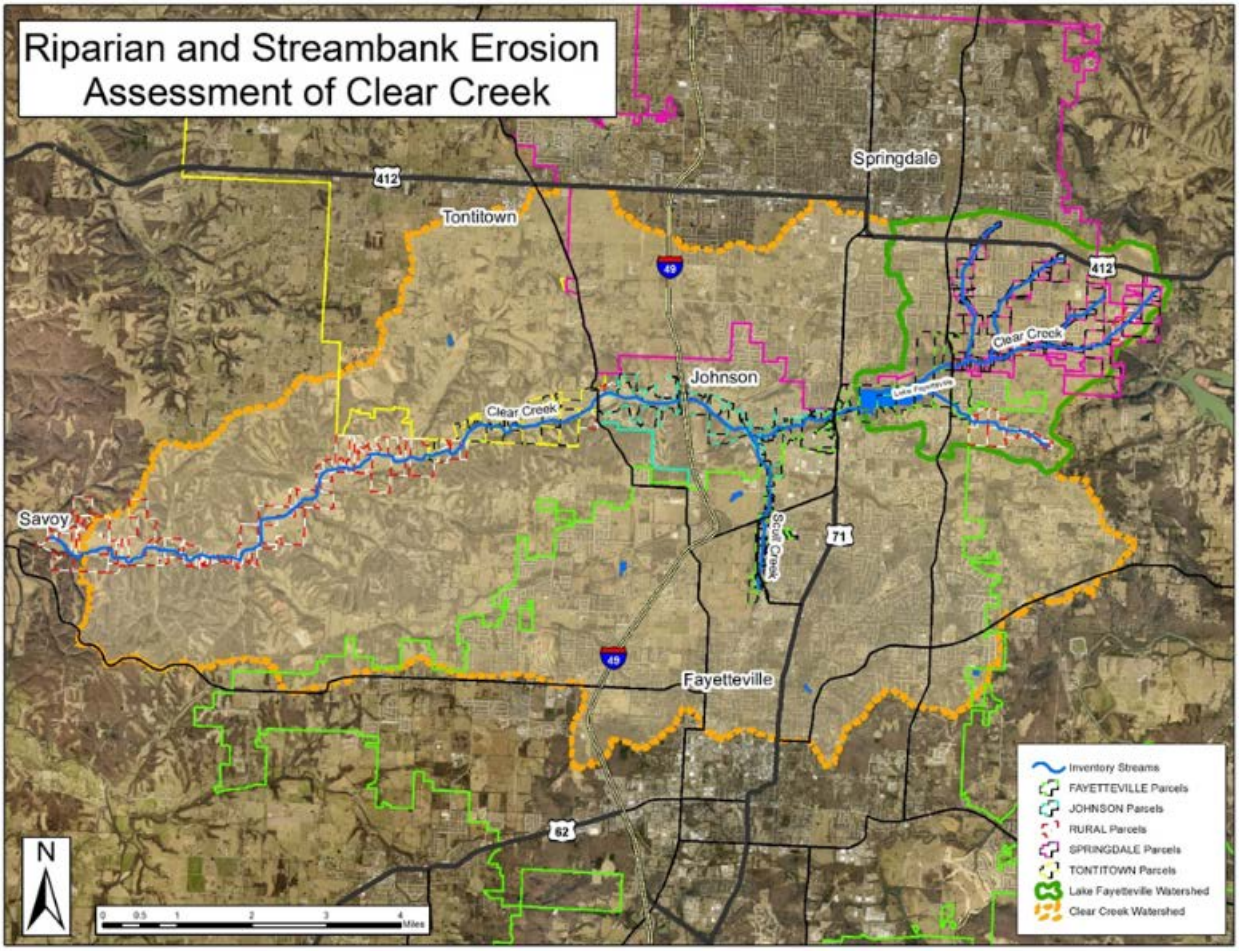


Figure 1-1. Map of Clear Creek Basin and Adjacent Parcels

The headwaters of Clear Creek encompass areas of Springdale, Fayetteville, Johnson, Tontitown and rural communities of Washington County. These communities both rely on and impact the quality and stability of Clear Creek. Infrastructure required by a thriving and growing population ultimately comes with significant impact to rivers and river ecology. Rivers are a system, formed by and functioning off the geology, topography, climate, soils and numerous other environmental factors that exist within and shape its watershed. When there are changes to these features in a short span of time, instability and erosion can occur almost immediately. Farmers expect land for crops and livestock adjacent to rivers to remain intact, land owners need property to remain whole and keep their beauty and value, cities and businesses need their investments and infrastructure to stay unaffected by large storm events, fishermen want fish to remain healthy and spawn, birders and hikers want to enjoy a biodiverse and healthy ecosystem functioning in their neighborhood, and swimmers and kayakers want a deep and functioning river system that contains all the features indicative of a balanced stream system.

The Washington County Cooperative Extension Service, Illinois River Watershed Partnership (IRWP), Lake Fayetteville Watershed Partnership, Natural Resources Conservation Service (NRCS) – State and Washington County offices, City of Fayetteville, City of Johnson, City of Springdale and City of Tontitown worked with the Watershed Conservation Resource Center (WCRC) on this assessment. An inventory of 26 miles of stream in the Clear Creek watershed and an evaluation of sediment production associated with land use change in the Lake Fayetteville watershed was conducted. The streambank and riparian inventory includes two major tributaries to Lake Fayetteville, one flowing from a Northeastern direction and one from a Southeastern direction, Scull Creek, a portion of Mud Creek, and the remainder of Clear Creek as it flows out of Lake Fayetteville and meets the Illinois River. The Clear Creek Watershed, as a whole, was evaluated by conducting an inventory of natural areas, riparian width and condition, streambank soil material types, and streambank erosion rates. Streambank erosion was measured by conducting bank profile measurements from permanent survey monuments and GIS evaluation. Using this information along with the inventory of eroding streambanks in the watershed and lab results from streambank sampling, loading rates of sediment and phosphorus to the river were estimated. An ecological assessment and GIS evaluation of riparian areas was conducted to determine plant species and habit, and understand the scale and health of remaining riparian areas. Volunteer events and outreach were conducted and an invasive plant removal guide was developed. A GIS evaluation of land use in the Lake Fayetteville watershed was conducted in order to understand the rate that development has increased within this area and the associated impacts to Lake Fayetteville. This evaluation initiated a detailed study of this rapidly urbanizing portion of the Clear Creek watershed to better estimate the amount of increased sediment and nutrient production, impacts to the stream morphology and stream bank erosion, and the impacts on water quality to Lake Fayetteville.

Section 2. Inventory of Streambank, Wetland, other Natural Features, and Riparian

Streambank Erosion Inventory

Between April 4th and May 15th of 2017, staff from the Watershed Conservation Resource Center (WCRC) inventoried over 26 miles of stream along the main stem of Clear and select tributaries. This included portions of the communities of Fayetteville, Springdale and Johnson. Data was collected for 413 eroding streambanks utilizing a Trimble GeoExplorer XH handheld GPS and a Nikon AW120 camera with geotagging capabilities to match each photograph with the associated Trimble entry. The following data and information was collected for streambanks (Figure 2-1) showing signs of accelerated erosion:

1) Erosion Potential was evaluated using the Bank Erosion Hazard Index (BEHI) method which includes the following factors
    a. Root Depth
    b. Root Density
    c. Bank Height Ratio
    d. Bank Angle
    e. Surface Protection
    f. Bank Material
    g. Bank Stratification
2) Near Bank Shear Stress (NBSS) was Evaluated
3) Bank height and length was measured
4) The soil horizons were categorized and weighted
5) Photo of each streambank was taken

Figure 2-1. BEHI and NBSS Data Being Categorized on Clear Creek

Field data was used to rank erosion potential from low to extreme based on a cumulative point total scoring system. This, in combination with the field assessed NBSS dictated the array of erosion potential scenarios to be monitored and measured in future surveys.

After analysis of the data, GIS shapefiles were developed to present the streambank conditions in a mapping format. A qualitative indication of accelerated erosion was observed at 413 banks within the study area. Data from each of these streambanks was included in the inventory analysis. The distribution of the 413 streambanks across the streams included in the inventory is shown in Table 2-1. Information for each individual streambank including location, erosion potential, and photographs can be found in Appendix 1 A&B and inset maps for all streambank locations are available in Appendix 2.

Table 2-1. Banks Inventoried and Streambank Erosion Density per Sub

Creek Name	Number of Banks	Miles of Creek Inventoried	Number of Banks Per Mile
NE Tributary	126	8.5	14.8
SE Tributary	40	1.9	21.1
Scull Creek	38	1.8	21.1
Mud Creek	7	0.5	14.0
Clear Creek	202	13.2	15.3
Total	413	25.9	15.9

The riparian area along the streams included in the inventory was also evaluated. The following information and data was collected:

1) The presence of wetland features, springs, and prairies
2) Forest coverage and vegetation composition
3) The width of the riparian area was evaluated using GIS

Erosion Rate Measurement and Sediment Loading

Toe Pin Monitoring

Toe Pin installation took place between June and August of 2017. Prior to installing the toe pins, 42 streambanks were selected to observe a variety of BEHI and NBSS combinations throughout the project area. Ease of access and obtaining a comprehensive array to the 26-mile project extent guided the selections. BEHI and NBSS are each categorized into one of the five following categories: Low, Moderate, High, Very High, and Extreme. A higher classification based on BEHI scores and field observation results in a higher erosion potential. The selected banks BEHI and NBSS classifications can be seen in Table 2-2.

Toe pin monitoring sites were created at each selected stream bank by installing a permanent survey monument by hammering a 2' long piece of rebar into the toe of the bank or by drilling in a concrete anchor and ratcheting in a bolt into bedrock sites. A leveling survey rod is placed vertically on top of the toe pin or bolt and another is held level horizontally from the profile of the bank (Figure 2-2). Vertical and horizontal changes in slope for the bank profile are recorded from the permanent monument. Appendix 3 details the measurements collected for the selected sites and Figures 2-3 – 2-5 show streambanks evaluated along with toe pin locations throughout the watershed. After approximately one year's time, the toe pin monitoring sites were revisited for re-survey between June and July of 2018. This often required a metal detector and shovel for excavation as deposition, erosion or some form of alteration to the river channel occurred. Not all toe pins remain undisturbed, so extra monitoring locations were initially installed to account for potential loss. During the follow-up field trip, three toe pins were never found at their location, most likely damaged and dislodged via a storm event and large debris. Several other toe pins were dislodged from their location but data was able to be reconciled by recreating the toe pin location via RTK positioning where GPS data was available. All other toe pins were located and measurements were recorded for analysis.

Figure 2-2. Toe Pin Monitoring Conducted on Clear Creek

Table 2-2. BEHI, NBSS Classification for Erosion Monitoring Banks

Bank ID	BEHI	NBSS	Bank ID	BEHI	NBSS		BEHI	NBSS
NECC 8	MODERATE	Low	CC 186	VERY HIGH	Very High	CC 321	VERY HIGH	Extreme
NECC 12	HIGH	Moderate	CC 196	MODERATE	Low	CC 327	EXTREME	Extreme
NECC 20	HIGH	Moderate	CC 204	MODERATE	High	CC 328	MODERATE	High
NECC 33	HIGH	Moderate	SC 208	MODERATE	High	CC 343	HIGH	Moderate
NECC 56	MODERATE	Low	SC 213	HIGH	High	CC 352	VERY HIGH	Moderate
NECC 73	MODERATE	Low	SC 214	HIGH	Moderate	CC 355	MODERATE	Extreme
NECC 81	HIGH	Moderate	SC 227	MODERATE	Moderate	CC 356a	EXTREME	Very High
NECC 106	HIGH	Very High	MC 249	HIGH	High	CC 356b	EXTREME	Extreme
NECC 110	HIGH	High	CC 254	EXTREME	Very High	CC 387	VERY HIGH	High
NECC 115	HIGH	Moderate	CC 260	MODERATE	High	CC 388	HIGH	Very High
NECC 119	VERY HIGH	Very High	CC 280	MODERATE	High	CC 389	HIGH	Moderate
NECC 122	HIGH	Moderate	CC 281	MODERATE	High	CC 411	HIGH	High
SECC 150	LOW	Low	CC 283	HIGH	Moderate	CC 412	MODERATE	Moderate
SECC 152	HIGH	Low						
SECC 157	HIGH	Moderate						
SECC 164	HIGH	Low						

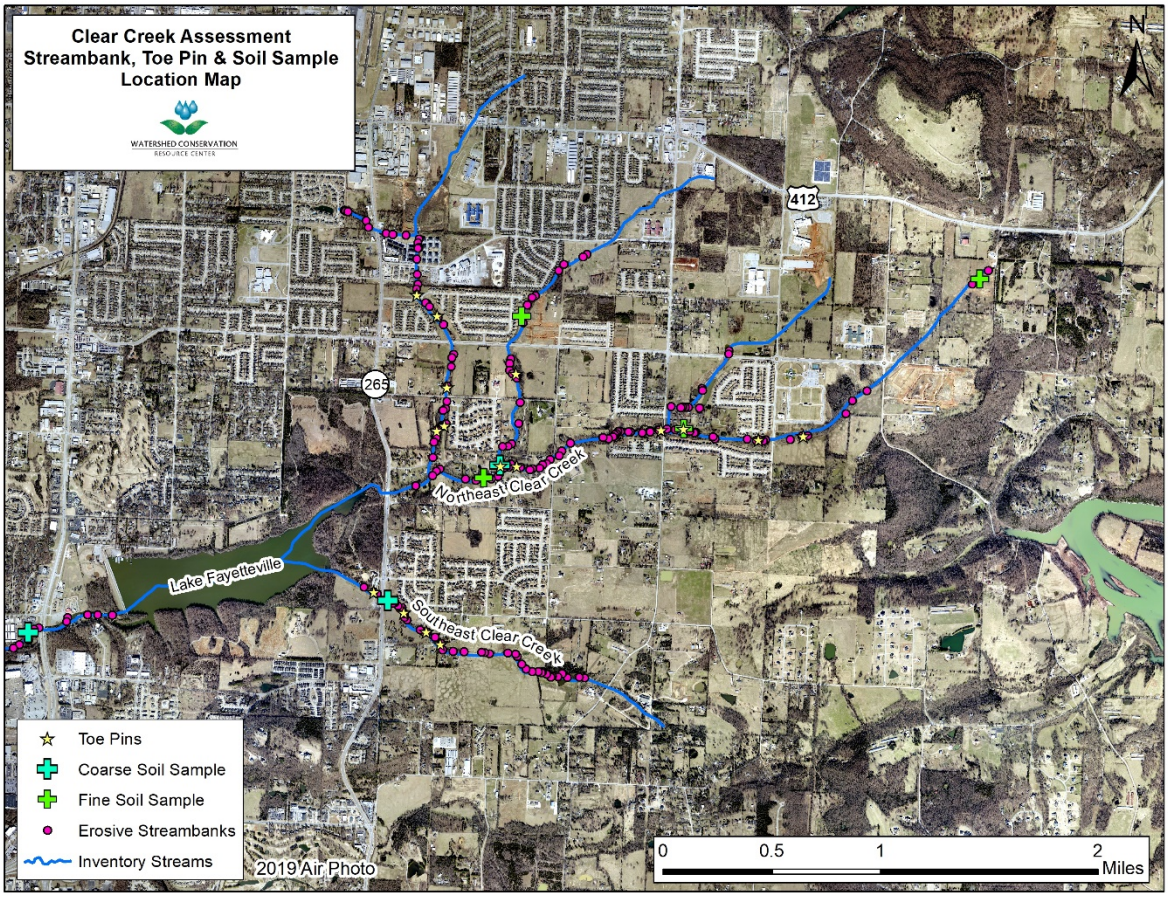


Figure 2-3. Eastern Section of the Clear Creek Watershed. This figure shows the streambank locations accounted in the inventory, toe pin locations and soil samples

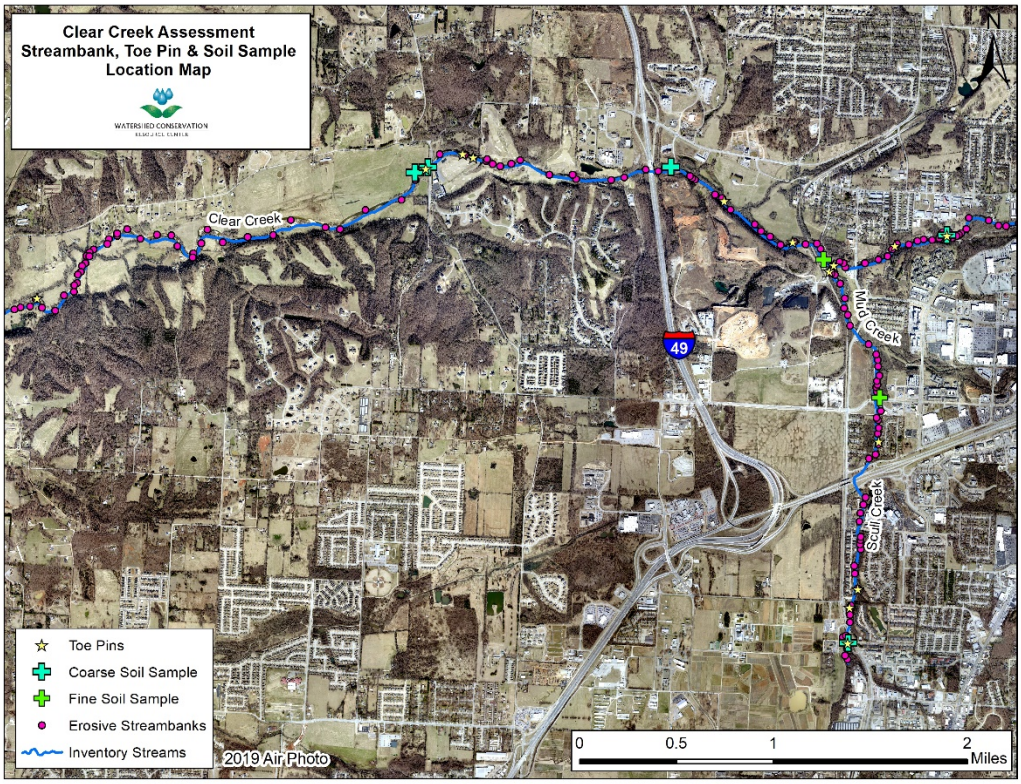


Figure 2-4. Central Section of the Clear Creek Watershed. This figure shows the streambank locations accounted in the inventory, toe pin locations, and soil samples

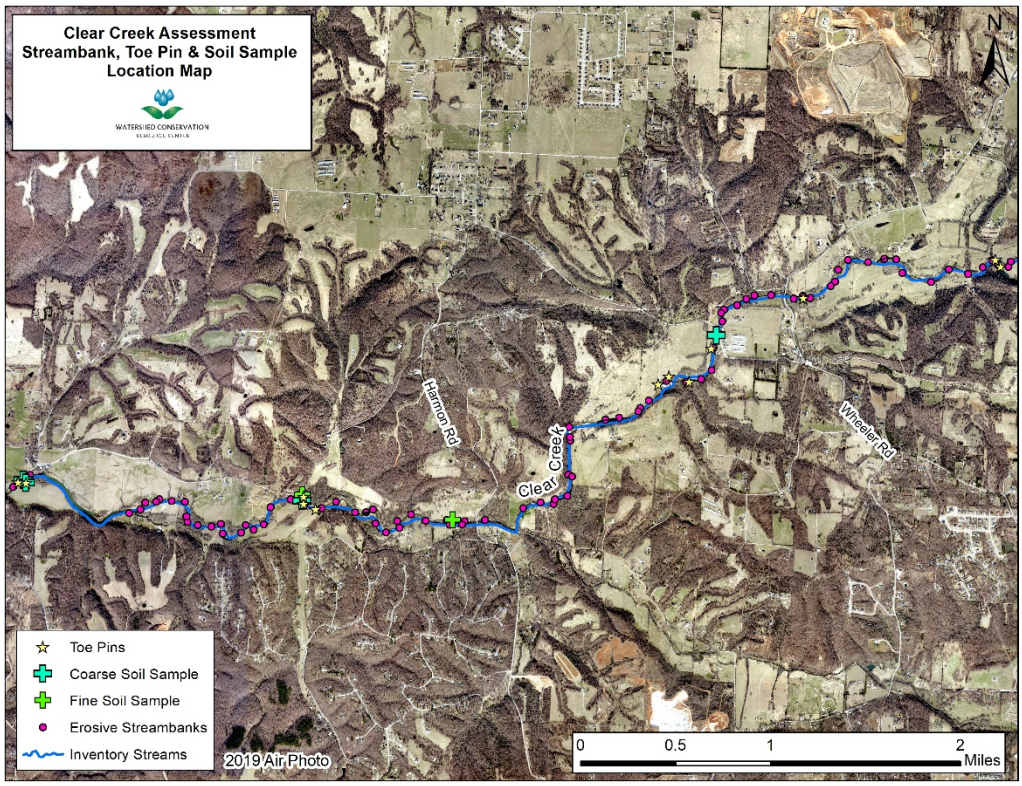


Figure 2-5. Western Section of the Clear Creek Watershed. This figure shows the streambank locations accounted in the inventory, toe pin locations, and soil samples

Streambank Materials Analysis

Samples of the streambank materials (Figure 2-6) were collected at twenty-two different banks throughout the watershed and their locations are shown in Figures 2-3 - 2-5. Sampling sites were selected to provide representation of the bank materials typically found within the study area. Of the samples collected for analysis, twelve coarse bank materials and ten fine bank materials were obtained. A coarse soil sample is generally composed of a mixture of gravel and/or cobble, sand, and soil while fine soil samples consisted only of sand and soils of various textures. Coarse samples were collected using techniques based on published methods (Brye, 2004). This includes the use of expanding polyurethane foam to assist with obtaining bulk density. Fine samples were collected using a 2" by 4" Shelby tube and a slide-hammer. Samples were processed in a laboratory to determine bulk density and particle size distribution. Particle size distribution was used to determine soil type. A sub-sample was sent to the University of Arkansas' Agricultural Department to determine nutrient content. The streambank samples underwent several tests to determine their nutrient content including a Mehlich 3 test (for 21 nutrients, especially total phosphorus), a total digestion (for soluble phosphorus), and a total nitrogen analysis (for total nitrogen). For fine samples, total nitrogen (TN) values ranged from 0.71 to 2.82 lb/ton of soil with an average of 1.38 lb/ton. For coarse samples, TN values ranged from 0.16 to 0.54 lb/ton of soil with an average of 0.32 lb/ton. For fine samples, total phosphorus (TP) values ranged from 0.21 to 0.90 lb/ton of soil with an average of 0.54 lb/ton. For coarse samples, TP values ranged from 0.12 to 0.34 lb/ton of soil with an average of 0.21 lb/ton. For fine samples, bulk densities ranged from 0.87 to 1.45 ton/yd^3 with an average of 1.18 ton/yd^3. For coarse samples, bulk densities ranged from 1.06 to 2.96 ton/yd^3 with an average of 1.89 ton/yd^3. Each soil sample was classified and subdivided into four categories based on particle size distribution: fine, gravel (up to 60% gravel), cobble (greater than 60% gravel), or bedrock. Mean concentration values for use in sediment and nutrient load calculation can be found in Table 2-3.

Figure 2-6. Coarse Soil Sampling on Clear Creek

Table 2-3. Soil Type, Sediment, and Nutrient Analysis

Soil Type	TN	TP	Bulk Density
	lb/ton	lb/ton	ton/yd³
Fine	1.38	0.54	1.18
Gravel	0.43	0.24	1.91
Cobble	0.27	0.2	1.87
Bedrock	0	0	0

Hydrology Analysis

The hydrologic conditions that take place during streambank erosion monitoring directly affect the general applicability of those observations to predict future erosion rates. Also, in order to compare erosion rates observed at each toe pin over the monitoring period, the hydrology of the watershed needs to be taken into consideration. USGS gage 071948095 (Mud Creek at Johnson, AR) provides a good representation of channel size, location, and physiography when compared to the streambanks assessed in this study, but is lacking a sufficient historical monitoring period. From initial toe pin installation to resurvey (8/2017-7/2018) the bankfull flow duration at the gage was approximately 62 hours.

The hours above bankfull discharge were also compared on five other USGS gages near Fayetteville (on the West Fork White River, White River, Town Branch, Osage Creek, and Illinois River). The additional gages show that like the Mud Creek gage, the duration of bankfull discharge was at or above average (Table 2-4). When compared to historical bankfull flow durations, the number of hours above bankfull flow for the additional gages during the monitoring periods was approximately 40 to 60% higher than the

average annual bankfull flow duration. Erosion predictions may need to be scaled down to account for this larger than normal bankfull discharge duration during the toe pin monitoring period.

Table 2-4. Bankfull Flow Data for Various Gage Stations in Proximity to Clear Creek

USGS Gauge	River	Hours Above Bankfull	Bankfull Discharge	Max Discharge	Date of Max Discharge	Average Annual Bankfull Discharge Hours
			cfs	cfs		
071948095	Mud Creek	62	550	2450	2/24/2018	63
07048550	West Fork White River	73	3400	7470	5/3/2018	53
07048600	White River	53	12500	20800	3/27/2018	35
07194800	Illinois River	36	5360	11800	2/24/2018	24
07048495	Town Branch	115	407	2850	5/3/2018	106
07195000	Osage Creek - Elm Springs	26	4200	9500	2/24/2018	16

Monitoring of Streambank Erosion in the Clear Creek Watershed

To estimate sediment loading to Clear Creek from streambank erosion, lateral erosion rates were first applied to inventoried streambanks using the BEHI and NBSS ratings. Streambank erosion rate prediction curves were developed based on physical measurements of streambank erosion in the Clear Creek watershed using streambank monitoring methods described by Rosgen (2006). By relating BEHI, NBSS, and the measured erosion rate at each toe pin monitoring site, lateral erosion prediction curves were developed. The streambank erosion prediction curves are presented in Figure 2-7. After some consideration, it was determined that the initial streambank erosion monitored for the Clear Creek watershed was most applicable to streambanks in the Lake Fayetteville watershed and low erosion streambanks. This was validated by GIS aerial erosion monitoring conducted for streambanks downstream of Lake Fayetteville and described as follows:

Additional GIS Analysis of Highly Erodible Streambanks in the Lower Clear Creek watershed

Within the lower Clear Creek watershed, a significant portion of the sediment and nutrient loading comes from a small minority of streambanks. Direct monitoring of these banks is often challenging, as toe pin monitoring placement does not always correspond to the most erosive areas, and in this case, utilizing toe pin data was shown to drastically under predict the actual amount of sediment entering Clear Creek on a yearly basis when looking at air photos taken yearly. Therefore, a GIS-based air photo analysis was performed on all banks downstream of the confluence of Clear Creek and Mud Creek to find these "Highest Priority" banks and quantify their contribution to water quality impacts within the watershed. Sediment and nutrient loads from the "Highest Priority" banks were compared with the rest of the inventoried streambanks.

In total, 203 individual streambanks were analyzed to determine the amount of streambank erosion that had occurred from 2017 to 2019. Of those 203 banks, 18 were determined to have shown significant erosion over the two-year period. Within a GIS environment, the top of bank was traced in ArcMap using Washington County aerial photography from 2017, 2018, and 2019 for each of the 18 streambanks. Polygon graphics were created between the top of bank lines (2017 to 2018 and 2018 to 2019) and a total eroded area was determined over the two-year period. An average annual erosion rate (per linear foot) was calculated by dividing the total eroded area by the eroding bank length times two (to account for the two-year period). Average erosion rates presented in Figure 2-7 should only be used in the Lake Fayetteville watershed. Additional data should be collected to develop a separate set of curves for the

lower part of the watershed or combine this data with the inventory results to develop a set of curves that could be used for the entire watershed.

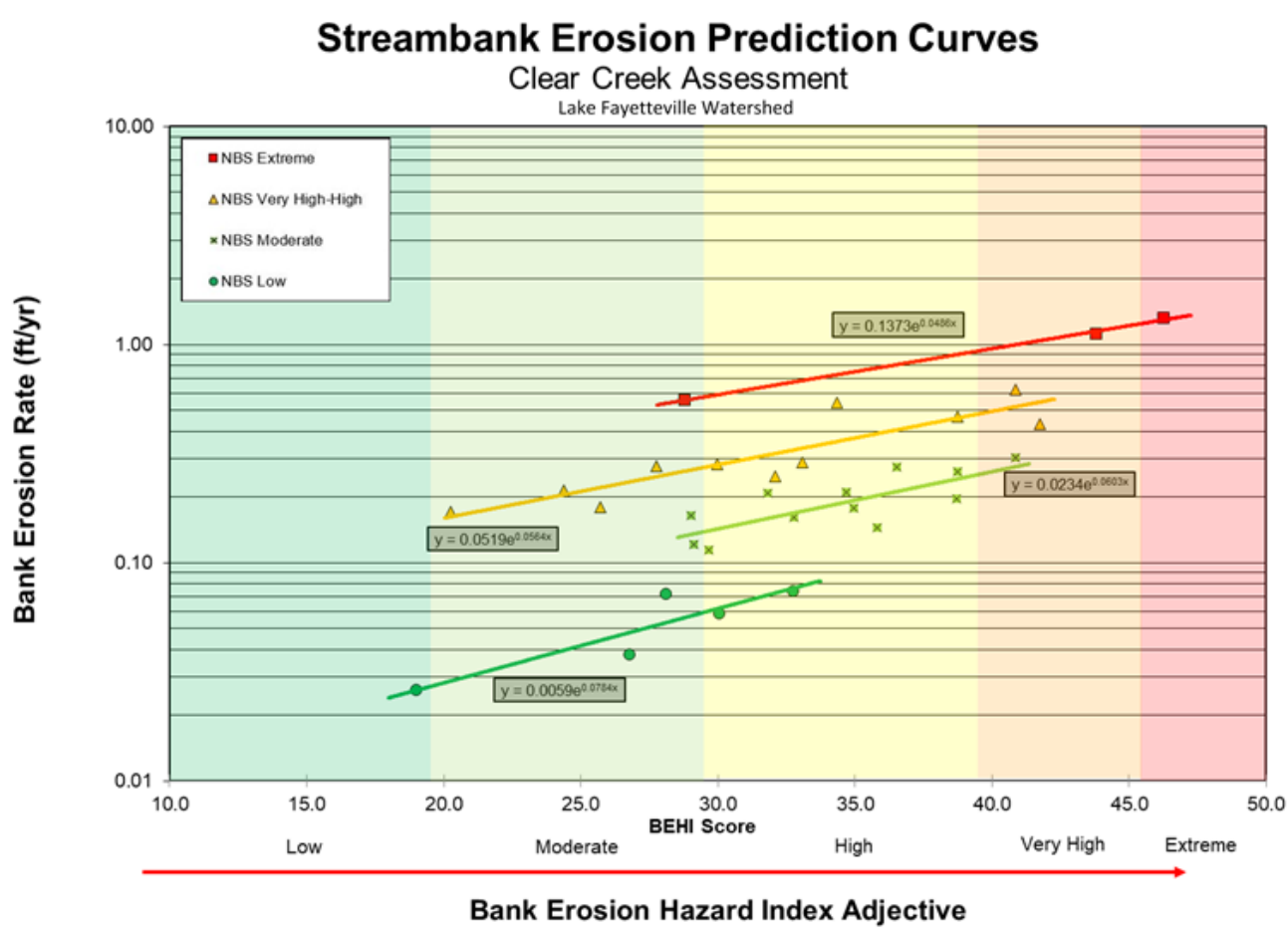


Figure 2-7. BEHI Plotted against Bank Erosion for Four NBSS Cases for Streambanks for use in the Lake Fayetteville Watershed only.

Using the GIS evaluation of the lower watershed, the average yearly sediment and nutrient load contributions were calculated. Sediment load was determined by multiplying the average annual erosion rate, the bank height, the eroding bank length, and the bulk density of the eroded soil weighted by the bank's soil composition. Nutrient loads were found by following that same process using nutrient concentration based on the soil composition in place of bulk density. Bank height and soil composition were determined during the initial Clear Creek Assessment inventory. Bulk density and nutrient concentrations were previously calculated using soil samples collected throughout the watershed. Average annual sediment loads for individual streambanks ranged from 200 to 10,000 tons per year. Average annual nutrient loads for individual stream banks ranged from 67 to 3,600 pounds per year for Total Phosphorus and 146 to 8,200 pounds per year for Total Nitrogen. Overall, the "Highest Priority" banks contribute approximately 37,000 tons of sediment, 13,000 pounds of total phosphorus, and 29,000 pounds of total nitrogen each year to the watershed. In comparison, the other 185 banks in the lower watershed are estimated to contribute only 11,700 tons of sediment, 3,800 pounds of total phosphorus, and 8,000 pounds of total nitrogen each year. Based on these numbers, approximately 75% of all sediment and nutrient loads come from these "Highest Priority" banks. All data discussed in this write-up is presented in Table 2-5 on the following page. Additionally, maps showing the locations of the "Highest Priority" banks and close-ups of the two worst eroding streambanks, CC287 and CC356, can be found in

Appendix 4. For all other streambanks, erosion prediction curves provide an estimate of sediment loading to Clear Creek (Figure 2-7). Streambank erosion rates increase with higher BEHI and NBSS ratings. The maximum lateral erosion for the Clear Creek curve data set for Lake Fayetteville and low priority banks was 1.33 ft/yr and the average was 0.30 ft/yr.

Table 2-5. Annual Loading from GIS Monitored Highest Priority Banks

Bank	BEHI	NBSS	Eroding Bank Length	Bank Height	Average Annual Lateral Erosion	Average Annual Sediment Load	Average Annual Total P Load	Average Annual Total N Load
			ft	ft	ft	ton/yr	lb/yr	lb/yr
CC356	Extreme	Extreme	840	8.0	25.1	10,094	3,634	8,176
CC287	Very High	Extreme	563	8.0	20.7	5,337	2,081	4,830
CC290	Very High	Extreme	626	7.0	16.5	5,100	1,224	2,193
CC336	High	Extreme	371	9.5	10.8	2,381	786	1,702
CC335	Extreme	Extreme	305	10.0	9.5	1,742	627	1,411
CC294	Very High	Extreme	420	10.0	7.3	1,598	719	1,750
CC396	High	Extreme	297	8.5	10.1	1,526	549	1,236
CC386	Very High	Very High	388	8.5	8.4	1,440	648	1,576
CC282	Extreme	Extreme	328	12.5	6.4	1,433	602	1,433
CC302	Very High	Extreme	182	9.5	10.9	1,334	320	573
CC286	Extreme	High	189	10.0	8.8	910	382	910
CC332	Very High	Extreme	375	8.0	4.7	848	305	687
CC344	Very High	Extreme	246	10.5	5.6	832	325	753
CC371	High	High	163	9.0	9.0	651	312	775
CC352	Very High	Very High	227	9.5	3.8	491	177	398
CC340	Very High	Extreme	158	9.0	4.3	379	125	271
CC403	Very High	Very High	130	9.5	6.5	353	191	487
CC385	High	High	180	5.5	3.3	204	67	146
					High Priority Bank Total	36,653	13,075	29,308
					Low Priority Bank Total	11,678	3,758	8,041
					Lake Fayetteville Wateshed Total	879	208	388
					Clear Creek Watershed Total	49,210	17,041	37,737

Ecological Analysis of Clear Creek

An inventory of natural features was conducted to better understand the presence of unique or under-represented natural areas of interest within the Clear Creek watershed. Areas of potential ecological and botanical interest are defined as those areas that represent unusual, declining, or high-quality natural communities; serve as especially valuable habitat for wildlife; and/or support occurrences of State Species of Greatest Conservation Need (SGCN). Theo Witsell conducted a GIS analysis of the riparian area along Clear Creek, the Lake Fayetteville watershed, and other identified streams. He identified and mapped 98 potential sites which include: open wetlands, prairie mounds/swale complexes, east slopes, north slopes, wet flatwoods, glades, spring-fed ponds, abandoned channels, channel scar ponds, spring and spring runs, mesic forests, ponds-spring fed, and backwater channels. A rank of high, medium, or low were assigned that indicated the priority of each feature to be ground-verified. Of the 98 features, 16 sites were visited one or more times and assessed on the ground by Theo Witsell and Karen Willard. Maps that display the GIS inventoried sites with an overlay of the field assessed site locations are seen in Figures 2-8 – 2-10. However, many sites identified as areas of potential interest from aerial imagery analysis could not be effectively evaluated due to 1) the condition of the vegetation at the time of the surveys (e.g. the vegetation was either grazed or mowed) or 2) lack of landowner permission to access the sites. As such, these areas were not fully evaluated; therefore, they should still be considered as areas of interest. A

summary report that includes a description of the 16 assessed sites can be found in Appendix 5 and maps showing the 98 sites and 16 assessed sites can be found in Appendix 6.

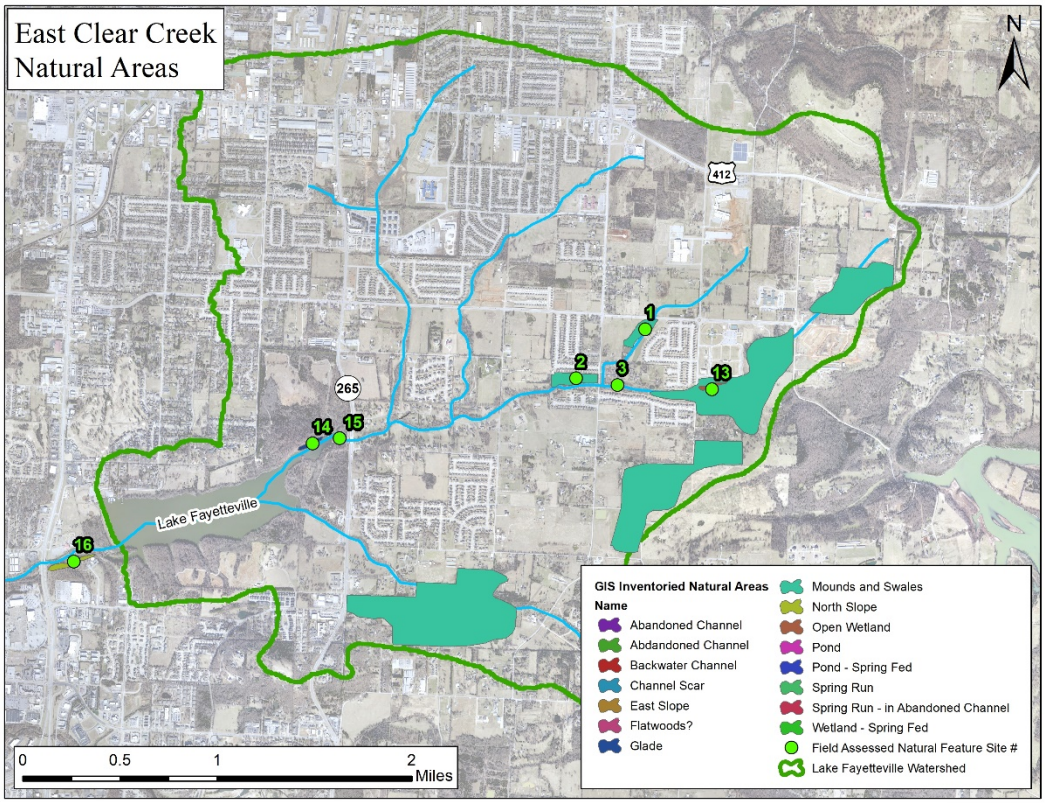


Figure 2-8. Natural Areas Inventoried in the Eastern Area of the Clear Creek Assessment

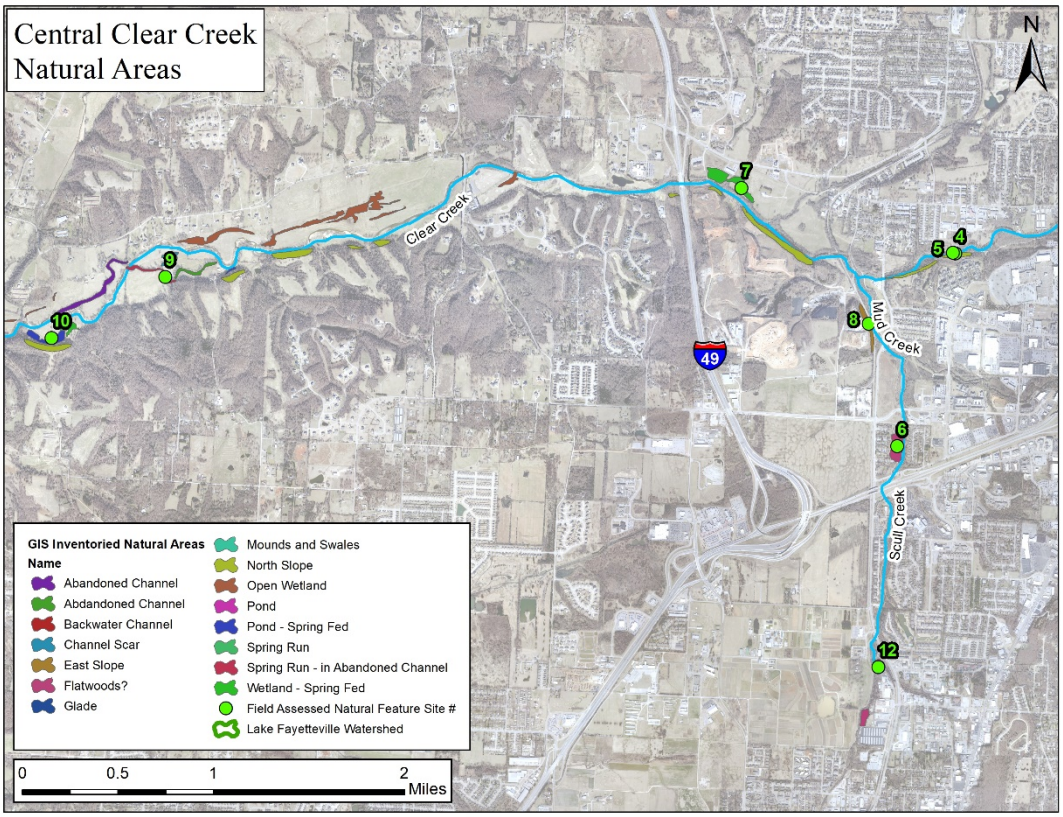


Figure 2-9. Natural Areas Inventoried in the Central Area of the Clear Creek Assessment

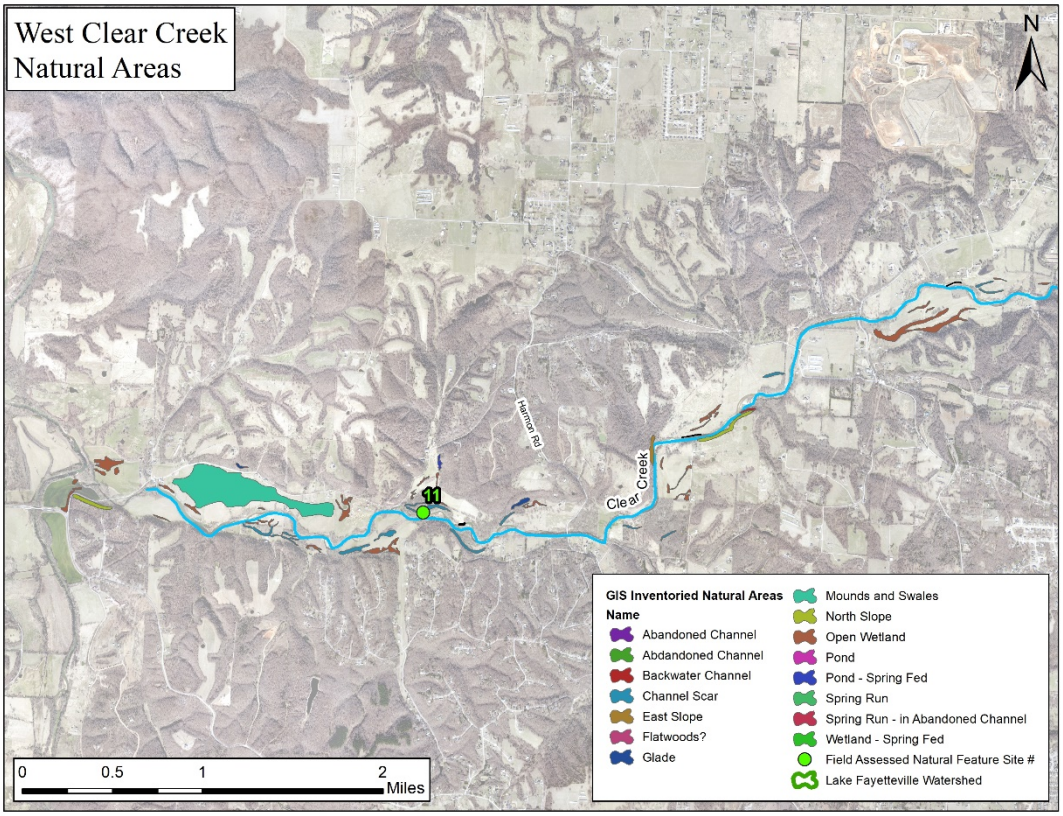


Figure 2-10. Natural Areas Inventoried in the Western Area of the Clear Creek Assessment

Discovery through Collaboration

The WCRC utilized the natural resource inventory information and worked with Arkansas Game and Fish Commission (AG&FC) and Arkansas Natural Heritage Commission (ANHC) to explore areas identified through this work that may have Least Darters (Etheostoma microperca), a State Species of Greatest Conservation Need (SGCN). The team from AG&FC and ANHC sampled several sites during their field trip and found 49 Least Darters at an identified site along Clear Creek (Figure 2-11).

Figure 2-11 Collaboration with Other Natural Resource Organizations Resulted in Finding a State Listed SGCN, Least Darter, at One of the Identified Natural Areas of Interest Along Clear Creek.

Riparian Analysis

A riparian buffer analysis was performed utilizing ArcGIS and 2018 Air Photos. The riparian width was measured along the streams evaluated for this study. Working from upstream to downstream, the location of the riparian width was demarcated as left, right, both or none. The width of the riparian as determined by the GIS analysis was separated into categories of less than 50 feet in width, greater than or equal to 50 feet in width, or no riparian width at all. Fifty feet was selected as the riparian width cutoff because this value is the prescribed protected width based on the City of Fayetteville's streamside protection ordinance. The results of the riparian assessment are shown in Figure 2-12 – 2-14 and Table 2-6 along with the width as a function of the percentage of stream length. Maps showing the riparian conditions along the length of the Clear Creek assessment basins are presented in Appendix 7. As much as 32.2% of riparian areas along South East Clear Creek had no riparian on either side of the stream.

Table 2-6. Riparian Conditions for the Clear Creek Watershed

Riparian Condition	North East Clear Creek	South East Clear Creek	Scull Creek	Clear Creek
	% of basin	% of basin	% of basin	% of basin
Riparian Both Sides ≥ 50	26.9%	7.0%	40.4%	62.7%
Left Riparian < 50, Right Riparian ≥ 50	12.1%	11.7%	32.2%	6.1%
Left Riparian ≥ 50, Right Riparian < 50	12.1%	0.0%	11.2%	6.7%
Left Riparian ≥ 50, No Right Riparian	13.3%	40.9%	6.3%	12.5%
Right Riparian ≥ 50, No Left Riparian	0.0%	6.0%	0.0%	0.0%
Riparian Both Sides < 50	0.0%	0.0%	0.0%	0.9%
Left Riparian < 50, No Right Riparian	2.8%	2.2%	1.2%	3.7%
Right Riparian < 50, No Left Riparian	2.4%	0.0%	0.0%	0.9%
No Riparian Both Sides	30.3%	32.2%	8.7%	6.5%

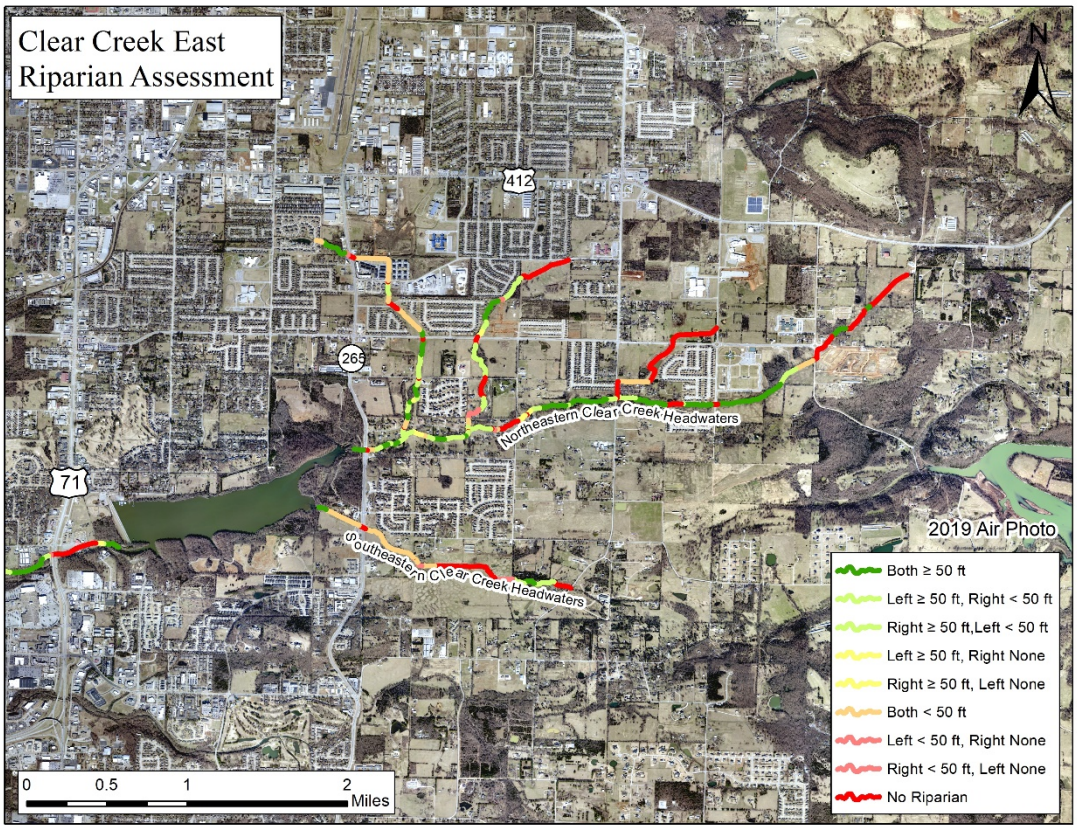


Figure 2- 12. Riparian Conditions for the Clear Creek Watershed in Lake Fayetteville

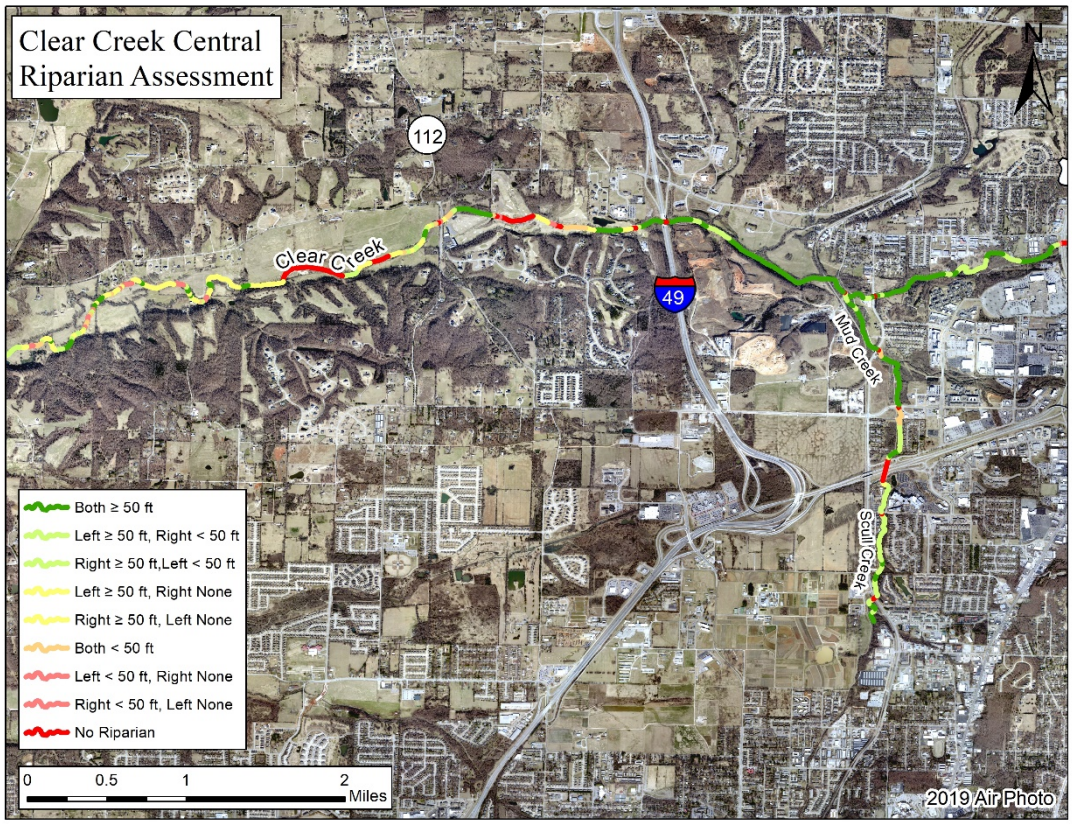


Figure 2-13. Riparian Conditions for the Clear Creek Watershed in the Central Section

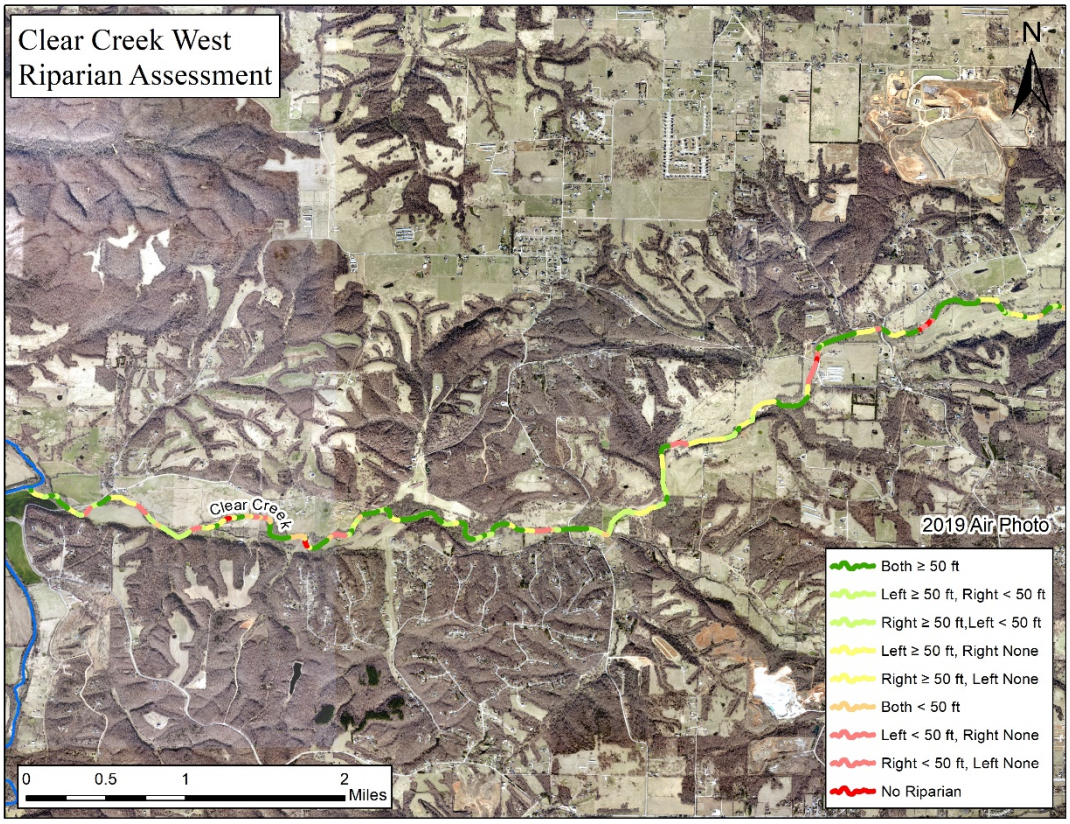


Figure 2-14. Riparian Conditions for the Clear Creek Watershed in the Western Section

Section 3. - Sediment Evaluation of the Lake Fayetteville Watershed

Sediment sources within the Lake Fayetteville watershed were evaluated to better understand the amount and impact imposed on this waterway from its various land uses. Sources of sediment were developed from general observations, discussion with City staff, direct monitoring of erosion, and general trends in sediment production derived from previous studies. The various sediment sources addressed in this study are presented in Table 3-1. These sources of sediment were developed from information and data collected during this study, data developed in previous studies for similar watersheds within this ecoregion, and simple to complex models of sediment production. **The sediment loads in this study are an estimate of sediment delivered to the stream**. **The estimates are for watershed planning purposes only, to help better understand and direct resources to reduce sediment loading and improve habitat in the Clear Creek watershed.**

Table 3-1. Sediment Sources, Data, and Methods Conducted to Estimate Sediment Production for the Lake Fayetteville Watershed

Source of Sediment	Data	Method for Estimating Load
Accelerated Stream Bank Erosion	Bank Erosion Hazard Index (BEHI) Near Bank Shear Stress (NBSS) Bank Measurements ・Height ・Length Streamank Material Sampling ・Bulk Density	Graphical Streambank Erosion Prediction Curves and physical monitoring data for the Lake Fayetteville Watershed
Pastures	Land Use Digital Elevation Model Watershed Characteristics Managament Practices Soil Classification	WEPP derived sediment production coefficients from Blossom Way watershed
Construction	Land Use	Published coefficents and data from a BMP to sediment production study conducted for Blossom Way Watershed
Urban Land Use	Land Use	Published coefficients
Other Sources	Land use	Published coefficients
Forest Lands		
Roads and Highways		
Undeveloped Land		
Farmsteads		
Barren Land		

Land Use Analysis

Historically, the Lake Fayetteville watershed was characterized by gently rolling hills, forest and prairie land, wetlands, open woods, thin timber with black oaks, blackjack oaks, post oaks, and hickory undergrowth with some red oaks and cherries, according to an analysis of a General Land Office (GLO) survey conducted in 1834 (Commissioner of State Lands, AR). A map showing the results of the natural areas inventory (Appendix 6) conducted during this project is presented in Figure 3-1 with the background imagery showing the results of the 1834 survey. Clear Creek tributaries were drawn in the 1834 survey, but were not recorded to be nearly as wide as they are today. In some areas there is no mention of water where there is currently a significant tributary, an indication of how development and impervious features within the watershed have altered channel width and reduced ground water infiltration. Wetland features were described in the 1834 survey and several of these same areas were observed in this study. Some areas of prairie features appear to have remained relatively unchanged, in some cases, since noted in the 1834 survey.

A land use analysis was conducted for the Lake Fayetteville watershed in order to quantify changes that have occurred within the watershed in a ten-year time span from 2006 through 2016. The Lake Fayetteville basin totals 6,001 acres or 9.4 mi^2 covering land within Springdale, Fayetteville, and Washington County. Clear Creek had two main tributaries identified in this study, one in the Southeast

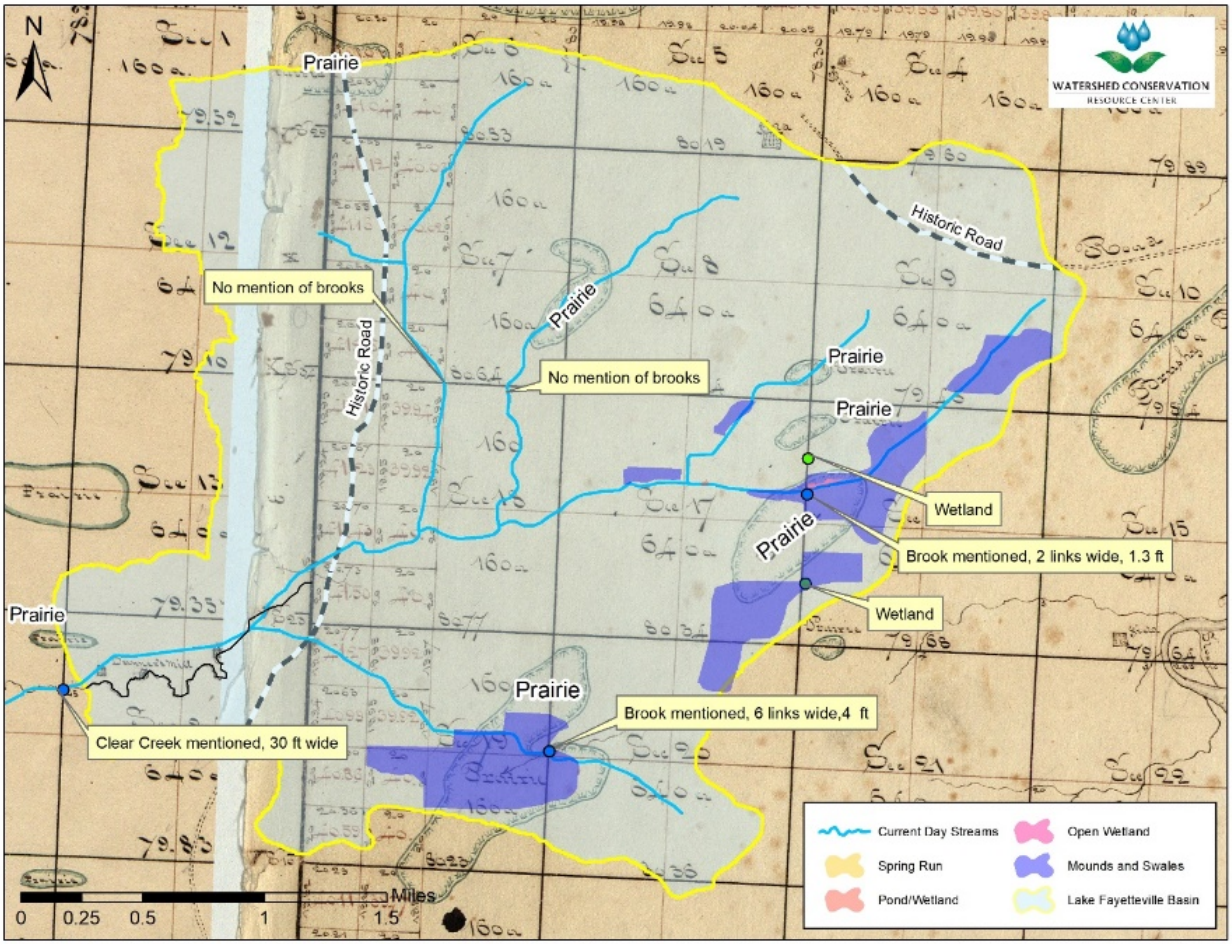


Figure 3-1. Lake Fayetteville Historical 1834 Survey Map Overlaid with Shapefile Features from the Natural Area Inventory.

and the other larger tributary comes from the Northeast, predominantly in Springdale. Where these two tributaries meet Lake Fayetteville is formed, which is impounded in the Southwest corner. The Lake Fayetteville watershed is almost entirely in the Springfield plateau in the Ozark Highlands Ecoregion. A portion of the watershed in the lower southeast juts into the Lower Boston Mountains of the Boston Mountain Ecoregion. The Ozark Highlands are characterized by a dominance of Paleozoic rock features and is underlain largely by highly soluble and fractured limestone and dolomite. Soils are often cherty and developed from carbonate rocks or interbedded chert, sandstone and shale. The Springfield plateau is characterized by Karst features such as sinkholes and caves, cold, perennial spring-fed streams, oak-hickory and oak-hickory-pine forests, savannahs and tall grass prairies. Most of the forests and almost all prairies have been replaced by agriculture and expanding residential areas (Woods et. al., 2004). In order to monitor the development and changes within the watershed, aerial imagery was obtained for 2006 and 2016 and land use was categorized using the USGS Anderson Land Classification Scheme. Land use was evaluated using a heads up digitization approach. Land use was categorized into six main categories and then further classified into a second level and sometimes third level of analysis.

Some results from the GIS analysis can be seen in Tables 3-2 – 3-4 and Figure 3-2. A Level I Analysis indicates urban land is the predominant land use covering 54% in 2016 and when compared to 2006, a rise in 5.8% of the basin occurred over the ten-year time span (Figure 3-2). Agricultural land use decreased by 7.7% of the basin as farm land and open space became developed (Table 3-1). A Level II Analysis of the urban land use category indicates that residential land use makes up the majority of this subcategory (Table 3-2). A level III analysis of residential land use is shown in Figure 3-3 and rural homes are still the highest residential use. Additional information and analyses are presented in Appendix 8.

Table 3-2. Level I Land Use in the Lake Fayetteville Watershed for the Years 2006 and 2016

Land Use Level I	2006	Percent of Total	2016	Percent of Total	Change	Change of Basin
	Acres	%	Acres	%	Acres	%
Urban	2895	48.2%	3243	54.0%	348.4	5.8%
Agricultural	2184	36.4%	1720	28.7%	-464.1	-7.7%
Forest-land	425	7.1%	523	8.7%	97.9	1.6%
Water	293	4.9%	328	5.5%	35	0.6%
Wetlands	1	0.0%	1	0.0%	0	0.0%
Barren Lands	203	3.4%	186	3.1%	-17.2	-0.3%
Total	6001		6001			

Table 3-3. Level II Urban Land Use in the Lake Fayetteville Watershed for the Years 2006 and 2016

Urban Level II	2006	Percent of Total	2016	Percent of Total	Change	Change of Basin
	Acres	%	Acres	%	Acres	%
Residential	1986	33.1%	2156	35.9%	170	2.8%
Commercial	256	4.3%	359	6.0%	102.5	1.7%
Industrial	140	2.3%	132	2.2%	-8.6	-0.1%
Transportation	128	2.1%	187	3.1%	59.6	1.0%
Industrial and commercial	70	1.2%	70	1.2%	0.4	0.0%
Open Urban Lands	314	5.2%	339	5.6%	24.6	0.4%

Table 3-4. Level III Residential Land Use in the Lake Fayetteville Watershed for the Years 2006 and 2016

Residential Level III	2006	Percent of Total	2016	Percent of Total	Change	Change of Basin
	Acres	%	Acres	%	Acres	%
Low	313	5.2%	394	6.6%	81.5	1.4%
Medium	452	7.5%	543	9.0%	90.9	1.5%
High	74	1.2%	78	1.3%	3.9	0.1%
Multi-family	119	2.0%	132	2.2%	12.9	0.2%
Rural Home	1010	16.8%	990	16.5%	-19.6	-0.3%
Mobile Home	18	0.3%	18	0.3%	-0.1	0.0%

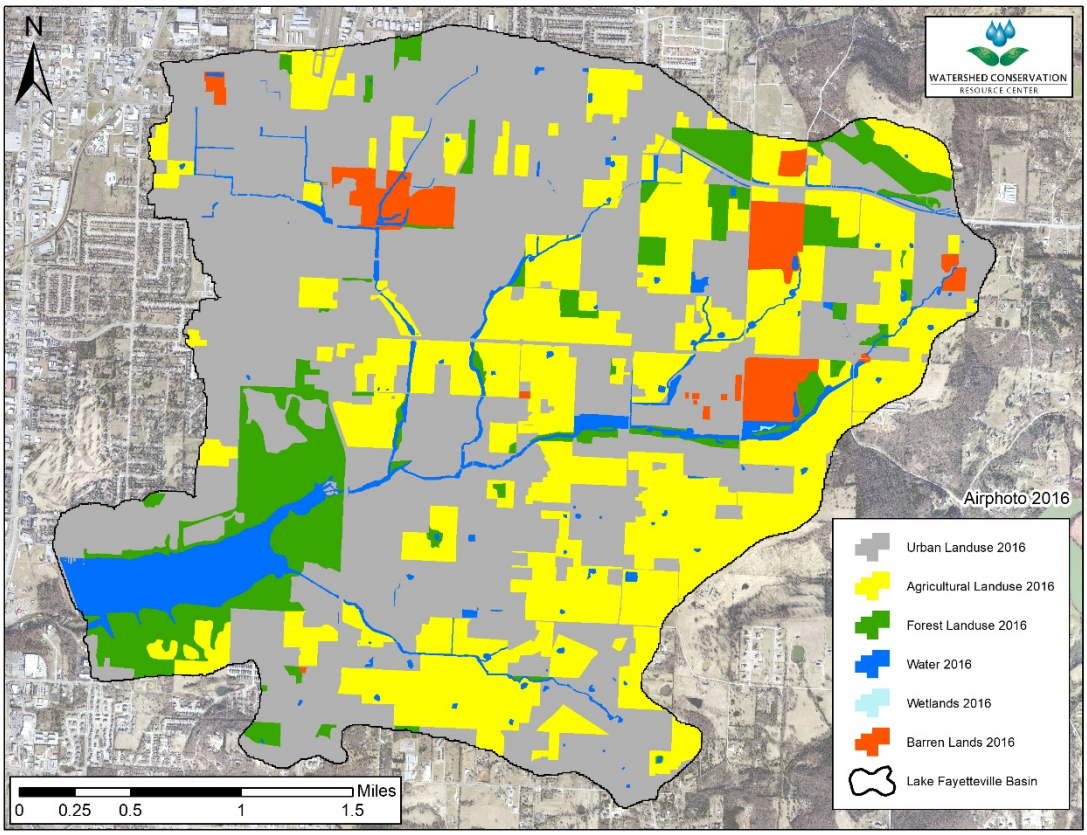


Figure 3-2. Level I Analysis Completed for the Lake Fayetteville Watershed in 2016

Determination of Impervious Cover

An assessment of the amount of impervious surface that coincides with each land use was conducted for the Clear Creek Watershed. Impervious Area Coefficient data developed in a study conducted for the Blossom Way watershed in Rogers, AR were used for this study (WCRC, 2008). The Blossom Way watershed is located in the same ecoregion and has the same soil type and general land use activities as the Lake Fayetteville watershed. The coefficients were developed as follows:

1) A minimum of 10% of the total area for a selected Level III land use was evaluated. Impervious surfaces were digitized within a selected land use. The area of impervious surface was divided into the total area for the selected land use.
2) Completely impervious surface features were added in the analysis. These included paved roads, paved highways, paved sidewalks, and paved runways.

The delineated land uses where the impervious coefficients were applied in the Lake Fayetteville watershed are shown in Figure 3-3. The coefficients for each land use that were applied to the Lake Fayetteville's Level II and III land uses and estimated impervious surface for the years 2006 and 2016 are presented in Table 3-5.

The Center for Watershed Protection has developed a tool for predicting the effects of the amount of impervious features within a watershed to the streams within them. This is known as the Impervious Cover Model (Schuler 2005). This model separates impact on streams into four categories of Impervious Cover (IC) 1) Sensitive (0% - 10% IC) 2) Impacted (10% - 25% IC) 3) Non-supporting (25% - 60% IC) 4) Urban Drainage (>60% IC). The results of the analysis showed that in 2006, 13% of the watershed was impervious and in 2016, the impervious surface increased to 16% of the watershed. Both of these percentages fall into the impacted category. Though the categorization hasn't changed since 2006, it has increased. Streams that are impacted suffer from degraded water quality, loss of riparian cover, and channel enlargement. However, these streams are generally good candidates for restoration as there is significant undeveloped land use where BMPs can be implemented to mitigate and restore loss of groundwater infiltration within the watershed.

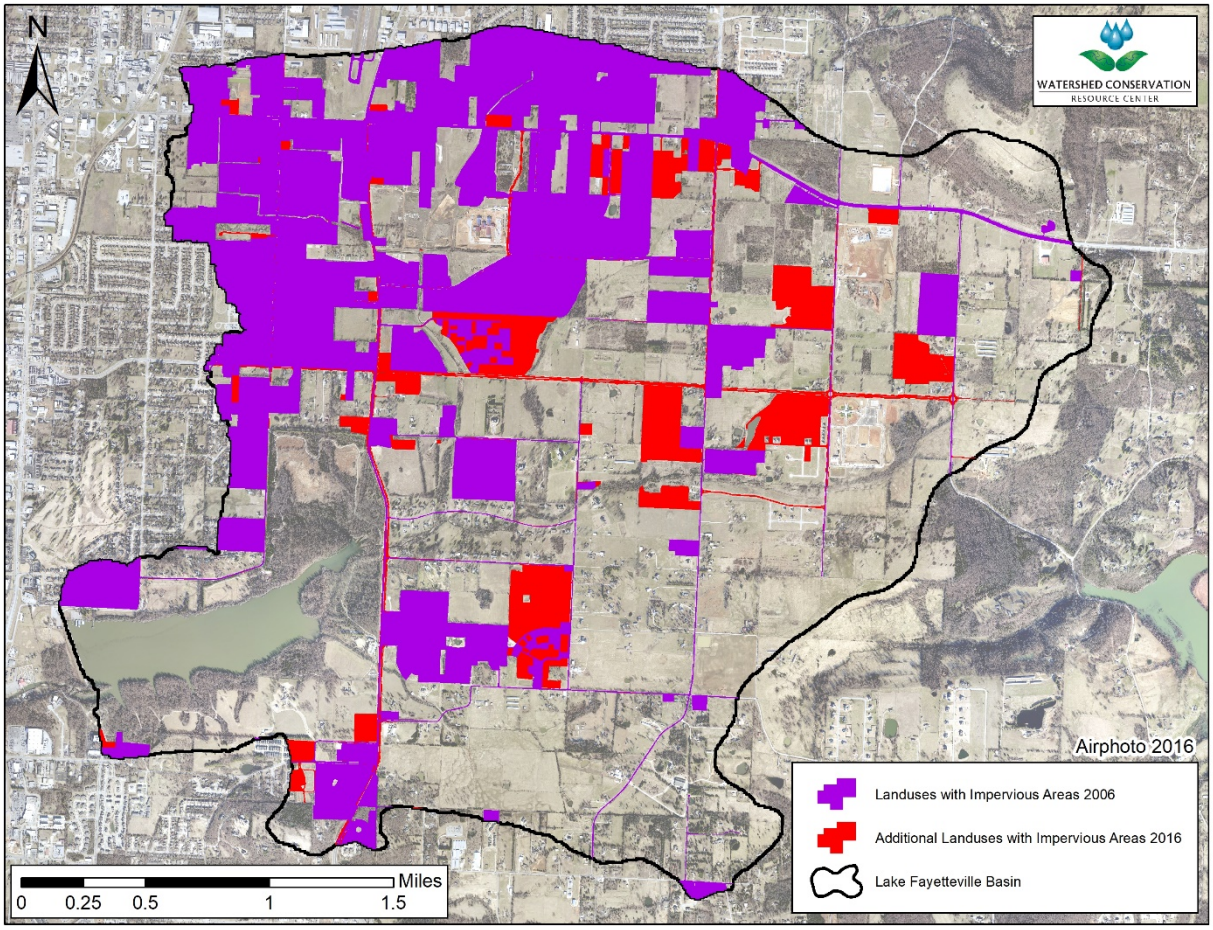


Figure 3-3. Land Use Types Identifying Areas with Imperviousness for 2006 and Additional Areas with Imperviousness in 2016.

Table 3-5. Impervious Area for Various Land Uses for the Lake Fayetteville Watershed in 2006 and 2016. Coefficients presented are from WCRC 2008.

Land Use	2006	2016	Change of Basin	Change of Basin	Coefficient	IAC or Percent Impervious Cover 2006	Imperviousness of Basin	2016	Imperviousness of Basin
Commercial	Acres	Acres	Acres	%	%	Acres	%	Acres	%
Low Impervious	183.3	252.8	69.5	1.2%	44.4%	81.4	1.4%	112.2	1.9%
High Impervious	72.9	106	33.1	0.6%	78.8%	57.4	1.0%	83.5	1.4%
Industrial									
Low Impervious	30.9	17	-13.9	-0.2%	37.6%	11.6	0.2%	6.4	0.1%
High Impervious	109.2	114.6	5.4	0.1%	90.5%	98.8	1.6%	103.7	1.7%
Residential									
Low	312.8	394.3	81.5	1.4%	15.7%	49.1	0.8%	61.9	1.0%
Medium	452	542.9	90.9	1.5%	35.0%	158.2	2.6%	190.0	3.2%
High	73.9	77.8	3.9	0.1%	50.6%	37.4	0.6%	39.4	0.7%
Multi-family	119.3	132.2	12.9	0.2%	40.7%	48.6	0.8%	53.8	0.9%
Rural Home	1009.6	990	-19.6	-0.3%	9.5%	95.9	1.6%	94.1	1.6%
Mobile Home	18.4	18.3	-0.1	0.0%	39.7%	7.3	0.1%	7.3	0.1%
Paved Roads	69.5	107.7	38.2	0.6%	100.0%	69.5	1.2%	107.7	1.8%
Paved Highways	43.1	54.9	11.8	0.2%	100.0%	43.1	0.7%	54.9	0.9%
Paved Sidewalks	6.1	18.8	12.7	0.2%	100.0%	6.1	0.1%	18.8	0.3%
Paved Runway	2.5	2.5	0	0.0%	100.0%	2.5	0.0%	2.5	0.0%
					Total	**767**	**12.78%**	**936**	**15.60%**

Streambank Material Sampling

Direct sampling of streambank material was conducted in the Lake Fayetteville watershed. Fine and coarse bank materials were sampled according to the methods described previously. After some consideration it was determined that fine bank material samples collected in the Lake Fayetteville watershed were abundant enough to be representative to all fine streambanks, but there was insufficient data collected solely within the Lake Fayetteville watershed for coarse soil samples, so bulk density amounts and nutrient content amounts were estimated from all streambank material samples in the Clear Creek watershed. Fine bank material has a bulk density of 1.27 ton/yd^3, gravel bank material is 1.91 ton/yd^3, cobble bank material is 1.87 ton/yd^3, and bedrock is 0 ton/yd^3 as this resilient bank material was assumed to not release sediment into the waterways.

Estimate of Annual Sediment Loads from Streambank Erosion

Using the streambank inventory, erosion prediction curves, and streambank materials analysis, the volume of eroded material and loads of sediment and nutrients can be developed for the Lake Fayetteville watershed. It was determined that an average of 879 tons/yr of sediment was being released into the waterways from accelerated streambank erosion. 777 tons/yr was released from the Northeast Tributary to Lake Fayetteville and 102 tons/yr is released from the Southeast tributary to Lake Fayetteville. The sediment prediction curves were applied to the various BEHI and NBSS conditions for streambanks in the watershed. This allows for city planners to understand how much a given streambank will erode, particularly ones that are in proximity to infrastructure that may pose a risk of eroding into those features.

Estimate of Annual Sediment Loads from Pasture

Land use in the Lake Fayetteville watershed for the year of 2016 consisted of 1,567 acres of pasture land, designated via heads-up digitization. The Level II land use analysis data used here is available in Appendix 8. Pasture land is generally used for producing and cutting hay and for livestock grazing. Pasture lands have less infiltration of rain water when compared to forested lands because of soil compaction from

livestock and farm equipment. Surface water runoff from pastures carries sediment particles from eroding soils to the Clear Creek stream network.

Soil loss from pasture lands was estimated from soil loss and sediment delivery coefficients based on slope and soil type developed in the Blossom Way watershed study using the Watershed Erosion Prediction Project (WEPP) hillslope model (WCRC 2008). The Blossom Way watershed is located in the same ecoregion as the Lake Fayetteville watershed and the predominant soil type, Clarksville soils, is the same for both watersheds. Therefore, the Blossom Way coefficients were applied to the pasture lands of the Lake Fayetteville watershed. A summary table developed for this study showcasing WEPP soil loss coefficients (WCRC 2008), area, and sediment delivery by slope value is presented in Table 3-6. There is a direct correlation in slope to soil loss with the majority of sediment entering Clear Creek occurring for the >5% slope pastures. Total soil entering Clear Creek from pastures in the Lake Fayetteville watershed is 216.8 tons/yr.

Table 3-6. WEPP Soil Loss Coefficients (WCRC 2008), Sediment Loss and Sediment Delivery by Pasture Slope in the Clear Creek Watershed

Average Pasture Slope	WEPP Soil Loss Coefficient	Area	Sediment Delivery	Percent of Total Sediment Load
	Ton/ac/yr	Acres	Tons	%
1 - 2%	0.33	17.7	1.1	0.5%
2 - 3%	0.52	565.1	55.8	25.8%
3 - 4%	0.65	522	64.5	29.7%
4 - 5%	0.8	186.6	28.4	13.1%
>5%	1.28	275.6	67.0	30.9%
	Total	1567	216.8	100.0%

Estimate of Annual Sediment Loading from Urban Land Use and Construction

Suspended sediment from urban areas can come from a variety of sources including streets, lawns, landscaping, driveways, atmospheric deposition, construction and erosion of drainage channels (USEPA 1999). Sediment loading will be addressed for this section in two parts 1) Urban land use 2) Construction for the Lake Fayetteville watershed.

Urban Land Use

Urban land use, excluding land use associated with construction for this part, will contribute sediment in a number of ways. Level II and Level III land use analysis data was applied here from Appendix 8, and the corresponding sediment production is quantified from coefficients developed in previous studies and applying them to the Lake Fayetteville watershed (Shaver, 2007; U.S EPA, 1999).The sediment production coefficients and corresponding loading rates are presented in Table 3-7, in the form of Total Suspended Solids (TSS) data. The minimum and maximum rates for each land use are presented with a mean value for comparison to separate studies. Total sediment production developed here is 149.7 tons/yr at a minimum, 655.6 tons/yr at a maximum, and 402.4 tons/yr as a mean loading rate.

Table 3-7. Sediment Loading Coefficients and Rates Developed for Urban Land Use in the Lake Fayetteville Watershed

Land Use	Area	Minimum Coefficient	Maximum Coefficient	Mean Coefficient	Minimum Load	Maximum Load	Mean Load
Residential	Acres	lb/ac/yr	lb/ac/yr	lb/ac/yr	ton/yr	ton/yr	ton/yr
Low	394.3	53	303	178	10.4	59.7	35.1
Medium	542.9	70	395	232	19.0	107.2	63.0
High	77.8	86	487	287	3.3	18.9	11.2
Multi-Family	132.2	118	672	395	7.8	44.4	26.1
Rural Home	990	53	303	178	26.2	150.0	88.1
Commercial	358.8	215	1218	716	38.6	218.5	128.5
Industrial	131.6	670	860	765	44.1	56.6	50.3
Public Park	123	3	3	3	0.2	0.2	0.2
				Total	149.7	655.6	402.4

Estimated Sediment Loading from Construction

Areas under construction has almost no vegetation and sediment is exposed to rainfall events. Without proper management practices in place, these sites can generate significant sediment loadings to waterways. Sediment delivery coefficients from construction sites were developed in the Blossom Way watershed for different levels of management of sediment at sites (WCRC 2008) and these values were applied to the Lake Fayetteville watershed. Using Aerial photography, construction sites were identified for 2006 and 2016 for the Lake Fayetteville watershed. The 2016 data was used. A summary of construction sediment coefficients (WCRC 2008) and loadings are presented in Table 3-8. Moderate BMP effectiveness, or the "Mean Load" of 98.2 ton/yr, was developed to quantify sediment production for this watershed due to construction.

Table 3-8. Construction Sediment Production Coefficients (WCRC 2008) and Sediment Production Rates

Construction Duration	Area	Runoff	Minimum Coefficient	Maximum Coefficient	Mean Coefficient	Minimum Load	Maximum Load	Mean Load
	acres	inches	mg/L	mg/L	mg/L	ton/yr	ton/yr	ton/yr
1 - year	132.3	9.4	365	11,217	680	51.4	1580.1	95.8
6 - months	6.7	9.4	365	11,217	680	1.3	40.0	2.4
					Total	52.7	1620.2	98.2

Estimated Sediment Load from Other Sources

Other land uses evaluated for this study were forest lands, major roads, undeveloped land, farmsteads and barren land, determined from the level 2 and level 3 land use analysis available in Appendix 8. Forest lands have obvious signs of substantial tree growth, roads and highways are defined under impervious, paved road types. Undeveloped land is defined as plots of land within the watershed that did not show obvious signs of agricultural activity. Farmsteads are defined as small plots of land in farming areas with housing and little signs of haying/cattle activity. Barren land is defined as lands devoid or nearly devoid of vegetation but with no signs of construction being put in place. Published coefficients were applied to the aforementioned land uses to provide an estimate for sediment production (Shaver. 2007). The sediment production coefficients and sediment loading rates are presented in Table 3-9.

Table 3-9. Sediment Production Coefficients and Sediment Production for Other Land Uses in the Lake Fayetteville Watershed

Land Use	Area	Minimum Coefficient	Maximum Coefficient	Mean Coefficient	Minimum Load	Maximum Load	Mean Load
	acres	lb/ac/yr	lb/ac/yr	lb/ac/yr	(ton/yr)	(ton/yr)	(ton/yr)
Forest	523	23	130	77	6.1	34	20.0
Roads/Highways	163	250	643	447	20.3	52	36.3
Undeveloped Land	182	92	519	305	8.3	47	27.7
Farmstead	14	92	519	305	0.7	4	2.2
Barren Land	47	92	519	305	2.1	12	7.2
				Total	38	149	93

Summary of Sediment Sources from Lake Fayetteville Watershed

The results of the evaluation of sources of sediment to the Lake Fayetteville watershed provides information to Cities and natural resource based organizations to understand potential impacts to the Lake Fayetteville watershed. A summary of the analysis is presented in Table 3-10 and displayed in Figure 3-6. A total of 1,690 tons/yr of sediment was estimated from the sources evaluated in the watershed. Sediment from streambank erosion had the highest loading with 879 tons/yr or 52% of the total. The second highest loading was urban land use with 402 tons/yr or 24%. Pasture land use was the third highest with 217 tons/yr or 13% of the total. Construction produced 98 tons/yr or 6%. Sediment from other

sources produces 93 tons/yr, 5.5% of the total. Sediment production from other sources ranged from 2 tons/yr for farmstead land use to 36 tons/yr for undeveloped land use.

Table 3-10. Total Sediment Production Estimates to the Lake Fayetteville Watershed

Sediment Source	Area or Length	Estimated Average Annual Sediment Load		
		Sediment (tons)	Percent of Total	Loading Rate
Streamank Erosion	**2.38 mi**	**879**	**52.0%**	**369.23**
Pasture	**1567 ac**	**217**	**12.8%**	**0.14**
Urban (w/out construction)	**2750.4 ac**	**402**	**23.8%**	**0.15**
Construction	**139 ac**	**98**	**5.8%**	**0.71**
Other Sources (Total)	**929 ac**	**93**	**5.5%**	**0.10**
Forests	523 ac	20.0	1.2%	0.04
Highways	163 ac	36.3	2.1%	0.22
Undeveloped Lands	182 ac	27.7	1.6%	0.15
Farmsteads	14 ac	2.2	0.1%	0.16
Barren Lands	47 ac	7.2	0.4%	0.15
	Total	1690	100.0%	

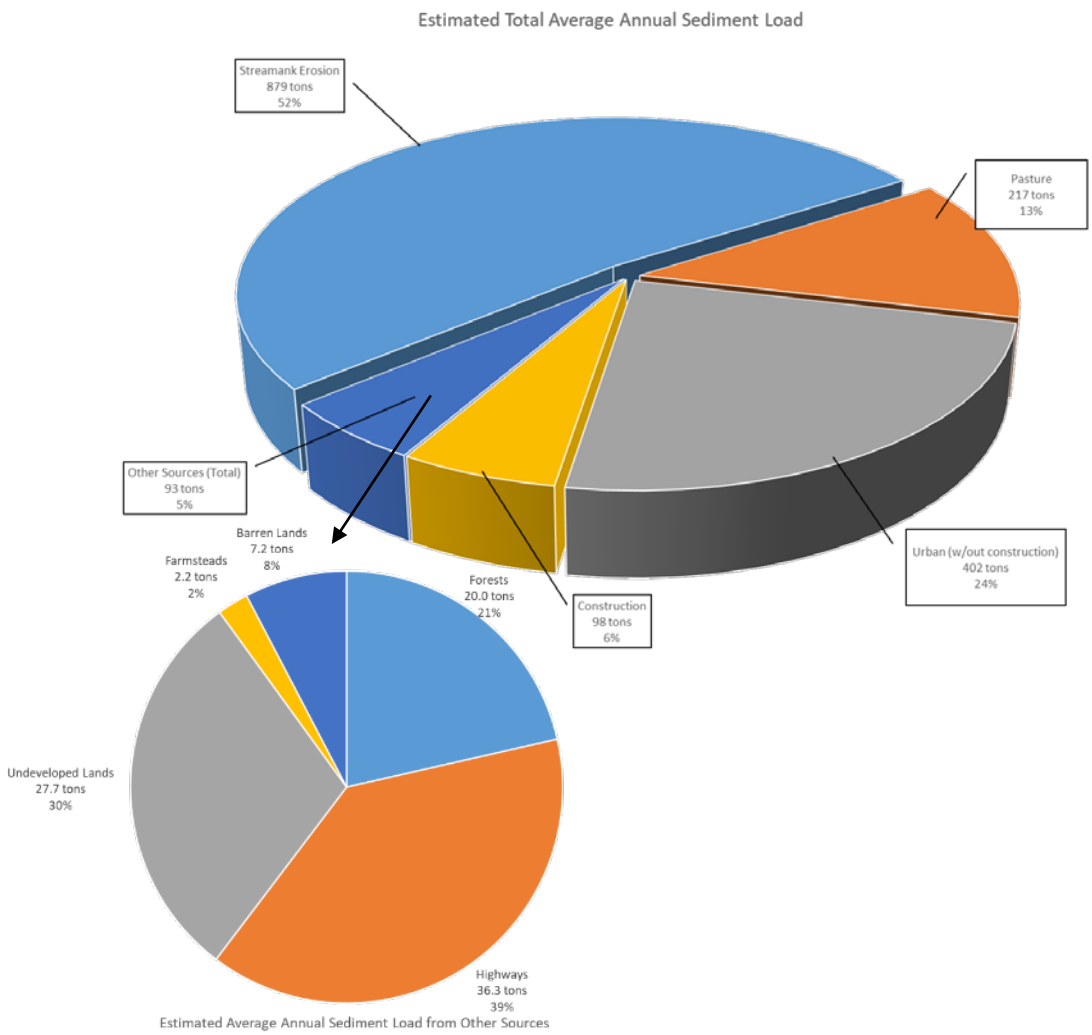


Figure 3-6. Sediment Sources in the Lake Fayetteville Watershed

Section 4. - Nutrient Evaluation of Lake Fayetteville Watershed

Sources of phosphorus within the Lake Fayetteville watershed were evaluated and loadings estimated utilizing simple calculations data, information from the sediment analysis, published water quality coefficients, and land use information specific to the Lake Fayetteville watershed. It is important to evaluate phosphorus and explore actions to reduce this nutrient because it can increase algae and other aquatics in Lake Fayetteville. In turn, these plants can decrease the amount of dissolved oxygen in the stream, initiating the process of eutrophication, harming other aquatic species that rely on entrained oxygen in the water supply. This can also lead to algae blooms, which produce toxins that are harmful to animal and human health.

Estimate of Annual Phosphorous from Streambank Erosion

Annual phosphorous (TP) load was developed from the streambank inventory and toe pin monitoring that determined various combinations of BEHI and NBSS erosion rates. This data was applied to non-directly monitored eroding streambanks to estimate total sediment production. Next, streambank material sampling results were applied. Fine bank material identified during the inventory had an estimated TP amount of 0.35 lb/ton, Gravel bank material had a TP of 0.24 lb/ton, and Cobble bank material had a TP of 0.2lb/ton. TP produced for the Northeast tributary to Lake Fayetteville was 179 lb/yr and TP produced from the Southeast Tributary to Lake Fayetteville was 30 lb/yr. A total of 208 lb/yr of TP load was estimated from streambank erosion.

Estimate of Annual Phosphorous from Pastures

The Lake Fayetteville watershed has a total of 1567 acres of pasture land according to the level 2 land use analysis from 2016. Coefficients were developed from a previous study conducted on pasture land use in the West Fork White River (WFWR) watershed. TP runoff coefficients were estimated from three varieties of soil types with similar land use and various average pasture slopes (ADEQ, 2004). These coefficients were based on published phosphorous export coefficients determined from similar watershed monitoring programs and WEPP modeling results of sediment loss coefficients for pastures in the WFWR watershed. One soil type modelled in this study was the Clarksville series, which makes up 97% of the Lake Fayetteville watershed. These coefficients, along with the land use analysis from 2016 and sediment production rates modelled for the same soil type, land use, and soil slopes discussed previously were utilized to develop TP production values. The average annual Phosphorous load is 718 lbs/yr. Table 4-1 presents a summary of coefficients used for the analysis, corresponding slopes, acreage, and Total Phosphorous delivery rates.

Table 4-1 Pasture Phosphorous Runoff Coefficients (ADEQ 2004) and Loading Rates by Pasture Slope

Average Pasture	Phosphorous Runoff	Area	Total Phosphorous
	lbs/ac/yr	acres	lbs/yr
1 - 2%	0.24	17.7	4.2
2 - 3%	0.39	565.1	220.4
3 - 4%	0.36	522.0	187.9
4 - 5%	0.66	186.6	123.2
>5%	0.66	275.6	181.9
	Total	1567.0	717.6

Estimated Septic Tank System Total Phosphorous Loading

Currently, there is no complete dataset for locations of onsite wastewater treatment systems for the entirety of the Lake Fayetteville watershed. Ongoing projects to map and document septic systems are underway, and in lieu of this lack of published research, data from Blossom Way watershed was utilized (WCRC, 2008). Data for the Blossom Way watershed was evaluated using the EPA's STEPL model (U.S. EPA, 2003). Extrapolating this data to the Lake Fayetteville watershed and adjusting for watershed size

lends an estimated total of 256 lbs/yr of Phosphorous load. A failure rate of 5% of septic systems is assumed.

Phosphorous Loading Sources from Urban Land Use and Construction

Phosphorous loading was estimated for urban land use types and construction land use types. Urban land uses includes varieties of residential land use, commercial land use, industrial land use, and public parks. Construction land use is defined for sites of ongoing, active construction. Both were delineated using data from the Level II and Level III land use analysis for the Lake Fayetteville watershed in 2016. Phosphorous from the urban land use types studied for this analysis were obtained utilizing published phosphorous loading coefficients (Shaver, 2007; USEPA, 1999). These are shown in Table 4-2. A total of 1,170 lb/yr of phosphorous was estimated from urban land use. Phosphorous loads from construction were estimated utilizing the Blossom Way watershed study of construction sites and typical sediment reduction practices (WCRC, 2008). This data was applied to the Lake Fayetteville watershed and a typical pound of phosphorous per ton of soil was determined to be 0.34 lb/ton. With the total sediment produced discussed in a previous section, phosphorous load were estimated to be 33.4 lb/yr.

Table 4-2. Total Phosphorous Production for the Lake Fayetteville Watershed from Urban Land Use

Land Use	Acres	Minimum Coefficient	Maximum Coefficient	Mean Coefficient	Minimum Load	Maximum Load	Mean Load
Residential		lb/ac/yr	lb/ac/yr	lb/ac/yr	lb/yr	lb/yr	lb/yr
Low	394.3	0.41	0.57	0.49	161.7	224.8	193.2
Medium	542.9	0.44	0.62	0.53	238.9	336.6	287.7
High	77.8	0.48	0.68	0.58	37.3	52.9	45.1
Multi-Family	132.2	0.53	0.72	0.62	70.1	95.2	82.0
Rural Home	990	0.01	0.22	0.12	9.9	217.8	118.8
Commercial	358.8	0.61	0.81	0.71	218.9	290.6	254.7
Industrial	131.6	1.3	1.3	1.3	171.1	171.1	171.1
Public Park	123	0.03	0.25	0.14	3.7	30.7	17.2
				Total	911.5	1419.6	1169.9

Other Sources of Total Phosphorous

Land uses not addressed in the urban land use section were evaluated for phosphorous production as well. These include forest land, roads and highways, undeveloped land, farmsteads and barren land. Utilizing Levels II and Level III land use data from the 2016 delineation, sediment production for other land uses, and published Phosphorous coefficients, Phosphorous load estimates from these sources in the Lake Fayetteville basin were calculated (Shaver, 2007). A summary of results is shown in Table 4-3. Average annual phosphorous loads for combined loads from other sources ranged from 136 lb/yr to 332 lb/yr with a median value of 241 lb/yr.

Table 4-3. Total Phosphorous Production Rates for the Lake Fayetteville Watershed from Other Sources

Land Use	Area	Minimum Coefficient	Maximum Coefficient	Mean Coefficient	Minimum Load	Maximum Load	Mean Load
	acres	lb/ac/yr	lb/ac/yr	lb/ac/yr	(lb/yr)	(lb/yr)	(lb/yr)
Forest	523	0.09	0.12	0.10	47.1	63	52.3
Roads/Highways	163	0.53	1.33	0.98	86.2	216	159.3
Undeveloped Land	182	0.01	0.22	0.12	1.8	40	21.8
Farmstead	14	0.01	0.22	0.12	0.1	3	1.7
Barren Land	47	0.01	0.22	0.12	0.5	10	5.6
				Total	**136**	**332**	**241**

Annual Total Phosphorous Summary for the Lake Fayetteville Watershed

The Lake Fayetteville watershed continues to develop farmlands into residential and other urban areas. The continued urbanization of this watershed poses a threat to the Clear Creek tributaries and Lake Fayetteville, so it is important to understand the amount of phosphorous loading that is occurring and what the sources are to make informed decisions. The results for each of the land use type's impact on Phosphorous loading to Lake Fayetteville are presented in Table 4-4. An average of 2,626 lb/yr of Phosphorous is estimated to reach Lake Fayetteville each year. The largest source of phosphorous came from urban land use at 1170 lb/yr.

Table 4-4. Annual Total Phosphorous from All Sources Evaluated in this Summary

Phosphorous Source	Area or Length	Estimated Average Annual Phosphorous Load		
		TP (lb/yr)	Percent of Total	Loading Rate
Streamank Erosion	**2.38 mi**	**208**	**7.9%**	**87.56**
Pasture	**1567 ac**	**718**	**27.3%**	**0.46**
Septic Tanks	**n/a**	**256**	**9.7%**	**n/a**
Urban (w/out construction)	**2750.4 ac**	**1170**	**44.5%**	**0.43**
Construction	**139 ac**	**33**	**1.3%**	**0.24**
Other Sources (Total)	**929 ac**	**241**	**9.2%**	**0.26**
Forests	523 ac	52.3	2.0%	0.10
Highways	163 ac	159.3	6.1%	0.98
Undeveloped Lands	182 ac	21.8	0.8%	0.12
Farmsteads	14 ac	1.7	0.1%	0.12
Barren Lands	47 ac	5.6	0.2%	0.12
	Total	2626	100.0%	

Section 5. Transfer of Results & Outreach

Project Outreach

The WCRC formed a project team with partners after the project was initiated. Representatives were from several nonprofit, governmental and environmental organizations including:

- Watershed Conservation Resource Center (WCRC)
- City of Fayetteville
- City of Springdale
- Natural Resources Conservation Service – NRCS Washington County Office
- Illinois River Watershed Partnership (IRWP)
- University of Arkansas Cooperative Extension Service (UACES)
- City of Johnson
- City of Tontitown

At the first meeting, the WCRC introduced the project and presented an overview, discussed and requested assistance on how to reach out to property owners within the project bounds for access, and presented criteria for prioritization based on sediment and nutrient loads. Members from the City of Fayetteville and Cooperative Extension Service discussed the brochure being developed for invasive species management and removal. The WCRC, UACES, and City of Fayetteville formed a subcommittee to develop an invasive removal guide for residents.

At the second planning meeting, the WCRC coordinated site tours of an urban and rural stream restoration projects and a site visit where restoration needed to be conducted. Representatives from the following organizations participated: WCRC, Beaver Watershed Alliance, City of Fayetteville, UACES, IRWP, Beaver Water District, Ozarks Water Watch, and City of Johnson

After the assessment was completed, the WCRC presented the results to project partners. Organizations in attendance for the event include: WCRC, City of Fayetteville, City of Springdale, Natural Resources Conservation Service – NRCS Washington County Office, and IRWP. The WCRC presented an overview of the project, results of the streambank erosion assessment, the natural areas assessment, the riparian assessment, land use, impervious area, and priority sites in the Lake Fayetteville Watershed, and the Invasive Removal Guide discussed below. A copy of the presentation is available in Appendix 9. The project partners then asked questions and discussed the use and implications of results.

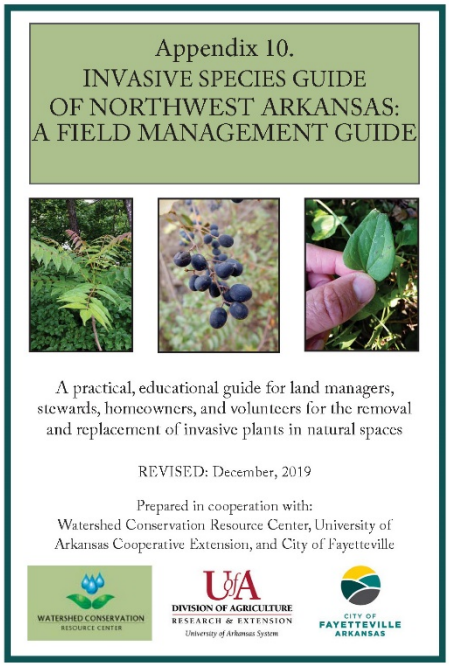
The WCRC and project partners conducted several outreach events in the watershed including several trash pick-ups in the Lake Fayetteville watershed. The WCRC gave a presentation on the project to the Lake Fayetteville Watershed Group. A follow-up presentation will be given in the near future to this group to discuss the results of the project and how the information can be used to improve the Lake Fayetteville watershed.

Invasive Species Removal Guide

The UACES, City of Fayetteville, and WCRC cooperatively prepared an invasive species removal guide for Northwest Arkansas to educate land managers, stewards, homeowners, and volunteers (Figure 5-1). This guide assists those concerned with managing the spread of invasive plant species, their threat to natural areas and ecological function of forest, soils, and waterways, and protection of property and wildlife habitat. The guide helps land stewards identify invasive species, gives techniques to manage them, raises awareness, and promotes the use of native alternative species. Species were selected based on a federal

designation as a noxious weed, reports from land managers, residents, and local experts, and if science based organizations have documented their negative ecological impact on plant and wildlife habitat. The guide instructs users on how to develop a management strategy and implement proper safety when utilizing chemical and mechanical removal methods. Invasive species addressed in this guide include:

- Tree of Heaven
- Mimosa
- Callery (Bradford) pear
- Chinese privet
- Bush honeysuckle
- Multiflora rose (Figure 5-2)
- Oriental bittersweet
- Sweet autumn virginsbower
- Wintercreeper
- Japanese honeysuckle
- Garlic mustard
- Poison hemlock
- Sericea lespedeza
- Perilla mint
- Johnsongrass


Appendix 10.
INVASIVE SPECIES GUIDE
OF NORTHWEST ARKANSAS:
A FIELD MANAGEMENT GUIDE

A practical, educational guide for land managers, stewards, homeowners, and volunteers for the removal and replacement of invasive plants in natural spaces

REVISED: December, 2019

Prepared in cooperation with:
Watershed Conservation Resource Center, University of Arkansas Cooperative Extension, and City of Fayetteville

WATERSHED CONSERVATION RESOURCE CENTER
U&A DIVISION OF AGRICULTURE RESEARCH & EXTENSION University of Arkansas System
CITY OF FAYETTEVILLE ARKANSAS

Figure 5-1. Invasive Plant Removal Guide

Figure 5-2. Multiflora Rose Bloom. A Common Invasive Species Encountered

An example of methods developed to manage Tree of Heaven, presented during a meeting of project partners and available in the Invasive Species Removal Guide is presented in Figure 5-3. The complete guide is available in Appendix 10. This guidance document will be used in future training workshops designed for residents of Northwest Arkansas.

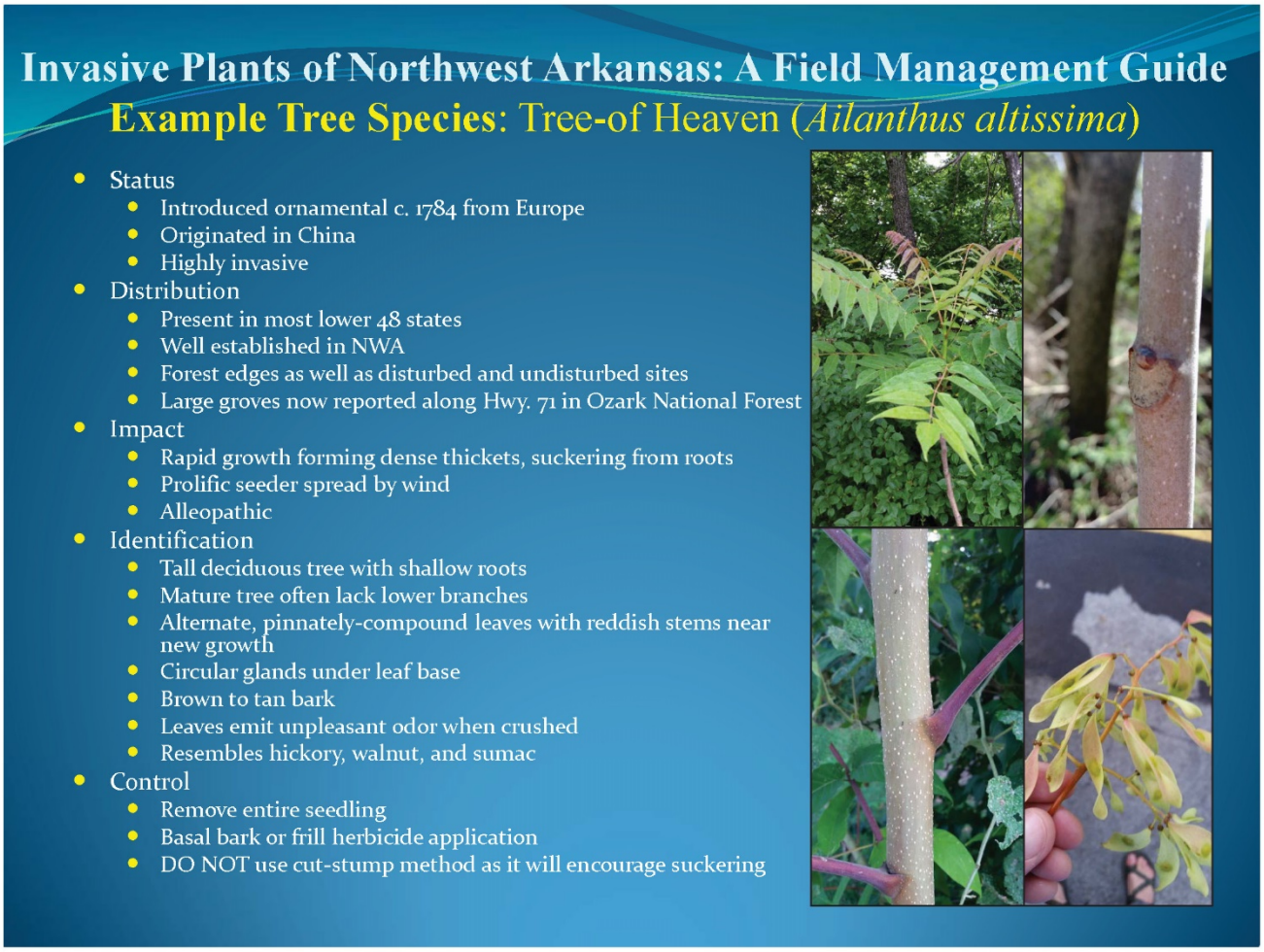


Figure 5-3. Tree of Heaven Management Information Presented to the Project Partners and Available in the Guide

Section 6. Prioritization and Recommendations

The data and information assembled from this project can be used by Cities, government agencies, non-governmental organizations, and other natural resource management groups. Specifically, the data and information is useful for local planning to:

- Select future project sites to reduce sediment, phosphorus, and nitrogen within the Illinois River Watershed.
- Be considered by the cities of Fayetteville, Springdale, Tontitown, & Johnson to evaluate proposed development that could potentially impact streams, wetlands, and springs and select stream restoration sites where infrastructure is threatened
- Provide information on unique areas that could potentially be protected, such as, wet prairies, wetlands, rare plant habitat, rare aquatic species habitat, and stable sections of stream.

Based on the results of this assessment, priorities were established as a guideline for restoration and conservation. The following are priorities and recommendations to be considered:

Lake Fayetteville Watershed

- Streambank Erosion and Potential Restoration
    - Priority streambanks and natural features identified in the Lake Fayetteville watershed are shown in Figure 6-1 with close-up maps shown in Figures 6-2 through 6-6:
        - Priority streambanks for restoration are defined as streambanks with BEHI and NBSS defined as High, Very High or Extreme and if NBSS is defined as Very High or Extreme.
        - Streambanks that occur where unique natural features were identified and have high erosion potential should be considered a higher priority.
    - Cities should consider putting the streambank erosion data and information from this study into a GIS based program that can be accessed by staff when evaluating new development, watershed planning, and infrastructure projects.
- Conservation of Natural Features
    - Six natural feature sites (Figure 6-1) that were assessed on the ground and are described in Appendix 5 were located in the Lake Fayetteville watershed. These sites should be considered a priority for conservation or at a minimum be protected as much as possible if development were to occur in that area. For example, one of these sites is a headwater swale in a historic prairie (Figure 6-1a).
    - Through a GIS analysis, potential natural features were identified which include: open wetlands, prairie mounds/swale complexes, east slopes, north slopes, wet flatwoods, glades, spring-fed ponds, abandoned channels, channel scar ponds, spring and spring runs, mesic forests, ponds-spring fed, and backwater channels. At a minimum, these sites should be evaluated further and considered for conservation before the areas

Figure 6-1 a – historic prairie in the headwaters of Clear Creek that is a unique feature that should be protected.

are developed. These sites are shown in Figures 6-1 through 6-6.
    - Search for a funding mechanism to conserve working farms where there is landowner interest.
- Improvement of Riparian Areas
    - Partners work together to increase the width of healthy riparian along the tributaries in the watershed.
        - Cities, NRCS, IRWP, and other conservation oriented entities should concentrate riparian restoration actions on locations identified in the assessment as lacking adequate riparian cover, but having stable or less erosive streambanks. The area of focus should be those areas that are not adjacent to locations that will require channel restoration work. Improving the riparian cover and increasing riparian buffers will help to lower water temperatures, reduce the velocity of floodwaters, and improve water quality via filtration properties of riparian buffers.
        - Promote native vegetation along the tributaries in the watershed by removing invasive plants and enhancing with native shrubs, trees, and grasses.
- Address Sediment and Phosphorus
    - Streambank Erosion contributed 54%, the highest percentage among all sources, of the estimated total sediment loadings to the watershed. Therefore, to reduce sediment loadings consider
        - Restoring priority streambanks or reaches of stream and include both channel and riparian
        - Conserve and/or restore with native vegetation 50 feet of riparian along both sides of the stream channels
    - Urban runoff contributed 45% and pasture areas contributed 24% of the estimated total phosphorus loading to the watershed. Therefore, to reduce phosphorus loadings consider
        - Conducting residential and commercial outreach on fertilizer usage and pet waste disposal
        - Encourage landowners to participate in agricultural programs, such as, EQIP
        - Increase retention and infiltration capacity of new stormwater management infrastructure
- The impervious surface evaluation for the watershed showed the streams to already be in an impacted state. To reverse or slow the increase of impervious surfaces consider the following:
    - Incorporate Low Impact Development techniques into future development
    - Retrofit existing impervious sites
    - Conserve family farm areas
    - Restore natural areas to appropriate historic habitat

Lower Clear Creek Watershed

- Streambank Erosion and Potential Restoration
    - Based on the air photo analysis, there are several streambanks along Clear Creek located downstream of Lake Fayetteville to the confluence with the Illinois River that generate the preponderance of sediment and nutrient loads to the stream. The average annual erosion rates ranged between 3 and 25 feet and these streambanks should be considered a priority for restoration. Figure 6-7 shows the locations of the streambanks with the highest erosion.

- A comprehensive masterplan for a portion of Clear Creek should be developed to address the priority sites in a way to leads to a holistic restoration effort. Many of the streambank priorities cannot be restored as a single site and upstream and downstream conditions must be considered to restore the most affected reaches of Clear Creek to morphological stability. The comprehensive masterplan should begin upstream of Arkansas Highway 112 and continue for approximately 2 miles downstream as shown in Figure 6-7. This area has been greatly affected by changes in the peak discharge and frequency of large run-off events associated with increased impervious surfaces in the upstream portions of the watershed. By developing a plan and addressing this section of Clear Creek, 16,500 ton/yr and 5,600 lb/yr of Total Phosphorus loading from streambank erosion could be eliminated.
- Streambank CC356 is the largest contributor of sediment from streambank erosion in the Clear Creek Watershed. It appears that this site could be addressed without having to significantly expand the scope of restoration upstream and downstream of the affected site. This site should be a priority for streambank restoration.
- The NRCS, IRWP, and University of Arkansas Cooperative Extension Service can use the data for priority sites for restoration of other areas that can be addressed as an individual streambank site.
- The NRCS should consider putting the streambank erosion data and information from this study into a GIS based program that can be accessed by staff when evaluating EQIP and other program applications for BMP implementation.

- Conservation of Natural Features
  - Several natural features of interest were identified using GIS methods and are shown in Appendix 6. The majority of these features are associated with floodplain hydrology and morphology. The entire floodplain of the lower Clear Creek watershed should be protected from encroachment and development as the ecological services provided by the floodplain are immeasurable. Protection of the floodplain could come in the form of farmland conservation through donated and purchased protective easements.
  - The NRCS should consider putting the natural features data and information from this study into a GIS based program that can be accessed by staff when evaluating EQIP and other program applications for BMP implementation.
- Improvement of Riparian Areas
  - The NRCS, IRWP, and other conservation oriented entities should concentrate riparian restoration actions on those locations identified in the assessment as lacking adequate riparian cover, but having stable or less erosive streambanks. The area of focus should be those areas that are not adjacent to locations that will require channel restoration work. Improving the riparian cover and increasing riparian buffers will help to lower water temperatures, reduce the velocity of floodwaters, and improve water quality via filtration properties of riparian buffers.

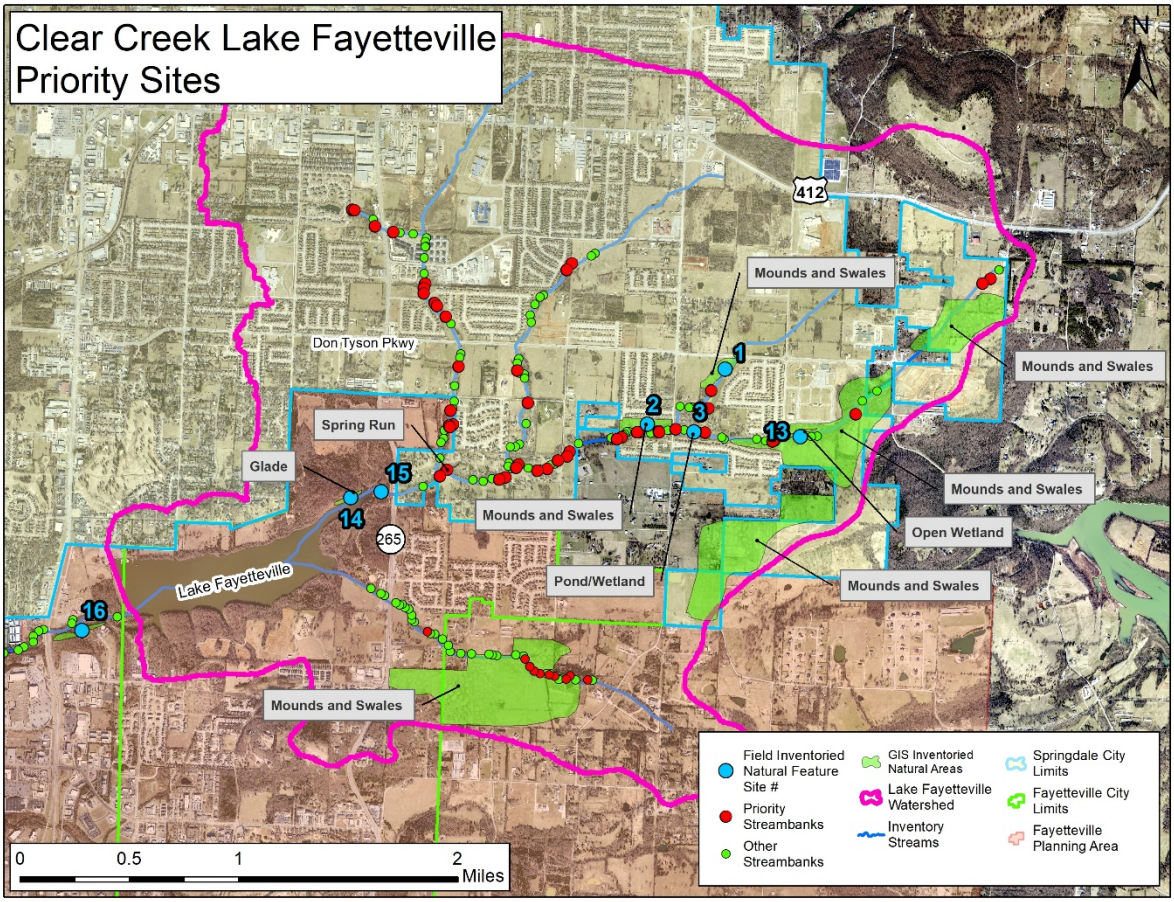


Figure 6-1. Priority Streambanks Overlaid with Natural Features Developed in the Ecological Analysis in the Lake Fayetteville watershed.

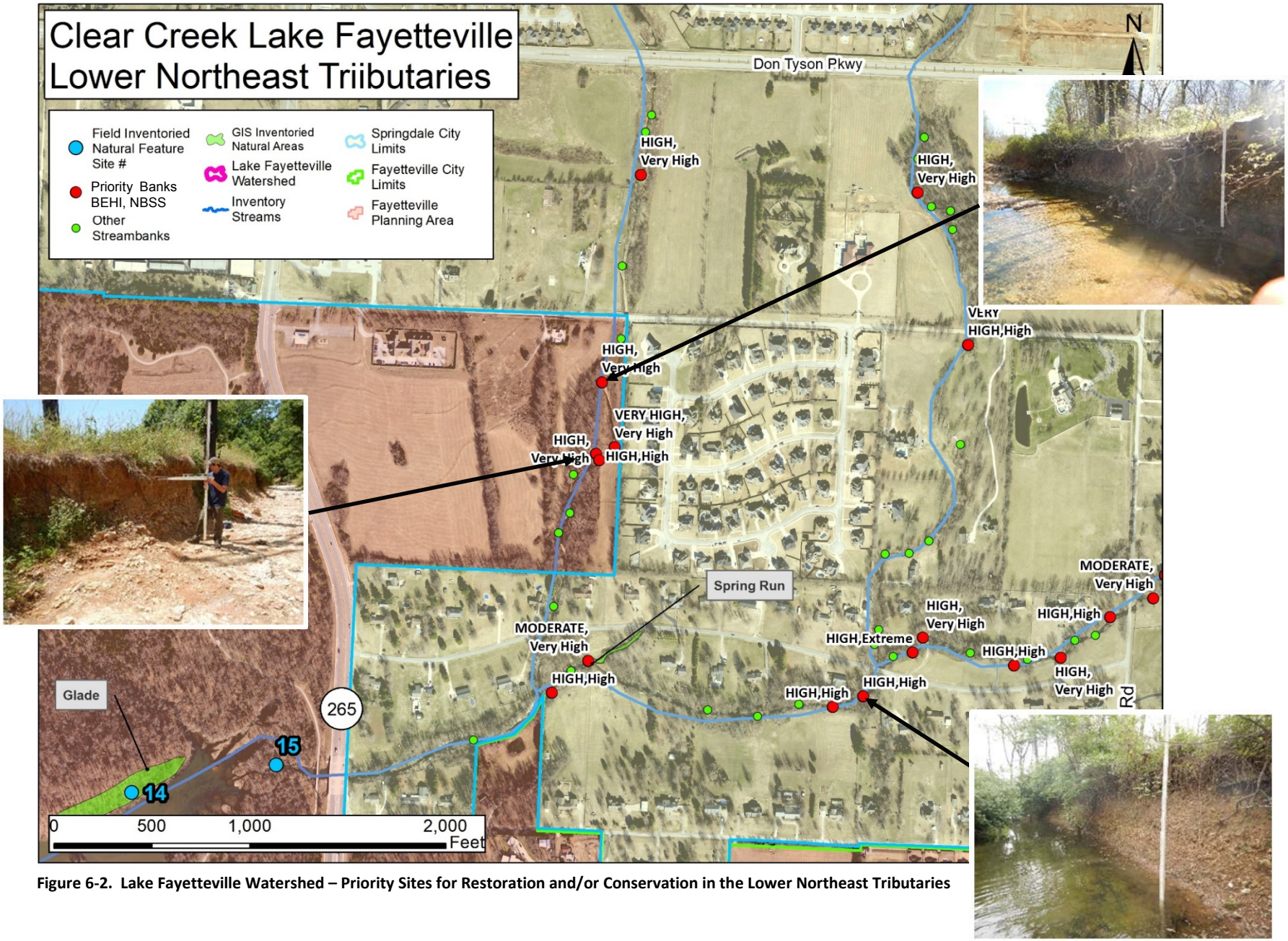


Figure 6-2. Lake Fayetteville Watershed – Priority Sites for Restoration and/or Conservation in the Lower Northeast Tributaries

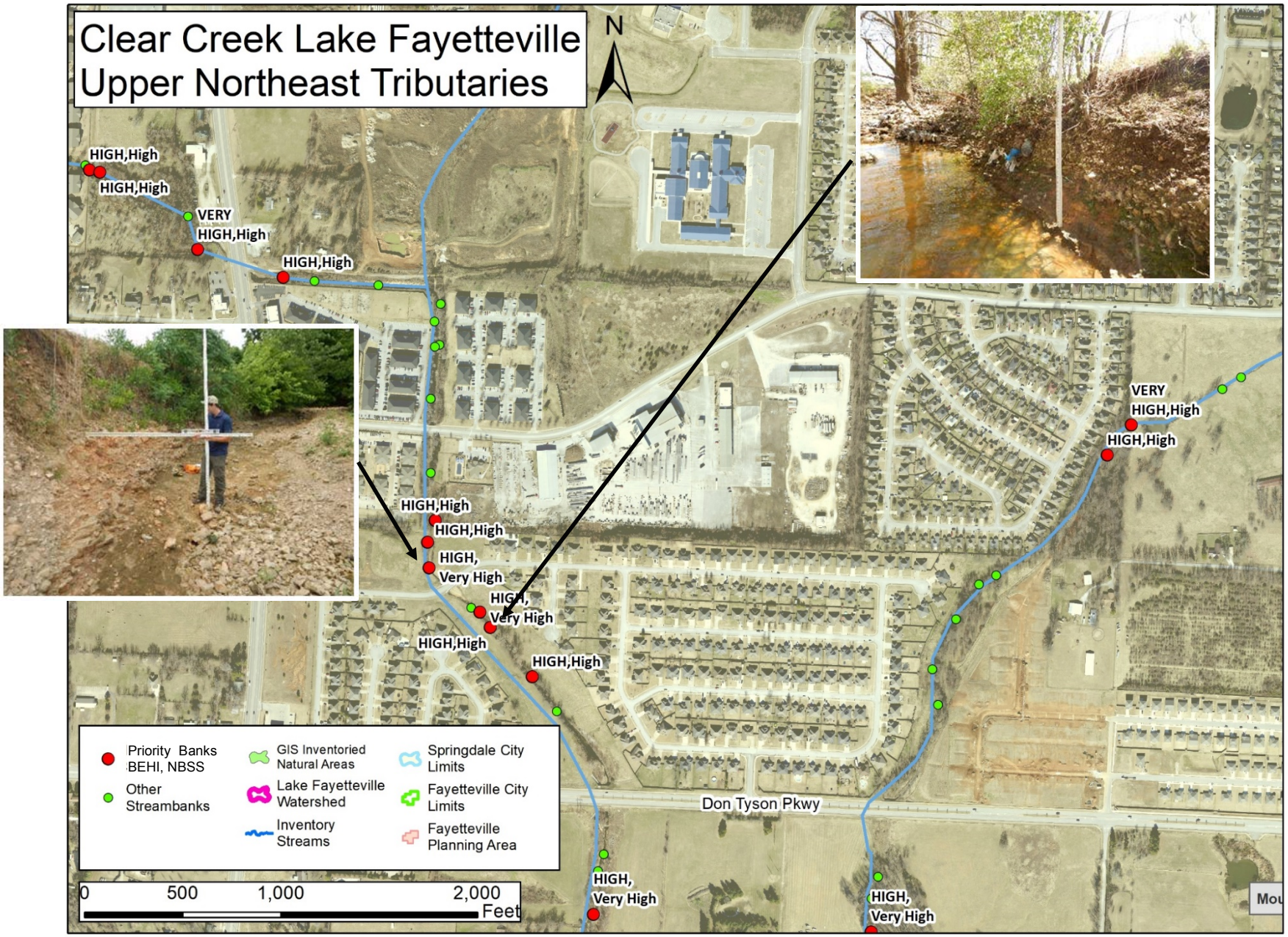


Figure 6-3. Lake Fayetteville Watershed – Priority Sites for Restoration and/or Conservation in the Upper Northeast Tributaries

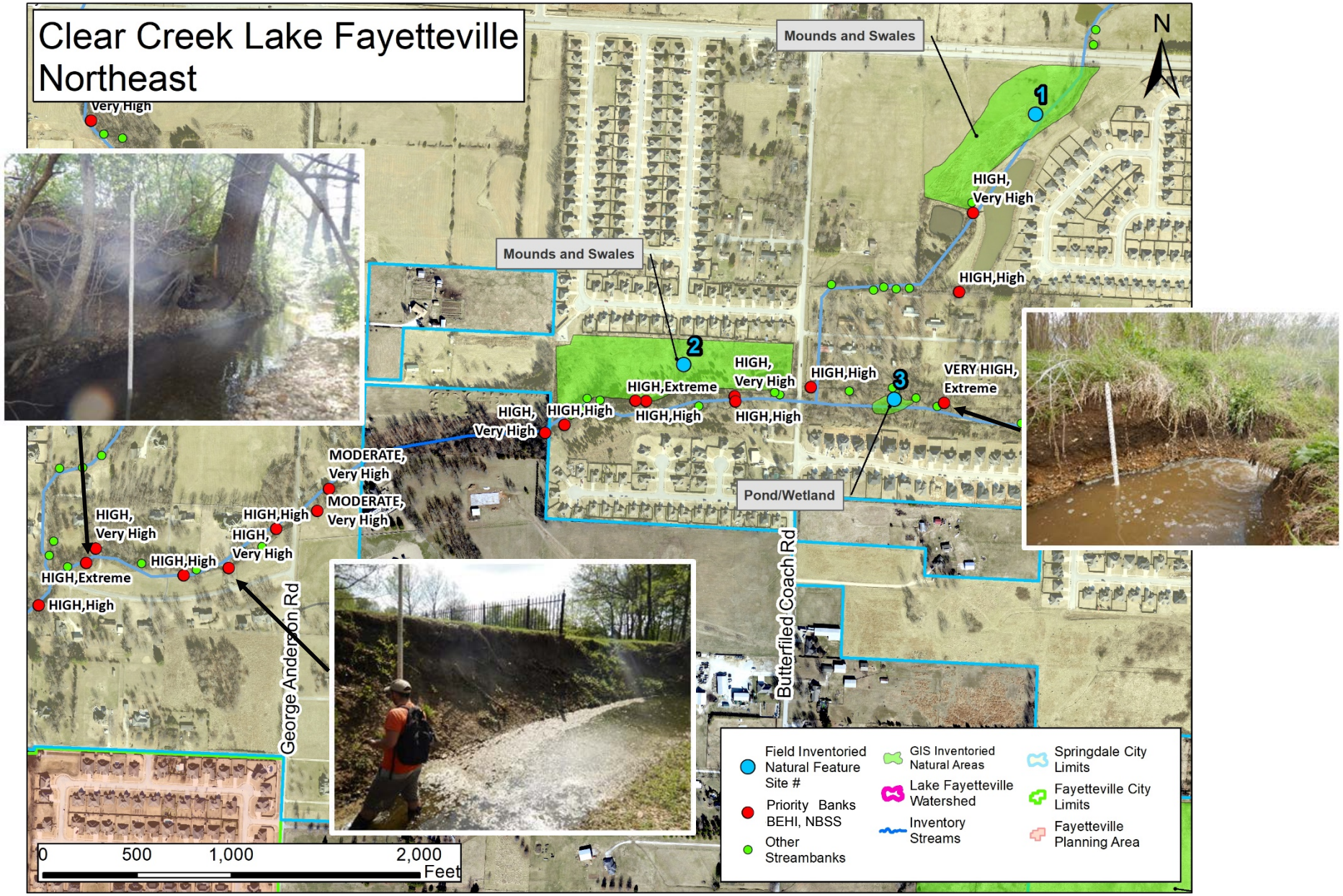


Figure 6-4. Lake Fayetteville Watershed – Priority Sites for Restoration and/or Conservation in the Northeast Portion of Clear Creek

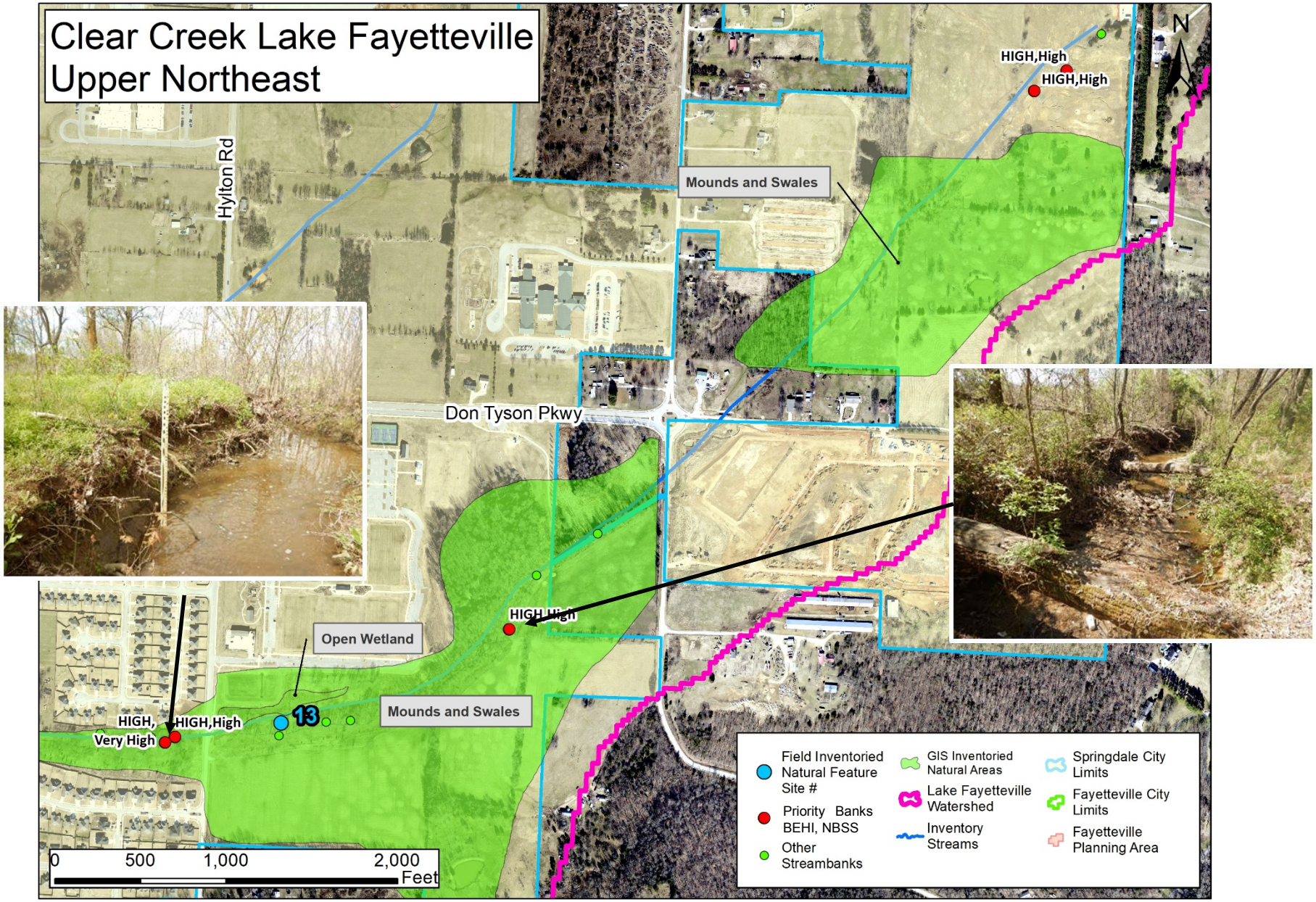


Figure 6-5. Lake Fayetteville Watershed – Priority Sites for Restoration and/or Conservation in the Upper Northeast Portion of Clear Creek

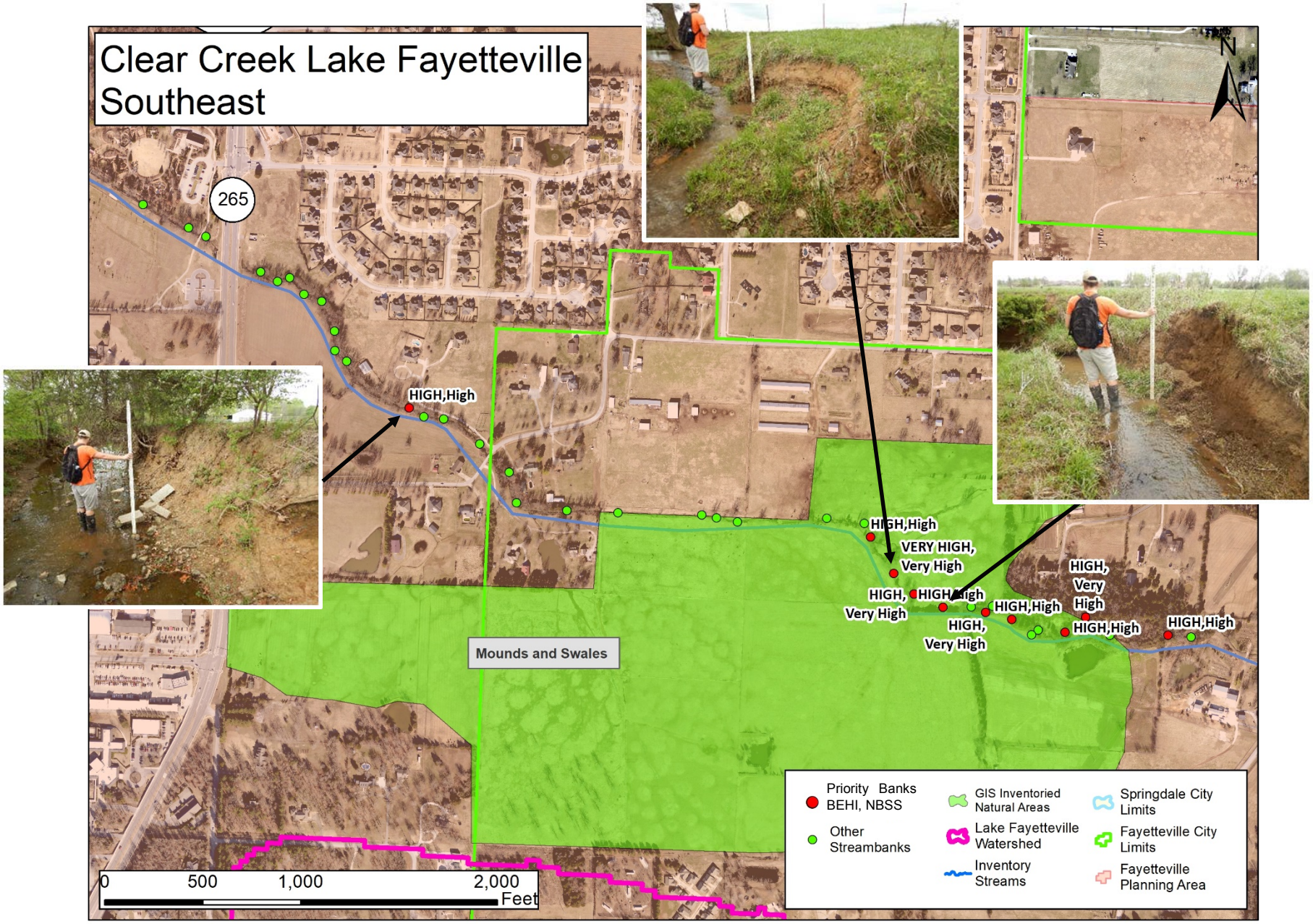


Figure 6-6 . Lake Fayetteville Watershed – Priority Sites for Restoration and/or Conservation in the Southeast Portion of Clear Creek

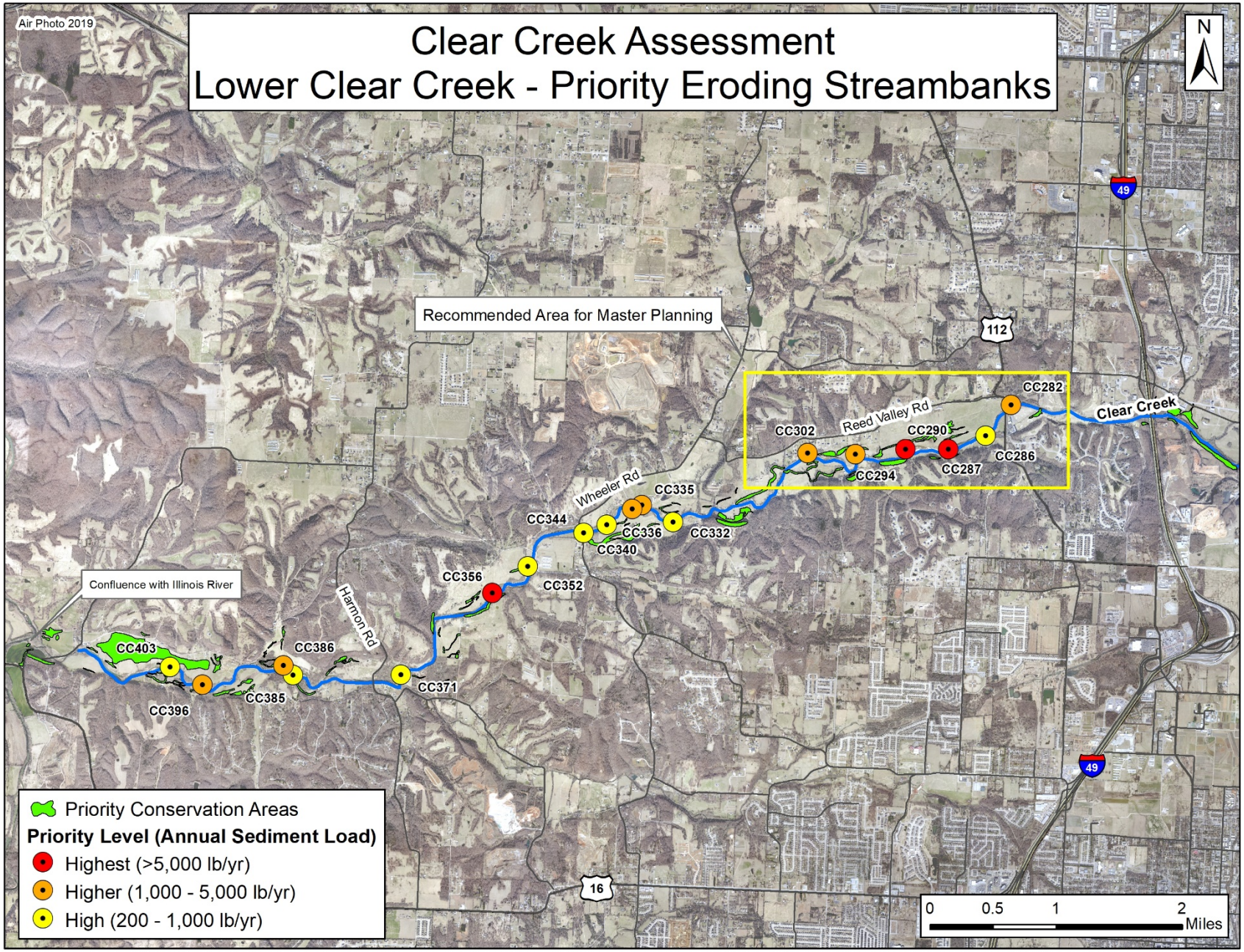


Figure 6-7. Priority Streambank Restoration Sites in the Lower Clear Creek Watershed

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2/10/21

FTN Associates Ltd.
water resources / environmental consultants

CITY OF FAYETTEVILLE
LAKE FAYETTEVILLE SPILLWAY MODIFICATION
PHASE 1 FEASIBILITY STUDY

CERTIFICATE OF AUTHORIZATION
FTN Associates, Ltd.
No. 63
ARKANSAS - ENGINEER

STATE OF ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No. 12942
JEFF J. BESHONER
12/11/2020

DECEMBER 11, 2020

CITY OF FAYETTEVILLE
LAKE FAYETTEVILLE SPILLWAY MODIFICATION
PHASE 1 FEASIBILITY STUDY

Prepared for

City of Fayetteville
Water & Sewer Department
2435 Industrial Drive
Fayetteville, Arkansas 72701

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December 11, 2020

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1.0 INTRODUCTION

Lake Fayetteville was formed in 1949 when the City of Fayetteville (the City) completed construction of the Lake Fayetteville Dam (the dam); thus, creating the reservoir to serve as the City's water supply until the development of the Beaver Water District in 1957. Since that time, the lake has provided a source of recreation for the citizens of Fayetteville and the surrounding areas.

In October 2018, the Arkansas Department of Agriculture's, Natural Resources Division (ANRD), formerly the Arkansas Natural Resources Commission (ANRC) and the agency in charge of regulating dam safety in Arkansas, performed its annual inspection of the dam. In terms of their size and potential hazard, dams are classified based on Tables 2.1 and 2.2 of ANRD's Title 7 - Rules Governing Design and Operation of Dams (Title 7). Based on these tables, the dam is classified as a high hazard dam of intermediate size. Additionally, because of this classification, the spillway must be capable of safely passing the Probable Maximum Flood (PMF). As documented by an ANRD letter to the City dated October 11, 2018, ANRD records indicated that the spillway could only handle 50% of the PMF event. The ANRD letter noted that the dam, based on the relevant classification criteria, should be sized to pass the full PMF event.

As a result of this information, the City retained FTN Associates, Ltd. (FTN) to evaluate various options for the possible modification of the Lake Fayetteville spillway. During the development of the Project scope, FTN reviewed the available information and suggested that a phased approach be considered, with subsequent phases structured in a manner that will provide the City with an opportunity to examine the results of the previous phase prior to choosing an alternative. This approach should allow the City to develop an orderly and cost-effective solution to modifying the dam and/or spillway, if required. The objective of this first phase was to determine the current inflows to the lake that the watershed is producing and then determining the current discharges capable of being released through the spillway without overtopping the dam. This phase also included performing an updated topographic survey for a portion of the dam embankment, the entire approach channel, exit channel, and spillway structure, and

performing a hydrologic and hydraulic analysis for future conditions of the Lake Fayetteville watershed.

The second phase will consist of a dam and spillway improvement feasibility analysis and conceptual design, which may include a geotechnical investigation, dam and/or spillway modification analyses, a feasibility study report and conceptual level design of potential improvements.

The third phase would consist of designing the selected improvements to achieve compliance with Title 7.

A specific scope of work and budget for Phase 2 will be developed after approval of the Phase 1 Study.

2.0 LAKE FAYETTEVILLE DAM INFORMATION

2.1 Original Dam Design

The Lake Fayetteville Dam is an earthen dam located on Clear Creek in northern Fayetteville, approximately 0.5 miles east of the City of Johnson's corporate limit. It has a drainage area of approximately 9.3 mi^2, per this analysis. It was completed in 1949 and was originally called the Clear Creek Dam. The dam was designed by Max A. Mehlburger, PE, of Little Rock, Arkansas, and W.R. Holway & Associates of Tulsa, Oklahoma, to create a lake to serve as a water supply for the City, which it did until the creation of the Beaver Water District in 1957. Since that time, Lake Fayetteville has provided the citizens of Fayetteville and the surrounding areas with a source for various recreational activities due to its fishing and trail amenities.

The original dam design consisted of a 1,733 feet long earthen embankment with a crown width of 20 feet at a stated crest elevation of 1,258.0 ft (NGVD 29). The typical section side slopes for the upstream earthen embankment consisted of a riprap covered embankment (from stated El 1,233.0 to the crest) at a slope of 3H:1V, while the downstream slope was designed with a vegetative cover and a 2.5H:1V slope, although the center section of the dam was also designed to have berms (10 ft wide on the upstream face, 20 ft wide on the downstream face) added at approximately the mid-height of the dam. Appendix A contains the original dam design drawings. In addition to the main embankment, the original project also consisted of a concrete water intake tower and a concrete spillway.

The intake tower was to not only serve as a water intake for the City's water supply but also as a means to drawdown the lake. According to the design drawings, the intake structure had an invert at stated El 1201.25 ft (NGVD 29), which was connected to a 48-inch diameter concrete conduit that led to the downstream outfall, where it was reduced to a 16-inch valved outfall and a 16-inch water supply line. Because the lake is no longer used as a water supply lake, the water supply line is no longer in use. The intake structure was designed to have three intakes, which allowed for withdrawing water from different levels of the lake for water supply. These levels were at stated El 1218.0, 1228.0, and 1238.0 ft (NGVD 29), respectively.

For the concrete spillway, the drawings show an ogee shaped spillway to be constructed with the crest at stated El 1248.0 ft (NGVD 29), to be located at the southern end of the dam. This spillway is connected to the lake through an approximately 1,050 feet long approach channel that is narrow and shallow. Per the design drawings, this spillway had a crest length of 175 feet, variable apron and spillway widths that depended on depths to rock encountered in the field, and vertical side walls ranging from 8 to 10 feet above the floor of the spillway.

Upon review of the original design drawings, it was noted that the elevations indicated a consistent top of dam at El 1,258.0 ft (NGVD 29), and a normal pool at El 1,248.0 feet (NGVD 29). Both of these listed elevations are approximately ten feet higher than that of the field survey data gathered as part of this project, indicating that the dam was apparently not constructed based on its original design. This elevation difference was also previously observed in the 1996 hydraulic analysis that was performed.

2.2 Dam Modifications

In 1974, the City retained McClelland Consulting Engineers, Inc. (MCE) to repair a cavity that had begun to form under the existing spillway and to remove existing growth in and around the spillway. This repair work consisted of excavation and removal of displaced rock and debris, removal of trees and other objects impacting the flow of water in the approach channel, and the construction of a new spillway within the footprint of the existing spillway. During this project, the spillway section was converted from an ogee spillway to a straight drop or free overfall spillway with a crest length of 130 ft. Because the original ogee spillway had a total crest length of 170 ft, the remaining crest length, approximately 10 to 15 feet on each side, continued to function as an ogee spillway. The modified spillway crest elevation was adjusted to El 1237.5 ft (NGVD 29), which is 0.5 feet lower than the original spillway crest of El 1238.0 ft (NGVD 29). In addition to the change to the spillway crest elevation, vertical training walls were added to the spillway to transition between the new and old spillway. These training walls are approximately 1.5 to 2 ft tall and approximately 3.5 ft wide and project above the weir crest. Refer to Appendix B for the MCE drawings related to these modifications.

2.3 Current Dam Configurations

Since the 1974 spillway modification, the Lake Fayetteville Dam and spillway have largely remained unchanged. The main alterations that have been made to the dam, outside of routine maintenance activities (i.e., mowing, etc.), have been the addition of a paved walking trail to the top of the dam, a trail bridge crossing immediately downstream of the spillway, the removal of large diameter trees that had started growing on the upstream face of the dam, the addition of riprap material to the upstream face to address minor erosion concerns, and the installation of toe drains to address increased seepage along the downstream face of the dam. Many of these items have been noted and corrected as found during dam safety inspections to continue to keep the dam functioning as intended.

The U.S. Army Corps of Engineers National Inventory of Dams (NID) lists the Lake Fayetteville Dam height as 49 feet with a maximum storage of 6,566 acre-feet. However, using the information gathered as part of this study, the height of the dam was measured to be approximately 46.1 feet. Also, based on the updated terrain data, the dam provides a maximum storage of approximately 4,570 acre-feet, at an El 1,439.0 ft (NAVD 88).

Because the Lake Fayetteville Dam is greater than 25 feet in height and has a storage capacity greater than 50 acre-feet, it is required to be permitted under the State of Arkansas's Dam Safety Program. Dams under 25 feet in height (as defined by ANRD), irrespective of storage volume are not automatically required to be permitted. Per Title 7, a dam's required spillway capacity is determined based on two criteria. These criteria are size and hazard potential. A dam's size classification is based on the more stringent of either the height of the dam or the maximum storage of the reservoir, while the hazard potential of a dam is determined based on the more stringent of either the potential for loss of human life or economic loss. Tables 2.1 and 2.2 from Title 7 are reproduced below. Note that there is a typographical error (corrected herein) in the actual Table 2.1 as published by ANRD that indicates that small dams range in height from 24 to 40 feet. The text within the applicable subtitles of Title 7 clearly state that 25 feet is the regulatory height.

Table 2.1. Size Classification.

Size	Maximum Storage (acre-feet)	Height (Feet)
Small	50 to 1000	25 to 40
Intermediate	≥ 1000 and < 50,000	≥ 40 and < 100
Large	≥ 50,000	≥ 100

Table 2.2. Hazard Classification.

Category	Loss of Human life	Economic loss
Low	No	Minimal (No significant structures; pastures, woodland, or largely undeveloped land); less than $100,000.
Significant	No	Appreciable (Significant structures, industrial, or commercial development, or cropland); $100,000 to $500,000.
High	Yes	Excessive (Extensive public, industrial, commercial, or agricultural development); over $500,000.

Notes:

- Loss of human life is based upon presence of habitable structures.
- Hazard classification does not indicate the physical condition of the dam.

Based on Tables 2.1 and 2.2, the Lake Fayetteville Dam is classified as an intermediate sized dam, and because of the large amount of public and commercial developments that would be subject to potential economic loss resulting from a dam breach located immediately downstream, the dam's hazard classification is classified as a high hazard dam. Based on these two criteria and Table 2.3, the Lake Fayetteville Dam is required to have a spillway that can pass the Probable Maximum Flood (PMF). This is in agreement with the State of Arkansas's Dam Safety Division current rating for the dam, as well as ratings determined in previous analyses.

Table 2.3. Spillway Design Flood for Dams.

Hazard Classification	Size	Spillway Design Flood
Low	Small	0.25 PMF
	Intermediate	0.25 to 0.50 PMF
	*Large	0.50 to 0.75 PMF
Significant	Small	0.25 to 0.50 PMF
	Intermediate	0.50 to PMF
	Large	PMF
High	Small	0.50 PMF to PMF
	Intermediate	PMF
	Large	PMF

Note: Where ranges are given in this table, the spillway design flood shall be determined by straight line interpolation, based upon the effective height of dam or maximum storage, whichever computed SDF is greater.

*SDF shall be extrapolated at the same rate of change as an intermediate size dam to a maximum of .75 PMF.

3.0 TOPOGRAPHIC SURVEY

To complete the detailed hydraulic modeling necessary to determine the existing spillway discharge capacity, FTN used a combination of three sources for the Project area. The first source was a new hydrographic and topographic survey conducted for a portion of the existing dam, approach channel, exit channel, and spillway structure that was performed by FTN's surveying subconsultant, B&F Engineering, Inc. (B&F); the second source was 2015 Light Detection And Ranging (LiDAR) elevation data collected for Washington County through a partnership between the Federal Emergency Management Agency (FEMA) and the United States Department of Agriculture's Natural Resources Conservation Service (NRCS); and the third source was historic bathymetry surveys for various portions of the lake conducted in 1950 and 1985. For this Project, all topographic data was converted to or collected in the horizontal coordinate system of NAD 83, Arkansas State Plane North Zone, US survey foot with a vertical coordinate system of NAVD 88 (vertical). Please see Appendix C. Topographic Data for additional details on the information used.

The bathymetric and topographic survey conducted by B&F for this study was performed in November and December 2019. The survey extent was limited to an area of approximately 10.5 acres, which primarily focused on the approach and exit channels, the spillway structure, approximately 220 feet of the dam embankment, including the upstream and downstream faces, and lake bathymetry in the approximate location of the old Clear Creek channel up to the inlet of the approach channel. Bathymetry information was also collected in a small area of the lake and the approach channel. Once the survey was completed, it was reviewed by FTN with comments being addressed by the surveyor. Once the review was complete, the survey data was used to develop a detailed terrain surface that could support 1-foot contour generation. In addition to the surface information produced, B&F also set four survey control points within the survey extents so that they can be used for future construction control, if needed. Each construction control point was set using a 5/8-inch rebar with aluminum cap on top. These four points are listed below in Table 3.1. Survey Control Points.

Table 3.1. Survey Control Points.

Control Point	Northing	Easting	Latitude	Longitude	Elevation (ft, NAVD 88)
1	662,511.49	680,626.40	36.1346°	-94.1393°	1249.48
2	662,181.90	680,725.78	36.1337°	-94.1389°	1250.97
3	661,878.02	680,370.72	36.1329°	-94.1402°	1252.02
4	662,065.12	680,196.29	36.1334°	-94.1408°	1223.40

Additionally, ANRD had recently completed modeling for an upstream reach of Clear Creek as part of a Federal Emergency Management Agency (FEMA) Washington County FIS update starting at State Highway 265 (Crossover Road) as part of its Cooperating Technical Partnership (CTP) with FEMA (herein referred to as the "Arkansas CTP" study). Therefore, to supplement the Clear Creek portion of the watershed upstream of the Lake, FTN used the existing topographic data developed as part of the Arkansas CTP study to reduce the data gathering effort. For the remaining areas of the watershed around Lake Fayetteville and for the Hylton Branch drainage area, the 2015 Washington County LiDAR data was used, which was the same source data as the Arkansas CTP study information. This data was obtained in the form of 1-meter bare earth digital elevation model (DEM) tiles. These individual tiles were developed through a partnership between FEMA and the NRCS. According to the metadata obtained for this data, the vertical accuracy of the data is listed at +/- 9.25 centimeters or better and supports the development of 1-foot contours. The LiDAR was flown when the lake water surface elevation was at normal pool elevation of 1237.5 ft, NAVD 88.

Since bathymetric data was collected for a small portion of the lake, FTN elected to incorporate historic bathymetry data collected at various times for the remaining parts of the lake. The information incorporated was taken from a 1950 NRCS Sedimentation Survey and a 1983 University of Arkansas Civil Engineering Department Hydrographic Map. While FTN understands that this bathymetry data is old, most of the tie-in locations between the different sources did not yield large differences; therefore, the information was incorporated as best available data. Additionally, this data was used to provide a better understanding of the travel time and storage potential of the lake and how it plays a role in potential spillway modifications.

4.0 HYDROLOGIC MODELING

In order to assess the dam's ability to meet current hydrologic criteria based on its' hazard classification, a new hydrologic analysis was performed to determine the runoff potential of the contributing watershed. The new hydrologic analysis included the use of the recent Clear Creek hydrologic analysis that was completed by the Arkansas CTP for FEMA's ongoing Washington County Flood Insurance Study (FIS) revision, use of updated LiDAR data, updated land-use data from varying sources, and updated precipitation data. The information used in the analysis was processed using ESRI's ArcGIS® software and supporting extensions and toolsets. Based on the topography and data processing, the watershed delineation for the Lake Fayetteville Dam was calculated to be approximately 5,933 acres (9.27 mi^2) using LiDAR, which compares reasonably well to the 1996 study's published value of 6,336 acres (9.9 sq mi), considering the differences in data resolution between the older USGS Topographic Quad maps used in the 1996 hydraulic evaluation and the 2015 high resolution LiDAR data being used today.

4.1 Base Model

By using the recently completed Clear Creek hydrologic analysis, this current study was able to build from a recently developed hydrologic model that contributed approximately 6.9 mi^2. This existing model used the USACE HEC-HMS (version 4.1) program to perform rainfall-runoff simulations for the 10-, 4-, 2-, 1-, and 0.2% annual-chance (10-, 25-, 50-, 100-, and 500-year) flood events.

The existing AR CTP study started approximately 1,000 feet downstream of Crossover Road (State Highway 265), near the upstream end of Lake Fayetteville, and it divided the watershed into 18 subbasins. The NRCS Unit Hydrograph Method was used with runoff Curve Numbers for calculating runoff for the area. The Curve Number is a runoff coefficient that is based on the hydrologic soil group, land use, and hydrologic condition of an area. The hydrologic soil group information was taken from the Soil Survey Geographic (SSURGO)

database for Washington County, with an Antecedent Moisture Condition Type II (average moisture condition) assumed. The soils data, land use information, and subbasins were then combined together in ArcGIS 10.4.1 to develop an area-weighted Curve Number for each subbasin.

Time of Concentration (T_c), calculated using the NRCS TR-55 method, was determined for each subbasin. T_c is defined as the time needed for water to flow from the hydraulically most remote point in a watershed to the watershed outlet. It is a function of the topography and land use within the watershed. The TR-55 method computes T_c assuming that water moves through a watershed as sheet flow, shallow concentrated flow, open channel flow, or some combination of the three. The open channel characteristics, as referenced in the T_c calculations, were based on channel section data derived from the LiDAR topography. The Manning's "n" values used in the T_c calculations were based on aerial photography and engineering judgment. Upon calculating the T_c for each subbasin, the lag time (T_{Lag}) was calculated as $0.6*T_c$. This relationship between T_{Lag} and T_c was given in the HEC-HMS Technical Reference Manual (2000) as the relationship suggested by the SCS (now the NRCS). This lag time (in minutes) was the input required for the transform method in HEC-HMS.

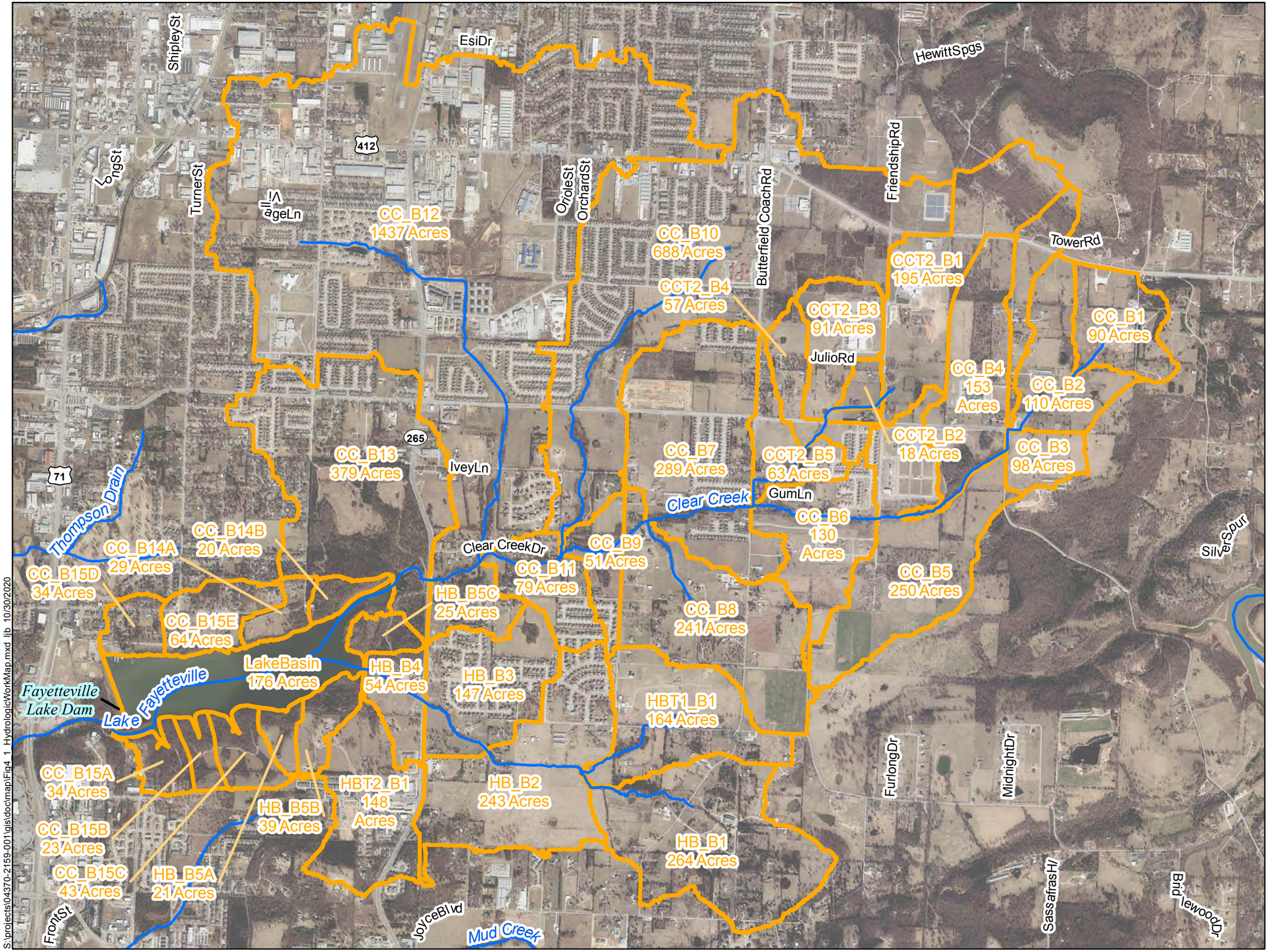
The routing method used for the Arkansas CTP study reaches was the Modified Puls method. This routing method was selected because of the drainage area's overbank conveyance. ArcGIS® and HEC-RAS were used to create a basic hydraulic model with cross sections extracted from the topographic data. The resulting storage output from the HEC-RAS model was compiled to extract the cumulative volume (storage) for each reach and entered into the HEC-HMS model as that reach's storage-discharge curve.

For precipitation inputs, the 50-, 10-, 4-, 2-, 1- and 0.2-percent frequency storm totals for the 24-hour event were obtained from the National Oceanic and Atmospheric Administration's (NOAA) Atlas 14 website. No baseflow was used in the hydrologic model. While FTN does note that there are springs present around the dam, FTN is not aware of any information available indicating the presence of large springs located in the headwaters of the watershed that would significantly impact the computed discharges of the contributing streams.

4.2 Updated Analysis

The lake watershed covers three different jurisdictions - Washington County and the cities of Springdale and Fayetteville. Each jurisdiction has its own prescribed methodology for hydrologic analysis, which may vary. Since approximately 6.9 mi^2 of the Lake Fayetteville Watershed was covered by the Arkansas CTP study, which falls within the City of Springdale and this new analysis utilizes much of that data and the methodologies established during that study, the decision was made to remain as consistent as possible with the existing data developed by the Arkansas CTP study. While this hydrologic analysis is being used to resize the Lake Fayetteville spillway, there are some slight variations from the City of Fayetteville 2014 Drainage Criteria Manual. After review, the variations from the 2014 Drainage Criteria Manual are considered to be minor as the differences are typically focused on parameter inputs; therefore, this information may be used for future analyses downstream, as long as one is cognizant of the differences in hydrologic methods used. The following paragraphs discuss the various modifications that were made as part of the new hydrologic analysis.

With the Arkansas CTP study as the base information, FTN used ESRI's ArcGIS (Version 10.5.1) software and tools to delineate the remaining watershed area down to the Lake Fayetteville spillway. The additional area was broken down based on a combination of factors, including drainage area, roadway crossings, and confluences with tributaries. Additionally, subbasins along the along the perimeter of Lake Fayetteville were further refined along with the lake itself being treated as its own subbasin in order to allow the contribution from direct precipitation onto the lake. All topographic data used for the new study is a combination of the 2015 Washington County LiDAR, available bathymetry data, and survey information where available. Figure 4.1 is a map showing various hydrologic features for the entire Project area.



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VICINITY MAP

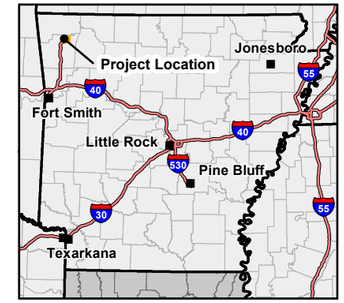

Figure 4.1
Lake Fayetteville Dam
Hydrologic Work Map

Legend

- Major Streams
- Subbasins

Aerial Imagery:
2017 Statewide Aerial Imagery

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Map Created - October 30 2020

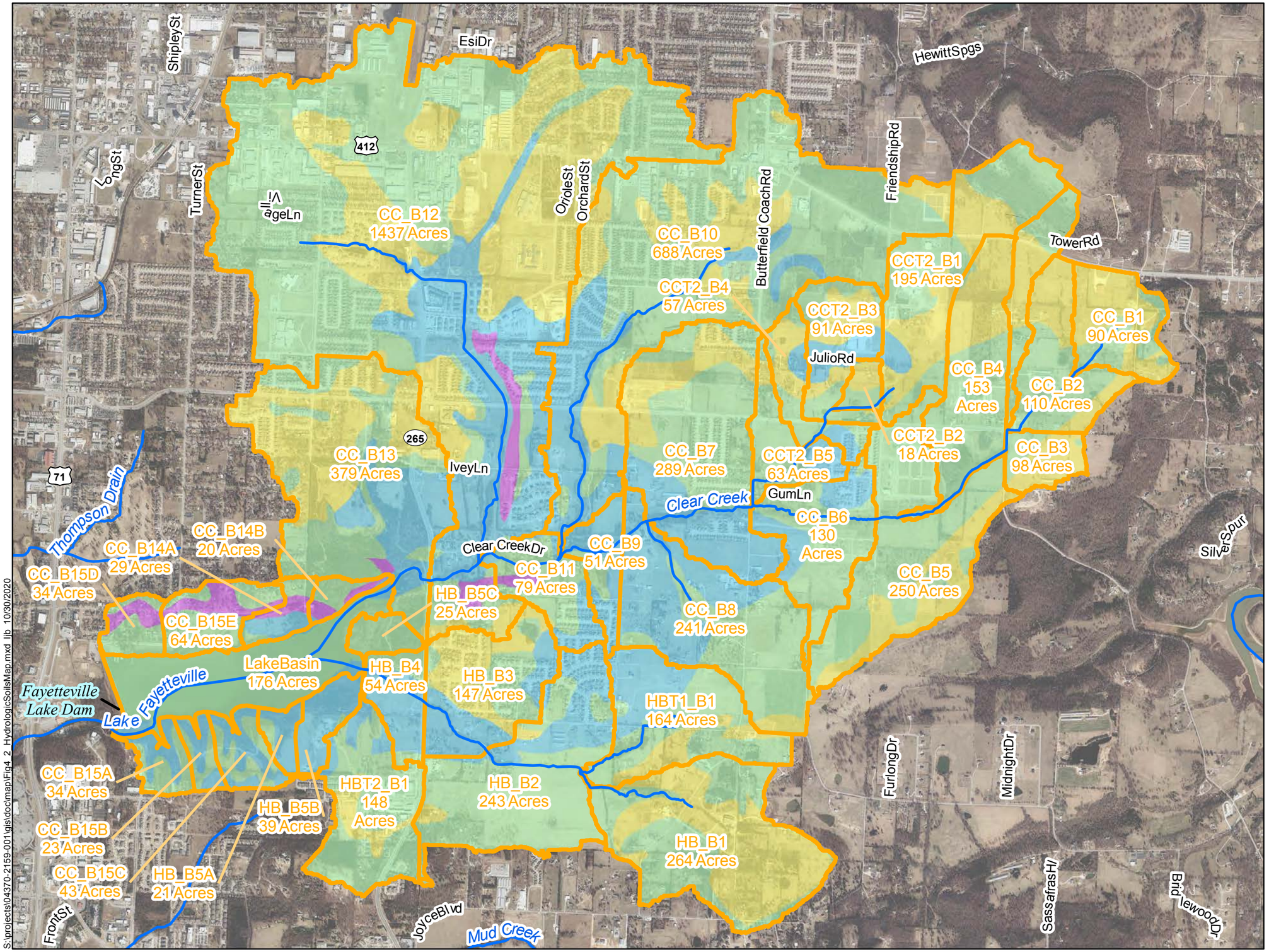
Map Coordinate System - NAD83 (Feet) Arkansas State Plane, North Zone

For the SCS Curve Number method, FTN obtained NRCS SSURGO data from the NRCS Geospatial Data Gateway, which from the available documentation on the Arkansas CTP study was consistent with the source data used on that project. As part of the soil characteristics, these soils have been grouped based on their Hydrologic Soil Group (HSG), which determines the ability of the soils to drain when saturated. The Lake Fayetteville Watershed consists of six classifications, which are A, B, B/D, C, C/D, and D. In the dual groups, the first letter is for drained areas while the second is for undrained areas. Additionally, for areas where dual groups were present, the more conservative group was used, as this was the approach taken in the Arkansas CTP study. Therefore, the predominant soil classifications in the watershed for this analysis are HSG C and D. Table 4.1 Land Use Types and Curve Numbers is a breakdown of the different land use types used for the study that can be linked to the Technical Release Number 55 (TR-55) runoff Curve Numbers and includes a summary of the applicable Curve Numbers. The soil characteristics for the entire study area are displayed on Figure 4.2. Hydrologic Soil Group Map.

Table 4.1. Land Use Types and Curve Numbers.

NLCD Grid Code	NLCD Description	TR-55 LANDUSE	Additional Notes	Soil Group *			
				A	B	C	D
11	Open Water	Water	--	99	99	99	99
21	Dev. Open Space	Open Space (Fair)	Parks w/ minor dev.	49	69	79	84
		Open Space (Good)	--	49	69	79	84
22	Dev. Low Intensity	Residential (2 acres)	Lots 2 acres or greater	46	65	77	82
23-L	Dev. Medium Intensity	Residential (1 acre)	1-2 acre lots	51	68	79	84
23-M		Residential (1/4 acre)	0.25-0.75 acre lots	61	75	83	87
23-H		Residential (up to 1/8 acre)	Townhouses/apartments	77	85	90	92
24	Dev. High Intensity	Commercial	--	89	92	94	95
31	Barren Land	Urban (Newly graded)	--	77	86	91	94
41	Deciduous Forest	Woods (Good)	--	30	55	70	77
42	Evergreen Forest	Woods (Poor)	--	45	66	77	83
43	Mixed Forest	Woods (Fair)	--	36	60	73	79
71	Grassland	Herb. grass, brush (Fair)	--	N/A	71	81	89
81	Pasture	Pasture (Good)	--	39	61	74	80

* Some values used differ from those in the 2014 Fayetteville Drainage Criteria Manual.



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VICINITY MAP

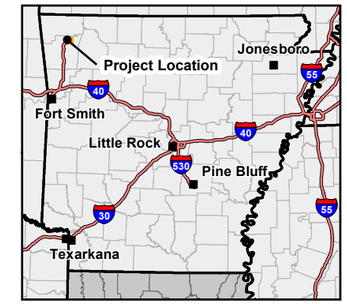

Figure 4.2
Lake Fayetteville Dam
Hydrologic Soils Map

Legend

- Major Streams
- Subbasins
- Hydrologic Soil Group A
- Hydrologic Soil Group B
- Hydrologic Soil Group C
- Hydrologic Soil Group D

Aerial Imagery:
2017 Statewide Aerial Imagery

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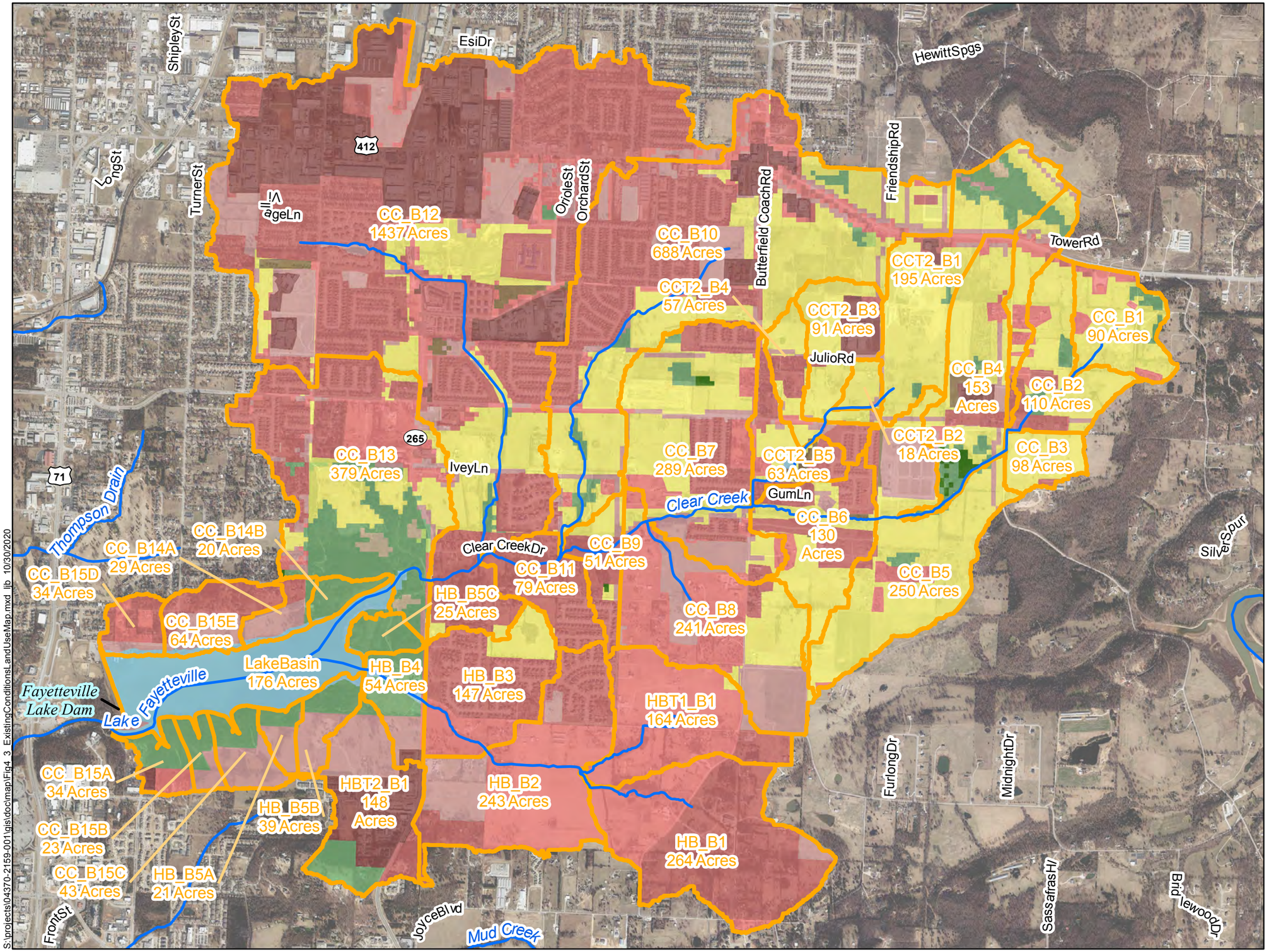
Map Created - October 30 2020

Map Coordinate System - NAD83 (Feet) Arkansas State Plane, North Zone

Using the 2011 NLCD as the initial starting point, the land use data was modified using publicly available imagery from various sources, with the exception of the portion of the watershed in the Arkansas CTP study area. As the Arkansas CTP study was recently completed, that information was taken as is with no changes being made. For the remaining areas of the watershed, the aerial imagery used to validate land use patterns types consisted of Microsoft's Bing and Google Aerial Imagery (dates vary), 2017 State of Arkansas Imagery, 2019 - 2020 City of Fayetteville imagery, and 2019-2020 City of Springdale imagery.

The current land use characteristics for the entire study area are displayed on Figure 4.3. Existing Conditions Land Use Map.



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VICINITY MAP

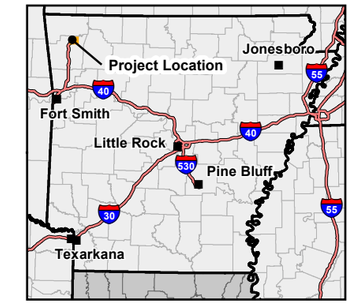

Figure 4.3
Lake Fayetteville Dam
Existing Conditions
Land Use Map

Legend

- Major Streams
- Subbasins
- Open Water
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Barren Land
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Grassland
- Pasture

Aerial Imagery:
2017 Statewide Aerial Imagery

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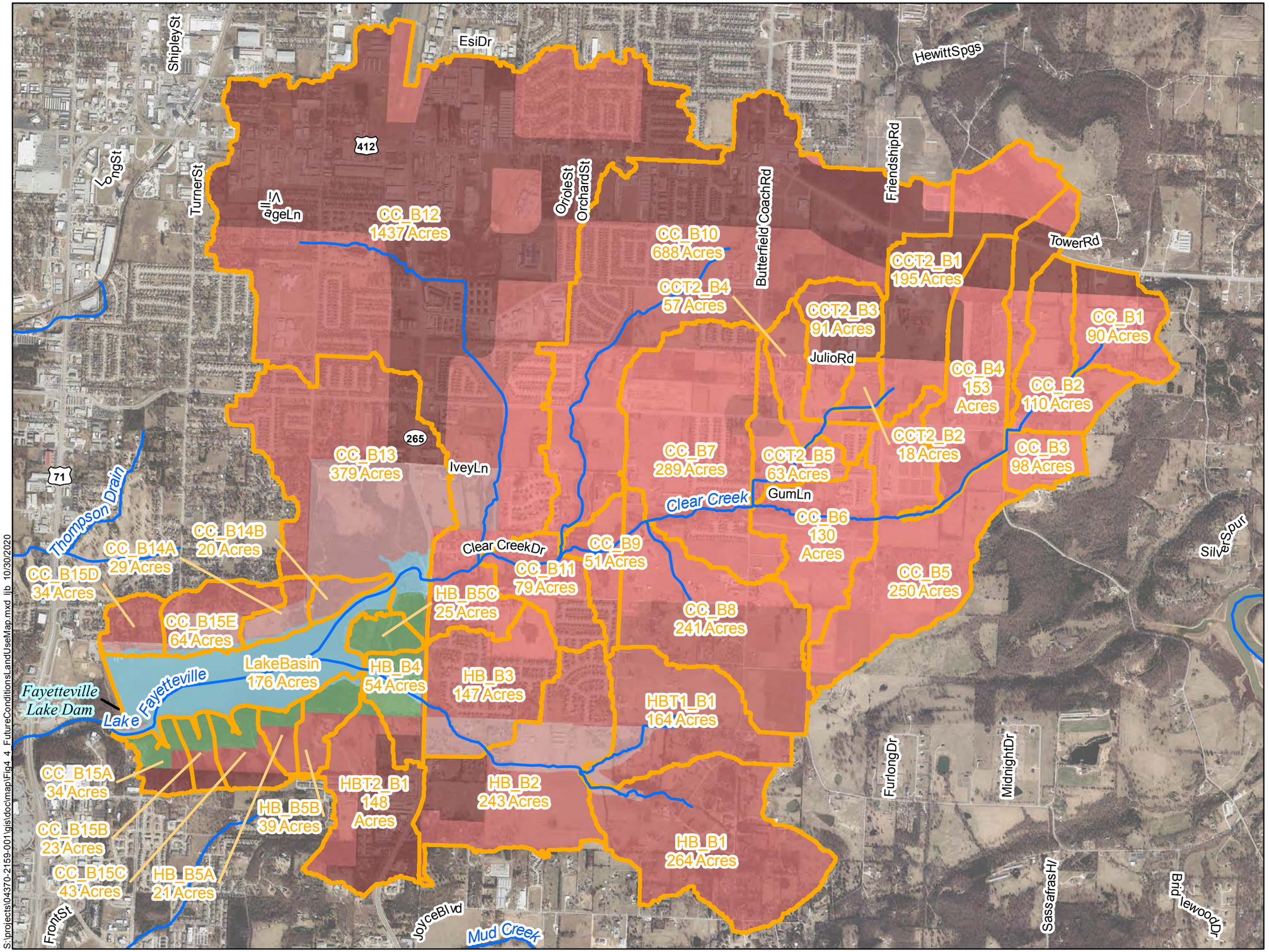
Map Created - October 30 2020

Map Coordinate System - NAD83 (Feet) Arkansas State Plane, North Zone

Another objective of the hydrologic analysis was to examine the impact that future development within the watershed may have on the spillway and resultant discharges. Consequently, a future conditions scenario was performed for the entire watershed. This scenario was completed by recomputing the Curve Number for each subbasin using the existing NRCS SSURGO data and the future land use data for the Cities of Fayetteville and Springdale, and the unincorporated areas of Washington County. For the City of Fayetteville, this consisted of utilizing the 2040 Master Plan land use geospatial data, while for the City of Springdale and Washington County, the best available geospatial master plan data was incorporated. This information was then reviewed and assigned a Curve Number based on the land use and HSG shown in Table 4.1. Additionally, for this study, antecedent moisture condition Type II (average moisture condition) was assumed for all analyses performed. If conflicts were found between the varying data sources, the classification based on the land areas current incorporation status for that particular location was chosen.

The projected land use characteristics for the entire study area are displayed on Figure 4.4. Future Conditions Land Use Map. Table 4.2 Subbasin hydrologic parameter summary is a tabular summary of the subbasin parameters used in the hydrologic analyses.



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VICINITY MAP

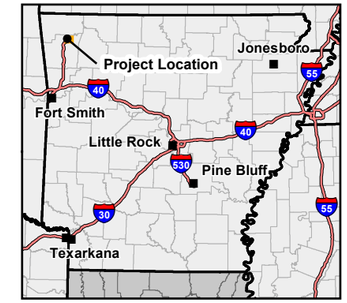

Figure 4.4
Lake Fayetteville Dam
Future Conditions
Land Use Map

Legend

- Major Streams
- Subbasins
- Open Water
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Deciduous Forest

Aerial Imagery:
2017 Statewide Aerial Imagery

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Map Created - October 30 2020

Map Coordinate System - NAD83 (Feet) Arkansas State Plane, North Zone

Table 4.2. Subbasin hydrologic parameter summary.

Basin ID	Subbasin Area (sq mi)	Cumulative Area (sq mi)	Curve Number (Existing)	Curve Number (Future)	Time of Concentration T_c (min)	Lag Time T_{Lag} (min)
CC_B1	0.140	0.140	76.4	82.0	37.3	22.4
CC_B2	0.170	0.310	78.3	81.8	64.2	38.5
CC_B3	0.150	0.460	77.3	83.1	46.0	27.6
CC_B4	0.240	0.700	79.6	83.6	82.2	49.3
CC_B5	0.390	1.090	79.4	80.8	66.5	39.9
CC_B6	0.200	1.290	79.4	79.4	73.0	43.8
CC_B7	0.450	2.400	77.0	77.0	74.4	44.6
CC_B8	0.380	2.780	72.5	77.7	78.6	47.2
CC_B9	0.080	2.860	70.1	70.2	31.3	18.8
CC_B10	1.080	3.940	80.9	85.5	128.6	77.2
CC_B11	0.120	4.060	79.0	79.0	59.2	35.5
CC_B12	2.240	6.300	83.8	87.2	109.9	65.9
CC_B13	0.590	6.890	75.9	82.3	66.3	39.8
CC_B14A	0.045	0.045	72.7	73.7	5.0	3.0
CC_B14B	0.031	0.031	61.1	72.3	14.6	8.8
CC_B15A	0.053	0.053	72.9	78.3	15.1	9.0
CC_B15B	0.036	0.036	68.6	76.9	21.3	12.8
CC_B15C	0.066	0.066	72.1	78.1	5.8	3.5
CC_B15D	0.053	0.053	77.6	80.3	7.4	4.4
CC_B15E	0.100	0.100	79.8	79.8	11.0	6.6
HBT1_B1	0.256	0.256	77.0	82.5	45.2	27.1
HBT2_B1	0.231	0.231	86.2	89.7	44.5	26.7
HB_B1	0.412	0.412	83.1	84.7	50.5	30.3
HB_B2	0.380	1.048	79.9	84.3	42.5	25.5
HB_B3	0.230	1.278	77.2	78.8	38.6	23.2
HB_B4	0.085	1.363	70.7	74.6	29.5	17.7
HB_B5A	0.032	0.032	67.6	71.0	5.4	3.3
HB_B5B	0.060	0.060	65.8	69.6	14.3	8.6
HB_B5C	0.038	0.038	72.6	77.9	40.6	24.4
CCT2_B1	0.300	0.300	77.5	87.7	59.7	35.8
CCT2_B2	0.030	0.330	76.2	78.8	25.6	15.3
CCT2_B3	0.140	0.470	78.6	85.4	69.1	41.5
CCT2_B4	0.090	0.560	78.2	78.2	50.0	30.0
CCT2_B5	0.100	0.660	81.9	81.9	49.4	29.7
Lake Basin	0.274	9.272	99.0	99.0	1.0	1.0

In addition to performing rainfall-runoff simulations for the 10-, 4-, 2-, 1-, and 0.2% annual-chance (10-, 25-, 50-, 100-, and 500-year) flood events, the 50% annual-chance (2-year) flood event and the three Probable Maximum Precipitation (PMP) rainfall events were also added. The 50% annual-chance event uses values obtained from NOAA's Atlas 14. The PMP rainfall values were obtained from Hydrometeorological Report Number 51 (HMR 51) and the 2019 Regional Probable Maximum Precipitation Study for Oklahoma, Arkansas, Louisiana, and Mississippi (herein referred to as the "2019 PMP Study").

Within the 2019 PMP Study, there are three different storm types that can be evaluated. These storm types are: Local, General, and Tropical.

- **Local:** storm events that consist of local thunderstorms/Mesoscale Convective Systems (MCS) where the main rainfall occurs over short durations (up to 24 hours) and cover a small area (less than 100 mi^2) and are most active from mid-spring through the early fall.
- **General:** storm events associated with areas of low pressure moving across the region from the west and meeting moisture from the Gulf of Mexico; occur in the fall and spring months; and are representative of where the main rainfall occurs over larger areas and cover longer durations of time.
- **Tropical:** storm events, which occur less frequently, are influenced by a tropical system or remnants of tropical moisture; occur from June through October; and have accumulation characteristics similar to the general storm type.

With multiple events available from the 2019 PMP study and based on guidance from ANRD, it is recommended that the most conservative scenario be used when looking at the performance of the Lake Fayetteville spillway and potential future modifications. Therefore, for this PMP analysis, a sensitivity analysis was performed using the three storm events described above to determine which model scenario would produce the most runoff within the watershed. While Lake Fayetteville is located in Northwest Arkansas, the Tropical scenario has been included as there could be the possibility for tropical moisture to impact the area (i.e., the from the remnants of a hurricane that has moved inland). Additionally, for a 24-hr period, the Local and Tropical precipitation values are very similar. The sensitivity analysis looked at various combinations of distributed rainfall scenarios using the State's new PMP Calculation Tool. This

tool is a python script designed to run in ArcGIS software and will provide the user with PMP values based on the size and location of a user specified watershed for various storm periods (e.g., 24-hr, 48-hr, or 72-hr).

As the 2019 PMP Study now supersedes HMR 51, the HMR 51 information is being provided for comparisons only. Table 4.3 Precipitation Data is a tabular summary of frequency events used in the analysis. Table 4.4 Probably Maximum Precipitation Data is a tabular summary of the PMP scenarios used.

Table 4.3. Precipitation Data.

Duration	Annual Chance Flood Frequency (Depth in inches)					
	50%	10%	4%	2%	1%	0.2%
5-min.	0.45	0.62	0.73	0.82	0.90	1.11
15-min.	0.80	1.11	1.30	1.46	1.61	1.97
1-hr.	1.59	2.25	2.69	3.03	3.38	4.23
2-hrs.	2.00	2.87	3.44	3.89	4.36	5.53
3-hrs.	2.28	3.27	3.94	4.49	5.05	6.47
6-hrs.	2.77	3.91	4.70	5.36	6.05	7.84
12-hrs.	3.29	4.47	5.31	6.02	6.78	8.77
24-hrs.	3.85	5.22	6.17	6.96	7.80	9.97

Table 4.4. Probable Maximum Precipitation Data.

Source	Probably Maximum Precipitation (Depth in inches)		
	24-hr	48-hr	72-hr
HMR 51	N/A	N/A	44.39
State - Local Event	28.53	N/A	N/A
State - General Event	23.85	28.45	28.94
State - Tropical Event	31.19	33.05	33.14

5.0 HYDRAULIC MODELING

5.1 HEC-RAS Model Development

For this study, a two-dimensional (2-D) model was developed using the USACE's HEC-RAS software (Version 5.0.7) to model both the existing and future condition scenarios. During scope development, the primary objective was to determine the existing condition discharges passing through the spillway of the dam. However, there were additional discussions about assessing potential impacts to downstream areas that may result from potential dam and spillway modifications. As a result, it was determined that while a one-dimensional (1-D) unsteady flow model could be used for the current analysis, a two-dimensional (2-D) model would provide more ancillary benefits to the City. This could be useful during subsequent phases of the project with respect to evaluating potential modifications. Therefore, the decision was made to use a 2-D model to capture the additional complexity (e.g., lateral variations in velocity, formation of eddies) in the system.

While 1-D HEC-RAS can be used as an unsteady flow model, it cannot model the spread of flow (i.e., flow in both the longitudinal and lateral directions) because it uses a series of cross sections to represent the terrain surface and roughness characteristics, and it is assumed that velocities only vary in the longitudinal direction. Between these cross sections, the 1-D model interpolates based on the available cross section data to perform its calculations for the area of interest. Dependent on the number of cross sections and the detail provided, the limitations of the 1-D model could lead to incorrect computations at the downstream, or tailwater, side of the spillway, which could impact computed spillway discharges.

With a 2-D hydraulic model, the system is modeled using a computational mesh rather than a series of cross sections along the longitudinal axis of the stream reach. The mesh consists of computational cells that have elevation ground profiles and roughness values along the cell faces that represent the topographic surface and frictional characteristics of the area and volumetric relationships for the cell area. The use of the 2-D model allows for more detailed resolution in water surface elevations, velocities, and flow patterns than is possible with a 1-D model that is only capable of computing average values for three general regions at each cross

section (i.e., that are averaged in the left and right overbanks and the channel). Based on engineering judgment and study goals, breaklines were defined along roads, dams, culverts and other significant features identified on the topography and aerial imagery. Further details of the model development are discussed in the sections below.

5.1.1 Structures

There are three primary structures in the immediate study area: Lake Fayetteville Dam, the existing spillway, and a trail bridge located approximately 80 feet downstream of the spillway structure. The Lake Fayetteville Dam and the existing spillway structure were represented by 2-D Area Connections in the hydraulic modeling, which utilized survey and LiDAR data. For the Lake Fayetteville Dam, approximately 300 feet of the southern end was resurveyed for this study. The remaining portion of the dam was represented by the high-resolution LiDAR data collected by FEMA in 2015, since comparison of the elevations to that of the 1996 study revealed a general agreement in elevations. The spillway was based on current survey data for all 2-D Area Connections modeled.

HEC-RAS is currently unable to model bridges in the 2-D version. However, as it was unclear if the water surface elevations would actually rise to the low chord of the trail bridge crossing, the initial models were run without the bridge in the geometry. After initial runs revealed that the low chord of the bridge crossing would not be impacted, the existing bridge piers were added to the topographic data to represent the constrictions they create. Since the trail bridge is constructed with a unique pier dimensions and shapes, these features cannot be modeled in HEC-RAS exactly as they are constructed. Therefore, the pier sizes that have been added into the topographic data were adapted from the design drawings of the Lake Fayetteville spillway bridge, as prepared by Carter-Burgess for the City in 2004. Note that the bridge deck and railing have not been included in the model because of the limitations of HEC-RAS and since the elevations for both were determined to be higher than all water surface elevations computed.

5.1.2 Hydraulic Parameters

For the hydraulic model, Manning's "n" values (roughness coefficients) were developed based on National Land Cover Database (NLCD) land use type, aerial imagery, field survey and reconnaissance photos, and/or engineering judgment. Table 5.1 Manning's "n" Roughness Coefficients is a tabular summary of the roughness coefficients used in the hydraulic model.

Table 5.1. Manning's "n" Roughness Coefficients.

Roughness Coefficients	Description
0.010	Smooth pavement, open water
0.035	Clean straight channels, little channel growth
0.040	Park areas
0.050	Open space
0.060	Open fields, pastures, Areas of light development
0.080	Areas of moderate development, lightly forested areas
0.100	Wooded areas and dense development

5.1.3 Boundary Conditions

To account for flows coming into and going out of the model, two types of boundary conditions were utilized in the modeling for this analysis. The first boundary condition used is normal depth slope. This type of boundary condition is applied to the downstream end of the 2-D model, which is located downstream of U.S. Highway 71B. This boundary condition applies a slope, which is calculated from the average slope of the terrain located downstream of the boundary, across the downstream edge of the modeling mesh. The second type of boundary condition used is a flow hydrograph. This type of boundary condition is used to represent the runoff entering the lake through streamflow, overland flow, or other drainage from the 12 separate subbasins. Two of these subbasins include the drainage areas of Clear Creek and Hylton Branch. Additionally, one of the subbasins also accounts for direct rainfall onto Lake Fayetteville. All hydrologic data was linked to the hydraulic model directly as flow hydrograph curves taken from the HEC-HMS model output files.

5.2 Model Runs

To set up the 2-D model, an initial run was created which allowed inflows from Clear Creek and Hylton Branch to fill the Lake up to its normal pool elevation. Once the lake level reached an elevation approximately equal to the normal pool elevation, the inflows from Clear Creek and Hylton Branch were stopped, and the model was allowed to run to create steady state conditions, and a "snapshot" of the water surface elevations and velocities everywhere within the model domain was made, which is referred to as a "hot start" file that provides a stable condition for the various inflow scenarios to be applied to moving forward. Therefore, it is the base scenario from which all remaining model scenarios start.

To simulate the remaining scenarios, additional model runs were developed as needed to complete the hydraulic analysis. Table 5.2 is a summary of the scenarios evaluated for the Lake Fayetteville Dam.

Table 5.2. Lake Fayetteville Scenarios.

Event	Scenario	Description
50% Event	Existing / Future	2-Year Discharge
10% Event	Existing / Future	10-Year Discharge
4% Event	Existing / Future	25-Year Discharge
2% Event	Existing / Future	50-Year Discharge
1% Event	Existing / Future	100-Year Discharge
0.2% Event	Existing / Future	500-Year Discharge
Local Storm	Existing / Future (24-hr)	Local PMP Scenario (2019 PMP Study)
General Storm	Existing / Future (24- & 72-hr)	General PMP Scenario (2019 PMP Study)
Tropical Storm	Existing / Future (24- & 72-hr)	Tropical PMP Scenario (2019 PMP Study)
HMR-52	Existing (72-hr)	Historic PMF (HMR 51) Scenario

Received from Jonathan
2/10/21

ftn Associates Ltd.
water resources / environmental consultants

DELINEATION OF POTENTIAL SECTION 404 ISSUES PROPOSED CHANDLER CROSSING SUBDIVISION PROJECT, FAYETTEVILLE, WASHINGTON COUNTY, ARKANSAS

FEBRUARY 1, 2021

DELINEATION OF POTENTIAL SECTION 404 ISSUES PROPOSED CHANDLER CROSSING SUBDIVISION PROJECT FAYETTEVILLE, WASHINGTON COUNTY, ARKANSAS

Prepared for

Engineering Services, Inc.
1207 S Old Missouri Rd,
Springdale, AR 72764

Prepared by

FTN Associates, Ltd.
124 West Sunbridge, Suite 3
Fayetteville, AR 72703

FTN No. R05220-2539-001

February 1, 2021

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1.0 INTRODUCTION

Engineering Services Inc. (ESI) (the Client) contracted with FTN Associates, Ltd. (FTN) of Fayetteville, Arkansas, to delineate Section 404 wetlands and other waters of the US (WOTUS) within the proposed project area of approximately 82 acres, located in Fayetteville, Washington County, Arkansas. The project area is located east of the intersection of North Crossover Road (AR-265) and East Zion Road in Fayetteville, Washington, Arkansas. The area of the delineation is mapped on US Geologic Survey (USGS) topographic quadrangle Sonora, AR (7.5-minute series) (Figure 2). Legal description of the project area is part of Section 19, Township 17 North, Range 29 West. Approximate central coordinates of the project area are 36.12915°N, - 94.11124°W (NAD 83). The project area is located in the Illinois watershed (Hydrologic Unit Code [HUC] 11110103), a watershed of approximately 1,700 mi^2, within the states of Arkansas and Oklahoma (Figure 1).

2.0 MATERIALS AND METHODS

FTN conducted a Level 3, routine wetland delineation as described in the US Army Corps of Engineers (USACE) *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987). Field investigations for the delineation were conducted on January 26 and 27, 2021. FTN evaluated the area of the delineation for potential Section 404 jurisdictional areas, i.e., wetlands and WOTUS, and complied with the USACE 1987 Manual and Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region Version 2.0 (Engineer Research and Development Center 2012).

Sampling point locations were selected to evaluate those low-lying areas and other areas appearing to have at least some potential for USACE regulation under Section 404 of the Clean Water Act (CWA). Twenty-two sampling point locations were established, and data was collected on vegetation, hydrology, and soils at the locations (Figures 3 and 4).

Edwin B. Smith's Keys to the Flora of Arkansas (1994) was used to confirm certain plant identifications and the USACE Cold Regions Research and Engineering Laboratory's Eastern

Mountains and Piedmont National Wetland Plant List (2016 with 2018 updates approved in 2020) was used to determine wetland indicator status for the dominant species. Soil pits were dug with a sharpshooter shovel to a depth of approximately 16 to 18 inches, where possible, and soil colors were determined with the aid of Munsell color charts. Soil survey data from the Soil Survey of Washington County, Arkansas (Soil Conservation Service (SCS) 1969) and the Natural Resources Conservation Service's (NRCS) Web Soil Survey (2020) were used to determine the SCS map units for the area. Also, the NRCS (Soil Data Access) Washington County, Arkansas Hydric Soils Map List and Map Units with Hydric Inclusions was used to assist in the selection of sampling points appearing to have a potential for the occurrence of hydric soils.

A Juniper Systems Geode sub-meter real time GPS receiver unit paired with a smartphone using ARCGIS collector was used for marking sampling site locations, channels, and wetland boundaries.

3.0 FINDINGS AND RESULTS

3.1 General Site Description

The project site is surrounded by residential and commercial development, maintained pasture areas, and undeveloped forested tracts. The project area itself consists mostly of improved upland pasture, with areas of herbaceous wetland communities. The topography of the project area slopes generally in a northern direction and includes wetland depressions and distinct mounded formations. Within the project area, three ponds, two intermittent channels, and a perennial channel are mapped on the United States Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI). One pond and one intermittent channel are mapped within the project area on the 1994 USGS topographic quadrangle Sonora, AR (7.5-minute series) (Figure 3). During the time of delineation, one pond, two ephemeral channels, one perennial channel, six man-made ditches, four upland swales, and nine wetland areas were observed within the project area. Section 3.2 below provides information regarding the onsite wetlands; Section 3.3 below provides information regarding the ponds and channels within the project area.

3.2 Wetlands

Nine herbaceous wetland features, totaling approximately 5.8 acres of technical wetlands, were observed within the project area. None of the wetland features observed within the project area are subject to jurisdiction under Section 404 of the CWA due to a lack of adjacency to a navigable water/tributary of a navigable water or anticipated flooding by a navigable water/tributary of a navigable water during a typical year. Attachment A provides completed USACE data forms specific to the sampling point locations. Attachment B provides representative photos of onsite features. Table 1 provides a summary of findings at the 22 sampling point locations. Table 2 provides a summary of the nine wetland features.

Table 1. Summary of findings at each of the 22 sampling point locations.

Sampling Site	**Hydrophytic Vegetation**	**Hydric Soils**	Wetland Hydrology	**Technical Wetland**
S-01	Yes	Yes	Yes	Yes
S-02	No	No	No	No
S-03	Yes	Yes	Yes	Yes
S-04	Yes	Yes	Yes	Yes
S-05	No	No	No	No
S-06	Yes	Yes	Yes	Yes
S-07	No	No	No	No
S-08	Yes	Yes	Yes	Yes
S-09	No	No	No	No
S-10	Yes	Yes	Yes	Yes
S-11	No	No	No	No
S-12	Yes	Yes	Yes	Yes
S-13	Yes	Yes	Yes	Yes
S-14	No	No	No	No
S-15	Yes	Yes	Yes	Yes
S-16	No	No	Yes	No
S-17	No	No	No	No
S-18	No	No	No	No
S-19	No	No	No	No
S-20	Yes	Yes	Yes	Yes
S-21	Yes	Yes	Yes	Yes
S-22	No	No	No	No

Table 2. Summary of nine wetlands features.

Wetland	Vegetative Community Type	Area (in Acres)	Jurisdictional Wetland	Photo(s) ID
WET-A	herbaceous	0.76	No	1
WET-B	herbaceous	0.90	No	2
WET-C	herbaceous	0.40	No	3
WET-D	herbaceous	0.05	No	N/A
WET-E	herbaceous	0.31	No	N/A
WET-F	herbaceous	1.6	No	4
WET-G	herbaceous	0.26	No	5
WET-H	herbaceous	0.28	No	6
WET-I	herbaceous	1.24	No	7
Total Acreage		5.8		

3.2.1 Vegetation

The project area consisted of the following two vegetative communities:

- Improved upland pasture community and
- Herbaceous wetland community.

The improved upland pasture community, observed throughout the majority of the project area, is dominated by: tall false rye grass (*Schedonorus arundinaceus*), broom sedge (*Andropogon virginicus*), and Bermuda grass (*Cynodon dactylon*), among other species.

The herbaceous wetland community areas, i.e., WET-A through WET-I, are dominated by: yellow-fruit sedge (*Carex annectens*), low spike sedge (*Kyllinga pumila*), Pennsylvania smartweed (*Persicaria pensylvanica*), yellow bristle grass (*Setaria pumila*), hairy buttercup (*Ranunculus sardous*), and broom rosette grass (*Dichanthelium scoparium*), among other species.

Positive indicators of hydrophytic vegetation were observed at Sampling Point Nos. S-01, S-03, S-04, S-06, S-08, S-10, S-12, S-13, S-15, S-20, and S-21 (Appendix A).

3.2.2 Wetland Hydrology

The wetland areas appear to receive hydrology primarily from local drainage and direct rainfall. Hydrologic indicators observed within the observed wetland features include: surface

water, high water table, saturation, oxidized rhizospheres along living roots, crayfish burrows, saturation visible on aerial imagery, and positive FAC neutral tests. Positive indicators of wetland hydrology were observed at Sampling Point Nos. S-01, S-03, S-04, S-06, S-08, S-10, S-12, S-13, S-15, S-16, S-20, and S-21 (Appendix A).

3.2.3 Hydric Soils

The SCS *Soil Survey of Washington County, Arkansas* (1969) and NRCS Web Soil Survey 3.3 (2020), illustrate thirteen map units within the project area:

- Captina silt loam, 3 to 6 percent slopes, eroded;
- Enders-Leesburg complex, 8 to 20 percent slopes;
- Hector-Mountainburg gravelly fine sandy loam, 3 to 8 percent slopes;
- Johnsburg complex, mounded;
- Johnsburg silt loam, 0 to 2 percent slopes;
- Nixa very gravelly silt loam, 3 to 8 percent slopes;
- Nixa very gravelly silt loam, 8 to 12 percent slopes;
- Razort loam;
- Razort silt loam, occasionally flooded;
- Samba silt loam;
- Samba complex, mounded;
- Savannah fine sandy loam, 3 to 8 percent slopes, eroded; and
- Taloka complex, mounded.

SCS describes the map units as follows. Captina silt loam, 3 to 6 percent slopes, eroded, map unit is described as moderately well drained, slowly permeable soils found on uplands and stream terraces. Enders-Leesburg complex, 8 to 20 percent slopes map unit is described as moderately well drained, very slowly permeable soils found on mountainsides. Hector-Mountainburg gravelly fine sandy loam, 3 to 8 percent slopes map unit is described as shallow, excessively drained soils, comprised of equal parts of Hector and Mountainburg soils. Johnsburg complex, mounded, and Johnsburg silt loam, 0 to 2 percent slopes map units are described as poorly drained, slowly permeable soils that possess a fragipan. Nixa very gravelly silt loam, 3 to

8 percent slopes and Nixa very gravelly silt loam, 8 to 12 percent slopes map units are described as cherty, moderately well drained, slowly permeable soils that occur along narrow ridgetops. Razort loam and Razort silt loam, occasionally flooded, map units are described as well-drained, moderately permeable soils found on floodplains and low terraces. Samba silt loam and Samba complex, mounded, map units are described as poorly drained, slowly permeable soils found on stream terraces and uplands. Savannah fine sandy loam, 3 to 8 percent slopes, eroded, map unit is described as moderately well drained, slowly permeable soils that possess a fragipan. Taloka complex, mounded, map unit is described as poorly drained, slowly permeable soils found on level broad uplands.

NRCS lists Samba silt loam and Samba complex, mounded, soil map units as hydric soils that possess the potential for hydric inclusions. NRCS lists Johnsburg complex, mounded, Johnsburg silt loam, 0 to 2 percent slopes, Razort loam, Razort silt loam, occasionally flooded, and Taloka complex, mounded, map units as non-hydric soils that possess the potential for hydric inclusions. NRCS does not include the remaining map units in the hydric soils list for Washington County, AR. Therefore, they are classified as non-hydric soils that lack the potential for hydric inclusions because they lack the components necessary to be considered a hydric soil or a soil that possesses the potential for hydric inclusions

3.3 Other Waters of the US

The 1994 USGS topographic quadrangle Sonora, AR (7.5-minute series) maps a single intermittent channel near the northern portion of the project area. However, the USGS US Topo Map 2017 Sonora, AR 7.5-minute series quadrangle) maps and named perennial channel, locally known as Hilton Creek, that flows east to west through the northern portion of the project area (in the location of the 1994 mapped intermittent channel). Field observations confirmed the classification of Hilton Creek as a perennial channel (PER-01) that extends approximately 760 linear feet within the project area. Due to its classification as a perennial channel and its hydrological connection to a downstream navigable water, PER-01 is subject to regulation by the USACE under Section 404 of the CWA (Figures 3.3 and 4.3).

USGS US Topo Map 2017 Sonora, AR 7.5-minute series quadrangle also maps an unnamed intermittent channel beginning near the central portion of the project area and flows

northward, exiting the project area, and draining into a pond located on a neighboring property. Field observations determined this channel to be an ephemeral channel (EPH-01) that extends approximately 708 linear feet within the project area before draining into a pond located on a neighboring property to the north via a broad area of sheet flow. Due to its classification as an ephemeral channel, EPH-01 is not subject to jurisdiction as a WOTUS under Section 404 of the CWA (Figures 3.2, 3.3, 4.2, and 4.3).

The 1994 USGS topographic quadrangle Sonora, AR (7.5-minute series), maps a single open-water feature i.e., a pond, near the southern project boundary. Field observations identified this feature a man-made pond (OW-1) totaling approximately 0.36 acres. OW-1 is not adjacent to a navigable water or a tributary of a navigable water, and is not anticipated to flood during a typical year; therefore, this open-water feature is not subject to regulation by the USACE as a WOTUS under Section 404 of the CWA (Figures 3.1 and 4.1).

USGS US Topo Map 2017 Sonora, AR 7.5-minute series quadrangle maps three freshwater pond features within the project area. Field observations determined two of the mapped freshwater pond features to be wetlands (i.e., WET-G and WET-H). Field observations confirmed the third pond to be an open water pond feature (i.e., OW-1).

In addition to the mapped features described above, field observations revealed the presence of a second ephemeral channel (EPH-02), six man-made ditches (Ditch-01, Ditch-02, Ditch-03, Ditch-04, Ditch-05, and Ditch-06), and four upland swales (UPL-01, UPL-02, UPL-03, and UPL-04).

EPH-02 appears to be the remnants of a former channel (which may have drained an adjacent property located west of AR HWY 265; past development activity associated with this adjacent property may have altered the hydrology associated with this channel) that now functions as a drainage channel between WET-A and WET-B. Due to its classification as ephemeral, EPH-02 is not subject to jurisdiction as a WOTUS under Section 404 of the CWA (Figures 3.1 and 4.1).

Six man-made ditches (Ditch-01 through Ditch-06) were observed within central portions of the project as linear channelized features. These man-made ditches may have been constructed to drain excess standing water in order to improve the quality of pasturelands within the project area. These ditches are man-made, likely constructed entirely within uplands, and ephemeral in

nature (i.e., flowing only in direct response to rainfall); therefore, these six ditches are not subject to jurisdiction as WOTUS under Section 404 of the CWA (Figures 3 and 4).

Four upland swales (UPL-01 through UPL-04) were observed within the project area. These swales appeared to functions as drains which direct rainfall and sheet flow runoff down gradient through the mounded topography of project area. Due to the lack of ordinary high-water marks and the presence of upland vegetation, these four upland swales are neither channel or wetland features and therefore not subject to jurisdiction as WOTUS under Section 404 of the CWA (Figures 3 and 4).

Table 3 provides a summary of non-wetland aquatic features observed within the project area.

Table 3. Summary of non-wetland aquatic features.

Feature ID	Classification	Linear Feet within Project Area	Jurisdictional Feature	Photos (ID)
PER-01	Perennial	760	Yes	8
EPH-01	Ephemeral	708	No	9
EPH-02	Ephemeral	95	No	10
Ditch-01	Man-made	460	No	11
Ditch-02	Man-made	404	No	12
Ditch-03	Man-made	799	No	13
Ditch-04	Man-made	770	No	N/A
Ditch-05	Man-made	978	No	N/A
Ditch-06	Man-made	446	No	N/A
UPL-01	Upland Swale	400	No	N/A
UPL-02	Upland Swale	467	No	N/A
UPL-03	Upland Swale	367	No	14
UPL-04	Upland Swale	184	No	15
OW-01	Pond	n/a	No	16

4.0 FEMA 100-YEAR FLOODPLAIN AND FLOODWAY ISSUES

The Federal Emergency Management Agency (FEMA) maps a small section in the north-central portion of the project area, associated with PER-01, as Zone A. Zone A is a designation for areas subject to inundation by the 1-percent-annual-chance flood event. The remainder of the project area is mapped as Zone X. Zone X is an area of minimal flood hazard. A FEMA FIRMette is provided in Appendix C.

5.0 SUMMARY AND CONCLUSIONS

- FTN observed nine herbaceous wetland features, totaling approximately 5.8 acres, that meet the technical definition of wetlands within the project area.
  - None of the wetland features observed within the project areas will likely be subjected to jurisdiction under Section 404 of the CWA due to a lack of adjacency to and/or the direct hydrological connection with downstream WOTUS.
- FTN observed one mapped perennial channel (PER-01; locally known as Hilton Creek) totaling approximately 760 linear feet within the project area, that is subject to jurisdiction as a WOTUS under Section 404 of the CWA.
- FTN observed several non-wetland aquatic features (i.e., two ephemeral channels, six man-made ditches, four upland swales, and one open water pond feature) that are not considered WOTUS and therefore not subject to jurisdiction under Section 404 of the CWA.

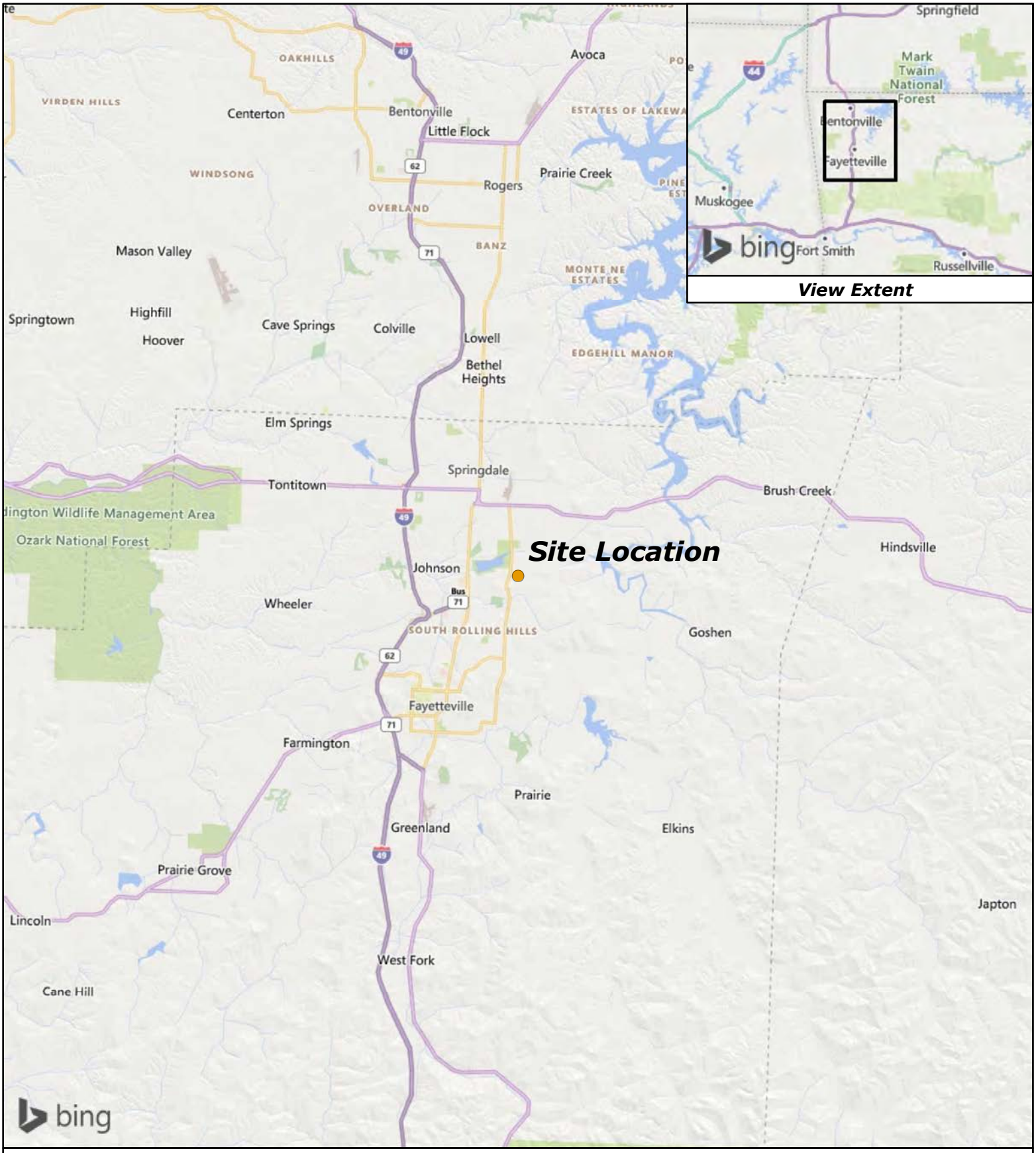
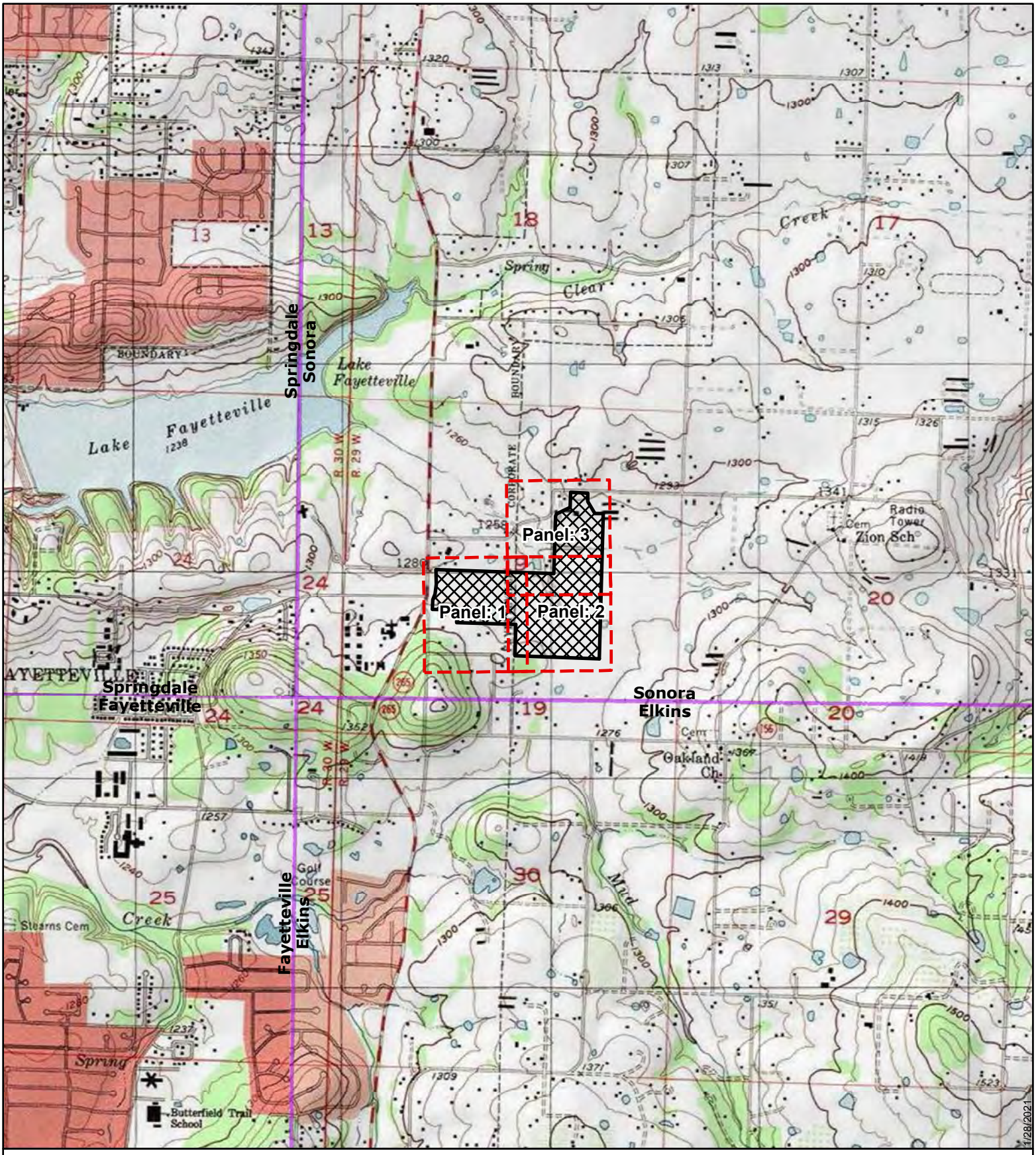


Figure 1. Vicinity Map



Chandler Crossing Subdivision

2,000 Feet

Panels

Project Area

tn Associates Ltd.

N W E S

D:\Projects\05220-2539-001\gis\doc\map\delin\figure_2.mxd

Background: USGS 1:24,000 DRG

Figure 2. Map showing overview of project area overlaid on the USGS topographic quadrangles Elkins, Fayetteville, Sonora, and Springdale, AR (7.5-minute series).

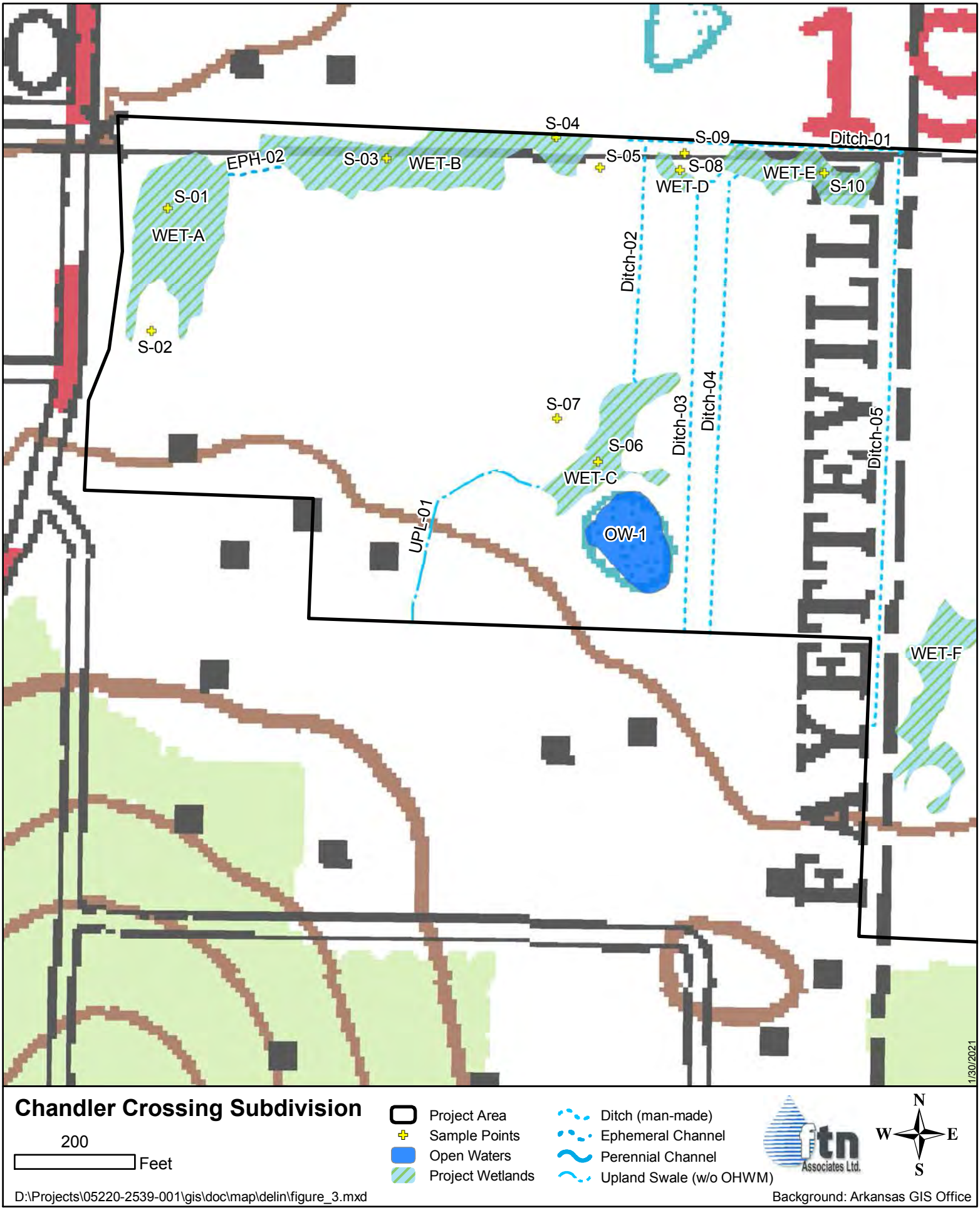


Figure 3.1 Map showing project area details overlaid on the USGS topographic quadrangle Sonora, AR (1994) (7.5-minute series).

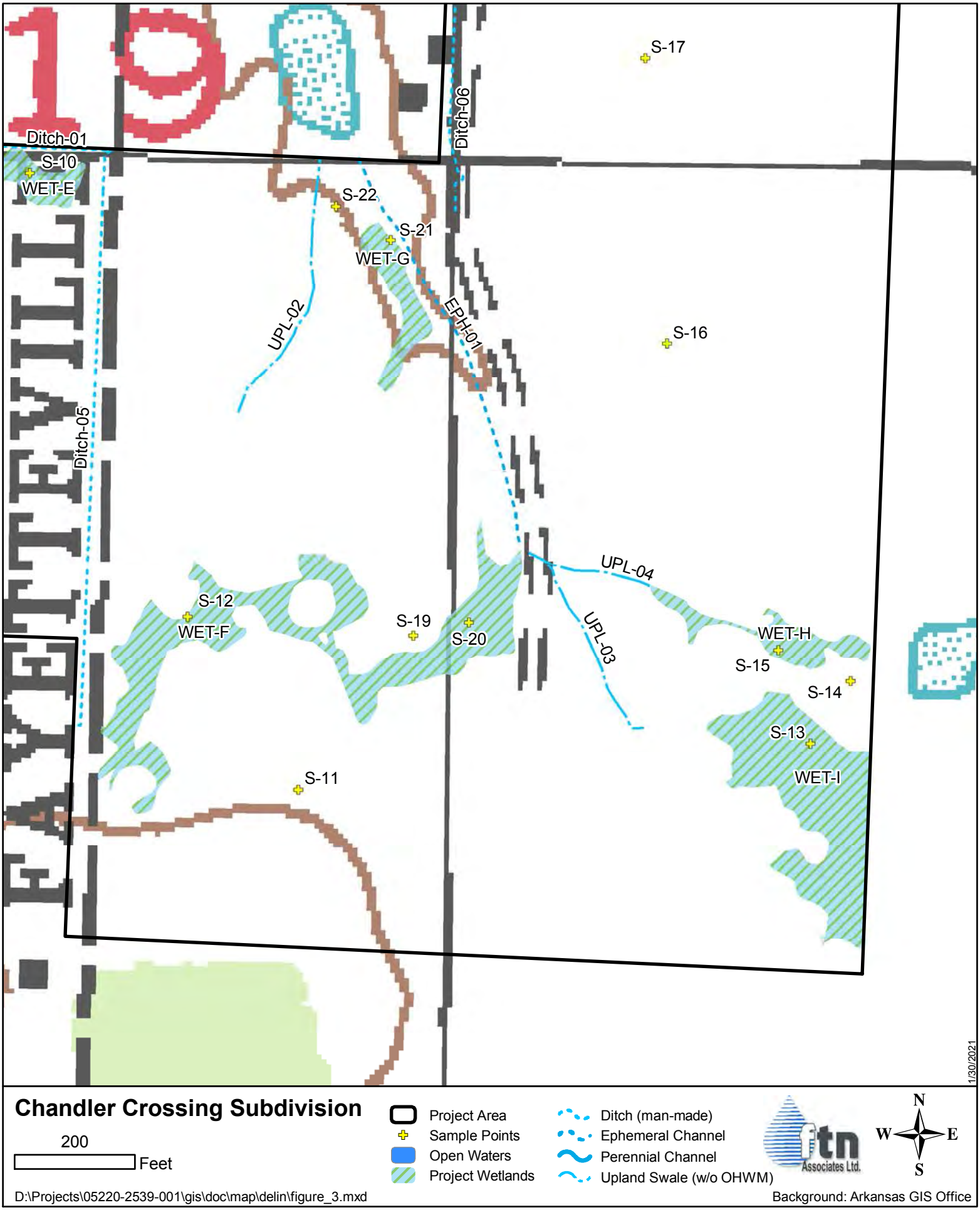


Figure 3.2 Map showing project area details overlaid on the USGS topographic quadrangle Sonora, AR (1994) (7.5-minute series).

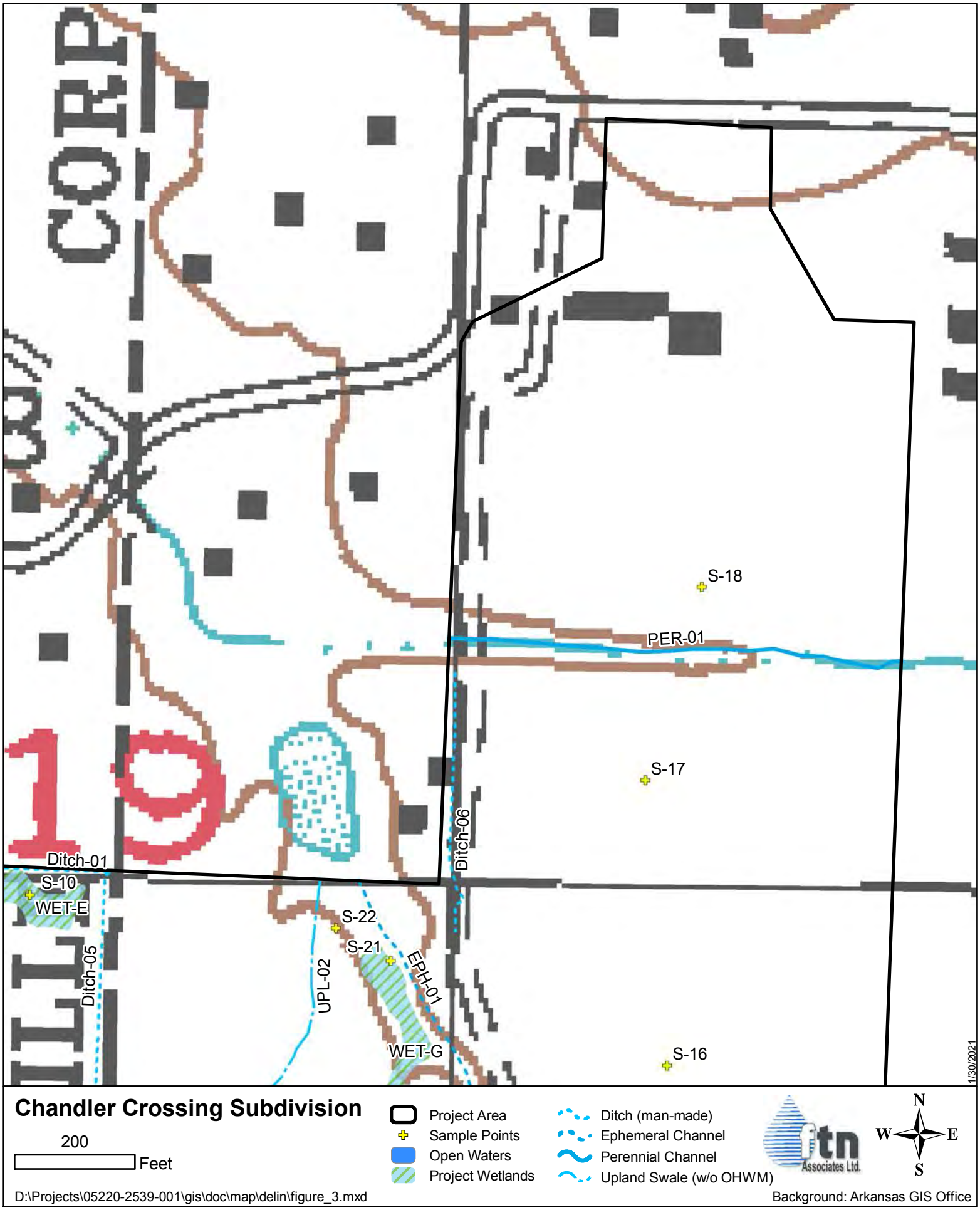
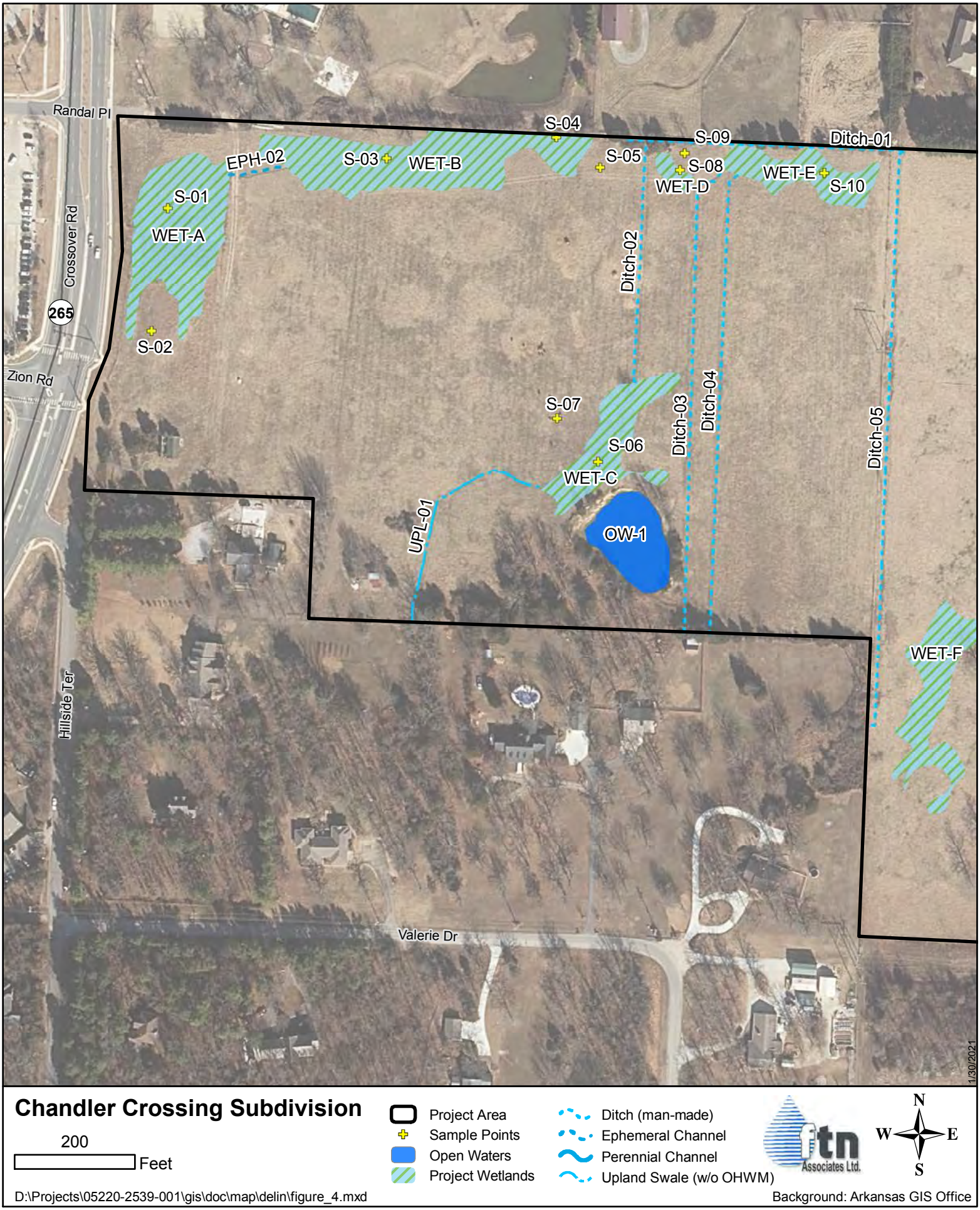


Figure 3.3 Map showing project area details overlaid on the USGS topographic quadrangle Sonora, AR (1994) (7.5-minute series).



Chandler Crossing Subdivision

200 Feet

Project Area
Sample Points
Open Waters
Project Wetlands
Ditch (man-made)
Ephemeral Channel
Perennial Channel
Upland Swale (w/o OHWM)

tn Associates Ltd.

N W E S

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Background: Arkansas GIS Office

Figure 4.1 Map showing project area details overlaid on 2017 Arkansas Digital Orthophotography Program imagery.

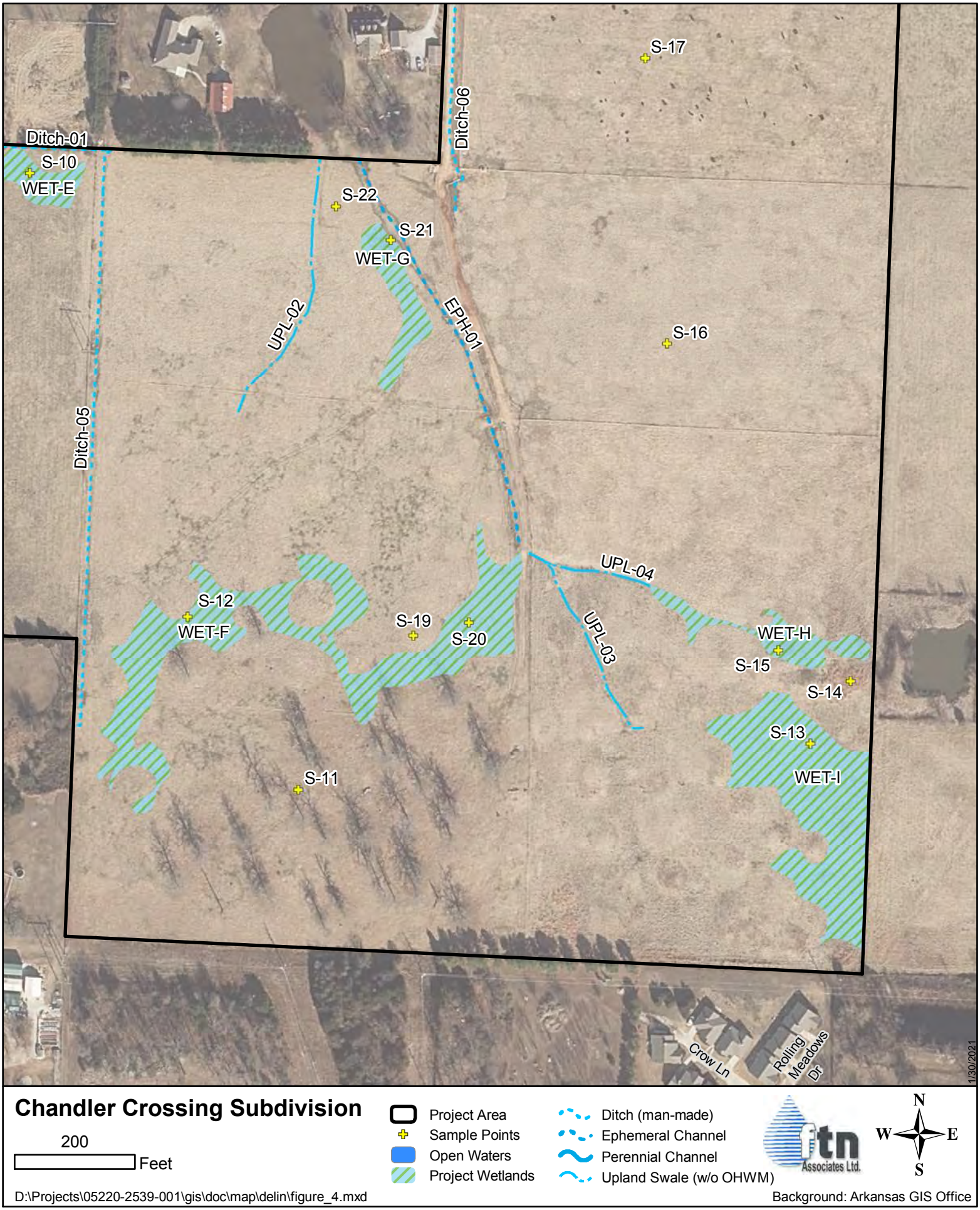


Figure 4.2 Map showing project area details overlaid on 2017 Arkansas Digital Orthophotography Program imagery.

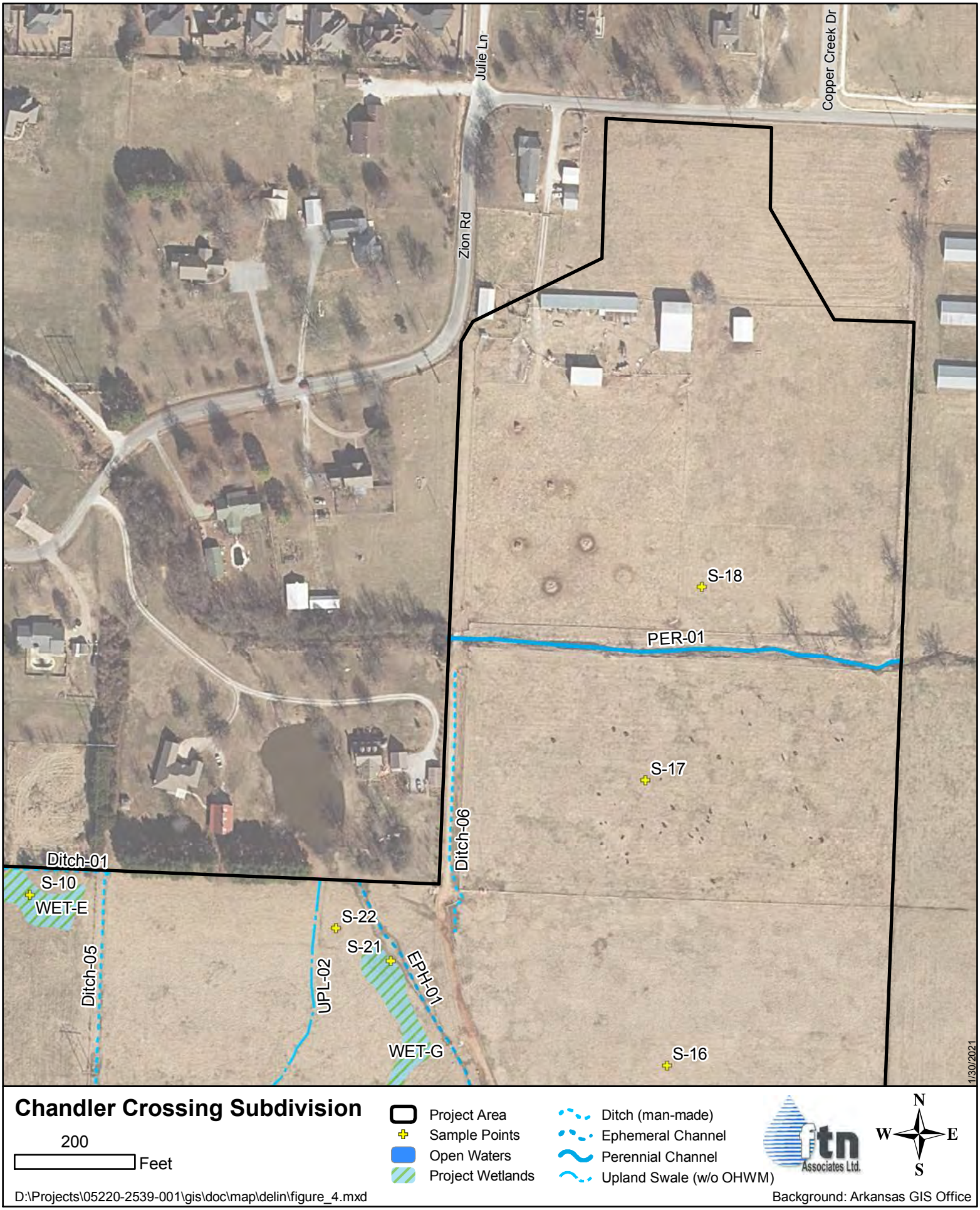


Figure 4.3 Map showing project area details overlaid on 2017 Arkansas Digital Orthophotography Program imagery.

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map
US Topo

SONORA QUADRANGLE
ARKANSAS
7.5-MINUTE SERIES

Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and 1 000-meter grid: Universal Transverse Mercator, Zone 15S
10 000-foot ticks: Arkansas Coordinate System of 1983 (north zone)

This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery.....NAIP, December 2015
Roads.....U.S. Census Bureau, 2015 - 2016
Names.....GNIS, 2016
Hydrography.....National Hydrography Dataset, 2015
Contours.....National Elevation Dataset, 2016
Boundaries.....Multiple sources; see metadata file 1972 - 2016
Public Land Survey System.....BLM, 2015
Wetlands.....FWS National Wetlands Inventory 1977 - 2014

MN
GN
0° 38'
11 MILS
1° 32'
27 MILS
UTM GRID AND 2017 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

U.S. National Grid
100,000-m Square ID
UA UV
VA VV
Grid Zone Designation
15S

SCALE 1:24 000

KILOMETERS 1 0.5 0 1 2
METERS 1000 500 0 1000 2000
MILES 1 0.5 0 1
FEET 1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000

CONTOUR INTERVAL 20 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Program US Topo Product Standard, 2011.
A metadata file associated with this product is draft version 0.6.19

ARKANSAS
QUADRANGLE LOCATION

ROAD CLASSIFICATION
Expressway
Secondary Hwy
Ramp
Local Connector
Local Road
4WD
Interstate Route
US Route
State Route

1	2	3
4		5
6	7	8

ADJOINING QUADRANGLES
1 Bentonville South
2 Rogers
3 War Eagle
4 Springdale
5 Spring Valley
6 Fayetteville
7 Elkins
8 Goshen

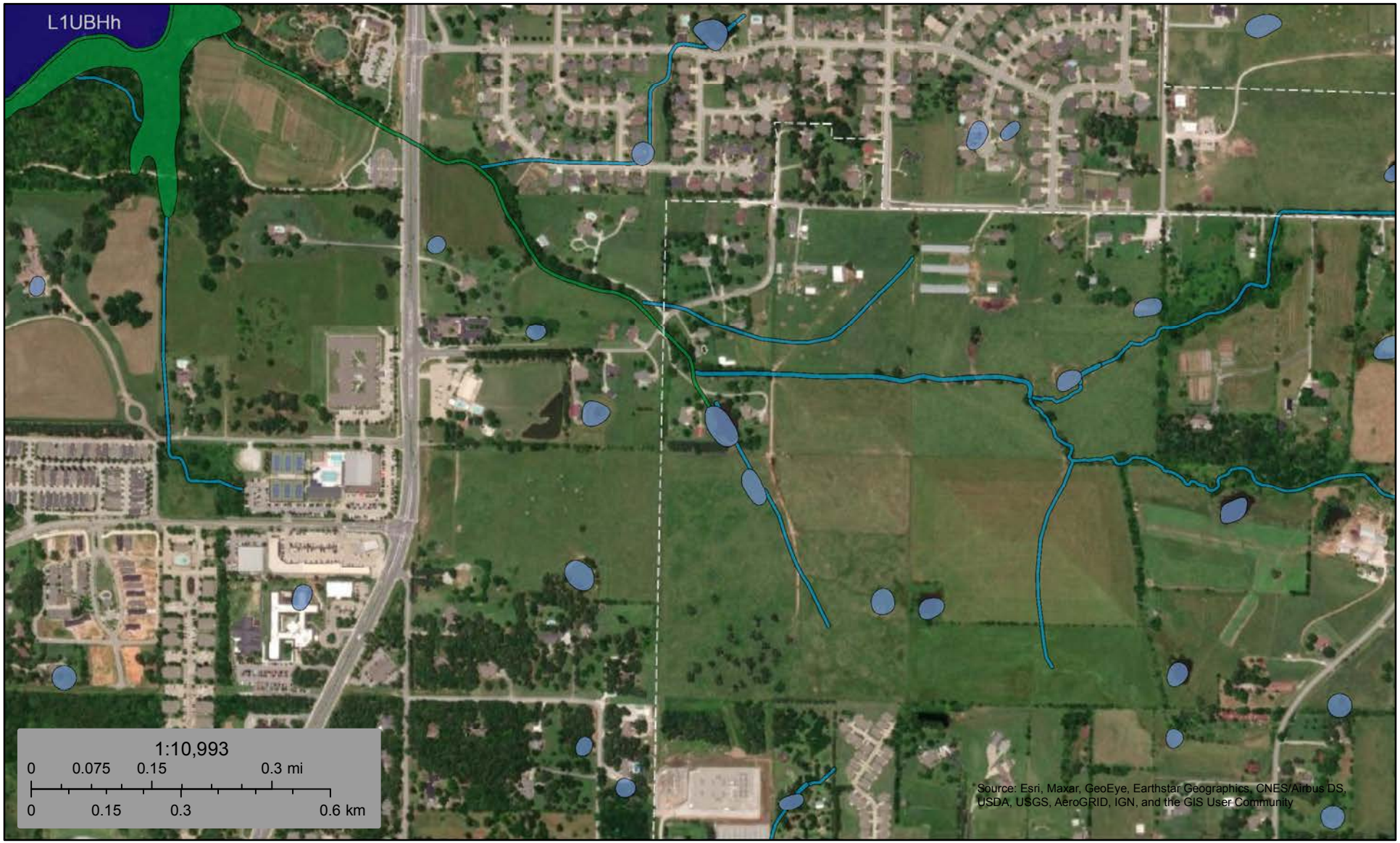
SONORA, AR
2017

NSN 7945-01-639-4702
NGA REF NO. USGSX24K42080

U.S. Fish and Wildlife Service

National Wetlands Inventory

Wetlands



January 29, 2021

Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

National Wetlands Inventory (NWI)
This page was produced by the NWI mapper

ATTACHMENT 1

Sampling Site Data Sheets

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Chandler Crossing Subdivision City/County: Fayetteville/Washington Sampling Date: 1/26/2021

Applicant/Owner: Engineering Services Inc. State: AR Sampling Point: S-01

Investigator(s): Kagan Davis Section, Township, Range: S19, T17N, R29W

Landform (hillslope, terrace, etc.): flat Local relief (concave, convex, none): none Slope (%): 0

Subregion (LRR or MLRA): LRR N Lat: 36.13021 Long: -94.11738 Datum: NAD 83

Soil Map Unit Name: Johnsburg silt loam NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks:

All three criteria for classification as a wetland were observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ✓ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ✓ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ✓ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ✓	No ____	Depth (inches): 4
Water Table Present?	Yes ✓	No ____	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes ✓	No ____	Depth (inches): 0

Wetland Hydrology Present? Yes ✓ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Positive indicators of wetland hydrology were observed.

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: S-01

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		

Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		

Herb Stratum (Plot size: 5')			
1. *Dichanthelium scoparium*	50	yes	FACW
2. *Juncus effusus*	30	yes	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	80 = Total Cover		

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: _____ (A)

Total Number of Dominant Species Across All Strata: _____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

✓ 1 - Rapid Test for Hydrophytic Vegetation

__ 2 - Dominance Test is >50%

__ 3 - Prevalence Index is ≤3.0[1]

__ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Positive indicators of hydrophytic vegetation were observed.

SOIL

Sampling Point: S-01

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12	10yr 6/1	60					clay	
	7.5yr 5/8	40					red clay	Foreign red clay fill material
12-16	10yr 6/1	80	10yr 5/6	20	C	M	clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

Positive indicators of hydric soils were observed.

From 0-12 inches two matrix colors were observed. The primary matrix color observed within the layer was a 10yr 6/1 (60%). The secondary matrix color observed with the layer is a 7.5yr 5/8 (40%) which is not typical for the area. Therefore, it is assumed that red clay fill material used for commercial construction may have inadvertently been placed in the wetland during the construction of either the farm road located to the east or commercial properties located to the west.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Chandler Crossing Subdivision City/County: Fayetteville/Washington Sampling Date: 1/26/2021

Applicant/Owner: Engineering Services Inc. State: AR Sampling Point: S-02

Investigator(s): Kagan Davis Section, Township, Range: S19, T17N, R29W

Landform (hillslope, terrace, etc.): mound Local relief (concave, convex, none): convex Slope (%): 0

Subregion (LRR or MLRA): LRR N Lat: 36.12965 Long: -94.11746 Datum: NAD 83

Soil Map Unit Name: Johnsburg silt loam NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks:

None of the criteria for classification as a wetland were observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No ✓	Depth (inches): ____
Water Table Present?	Yes ____	No ✓	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No ✓	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Positive indicators of wetland hydrology were not observed.

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: S-02

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		

Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		

Herb Stratum (Plot size: 5')			
1. *Andropogon virginicus*	60	yes	FACU
2. *Schedonorus arundinaceus*	20	yes	FACU
3. *Setaria pumila*	2	no	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	82 = Total Cover		

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species	2	x 3 =	6
FACU species	80	x 4 =	320
UPL species		x 5 =	
Column Totals:	82 (A)		326 (B)

Prevalence Index = B/A = 3.98

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes _____ No ✓

Remarks: (Include photo numbers here or on a separate sheet.)

Positive indicators of hydrophytic vegetation were not observed.

SOIL

Sampling Point: S-02

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-16	10yr 5/6	100					silt loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ____ **No** ✓

Remarks:

Positive indicators of hydric soils were not observed.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Chandler Crossing Subdivision City/County: Fayetteville/Washington Sampling Date: 1/26/2021

Applicant/Owner: Engineering Services Inc. State: AR Sampling Point: S-03

Investigator(s): Kagan Davis Section, Township, Range: S19, T17N, R29W

Landform (hillslope, terrace, etc.): swale Local relief (concave, convex, none): concave Slope (%): 1

Subregion (LRR or MLRA): LRR N Lat: 36.13046 Long: -94.11615 Datum: NAD 83

Soil Map Unit Name: Samba silt loam NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks:

All three criteria for classification as a wetland were observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ✓ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ✓ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ✓	No ____	Depth (inches): 5
Water Table Present?	Yes ✓	No ____	Depth (inches): 6
Saturation Present? (includes capillary fringe)	Yes ✓	No ____	Depth (inches): 0

Wetland Hydrology Present? Yes ✓ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Positive indicators of wetland hydrology were observed.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: S-03

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. *Quercus stellata*	5	yes	UPL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	5 = Total Cover		

Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		

Herb Stratum (Plot size: 5')			
1. *Kyllinga pumila*	80	yes	FACW
2. *Dichanthelium scoparium*	15	yes	FACW
3. *Setaria pumila*	10	no	FAC
4. *Schedonorus arundinaceus*	5	no	FACU
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	110 = Total Cover		

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66.67% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species	95	x 2 =	190
FAC species	10	x 3 =	30
FACU species	5	x 4 =	20
UPL species	5	x 5 =	25
Column Totals:	115 (A)		265 (B)

Prevalence Index = B/A = 2.30

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ✓ No ___

Remarks: (Include photo numbers here or on a separate sheet.)

Positive indicators of hydrophytic vegetation were observed.

SOIL

Sampling Point: S-03

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-10	10yr 6/1	90	7.5yr 5/6	10	C	M	clay	
10-16	10yr 5/2	95	10yr 4/6	5	C	M	clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ✓ **No** ___

Remarks:

Positive indicators of hydric soils were observed.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Chandler Crossing Subdivision City/County: Fayetteville/Washington Sampling Date: 1/26/2021

Applicant/Owner: Engineering Services Inc. State: AR Sampling Point: S-04

Investigator(s): Kagan Davis Section, Township, Range: S19, T17N, R29W

Landform (hillslope, terrace, etc.): swale Local relief (concave, convex, none): concave Slope (%): 1

Subregion (LRR or MLRA): LRR N Lat: 36.13057 Long: -94.11520 Datum: NAD 83

Soil Map Unit Name: Samba silt loam NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks:

All three criteria for classification as a wetland were observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ✓ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ✓ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ✓	No ____	Depth (inches): 2
Water Table Present?	Yes ✓	No ____	Depth (inches): 7
Saturation Present? (includes capillary fringe)	Yes ✓	No ____	Depth (inches): 0

Wetland Hydrology Present? Yes ✓ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Positive indicators of wetland hydrology were observed.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: S-04

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. *Diospyros virginiana*	30	yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	30 = Total Cover		

Sapling/Shrub Stratum (Plot size: 15')			
1. *Juniperus virginiana*	10	yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	10 = Total Cover		

Herb Stratum (Plot size: 5')			
1. *Dichanthelium scoparium*	40	yes	FACW
2. *Ranunculus sardous*	20	yes	FAC
3. *Carex lurida*	15	no	OBL
4. *Persicaria pensylvanica*	10	no	FACW
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	85 = Total Cover		

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 75% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species	50	x 2 =	100
FAC species	50	x 3 =	150
FACU species	10	x 4 =	40
UPL species		x 5 =	
Column Totals:	110 (A)		290 (B)

Prevalence Index = B/A = 2.64

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ✓ No ___

Remarks: (Include photo numbers here or on a separate sheet.)

Positive indicators of hydrophytic vegetation were observed.

SOIL

Sampling Point: S-04

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-16	10yr 5/1	95	10yr 5/6	5	C	M	silty clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

Positive indicators of hydric soils were observed.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Chandler Crossing Subdivision City/County: Fayetteville/Washington Sampling Date: 1/26/2021

Applicant/Owner: Engineering Services Inc. State: AR Sampling Point: S-05

Investigator(s): Kagan Davis Section, Township, Range: S19, T17N, R29W

Landform (hillslope, terrace, etc.): mound Local relief (concave, convex, none): convex Slope (%): 0

Subregion (LRR or MLRA): LRR N Lat: 36.13044 Long: -94.11495 Datum: NAD 83

Soil Map Unit Name: Samba silt loam NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks:

None of the three criteria for classification as a wetland were observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No ✓	Depth (inches): ____
Water Table Present?	Yes ____	No ✓	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No ✓	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Positive indicators of wetland hydrology were not observed.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: S-05

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		

Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		

Herb Stratum (Plot size: 5')			
1. *Schedonerous arundinaceus*	40	yes	FACU
2. *Andropogon virginicus*	30	yes	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	70 = Total Cover		

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species	70	x 4 = 280
UPL species		x 5 =
Column Totals:	70 (A)	280 (B)

Prevalence Index = B/A = 4.00

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes _____ No ✓

Remarks: (Include photo numbers here or on a separate sheet.)

Positive indicators of hydrophytic vegetation were not observed.

SOIL

Sampling Point: S-05

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-8	10yr 5/4	100					silt loam	
8-16	10yr 4/4	100					silt loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No ✓

Remarks:

Positive indicators of hydric soils were not observed.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Chandler Crossing Subdivision City/County: Fayetteville/Washington Sampling Date: 1/26/2021

Applicant/Owner: Engineering Services Inc. State: AR Sampling Point: S-06

Investigator(s): Kagan Davis Section, Township, Range: S19, T17N, R29W

Landform (hillslope, terrace, etc.): flat Local relief (concave, convex, none): none Slope (%): 0

Subregion (LRR or MLRA): LRR N Lat: 36.12910 Long: -94.11493 Datum: NAD 83

Soil Map Unit Name: Samba silt loam NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ___	**Is the Sampled Area within a Wetland?** Yes ✓ No ___
Hydric Soil Present?	Yes ✓	No ___	
Wetland Hydrology Present?	Yes ✓	No ___	

Remarks:

All three criteria for classification as a wetland were observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ✓ Oxidized Rhizospheres on Living Roots (C3)
- ✓ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ✓ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ✓	No ___	Depth (inches): 1
Water Table Present?	Yes ✓	No ___	Depth (inches): 10
Saturation Present? (includes capillary fringe)	Yes ✓	No ___	Depth (inches): 0

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Positive indicators of wetland hydrology were observed.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: S-06

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		

Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		

Herb Stratum (Plot size: 5')			
1. *Dichanthelium scoparium*	40	yes	FACW
2. *Schedonerous arundinaceus*	20	yes	FACU
3. *Ranunculus sardous*	20	yes	FAC
4. *Setaria pumila*	15	no	FAC
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	95 = Total Cover		

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66.67% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species	40	x 2 =	80
FAC species	35	x 3 =	105
FACU species	20	x 4 =	80
UPL species		x 5 =	
Column Totals:	95 (A)		265 (B)

Prevalence Index = B/A = 2.79

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ✓ No ___

Remarks: (Include photo numbers here or on a separate sheet.)

Positive indicators of hydrophytic vegetation were observed.

SOIL

Sampling Point: S-06

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-16	10yr 5/1	90	7.5yr 4/4	10	C	M	clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

Positive indicators of hydric soils were observed.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Chandler Crossing Subdivision City/County: Fayetteville/Washington Sampling Date: 1/26/2021

Applicant/Owner: Engineering Services Inc. State: AR Sampling Point: S-07

Investigator(s): Kagan Davis Section, Township, Range: S19, T17N, R29W

Landform (hillslope, terrace, etc.): mound Local relief (concave, convex, none): convex Slope (%): 1

Subregion (LRR or MLRA): LRR N Lat: 36.12929 Long: -94.11511 Datum: NAD 83

Soil Map Unit Name: Samba silt loam NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks:

None of the three criteria for classification as a wetland were observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No ✓	Depth (inches): ____
Water Table Present?	Yes ____	No ✓	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No ✓	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Positive indicators of wetland hydrology were not observed.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: S-07

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		

Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		

Herb Stratum (Plot size: 5')			
1. *Schedonerous arundinaceus*	40	yes	FACU
2. *Dichanthelium scoparium*	20	yes	FACW
3. *Juncus interior*	10	no	FACU
4. *Setaria pumila*	5	no	FAC
5. *Cynodon dactylon*	5	no	FACU
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	80 = Total Cover		

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species	20	x 2 =	40
FAC species	5	x 3 =	15
FACU species	55	x 4 =	220
UPL species		x 5 =	
Column Totals:	80 (A)		275 (B)

Prevalence Index = B/A = 3.44

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ___ No ✓

Remarks: (Include photo numbers here or on a separate sheet.)

Positive indicators of hydrophytic vegetation were not observed.

SOIL

Sampling Point: S-07

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-16	10yr 3/2	100					clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No ✓

Remarks:

Positive indicators of hydric soils were not observed.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Chandler Crossing Subdivision City/County: Fayetteville/Washington Sampling Date: 1/26/2021

Applicant/Owner: Engineering Services Inc. State: AR Sampling Point: S-08

Investigator(s): Kagan Davis Section, Township, Range: S19, T17N, R29W

Landform (hillslope, terrace, etc.): swale Local relief (concave, convex, none): concave Slope (%): 0

Subregion (LRR or MLRA): LRR N Lat: 36.13044 Long: -94.11450 Datum: NAD 83

Soil Map Unit Name: Samba silt loam NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks:

All three criteria for classification as a wetland were observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ✓ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ✓ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ✓	No ____	Depth (inches): 6
Water Table Present?	Yes ✓	No ____	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes ✓	No ____	Depth (inches): 0

Wetland Hydrology Present? Yes ✓ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Positive indicators of wetland hydrology were observed.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: S-08

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		

Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		

Herb Stratum (Plot size: 5')			
1. *Setaria pumila*	40	yes	FAC
2. *Persicaria pensylvanica*	20	yes	FACW
3. *Schedonerous arundinaceus*	20	yes	FACU
4. *Carex lurida*	5	no	FAC
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	85 = Total Cover		

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66.67% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species	20	x 2 =	40
FAC species	45	x 3 =	135
FACU species	20	x 4 =	80
UPL species		x 5 =	
Column Totals:	85 (A)		255 (B)

Prevalence Index = B/A = 3.00

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ✓ No ___

Remarks: (Include photo numbers here or on a separate sheet.)

Positive indicators of hydrophytic vegetation were observed.

SOIL

Sampling Point: S-08

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-10	10yr 5/1	90	10yr 6/8	10	C	M	silty clay loam	
10-16	10yr 5/1	70	10yr 6/8	30	C	M	silty clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

Positive indicators of hydric soils were observed.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Chandler Crossing Subdivision City/County: Fayetteville/Washington Sampling Date: 1/26/2021

Applicant/Owner: Engineering Services Inc. State: AR Sampling Point: S-09

Investigator(s): Kagan Davis Section, Township, Range: S19, T17N, R29W

Landform (hillslope, terrace, etc.): mound Local relief (concave, convex, none): convex Slope (%): 1

Subregion (LRR or MLRA): LRR N Lat: 36.13051 Long: -94.11448 Datum: NAD 83

Soil Map Unit Name: Samba silt loam NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks:

None of the three criteria for classification as a wetland were observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No ✓	Depth (inches): ____
Water Table Present?	Yes ____	No ✓	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No ✓	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Positive indicators of wetland hydrology were not observed.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: S-09

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. *Diospyros virginiana*	20	yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	20	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15')			
1. *Juniperus virginiana*	5	yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	5	= Total Cover	

Herb Stratum (Plot size: 5')			
1. *Schedonerous arundinaceus*	10	yes	FACU
2. *Dichanthelium scoparium*	10	yes	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	20	= Total Cover	

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species	10	x 2 =	20
FAC species	20	x 3 =	60
FACU species	15	x 4 =	60
UPL species		x 5 =	
Column Totals:	45 (A)		140 (B)

Prevalence Index = B/A = 3.11

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ___ No ✓

Remarks: (Include photo numbers here or on a separate sheet.)

Positive indicators of hydrophytic vegetation were not observed.

SOIL

Sampling Point: S-09

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-16	10yr 5/4	100					silt loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** ✓

Remarks:

Positive indicators of hydric soils were not observed.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Chandler Crossing Subdivision City/County: Fayetteville/Washington Sampling Date: 1/26/2021

Applicant/Owner: Engineering Services Inc. State: AR Sampling Point: S-10

Investigator(s): Kagan Davis Section, Township, Range: S19, T17N, R29W

Landform (hillslope, terrace, etc.): depression Local relief (concave, convex, none): concave Slope (%): 0

Subregion (LRR or MLRA): LRR N Lat: 36.13044 Long: -94.11369 Datum: NAD 83

Soil Map Unit Name: Samba silt loam NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks:

All three criteria for classification as a wetland were observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ✓ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ✓ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ✓ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ✓	No ____	Depth (inches): 4
Water Table Present?	Yes ✓	No ____	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes ✓	No ____	Depth (inches): 0

Wetland Hydrology Present? Yes ✓ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Positive indicators of wetland hydrology were observed.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: S-10

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		

Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		

Herb Stratum (Plot size: 5')			
1. *Kyllinga pumila*	50	yes	FACW
2. *Dichanthelium scoparium*	30	yes	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	80 = Total Cover		

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species	80	x 2 =	160
FAC species		x 3 =	
FACU species	10	x 4 =	40
UPL species		x 5 =	
Column Totals:	90 (A)		200 (B)

Prevalence Index = B/A = 2.22

Hydrophytic Vegetation Indicators:

✓ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ✓ No ___

Remarks: (Include photo numbers here or on a separate sheet.)

Positive indicators of hydrophytic vegetation were observed.

SOIL

Sampling Point: S-10

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-16	10yr 5/1	80	10yr 4/6	20	C	M	silty clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ✓ **No** ___

Remarks:

Positive indicators of hydric soils were observed.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Chandler Crossing Subdivision City/County: Fayetteville/Washington Sampling Date: 1/27/2021

Applicant/Owner: Engineering Services Inc. State: AR Sampling Point: S-11

Investigator(s): Kagan Davis Section, Township, Range: S19, T17N, R29W

Landform (hillslope, terrace, etc.): mounded hillside Local relief (concave, convex, none): convex Slope (%): 1

Subregion (LRR or MLRA): LRR N Lat: 36.12765 Long: -94.11211 Datum: NAD 83

Soil Map Unit Name: Hector-mountainburg gravelly fine sandy loam, 3 to 8 percent slopes NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks:

None of the three criteria for classification as a wetland were observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No ✓	Depth (inches): ____
Water Table Present?	Yes ____	No ✓	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No ✓	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Positive indicators of wetland hydrology were not observed.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: S-11

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. *Quercus stellata*	20	yes	UPL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	20 = Total Cover		

Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		

Herb Stratum (Plot size: 5')			
1. *Schedonerous arundinaceus*	50	yes	FACU
2. *Lolium perrene*	20	yes	FACU
3. *Ambrosia artemisiifolia*	5	no	FACU
4. *Persicaria pensylvanica*	5	no	FACW
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	80 = Total Cover		

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species	5	x 2 =	10
FAC species		x 3 =	
FACU species	75	x 4 =	300
UPL species	20	x 5 =	100
Column Totals:	100 (A)		410 (B)

Prevalence Index = B/A = 4.10

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes _____ No ✓

Remarks: (Include photo numbers here or on a separate sheet.)

Positive indicators of hydrophytic vegetation were not observed.

SOIL

Sampling Point: S-11

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-8	10yr 4/3	100					silt loam	
8-16	7.5yr 5/6	100					silt loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** ✓

Remarks:

Positive indicators of hydric soils were not observed.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Chandler Crossing Subdivision City/County: Fayetteville/Washington Sampling Date: 1/27/2021

Applicant/Owner: Engineering Services Inc. State: AR Sampling Point: S-12

Investigator(s): Kagan Davis Section, Township, Range: S19, T17N, R29W

Landform (hillslope, terrace, etc.): swale Local relief (concave, convex, none): concave Slope (%): 0

Subregion (LRR or MLRA): LRR N Lat: 36.12843 Long: -94.11275 Datum: NAD 83

Soil Map Unit Name: Samba complex, mounded NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks:

All three criteria for classification as a wetland were observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ✓ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ✓ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ✓	No ____	Depth (inches): 1
Water Table Present?	Yes ✓	No ____	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes ✓	No ____	Depth (inches): 0

Wetland Hydrology Present? Yes ✓ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Positive indicators of wetland hydrology were observed.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: S-12

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		

Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		

Herb Stratum (Plot size: 5')			
1. *Carex annectens*	60	yes	FACW
2. *Schedonerous arundinaceus*	30	yes	FACU
3. *Juncus effusus*	20	no	FACW
4. *Persicaria pensylvanica*	5	no	FACW
5. *Xanthium strumarium*	5	no	FAC
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	120 = Total Cover		

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species	85	x 2 =	170
FAC species	5	x 3 =	15
FACU species	30	x 4 =	120
UPL species		x 5 =	
Column Totals:	120 (A)		305 (B)

Prevalence Index = B/A = 2.54

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ✓ No ___

Remarks: (Include photo numbers here or on a separate sheet.)

Positive indicators of hydrophytic vegetation were observed.

SOIL

Sampling Point: S-12

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-16	10yr 5/1	80	10yr 4/4	20	C	M	clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ✓ **No** ___

Remarks:

Positive indicators of hydric soils were observed.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Chandler Crossing Subdivision City/County: Fayetteville/Washington Sampling Date: 1/27/2021

Applicant/Owner: Engineering Services Inc. State: AR Sampling Point: S-13

Investigator(s): Kagan Davis Section, Township, Range: S19, T17N, R29W

Landform (hillslope, terrace, etc.): swale Local relief (concave, convex, none): concave Slope (%): 0

Subregion (LRR or MLRA): LRR N Lat: 36.12791 Long: -94.10923 Datum: NAD 83

Soil Map Unit Name: Johnsburg complex, mounded NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks:

All three criteria for classification as a wetland were observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ✓ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ✓ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ✓ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ✓	No ____	Depth (inches): 1
Water Table Present?	Yes ✓	No ____	Depth (inches): 3
Saturation Present? (includes capillary fringe)	Yes ✓	No ____	Depth (inches): 0

Wetland Hydrology Present? Yes ✓ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Positive indicators of wetland hydrology were observed.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: S-13

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		

Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		

Herb Stratum (Plot size: 5')			
1. *Carex annectans*	80	yes	FACW
2. *Schedonerous arundinaceus*	10	no	FACU
3. *Andropogon virginicus*	5	no	FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	95 = Total Cover		

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species	80	x 2 = 160
FAC species		x 3 =
FACU species	15	x 4 = 60
UPL species		x 5 =
Column Totals:	95 (A)	220 (B)

Prevalence Index = B/A = 2.32

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ✓ No ___

Remarks: (Include photo numbers here or on a separate sheet.)

Positive indicators of hydrophytic vegetation were observed.

SOIL

Sampling Point: S-13

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-9	10yr 5/1	90	7.5yr 5/6	10	C	M	silty clay	
9-16	10yr 5/1	80	7.5yr 5/6	20	C	M	silty clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

Positive indicators of hydric soils were observed.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Chandler Crossing Subdivision City/County: Fayetteville/Washington Sampling Date: 1/27/2021

Applicant/Owner: Engineering Services Inc. State: AR Sampling Point: S-14

Investigator(s): Kagan Davis Section, Township, Range: S19, T17N, R29W

Landform (hillslope, terrace, etc.): large mound Local relief (concave, convex, none): convex Slope (%): 1

Subregion (LRR or MLRA): LRR N Lat: 36.12819 Long: -94.10901 Datum: NAD 83

Soil Map Unit Name: Johnsburg complex, mounded NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks:

None of the three criteria for classification as a wetland were observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No ✓	Depth (inches): ____
Water Table Present?	Yes ____	No ✓	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No ✓	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Positive indicators of wetland hydrology were not observed.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: S-14

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		

Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		

Herb Stratum (Plot size: 5')			
1. *Andropogon virginicus*	50	yes	FACU
2. *Schedonerous arundinaceus*	10	no	FACU
3. *Plantago lanceolata*	10	no	UPL
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	70 = Total Cover		

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species	60	x 4 =	240
UPL species	10	x 5 =	50
Column Totals:	70 (A)		290 (B)

Prevalence Index = B/A = 4.14

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes _____ No ✓

Remarks: (Include photo numbers here or on a separate sheet.)

Positive indicators of hydrophytic vegetation were not observed.

SOIL

Sampling Point: S-14

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-8	10yr 3/3	100					silty clay loam	
8-16	7.5yr 5/3	100					silty clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** ✓

Remarks:

Positive indicators of hydric soils were not observed.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Chandler Crossing Subdivision City/County: Fayetteville/Washington Sampling Date: 1/27/2021

Applicant/Owner: Engineering Services Inc. State: AR Sampling Point: S-15

Investigator(s): Kagan Davis Section, Township, Range: S19, T17N, R29W

Landform (hillslope, terrace, etc.): depression Local relief (concave, convex, none): concave Slope (%): 0

Subregion (LRR or MLRA): LRR N Lat: 36.12833 Long: -94.10942 Datum: NAD 83

Soil Map Unit Name: Johnsburg complex, mounded NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks:

All three criteria for classification as a wetland were observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ✓ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ✓ Crayfish Burrows (C8)
- ✓ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ✓ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ✓	No ____	Depth (inches): 4
Water Table Present?	Yes ✓	No ____	Depth (inches): 4
Saturation Present? (includes capillary fringe)	Yes ✓	No ____	Depth (inches): 0

Wetland Hydrology Present? Yes ✓ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Positive indicators of wetland hydrology were observed.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: S-15

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		

Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		

Herb Stratum (Plot size: 5')			
1. *Carex annectens*	40	yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	40 = Total Cover		

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species	40	x 2 = 80
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	40 (A)	80 (B)

Prevalence Index = B/A = 2.00

Hydrophytic Vegetation Indicators:

✓ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ✓ No ___

Remarks: (Include photo numbers here or on a separate sheet.)

Positive indicators of hydrophytic vegetation were observed.

SOIL

Sampling Point: S-15

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-16	10yr 5/1	70	10yr 6/8	30	C	M	clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

Positive indicators of hydric soils were observed.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Chandler Crossing Subdivision City/County: Fayetteville/Washington Sampling Date: 1/27/2021

Applicant/Owner: Engineering Services Inc. State: AR Sampling Point: S-16

Investigator(s): Kagan Davis Section, Township, Range: S19, T17N, R29W

Landform (hillslope, terrace, etc.): flat Local relief (concave, convex, none): none Slope (%): 0

Subregion (LRR or MLRA): LRR N Lat: 36.12972 Long: -94.11009 Datum: NAD 83

Soil Map Unit Name: Johnsburg complex, mounded NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks:

Only one of the three criteria for classification as a wetland was observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No ✓	Depth (inches): ____
Water Table Present?	Yes ✓	No ____	Depth (inches): 7
Saturation Present? (includes capillary fringe)	Yes ✓	No ____	Depth (inches): 5

Wetland Hydrology Present? Yes ✓ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Positive indicators of wetland hydrology were observed.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: S-16

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		

Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		

Herb Stratum (Plot size: 5')			
1. *Cynodon dactylon*	40	yes	FACU
2. *Schedonerous arundinaceus*	10	no	FACU
3. *Ranunculus sardous*	5	no	FAC
4. *Trifolium pratense*	2	no	FACU
5. *Physalis sp.*	2	no	NI
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	59 = Total Cover		

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species	5	x 3 = 15
FACU species	52	x 4 = 208
UPL species		x 5 =
Column Totals:	57 (A)	223 (B)

Prevalence Index = B/A = 3.91

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes _____ No ✓

Remarks: (Include photo numbers here or on a separate sheet.)

Positive indicators of hydrophytic vegetation were not observed.

SOIL

Sampling Point: S-16

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12	10yr 2/2	100					clay loam	
12-16	7.5yr 6/4	100					clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No ✓

Remarks:

Positive indicators of hydric soils were not observed.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Chandler Crossing Subdivision City/County: Fayetteville/Washington Sampling Date: 1/27/2021

Applicant/Owner: Engineering Services Inc. State: AR Sampling Point: S-17

Investigator(s): Kagan Davis Section, Township, Range: S19, T17N, R29W

Landform (hillslope, terrace, etc.): flat Local relief (concave, convex, none): none Slope (%): 0

Subregion (LRR or MLRA): LRR N Lat: 36.13102 Long: -94.11024 Datum: NAD 83

Soil Map Unit Name: Johnsburg silt loam NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks:

None of the three criteria for classification as a wetland were observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No ✓	Depth (inches): ____
Water Table Present?	Yes ____	No ✓	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No ✓	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Positive indicators of wetland hydrology were not observed.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: S-17

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		

Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		

Herb Stratum (Plot size: 5')			
1. *Cynodon dactylon*	40	yes	FACU
2. *Schedonerous arundinaceus*	15	yes	FACU
3. *Trifolium pratense*	2	no	FACU
4. *Physalis sp.*	2	no	NI
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	59 = Total Cover		

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species	57	x 4 = 228
UPL species		x 5 =
Column Totals:	57 (A)	228 (B)

Prevalence Index = B/A = 4.00

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes _____ No ✓

Remarks: (Include photo numbers here or on a separate sheet.)

Positive indicators of hydrophytic vegetation were not observed.

SOIL

Sampling Point: S-17

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12	10yr 3/2	100					clay loam	
12-16	7.5yr 4/4	100					clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No ✓

Remarks:

Positive indicators of hydric soils were not observed.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Chandler Crossing Subdivision City/County: Fayetteville/Washington Sampling Date: 1/27/2021

Applicant/Owner: Engineering Services Inc. State: AR Sampling Point: S-18

Investigator(s): Kagan Davis Section, Township, Range: S19, T17N, R29W

Landform (hillslope, terrace, etc.): flat Local relief (concave, convex, none): none Slope (%): 0

Subregion (LRR or MLRA): LRR N Lat: 36.13191 Long: -94.10995 Datum: NAD 83

Soil Map Unit Name: Johnsburg silt loam NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks:

None of the three criteria for classification as a wetland were observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No ✓	Depth (inches): ____
Water Table Present?	Yes ____	No ✓	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No ✓	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Positive indicators of wetland hydrology were not observed.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: S-18

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		

Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		

Herb Stratum (Plot size: 5')			
1. *Cynodon dactylon*	30	yes	FACU
2. *Schedonerous arundinaceus*	20	yes	FACU
3. *Trifolium pratense*	5	no	FACU
4. *Physalis sp.*	2	no	NI
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	57 = Total Cover		

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species	55	x 4 = 220
UPL species		x 5 =
Column Totals:	55 (A)	220 (B)

Prevalence Index = B/A = 4.00

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes _____ No ✓

Remarks: (Include photo numbers here or on a separate sheet.)

Positive indicators of hydrophytic vegetation were not observed.

SOIL

Sampling Point: S-18

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-10	10yr 2/2	100					clay loam	
10-16	7.5yr 5/4	100					clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** ✓

Remarks:

Positive indicators of hydric soils were not observed.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Chandler Crossing Subdivision City/County: Fayetteville/Washington Sampling Date: 1/27/2021

Applicant/Owner: Engineering Services Inc. State: AR Sampling Point: S-19

Investigator(s): Kagan Davis Section, Township, Range: S19, T17N, R29W

Landform (hillslope, terrace, etc.): mound Local relief (concave, convex, none): convex Slope (%): 1

Subregion (LRR or MLRA): LRR N Lat: 36.12836 Long: -94.11148 Datum: NAD 83

Soil Map Unit Name: Samba complex, mounded NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓	
Wetland Hydrology Present?	Yes ____	No ✓	

Remarks:

None of the three criteria for classification as a wetland were observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No ✓	Depth (inches): ____
Water Table Present?	Yes ____	No ✓	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No ✓	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Positive indicators of wetland hydrology were not observed.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: S-19

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		

Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		

Herb Stratum (Plot size: 5')			
1. *Schedonerous arundinaceus*	30	yes	FACU
2. *Cynodon dactylon*	20	yes	FACU
3. *Persicaria pensylvanica*	2	no	FACW
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	52 = Total Cover		

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species	2	x 2 = 4
FAC species		x 3 =
FACU species	50	x 4 = 200
UPL species		x 5 =
Column Totals:	52 (A)	204 (B)

Prevalence Index = B/A = 3.92

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes _____ No ✓

Remarks: (Include photo numbers here or on a separate sheet.)

Positive indicators of hydrophytic vegetation were not observed.

SOIL

Sampling Point: S-19

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-16	10yr 4/2	100					clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** ✓

Remarks:

Positive indicators of hydric soils were not observed.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Chandler Crossing Subdivision City/County: Fayetteville/Washington Sampling Date: 1/27/2021

Applicant/Owner: Engineering Services Inc. State: AR Sampling Point: S-20

Investigator(s): Kagan Davis Section, Township, Range: S19, T17N, R29W

Landform (hillslope, terrace, etc.): swale Local relief (concave, convex, none): concave Slope (%): 0

Subregion (LRR or MLRA): LRR N Lat: 36.12843 Long: -94.11117 Datum: NAD 83

Soil Map Unit Name: Taloka complex, mounded NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks:

All three criteria for classification as a wetland were observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ✓ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ✓ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ✓ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ✓	No ____	Depth (inches): 2
Water Table Present?	Yes ✓	No ____	Depth (inches): 2
Saturation Present? (includes capillary fringe)	Yes ✓	No ____	Depth (inches): 0

Wetland Hydrology Present? Yes ✓ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Positive indicators of wetland hydrology were observed.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: S-20

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		

Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		

Herb Stratum (Plot size: 5')			
1. *Carex annectens*	40	yes	FACW
2. *Schedonerous arundinaceus*	20	yes	FACU
3. *Juncus effusus*	20	yes	FACW
4. *Persicaria pensylvanica*	5	no	FACW
5. *Xanthium strumarium*	5	no	FAC
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	90 = Total Cover		

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66.67% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:
OBL species		x 1 =	
FACW species	65	x 2 =	130
FAC species	5	x 3 =	15
FACU species	20	x 4 =	80
UPL species		x 5 =	
Column Totals:	90 (A)		225 (B)

Prevalence Index = B/A = 2.50

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ✓ No ___

Remarks: (Include photo numbers here or on a separate sheet.)

Positive indicators of hydrophytic vegetation were observed.

SOIL

Sampling Point: S-20

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-16	10yr 5/1	80	10yr 4/4	20	C	M	clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ✓ **No** ___

Remarks:

Positive indicators of hydric soils were observed.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Chandler Crossing Subdivision City/County: Fayetteville/Washington Sampling Date: 1/27/2021

Applicant/Owner: Engineering Services Inc. State: AR Sampling Point: S-21

Investigator(s): Kagan Davis Section, Township, Range: S19, T17N, R29W

Landform (hillslope, terrace, etc.): depression Local relief (concave, convex, none): concave Slope (%): 0

Subregion (LRR or MLRA): LRR N Lat: 36.13017 Long: -94.11165 Datum: NAD 83

Soil Map Unit Name: Samba complex, mounded NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____	**Is the Sampled Area within a Wetland?** Yes ✓ No ____
Hydric Soil Present?	Yes ✓	No ____	
Wetland Hydrology Present?	Yes ✓	No ____	

Remarks:

All three criteria for classification as a wetland were observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ✓ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ✓ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ✓ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ✓	No ____	Depth (inches): 5
Water Table Present?	Yes ✓	No ____	Depth (inches): 3
Saturation Present? (includes capillary fringe)	Yes ✓	No ____	Depth (inches): 0

Wetland Hydrology Present? Yes ✓ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Positive indicators of wetland hydrology were observed.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: S-21

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		

Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		

Herb Stratum (Plot size: 5')			
1. *Persicaria pensylvanica*	30	yes	FACW
2. *Carex annectens*	20	yes	FACW
3. *Dichanthelium scoparium*	20	yes	FACW
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	70 = Total Cover		

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: _____ (A)

Total Number of Dominant Species Across All Strata: _____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

✓ 1 - Rapid Test for Hydrophytic Vegetation

__ 2 - Dominance Test is >50%

__ 3 - Prevalence Index is ≤3.0[1]

__ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ✓ No _____

Remarks: (Include photo numbers here or on a separate sheet.)

Positive indicators of hydrophytic vegetation were observed.

SOIL

Sampling Point: S-21

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-16	10yr 5/2	70	7.5yr 4/6	30	C	M	clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ✓ **No** ___

Remarks:

Positive indicators of hydric soils were observed.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Chandler Crossing Subdivision City/County: Fayetteville/Washington Sampling Date: 1/27/2021

Applicant/Owner: Engineering Services Inc. State: AR Sampling Point: S-22

Investigator(s): Kagan Davis Section, Township, Range: S19, T17N, R29W

Landform (hillslope, terrace, etc.): mound Local relief (concave, convex, none): convex Slope (%): 1

Subregion (LRR or MLRA): LRR N Lat: 36.13031 Long: -94.11196 Datum: NAD 83

Soil Map Unit Name: Samba complex, mounded NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No ✓	**Is the Sampled Area within a Wetland?** Yes _____ No ✓
Hydric Soil Present?	Yes _____	No ✓	
Wetland Hydrology Present?	Yes _____	No ✓	

Remarks:

None of the three criteria for classification as a wetland were observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No ✓	Depth (inches): _____
Water Table Present?	Yes _____	No ✓	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No ✓	Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Positive indicators of wetland hydrology were not observed.

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: S-22

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		

Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		

Herb Stratum (Plot size: 5')			
1. *Schedonerous arundinaceus*	30	yes	FACU
2. *Cynodon dactylon*	20	yes	FACU
3. *Andropogon virginicus*	10	no	FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	60 = Total Cover		

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species	60	x 4 = 240
UPL species		x 5 =
Column Totals:	60 (A)	240 (B)

Prevalence Index = B/A = 4.00

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes _____ No ✓

Remarks: (Include photo numbers here or on a separate sheet.)

Positive indicators of hydrophytic vegetation were not observed.

SOIL

Sampling Point: S-22

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-16	10yr 4/4	100					clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No ✓

Remarks:

Positive indicators of hydric soils were not observed.

ATTACHMENT 2

Representative Photos

Photo 1. View of WET-A (looking westward).

Photo 2. View of WET-B (looking westward).

Photo 3. View of WET-C (looking northward).

Photo 4. View of WET-F (looking southward).

Photo 5. Partial view of WET-G abutting INT-01.

Photo 6. View of WET-H (looking northward).

Photo 7. View of WET-I (looking southeastward).

Photo 8. PER-01 (looking westward).

Photo 9. EPH-01 (looking southward).

Photo 10. View of EPH-02 (looking eastward).

Photo 11. View of Ditch-01 (looking northward).

Photo 12. View of Ditch-02 (looking southward).

Photo 13. View of Ditch-03 (looking northward).

Photo 14. View of Upland Swale-03 (looking southwestward)

Photo 15. View of Upland Swale-04 (looking eastward).

Photo 16. View of OW-1 (looking southward).

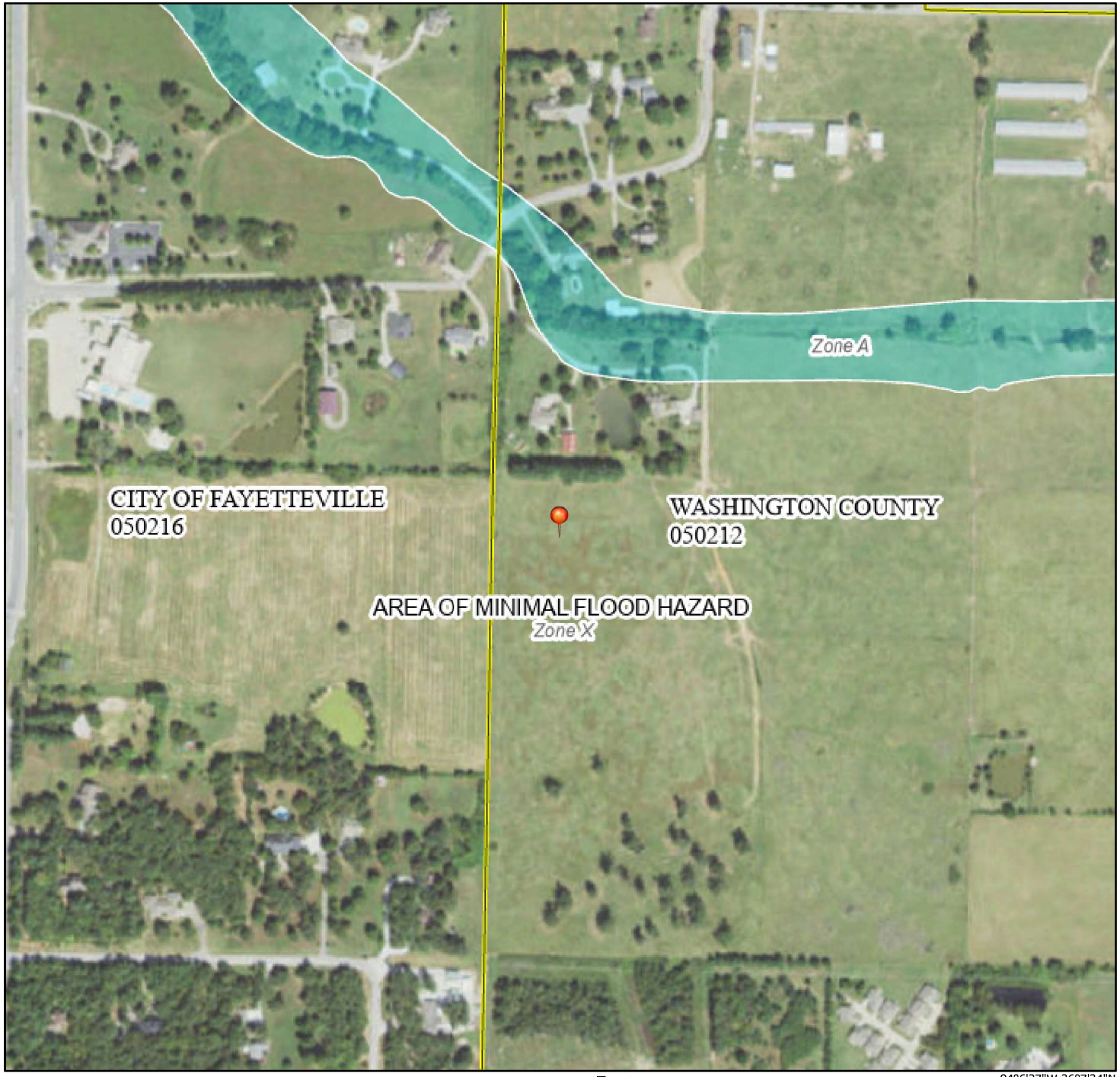
ATTACHMENT 3

FEMA FIRMettes

National Flood Hazard Layer FIRMette

FEMA

94°7'4"W 36°8'3"N



94°6'27"W 36°7'34"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS

- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD

- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS

- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES

- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES

- B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS

- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

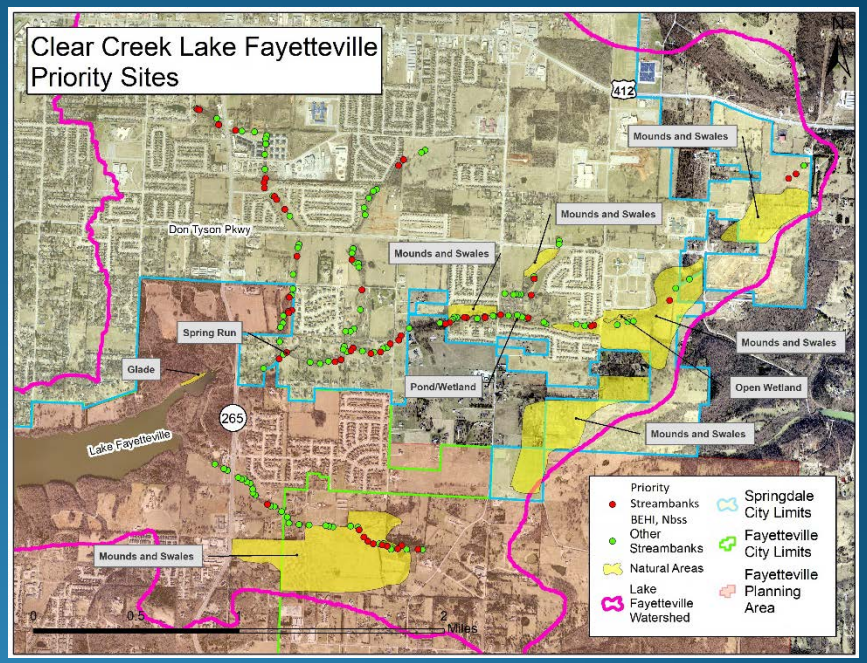
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 2/1/2021 at 11:09 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

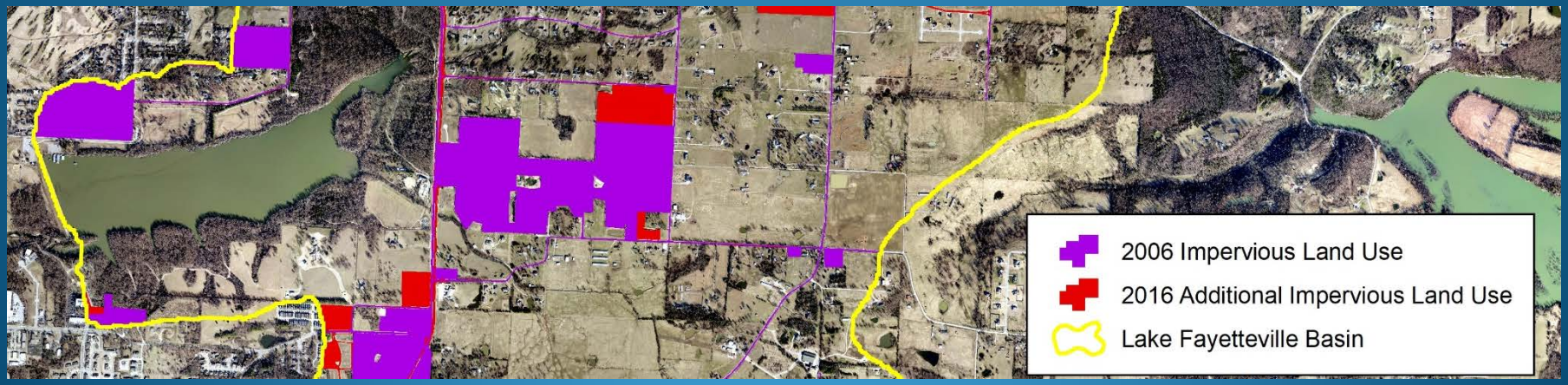
This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Received from Jonathan 02/10/21

Riparian and Streambank Erosion Assessment of Clear Creek

Lake Fayetteville Watershed





Watershed Conservation Resource Center

Riparian and Streambank Erosion Assessment of Clear Creek

(Study was completed in 2020)

Partners

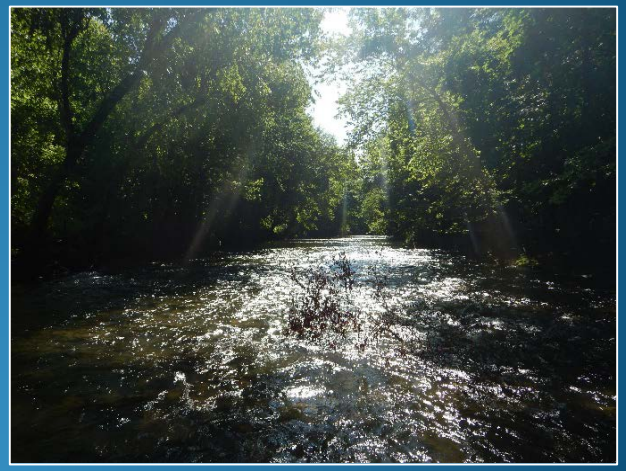
- Provided Funding
  - USDA Natural Resource Conservation Service
  - Watershed Conservation Resource Center (Lead)
  - City of Fayetteville
  - City of Springdale
- Provided In-kind Match, Assistance, or Participation
  - Washington County Cooperative Extension Service
  - Lake Fayetteville Watershed Partnership
  - Illinois River Watershed Partnership
  - Cities of Tontitown & Johnson

Riparian and Streambank Erosion Assessment of Clear Creek

Assessment Results

- Results of Assessment Work
  - Streambank Erosion
  - Natural Areas
  - Riparian

- Data and Information Useful for Local Planning
  - Help to select future project sites
    - To reduce Sediment, Phosphorus, and Nitrogen within the Illinois River Watershed
  - Help Fayetteville, Springdale, Tontitown, & Johnson to
    - Evaluate proposed development that could potentially impact streams, wetlands, and springs
    - Select stream restoration sites where infrastructure is threatened
  - Provide information on unique areas that could potentially be protected, such as, wet prairies, wetlands, rare plant habitat, rare aquatic species habitat, and stable sections of stream.

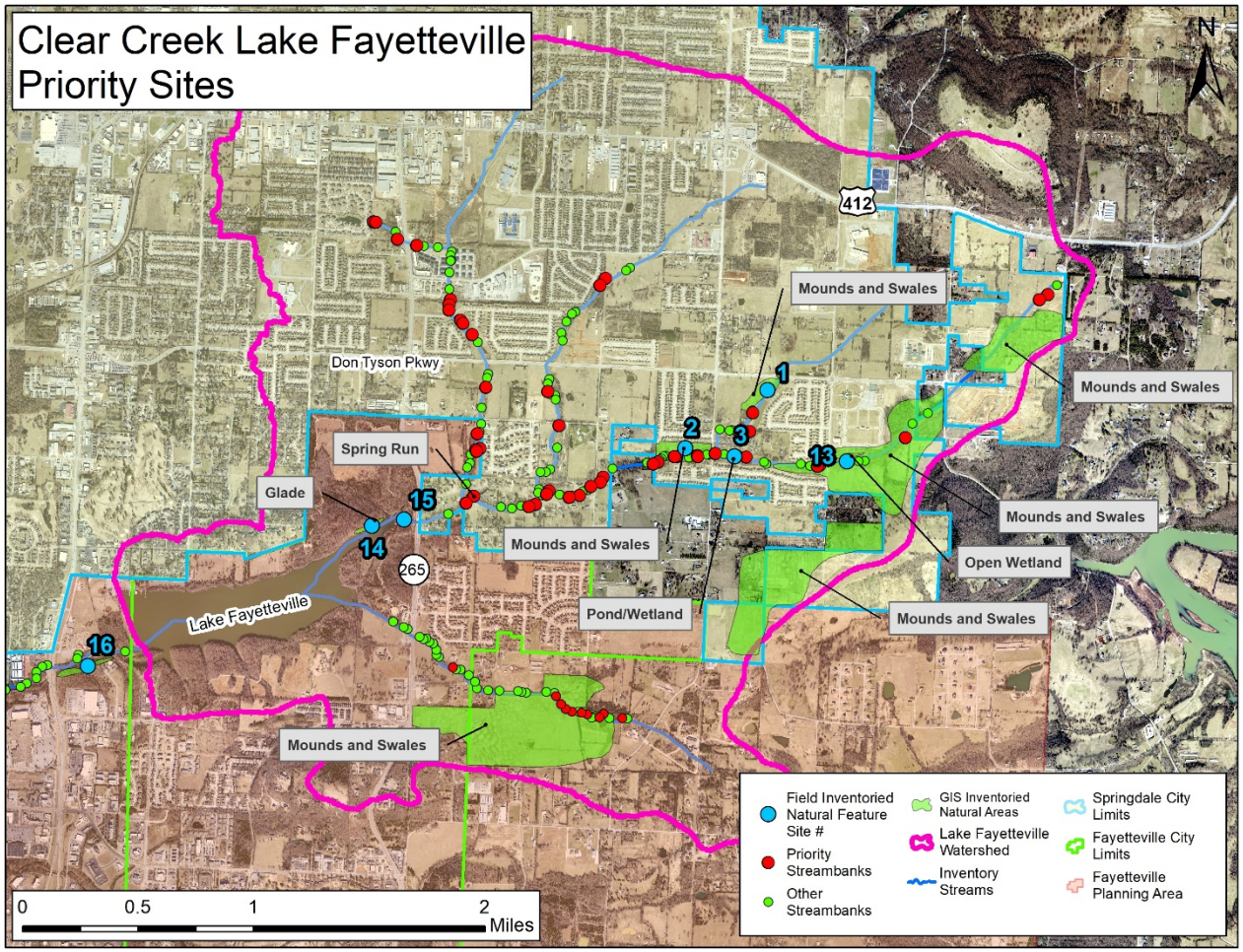


Riparian and Streambank Erosion Assessment of Clear Creek

Lake Fayetteville Watershed

Priority Sites for Restoration and/or Conservation

Priority Streambank– Both BEHI and NBSS are defined as High, Very High or Extreme, and if NBSS is Very High or Extreme



Riparian and Streambank Erosion Assessment of Clear Creek

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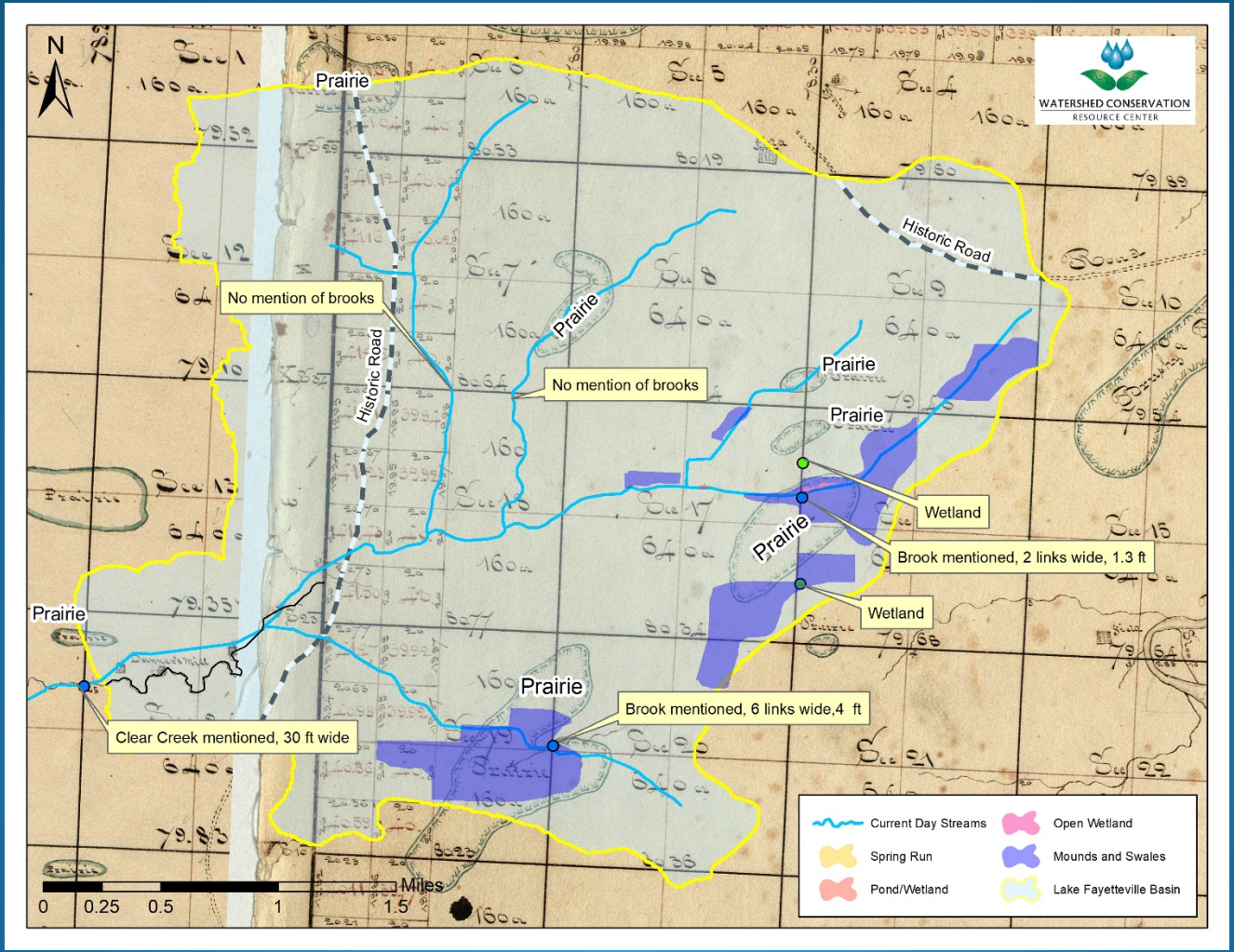
1834 Survey Map Overlaid with Features from the Natural Areas Inventory



Riparian and Streambank Erosion Assessment of Clear Creek

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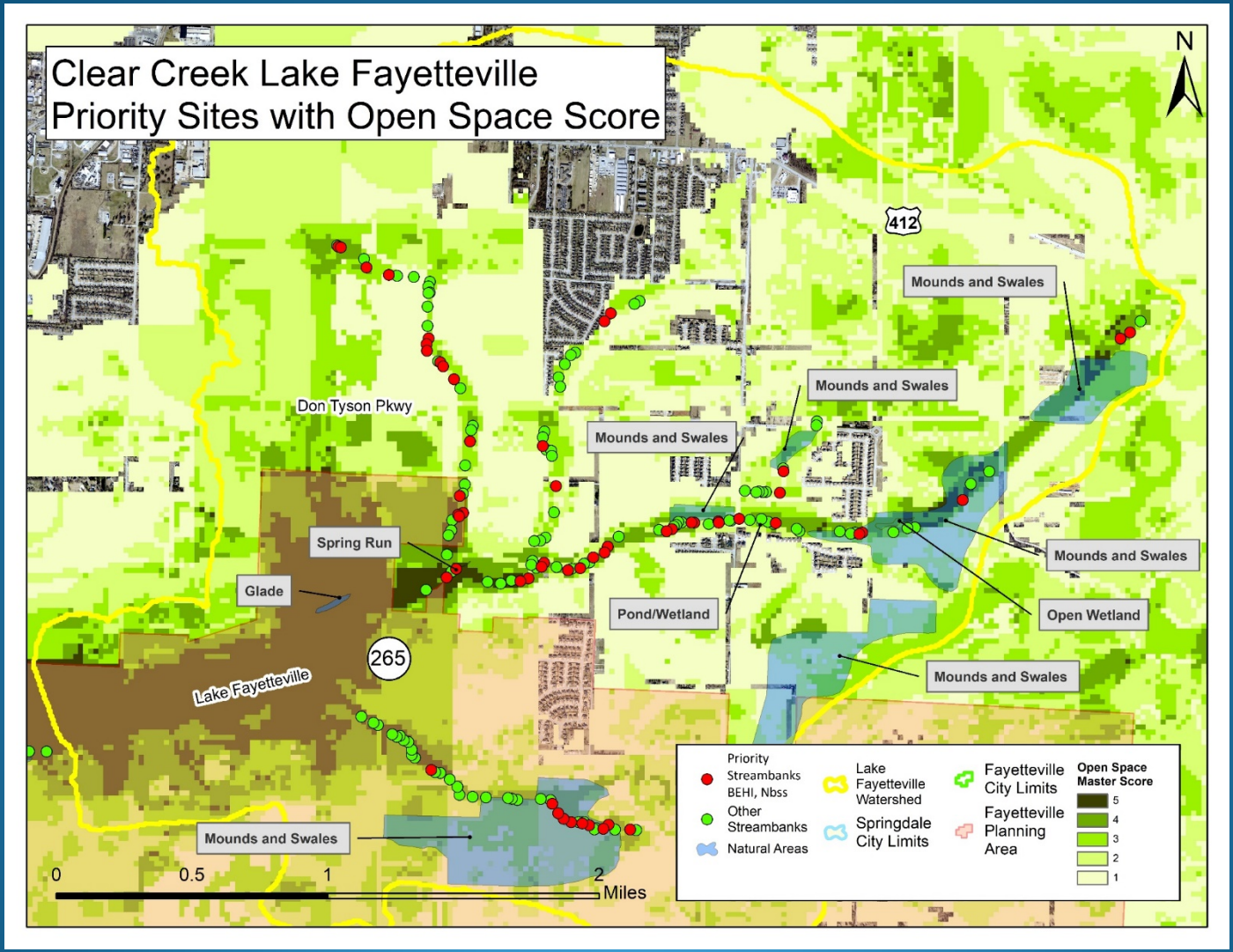
Priority Sites with NWA Open Space Plan Areas: Site has Priority Areas



Riparian and Streambank Erosion Assessment of Clear Creek

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Recommendations

- Address Sediment and Phosphorus
  - Conserve and/or restore with native vegetation 50 feet of riparian along both sides of the stream channels
  - Restore priority streambanks or reaches of stream
    - Include 50 ft riparian buffer
  - Conduct residential and commercial outreach on fertilizer usage.
  - Agriculture producers participate in EQIP
  - Cities should consider putting the streambank erosion data and information from this study into a GIS based program that can be accessed by staff when evaluating new development, watershed planning, and infrastructure projects
  - Six natural feature sites were located in the Lake Fayetteville watershed should be considered a priority for conservation or at a minimum be protected as much as possible if development were to occur
    - GIS assessed features should be further evaluated on the ground
- Address Impervious Surface
  - Incorporate low impact development or LID techniques into future development
  - Retrofit to LID existing impervious sites
  - Conserve family farms as working farms where there is interest
  - Restore natural areas to appropriate historic habitat
- Using this assessment and stakeholder participation, develop a watershed restoration plan to address concerns and protect water and natural resources
  - Seek funding to implement the plan

Riparian and Streambank Erosion Assessment of Clear Creek

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Natural Feature to be Considered for Conservation

Why is this site important?

- This is historic prairie that was mapped in 1834.
- Infra-red shows distinct mounds, swales between the mounds, and water pathways or small connected drainages.
- These mounds (nebkhas or prairie pimples) are ancient wind-blown dunes that date from drier, hotter climatic periods in the past.*
- Though disturbed from grazing, this site may have retained some native prairie species, especially in the lower, wetter, swales between the mounds.*
    - These native species of plants and animal have declined and have become rare.*

*WCRC summarized communication with ANHC, February 4, 2021; Information is from 'Relict nebkhas (pimple mounds) record prolonged late Holocene drought in the forested region of south-central United States,' C.L. Seifert, R.T. Cox, S.L. Forman, T.L. Foti, T.A. Wasklewicz, A.T. McColgan, Quaternary Research, 2008.

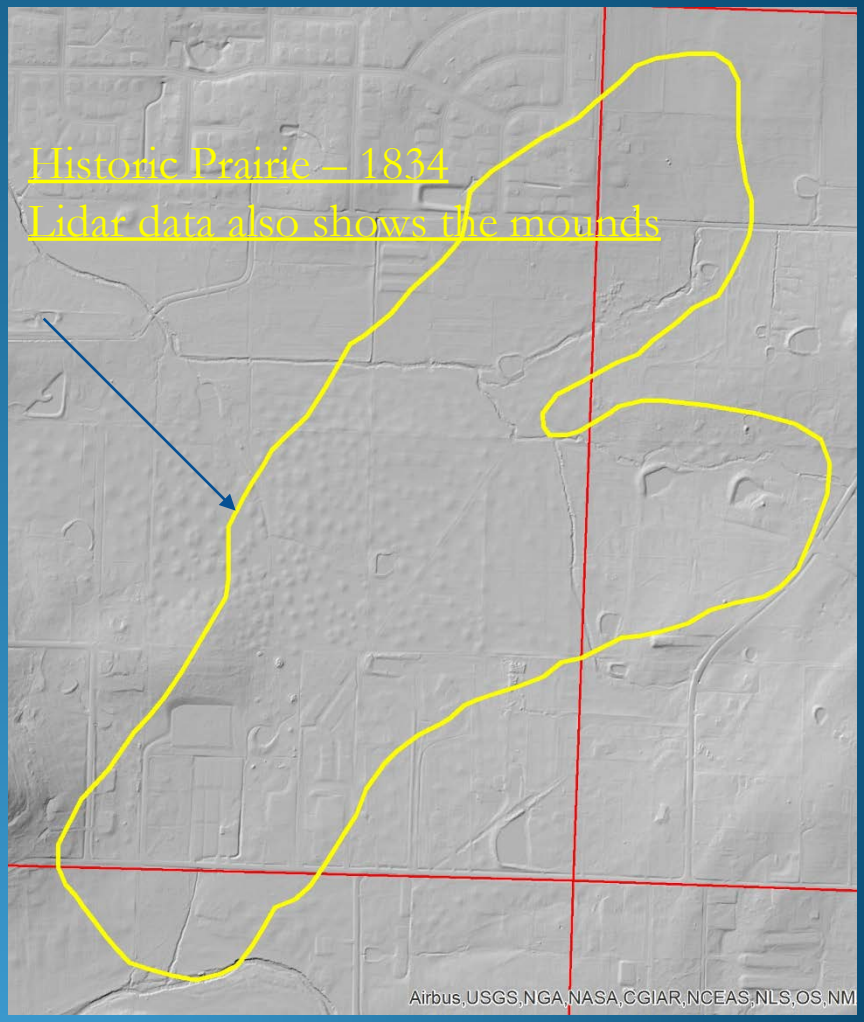
Riparian and Streambank Erosion Assessment of Clear Creek

Lake Fayetteville Watershed

Natural Feature to be Considered for Conservation

Why is this site important?

- These intact mounds indicate the site was never ploughed; therefore may retain original species of plants.
- The area between the mounds are hydric soils and often support wetland vegetation.
  - Native grasslands that have mounds are especially diverse because they have drier upland habitat (the mounds) interspersed in seasonally wet flats and these are mixed and in close proximity.*
- They are also strongly correlated to the presence of burrowing crayfish, which are very often present, and identifiable by the mud chimneys they make.*
- These sites can be successfully restored to prairie and support rare wet prairie species as has been shown at award winning Woolsey Wet Prairie.



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Natural Feature to be Considered for Conservation

Consider next step recommended in the study conducted by WCRC

- ***Study Recommended that Identified Natural Features through GIS be Further Evaluated***
  - ***Conduct botanical and other surveys, to understand the ecological significance of the site:***
    - Identify plants (summer) and animals to determine if there are rare species at the site.
    - Determine if there are other important natural features
- ***A summary of the site's benefits to the Lake Fayetteville watershed should be prepared based on survey results and the natural features at the site***
  - Recommendations for protecting wetlands, mounds, rare species, and other findings could be made

Left – Crawfish Frog and Bottom – Graham's Crayfish Snake - Both species are considered rare species by ANHC (photos from AR Herp Atlas)

Right - Swamp Milkweed - Important to sustaining the Monarch Butterfly (photo by WCRC)