US Army Corps
of Engineers ®

Little Rock District
Southwestern Division

David D. Terry Lock & Dam No. 6 Major Rehabilitation Evaluation Report

May 2023

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Executive Summary

David D. Terry Lock & Dam No. 6 Major Rehabilitation Evaluation Report

Study Purpose and Scope

David D. Terry Lock and Dam (L&D) is one of 16 locks and dams on the McClellan-Kerr Arkansas River Navigation System (MKARNS) in Oklahoma and Arkansas designed, constructed, and operated by the U.S Army Corps of Engineers (USACE). USACE Tulsa District (SWT) operates MKARNS locks and dams in Oklahoma, and the Little Rock District (SWL) operates facilities in Arkansas including Terry L&D. Terry L&D has substantial problems with aging structural and mechanical components that could fail and halt navigation. As a result, SWL leadership initiated a Major Rehabilitation Evaluation Report (MRER) to assess potential solutions.

A MRER identifies the most economical strategy to address deficiencies and improve L&D reliability. Methods applied are consistent with Engineering Regulation (ER) 1130-2-500, supplemented by Engineering Pamphlet (EP) 1130-2-500 (December 1996), and include incorporating risk and uncertainty and probabilistic reliability analyses of project components. Engineering reliability and risk follow guidelines in Engineering Circular (EC) 1110-2-6062 (February 2011).

The Terry L&D MRER project delivery team (PDT) includes USACE engineers, economists, planners, and operations staff from the Little Rock District (CESWL), the Planning Center of Expertise for Inland Navigation and Risk-Informed Economics Division (PCXIN-RED), the Regional Planning and Environmental Center (SWD-RPEC) Southwestern Division, the Risk Management Center (RMC), and Inland Navigation Design Center (INDC).

Study Authority

WRDA 1992 (P.L. 102-580) SEC. 205, dated Oct. 31, 1992, amended by WRRDA 2014 (P.L. 113-121) SEC. 2006, dated June 10, 2014 and through P.L. 117-286, Enacted December 27, 2022.

33 U.S. Code § 2327 - Definition of rehabilitation for inland waterway projects
For purposes of laws relating to navigation on inland and intracoastal waterways of the United States, the term "rehabilitation" means—

(1) major project feature restoration—

(A) which consists of structural work on an inland navigation facility operated and maintained by the Corps of Engineers;

(B) which will significantly extend the physical life of the feature;

(C) which is economically justified by a benefit-cost analysis;

(D) which will take at least 2 years to complete; and

(E)

(i) which is initially funded before October 1, 1994, and will require at least $5,000,000 in capital outlays; or

(ii) which is initially funded on or after such date and will require at least $20,000,000 in capital outlays; and

(2) structural modification of a major project component (not exhibiting reliability problems)—
(A) which will enhance the operational efficiency of such component or any other major component of the project by increasing benefits beyond the original project design; and
(B) which will require at least $1,000,000 in capital outlays.

Such term does not include routine or deferred maintenance. The dollar amounts referred to in paragraphs (1) and (2) shall be adjusted annually according to the economic assumption published each year as guidance in the Annual Program and Budget Request for Civil Works Activities of the Corps of Engineers.

(Pub. L. 102–580, title II, § 205, Oct. 31, 1992, 106 Stat. 4827; Pub. L. 113–121, title II, § 2006(a)(4), June 10, 2014, 128 Stat. 1268.)

Federal Interest

Terry L&D is an integral part of the MKARNS that ensures efficient inland navigation. On average, the MKARNS moves about 12 million tons of cargo per year. An extended outage at Terry L&D would be significant given that about 85 percent of traffic on the MKARNS is throughput, which means the traffic enters or exits the system from the Mississippi River. USACE maintains a nine-foot depth in the navigation channel at Terry L&D. Other beneficial uses include recreational boating, fishing access, and shoreline recreation.

Non-Federal Partner

MKARNS is an Inland Waterway System subject to tax on fuel used in commercial transportation from the junction with the Mississippi River at RM 0 to port of Catoosa, Oklahoma, at RM 448.2 paid into the Inland Waterways Trust Fund (IWTF). Construction and OMRR&R are Federal costs, which includes the preparation of this Major Rehabilitation Report funded under Operation and Maintenance, General, appropriation.

Study Area and Project Area

Inaugurated in 1971, the MKARNS has evolved into one of the nation's major inland waterways. In May of 2015, the U.S. Department of Transportation upgraded the MKARNS from a "connector" system to "corridor" system as part of the Maritime Administration America's Marine Highway Program. The upgrade in status brings the MKARNS into the same category as other major inland waterways such as the Mississippi and Ohio rivers. The MKARNS is a major conduit for U.S. agricultural exports, and transports various inbound cargoes such as fertilizers, fuels, chemicals and iron and steel. Today, the MKARNS ships about $3.6 billion (about 12 million tons) worth of commodities to and from Arkansas and Oklahoma each year. The system is 445-miles long and includes the Verdigris, Arkansas and White rivers. With 19 locks, it has an elevation differential of 420 feet from its beginning at mile 600 on the Mississippi River to the head of navigation near Tulsa, Oklahoma and the Port of Catoosa.

Located at navigation mile 108.1 on the Arkansas River about 11 miles southeast of Little Rock, Arkansas, Terry L&D was authorized and built for navigation and recreation. The project's main components consist of a navigation lock, gated spillway and right and left overflow embankments. The lock has a 110-foot by 600-foot chamber with a maximum lift of 18 feet with two miter gates (upstream and downstream). The gated spillway is 1,190 feet long with seventeen 60-foot wide by 27-foot high tainter gates.

The project does not have hydropower, and the pool above the dam does not support municipal or industrial water intakes. Over about the past 20 years, tonnage passing through the project has averaged about 8.1 million tons with inbound chemicals (mostly fertilizers) accounting for 25 percent of cargo, and down bound agricultural commodities such as wheat and soybean making up roughly 25 percent. Aggregate (sand and gravel), chemicals, petroleum products, iron and steel, and manufactured goods comprise most the remaining traffic. With the exception of the Port of Pine Bluff, Arkansas, most terminals and ports are above Terry L&D including facilities in Little Rock, Van Buren, Ft. Smith, Catoosa and Tulsa. In addition, about 85 percent of traffic on the MKARNS is throughput meaning it enters and exits the system via the Lower Mississippi and at least 50 percent of throughput traffic traverses the entire system to and from the Port of Catoosa near the northern terminus of the MKARNS. Thus, an outage at Terry L&D would have significant economic consequences.

Problems and Opportunities

Problems:

1) Multiple lock and dam components are exhibiting increased risk of failure, which may result in unanticipated lock closures, repair costs, vessel delays, and congestion on the McClellan–Kerr Arkansas River Navigation System (MKARNS).
2) The project's current emergency dewatering method, utilizing 55-foot stop logs joined with a center post is considered structurally deficient due to the center post anchorage which results in potentially increased life safety risk to workers during inspections and repairs.

Opportunities:

1) Incorporate procedures or low-cost features which might increase lockage throughput efficiencies and reduce navigation costs.
2) Identify the optimal timing for implementing each major rehabilitation strategy.

Planning objectives:

1) Avoid unanticipated lock closures, vessel delays, and congestion by reducing lock and dam component failure risk.
2) Decrease life safety risk during lock dewatering.
3) Identify measures, consistent with the scope of the major rehabilitation program, that would increase lockage throughput efficiencies and reduce navigation costs.

Planning constraints:

1) Minimize any significant impacts to waterway users during implementation of a major rehabilitation strategy.

2) The risk assessment will assume there will be no change to the authorized 12-foot depth of the Arkansas River channel.

Existing Navigation

At river mile 108.1, Terry L&D is downstream of the systems major ports such as the Port of Little Rock in Arkansas and the Port of Catoosa near Tulsa, Oklahoma. As is the case with all MKARNS lock and dams, Terry L&D has one 600-foot long and 110-foot chamber. From 2010 through 2018, tonnage moving through the project has averaged about 8.3 million tons per year with a high of 9.1 million in 2013 to a low of 7.3 million in 2015, although in 2015 the low value was partially due to major flooding in the peak season for upbound fertilizer shipments (winter). Similarly, in 2019, traffic declined substantially to 5.4 million tons due to historic flooding on the MKARNS, which closed most Corps projects for at least 2 months and some nearly 4 months. Commodities including grains (outbound for global export and inbound for animal feed), chemicals (mostly inbound fertilizers) and iron and steel make up nearly 80 percent of tonnage.

Existing Structural Conditions

In 2016, SWL dewatered the lock for inspection. The lower miter gates had several fatigue/torsional stress cracks in the steel girder flanges around the pintle ball. Some of the stress cracks were considered severe and propagated into the pintle cap casting. All of the cracks in the lower miter gates were repaired during this dewatering. Similar cracks were repaired in August 2000, during the last dewatering although the 2016 cracks were considered worse than the cracks noted and repaired in 2000. Similar cracks were also repaired during the 2021 dewatering with an experimental fiber-reinforced plastic (FRP) wrap. During this dewater, the grease line to the upstream land wall pintle was observed to be broken and replaced. It was noted in the 2021 Hydraulic Steel Structure (HSS) inspection report that the absence of grease to the land wall pintle has potentially decreased the life span of the pintle bushing. The upper river wall miter gate was inspected in July 2018 above water and in August 2018 below water with the USACE dive team. The reason for this inspection was due to a noise that was occurring during operation that indicated there was an issue with the sector gear bearing. There were several issues that were noted during this inspection including a recommendation to replace the strut pin bushings and sector gear bearings. Several bent flanges and diagonals were noted on the miter gates. In general, lock components are approaching the end of their design life.

Component Screening

Screening is an important part of the MRER process and is a district level analysis aimed at identifying components at Terry L&D with significant problems that U.S. Army Corps of Engineers (USACE), Southwestern Division (SWD), Little Rock District (SWL) may address in an MRER. Component screening is the first step in identifying candidate components for the main major rehabilitation study.

Screening analysis is based on Operational Conditional Assessments (OCA) and qualitative consequences of component failure and also incorporates order of magnitude risks and consequences along with benefit to cost ratios based upon professional judgment and elicitation of the PDT. Engineering consequences capture the effects of lock closures in terms of closure durations and repair costs in the event of component failures, and economic analyses measure the economic costs. Since consequences are elicited values, they included ranges of outcomes that acknowledge uncertainty.

Listed below are the Terry L&D components identified for MRER screening report. These include:

- River side lock and guide walls
- Upstream and downstream miter gates
- Tainter gate anchorages
- Upstream and downstream miter gate anchorages
- Upstream and downstream pintles
- Upstream and downstream quoins.

Components recommended for the MRER after screening consisted of:

1) upstream and downstream pintles,
2) upstream and downstream quoins,
3) upstream and downstream miter gates; and,
4) upstream and downstream miter gate anchorages.

Guide walls and the riverside lock wall as well as tainter gate anchorages and piers were not recommended for the MRER analysis given high remediation costs and low probability of failure. Unfortunately, there is no permanent solution to fully address the ASR deterioration for dam components other than to build a new dam, and making repairs to each of the 17 sets of tainter gate anchorages/piers would be cost-prohibitive.

Formulated Alternative Plans

Engineering Pamphlet (EP) 1130-2-500, Appendix B, page B-6, specifies four strategies for investment that the USACE should use evaluating MRER alternatives:

- **Immediate Rehabilitation** involves replacing economically justified components as soon as possible with due consideration of project operations and general priorities of the district.
- **Scheduled Rehabilitation** involves replacing economically justified components at the "optimum" times (2 closures) which will be based on outputs from the economic modeling.
- **Advance Maintenance** involves repairing components for which expenditures are in excess of routine O&M. Repairs focus on reducing the likelihood of some emergency repairs, temporary service losses, and/or the rate of service degradation.
- **Scheduled Repair** involves repairing components in terms of service disruption probabilities and reliability of the structure. Repairs focus on reducing the consequences of failures and may include stockpiling replacement parts to reduce the time of expected service disruption.

Final Array of Alternatives

No-action Alternative (WOPC)

As part of this MRER study, the PDT analyzed the potential FWOP scenarios and based on the results, FWOP 2 (coffer cells followed by planned 110-foot stoplog conversion) showed to be the optimized condition. NIM results showed that the annualized costs to both the navigation industry and the USACE was $381 million for FWOP 1, $273 million for FWOP 3, versus about $250 million for FWOP 2. As a result, the No-action alternative (coffer cells followed by planned 110-foot stoplog conversion) is the baseline to which all other alternatives are compared.

Final Array of Action Alternatives (WPC)

For action alternatives, plans vary based on dewatering approach and timing. Every alternative will impact the condition of components. In the case of a full rehabilitation, component conditions will restore to their original or new state meaning that the probability of failure resets to year zero (i.e., 1971 when the project came online). Scheduled repairs and advanced maintenance vary based on the component in question.

- **Alternative 2A (Immediate Rehabilitation via Planned 110-Foot Stoplog Conversion)** would replace all lock components selected for the MRER (downstream and upstream). Work would begin in 2025 (year 1) with the procurement of the metal inserts for the 110-foot stoplog slots and the design of all identified components for rehabilitation. The 110-foot stoplog conversion slot cutting would commence in 2026 (year 2) by use of the one sided approach (see section Baseline Failure Modes in the WOPC: FWOP 2) which will allow 2 wide tows to navigate the lock for the 150 days required for cutting. After slot cutting, regular navigation would commence for several months and then the lock would close for an additional 35 days to conduct sill work. Starting in 2027 (year 3), the upstream and downstream miter gates and other identified components would be fabricated. In 2029 (year 5), the lock would close for 37 days during the off-peak navigation season (typically July through August) to replace all upstream components including miter gates. In 2030 (year 6), the lock would again close for 37 days during the off-peak navigation season to replace all downstream components including miter gates. All required fabrication and acquisition of materials would occur in years 3 through 5. This alternative would reset the hazard function for all components to their original state (approximately zero).
- **Alternative 2B (Immediate Rehabilitation via Coffer Cells Dewater)** would replace all components and work would begin in 2025 with component fabrication. Dewatering and component installation would occur in 2026 with a 157-day full closure of the lock. This alternative would reset the hazard function for all components to their original state (approximately zero).
- **Alternative 4A Advanced Maintenance** would repair components for which expenditures are in excess of routine O&M. Repairs focus on reducing the likelihood of some emergency repairs, temporary service losses, and/or the rate of service degradation. This alternative starts in 2025 with design, followed by the 110-foot stoplog conversion (defined in Alternative 2A) in 2026, and then the first iteration of repair work starts in 2028. Advanced Maintenance would occur every 10 years starting in year 2028 and would include the following tasks: repair cracked welds, replace grease lines, apply Belzona (quoins) and replace bubblers (miter gates). Advanced maintenance interval 1 (year 2028) would reset the probability failure by 2 years and would close the lock for 14 days. Advanced maintenance interval 2 (year 2038) would also reset the probability failure by 2 years but would close the lock for 16 days. The increase in days is due to only resetting the probability failure by 2 years in interval 1. This means that more repairs are likely to be needed each time it is dewatered for advanced maintenance since the components are not replaced with new components.

- **Alternative 5A Scheduled Repair** would involve repairing cracked welds, replacing bent members (miter gates), and sand blast and paint components every 20 years starting in year 2028. This alternative starts in 2025 with design, followed by the 110-foot stoplog conversion (defined in Alternative 2A) in 2026, and then the first iteration of repair work starts in 2028. The first scheduled repair interval would reset the probability failure by 4 years. Each scheduled repair interval after would have a probability failure of one less than the previous iteration. The maintenance period for the first iteration of scheduled repairs would close the lock for 21 days. Evaluation and Comparison of Alternative Plans

Comparison of the final array of alternatives relies on criteria specified in the four accounts established by the *Economic and Environmental Principals and Guidelines for Water and Land Resources Implantation Studies* of 1983 (P&G). On April 3, 2020, the Assistant Secretary of the Army issued a memorandum, Subject: Comprehensive Documentation of Benefits in Feasibility Studies, directing USACE to identify, analyze and maximize benefits in the NED, RED and OSE accounts and EQ. The four accounts are National Economic Development (NED), Environmental Quality (EQ), Regional Economic Development (RED), and Other Social Effects (OSE):

- **National Economic Development** (NED) capture changes in the economic value of output of goods and services for the nation as a whole.
- **Environmental Quality** (EQ) impacts include non-monetary effects on significant natural and cultural resources both beneficial and adverse.
- **Regional Economic Development** (RED) benefits consist of changes in the distribution of regional economic activity that result from alternative plans typically measured by gross regional product (income, profits, and tax revenues), and employment.
- **Other Social Effects** (OSE) account captures plan effects from perspectives that are relevant to the planning process but are not reflected in the other three accounts. Categories include urban and community impacts; life, health, and safety factors; displacements; long-term productivity and energy requirements and energy conservation.

NED is the key metric in selecting a plan. The following table depicts the NED benefits for each alternative in the final array.

National Economic Development (NED) Metrics for Final Array of MRER Alternatives for Terry Lock and Dam MRER*

Metrics	Alternative 2A Immediate Rehabilitation via Planned 110-Ft Stoplog Conversion	Alternative 2B Immediate Rehabilitation via Coffer Cells Dewater	Alternative 4A Advanced Maintenance via Planned 110-Ft Stoplog Conversion	Alternative 5A Scheduled Repair via Planned 110-Ft Stoplog Conversion
Plan Benefits	$10,462,000	($48,870,000)	$5,359,000	$4,466,000
Plan Costs	$2,151,000	$1,644,000	$795,000	$979,000
Net Benefits	$8,311,000	($50,51,000)	$4,564,000	$3,487,000
Benefit to Cost Ratio	4.9	(29.8)	6.7	4.6

*FY 2022 dollars, planning period 2024-2078 with base year 2029 and annualized at the FY discount rate of 2.25 percent

Recommended Tentatively Selected Plan

Based on alternatives screening and NED analysis using the NIM model, the MRER PDT recommends Alternative 2A as the TSP. The plan would restore upstream and downstream components (miter gates pintles, quoins and miter gate anchorages) selected for the MRER to their original condition thereby greatly reducing the risk of component failure over the period of analysis. The BCR for Alternative 2A is 4.9 indicating a justified project based on NED benefits.

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1 Introduction

Inaugurated in 1971, the MKARNS has evolved into one of the nation's major inland waterways. In May of 2015, the U.S. Department of Transportation upgraded the MKARNS from a "connector" system to "corridor" system as part of the Maritime Administration America's Marine Highway Program. The upgrade in status brings the MKARNS into the same category as other major inland waterways such as the Mississippi and Ohio rivers. The MKARNS is a major conduit for U.S. agricultural exports, and transports various inbound cargoes such as fertilizers, fuels, chemicals and iron and steel. Today, the MKARNS ships about $3.6 billion (about 12 million tons) worth of commodities to and from Arkansas and Oklahoma each year. The system is 445-miles long and includes the Verdigris, Arkansas and White rivers. With 18 locks, it has an elevation differential of 420 feet from its beginning at mile 600 on the Mississippi River to the head of navigation near Tulsa, Oklahoma and the Port of Catoosa (Figure 1).

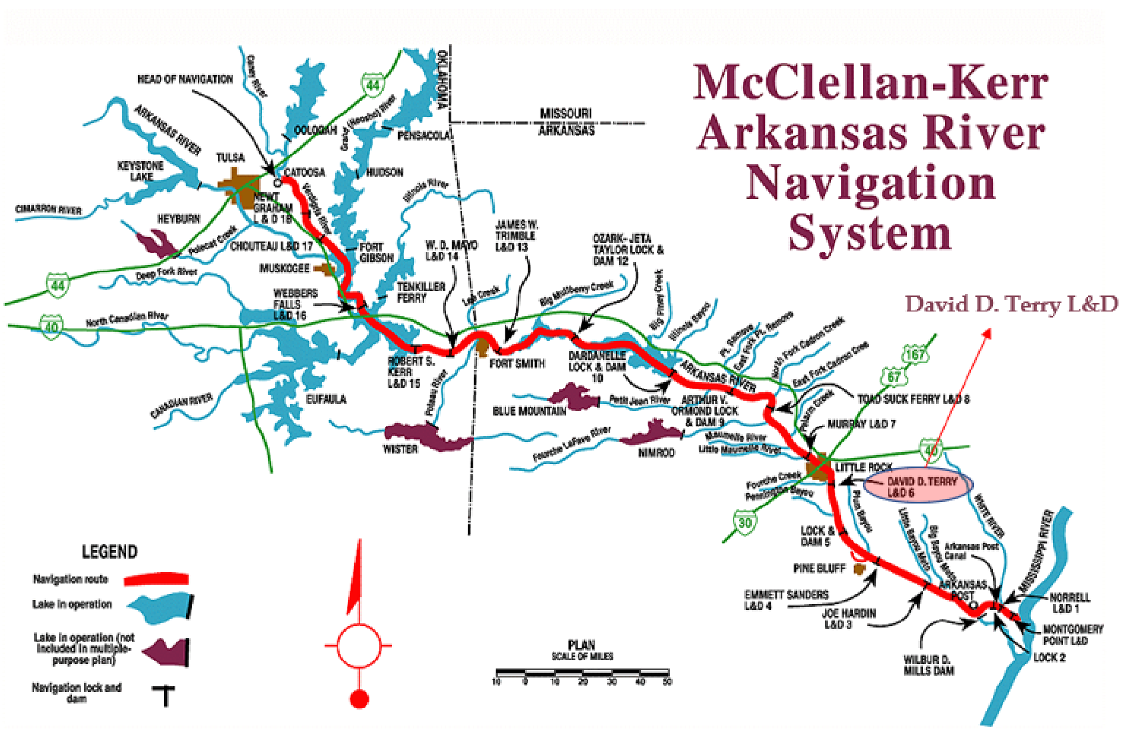

Figure 1. McClellan-Kerr Arkansas River Navigation System

1.1. Project Authorization

David D. Terry Lock and Dam was authorized by the River and Harbor Act of 24 July 1946 and constructed to provide navigation depth within its pool. It is a unit of the McClellan-Kerr Arkansas River Navigation System, which consists of 49 dams and various associated channel improvements and levees operated to provide navigation, hydropower generation, flood-control, and other beneficial purposes along the Arkansas River. Of the 49 projects, 34 are in SWT and fifteen are in SWL. Eighteen are navigation projects and 31 are flood control projects.

Section 136 of the Energy and Water Development Appropriations Act of 2004, authorized a project depth of 12 feet. USACE's project to upgrade the MKARNS from a 9-foot navigation channel to a 12-foot navigation channel will provide industry with an additional 200 tons of cargo for every foot of draft provided by the deepened channel. The additional tonnage allows shippers to move more cargo and be more competitive.

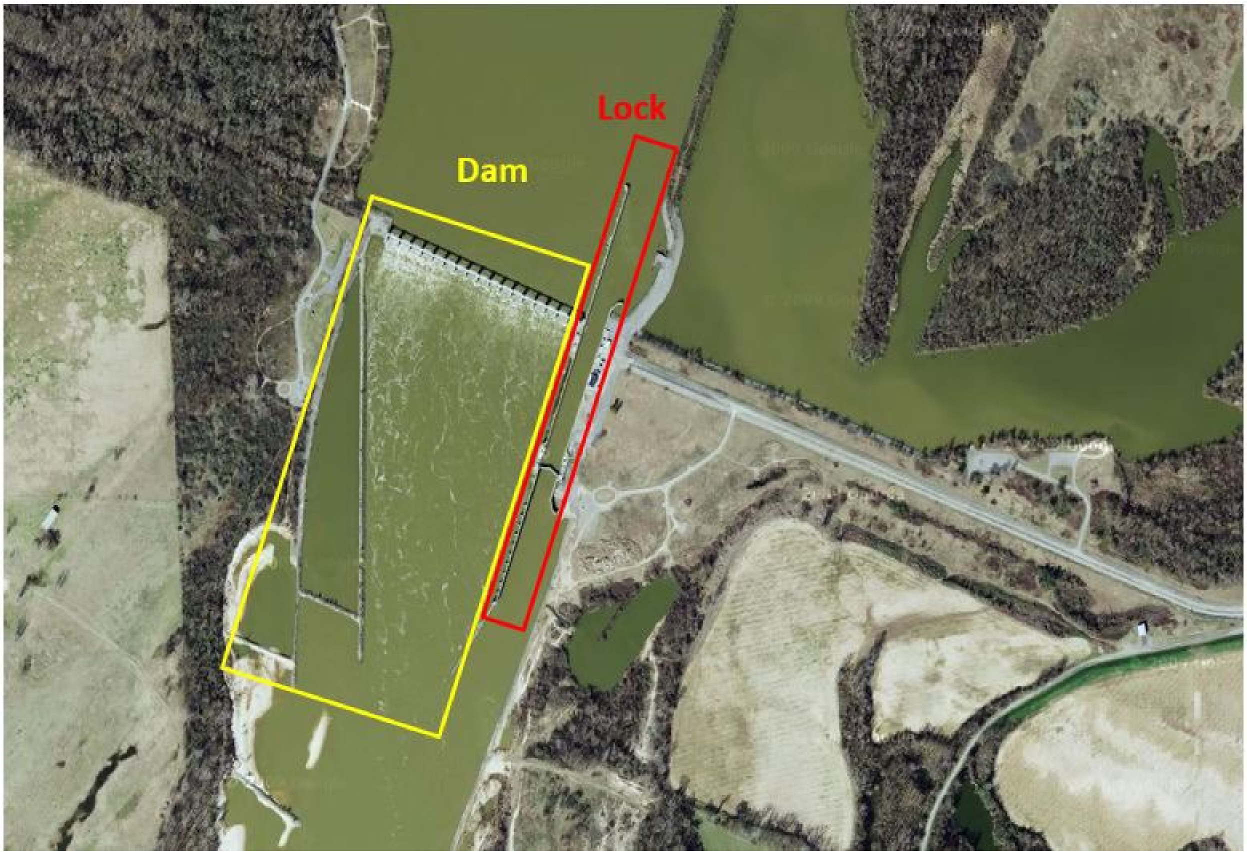

Figure 2. David D. Terry Lock & Dam No. 6

1.2. Location and Description

David D. Terry Lock and Dam is located at Navigation Mile (NM) 108.1 on the Arkansas River in Pulaski County, Arkansas, approximately 10 miles downstream of the Main Street Bridge near downtown Little Rock, Arkansas. The Interstate Highway 440 bridge crosses the Arkansas River 4.9 navigation miles above the lock and dam structure. The navigation pool regulated by David D. Terry Lock and Dam extends approximately 17.3 navigation miles upstream to Murray Lock and Dam (Pool No. 7) located at NM 125.4. The next downstream project is Colonel Charles D. Maynard Lock and Dam No. 5. The project is shown on Figure 2.

2 Project History

The project was established by Public Law 91-649, 91st Congress, Second Session on 8 January 1971 and was named after David D. Terry, a United States Congressman from Little Rock, Arkansas and the director of the Division of Flood Control Water and Soil Conservation of the Arkansas Resources and Development Commission (1945-1963). Prior to this Act, the project was named Lock and Dam No. 6.

David D. Terry Lock and Dam is a unit in the multiple-purpose plan for development of the lower Arkansas River Basin in Arkansas and Oklahoma, which was authorized by the River and Harbor Act of 24 July 1946. This Act approved the plan recommended in the report of the Chief of Engineers dated 20 September 1945, and in the letter of the Chief of Engineers dated 19 March 1946. The report and letter are contained in House Document No. 758, 79th Congress, 2nd Session. The approved multiple purpose plan for the development of the lower Arkansas River provides for navigation, hydroelectric power, flood control and allied benefits. David D. Terry Lock and Dam is one of fourteen navigation projects located along the McClellan-Kerr Arkansas River Navigation System in Arkansas. Eleven of the navigation projects are actually on the Arkansas River mainstem and the other three projects are on the Arkansas Post Canal and White River. Table 1 lists the name, river, and completion date of the Arkansas River Basin Projects.

Table 1. Arkansas River Basin Projects

Project	River	Year Completed
James W. Trimble Lock and Dam (L&D No. 13)	Arkansas	1970
Ozark-Jeta Taylor Lock and Dam (L&D No. 12)	Arkansas	1969
Dardanelle Lock and Dam (L&D No. 10)	Arkansas	1964
Blue Mountain Dam	Petit Jean	1947
Arthur V. Ormond Lock and Dam (L&D No. 9)	Arkansas	1969
Toad Suck Ferry Lock and Dam (L&D No. 8)	Arkansas	1969
Nimrod Dam	Fourche LaFave	1942
Murray Lock and Dam (L&D No. 7)	Arkansas	1969
David D. Terry Lock and Dam (L&D No. 6)	Arkansas	1968
Colonel Charles Maynard Lock and Dam (L&D No. 5)	Arkansas	1968
Emmett Sanders Lock and Dam (L&D No. 4)	Arkansas	1968
Joe Hardin Lock and Dam (L&D No. 3)	Arkansas	1968
Wilbur D. Mills Dam (Dam No. 2)	Arkansas	1968
Lock No. 2	Arkansas Post Canal	1967
Norrell Lock and Dam (L&D No. 1)	Arkansas Post Canal	1968
Montgomery Point Lock and Dam	White	2005

2.1. Physical Components

David D. Terry Lock and Dam consists of a gated concrete spillway with a navigation lock located on the left bank side. The lock is connected to the left bank high ground by a lock esplanade and embankment at elevation 241.0 (NGVD). An earth filled overflow embankment connects the rightend of the spillway to high ground.

2.1.1. Embankments

Right Overflow Embankment

The right embankment includes a 2,850 foot overflow embankment section at elevation 236.0. The overall crown width is about 20 feet. The upstream side is sloped on a 3:1 (H:V) grade and the downstream side is graded at 4:1. Heavy rock lines the upstream side to provide resistance to scour under overflow conditions.

Left Embankment Esplanade

The project consists of a 4,850 foot left embankment at about elevation 241.0, connected to the structure by the lock esplanade at elevation 243.0. The left embankment extends from the lock esplanade to a flood control levee on the left bank. The upstream side is sloped on a 3:1 grade and the downstream side is graded at 4:1. The width of the crown is about 38 feet and serves as a road for access to the lock control area. Rip-rap lines the upstream embankment to provide resistance to scour under overflow conditions.

2.1.2. Spillway

The spillway has a gross length of 1,190 feet including seventeen 60-foot bays, with 10-foot wide piers across the main channel of the river. The spillway sill is level at elevation 206.0 with a flat crest, a 4-foot upstream radius and a downstream parabolic curvature of x2=53.47y. The gates used to control the headwater elevation are a radial arm design with a 36-foot radius. The gate trunnions, set at elevation 232.0 (NGVD), are expected to be inundated 0.5 percent of the time. At the fully opened position, the gate lips are at elevation 252.0 and will clear the modified standard project flood of 625,000 cubic feet per second. In the closed position, the top of gates is elevation 233.0 to permit operational flexibility to raise the navigation pool for short periods of time and for wave wash freeboard. The gates are operated by individual electric motor cable hoists from either the spillway bridge or the upstream operators shelter.

2.1.3. Stilling Basin

The spillway has a horizontal stilling basin with a four- foot end sill. The stilling basin apron has a top elevation of 191.0 and a bottom elevation of 185.0. The end sill is set parallel to the spillway axis. Both the spillway and the stilling basin are founded on steel piles in sand.

2.1.4. Navigation Lock

The navigation lock located on the left side of the spillway is 110-feet wide by 670-feet long (pintle to pintle). The useable lock chamber is 110-feet wide by 600-feet long. The lock wall elevations are set at 243.0 to provide a 12-foot freeboard above the normal upper pool elevation. The normal lock lift is 18 feet. There is a 12-foot by 12-foot culvert located in each guide wall to allow filling and emptying of the lock chamber. The culvert intake manifold consists of eight ports with an invert elevation of 196.0. The invert of the eight ports of the downstream exit manifold is 196.0. The lock chamber filling and emptying manifolds in each wall consist of fourteen 3í-6î ports on 28-foot centers with a bottom elevation of 196.0. Culvert flow is controlled by a reversed radial arm gate. The lower lock sill is at elevation 199.0 and the upper sill is at 213.0. The chamber has a minimum cushion depth of 17 feet. The upper sill elevation was established to provide a minimum submergence of 13 feet during a 5-foot hinged pool operation (headwater elevation 226.0). The lower was set to provide 14 feet. The lock chamber is equipped with miter gates for lockage ingress and egress.

These project components are shown in Figure 3 and Figure 4, plates taken from the project's water control manual completed in June 2010.

Redacted figure

Figure 3. Gated Spillway Plate

Redacted figure.

Figure 4. Navigation Lock Plan, Elevation, and Sections Plate

2.1.5. Pintles

The pintle is comprised of a cast steel pintle base, a cast steel pintle (ball), a steel cover plate, an aluminum bronze pintle bushing with machined grease grooves, and a cast steel pintle cap (socket). The pintle was designed for the maximum thrust imposed by the dead load of the gate. Bearing material for the pintle and gudgeon pin was ‘Ampco 16’ or equal with an allowable stress of 6,000 psi. Design loads for the upper hinge system and the pintle are maximum loads determined from the entire project to permit standardization. Additional figures are included in enginnering appendix (Appendix A).

Redacted figure

Figure 5. Downstream View of Pintle

2.1.6. Quoins

Horizontal girders were designed as arched members hinged at the quoin and miter contacts. At the ends of each girder there is a thrust web that transmits load through the convex quoin blocks attached to the end of the gate leaf into the contact blocks embedded in the lock wall. There is a similar thrust web and contract blocks on the miter side of the gate leaf. Additional figures are included in enginnering appendix (Appendix A).

Redacted figure

Figure 6. Downstream View of Landside Quoin

2.1.7. Miter Gates

Both the upper and lower gates are horizontally framed, with the skin plate on the upstream face. The skin plate is supported by intercostals framed into built-up girders. Gates are constructed of A36 steel with welded connections. Ladders are provided on the downstream face of both the upper and lower gates. The gudgeon pin connection is placed below the centerline of the top girder to provide clearance for the anchorage system below the top of the lock wall. The operating strut connection has been placed between the top two girders to provide clearance for the operating machinery below the top of the lock wall. A 5-foot-wide walkway has been provided at the top of gates at the elevation of the top of wall. The walkway consists of aluminum grating supported by structural steel members. The skin plate extends to the top of lock wall to provide additional height for navigation for flood-fighting vessels. Gate fenders are constructed of bent steel plates welded to the girder flanges. The miter gates are similar to Lock and Dam No. 4, except for the arrangement of the upper anchorage bars. The anchor bar is perpendicular to the lock wall and has a two-pin connection and the bar parallel to the lock wall has a one-pin connection. This eliminates the possibility of movement between the perpendicular anchor bar and the wedges resulting from stress reversal during gate operation. The height of the upper miter gate is 28 feet, and the height of the lower miter gate is 42 feet. The elevation of the centerline of the top girders is 243.0 feet the elevation of the upper sill is 213.0 feet, and the elevation of the lower sill is 199.0 feet.

Redacted figure

Figure 7. Downstream View of Upper Miter Gate

2.1.8. Miter Gate Anchorages

The miter gate anchorage uses an adjustable wedge system to pull the top of the gate leaf in tight against the quoin. The wedge pins can be raised or lowered by adjusting the head bolts. By doing so the wedge pins push or pull the gudgeon arm to adjust the lateral position of the miter gate leaf. A hinged anchorage was used so that the wedge system can remain in adjustment when a gate leaf is removed.

Redacted figure

Figure 8. Components of the Miter Gate Anchorage

2.1.9. Related Control Facilities

David D. Terry Lock and Dam is part of the McClellan-Kerr Arkansas River Navigation System, which consists of 49 Corps of Engineers water management projects and various channelization and levee projects operated to control floods, produce hydropower and provide navigation on the Arkansas River and its tributaries.

2.1.10. Real Estate Acquisition

Fee simple title was obtained on 1,797.0 acres of land for the project (101 acres), park or public use areas (579 acres), and easement (1,117 acres).

2.1.11. Public Facilities

David D. Terry Damsite West and David D. Terry Damsite East Parks are two public recreation areas along the Arkansas River near David D. Terry Lock and Dam. East Park provides river access. Additional parks along Pool No. 6 include: Willow Beach Park, Riverfront Park, Riverview Park, Burns Park, and Murray Dam Site and Overlook Park. Approximately 579 acres of land above the navigation pool are designated for use by the general public for recreational purposes.

2.2. Historical Remedial Measures

District Staff maintains a partial history of the following remedial measures undertaken at the project:

Year	Item of Repair
2000	Straightened bent stiffeners, girder flanges and diagonals. Repaired crack areas with full penetration welds.
2016	Straightened bent stiffeners, girder flanges and diagonals. Repaired crack areas with full penetration welds.
2021	Straightened bent stiffeners, girder flanges and diagonals. Repaired crack areas with full penetration welds. Experimental Fiber-Reinforced Plastic (FRP) was applied to stress cracks encountered in the girders. Due to the experimental nature of the FRP wrap, it is unknown if this method will provide any significant risk reduction in comparison to the traditional repair method.

2.3. Hydraulic Steel Structure Inspections

As part of the Little Rock District's Hydraulic Steel Structures (HSS) Program, all HSS gates are to undergo a complete "hands-on" inspection once every 25-years in accordance with ER 1110-2-8157. Since 2016 the miter gates have been inspected on a 5-year cycle. The inspections of the miter gates were performed as indicated in Table 2. The upper river wall miter gate was inspected in July 2018 above water and in August 2018 below water with the USACE dive team. A complete copy of the Inspection Report is provided in Section 7 of Appendix A.

2.3.1. Inspection Procedure

The 2016 and 2021 field inspections included a complete visual inspection by Craig Evans, PE of SWL. After dewatering was completed, the miter gates were inspected. The inspection included observing and noting the condition of the pintles, girders, intercostals, diaphragms, diagonals, fenders, skin plates, strut connection, thrust web, gudgeon pin connection and other miter gate components. Photographs were taken to record general condition of the gates and specific deficiencies at the time of the inspection (See HSS inspections in Section 7).

2.3.2. Inspection Results

Pintles

Several typical conditions and deficiencies noted on the pintles:

- Fatigue torsional stress cracks that propagate around each of the pintle balls.

In addition, during the 2021 Dewater, it was noted there was an 8-inch crack through the 1.5-inch-thick plate at the bottom of downstream landwall pintle casting. This crack and others were repaired in August 2021 by placing a full penetration weld and wrapping the areas with FRP. Similar cracks around the pintles were also repaired in 2016. These cracks will continue to occur due to fatigue and the high stress area around the pintle. Due to the experimental nature of the FRP wrap, it is unknown if this method will provide any significant risk reduction in comparison to the traditional repair method.

It was also noted in the 2018 Upper Gate Inspection Report that "The pintle ball bronze bushing seems to be showing signs of wear. The gap according to the plans is one inch between the top of the pintle ball cover plate and pintle cap casting. This gap was measured with a tape measure, a steel ruler and a wire rope sheeve gauge. Each of the measurements were consistent. The gap measured around 13/16 inches. Based on these measurements of the pintle gap, the bushings have worn approximately 3/16 inches on both upstream miter gates. There is still considerable bushing left, but after ¼ inch wear the grease grooves in the bushing will be gone. When the bearing wears to 3/8 inches the miter gate will hit the pintle cover plate bolt heads. Estimated wear life thickness is 1/16 inches to 1/8 inches. Another 1/8 inches wear will mandate replacement."

Quoins

Several typical conditions and deficiencies noted on or near the quoin:

- Fatigue cracks observed in the quoin near the pintle.
- Damaged armor around the quoin contact block.
- Corrosion and weld deterioration of miter gate quoin contact block.
- Leakage observed at the quoin contact block.

In addition, the following has been noted in the OCA database: Annual Inspection May 25, 2011. The downstream land wall miter gate is making a popping sound right at miter. The sound appears to be coming from the quoin end. The quoin end contact blocks have been greased above water in attempt to eliminate "Belzona Binding" noise. Divers have checked the underwater portion and found a seal loose and tightened it. The popping sound is still there. Notice that there is 0.007 feet difference between the elevation open and closed from 2006 to 2008. This should be the same elevation, but we could expect a change of 0.001 or 0.002. Based on engineering judgement, the drop in the gate is most likely what is causing the binding.

Miter Gates

Several typical conditions and deficiencies noted on the miter gates:

- Moderate to heavy corrosion below the water line. Pitting is typical.
- Several bent girder flanges.
- Several bent steel fenders.
- Several bent and damaged diagonals.
- Several damaged stiffener plates.
- Several fatigue cracks around the quoin end, pintles and girders.

Cracks that were repaired during previous dewaterings have been observed recurring in or around the repair weld.

2.3.3. Inspection Conclusions

In general, the following conclusions were determined:

- Pintles: the upstream and downstream pintles are in poor condition due to the presence of fatigue cracks.

- Quoins: the upstream and downstream quoin areas are in poor condition due to the fatigue cracks in the quoin near the pintle.
- Miter Gates: the upstream and downstream miter gates are in poor condition due to the several bent structural members as well as the presence of several fatigue cracks, primarily located on the downstream miter gate.
- Miter Gate Anchorages: the upstream and downstream anchorage is in good to fair condition with some corrosion observed.

2.4. History of Non-Routine Repairs

Since Terry L&D began operating, there have been many non-routine repairs including:

- 1968, work was performed to address the esplanade settlement, including mud-jacking the concrete slab adjacent to the lock wall to its original elevation.
- 1970, work was performed to:
  - address the right overflow embankment seepage by extending the weir 100 feet landward and installing piezometers in the embankment.
  - add riprap downstream from stilling basin in localized areas adjacent to the stilling basin's end sill.
  - Significantly repair Tainter gates including repairs to structural connections, cracks in girder stiffeners and braces, bolting of the ribs to the bottom girder, adjusting rubber side seals, installing stiffening braces between the bottom girders and the vertical ribs, and revising the bottom gate lip.
- 1979, Tainter gate trunnion girder cracks were sealed.
- 1991, an engineering study was performed which showed the piers were adequately designed for the anticipated loads and recommended epoxy injection of the cracks.
- 1992, a contractor was hired and tasked with injecting cracked piers with epoxy resin after the cracks were capped with epoxy paste. This was repeated by the SWL Marine Terminal Crew in 1997 with the addition of injection ports at crack locations.
- 1993, work was performed to address lock wall erosion located on the backside of Monolith No. 11 by patching a deep erosion hole. Also, cracked concrete on 3 river wall counterforts was repaired.
- 2000, Waterway Experiment Station (WES) produced a report stating that the cracking was caused by ASR.
- 2000-2001, a report was created by Acres International that recommended the installation of anchor bars into the downstream side of the piers, tying the piers to the spillway base.
- 2003-2005, pier repairs were performed by contractors in which anchors were installed in piers 2, 4, 14, 15, 16, and 17 and extensometers were installed in piers 4, 15, and 16.
- 2003, cracks in spillway Tainter gates were repaired including cracks in the downstream tension flange of the top girder on Gate 12 by routing to depth and welding.
- 2009-2011, pier repairs were performed again in which contractors installed anchors in piers 3, 5, 6, 7, 8, 9, 10, 11, 12, 13 and 18.

2.5. Dewatering Methods

When USACE built the MKARNS in the late 1960s, dewatering was done by using a center post, centerpost receiver and 50-foot stop logs. Since then, centerpost anchorages at multiple projects on the MKARNS are in a completely failed state, and those not in a completely failed state are in poor condition therefore posing serious safety concerns to work crews during a dewater. Little Rock District has determined that the use of centerpost anchorages and 50-foot logs is not a valid option for future dewaterings; therefore, new upstream and downstream closure structures (which converts the closure system to using 110foot stop logs and eliminates the need of the centerpost and centerpost anchorage) must be considered as a necessary step moving forward.

3 Engineering Considerations

3.1. Existing Structural Conditions

In 2016, SWL dewatered the lock for inspection. The lower miter gates had several fatigue/torsional stress cracks in the steel girder flanges around the pintle ball. Some of the stress cracks were considered severe and propagated into the pintle cap casting. All of the cracks in the lower miter gates were repaired during this dewatering. Similar cracks were repaired in August 2000, during the last dewatering although the 2016 cracks were considered worse than the cracks noted and repaired in 2000. Similar cracks were also repaired during the 2021 dewatering with an experimental fiber-reinforced plastic (FRP) wrap. Due to the experimental nature of the FRP wrap, it is unknown if this method will provide any significant risk reduction in comparison to the traditional repair method. Reduction in risk due to installation of the FRP was not included in the engineering reliability analysis. During this dewater, the grease line to the upstream land wall pintle was observed to be broken and replaced. It was noted in the 2021 Hydraulic Steel Structure (HSS) inspection report that the absence of grease to the land wall pintle has potentially decreased the life span of the pintle bushing. The upper river wall miter gate was inspected in July 2018 above water and in August 2018 below water with the USACE dive team. The reason for this inspection was due to a noise that was occurring during operation that indicated there was an issue with the sector gear bearing. There were several issues that were noted during this inspection including a recommendation to replace the strut pin bushings and sector gear bearings. Several bent flanges and diagonals were noted on the miter gates. In general, lock components are approaching the end of their design life.

3.2. Modeling

3.2.1. Baseline Failure Modes in the WOPC

Baseline failure modes and hazard functions for MRER components comprise a substantial portion of the time and budget for a typical study. This effort involves both engineering and operations staff. For a given component such as a miter gate, the PDT first determines failure modes along with a corresponding probability. Once the modes are established, the team then develops the most likely course of remedial action, repair costs and repair durations of potential lock closures. Lock closure durations are critical given that the cost of vessel delays and rerouting of cargo are costly for both shippers and consumers nationwide. Lock closure durations and repair costs vary based on different failure modes, but one major factor and risk driver is the approach the district takes to dewater the lock to make repairs.

When USACE built the MKARNS in the late 1960s, dewatering was done by using a center post receiver and 50-foot stoplogs rather than 110-foot stoplogs, which is more common today. The only lock and dam on the MKARNS equipped for 110-foot stoplogs is Montgomery Point L&D, built in the 2004 versus the remaining MKARNS locks completed in 1970. Center post anchorages at other projects are in a failed state, and those not in a failed state are in poor condition thereby posing serious safety concerns to work crews during a dewater.

SWL can still dewater Terry L&D via the center post receiver and 50-foot stoplogs, if and only if the receivers pass a pull (load) test within a twelve-month window prior to dewater and visual inspection immediately prior to dewater. So far, all center post receiver anchorages that have been identified as being in a failed state have been identified through visual inspection versus load testing. As a result, SWL has assumed center post anchorages at Terry L&D are near failure, and that this method is not an option for future dewatering to address emergency component failures. For the MRER and NIM modeling, the WOPC assumes the following dewater options in response to a failure mode:

- **WOPC 1: Coffer Cells Only** – setting coffer cells to dewater in all instances where a dewater is required. Each dewater would close the lock 120 days with an additional period to address the relevant component.
- **WOPC 2: Coffer Cells Followed by Planned 110-Foot Stoplog Conversion** – coffer cells are set for emergency dewatering and repairs in the first year, followed by planned closure for 110-foot stoplog conversion using 110-foot stoplogs for any subsequent dewatering needed to repair the lock. SWL would acquire the metal inserts for the 110-foot stoplog slots in the first year of the emergency closure. Cutting new slots for the 110-foot logs would be “one sided” meaning the lock would not be dewatered. Workers would cut slots on one side (land/river wall) of the lock, and then move to the other. Traffic continues but tows would be restricted to two barges in width (typically tows three barges wide can navigate MKARNS locks). After slot cutting, regular navigation would commence for several months and then the lock would close for an additional 35 days to conduct sill work.
- **WOPC 3**: **Emergency 110-Foot Stoplog Conversion** would involve dewatering with coffer cells, acquiring metal inserts, cutting slots on both sides of the lock chamber and conducting the necessary sill work in a full closure for 365 days (at minimum).

Each WOPC scenario considered included lock closure impacts to the navigation industry with repair costs that vary by component and failure mode. A detailed description of each exceeds the limits of a report summary so, as an example, **Error! Reference source not found.** shows the baseline event tree and failure modes for an unexpected failure of an upstream miter gate with a dewater option of setting coffer cells each time the chamber needs dewatering for subsequent repairs (WOPC 1). The initial node is probability of failure for a miter gate leaf in year 1 (2025) of the analysis (9.4 percent). There are potential failure modes with varying degrees of repair costs and navigation closure durations. With the exception of failure mode 1, replacement of the miter gate and other applicable components would occur over a 3-year period (2025 through 2028). Note that this is a simplified assumption for modeling, and the repair duration could be as long as five years according to SWL engineers.

3.2.2. Lock Capacity Modeling

Lock capacity curves generated for this study were developed the ARNOLT model created and maintained by the PXCIN-RED. ARNOLT is a successor to the shallow draft version of the Waterway

Analysis Model (WAM), and replicates and expands on the functionality of WAM by leveraging advances in computing power and data storage since the last major update to WAM.

ARNOLT, like the shallow draft WAM model, is an annual simulation model used to evaluate the capacity of lock projects on the inland system. Capacity in this context is defined as the relationship between the volume of traffic that desires to transit the project in a given year and the average transit time, the time to navigate fully from arrival at one end to departure at the other, of all such traffic that can successfully complete a transit in that year. This capacity estimate ordinarily takes the form of what is known as a 'tonnage transit curve', the average transit time (on the y axis) displayed as a function of the annual tonnage (x axis) that attempts to transit the project. These curves typically have a set of common properties; they exhibit exponential growth, and eventually at a given tonnage level become asymptotic meaning that a given lock or system is at full capacity. This tonnage level, or its approximate location on the curve at least, is referred to as "capacity" for the evaluated project, the point at which no more traffic can viably use the project.

A tonnage transit time relationship (Figure 9), or tonnage transit curve, can be generated by a capacity simulation model for a range of scenarios which may through various mechanisms alter a projects capacity, both in the sense of its capacity threshold and its capability to pass a set tonnage volume. These scenarios could include a period of closure of one or more chambers at the project, slower or quicker processing of tows, changes in the composition and characteristics of traffic, etc. Normally these scenarios describe a range of lock closure or other disruptions to service that can result from routine or catastrophic failure of lock components. These scenarios comprise what is known as a 'family of curves', which together describe the locks capacity across as series of hypothetical current and future scenarios. The ultimate use of these tonnage transit relationships is in system equilibrium modeling, normally performed by NIM. The Economic Appendix provides detail including assumptions applied in ARNOLT.

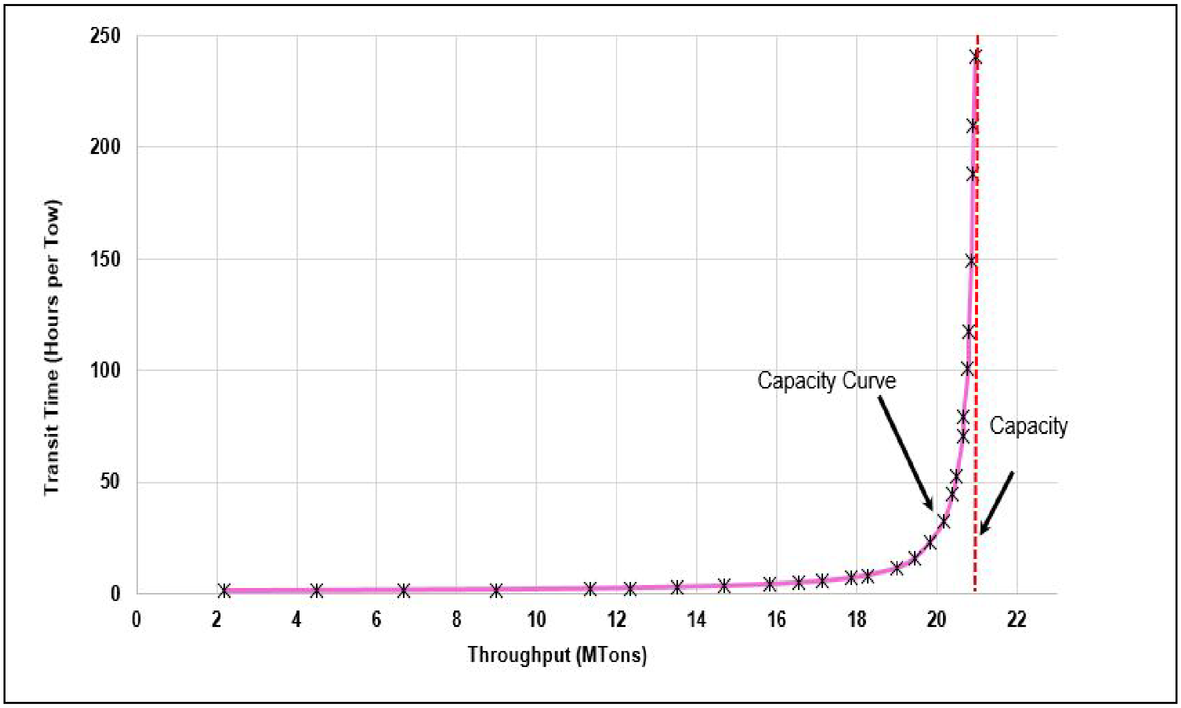

Figure 9. Tonnage Transit Curve (Capacity Curve) Example
Source: USACE PCXIN-RED

3.2.3. Navigation Investment Model

The Navigation Investment Model (NIM) developed and maintained by the PXCIN-RED and Oak Ridge National Laboratory (ORNL) is a behavioral model that serves two tasks: develop least-cost movement level shipping-plans and estimate equilibrium system traffic levels from a bottom-up movement level analysis. It is a USACE corporate model developed for estimating NED impacts for inland navigation, and the standard model used for MRERs. By using detailed data describing the waterways network, the equipment used for towing operations, and the commodity flow volume and pattern, NIM calculates the resources (i.e., number towboats, trip time, and fuel consumption) required to satisfy the demand on a least-cost basis for each movement in the system, and how much of that movement demand can move in system equilibrium with a positive willingness-to-pay for barge transportation.

Transportation surplus benefits are realized primarily through the implementation of navigation improvements and consist of cost reductions to shippers that prefer to move on the waterway system over the planning period. For some studies, such changes may involve projects that increase lock capacity or transit efficiencies with improvements such as tow haulage equipment.

In the case of an MRER, economic analysis focuses on delay and congestion costs that shippers and vessel operators realize when unplanned outages occur due to mechanical failures at a lock and dam. Shippers and vessel operators would still use the waterway system in the year an unplanned outage occurs, but they would experience substantial delay, congestion, and queuing effects, depending on the extent of the lock outage. Since outages are unplanned and shipping contracts are in place to move commodities, it is assumed that shippers are locked into the transportation option that they measured to be the lowest-cost method going into a particular year. In other words, shippers do not divert to rail, truck, or other modes under this benefit category. Instead, the shipment is planned, and unplanned congestion affects all users of the waterway. With improved reliability, delay costs are largely avoided by replacing the riskiest components; and thus, the likelihood of negative economic impacts to the navigation industry are greatly reduced.

Unscheduled outages can create substantial transportation impacts. When they occur, shippers and vessel operators are unable to plan their shipments efficiently around the outage. Not only can this create excessive delays and congestion, but it can also affect the ability of a lock to process traffic that shippers have planned to move in a given year. When this happens, shipments that are unable to use the lock in any period during the year due to physical capacity constraints would be forced to use other more costly transportation methods such as truck and or rail. The Economic Appendix provides detail including assumptions applied in NIM.

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Figure 10. Baseline (2025) Event Tree and Consequences for a Failure of the Upstream Miter Gate at Terry Lock and Dam (assumes dewater method is to set coffer cells each time dewatering is required)

3.2.4. Hazard Functions in the WOPC

In the above example, there is a 9.4 percent chance that the upstream miter gate will fail in year 2025. Probability of failure increases through time in the WOPC as a component continues to deteriorate. Expected rates of component deterioration through time and a corresponding increase in potential component failure are measured by hazard functions, which are based on time dependent Weibull distribution. Hazard rate is the condition that a component has survived from time 0 to time t and fails in the next increment of time (dt), (years in the case of an MRER). Hazard functions vary by component, and were developed by SWL engineers in consultation with the RMC and INDC. The Engineering Appendix and main chapter contain event trees and hazard functions.

Pintle, Quoins, and Miter Gate Anchorages

Based on the condition of the pintles, quoins and miter gate anchorages as detailed in the inspection report and comparing the condition and configuration to other Corps projects, the Weibull parameters were selected that best approximated the current condition and anticipated deterioration of each of these components.

Miter Gates

Based on the condition of the miter gate as detailed in the inspection report, it was concluded that the gate configuration and corresponding stress analysis was similar to the miter gates at Markland L&D. A HWELD analysis (reference Section 8), which determined the failure curve for the Markland miter gates was used to compare the HWELD analysis for the Terry miter gates. The HWELD model utilizes miter gate cross-section properties such as web/flange and thrust plate thickness, crack parameters such as initial crack length, head histogram which reflects the actual past distribution of the head differential, the traffic cycles for the life of the miter gates and the paint history. Gate coefficients in HWELD were adjusted until the crack welds closely matched the recorded crack length growth.

Miter Gate Crack Growth

Based on the photographs from the HHS inspections in 2000, 2016 and 2021 an illustration was created that located these stress cracks along with the approximate length. Actual measurements were not taken during the HSS inspections, so a generalized approach was taken which included determining the approximate crack lengths from the photos and comparing the lengths between the two HSS inspection dates (see figure below).

Redacted figure

Figure 11. Stress Crack Locations from 2000, 2016, & 2021 HSS Inspections

3.2.1. Miter Gate Design Investigation

Modeling of the miter gates for stress crack growth (HWELD) due to the number of cycles and findings of previous inspections generated several failure curves. Moving forward the results of the analysis were reviewed and compared to projects with similar miter gate design and loading conditions/cycles.

3.2.2. Component Screening

Screening is an important part of the MRER process and is a district level analysis aimed at identifying components at Terry L&D with significant problems that U.S. Army Corps of Engineers (USACE), Southwestern Division (SWD), Little Rock District (SWL) may address in an MRER. Component screening is the first step in identifying candidate components for the main major rehabilitation study.

Appendix A to the MRER contains the screening report. A key component of screening analyses for MRERs is based on Operational Conditional Assessments (OCA) for Terry L&D and qualitative consequences of component failure. Screening analysis also incorporated order of magnitude risks and consequences along with benefit to cost ratios based upon professional judgment and elicitation of the PDT that included engineers and economists. Engineering consequences captured the effects of lock closures in terms of closure durations and repair costs in the event of component failures, and economic analyses measure the economic costs. Since consequences are elicited values, they included ranges of outcomes that acknowledge uncertainty.

Table 2 displays Terry L&D components identified for MRER screening report along with their OCA rating and a summary of potential issues. These include:

- River side lock and guide walls
- Upstream and downstream miter gates
- Tainter gate anchorages
- Upstream and downstream miter gate anchorages
- Upstream and downstream pintles

- Upstream and downstream quoins.

Table 2. Terry Lock and Dam Components Selected for Screening and Operational Condition Assessment

Redacted table		

Components recommended for the MRER after screening consisted of:

1) upstream and downstream pintles,
2) upstream and downstream quoins,
3) upstream and downstream miter gates; and,
4) upstream and downstream miter gate anchorages.

Guide walls and the riverside lock wall as well as tainter gate anchorages and piers were not recommended for the MRER analysis given high remediation costs and low probability of failure. Unfortunately, there is no permanent solution to fully address the ASR deterioration for dam components other than to build a new dam, and making repairs to each of the 17 sets of tainter gate anchorages/piers would be cost-prohibitive.

4 Identification of Problems and Opportunities

Problems:

1) Multiple lock and dam components are exhibiting increased risk of failure, which may result in unanticipated lock closures, repair costs, vessel delays, and congestion on the McClellan–Kerr Arkansas River Navigation System (MKARNS).
2) The project’s current emergency dewatering method, utilizing 55-foot stop logs joined with a center post is considered structurally deficient due to the center post anchorage which results in potentially increased life safety risk to workers during inspections and repairs.

Opportunities:

1) Incorporate procedures or low-cost features which might increase lockage throughput efficiencies and reduce navigation costs.
2) Identify the optimal timing for implementing each major rehabilitation strategy.

Planning objectives:

1) Avoid unanticipated lock closures, vessel delays, and congestion by reducing lock and dam component failure risk.
2) Decrease life safety risk during lock dewatering.
3) Identify measures, consistent with the scope of the major rehabilitation program, that would increase lockage throughput efficiencies and reduce navigation costs.

Planning constraints:

1) Minimize any significant impacts to waterway users during implementation of a major rehabilitation strategy.
2) The risk assessment will assume there will be no change to the authorized 12-foot depth of the Arkansas River channel.

5 Development of Reliability Model and Hazard Rates

Calculations of probability of failure of the pintles at David D. Terry utilize the Weibull distribution curve data collected from Corps projects throughout the U.S. The curves were based on the national Weibull curves developed in the NESP study for similarly sized and configured components, then adjusted based on the most recent OCA rating available for Terry modified based on known issues.

5.1. Pintles

This Weibull distribution uses two parameters, MTTF or α and β which is the shape of the distribution. For this Weibull model, α is normally around 65 and β is normally around 4 based on other pintles in the Corps inventory with similar configurations/conditions. OCA ratings are based on conditions that are observed. When a component cannot be adequately observed, it is extremely difficult to downgrade below a B rating—this is the case for the pintles. The concern is failure of critical miter gate components can cause an inoperable gate, which leaves the chamber inoperable. Terry has a single lock chamber, so inability to operate the chamber for an extended period of time would result in navigation impacts. The Weibull parameters for the upstream pintles were adjusted for a "C" OCA rating and the downstream pintles were adjusted for a "D" OCA rating due to issues noted regarding wear at the pintle. Numerous reliability models were generated using various α and β values. The final α and β values were selected that produced a distribution curve that accurately reflected the current pintle condition and compared to other pintle projects. The final values are presented in the following table.

Based on these Weibull parameters, the values for the pintles are shown in Table 3.

Table 3. Weibull Parameters for Pintles

Redacted table

The annual hazard rate is calculated using the Weibull parameters for the pintles using the formula:

$$h(t) = \frac{\beta(t)^{\beta-1}}{\alpha^{\beta}}$$

Equation 1. Annual Hazard Rate for Pintles

The annual hazard rate curve is shown in Figure 12 and Figure 13 for the pintles. These hazard rates were entered in the event tree as discussed in the section below.

Alternative A represents the advanced maintenance strategy of replacing grease lines every maintenance interval; however, it was determined that there is not an additional advanced maintenance task that can be performed beyond what we have historically been completed. This project is currently being maintained at the advanced maintenance level of maintenance. This means the WOPC (With-Out Project Condition also referred to as the "fix as fails" or "status quo" option) aligns with the advanced maintenance strategy and, therefore, does not have a reset value.

Alternative B represents the scheduled repair maintenance strategy of replacing grease lines and pintle ball bushings every maintenance interval. This strategy for pintles has a 4-year reset value the first iteration, a 3-year reset value the second iteration and a 2-year reset value the third iteration. This is due to only replacing specific components and not replacing the entire pintle assembly as represented in an immediate or scheduled rehabilitation strategy.

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Figure 12. Annual Hazard Rate for Upstream Pintles

Redacted figure

Figure 13. Annual Hazard Rate for Downstream Pintles

5.2. Quoins

This Weibull distribution uses two parameters, MTTF or α and β which is the shape of the distribution. For this Weibull model, α is normally around 65 and β is normally around 4 based on other quoins in the Corps inventory with similar configurations/conditions. OCA ratings are based on conditions that are observed. When a component cannot be adequately observed, it is extremely difficult to downgrade below a B rating—this is the case for the quoins. The concern is failure of critical miter gate components can cause an inoperable gate, which leaves the chamber inoperable. Terry has a single lock chamber, so inability to operate the chamber for an extended period of time would result in navigation impacts. The Weibull parameters for the upstream and downstream quoins were adjusted for a "C" OCA rating due to excessive popping at the miter/quoin end as well as the measured elevation difference. "Notice that there is 0.007 feet difference between the elevation closed and closed for 2006 to 2008. This should be the same elevation, but we could expect a change of 0.001 or 0.002." Numerous reliability models were generated using various α and β values. The final α and β values were selected that produced a distribution curve that accurately reflected the current quoin condition and compared to other quoin projects. The final values are presented in the following table.

Based on these Weibull parameters, the values for the quoins are shown in Table 4.

Table 4. Weibull Parameters for Quoins

Redacted table

The annual hazard rate is calculated using the Weibull parameters for the quoins using the formula:

$$h(t) = \frac{\beta(t)^{\beta-1}}{\alpha^{\beta}}$$

Equation 2. Annual Hazard Rate for Quoins

The annual hazard rate curve is shown in Figure 14 for the quoins. These hazard rates were entered in the event tree as discussed in the section below.

Alternative A represents the advanced maintenance strategy of fixing cracks and applying Belzona every maintenance interval; however, it was determined that there is not an additional advanced maintenance task that can be performed beyond what we have historically been completed. This project is currently being maintained at the advanced maintenance level of maintenance. This means the WOPC (With-Out Project Condition also referred to as the “fix as fails” or “status quo” option) aligns with the advanced maintenance strategy and, therefore, does not have a reset value.

Alternative B represents the scheduled repair maintenance strategy of machine fixing the cracks and leveling every maintenance interval. This strategy for quoins has a 4-year reset value the first iteration, a 3-year reset value the second iteration and a 2-year reset value the third iteration. This is due to only replacing specific components and not replacing the entire assembly as represented in an immediate or scheduled rehabilitation strategy.

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Figure 14. Annual Hazard Rate for Upstream and Downstream Quoins

5.3. Miter Gates

This Weibull distribution uses two parameters, MTTF or α and β which is the shape of the distribution. For this Weibull model, α is normally around 53 and β is normally around 3.5 based on other miter gates in the Corps inventory with similar configurations/conditions. The final α and β values were selected by use of the HWELD model (reference Section 8 for HWELD results) that produced a distribution curve that accurately reflected the current miter gate condition and compared to other miter gate projects. The final values are presented in the following table.

Based on these Weibull parameters, the values for the miter gates are shown in Table 5.

Table 5. Weibull Parameters for Miter Gates

Redacted table

The annual hazard rate is calculated using the Weibull parameters for the miter gates using the formula:

$$h(t) = \frac{\beta(t)^{\beta-1}}{\alpha^{\beta}}$$

Equation 3. Annual Hazard Rate for Miter Gates

The annual hazard rate curve is shown in Figure 15 and Figure 16. These hazard rates were entered in the event tree as discussed in the section below.

Alternative A represents the advanced maintenance strategy of replacing cracked welds and fixing bubblers every maintenance interval. This strategy for miter gates has a 2-year reset value the first and second iterations, a 1-year reset value the third and fourth iterations and a 0-year reset value the fifth iteration. This type of fix has been observed on the MKARNS throughout the years.

Alternative B represents the scheduled repair maintenance strategy of replacing cracked welds, bent members, and sandblast/paint every maintenance interval. This strategy for miter gates has a 4-year reset value the first iteration, a 3-year reset value the second iteration and a 2-year reset value the third iteration. This is due to only replacing specific components and not replacing the entire assembly as represented in an immediate or scheduled rehabilitation strategy.

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Figure 15. Annual Hazard Rates for Upstream Miter Gates

Redacted figure

Figure 16. Annual Hazard Rates for Downstream Miter Gates

5.4. Miter Gate Anchorages

This Weibull distribution uses two parameters, MTTF or α and β which is the shape of the distribution. For this Weibull model, α is normally around 70 and β is normally around 4.3 based on other miter gate anchorages in the Corps inventory with similar configurations/conditions. Numerous reliability models were generated using various α and β values. The final α and β values were selected that produced a distribution curve that accurately reflected the current miter gate anchorage condition and compared to other miter gate anchorage projects. The final values are presented in the following table.

Based on these Weibull parameters, the values for the miter gate anchorages are shown in Table 6.

Table 6. Weibull Parameters for Miter Gate Anchorages

Redacted table

The annual hazard rate is calculated using the Weibull parameters for the anchorages using the formula:

$$h(t) = \frac{\beta(t)^{\beta-1}}{\alpha^{\beta}}$$

Equation 4. Annual Hazard Rate for Miter Gate Anchorages

The annual hazard rate curve is shown in Figure 17. These hazard rates were entered in the event tree as discussed in the section below.

Alternative A represents the advanced maintenance strategy; however, it was determined that there is not a viable advanced maintenance task that can be performed and therefore this was not included.

Alternative B represents the scheduled repair maintenance strategy of repairing any cracks on the exposed anchorage as well as sand blast/paint every maintenance interval. This strategy for miter gate anchorages has a 4-year reset value the first iteration, a 3-year reset value the second iteration and a 2-year reset value the third iteration. This is due to only being able to perform minimal scheduled repair maintenance tasks.

Redacted figure

Figure 17. Annual Hazard Rate for Miter Gate Anchorages

5.5. Event Trees

5.5.1. Pintle Event Tree

Event trees were constructed which model various sequences of events which are differentiated by severity and tie them to consequences. The tree's progress from left to right and are initiated by an event which in this case is the failure of a pintle. The probability of this event occurring is given by the hazard curve. The results with rough order of magnitude estimates of repairs and service outages were then used in the economic modeling. The intent for the event trees were to model the reliability of the pintle with the hazard curve to capture the appropriate amount of risk. However, at the first failure out of the upstream or downstream set, both pintles would be replaced in the same closure to reduce the number of closures in order to measure the navigation impact over the study period.

The following will describe the event, reasoning, and methodology for each event after a pintle fault or failure in the event tree in Figure 18.

5.5.2. Pintle Failure

The probability of the pintle or its various components experiencing a fault is based on the annual hazard rate (AHR). The hazard rate of the pintle includes the pintle base, pintle ball, pintle bushing and pintle socket (pintle cap). The probability that the pintle is performing as designed is equal to 1-AHR.

5.5.3. P(Event)

Pintles can fail in various levels of severity. For this study the severity of the failure is captured by the p designation in the event tree. For the p1 event, the bushing and pintle ball fail and require replacement. In this event the lock would require to be dewatered and the miter gate jacked in order for the required components to be replaced. For the p2 event, the pintle socket, bushing, and pintle ball require replacement. In this event the lock would be dewatered, the miter gate pulled, the required components replaced and then the gate reinstalled. For the p3 event, the pintle base, pintle ball, bushing, and pintle socket require replacement. In this event the lock would be dewatered and segmental temporary gates installed to allow navigation to continue. The existing miter gates would be placed on land and repaired as necessary. Once the gates are repaired, another dewater would occur to allow reinstallation of these gates.

5.5.4. Dewatering

Regardless of the level of severity to the pintles, the chamber will require dewatering to repair the pintle and the various components. Underwater repair was deemed impractical to repair any of the various pintle components.

5.5.5. Segmental Gate

The most severe failure mode (p3) includes the use of a segmental gate that is currently stored at the Dardanelle Marine Terminal in Russellville, Arkansas. A separate branch (p3a & p3b) was included to capture the possibility that the segmental gate would not function as anticipated. Additional time was added to the p3b event to capture this possibility.

5.5.6. Lock Closure

In the event tree (see Figure 18), lock closure consequences are realized after a pintle failure. Under p1 and p2 branches of the event trees, a pintle failure would result in a lock closure and under p3 branch a failure would result in the chamber being dewatered twice. Under p3 branch, the pintle failure would require the first dewater where the existing miter gates would be removed, new pintles and assemblies installed, and then temporary gates installed. After the miter gates were repaired the chamber would again be dewatered. The temporary gates would be removed and then the repaired gates would be installed. The length of the lock closure is based on the anticipated days to remove and install the miter gates.

5.5.7. Post-Repair Reliability Improvement After Repair

This column in the event tree estimates the extension in life that would be expected after a failure of a pintle. In other words, it is the shift of the hazard curve to the right after a component repair. It was assumed if the pintle is replaced its life is reset to 1 (“new” condition).

5.5.8. Repair Cost Estimates

The following are Rough Order of Magnitude (ROM) estimates after a failure for each branch of the event tree. A 50 percent emergency cost to M&S and rentals was assumed and 50 percent contingency.

Redacted figure

Figure 18. Upstream and Downstream Pintle Event Tree Repair Strategies

5.6. Quoin Event Tree

Event trees were constructed which model various sequences of events which are differentiated by severity and tie them to consequences. The tree's progress from left to right and are initiated by an event which in this case is failure of one of the quoins. The probability of this event occurring is given by the hazard curve. The results with rough order of magnitude estimates of repairs and service outages were then used in the economic modeling. The intent for the event trees were to model the reliability of the quoin with the hazard curve to capture the appropriate amount of risk.

The following will describe the event, reasoning, and methodology for each event after a quoin fault or failure in the event tree in Figure 19 and Figure 20.

5.6.1. Quoin Failure

The probability of the quoin or its various components experiencing a fault is based on the annual hazard rate (AHR). The hazard rate for the quoin includes the contact block. The probability that the quoin is performing as designed is equal to 1-AHR.

5.6.2. P(Event)

Quoins can fail in various levels of severity. For this study the severity of the failure is captured by the p designation in the event tree. For the p1 event, the failure of the contact block results in temporary lock closure. For the p2 event, the contact block failure leads to a gate failure.

5.6.3. Dewatering

Regardless of the level of severity to the quoins, the chamber will require dewatering to repair the quoin/contact block. Underwater repair was deemed impractical to repair the quoin/contact block.

5.6.4. Lock Closure

In the event tree (see Figure 17 and Figure 18), lock closure consequences are realized after a quoin failure. Under the branches of the event trees, a quoin failure would result in a lock closure and result in the dewatering of the chamber. The length of the lock closure is based on the anticipated days to repair the contact block and/or miter gate.

5.6.5. Post-Repair Reliability Improvement After Repair

This column in the event tree estimates the extension in life that would be expected after a failure of a quoin. In other words, it is the shift of the hazard curve to the right after a component repair. It was assumed if the quoin is repaired (p1) it reset the component life by 4 years for the first repair occurrence, 3 years for the second, 2 years for the third and 1 year for the fourth. With each maintenance occurrence the duration of closure would increase due to the increased complexity of the work to be performed. If the quoin is replaced its life is reset to 1 ("new" condition).

5.6.6. Upstream Repair Cost Estimates

The following are Rough Order of Magnitude (ROM) estimates after a failure for each branch of the event tree. A 50 percent emergency cost to M&S and rentals was assumed and 50 percent contingency.

Figure redacted

Figure 19. Upstream Quoin Event Tree Repair Strategies

5.6.7. Downstream Repair Cost Estimates

The following are Rough Order of Magnitude (ROM) estimates after a failure for each branch of the event tree. A 50 percent emergency cost to M&S and rentals was assumed and 50 percent contingency.

Figure redacted

Figure 20. Downstream Quoin Event Tree Repair Strategies

5.7. Miter Gate Event Tree

Event trees were constructed which model various sequences of events which are differentiated by severity and tie them to consequences. The tree's progress from left to right and are initiated by an event which in this case is failure of a at the miter gates. The probability of this event occurring is given by the hazard curve. The results with rough order of magnitude estimates of repairs and service outages were then used in the economic modeling. The intent for the event trees were to model the reliability of the miter gate with the hazard curve to capture the appropriate amount of risk.

The following will describe the event, reasoning, and methodology for each event after a miter gate fault or failure in the event tree in Figure 21 and Figure 22.

5.7.1. Miter Gate Failure

The probability of the miter gate experiencing a fault is based on the annual hazard rate (AHR). The probability that the miter gate is performing as designed is equal to 1-AHR.

5.7.2. P(Event)

Miter gates can fail in various levels of severity. For this study the severity of the failure is captured by the p designation in the event tree. For the p1 event, cracks develop in the miter gate which require repair. For the p2 event, the miter gate fails and for the p3 event the miter gate fails along with the pintle.

5.7.3. Dewatering

Regardless of the level of severity to the miter gates the chamber will require dewatering to repair the miter gate. Underwater repair was deemed impractical for repairs.

5.7.4. Segmental Gate

The p2 and p3 event tree includes the use of a segmental gate that is currently stored at the Dardanelle Marine Terminal in Russellville, Arkansas. A separate branch (p2b & p3b) was included to capture the possibility that the segmental gate would not function as anticipated. Additional time was added to the p3b event to capture this possibility.

5.7.5. Lock Closure

In the event tree (see Figure 21 and Figure 22), lock closure consequences are realized after a miter gate failure. Under the p2 and p3 branches of the event trees, a miter gate failure would result in a lock closure and result in dewatering the chamber twice. The first dewater would result from the miter gate failure and would require the removal of the existing miter gates and the installation of temporary gates. After new miter gates were manufactured the chamber would again be dewatered. The temporary gates would be removed and then the new manufactured gates would be installed. The length of the lock closure is based on the anticipated days to remove and install the miter gates.

5.7.6. Post-Repair Reliability Improvement After Repair

This column in the event tree estimates the extension in life that would be expected after a failure of a miter gate. In other words, it is the shift of the hazard curve to the right after a component repair. It was assumed if the miter gate is replaced its life is reset to 1 ("new" condition).

5.7.7. Upstream Repair Cost Estimates

The following are Rough Order of Magnitude (ROM) estimates after a failure for each branch of the event tree. A 50 percent emergency cost to M&S and rentals was assumed and 50 percent contingency.

Figure redacted

Figure 21. Upstream Miter Gate Event Tree Repair Strategies

5.7.8. Downstream Repair Cost Estimates

The following are Rough Order of Magnitude (ROM) estimates after a failure for each branch of the event tree. A 50 percent emergency cost to M&S and rentals was assumed and 50 percent contingency.

Figure redacted

Figure 22. Downstream Miter Gate Event Tree Repair Strategies

5.8. Miter Gate Anchorage Event Tree

Event trees were constructed which model various sequences of events which are differentiated by severity and tie them to consequences. The tree's progress from left to right and are initiated by an event which in this case is failure of a at the miter gate anchorages. The probability of this event occurring is given by the hazard curve. The results with rough order of magnitude estimates of repairs and service outages were then used in the economic modeling. The intent for the event trees were to model the reliability of the miter gate anchorage with the hazard curve to capture the appropriate amount of risk. However, at the first failure out of the upstream or downstream set, both miter gate anchorages would be replaced in the same closure to minimize the number of closures and therefore the navigation impact over the study period.

The following will describe the event, reasoning, and methodology for each event after a miter gate anchorage fault or failure in the event tree in Figure 23.

5.8.1. Miter Gate Anchorage Failure

The probability of the miter gate anchorage or its various components experiencing a fault is based on the annual hazard rate (AHR). The hazard rate of the miter gate anchorage includes the miter gate anchorage base, miter gate anchorage ball, miter gate anchorage bushing and miter gate anchorage socket (miter gate anchorage cap). The probability that the miter gate anchorage is performing as designed is equal to 1-AHR.

5.8.2. P(Event)

Miter gate anchorages can fail in various levels of severity. For this study the severity of the failure is captured by the p designation in the event tree. For the p1 event, the structural beams and/or link arms fail and require replacement. In this event, repairs would be completed without a dewater while the gates are pinned back to ensure no load. For the p2 event, the miter gate anchorage require replacement along with minor repairs to the miter gate. In this event, the failure would result in the gate leaf hanging in the chamber. This will require a dewater to replace the anchorage and repair the existing gate leaf. For the p3 event, the miter gate anchorage require replacement along with significant damage to the miter gate. In this event, the failure would result in the gate falling off into the chamber causing damage to the gate. The temporary segmental gate would be installed to allow navigation to pass while the existing gate would be repaired on land. Once the repairs are complete, the gate would be reinstalled.

5.8.3. Dewatering

Regardless of the level of severity to the miter gate anchorages the chamber will require dewatering to repair the miter gate anchorage and the various components. Underwater repair was deemed impractical to repair any of the various miter gate anchorage components.

5.8.4. Segmental Gate

The most severe failure mode (p3) includes the use of a segmental gate that is currently stored at Dardanelle Marine Terminal in Russellville, Arkansas. A separate branch (p3a & p3b) was included to capture the possibility that the segmental gate would not function as anticipated. Additional time was added to the p3b event to capture this possibility.

5.8.5. Lock Closure

In the event tree (see Figure 23), lock closure consequences are realized after a miter gate anchorage failure. Under the branches of the event trees, a miter gate anchorage failure would result in a lock closure. P2 and P3 events would result in lock dewaters. For the p3 events, the miter gate anchorage failure would require the removal of the existing miter gates and the installation of temporary gates. New miter gate anchorages and assemblies would be installed prior to the installation of the temporary gates. After the existing miter gates are repaired, the chamber would again be dewatered. The temporary gates would be removed and then the repaired gates would be installed. The length of the lock closure is based on the anticipated days to remove and install the miter gates.

5.8.6. Post-Repair Reliability Improvement After Repair

This column in the event tree estimates the extension in life that would be expected after a failure of a miter gate anchorage. In other words, it is the shift of the hazard curve to the right after a component repair. It was assumed if the miter gate anchorage is replaced its life is reset to 1 ("new" condition).

5.8.7. Repair Cost Estimates

The following are Rough Order of Magnitude (ROM) estimates after a failure for each branch of the event tree. A 50 percent emergency cost to M&S and rentals was assumed and 50 percent contingency.

Figure redacted

Figure 23. Miter Gate Anchorage Event Tree Repair Strategies

6 Repair Strategies

As part of this MRER study, the PDT analyzed the potential scenarios using the NIM model. Based on the results, the use of coffer cells followed by planned 110-foot stoplog conversion showed to be the optimized condition. As a result, the No-action alternative (coffer cells followed by planned 110-foot stoplog conversion) is the baseline to which all other alternatives are compared. As discussed previously, in the event of an unexpected failure of any component included in the MRER, this method would set coffer cells to dewater the lock chamber and repair a component or install a temporary fix in year 1, followed by a planned closure in the second year where crews would cut slots, install metal inserts and modify the sill. Any additional dewatering for additional component repairs would entail the use of 110-foot stop logs and would be the most economical strategy in an unplanned failure of any component.

Figure redacted

Figure 24. Annual Hazard Rate Upstream All Components

Figure redacted

Figure 25. Annual Hazard Rate Downstream All Components

6.1. Immediate Rehabilitation

Under an Immediate Rehabilitation Strategy, the project is restored to ensure project functions or outputs immediately; in this case beginning in FY 2025 with the end state of replacing all lock components selected for the MRER (downstream and upstream).

6.1.1. Immediate Rehabilitation and with Dewater With 110-foot Stop Log Conversion

Work would begin in 2025 (year 1) with the procurement of the metal inserts for the 110-foot stoplog slots and the design of all identified components for rehabilitation. The 110-foot stoplog conversion slot cutting would commence in 2026 (year 2) by use of the one-sided approach which will allow 2 wide tows to navigate the lock for the 150 days required for cutting. After slot cutting, regular navigation would commence for several months and then the lock would close for an additional 35 days to conduct sill work. Starting in 2027 (year 3), the upstream and downstream miter gates and other identified components would be fabricated. In 2030 (year 6), the lock would close for 60 days during the off-peak navigation season (typically July through August) to replace all upstream and downstream components including miter gates. All required fabrication and acquisition of materials would occur in years 3 through 5. This alternative would reset the hazard function for all components to their original state (approximately zero).

Design and Construction Schedule

Table 7. Schedule for Immediate Rehab with 110-Foot Stop Log Conversion

Year	Task
2025	Procurement of metal inserts for 110-foot stoplog slots. Design all identified components for rehabilitation.
2026	Complete the 110-foot stop log conversion.
2027	Fabricate upstream and downstream miter gates and other identified components.
2030	Replace all upstream and downstream components

6.1.2. Immediate Rehabilitation and Dewater With Coffer Cells

Work would begin in 2025 with component fabrication for all components selected for the MRER. Dewatering and component installation would occur in 2026 with a 157-day full closure of the lock. This alternative would reset the hazard function for all components to their original state (approximately zero).

Design and Construction Schedule

Table 8. Schedule for Immediate Rehab with Coffer Cells

Year	Task
2025-2027	Design and fabricate components for rehab.
2028	Install components.

6.2. Scheduled Rehabilitation

Under a Scheduled Rehabilitation Strategy, the project is restored to ensure projects functions or outputs at optimum times based on the NIM modeling.

6.2.1. Scheduled Repairs and Dewater With 110-foot Stop Log Conversion

Work would begin in 2025 (year 1) with the procurement of the metal inserts for the 110-foot stoplog slots and the design of all identified components for rehabilitation. The 110-foot stoplog conversion slot cutting would commence in 2026 (year 2) by use of the one-sided approach which will allow 2 wide tows to navigate the lock for the 150 days required for cutting. After slot cutting, regular navigation would commence for several months and then the lock would close for an additional 35 days to conduct sill work. Starting in 2027 (year 3), the upstream and downstream miter gates and other identified components would be fabricated. After year 3, the project's components would be replaced over the 3-year period.

6.2.2. Scheduled Repairs and Dewater with Coffer Cells

Under a Scheduled Rehabilitation Strategy, each time the NIM modeling states optimal timing to replace a component, coffer cells would need to be constructed. Immediately following that component replacement, the coffer cells would be removed to allow traffic to transit.

6.3. Advanced Maintenance Alternative

The definition of an advanced maintenance strategy from ER-1105-2-100, "Advance maintenance consists of expenditures in excess of routine O&M that reduces the likelihood of some emergency repairs and temporary service losses, or the rate of service degradation. Under this scenario, one must evaluate the effect that probabilities and consequences of the strategy have on expected service disruptions and reliability."

6.3.1. Advanced Maintenance and Dewater with 110-foot Stop Log Conversion

The Advanced Maintenance Strategy would repair components for which expenditures are in excess of routine O&M. This alternative starts in 2025 with design, followed by the 110-foot stoplog conversion (defined in Alternative 2A) in 2026, and then the first iteration of repair work starts in 2028. Scheduled repairs would occur every 10 years starting in year 2028 and would include the following tasks: repair cracked welds, replace grease lines, apply Belzona (quoins) and replace bubblers (miter gates). Scheduled repair interval 1 (year 2028) would reset the probability failure by 2 years and would close the lock for 14 days. Scheduled repair interval 2 (year 2038) would also reset the probability failure by 2 years but would close the lock for 16 days. The increase in days is due to only resetting the probability failure by 2 years in interval 1. This means that more repairs are likely to be needed each time it is dewatered for scheduled repairs since the components are not replaced with new components. The reset value and duration of closure for iterations 1-5 are depicted in the table below.

Table 9. Advanced Maintenance Strategy Reset Values and Duration of Closures

Iteration	Year	Reset Value	Closure Duration
1	2028	2	14 days
2	2038	2	16 days
3	2048	1	18 days
4	2058	1	20 days
5	2068	0	22 days

Based on engineering judgment coupled with historical data collected from Terry L&D, the reset value is set to decrease as the number of iterations of scheduled repairs are executed (i.e., the reliability of the components decreases over time even with advance maintenance). Recognizing that reliability decreases over time causes an increase in time needed to conduct repairs due to increased complexity of the repairs, which ultimately increases the cost.

Design and Construction Schedule

Table 10. Schedule for Advanced Maintenance with 110-foot Stop Log Conversion

Year	Task
2025	Procurement of metal inserts for 110-foot stoplog slots. Design all identified components for rehabilitation.
2026	Complete the 110-foot stop log conversion.
2028	Advanced maintenance repairs
2038	Advanced maintenance repairs
2048	Advanced maintenance repairs
2058	Advanced maintenance repairs
2068	Advanced maintenance repairs

6.3.2. Advanced Maintenance and Dewater with Coffer Cells

This maintenance strategy is identical to the strategy depicted in 6.3.1 with the exception of the dewatering method. Dewatering would require stetting coffer cells for each maintenance iteration.

6.4. Scheduled Repair Alternative

According to ER-1105-2-100, the Scheduled Repair Alternative should “Assess the components of the feature in terms of the service disruption probabilities and consequences to the reliability of the structure. Based on this assessment, stockpile replacement parts and make other preparations on this assessment to reduce the time of expected project service disruption.”

6.4.1. Scheduled Repair Alternative and Dewater With 110-Foot Stop Log Conversion

Repairs focus on reducing the likelihood of some emergency repairs, temporary service losses, and/or the rate of service degradation. Scheduled repairs would involve repairing cracked welds, replacing bent members (miter gates), and sand blast and paint components every 20 years starting in year 2028. This alternative starts in 2025 with design, followed by the 110-foot stoplog conversion (defined in Alternative 2A) in 2026, and then the first iteration of repair work starts in 2028. The first scheduled repair interval would reset the probability failure by 4 years. Each advanced maintenance interval after would have a probability failure of one less than the previous iteration. The maintenance period for the first iteration of advanced maintenance would close the lock for 21 days. The reset value and duration of closure for iterations 1 to 3 are depicted in the table below.

Table 11. Scheduled Repair Strategy Reset Values and Duration of Closures

Iteration	Year	Reset Value	Closure Duration
1	2028	4	21 days
2	2048	3	26 days
3	2068	2	31 days

Based on engineering judgment coupled with historical data collected from Terry L&D, the reset value is set to decrease as the number of iterations of advanced maintenance repairs are executed (i.e., the reliability of the components decreases over time even with scheduled repairs). Reliability or reset values decrease over time for repairs, and as a result, repairs take longer and cost more

Design and Construction Schedule

Table 12. Schedule for Scheduled Repair with 110-foot Stop Log Conversion

Year	Task
2025	Procurement of metal inserts for 110-foot stoplog slots
2026	Complete the 110-foot stop log conversion
2028	Scheduled maintenance repairs
2048	Scheduled maintenance repairs
2068	Scheduled maintenance repairs

6.4.2. Scheduled Repair Alternative and Dewater with Coffer Cells

This maintenance strategy is identical to the strategy depicted in 5.4.1 with the exception of the dewatering method. Dewatering would require stetting coffer cells for each maintenance iteration.

7 Economic Considerations

7.1. Federal Interest

Terry L&D is an integral part of the MKARNS that ensures efficient inland navigation. On average, the MKARNS moves about 12 million tons of cargo per year. An extended outage at Terry L&D would be significant given that about 85 percent of traffic on the MKARNS is throughput, which means the traffic enters or exits the system from the Mississippi River. USACE maintains a nine-foot depth in the navigation channel at Terry L&D. Other beneficial uses include recreational boating, fishing access, and shoreline recreation.

7.2. Without Project Condition
7.2.1. Existing Navigation

At river mile 108.1, Terry L&D is downstream of the systems major ports such as the Port of Little Rock in Arkansas and the Port of Catoosa near Tulsa, Oklahoma. As is the case with all MKARNS lock and dams, Terry L&D has one 600-foot long and 110-foot chamber. From 2010 through 2018, tonnage moving through the project has averaged about 8.3 million tons per year with a high of 9.1 million in 2013 to a low of 7.3 million in 2015, although in 2015 the low value was partially due to major flooding in the peak season for upbound fertilizer shipments (winter). Similarly, in 2019, traffic declined substantially to 5.4 million tons due to historic flooding on the MKARNS, which closed most locks for at least 2 months and some nearly 4 months. The Economics Appendix contains details regarding types of commodities shipped through the lock and historical traffic trends.

7.2.2. Existing Condition of Lock Components

The Engineering Appendix and discussion in the main report detail existing state of lock components via Operational Condition Assessment (OCA) reviews, results of Periodic Inspections, and other historical data. Based on these data and a screening assessment, the PDT and leadership identified the following upstream and downstream lock systems for the major rehabilitation study including miter gates, pintles, quoins and anchorages. Note that all of the components for either the upstream or downstream gates are a system.

7.3. Future Without Project Condition

The Without Project Condition (WOPC) or No Action alternative serves as the baseline to which the PDT compares alternatives during plan evaluation. The WOPC is a reactive or “fix as fails” strategy meaning that SWL continues maintaining the lock and dam as it has in the past using inspections and repairs funded by the SWL annual Operation and Maintenance (O&M) budgets. The WOPC includes:

- Developing baseline stochastic event trees (i.e., failure modes) for each component selected for the MRER along with repair costs and duration of lock outages;
- Estimating time dependent hazard functions for baseline failure modes that measure how the risk of component failure increases over the period of analysis;
- Projections of future traffic through the Terry L&D over the period of analysis; and,
- Lock capacity curves.

Each of the above items are key inputs into the USACE Navigation Investment Model (NIM), a risk-based life cycle cost and benefit analysis model developed and maintained by the PCXIN-RED and Oak Ridge National Laboratory. NIM incorporates both engineering and economic data. Engineers conduct a quantitative risk assessment that captures the probability that components will fail through time, expected lock closures in the event of a random failure, and the financial costs needed to make the lock operational again. Economists then monetize the impacts of a closure to the navigation industry with NIM in terms of delays and/or rerouting of cargo to higher cost land modes of transportation. Navigation impacts avoided by implementing alternatives and reductions in implementation costs are the benefits applied to determine a National Economic Development (NED) plan.

7.3.1. Traffic Projections

The methodology for estimating future traffic is straightforward and typical of USACE studies where future estimates are driven long-term growth rates from secondary sources such as the U.S. Department of Agriculture Economic Research Service, and U.S. Energy Information Administration. Methods were developed as part of the *Three Rivers Arkansas River Navigation Study* (General Investigation per WRDA) and have undergone both Agency Technical Review and Independent External Peer Review, and follow procedures outlined in the USACE Planning Guidance Notebook.

Projections run through 2080, and the baseline is a three-year average of 2016, 2017, and 2018. From 2023 through 2083, mid-point forecasts indicate that tonnage through David D. Terry L&D may grow from about 8.3 million per year tons to 12.7 million (an increase of 84 percent) at rate of 0.8 percent per year. Projections are stochastic, and shown in Figure 26 range from a low (95 percent chance exceedance in a given year) to a high (5 percent chance of exceedance in a given year). The mid-point (50 percent chance of exceedance) was applied for the NED metrics applied in plan selection; however, sensitivity analysis for different percentiles is presented in subsequent sections of this chapter. The Economics Appendix details the methodology for traffic forecasts.

Traffic projections are assumed constant for both the WOPC and plan alternatives. In other words, traffic demand inelastic and there is no induced traffic from implementing an alternative plan.

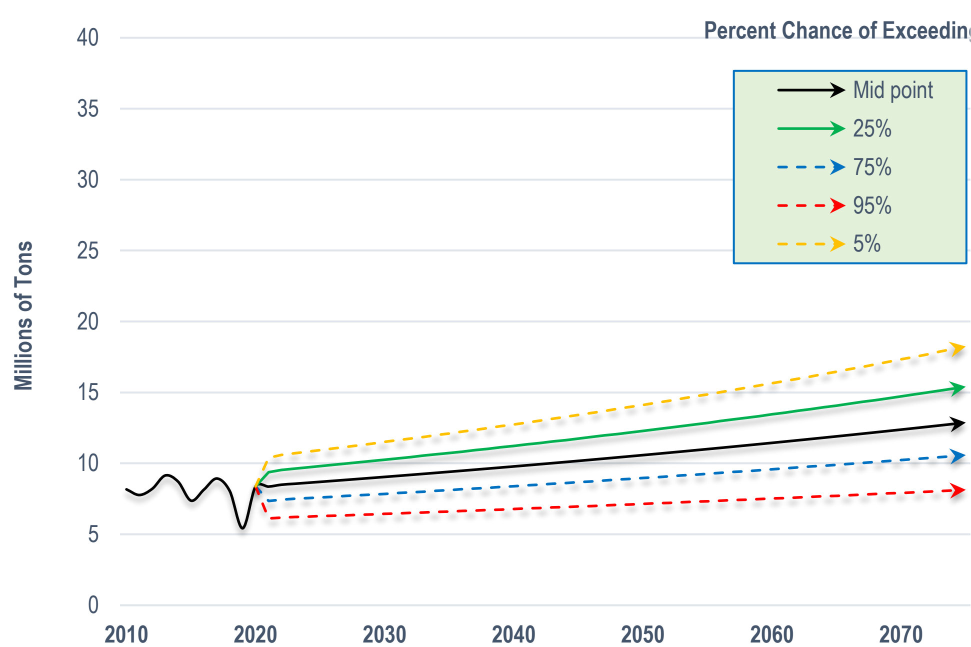


Figure 26. Historical and Projected Traffic through the David D. Terry Lock and Dam
(2010 through 2071, millions of tons)

Data source: U.S. Army Corps of Engineers Waterborne Commerce Statistics Center, and the USACE Lock Performance Monitoring System.

7.4. Alternative Plans Evaluated

Engineering Pamphlet (EP) 1130-2-500, Appendix B, page B-6, specifies four strategies for investment that the USACE should use evaluating MRER alternatives:

- **Immediate Rehabilitation** involves replacing economically justified components as soon as possible with due consideration of project operations and general priorities of the district.
- **Scheduled Rehabilitation** involves replacing economically justified components at the "optimum" times (2 closures) which will be based on outputs from the economic modeling.
- **Advance Maintenance** involves repairing components for which expenditures are in excess of routine O&M. Repairs focus on reducing the likelihood of some emergency repairs, temporary service losses, and/or the rate of service degradation.
- **Scheduled Repair** involves repairing components in terms of service disruption probabilities and reliability of the structure. Repairs focus on reducing the consequences of failures and may include stockpiling replacement parts to reduce the time of expected service disruption.

Formulation of an initial array of alternatives follows EP 1130-2-500 with the addition of a No-action alternative.

7.4.1. Initial Array of Alternatives

Unlike many other USACE planning studies, alternative formulation for a MRER is relatively rigid. There are only a handful of ways to address rehabilitation unlike an ecosystem restoration or flood risk management study where a number of management measures can be combined into alternative plans. Rehabilitation plans are straight forward in that USACE either replaces worn components or does not. The only variable may involve timing or in some cases costs. The final array of alternatives for the Terry L&D MRER satisfies the four strategies for investment outlined in EP 1130-2-500 with the difference among the alternatives involving timing and whether components are fully rehabilitated versus advanced maintenance or scheduled repairs.

No-action Alternative (WOPC)

As part of the study, the PDT analyzed the WOPC scenarios described in Baseline Failure Modes in the WOPC using the NIM model. Based on the results, WOPC 2 (coffer cells followed by planned 110-foot stoplog conversion) showed to be the optimized condition. NIM results showed that the annualized costs to both the navigation industry and the USACE was $381 million for WOPC 1, $273 million for WOPC 3, versus about $250 million for WOPC 2. As a result, the No-action alternative (coffer cells followed by planned 110-foot stoplog conversion) is the baseline to which all other alternatives are compared. As discussed previously, in the event of an unexpected failure of any component included in the MRER, the WOPC would set coffer cells to dewater the lock chamber and repair a component or install a temporary fix in year 1, followed by a planned closure in the second year where crews would cut slots, install metal inserts, and modify the sill. Any additional dewatering for additional component repairs would entail the use of 110-foot stop logs and would be the most economical strategy in an unplanned failure of any component.

Action Alternatives (WPC)

For action alternatives, plans vary based on dewatering approach and timing. Before discussing alternatives, it is important to explain "reset" value. Every alternative will impact the condition of components. In the case of a full rehabilitation, component conditions will restore to their original or new state meaning that the probability of failure resets to year zero (i.e., 1971 when the project came online). Scheduled repairs and advanced maintenance vary based on the component in question.

- **Alternative 2A (Immediate Rehabilitation via Planned 110-Foot Stoplog Conversion)** would replace all lock components selected for the MRER (downstream and upstream). Work would begin in 2025 (year 1) with the procurement of the metal inserts for the 110-foot stoplog slots and the design of all identified components for rehabilitation. The 110-foot stoplog conversion slot cutting would commence in 2026 (year 2) by use of the one sided approach (see Baseline Failure Modes in the WOPC: FWOP 2) which will allow 2 wide tows to navigate the lock for the 150 days required for cutting. After slot cutting, regular navigation would commence for several months and then the lock would close for an additional 35 days to conduct sill work. Starting in 2027 (year 3), the upstream and downstream miter gates and other identified components would be fabricated. In 2029 (year 5), the lock would close for 37 days during the off-peak navigation season (typically July through August) to replace all upstream components including miter gates. In 2030 (year 6), the lock would again close for 37 days during the off-peak navigation season to replace all downstream components including miter gates. All required fabrication and acquisition of materials would occur in years 3 through 5. This alternative would reset the hazard function for all components to their original state (approximately zero).
- **Alternative 2B (Immediate Rehabilitation via Coffer Cells Dewater)** would replace all components and work would begin in 2025 with component design and fabrication. Dewatering and construction would occur in 2028 with a 157-day full closure of the lock. This alternative would reset the hazard function for all components to their original state (approximately zero).
- **Alternative 3 Scheduled Rehabilitation** would replace components per Alternatives 1A and 1B at optimum times based on outputs from NIM modeling.
- **Alternative 4A Advanced Maintenance** would repair components for which expenditures are in excess of routine O&M. Repairs focus on reducing the likelihood of some emergency repairs, temporary service losses, and/or the rate of service degradation. This alternative starts in 2025 with design, followed by the 110-foot stoplog conversion (defined in Alternative 2A) in 2026, and then the first iteration of repair work starts in 2028. Advanced Maintenance would occur every 10 years starting in year 2028 and would include the following tasks: repair cracked welds, replace grease lines, apply Belzona (quoins) and replace bubblers (miter gates). Advanced maintenance interval 1 (year 2028) would reset the probability failure by 2 years and would close the lock for 14 days. Advanced maintenance interval 2 (year 2038) would also reset the probability failure by 2 years but would close the lock for 16 days. The increase in days is due to only resetting the probability failure by 2 years in interval 1. This means that more repairs are likely to be needed each time it is dewatered for advanced maintenance since the components are not replaced with new components. Based on engineering judgment coupled with historical data collected from Terry L&D, the reset value is set to decrease as the number of iterations of advanced maintenance are executed (i.e., the reliability of the components decreases over time even with advance maintenance). Recognizing that reliability

decreases over time causes an increase in time needed to conduct repairs due to increased complexity of the repairs, which ultimately increases the cost.

- **Alternative 4B Advanced Maintenance** is identical to 4A with the exception of dewatering method. Dewatering would require setting coffer cells for each maintenance iteration.
- **Alternative 5A Scheduled Repair** would involve repairing cracked welds, replacing bent members (miter gates), and sand blast and paint components every 20 years starting in year 2028. This alternative starts in 2025 with design, followed by the 110-foot stoplog conversion (defined in Alternative 2A) in 2026, and then the first iteration of repair work starts in 2028. The first scheduled repair interval would reset the probability failure by 4 years. Each scheduled repair interval after would have a probability failure of one less than the previous iteration. The maintenance period for the first iteration of scheduled repairs would close the lock for 21 days. Based on engineering judgment coupled with historical data collected from Terry L&D, the reset value is set to decrease as the number of iterations of scheduled repairs are executed (i.e., the reliability of the components decreases over time even with scheduled repairs). Reliability or reset values decrease over time for repairs, and as a result, repairs take longer and cost more.
- **Alternative 5B Scheduled Repair** is identical to 5A with the exception of dewatering method. Dewatering would require setting coffer cells for each maintenance iteration.

The Alternative Milestone Report (AMM) included two additional alternatives that the PDT subsequently eliminated from the initial array of alternatives:

- **Alternative 6 – Mixed Alternative** would combine two alternative strategies from alternatives 2 to 5. Downstream components would be prioritized for timing and upstream components would follow.
- **Alternative 7 – Economic Optimization** would include measures that produce the most net benefits while optimizing the timing of the component repairs or replacements throughout the entire 50-year planning analysis period. This alternative is typically used as a reference point to evaluate the timing of the other alternatives, and how work should be bundled or packaged together to maximize the amount of risk reduction.

Pending further discussion with team and SME engineers, alternative 6 was not retained given that there is no difference in the probability of failure for upstream and downstream components. Alternative 7 (economic optimization) is typically applicable if various components that are not part of a functional sub-system (i.e., miter gates) are in different states of condition. In these cases, it may be more efficient in theory to replace components in the worst state earlier, and leave other components in fix or fails state thereby deferring some costs well into the future. In the case of Terry L&D, SWL is focusing on miter gates and supporting components, and all are in similar states of decay, and an action to replace any miter gate component would require dewatering and lock closure.

7.4.2. Evaluation and Comparison of Alternative Plans

The PDT evaluated the initial array of alternatives and compared each using best professional judgement to determine which alternatives would then be fed into NIM for a final evaluation. Criteria for this round of evaluation centered on the expected probability of failure given strategy. For example, immediate rehabilitation alternatives were included in the final array to be run through NIM due to their expected effectiveness in reducing the risk of component failure. Scheduled rehabilitation alternatives were screened based on the potentially high probability of component failure. Additionally, alternatives based on advance maintenance and scheduled repair, Alternatives 4A and 5A respectively which include 110-foot stoplog conversions, were included to be run in NIM as comparisons to immediate rehabilitation alternatives. The variations of those alternatives that require coffer cells to dewater, Alternatives 4B and 5B respectively, were screened due to the expected dewater risk in the with project condition being more costly than implementing 110-foot stoplog conversion. The results of this screening are displayed in Table 13.

Table 13. Evaluation of Initial Array of MRER Alternatives for Terry Lock and Dam Components

Alternative	Screened	Rationale
Alternative 2A Immediate Rehabilitation via Planned 110-Foot Stoplog Conversion		Effectively reduces component failure risk
Alternative 2B Immediate Rehabilitation via Coffer Cells Dewater		Effectively reduces component failure risk
Alternative 3A Scheduled Rehabilitation via Planned 110-Foot Stoplog Conversion	X	High probability of component failure. Individual component rehab would require removing miter gates multiple times, which would be cost prohibitive and would require longer closure durations.
Alternative 3B Scheduled Rehabilitation via Coffer Cells Dewater	X	Cost prohibitive both in terms of dewatering and lock closure durations relative to 110-ft stoplog conversion
Alternative 4A Advance Maintenance via Planned 110-Foot Stoplog Conversion		10-year cycle to reduce probability of emergency repairs/service degradation
Alternative 4B Advance Maintenance Coffer Cells Dewater	X	Cost prohibitive both in terms of dewatering and lock closure durations relative to 110-ft stoplog conversion
Alternative 5A Scheduled Repair via Planned 110-Foot Stoplog Conversion		20-year cycle to reduce probability of emergency repairs/service degradation
Alternative 5B Scheduled Repair Coffer Cells Dewater	X	Cost prohibitive both in terms of dewatering and lock closure durations relative to 110-ft stoplog conversion

Comparison of the final array of alternatives relies on criteria specified in the four accounts established by the *Economic and Environmental Principals and Guidelines for Water and Land Resources Implantation Studies* of 1983 (P&G). On April 3, 2020, the Assistant Secretary of the Army issued a memorandum, Subject: Comprehensive Documentation of Benefits in Feasibility Studies, directing USACE to identify, analyze and maximize benefits in the NED, RED and OSE accounts and EQ. The four accounts are National Economic Development (NED), Environmental Quality (EQ), Regional Economic Development (RED), and Other Social Effects (OSE):

- **National Economic Development** (NED) capture changes in the economic value of output of goods and services for the nation as a whole.
- **Environmental Quality** (EQ) impacts include non-monetary effects on significant natural and cultural resources both beneficial and adverse.
- **Regional Economic Development** (RED) benefits consist of changes in the distribution of regional economic activity that result from alternative plans typically measured by gross regional product (income, profits, and tax revenues), and employment.
- **Other Social Effects** (OSE) account captures plan effects from perspectives that are relevant to the planning process but are not reflected in the other three accounts. Categories include urban and community impacts; life, health, and safety factors; displacements; long-term productivity and energy requirements and energy conservation.

National Economic Development Cost Benefit Analysis

NED is an important metric in selecting an MRER plan. The PDT relied on the NIM model to estimate NED benefits for each plan. Figures are in FY22 dollars, and the planning period runs from 2024 through 2080 and benefits would begin to accrue in 2030. Costs and benefits are annualized using the FY22 discount rate of 2.25 percent. Price levels and the relevant current discount rate for the recommended plan will be updated prior to publication of the final report.

Alternative Plan Costs

Project first costs for the final array of plans vary in terms of funding source and timing of implementation. Construction of Alternative 2A (Immediate Rehab with 110-foot Slot Conversion) has five key tasks involving design, fabrication, and installation of upstream and downstream lock components beginning in 2025 and ending in 2030 (Table 14). Funding would be Construction General (CG). Alternative 2B (Immediate Rehab with Coffer Cells) is similar to 2A, but does include the 110-foot slot conversion (Table 15). Coffer dams would dewater the lock. Implementation of both Alternatives 4A and 5A would rely on Operations and Maintenance (OM) funding, and would include the 110-foot stoplog conversion in 2025 and 2026. Additional expenditures for maintenance activities and scheduled repairs occur at different intervals over the period of analysis (Table 16 and Table 17). Table 18 summarizes average annual equivalent costs including interest during construction for all alternative plans.

Table 14. Construction Costs Alternative 2A (Immediate Rehab 110 Slot Conversion, $millions)

Activity	2025	2026	2027	2028	2029	2030	Total by activity
Design slot conversion and immediate rehab.	$3.87	$2.59	-	-	-	-	$6.46
110-foot stoplog conversion [1]	-	$10.43	-	-	-	-	$10.43
Fabricate miter gates	-	-	$9.79	$4.90	$4.90	-	$19.58
Install components	-	-	-	-	-	$25.02	$25.02
Total by year	$3.87	$13.02	$9.79	$4.90	$4.90	$25.02	$61.49

[1] Fabricate and install metal inserts, cut slots, and modify sills.

Table 15. Implementation Costs Alternative 2B (Immediate Rehab 110 Coffer Cells, $millions)

Activity	2025	2026	2027	2028	Total by activity
Design and fabricate components for rehab.	$11.72	$6.19	$4.90	-	$22.81
Install components	-	-	-	$25.02	$25.02
Total by year	$11.72	$6.19	$4.90	$25.02	$47.83

Table 16. Implementation Costs Alternative 4A (Advanced Maintenance, $millions)

Activity	2025	2026	2028	2038	2048	2058	2068	Total by activity
110-foot stoplog design	$1.50	-	-		-	-	-	$1.50
110-foot stoplog conversion [1]	-	$9.50	-		-	-	-	$9.50
Advanced maintenance activities	-	-	$2.30	$2.83	$3.48	$4.28	$5.27	$18.16
Total by year	$1.50	$9.50	$2.30	$2.83	$3.48	$4.28	$5.27	$29.16

[1] Fabricate and install metal inserts, cut slots, and modify sills.

Table 17. Implementation Costs Alternative 5A (Scheduled Repairs, $millions)

Activity	2025	2026	2028	2038	2048	Total by activity
110-foot stoplog design	$1.50	-	-		-	$1.50
110-foot stoplog conversion [1]	-	$9.50	-		-	$9.50
Advanced maintenance activities	-	-	$5.59	$8.47	$12.83	$26.89
Total by year	$1.50	$9.50	$5.59	$8.47	$12.83	$37.89

[1] Fabricate and install metal inserts, cut slots, and modify sills.

Table 18. With-project Condition First Costs and Average Annual Equivalent Costs for the Final Array of Alternatives ($millions)

Alternative 2A (Immediate Rehab 110 Slot Conversion)	
Construction general funds	$61.49
Operations and maintenance funds	-
Interest during construction	$2.68
Total implementation cost	$64.17
Total average annual construction costs	$2.15
Alternative 2B (Immediate Rehab with Coffer Cells)	
Construction general funds	$47.83
Operations and maintenance funds	-
Interest during construction	$1.09
Total implementation cost	$48.92
Total average annual construction costs	$1.64
Alternative 4A (Advanced Maintenance)	
Construction general funds	-

Operations and maintenance funds	$29.16
Interest during construction[1]	($5.44)
Total implementation cost	$23.71
Total average annual implementation costs	$0.79
Alternative 5A (Scheduled Repairs)	
Construction general funds	-
Operations and maintenance funds	$37.89
Interest during construction[1]	($8.69)
Total implementation cost	$29.21
Total average annual implementation costs	$0.98

Some expenditures occur after the project on-line year (i.e., negative IDC). Negative IDC is considered a negative cost rather than a cost in the benefit-to-cost ratio calculation per USACEHQ direction.

Alternative Plan Benefits

As discussed previously, alternative benefits primarily consist of avoided costs associated with unscheduled loss of service due to component failure. In Table 19 below, these impacts are reported as dis-benefits (i.e., negative) given that they reduce the total annual NED benefits of full operation of lock and dam that accrue to the nation including shippers, carriers, and U.S. consumers (transportation surplus benefits). Unscheduled repair costs are the costs to the U.S Treasury in terms of repairing components that fail. These costs are the lowest for Alternatives 2A and 2B since these plans would buy down the greatest amount of risk over the period of analysis. In other words, SWL would install brand new components.

Table 19. With-project Average Annual Equivalent Costs for Final Array of Alternatives ($millions)

	Without Project (Coffer Cells then Slot Cutting)	Alternative 2A (Immediate Rehab 110 Conversion)	Net Benefits
Transportation surplus benefits			
Full operations annual benefits (no service disruption)	$535.29	$534.29	($0.996)
Unscheduled over capacity diversions to land	($0.0017)	($0.0005)	$0.001
Unscheduled failure repair service disruptions	($13.07)	($3.52)	$9.554
Total average annual transportation surplus benefits	$522.22	$530.77	$8.559
Other annual benefits	-	-	-
Unscheduled repair costs (avoided costs versus WOPC)	$3.11	$1.21	$1.903
Total average annual benefits	-	-	$10.462
	Without Project (Coffer Cells then Slot Cutting)	**Alternative 2B (Immediate Rehab Coffer Cells)**	**Net Benefits**
Transportation surplus benefits			
Full operations annual benefits (no service disruption)	$535.29	$534.29	($0.996)
Unscheduled over capacity diversions to land	($0.001)	($0.002)	($0.001)
Unscheduled failure repair service disruptions	($13.64)	($61.80)	($48.16)
Total average annual transportation surplus benefits	$521.65	$472.49	($49.16)

Other annual benefits			
Unscheduled repair costs (avoided costs versus WOPC)	$3.03	$2.74	$0.29
Total average annual benefits	-	-	($48.87)

	Without Project (Coffer Cells then Slot Cutting)	Alternative 4A (Advanced Maintenance)	Net Benefits
Transportation surplus benefits			
Full operations annual benefits (no service disruption)	$535.29	$534.60	($0.69)
Unscheduled over capacity diversions to land	($0.002)	($0.001)	$0.001
Unscheduled failure repair service disruptions	($13.074)	($8.442)	$4.632
Total average annual transportation surplus benefits	($13.07)	($8.44)	$4.63
Other annual benefits			
Unscheduled repair costs (avoided costs versus WOPC)	$3.11	$1.69	$1.42
Total average annual benefits	-	-	$5.36

	Without Project (Coffer Cells then Slot Cutting)	Alternative 5A (Advanced Maintenance)	Net Benefits
Transportation surplus benefits			
Full operations annual benefits (no service disruption)	$535.29	$534.53	($0.76)
Unscheduled over capacity diversions to land	($0.002)	($0.001)	$0.001
Unscheduled failure repair service disruptions	($13.074)	($8.980)	$4.094
Total average annual transportation surplus benefits	($13.07)	($8.98)	$4.09
Other annual benefits			
Unscheduled repair costs (avoided costs versus WOPC)	$3.11	$1.98	$1.13
Total average annual benefits	-	-	$4.47

National Economic Development Plan

The plan with the highest net benefits is Alternative 2A (immediate rehabilitation with one sided slot cutting and 110-foot stop logs for dewatering) (Table 20).

Table 20. Updated National Economic Development Metrics for Final Array of MRER Alternatives for Terry Lock and Dam MRER*

Metrics	Alternative 2A Immediate Rehabilitation via Planned 110-Ft Stoplog Conversion	Alternative 2B Immediate Rehabilitation via Coffer Cells Dewater	Alternative 4A Advanced Maintenance via Planned 110-Ft Stoplog Conversion	Alternative 5A Scheduled Repair via Planned 110-Foot Stoplog Conversion
Plan Benefits	$10,462,000	($49,418,000)	$5,359,000	$4,466,000
Plan Costs	$2,151,000	$1,475,000	$795,000	$979,000
Net Benefits	$8,311,000	($50,894,000)	$4,564,000	$3,487,000
Benefit to Cost Ratio	4.9	-33.5	6.7	4.6

*FY 2022 dollars, planning period 2024-2078 with base year 2029 and annualized at the FY discount rate of 2.25 percent

7.4.3. Recommended NED Plan

Based on alternatives screening and NED analysis, the MRER PDT recommends Alternative 2A as the TSP based on NED benefits. The plan would restore upstream, and downstream components (miter gates pintles, quoins and miter gate anchorages) selected for the MRER to their original condition thereby greatly reducing the risk of component failure over the period of analysis. The BCR for Alternative 2A is 4.9 indicating an economically justified project.

NED Benefits Sensitivity Analysis

Sensitivity analyses in MRERs can include a wide array of metric such as hazard functions, closure durations, component composition of alternatives plans, but the amount of traffic a lock processes is major variable when estimating NED benefits. As such, traffic is a key metric for sensitivity analysis. Reasonable assumed or estimated variation in other metrics such as hazard functions (risk) or closure durations and costs (consequences) will generally fall well within the range of NED metrics for traffic projection bounds (Table 21). Traffic forecasts are stochastic with the lower bound set at a 95 percent chance of exceedance in any given year over the period of analysis. Net benefits at the lower bound are still positive at 5.62 million with a BCR of 2.6

Table 21. National Economic Development Metrics for the Range of Projected Traffic Levels Estimated for Terry Lock and Dam MRER

NED Metric	95 Percent Chance of Exceeding	75 Percent Chance of Exceeding	50 Percent Chance of Exceeding	25 Percent Chance of Exceeding	5 Percent Chance of Exceeding
Average annual tonnage over period of analysis	7.05	8.96	10.43	12.11	13.92
Net benefits	$5.62	$7.14	$10.46	$12.15	$13.97
BCR	2.6	3.3	4.9	5.6	6.5

8 Comprehensive Benefits Analysis

USACE Policy Directive memorandum from the Assistant Secretary of the Army (Civil Works) entitled *Comprehensive Documentation of Benefits in Decision Document* (January 2021) supplements the Planning Guidance Notebook (ER 1105-2-100) by requiring project teams to analyze and consider "comprehensive" project benefits (and dis-benefits if applicable) in addition to NED including regional development, environmental, and other social effects. Total benefits can be monetized and/or quantified benefits if possible or cost feasible with project budgets, along with an accounting of qualitative benefits for final arrays of project alternatives.

8.1. Regional Economic Development Benefits

Regional economic impacts are measured as changes in economic output, jobs, and income resulting from project construction and operation. The USACE Regional Economic System (RECONS) is a certified regional economic impact model, designed to provide accurate and defensible estimates of regional economic impacts and contributions associated with USACE projects, programs, and infrastructure. RECONS generates estimates simultaneously for three levels of geographic impact area: local, state, and national level.

RECONS is an input output model and social accounting matrix, which are the standard tools to conduct economic impact analysis and model the structure of regional and national economies. RECONS estimates interlinkages between consumption sectors and supply chains among different private sectors such as business, industry, and government. The end result is model that measures how expenditures or consumption in one economic sector affect other sectors. For example, if the USACE rehabilitates a lock, they would hire a construction contractor. The construction contractor would use the revenue to pay their employees and company owners or shareholders, and they would purchase materials and services from other business in a region. Thus, the original dollars spent on construction circulate through the economy via multiplier effects. Construction impacts are transitory and end when the construction is complete. On the other hand, maintenance expenditures may be recurring on a periodic basis as is the case with two alternative plans (Alternative 4A Advanced Maintenance and Alternative 5A Scheduled Repairs).

Users can specify geography for local economic impacts. Generally, local economies consist of groups of counties that form a functional economic region. Terry L&D is in the Little Rock Conway Combined Statistical Area (Figure 27). Combined Statical Areas (CSAs) represent multiple metropolitan or micropolitan areas that have an employment interchange of at least 15 percent, and are good representations of regional or local economies.

- **Output**: Total production measured by sales revenues with the exception of retail sales, which is not physical production of goods or services, but rather mercantile transactions.
- **Jobs**: Number of full-time equivalents (FTE) jobs (annual average) required by a given industry including self-employment measure on annual basis.
- **Labor Income**: Payroll cost for a given industry including annual employee compensation and benefits.
- **Value Added (Gross Domestic Product or GDP)**: Labor income as described above and corporate income, rental income, interest payments, and taxes pr fees paid by an industry to local, state and federal government. Value Added or GDP is a common measure of the size of an economy. Basically, GDP is money created by regional economic sectors that stays in the region, and does not flow out in the form of expenditures on imported goods and services or other transfers of capital outside an economy's geographic boundaries.

Table 22 displays project expenditures for the final array of alternatives less Alternative 2B that has substantial negative net NED benefits and a BCR of (-34.0) and resultant economic impacts at a local, state and national level. As discussed above, regional economic impacts capture leakages from each impact area, and multiplier effects that capture circulation of project expenditures through supply chains from purchases of goods and services needed to operate businesses and industries and spending by employees in each area. The recommended plan (Immediate Rehabilitation) maximizes regional economic benefits.

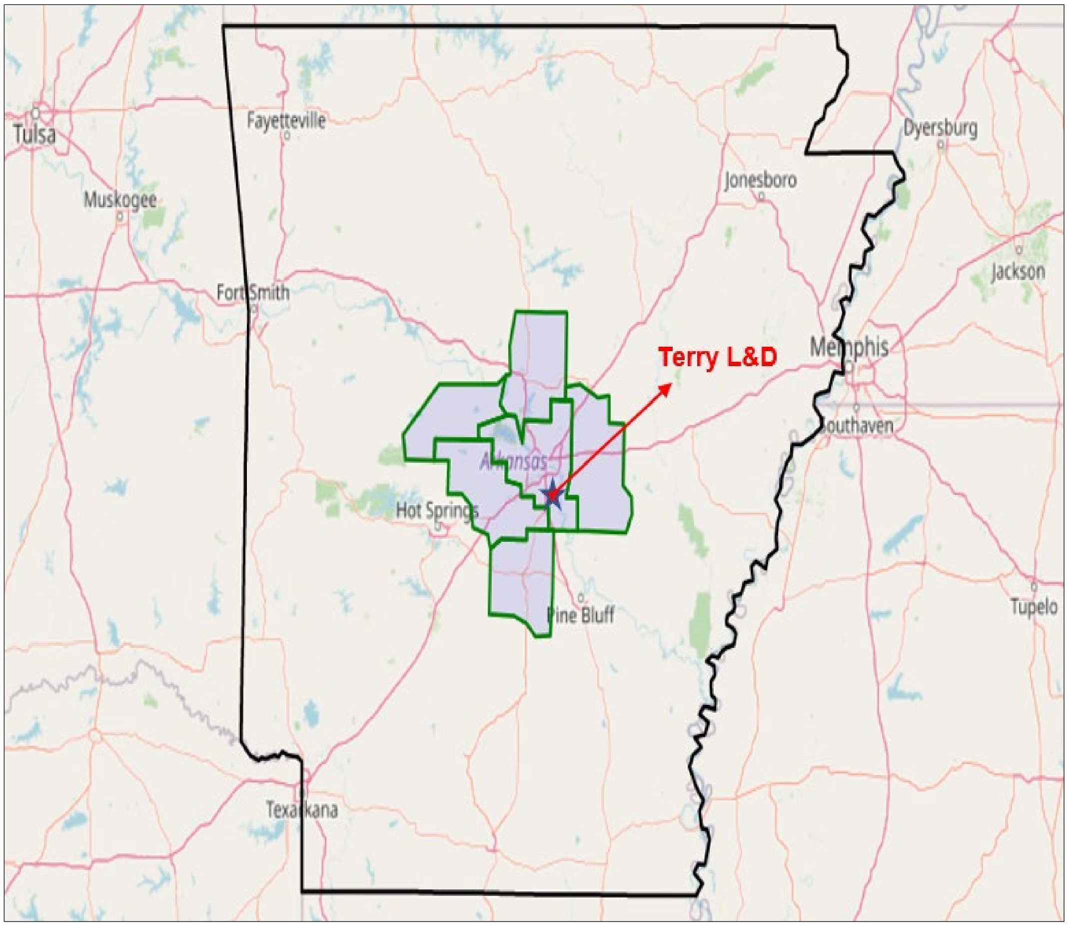


Figure 27. Little Rock Conway Combined Statistical Area (local impact area used for regional economic development benefit analysis)

Table 22. Regional Economic Impacts of Plan Implementation of Final Alternatives Arrays

Impact Area	Plan Expenditures	Regional Economic Impacts			
		Output	Jobs	Labor Income	GDP
Tentatively Selected Plan (Immediate Rehabilitation)					
Little Rock-Conway CSA	$61.5	$78.5	112	$41.7	$49.5
Arkansas	$61.5	$82.2	119	$42.8	$51.2
U.S.	$61.5	$164.2	172	$69.7	$93.6
Alternative 4A Advanced Maintenance					
Little Rock-Conway CSA	$31.2	$30.9	15	$16.2	$19.9
Arkansas	$31.2	$33.1	15	$16.9	$21.0
U.S.	$31.2	$82.9	19	$32.1	$45.5
Alternative 5A (Scheduled Repairs)					
Little Rock-Conway CSA	$39.9	$39.9	19	$20.8	$25.5
Arkansas	$39.9	$42.3	19	$21.6	$26.8
U.S.	$39.9	$106.1	24	$41.2	$58.2

8.2. Environmental Quality and Other Social Effects

For each alternative plan, study teams are required to analyze and tabulate positive and negative environmental impacts consistent with current ecosystem restoration or environmental compliance guidance. At the time of appendix preparation, environmental impacts are negligible given the small project footprint, and as result, the recommended plan is expected to qualify for a categorical exclusion under NEPA. Other social effects are often less tractable and include range of factors such urban, environmental justice, rural and community impacts; life, health, and safety factors; displacement; and long-term productivity.

From a social standpoint, any alternative would benefit communities on a local, regional, and even national level. Alternatives would help ensure efficient navigation by reducing the risk of unplanned project closures due to mechanical failure. In the absence of a plan to reduce failure risks, the MKARNS will experience ongoing closures, some of which would be substantial, resulting in lost business activity for ports and terminals, tow companies and the businesses that support them via supply chains. These businesses employ thousands of people in Arkansas and Oklahoma, when revenues from shipping on the MKARNS fall, the industry and employees suffer. Over the long term an unreliable system would also lower shipper demand as businesses who pay to have cargo moved on the river looked for more efficient and reliable routes elsewhere. So basically, a reliable waterway sustains a significant economic engine in the region, that provides jobs and income to regional workers and business owners.

9 Environmental Considerations

9.1. NEPA Framework

The proposed action has been reviewed in accordance with 33 CFR Part 230, Procedures for Implementing NEPA (ER 200-2-2); and 40 CFR Parts 1500-1508, Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA. The proposed action would constitute maintenance, repair, rehabilitation, and/or replacement of existing lock components to maintain the authorized project purpose of navigation. The Best Management Practices (BMPs) listed in Enclosure 2 to the Environmental Compliance Memorandum would avoid and minimize to the greatest extent practicable all temporary impacts to navigation user groups, as well as terrestrial and aquatic resources. There would be no adverse, permanent impacts as a result of the MRER efforts. There are no extraordinary circumstances which would dictate the need to prepare an Environmental Assessment or Environmental Impact Statement. The proposed project would meet the conditions for a Categorical Exclusion from the need to prepare NEPA documentation according to ER 200-2-2 (9) Categorical Exclusions (a):

"*Activities at completed Corps projects which carry out the authorized project purposes. Examples include routine operation and maintenance actions, general administration, equipment purchases, custodial actions erosion control, painting, repair, rehabilitation, replacement of existing structures, and facilities such as buildings, roads, levees, groins and utilities, and installation of new buildings utilities, or roadways in developed areas.*"

9.2. Environmental Impacts

The proposed action will result in no permanent adverse impacts to the human environment nor the physical environment. Several Best Management Practices (BMPs) will be implemented to avoid and minimize impacts to navigation as well as regulated and trust resources prior to, during, and after construction. Early coordination efforts with the navigation industry will minimize any disruptions caused by lock restrictions and closures as a result of the proposed actions. Boat ramp closures will be implemented only when deemed necessary during weekdays, and public access roads and parking areas will be clearly delineated to ensure recreation resources within David D. Terry East Park are not impacted by MRER construction efforts.

Five species under the Endangered Species Act may be found within the proposed project area, including the eastern black rail (threatened), piping plover (threatened), red knot (threatened), alligator snapping turtle (proposed threatened), and monarch butterfly (candidate). The U.S. Fish and Wildlife Service concurred that habitat found within the project area is only likely to support the alligator snapping turtle, which may be found in the backwaters upstream and to the east of the Terry lock where there is more debris and structure along the shorelines. While the alligator snapping turtle may be present in this area, the implementation of BMPs will equate construction-related water access to that of typical recreation that the area experiences on a regular basis, and no impacts to the alligator snapping turtle are expected. The USACE has issued a No Effect determination for all species listed in the proposed project area.

Because the proposed action involves repairing and/or replacing components within the Terry lock, this is considered a form of filling waters of the United States, and is therefore subject to Section 404 of the Clean Water Act. Existing features will be replaced and no new dredge and/or fill activities will be implemented under the proposed action. BMPs to ensure minimal impacts to water quality can be found in Enclosure 2, and a CWA Section 404(b)(1) short form analysis can be found in Enclosure 4 to the Environmental Compliance Memo. The proposed action will require a Section 401 Water Quality Certification and permit from ADEQ to allow for instream work prior to entering waters of the State.

Federal agencies are required under Section 106 of the National Historic Preservation Act (NHPA) to evaluate impacts of a proposed action on historic properties. A desktop review revealed that no archeological sites have been identified in the area, but only minimal cultural resources survey work has been performed in the vicinity. Terry Lock and Dam is over 50 years in age, and thus must be evaluated for eligibility for listing on the National Register of Historic Places prior to the proposed action to be in compliance with the NHPA. State Historic Preservation Officer coordination is pending, and documentation will be included in Enclosure 5 to the Environmental Compliance Memorandum upon completion.

Other BMPs currently developed and to be further developed as project specifications are determined address wildlife, vegetation, invasive species management, erosion, and general construction best practices to ensure minimal impacts to the human environment and trust resources as a result of the proposed MRER actions within the framework of the applicable categorical exclusion. Further information can be found in Appendix C, Environmental Considerations.

10 Real Estate Considerations

It is anticipated that the land required for the project will be within the bounds of existing federally owned fee land managed by USACE. For the fee Simple tracts near the dam, the United States of America acquired "all tenements, appurtenances, and hereditaments thereunto belonging or in anywise appertaining free, clear, and discharged of and from all former grants, taxes, judgements, mortgages, mineral rights, easements, restrictions, leases, assessments, liens, encumbrances and claims of any and every kind and nature. Subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines."

There is no lands, easements, nor rights-of-way within the proposed project limits acquired for, or with use of funds from, another Federal Program or project.

11 Cost Considerations

The current estimated total project cost (fully funded) for implementing the recommended plan is $81,393,000. Fully funded construction costs (excludes PED & Construction Management costs) are estimated as:

- 110' Conversion: $18,769,000
- Miter Gates Fabrication: $24,904,000
- Dewater & Fleet Costs: $7,105,000
- Pintles, Quoins, Anchorages: $10,865,000

Cost estimates for each component were brought to the 2022 price level using MCACES software MII version 4.3. Costs for the rehabilitation were calculated assuming replacement of all components in the same lock closure and accounts for cost savings expected through sharing services such as mobilization costs. The Total Project Cost Summary can be found in Appendix D which shows the overall cost for the project and by component. These cost are likely to change throughout the major rehabilitation evaluation report process and associated reviews.

12 Recommended Tentatively Selected Plan

Based on alternatives screening and NED analysis using the NIM model, the MRER PDT recommends Alternative 2A as the TSP. The plan would restore upstream and downstream components (miter gates pintles, quoins and miter gate anchorages) selected for the MRER to their original condition thereby greatly reducing the risk of component failure over the period of analysis. The BCR for Alternative 2A is 4.9 indicating a highly justified project based on NED benefits.

This alternative would replace all lock components selected for the MRER (downstream and upstream). Work would begin in 2025 (year 1) with the procurement of the metal inserts for the 110-foot stoplog slots and the design of all identified components for rehabilitation. The 110-foot stoplog conversion slot cutting would commence in 2026 (year 2) by use of the one sided approach (see section Baseline Failure Modes in the WOPC: FWOP 2) which will allow 2 wide tows to navigate the lock for the 150 days required for cutting. After slot cutting, regular navigation would commence for several months and then the lock would close for an additional 35 days to conduct sill work. Starting in 2027 (year 3), the upstream and downstream miter gates and other identified components would be fabricated. In 2029 (year 5), the lock would close for 37 days during the off-peak navigation season (typically July through August) to replace all upstream components including miter gates. In 2030 (year 6), the lock would again close for 37 days during the off-peak navigation season to replace all downstream components including miter gates. All required fabrication and acquisition of materials would occur in years 3 through 5. This alternative would reset the hazard function for all components to their original state (approximately zero).

13 Cost Sharing Considerations

MKARNS is an Inland Waterways System subject to tax on fuel used in commercial transportation from the junction with the Mississippi River at RM 0 to port of Catoosa, Oklahoma, at RM 448.2 paid into the Inland Waterways Trust Fund (IWTF). Construction for any waterway project funded from FY2021 through FY2031 would have an IWTF contribution of 35 percent and 65 percent Federal funding. Operation and maintenance costs for navigation on the inland waterways are 100 percent Federal costs, which includes the preparation of this Major Rehabilitation Report funded under the Operation and Maintenance, General, appropriation.

Economic Appendix

May 22, 2023

Contents

1.0 Introduction and Content

Engineering Pamphlet (EP) 1130-2-500 *Project Operations – Partners and Support (Work Management Guidance and Procedures); Appendix B – Rehabilitation Evaluation Report* identifies an 8-step process for MRERs:

1) Identify project components necessary for operations;
2) Identify components that are reliability concerns;
3) Depict the most likely sequences of events following failure;
4) Quantify the potential consequences of failure;
5) Develop a representative simulation model;
6) Develop options for addressing reliability problems;
7) Simulate project performance for the baseline and pro-active alternatives; and,
8) Identify the best plan.

Project delivery team (PDT) economists and planners are responsible for steps 5, 7 and 8 and work closely with engineering teams on step 6. Remaining items are the focus of the engineering team.

The Economics Appendix summarizes the process used to satisfy EP 1130-2-500 and includes an inventory of existing navigation conditions, a forecast of future navigation, and a description of the engineering and economic reliability model used (the Navigation Investment Model). Lastly, we summarize the National Economic Development (NED) benefits of alternative rehabilitation strategies compared to the future without project condition with sensitivity analyses for the recommended plan. Comprehensive benefits per recent directives from the Assistant Secretary of the Army (Civil Works) are discussed as well.

2.0 Existing and Projected Navigation on the MKARNS

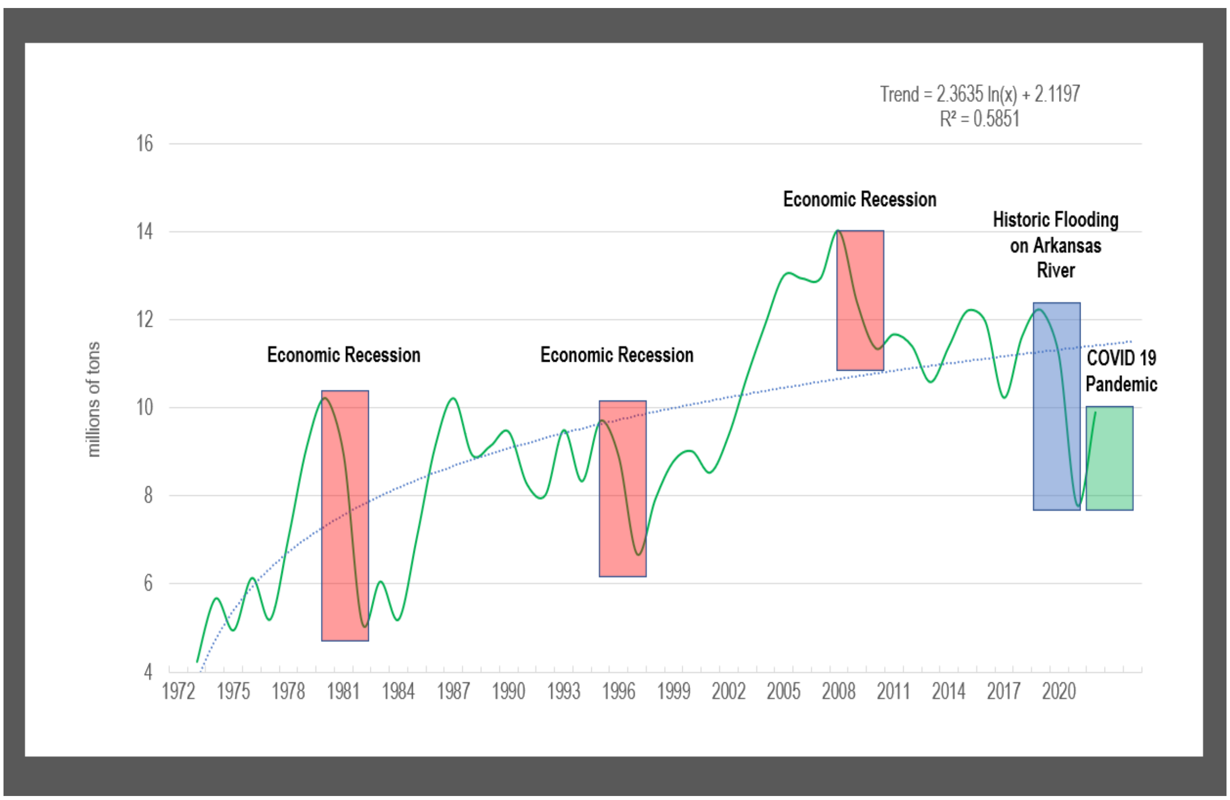
Given that traffic (i.e., demand forecasts) are an important component in NIM, Section 2.0 summarizes existing conditions for navigation on the MKARNS and Terry L&D including traffic volumes in terms of tonnage, and projected future traffic over the period of analysis. Methodology applied is consistent with Planning Guidance for inland navigation. Commodities are classified and aggregated into manageable groups from an analytical standpoint. Short and long-term growth rates from secondary sources and are applied estimate future demands.

Discussion focuses on the MKARNS as whole since most traffic (around 80 to 90 percent in most years) is throughput meaning that it enters or exits from the Lower Mississippi River. Internal or intra-waterway traffic consists primarily of aggregates (sand, gravel, and stone). Therefore, historical trends, underlying fundamentals, and growth rates for commodities shipped on the system are generally applicable to all locks on the system.

2.1 Traffic Volumes and Commodity Types on the MKARNS

Before constructing the MKARNS, commercial navigation on the Arkansas River ranged between 0.5 million and one million tons a year. In 1970, after the MKARNS opened traffic grew rapidly through about 1978 to nearly 10 million tons per year (Table 1 and Figure 1). Traffic then declined slightly and stabilized for the next ten years at a level of about 8 million tons. Traffic again increased in the 1990's and peaked at an all-time high 14 million tons in 2007, and then declined after the financial crisis of 2008 through 2009. Since 2011, volumes began to increase again to current normal levels of about 11 to 12 million tons per year. Two recent flood events (2015 and 2019) ceased traffic on the river for extended periods. The 2019 flood was historic (annual exceedance probability of about 0.025 percent), and closed traffic at most lock and dams for several months. In 2020 (the latest data available), traffic levels recovered to 9.9 million tons, but were still well below annual volumes in near term years before the 2019 flood in large part due the COVID-19 pandemic.

Figure 1: Historical Traffic on the MKARNS
(1971 through 2020 millions of tons) *



* In 2015, there was a significant flooding on the Arkansas River (annual exceedance probability of 1 percent, and in 2019 there was historical flooding with an annual exceedance probability of about 0.25 percent. In 2019, traffic through many locks ceased for about 3 months from May through July until flows reduced to navigable levels. Source: U.S. Army Corps of Engineers Lock Performance Monitoring System (1971 through 2006), U.S. Army Corps of Engineers Waterborne Commerce Statistics Center (2007 through 2019).

Table 1
Historical and Current Commodity Traffic on the MKARNS
(1971 through 2020, millions of tons)

Year	Total	Inbound	Outbound	Internal	Throughput (cargo entering and exiting the MKARNS)
1971	4.24	0.76	0.46	2.43	1.22
1972	5.67	1.17	1.03	3.46	2.20
1973	4.96	0.97	0.75	2.95	1.71
1974	6.14	1.71	1.27	2.75	2.98
1975	5.20	1.44	0.87	2.47	2.31
1976	7.08	1.99	1.66	3.03	3.65
1977	9.14	2.84	2.34	3.46	5.18
1978	10.22	2.60	3.90	3.17	6.50
1979	8.93	2.04	3.46	2.93	5.49
1980	5.13	1.80	0.66	2.67	2.46
1981	6.06	1.95	0.77	2.96	2.72
1982	5.20	1.44	0.87	2.46	2.31
1983	7.08	1.99	1.66	3.03	3.65
1984	9.14	2.84	2.34	3.46	5.18
1985	10.21	2.60	3.90	3.17	6.50
1986	8.93	2.04	3.46	2.93	5.50
1987	9.13	1.61	4.64	2.42	6.25
1988	9.45	1.56	5.68	1.74	7.24
1989	8.26	1.52	4.61	1.56	6.13
1990	8.02	1.91	3.91	1.90	5.82
1991	9.49	2.13	4.26	2.43	6.39
1992	8.33	2.10	3.19	2.52	5.29
1993	9.70	2.61	3.45	2.96	6.06
1994	8.89	2.13	3.35	2.75	5.48
1995	6.68	2.09	3.09	2.11	5.18
1996	7.93	2.17	3.84	1.91	6.01
1997	8.79	2.28	3.54	2.47	5.82
1998	9.01	2.25	4.29	2.20	6.54
1999	8.53	2.08	4.43	2.12	6.51
2000	9.38	2.42	4.24	2.56	6.66
2001	10.71	2.99	4.55	3.08	7.54
2002	11.90	3.21	5.07	4.38	8.28
2003	12.99	4.38	5.50	2.91	9.88
2004	12.93	3.56	5.22	3.56	8.77
2005	12.93	3.96	4.40	4.56	8.36
2006	14.01	4.35	5.25	4.41	9.60
2007	12.38	4.05	4.77	3.57	8.82
2008	11.35	2.92	4.84	3.59	7.76
2009	11.66	3.32	4.99	3.35	8.31
2010	11.39	3.71	4.84	2.84	8.55
2011	10.58	3.68	4.46	2.44	8.14
2012	11.38	3.94	5.40	2.04	9.34
2013	12.19	4.54	5.65	2.00	10.19

Year	Total	Inbound	Outbound	Internal	Throughput (cargo entering and exiting the MKARNS)
2014	11.95	5.07	4.68	2.19	9.75
2015*	10.23	4.68	3.41	2.13	8.09
2016	11.62	4.43	4.35	2.84	8.78
2017	12.22	4.48	5.12	2.62	9.60
2018	11.20	4.37	4.34	2.50	8.70
2019*	7.79	3.25	2.60	1.95	5.84
2020*	9.90	2.81	3.48	3.60	7.09

* In 2015, there was a significant flooding on the Arkansas River (annual exceedance probability of 1 percent, and in 2019 there was historical flooding with an annual exceedance probability of about 0.25 percent. In 2019, traffic through most locks ceased for about 3 months during the months of May through August. Year 2020 was also anomalous due the COVID19 pandemic. Source: U.S. Army Corps of Engineers Lock Performance Monitoring System (1971 through 2006), U.S. Army Corps of Engineers Waterborne Commerce Statistics Center (2007 through 2019).

Table 2 summarizes traffic by major commodity groups on the MKARNS by direction (inbound or outbound):

- Aluminum, aluminum ores and concentrates.
- Building materials and minerals,
- Coal and coke,
- Fertilizers,
- Grains, soybeans, rice, and other farm goods,
- Iron and steel,
- Machinery and industrial equipment,
- Manufacturing ores and chemicals; and,
- Petroleum products.

Building materials and minerals (primarily sand, gravel, and stone), Fertilizers, and agricultural commodities such as grain and soybeans comprise about 80 percent of total commodity flows in terms of volume.

Table 2
Commodity Traffic on the MKARNS by Direction and Commodity Types
(Average of 2016 through 2018, thousands of tons per year) *

Commodity	Volume (thousands of tons)				
	Outbound	**Inbound**	**Internal**	**Throughput**	**Total**
Coal and coke	148	57	0	205	205
Petroleum products	193	116	52	309	361
Building materials and minerals	294	181	2,768	475	3,243
Grains, soybeans, rice, and other farm goods	2,840	263	77	3,104	3,181
Fertilizer	738	2,286	3	3,024	3,027
Manufacturing ores and chemicals	12	292	6	304	310
Iron and Steel	145	768	173	912	1,085
Machinery and industrial equipment	6	9	5	15	19
Aluminum, aluminum ores and concentrates	27	229	45	256	301
Total	4,403	4,201	3,128	8,604	11,731
Commodity	**Percent**				
	Outbound	**Inbound**	**Internal**	**Throughput**	**Total**
Coal and coke	3%	1%	0%	2%	2%
Petroleum products	4%	3%	2%	4%	3%
Building materials and minerals	7%	4%	89%	6%	28%
Grains, soybeans, rice, and other farm goods	65%	6%	2%	36%	27%
Fertilizer	17%	54%	0%	35%	26%
Manufacturing ores and chemicals	0%	7%	0%	4%	3%
Iron and steel	3%	18%	6%	11%	9%
Machinery and industrial equipment	0%	0%	0%	0%	0%
Aluminum, aluminum ores and concentrates	1%	5%	1%	3%	3%
Total	100%	100%	100%	100%	100%

Source: U.S. Army Corps of Engineers Waterborne Commerce Statistics Center

The top inbound commodities are Fertilizers (55 percent), Iron and Steel (18 percent), Grains, Soybeans, Rice, and other Farm Goods (7 percent), and Manufacturing Ores and Chemicals (6 percent). Fertilizers are a major inbound commodity from late summer through late winter. Basically, the MKARNS is a major maritime highway for agriculture that moves the nation's harvest in the heartland to export ports along the Gulf Coast, and brings fertilizer into the heartland to produce grains, soybean, sorghum, rice, and other agriculture goods. Most fertilizer shipped into the MKARNs comes from manufacturers and distributors along the Gulf Coast, particularly in Louisiana and Southeast Texas. Growers in the Midwest use the majority of fertilizer products (primarily nitrogenous).

Upbound iron and steel products (18 percent of inbound cargo) generally consist of fabricated basic shapes (ingot, pipes, tubes, and rolled flat steel). The primary consumers of iron and steel are industries in Arkansas and Oklahoma such as appliance manufacturers and firms that produce piping and other components for oil refineries. Building materials that include aggregates (primarily limestone from quarries along the Gulf Coast) makes up 4 percent of imported construction materials. Other important construction materials including sand and gravel (aggregates used for Portland cement and road construction and maintenance) come from regional quarries located along the MKARNS.

Grains, Soybeans, and other Farm Goods comprise 6 percent of inbound cargoes, and are mostly used for animal feed at poultry farms, and hog and cattle operations in Arkansas and Oklahoma. Arkansas's poultry industry ranks second in the nation in total pounds of chicken meat produced, and third in turkey production. Turkey and poultry farms and processing facilities are important regional industries in Arkansas. Finished aluminum used in packaging, transportation and construction and aluminum ores make up 5 percent of inbound traffic. Finished aluminum is used in a variety of industries in Arkansas, Oklahoma and Missouri, and aluminum ores or bauxite rock is the feedstock used to make finished aluminum, and is for barge shipment given its weight and large volumes demanded by aluminum smelters.

Imports of petroleum products are more or less evenly split between asphalt, naphtha and solvents and distillate fuel oils (diesel fuel). Asphalt, naphtha, and solvents is used in road construction and other industrial applications, and diesel fuel is used for transportation, power generation and a major consumer of diesel fuel over the past several decades has been drilling rigs operating in the Fayetteville Shale deposit in northwest Arkansas. The Fayetteville Shale is an unconventional gas reservoir that extends across northern Arkansas from the state's western edge throughout north central Arkansas. Southwestern Energy, Inc. began drilling in Fayetteville Shale in 2005 and gas production has steadily increased since. Most horizontal drillings rigs are powered with diesel fuel, and since they typically operate continuously the rigs consume substantial amounts of fuel.

About one half of outbound tonnage from the MKARNS is wheat and soybeans shipped primarily to the ports of South Louisiana and New Orleans for export to global markets. According to the USDA Economic Research Service, main export destinations for U.S. oilseeds, oilseed meal, and vegetable oil include China, the European Union, Japan, Mexico, and Taiwan.[1] Other important markets−including Indonesia, South Korea, and Thailand. Canada, Mexico, the Philippines, and several Latin American countries also import significant quantities of U.S. oilseed meals.

Exports of wheat from the system dropped between 2001 through 2012 from a high of 1.32 million tons in 2001 to 0.6 million in 2012. The decline was probably more related to domestic

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[1] Unless otherwise stated, discussion of crop markets and production are based on information and analysis prepared by the USDA's Economic Research Service. Available online at: http://www.ers.usda.gov/topics/crops/.aspx

wheat production trends rather than global demand. Harvested acreage of U.S. wheat has dropped off nearly 30 million acres, or nearly one-third, from its peak in 1981 because of declining returns compared with other crops and changes in government programs that allow farmers more planting flexibility.[2] But since 2011, in response to increasing global demand, wheat exports from the MKARNs have rebounded and have averaged 1.5 million tons per year from 2016 through 2018, but fell sharply during the 2019 flood on the MKARNS.

Iron and steel scrap metal is another important outbound commodity on the system (nine percent of outbound tonnage). Most iron and steel consist of scrap and re-melting ingot used by domestic steel producers along the Lower Mississippi River. According to the U.S. Geologic Survey (USGS), steel scrap consumption by domestic steel mills revealed that two key trends have emerged during the last few decades.[3] First, steelmakers have increased use of electric arc furnaces, which primarily use scrap as a charge material to produce raw steel. Second, steel producers have increased continuous casting–a more efficient forming technology than ingot casting that has increased mill yields.

Today, very little if any lignite coal is shipped out of the MKARNS. In the past, it was more important, and came from Montana's Powder River basin and went to terminals near New Orleans where it was transferred to ships for distribution to domestic electricity producers along the Gulf Coast; however, like most thermoelectric generators in the U.S., the plants have switched from coal to natural gas. Coke is still shipped out the system to domestic processors along the Gulf Coast. These firms treat coke to produce calcined petroleum coke, which ultimately finds its way into the primary aluminum and steel industry. Other uses include the production of titanium dioxide, which is used as a pigment for paint, plastics, sunscreens, and food coloring. Outbound fertilizer shipments comprise about eight percent of MKARNs exports, primarily for domestic consumption. Outbound shipments of petroleum products consist mostly of refined bitumen (asphalt) used in the construction industry for paving and roofing applications.

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[2] Authorization of the Conservation Reserve Program (CRP) in the 1985 Farm Act, followed by planting flexibility provisions in the 1990 Farm Act, provided wheat farmers with other options for use of their acreage. Under the 1990 Act, farmers participating in commodity programs could plant up to 25 percent of their base wheat acreage to crops other than wheat without losing base acreage.[2] Thus, farmers had an incentive to grow crops with higher returns or to earn rental payments from idling land under the CRP. Planting flexibility facilitated expansion of soybeans, corn, and other crops in traditional wheat areas, hence the steady increases in soybean and corn exports on the MKARNS.

[3] Brown, R.E. "Iron and Steel Scrap Statistical Compendium." U.S. Department of Interior, U.S. Geologic Survey. Accessed online at: http://minerals.usgs.gov/minerals/pubs/commodity/iron_&_steel_scrap/stat/

2.2 Trade Routes

Tables 3 and 4 summarize origins and destinations of MKARNS commodities by state and waterway based on 2018 WCSC data. With the exception of outbound agricultural crops, which are shipped to deep draft ports in Louisiana for foreign world export, the bulk of goods shipped on the MKARNS flow to and from domestic producers and consumers; although some may be processed into value added goods and ultimately exported.

Table 3
Distribution of Primary Inbound Commodity Flows from the MKARNs by Origin and Destination

Commodity	Primary shipping state(s)	Share of tonnage	Receiving state	Shares of tonnage
Building materials and minerals	Kentucky	6%	Arkansas	0%
			Oklahoma	100%
	Louisiana	31%	Arkansas	48%
			Oklahoma	52%
	Missouri	46%	Arkansas	77%
			Oklahoma	23%
	Mississippi	8%	Arkansas	0%
			Oklahoma	100%
Chemical fertilizers	Louisiana (posts of New Orleans and Baton Rouge)	93%	Arkansas	16%
			Oklahoma	84%
	Mississippi (Bayou Casotte)	5%	Arkansas	6%
			Oklahoma	94%
Coal (lignite and coke)	Louisiana (posts of New Orleans and South LA)	93%	Arkansas	44%
			Oklahoma	56%
	Kentucky	7%	Arkansas	0%
			Oklahoma	100%
Food and other farm goods (primarily animal feed)	Iowa	9%	Arkansas	0%
			Oklahoma	100%
	Illinois	12%	Arkansas	0%
			Oklahoma	100%
	Louisiana	76%	Arkansas	16%
			Oklahoma	84%
Iron and steel	Alabama	28%	Arkansas	41%
			Oklahoma	59%
	Illinois	6%	Arkansas	44%
			Oklahoma	56%
	Indiana	5%	Arkansas	92%
			Oklahoma	8%
	Kentucky	10%	Arkansas	16%
			Oklahoma	84%
	Louisiana	47%	Arkansas	67%
			Oklahoma	33%
Manufacturing ores and	Louisiana	98%	Arkansas	50%

chemicals			Oklahoma	50%
Petroleum products (primarily distillate fuels)	Louisiana	99%	Arkansas	98%
			Oklahoma	2%

Source: Generated based on 2018 data from the USACE Waterborne Commerce Statistics Center

Table 4
Current Distribution of Primary Outbound Commodity Flows from the MKARNs by Origin and Destination

Commodity	Primary shipping state	Shares of tonnage	Receiving state(s)	Shares of tonnage
Building materials and minerals	Arkansas	52%	Illinois	20%
			Louisiana (primarily terminals on Lower Miss.)	27%
			Mississippi	6%
			Tennessee	21%
			Texas	15%
	Oklahoma	48%	Illinois	21%
			Louisiana (primarily river terminals)	57%
			Minnesota	6%
			Texas	5%
Coal (coke)	Arkansas	5%	Kentucky	100%
	Oklahoma	95%	Louisiana (Lower Mississippi river)	36%
			Texas (Intra-coastal Waterway terminals)	55%
Iron and steel	Arkansas	40%	Alabama	17%
			Arkansas (Lower Mississippi river terminals)	54%
			Kentucky	16%
			Tennessee	5%
	Oklahoma	60%	Alabama	10%
			Arkansas (Lower Mississippi river terminals)	40%
			Kentucky	9%
			Louisiana	17%
			Tennessee	10%
			Texas	6%
Soybeans	Arkansas	50%	Louisiana (ports of Plaquemines and South Louisiana)	100%
	Oklahoma	50%	Louisiana (ports of Plaquemines and South Louisiana)	98%
Wheat	Arkansas	10%	Louisiana (ports of Plaquemines and South Louisiana)	97%
	Oklahoma	90%	Louisiana (ports of Plaquemines and South Louisiana)	85%

Source: Generated based on annual 2014 data from the USACE Waterborne Commerce Statistics Center.

2.3 Traffic Projections for Terry Lock and Dam

Section 2.3 presents the methods, assumptions, and results of estimated future traffic applied in the MRER. As noted above, the types of commodities and historical trends for the MKARNS as a whole are applicable to most projects on the system. The methodology and arithmetic for projections is the same as those used in the Three Rivers Southeast Arkansas Integrated Feasibility Report and Environmental Assessment (2017). Methods have undergone both Agency Technical Review and Independent External Peer Review, and follow procedures outlined in the USACE Planning Guidance Notebook. Projections run through 2075, and the baseline is a three-year average of 2016, 2017, and 2018. The approach is straightforward and typical of USACE studies where future estimates are driven long-term growth rates from secondary sources such as the U.S. Department of Agriculture Economic Research Service, and U.S. Energy Information Administration.

2.3.1 Baseline

Table 5 shows baseline tonnage for the Terry L&D applied in the forecast. Given that Terry L&D is the 5th lock and dam west of the Lower Mississippi River, most traffic is throughput (about 90 percent), and only 10 percent is internal. The distribution of cargo shipped through the lock closely parallels the MKARNS as a whole. Commodity traffic for 2019 and 2020 are not included in the baseline. Data for 2021 and 2022 are not yet available. In 2019, historic flooding shut down the MKARNs for several months, and traffic in 2020 was anomalous due to the COVID-19 pandemic and its negative impact on the national economy. In general, it is best to try and capture business as usual traffic flows in a projection baseline versus rare outlier events such as extreme flooding or pandemics.

Table 5
Commodity Traffic through David D. Terry Lock and Dam by Direction and Commodity
(Average of 2016 through 2018, tons per year)

Commodity	Volume (thousands of tons)				
	Outbound	Inbound	Internal	Throughput	Total
Coal and coke	141,224	57,307	0	198,531	198,531
Petroleum products	181,729	84,219	13,532	265,948	279,480
Building materials and minerals	283,976	164,934	193,486	448,910	642,396
Grains, soybeans, rice, and other farm goods	2,421,946	253,133	56,749	2,675,079	2,731,828
Fertilizer	721,697	2,171,380	3,800	2,893,077	2,896,877
Manufacturing ores and chemicals	37,659	423,954	5,902	461,613	467,515
Iron and steel	116,763	721,314	232,294	838,077	1,070,371

Commodity	Volume (thousands of tons)				
	Outbound	Inbound	Internal	Throughput	Total
Machinery and industrial equipment	6,183	8,516	970	14,700	15,670
Aluminum, aluminum ores and concentrates	0	71,737	479	71,737	72,216
Total	3,911,177	3,956,494	507,212	7,867,671	8,374,883
Commodity	**Percent**				
	Outbound	**Inbound**	**Internal**	**Throughput**	**Total**
Coal and coke	3.6%	1.4%	0.0%	2.5%	2.4%
Petroleum products	4.6%	2.1%	2.7%	3.4%	3.3%
Building materials and minerals	7.3%	4.2%	38.1%	5.7%	7.7%
Grains, soybeans, rice, and other farm goods	61.9%	6.4%	11.2%	34.0%	32.6%
Fertilizer	18.5%	54.9%	0.7%	36.8%	34.6%
Manufacturing ores and chemicals	1.0%	10.7%	1.2%	5.9%	5.6%
Iron and steel	3.0%	18.2%	45.8%	10.7%	12.8%
Machinery and industrial equipment	0.2%	0.2%	0.2%	0.2%	0.2%
Aluminum, aluminum ores and concentrates	0.0%	1.8%	0.1%	0.9%	0.9%
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Source: U.S. Army Corps of Engineers Waterborne Commerce Statistics Center

2.3.2 Growth Rates

Growth rates vary by commodity, commodity direction (internal, inbound, and outbound), primary markets, and time period (short-term through 2040 or 2030 depending upon the commodity group, and long-term growth rates through 2075). Sources and background for each are discussed below (Tables 6 through 8). Growth rates apply to both total tonnage on the MKARNS and tonnage through individual lock and dams including Terry L&D.

Table 6
Growth Rates for Inbound Commodities on the MKARNs

Commodity	Primary market(s)	Short-term (Baseline-2030)	Long-term (2030-2080)	Description and sources
Aluminum, Aluminum ores and concentrates	Domestic metals manufacturing	1.13%	1.13%	*Short-term*: U.S. Energy Information Administration, Annual Energy Outlook (2019), Table 70: Real Value of Shipments for Alumina and Aluminum Products (2020-2050). *Long-term*: Same as short-term
Chemical Fertilizers	Domestic agriculture	1.25%	0.75%	*Short-term*: Average of U.S. projected planted acreage for corn, wheat, sorghum, soybean and rice. U.S. Department of Agriculture, Office of the Chief Economist and Interagency Agricultural Projections Council. "USDA Agricultural Projections to 2030 (OCE 2019-1)." February 2019. *Long-term*: Average of projected U.S. population through 2070 from U.S. Census Bureau, and global United Nations population projections through 2070.
Building materials and minerals	Domestic construction	0.61%	0.61%	*Short-term*: Average of Arkansas and Oklahoma population projections published by Oklahoma Department of Commerce (2020-2075), and Arkansas Economic Development Institute (2020-2060). *Long-term*: Same as short-term
Coal	Domestic energy	(0.57)	0%	*Short-term*: U.S. Energy Information Administration, Annual Energy Outlook (2019), Table 70: Real Value of Shipments for Coal (2020-2050). *Long-term*: Assumed constant after 2040.
Coke	Domestic metals manufacturing	1.13%	1.13%	*Short-term*: U.S. Energy Information Administration, Annual Energy Outlook (2019), Table 70: Real Value of Shipments for Alumina and Aluminum Products (2020-2050). *Long-term*: Same as short-term

Commodity	Primary market(s)	Short-term (Baseline-2030)	Long-term (2030-2080)	Description and sources
Petroleum products	Domestic other	0.63%	0.63%	*Short-term*: U.S. Energy Information Administration, Annual Energy Outlook (2019), Table 70: Real Value of Shipments for Alumina and Aluminum Products (2020-2050). *Long-term*: Same as short-term
Food and other farm goods (primarily animal feed)	Domestic livestock production	0.97%	0.75%	*Short-term*: Growth in U.S. livestock production (poultry and beef) Growth rates from: U.S. Department of Agriculture, Office of the Chief Economist and Interagency Agricultural Projections Council. "USDA Agricultural Projections to 2030 (OCE 2019-1)." February 2019. *Long-term*: Average of projected U.S. population through 2070 from U.S. Census Bureau, and global United Nations population projections through 2070.
Manufacturing ores and chemicals	Domestic manufacturing	1.25%	1.25%	*Short-term*: U.S. Energy Information Administration, Annual Energy Outlook (2019), Table 70: Average of Real Value of Shipments for Other Non-metallic Mineral Products and Bulk Chemicals (2020-2050). *Long-term*: Same as short-term
Machinery and equipment	General domestic markets	1.99%	1.99%	*Short-term*: U.S. Energy Information Administration, Annual Energy Outlook (2019), Table 70: Real Value of Shipments for Machinery (2020-2050). *Long-term*: Same as short-term
Iron and steel	Domestic metals manufacturing	0.40%	0.40%	*Short-term*: U.S. Energy Information Administration, Annual Energy Outlook (2019), Table 70: Real Value of Shipments for Iron and Steel Mills and Products (2020-2050). *Long-term*: Same as short-term

Table 7
Growth Rates for Outbound Commodities on the MKARNs

Commodity group	Primary market(s)	Short-term (2016-2030)	Long-term (2030-2070)	Description and sources
Aluminum, Aluminum ores and concentrates	Domestic metals manufacturing	1.13%	1.13%	*Short-term*: U.S. Energy Information Administration, Annual Energy Outlook (2019), Table 70: Real Value of Shipments for Alumina and Aluminum Products (2020-2050). *Long-term*: Same as short-term.
Chemical Fertilizers	Domestic agriculture	1.25%	0.75%	*Short-term*: Average of U.S. projected planted acreage for corn, wheat, sorghum, soybean and rice. U.S. Department of Agriculture, Office of the Chief Economist and Interagency Agricultural Projections Council. "USDA Agricultural Projections to 2030 (OCE 2019-1)." February 2019. *Long-term*: Average of projected U.S. population through 2070 from U.S. Census Bureau, and global United Nations population projections through 2070.
Building materials and minerals	Domestic construction	0.54%	0.54%	*Long-term*: Projected U.S. population through 2070 from U.S. Census Bureau. *Long-term*: Same as short-term.
Coal	Domestic energy	0%	0%	Forecasted volumes of down-bound coal are assumed to be zero over the period of analysis.
Coke	Domestic metals manufacturing	1.13%	1.13%	*Short-term*: U.S. Energy Information Administration, Annual Energy Outlook (2019), Table 70: Real Value of Shipments for Alumina and Aluminum Products (2020-2050). *Long-term*: Same as short-term.
Petroleum products	Domestic other	0.63%	0.63%	*Short-term*: U.S. Energy Information Administration, Annual Energy Outlook (2019), Table 70: Real Value of Shipments for Alumina and Aluminum Products (2020-2050). *Long-term*: Same as short-term.

Commodity group	Primary market(s)	Short-term (2016-2030)	Long-term (2030-2070)	Description and sources
Soybeans	Soybeans	0.54%	0.75%	*Short-term*: U.S. soybean exports (2020-2030). U.S. Department of Agriculture, Office of the Chief Economist and Interagency Agricultural Projections Council. "USDA Agricultural Projections to 2030 (OCE 2019-1)." February 2019. *Long-term*: Average of projected U.S. population through 2070 from U.S. Census Bureau, and global United Nations population projections through 2070.
Wheat	Wheat	0.34%	0.75%	*Short-term*: U.S. wheat exports (2020-2030). U.S. Department of Agriculture, Office of the Chief Economist and Interagency Agricultural Projections Council. "USDA Agricultural Projections to 2030 (OCE 2019-1)." February 2019. *Long-term*: Average of projected U.S. population through 2070 from U.S. Census Bureau, and global United Nations population projections through 2070.
Food and other farm goods	Food and other farm goods	5.96%	0.75%	*Short-term*: Average U.S. corn, sorghum and barley exports (2020-2030). U.S. Department of Agriculture, Office of the Chief Economist and Interagency Agricultural Projections Council. "USDA Agricultural Projections to 2030 (OCE 2019-1)." February 2019. *Long-term*: Average of projected U.S. population through 2070 from U.S. Census Bureau, and global United Nations population projections through 2070.
Rice	Rice	0.61%	0.75%	*Short-term*: U.S. rice exports (2020-2030). U.S. Department of Agriculture, Office of the Chief Economist and Interagency Agricultural Projections Council. "USDA Agricultural Projections to 2030 (OCE 2019-1)." February 2019. *Long-term*: Average of projected U.S. population through 2070 from U.S. Census Bureau, and global United Nations population projections through 2070.
Manufacturing ores and chemicals	Domestic manufacturing	1.25%	1.25%	*Short-term*: U.S. Energy Information Administration, Annual Energy Outlook (2019), Table 70: Average of Real Value of Shipments for Other Non-metallic Mineral Products and Bulk Chemicals (2020-2050). *Long-term*: Same as short-term

Commodity group	Primary market(s)	Short-term (2016-2030)	Long-term (2030-2070)	Description and sources
Machinery and equipment	General domestic markets	1.99%	1.99%	*Short-term*: U.S. Energy Information Administration, Annual Energy Outlook (2019), Table 70: Real Value of Shipments for Machinery (2020-2050). *Long-term*: Same as short-term
Iron and steel	Domestic metals manufacturing	0.40%	0.40%	*Short-term*: U.S. Energy Information Administration, Annual Energy Outlook (2019), Table 70: Real Value of Shipments for Iron and Steel Mills and Products (2020-2050). *Long-term*: Same as short-term

Table 8
Growth Rates for Internal Commodities on the MKARNs

Commodity group	Primary market(s)	Short-term (2016-2030)	Long-term (2030-2070)	Description and sources
Aluminum, Aluminum ores and concentrates	Domestic metals manufacturing	0%	0%	Assumed to be zero over the period of analysis.
Chemical Fertilizers	Domestic agriculture	0%	0%	Assumed to be zero over the period of analysis.
Building materials and minerals	Domestic construction	1.10%	1.10%	*Long-term*: Projected population in Oklahoma and Arkansas through 2070, Arkansas figures from Arkansas Economic Development Institute, University of Arkansas at Little Rock, and Oklahoma data from Oklahoma Department of Commerce. *Long-term*: Same as short-term.
Coal	Domestic energy	0%	0%	Assumed to be zero over the period of analysis.
Coke	Domestic metals manufacturing	0%	0%	Assumed to be zero over the period of analysis.
Petroleum products	Domestic other	1.10%	1.10%	*Short-term*: U.S. Energy Information Administration, Annual Energy Outlook (2019), Table 70: Real Value of Shipments for Alumina and Aluminum Products (2020-2050). *Long-term*: Same as short-term.

Commodity group	Primary market(s)	Short-term (2016-2030)	Long-term (2030-2070)	Description and sources
Soybeans	Domestic livestock consumption	0.61%	0.61%	*Short-term*: U.S. soybean exports (2020-2030). U.S. Department of Agriculture, Office of the Chief Economist and Interagency Agricultural Projections Council. "USDA Agricultural Projections to 2030 (OCE 2019-1)." February 2019. *Long-term*: Average of projected U.S. population through 2070 from U.S. Census Bureau, and global United Nations population projections through 2070.
Wheat	Domestic human and livestock consumption	0.24%	0.65%	*Short-term*: U.S. wheat exports (2020-2030). U.S. Department of Agriculture, Office of the Chief Economist and Interagency Agricultural Projections Council. "USDA Agricultural Projections to 2030 (OCE 2019-1)." February 2019. *Long-term*: Average of projected U.S. population through 2070 from U.S. Census Bureau, and global United Nations population projections through 2070.
Food and other farm goods	Domestic human and livestock consumption	0%	0%	Assumed to be zero over the period of analysis.
Rice	Domestic human and livestock consumption	0%	0%	Assumed to be zero over the period of analysis.
Manufacturing ores and chemicals	Domestic manufacturing	0.24%	0.65%	*Short-term*: U.S. Energy Information Administration, Annual Energy Outlook (2019), Table 70: Average of Real Value of Shipments for Other Non-metallic Mineral Products and Bulk Chemicals (2020-2050). *Long-term*: Same as short-term

2.3.3 Deterministic Forecast for Terry Lock and Dam

From 2020 through 2075, forecasts indicate that tonnage through David D. Terry L&D may grow from about 8.3 million per year tons to 12.7 million (an increase of 53 percent) at rate of 0.8 percent per year (Table 9). In contrast, the projected rate is lower than the long-term historical rate for the system as whole from 1971 through 2020. The reason is that traffic on the MKARNS increased rapidly in the waterway MKARNs opened as some shippers adjusted logistics to take advantage of the cheaper mode of transport. For example, from 1971 through 1980, tonnage shipped on the system grew from 1.8 to 6.7 million tons (270 percent increase), but as the system matured, demand leveled off and annual increases tapered and reflected overall macroeconomic conditions versus shift of modes for shipping cargo. In other words, the market achieved some level of equilibrium between supply and demand for inland navigation versus alternatives modes (truck and rail).

Table 9
Historical and Projected Commodity Flows for David D. Terry Lock and Dam
(2010 through 2075, millions of tons)

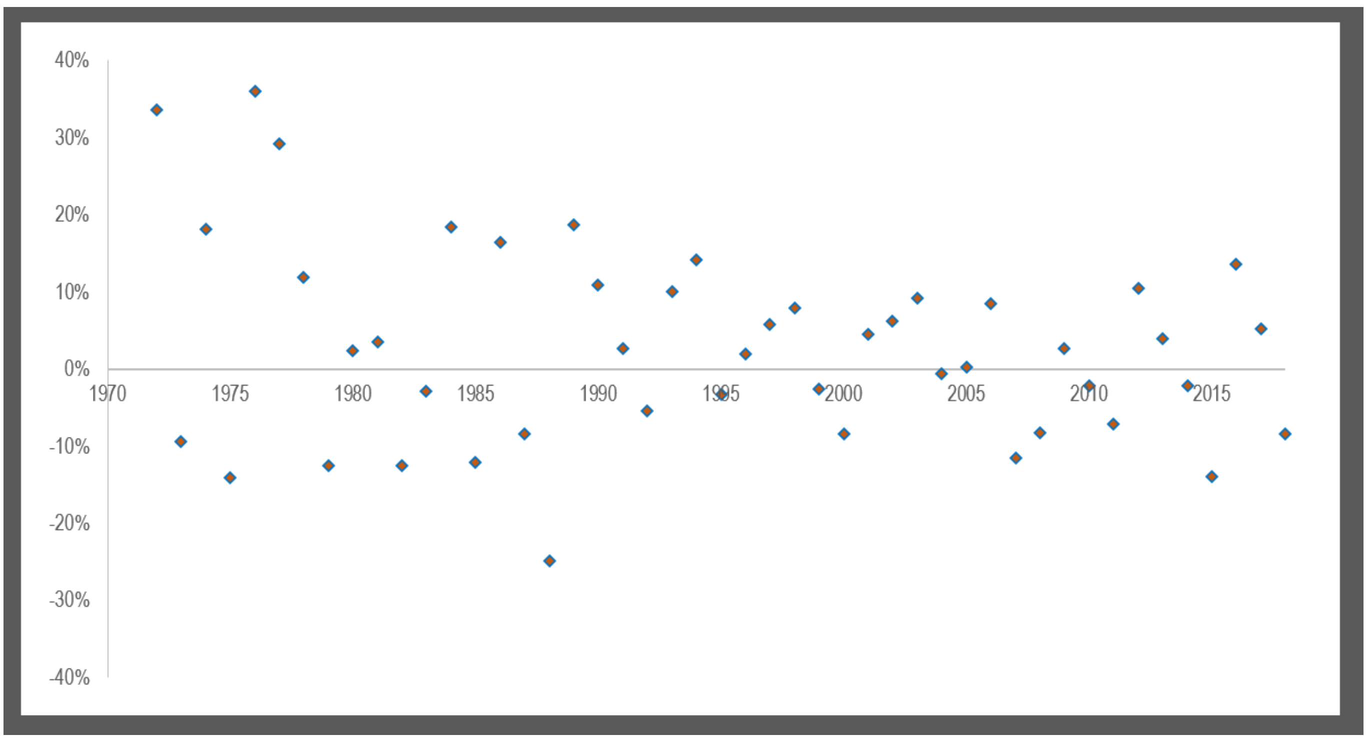
Year	Inbound	Outbound	Internal	Total	Throughput
Historical Traffic					
2016	4.07	3.67	0.41	8.15	7.74
2017	4.00	4.43	0.49	8.93	8.44
2018	3.80	3.63	0.62	8.05	7.43
2019	2.56	2.45	0.42	5.42	5.01
Projected Traffic					
Baseline (Average 2016-2018)	3.96	3.91	0.51	8.37	7.87
2025	4.16	4.04	0.52	8.72	8.20
2030	4.38	4.18	0.53	9.09	8.56
2035	4.61	4.33	0.55	9.48	8.94
2040	4.86	4.49	0.56	9.90	9.34
2045	4.76	4.75	0.58	10.10	9.52
2050	4.95	4.94	0.60	10.49	9.89
2055	5.14	5.14	0.61	10.89	10.28
2060	5.34	5.35	0.63	11.32	10.68
2065	5.54	5.56	0.65	11.76	11.11
2070	5.76	5.79	0.67	12.21	11.55
2075	5.99	6.02	0.68	12.69	12.01
Projected growth rate (baseline-2075)	0.8%	0.9%	0.6%	0.8%	0.8%

An assumption for projections is that current origin destination patterns remain the same over the forecast horizon; however, over the long-term commodity flow patterns will likely change, but it is difficult to project these changes with any degree of accuracy 50 years into the future. On the other hand, the pattern for major inbound and outbound commodities shipped on the MKARNs and Terry L&D has remained relatively constant through time. For example, grain from the Midwest has flowed down to Gulf Coast ports for export, and inbound fertilizers have come from producers in Texas and Louisiana and sold to farmers in the Midwest. Regardless, there will likely be some changes in origins and destinations, and the U.S. and world economies will wax and wane resulting in positive and negative variations on an annual basis. In some years, major flooding will result in sharp annual declines, but in the absence of global upheaval or substantial and protracted economic decline, future demand for shipping on the MKARNs will likely increase, or stay relatively constant.

2.3.4 Stochastic Forecast for Terry Lock and Dam (Risk and Uncertainty)

Projections in Table 9 are deterministic and do incorporate uncertainty in a given year, which as shown in historical data varies year to year due to the economy or environmental conditions such as extended periods of high flow that restrict navigation. Despite probable increases in traffic, analyzing uncertainty is an important part of plan formulation. For study projections, the study team examined historic long-term variation in traffic on the MKARNS. As shown in Figure 6, annual ups and downs in tonnage since the system was built vary with the greatest annual changes occurring shortly after the waterway opened (about 1971 through 1978) as the number of terminals increased and producers modified production processes to take advantage of the new waterway. Since then, annual changes have followed a more stable pattern varying on average roughly plus or minus 10 percent per year with an overall positive trend.

Figure 6
Percent Annual Variation in Commodity Flows on the MKARNS (1980-2018)



To model uncertainty in projections, probability distributions were fitted to data for annual percent variation in traffic since 1980. Inter-annual variability prior to 1980 was not included, since these large positive values were due to the system ramping up. Goodness of fit statistical tests including the Chi-square, Anderson-Darling, Bayesian (BIC), Akaike (AIC), and Kolmogorov-Smirnov are in consensus that a Gaussian distribution is best suited based on the historical data (Table 10). Variation captured in the Gaussian distribution was applied to aggregate commodity growth rates to develop a stochastic range of projections. Figure 3 and Table 11 display stochastic ranges for traffic projections applied in the Terry L&D MRER.

Table 10
Probability Distributions for Annual Variation in Commodity Traffic on the MKARNS (1980-2018)

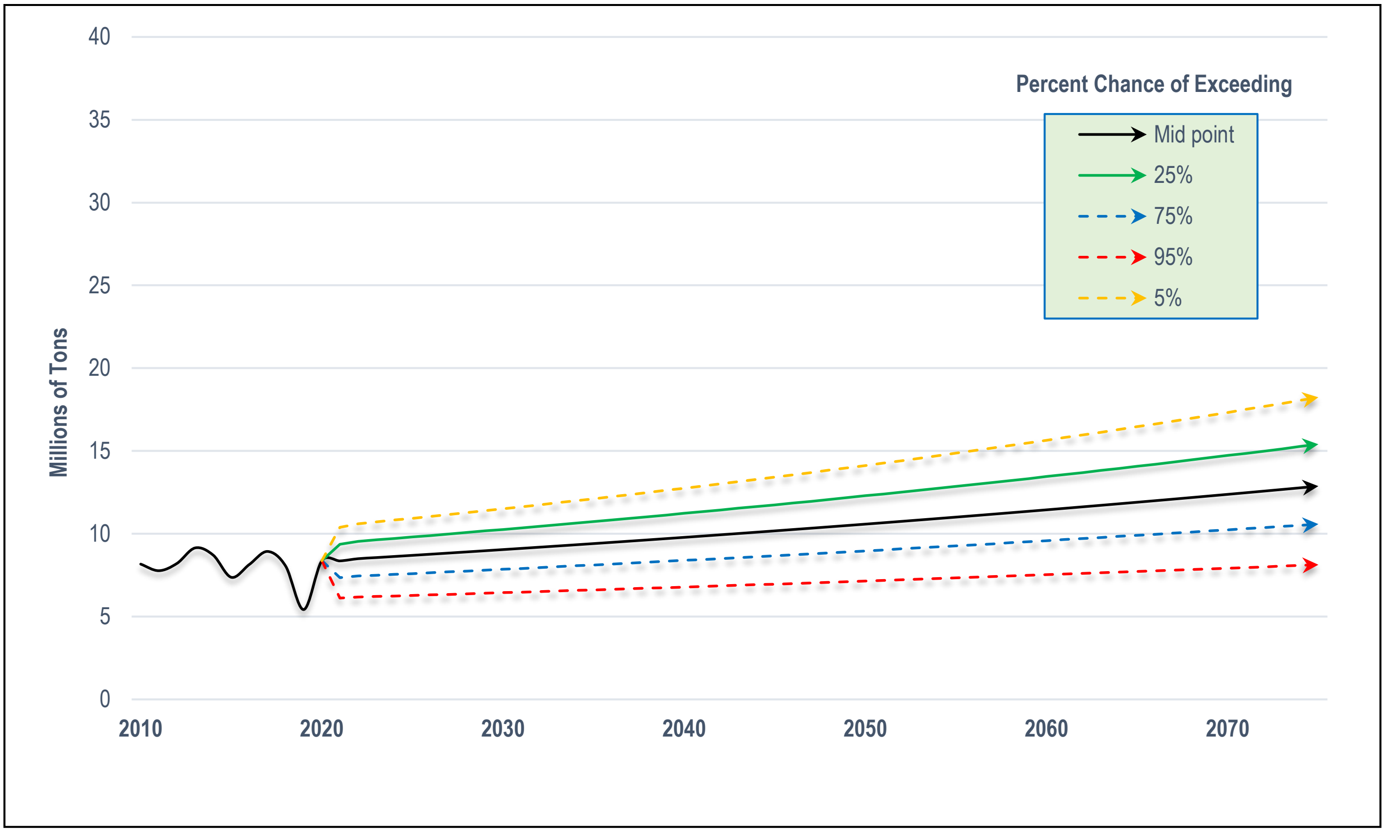
Goodness of fit test	Distribution ranking based on goodness of fit statistic		
	ExtValue	Logistic	Normal
Akaike (AIC)	4	3	1
Bayesian (BIC)	4	3	1
Chi-Square	1	2 (tie)	2 (tie)
Kolmogorov-Smirnov	2	3	1
Anderson-Darling	3	2	1
	Data ranges (fitted)		
Percentile	ExtValue	Logistic	Normal
95%	-12.4%	-14.3%	-13.4%
90%	-10.1%	-10.3%	-10.1%
85%	-8.4%	-7.7%	-7.9%
80%	-7.0%	-5.8%	-6.1%
75%	-5.7%	-4.3%	-4.5%
70%	-4.5%	-2.9%	-3.2%
65%	-3.3%	-1.7%	-1.9%
60%	-2.1%	-0.5%	-0.7%
55%	-0.9%	0.6%	0.5%
50%	0.3%	1.7%	1.7%
45%	1.6%	2.8%	2.8%
40%	2.9%	3.9%	4.0%
35%	4.4%	5.1%	5.2%
30%	6.0%	6.3%	6.5%
25%	7.9%	7.7%	7.9%
20%	10.1%	9.3%	9.4%
15%	12.8%	11.1%	11.2%
10%	16.5%	13.7%	13.4%
5%	22.7%	17.7%	16.8%

Table 11
Stochastic Projections for Total Commodity Flows for the Terry D. David Lock and Dam
(2010 through 2075, millions of tons)

Year	Historical				
2010	-	-	8.17	-	-
2015	-	-	7.37	-	-
2016	-	-	8.15	-	-
2017	-	-	8.93	-	-
2018	-	-	8.05	-	-
2019	-	-	5.42	-	-
	Projected *				
2020 Baseline (Average 2016-2018)	8.37	8.37	8.37	8.37	8.37
Year	95% exceedance	75% exceedance	50% exceedance	25% exceedance	5% exceedance
2021	6.12	7.35	8.36	9.37	10.39
2025	6.27	7.59	8.69	9.80	10.93
2030	6.43	7.84	9.03	10.25	11.49
2035	6.60	8.10	9.39	10.71	12.09
2040	6.76	9.76	9.76	11.20	12.71
2045	6.94	8.64	10.14	11.71	13.37
2050	7.11	8.93	10.54	12.24	14.06
2055	7.29	9.22	10.95	12.79	14.79
2060	7.48	9.53	11.38	13.38	15.56
2065	7.67	9.84	11.83	13.98	16.36
2070	7.86	10.17	12.29	14.62	17.21
2075	8.06	10.50	12.77	15.28	18.10

* Percent exceedance is the probability that the realized value in any given year will be greater than the percentile. For example, in year 2021, there is a 95 percent chance that the recorded value will be greater than 6.12 million tons.

Figure 3
Historical and Projected Traffic through the David D. Terry Lock and Dam on the MKARNS
(2025 through 2075, millions of tons)



3.0 Engineering and Economic Reliability Modeling

Section 3 presents an overview of engineering and economic reliability modeling with a focus on economics.

3.1 Overview of Data and Models

Two databases were used in this study to analyze historical data; Waterborne Commerce Statistics (WCS) database and the Corp's Lock Performance Monitoring System (LPMS) database. The WCS database is populated with domestic commercial cargo movements in the U.S. for deep draft and shallow draft projects along with vessel operating characteristics. WCS data were used in this study for both historical data related to tonnage and forecasting purposes. WCS data were then entered into NIM to estimate current and future traffic demands. The Corps Lock Performance Monitoring System (LPMS) database has performance characteristic metrics for inland navigation locks and dams, and unlike WCS that focuses on traffic volumes, commodity types, origin and destination and routes; captures data regarding tow configurations and transit times through each USACE project.

Two models developed and maintained by the PXCIN-RED were used in the analysis: 1) the Navigation Investment Model (NIM), and 2) the Analysis of River Navigation and Operational Lock Throughput (ARNOT). NIM is a spatially detailed, partial-equilibrium waterway transportation cost model. While it is not designed to estimate the total benefits of a river system, or the benefits the nation would lose if the river system no longer existed, it is appropriate to estimate the benefits of incremental improvements to river systems including rehabilitation of navigation lock and dam components. NIM received HQ Planning Model Corporate Certification in 2012, and was renewed in 2022 after a series of added features that have greatly facilitation data compilation in the form graphical user interfaces. NIM is a data intensive model, and relies on movement level data from the WCSC and LPMS along with user inputs in the form of engineering data and forecasts. ARNOLT estimates lock capacity curves or transit curves that capture the effects of lock closures or delays for carriers using the waterway. These curves are instrumental in analyzing how improvements in navigation efficiency translate into NED benefits.

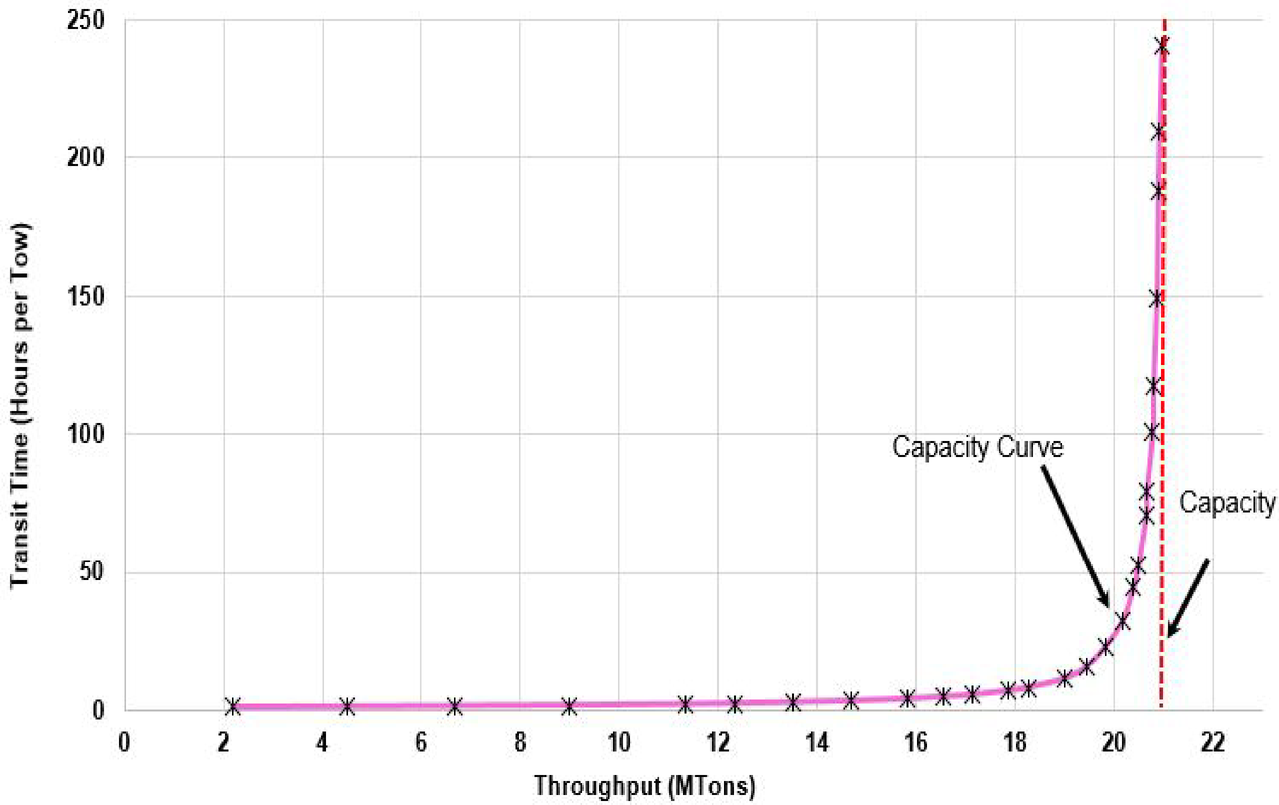
3.1.1 Lock Capacity Modeling (ARNOLT Model)

Lock capacity curves generated for this study (Table 12) were developed using the ARNOLT model created and maintained by the PXCIN-RED. ARNOLT is the successor to the shallow draft version of the Waterway Analysis Model (WAM), and replicates and expands on the functionality of WAM by leveraging advances in computing power and data storage since the last major update to WAM.

ARNOLT, like the shallow draft WAM model, is an annual simulation model used to evaluate the capacity of lock projects on the inland system. Capacity in this context is defined as the relationship between traffic volume that transits the project in a given year (traffic demand), and average transit times through a lock measured in hours. This capacity estimate ordinarily takes the form of what is known as a tonnage transit curve where average transit times are on the vertical axis, and average annual tonnage is on the horizontal axis (Figure 4).

Transit curves are typically exponential functions, and eventually at a given tonnage level become asymptotic meaning that a given lock or system is at full capacity. This tonnage level, or its approximate location on the curve, is project capacity, and represents the point at which no more traffic can viably use the project. For example, in Figure 4 traffic begins to back up at about 17 million tons per year, and at roughly 21 million tons it is at full capacity. Transit curves can be generated by a capacity simulation model for a range of scenarios that alter transit times through a project that will impact project capacity. Scenarios often consist of a period of closure of one or more chambers at the project, slower or quicker processing of tows, changes in the composition and characteristics of traffic. Normally these scenarios describe a range of lock closure or other disruptions to service that can result from routine or catastrophic failure of lock components. Scenarios comprise what are known as a family of curves, which together describe lock capacity across as series of hypothetical current and future scenarios. The ultimate use of these tonnage transit relationships is in system equilibrium modeling, normally conducted using NIM.

Figure 4
Tonnage Transit Curve (Capacity Curve) Example



Source: USACE PCXIN-RED

Table 12
Lock Capacity Curves FOR Terry Lock and Dam MRER (*WOPC = Without Projection Conditions, WPC = With Project Condition)

Closure ID (NIM)	Scenario*	Primary closure (days)	Notice level	Secondary closure (days)	Notice level	Comments and Assumptions
1	WOPC	None	NA	None	NA	No failure
2	WOPC	7	Unscheduled	None	NA	Emergency component repair (does not include dewater)
3	WOPC	14	Unscheduled	None	NA	Emergency component repair (does not include dewater)
4	WOPC	21	Unscheduled	None	NA	Emergency component repair (does not include dewater)
5	WOPC	30	Unscheduled	None	NA	Emergency component repair (does not include dewater)
6	WOPC	35	Unscheduled	None	NA	Emergency component repair (does not include dewater)
7	WOPC	45	Unscheduled	None	NA	Emergency component repair (does not include dewater)
8	WOPC	50	Unscheduled	None	NA	Emergency component repair (does not include dewater)
9	WOPC	60	Unscheduled	None	NA	Emergency component repair (does not include dewater)
10	WOPC	65	Unscheduled	None	NA	Emergency component repair (does not include dewater)
22	WOPC	65	Unscheduled	21	Scheduled	60-day unscheduled component repair plus 21 day scheduled component repair
23	WOPC	65	Unscheduled	21	Scheduled	65-day unscheduled component repair plus 21 day scheduled component repair
12	WOPC	134	Unscheduled	None	NA	Emergency component repair (includes 120 days dewater with coffee cells)
13	WOPC	141	Unscheduled	None	NA	Emergency component repair (includes 120 days dewater with coffee cells)
14	WOPC	150	Unscheduled	None	NA	Emergency component repair (includes 120 days dewater with coffee cells)
15	WOPC	155	Unscheduled	None	NA	Emergency component repair (includes 120 days dewater with coffee cells)
16	WOPC	165	Unscheduled	None	NA	Emergency component repair (includes 120 days dewater with coffee cells)
17	WOPC	170	Unscheduled	None	NA	Emergency component repair (includes 120 days dewater with coffee cells)
18	WOPC	180	Unscheduled	None	NA	Emergency component repair (includes 120 days dewater with coffee cells)
19	WOPC	185	Unscheduled	None	NA	Emergency component repair (includes 120 days dewater with coffee cells)
29	WOPC	90	Unscheduled	14	Unscheduled	90-day emergency 110 stoplog conversion (full closure) plus 14-day unscheduled component repair
30	WOPC	90	Unscheduled	21	Unscheduled	90-day emergency 110 stoplog conversion (full closure) plus 21-day unscheduled component repair
31	WOPC	90	Unscheduled	30	Unscheduled	90-day emergency 110 stoplog conversion (full closure) plus 30-day unscheduled component repair
32	WOPC	90	Unscheduled	45	Unscheduled	90-day emergency 110 stoplog conversion (full closure) plus 35-day unscheduled component repair
33	WOPC	90	Unscheduled	45	Unscheduled	90-day emergency 110 stoplog conversion (full closure) plus 45-day unscheduled component repair
34	WOPC	90	Unscheduled	50	Unscheduled	90-day emergency 110 stoplog conversion (full closure) plus 50-day unscheduled component repair
11	WPC	21	Scheduled	None	NA	21 day planned component repair or planned main period
20	WPC	141	Scheduled	None	NA	120 days planned dewater with coffer cells plus 21 day planned component repair
24	WPC	150	Scheduled	35	Scheduled	150 day 110 stoplog conversion (allows traffic) and subsequent 35-day full closure for sill work
25	WPC	150	Scheduled	35 plus 21	Scheduled	150 day single-side slot cut (allows traffic) and subsequent 35-day full closure for sill work plus 21 day planned component repair
26	WPC	37	Scheduled	None	NA	37 day planned closure for full rehab or planned maintenance alternative
27	WPC	127	Scheduled	None	NA	127 planned closures
28	WPC	120	Scheduled	37	Scheduled	120 days planned dewater with coffer cells and 37-day full rehab

Parameters, and assumptions for the ARNOLT model are summarized below.

- *Study Area Data Upload*: Relied on cached data from the PCXIN-RED server (comes preloaded with the model files).

- *Simulation Definition*: *Chamber:* Terry L&D is a single chamber (600 by 110 feet wide), and all closures use this definition with the exception of closures that involve a 110 stoplog conversion for future water dewatering in emergency closures, and planned dewatering in planned closures. For either scenario, traffic with a three-wide barge would have to cut and traverse the chamber with a two wide configuration, thereby adding time and expense to the transit. In ARNOLT, a dummy chamber of 70 feet wide was created to capture these costs. Thus, for 150 days tows would be restricted to two-wide configurations, and any remaining closure periods would be full closures.

- *Project Definition:* LPMS data for the simulation were loaded for years 2010 through 2018. Base year for the simulation was 2010 through 2018 as well. This is not the same as base year in the planning context, but rather identifies average tonnage volumes that projected growth rates are applied as estimated in traffic projects. In other words, it represents existing conditions, or a baseline terms of tow transit characteristics.

- *Traffic sampling* options are based on default ARNOLT options.

- *Tow Processing*, that allows users to change settings that govern how tow processing is performed at the project during simulations was not adjusted and default ARNOLT settings were applied.

- *Closure definitions* for WOPC or emergency closures assume a random start date over a given year with no post shipping, or pre-shipping days. Any planned closures were assigned a specific date with shorter durations occurring during seasonal low traffic on the MKARNS (late summer). For longer planned closures such as the 110 FOOT stoplog conversion, closure start dates were adjusted as much as possible to coincide with seasonal lows in traffic. Generally, traffic on the MKARNS ebbs in late summer through early fall. Most planned closures for periodic inspections and or maintenance occur during this time frame.

- *Simulation Settings and Calibration*: For each closure simulation, the start and end date were 2021 and 2022 respectively, and each closure simulation involved 1000 iterations with a convergence at minimum set at 100 iterations (tolerance of 5 percent and confidence level of 95 percent). Fixed capacity limit was zero. Calibration for each closure simulation for total transits, commercial transits, other transits, tonnage processed, and average transit time were reviewed. The key metric is average transit time, which is the transit curve values entered into NIM, and errors for all curves were 10 percent or less.

3.2 Navigation Investment Model (NIM)

NIM is a behavioral model that serves two tasks: develop least-cost movement level shipping-plans and estimate equilibrium system traffic levels from a bottom-up movement level analysis. By using detailed data describing the waterways network, the equipment used for towing operations, and the commodity flow volume and pattern, NIM calculates the resources (i.e., number towboats, trip time, and fuel consumption) required to satisfy the demand on a least-cost basis for each movement in the system, and how much of that movement demand can move in system equilibrium with a positive willingness-to-pay for barge transportation.

3.2.1 Model Development and Structure

Simulation models fall into two basic categories: event-based and period-based. In an event-based model, a set of events that the model is concerned with are defined, and time moves forward in jumps, as each event takes place. Period-based models divide time into discrete periods such as years. All calculations are made for a given period, then time advances to the next period. NIM is a period-based model using yearly time steps. NIM System has three primary modules: the Lock Risk Model (LRM), the Waterway Supply and Demand Model (WSDM), and the Optimal Investment Module (Optimization).

- The LRM Module estimates structural performance by simulating component-level engineering reliability data (hazard functions and event-trees) to determine life-cycle repair costs and service disruptions. The LRM summarizes the probabilities of reliability driven service disruptions (typically lock closures) for each lock for each component for each year, which are then used by the WSDM and Optimization modules to estimate expected transportation impacts resulting from the service disruptions.
- The WSDM Module estimates equilibrium waterway traffic levels and transportation costs given a traffic demand forecast, movement willingness-to-pay, and waterway system performance characteristics. NIM's major economic assumptions are embedded in WSDM.
- The Optimization Module organizes and analyzes investment life-cycle benefit and cost streams and recommends optimally timed investments.

3.2.2 Sectoral, Spatial and Temporal NIM Components

Economic models vary in terms of sectoral, spatial, and temporal detail. Simplifying assumptions are made in empirical models because of data, time, computational, and resource limitations. The key to making these simplifying assumptions are to clearly understand: 1) the theoretical model that serves as a starting point for the analysis; 2) how the simplifying assumptions deviate from the theoretical model; 3) the reasonableness of the assumptions as compared to what we know about real-world markets; and 4) the implications of the assumptions in terms of biasing and or reducing the accuracy of the model's results (i.e., estimation of WPC benefits). As a result, the fundamental sectoral assumption in the NIM model framework is to analyze inland navigation investments under a spatially detailed barge transportation partial-equilibrium framework. Spatial and temporal detail level in NIM is data driven (user specified) as discussed in the sections below.

Spatial Detail

The spatial detail is defined by the model user through the waterway transportation network, and through the aggregation level of the commodity groups and barge types. In the model, a commodity origin-destination route and barge type define the shipment that demands barge transportation. Spatial detail does not come without a cost. Since each and every movement (commodity origin-destination barge type) must be equilibrated with every other movement, each increment of detail increases computational time exponentially.

Temporal Detail

The model does not simulate individual waterway shipments (e.g., tow), but operates off a movement-level (an aggregation of shipments) cost in discrete annual time periods. To summarize, a movement is defined as the annual volume of shipments for the commodity origin-destination barge type.

Inter-Temporal Detail

Each time period in the model is independent of other time periods; however, there is an inter-temporal effect interjected into the modeling process through user specification of infrastructure changes, and through any engineering reliability data included in the analysis. For example, in the MRER each component has a time dependent hazard function that measures the probability of component failure through time as a component ages. The hazard rate is the probability of failure at a given point in time.

Lock performance characteristics can be specified by the user to change through time. This allows for currently authorized projects to come online and change the waterway system transportation characteristics at the appropriate time. Additionally, the analysis of the WPC alternatives requires the investment to be timed, and the characteristics of the waterway system transportation to be adjusted accordingly at the correct times. Lock performance characteristics in this respect are not a factor in the Terry L&D MRER given that any rehabilitation effort will increase reliability, or conversely decrease the probability of component failure rather than installing additional capacity via a new or expanded chamber or infrastructure than increases transit efficiency such as tow haulage equipment.

Of course, lock performance can change through time probabilistically in terms of reliability, which is the focus of an MRER analysis. In this respect, the expected benefits and costs calculated in a given year is dependent upon the results in the previous years. With increasing service disruption through time, expected equilibrium traffic levels can decline as expected capacity declines.

Network and Movement Detail

Much of the model's spatial detail comes through the waterway transportation network definition. The transportation network not only defines pick-up and drop-off nodes, but it also defines constraint points in the system (bottlenecks). Constraint nodes can be any obstruction where vessel queuing, and congestion occurs. While constraint nodes can be areas such as bends or one-way channel sections, typically the only constraint nodes modeled with NIM are navigation projects.

To determine the impact of congestion effects on a movement's transportation costs (and ultimately the movement's equilibrium and transportation surplus), a movement's trip time needs to be estimated. Distances between each model node (both pick-up and drop-off nodes and the constraint nodes) are defined through the input data. Additionally, data on current speeds, channel depths, and equipment drag are input and utilized by a speed function and combined with the trip distance to estimate line-haul trip time. Estimating trip time at the constraint points is different and requires the utilization of the lock project tonnage-transit curves.

Movement Shipping Plans

Waterway congestion does not affect all movements equally. To determine the impact of congestion effects on a movement's transportation costs, shipping costs and characteristics of a movement are needed. Shipment characteristics for tows in NIM are referred to as "shipping-plans." A shipping-plan is needed for each non-self-propelled commodity origin-destination-route barge type movement in the model. Tow shipping plans drive shipping cost measured by dollars per hour per ton. Plans specify shipment tow-size, towboat class, empty backhaul requirements, re-fleeting points, and tons per trip. Given movement tonnage and trip time, a movement costs are calculated and compared to willingness-to-pay for water transportation.

The shipping plans could be specified by the user and given to the model through input; however, this data is not readily available and difficult to compile for large systems and data sets.

Instead, NIM is designed to develop a least-cost shipping-plan for each movement which is then calibrated against observed lock project level data. This NIM shipping-plan developer also allows for re-specification of shipping-plans under increased congestion and for what-if scenarios (e.g., a new larger 1,200-foot main chamber).

3.2.3 Transportation National Economic Development Benefits

Transportation surplus benefits are realized primarily through the implementation of navigation improvements and consist of cost reductions to shippers that prefer to move on the waterway system over the planning period. For some studies, such changes may involve projects that increase lock capacity or transit efficiencies with improvements such as tow haulage equipment.

In the case of an MRER, economic analysis focuses on delay and congestion costs that shippers and vessel operators realize when unplanned outages occur due to mechanical failures at a lock and dam. Shippers and vessel operators would still use the waterway system in the year an unplanned outage occurs, but they would experience substantial delay, congestion, and queuing effects, depending on the extent of the lock outage. Since outages are unplanned and shipping contracts are in place to move commodities, it is assumed that shippers are locked into the transportation option that they measured to be the lowest-cost method going into a particular year. In other words, shippers do not divert to rail, truck, or other modes under this benefit category. Instead, the shipment is planned, and unplanned congestion affects all users of the waterway. With improved reliability, delay costs are largely avoided by replacing the riskiest components; and thus, the likelihood of negative economic impacts to the navigation industry are greatly reduced.

Unscheduled outages can create substantial transportation impacts. When they occur, shippers and vessel operators are unable to plan their shipments efficiently around the outage. Not only can this create excessive delays and congestion, but it can also affect the ability of a lock to process traffic that shippers have planned to move in a given year. When this happens, shipments that are unable to use the lock in any period during the year due to physical capacity constraints would be forced to use other more costly transportation methods such as truck and or rail.

3.2.4 Engineering Reliability Inputs for NIM (System Service Disruption Risk)

Component risk measures the probability of component failure for various failure modes, and each failure mode results in consequences that may be minor, major, or catastrophic depending on the length of the closure, time required to repair components, and the cost of repairs, rehabilitation and or replacement.

Without-project Condition (WOPC)

It is important to understand WOPC reliability of aging locks and the associated probable cost to operate and maintain them into the future. For inland navigation studies, this information is the primary driver of WOPC, or baseline risk. Lock components for Terry L&D are currently in a fix-as-fails state from an engineering perspective despite regular and recurring maintenance. Fix or fails is the no-action alternative or WOPC. WOPC reliability and risk quantification is a major output of the MRER analysis. Appendix A (Engineering Appendix) provides details regarding component risk estimation, and data tables provided with this appendix contain related reliability inputs for NIM including component reliability data, hazard functions, failure consequences in terms of lock closures and or delays, and emergency repair costs.

With-project Condition (WPC)

The MRER analysis then considers how rehabilitation strategies affect risk and reliability of study components. Under the WOPC, alternatives compare different ways to rehabilitate and or maintain study components by reducing risks of component failure; and thus, the likelihood of unplanned lock closures. This risk reduction is quantified via the system benefits between the WOPC and the WPC. Fewer and less frequent lock closures translate into reductions in transportation costs for shippers and consumers of products shipped.

3.2.5 NIM Model Calibration

Using the NIM Target Generator module, the model applied for Terry L&D was calibrated to assess how the network created compares to historical LPMS and WCS data. Calibration in NIM compares historical data to estimated or simulated number of barges (loaded and empty), tonnage, and tows including average horsepower for towboats and the number of barges per tow. For Terry L&D, deviations are minor (Table 13).

Table 13
NIM Calibration Results for Terry L&D Model

Loaded barges		
Target	Model	Percent Difference
5,463	5,463	0%
Empty Barges		
Target	Model	Percent Difference
1,742	1,732	-0.6%
Tonnage		
Target	Model	Percent Difference
8,754,275	8,754,272	~ 0%
Tows		
Target	Model	Percent Difference
928	869	-6%
Average Horsepower		
Target	Model	Percent Difference
3,458	3,404	-2%
Barge Per Tow		
Target	Model	Percent Difference
7.8	8.3	+7%

3.2.6 Study Specific Planning and Economic Assumptions for NIM

Study specific planning assumptions include:

1) When developing the traffic network, no changes were made to the default network generated using the Network Generator NIM module given that it is very unlikely that lock rehabilitation would affect origin and destination pairs or other characteristics of waterway.

2) Start year is 2024 and the base year for the alternatives evaluation is 2031, and the alternatives analysis terminates in 2080. The six years between the start time is necessary to account for schedules of implementing alternative strategies and emergency repairs. For example, all strategies would require conversion to 110-foot stoplogs for dewatering, that in turn require cutting slots and fabricating metal inserts for the slots. In addition, many scenarios would require fabrication of replacement components depending on the event tree failure path.

3) It is assumed there will not be component failures in the implementation years of the 110-foot bulkhead conversion (i.e., slot cutting), or in the years of rehabilitation, or scheduled maintenance.

4) Components are assumed to be eligible to fail in the design and fabrication years of each alternative. This may lead to unscheduled component failures that replace components and a double counting of costs that are included in rehabilitation alternatives.

5) Planned closures due to normal O&M activities are not projected or modeled given that SWL does not close projects for all maintenance activities, and closures do not occur on a regularly scheduled basis. Scheduled closures for regular O&M tend to exacerbate lock closure risk at the project if they occur in the same year as an unscheduled closure.

6) The optimized (least-costly) reactive or fix-as-fails without-project condition (WOPC) was chosen based on preliminary model results, which was the plan to set coffer cells in response to the first component failure requiring a dewater, and to schedule the 110-foot bulkhead conversion in the next year.

7) Normal O&M costs are assumed to be identical between all alternatives, and are not included in the cost-benefit analysis.

8) Discounting and costs assume a 2.25 percent[4] discount rate for federal water resources projects with end of year discounting.

9) NED analysis is based on the mid-point (50th percentile) traffic forecast. Forecasts were estimated for 5 percentiles (lower 5th, lower 25th, 50th, upper 25th, and upper 5th).

10) Inelastic demand of zero is assumed meaning that the selected plan would not induce additional traffic above baseline values. In other words, shippers that currently do not use the waterway would not be enticed to shift to waterway transport due to increased project reliability due to a rehabilitation strategy.

11) For NIM reporting, we used the "most likely hazard functions," and "historic routings" and all other options were default or null.

4.0 NED Evaluation for Study Alternatives

Section 4 outlines the NED evaluation process based on economic modeling using NIM, ARNOLT and inputs from engineering and planning. Alternatives and engineering inputs are summaries provided for readers. The main report and engineering appendix provide detailed discussions.

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[4] Model runs for the TSP took place in Sept of 2022, and will be updated to FY 23 price levels and discount rate (2.50 percent) pending receipt of final certified costs in the 2nd quarter of FY23.

4.1 Without Project Condition

The Without Project Condition (WOPC) or No-action alternative serves as the baseline for comparing alternatives during plan evaluation. The WOPC is a reactive or "fix as fails" strategy meaning that SWL continues maintaining the lock and dam as it has in the past using inspections and repairs funded by annual Operation and Maintenance (O&M) funds. The WOPC includes:

- Developing baseline stochastic event trees (i.e., failure modes) for each component selected for the MRER along with repair costs and duration of lock outages;
- Estimating time dependent hazard functions for baseline failure modes that measure how the risk of component failure increases over the period of analysis;
- Projections of future traffic through the Terry L&D over the period of analysis; and,
- Lock capacity curves.

As discussed previously, each of the above items are key inputs into the NIM.

4.1.1 Baseline Failure Modes in the WOPC

Baseline failure modes and hazard functions for MRER components comprise a substantial portion of the time and budget for a typical study. This effort involves both engineering and operations staff. For a given component such as a miter gate, the PDT first determines failure modes along with a corresponding probability. Once the modes are established, the team then develops the most likely course of remedial action, repair costs and repair durations of potential lock closures. Lock closure durations are critical given that the cost of vessel delays and rerouting of cargo are costly for both shippers and consumers nationwide. Lock closure durations and repair costs vary based on different failure modes, but one major factor and risk driver is the approach the district takes to dewater the lock to make repairs.

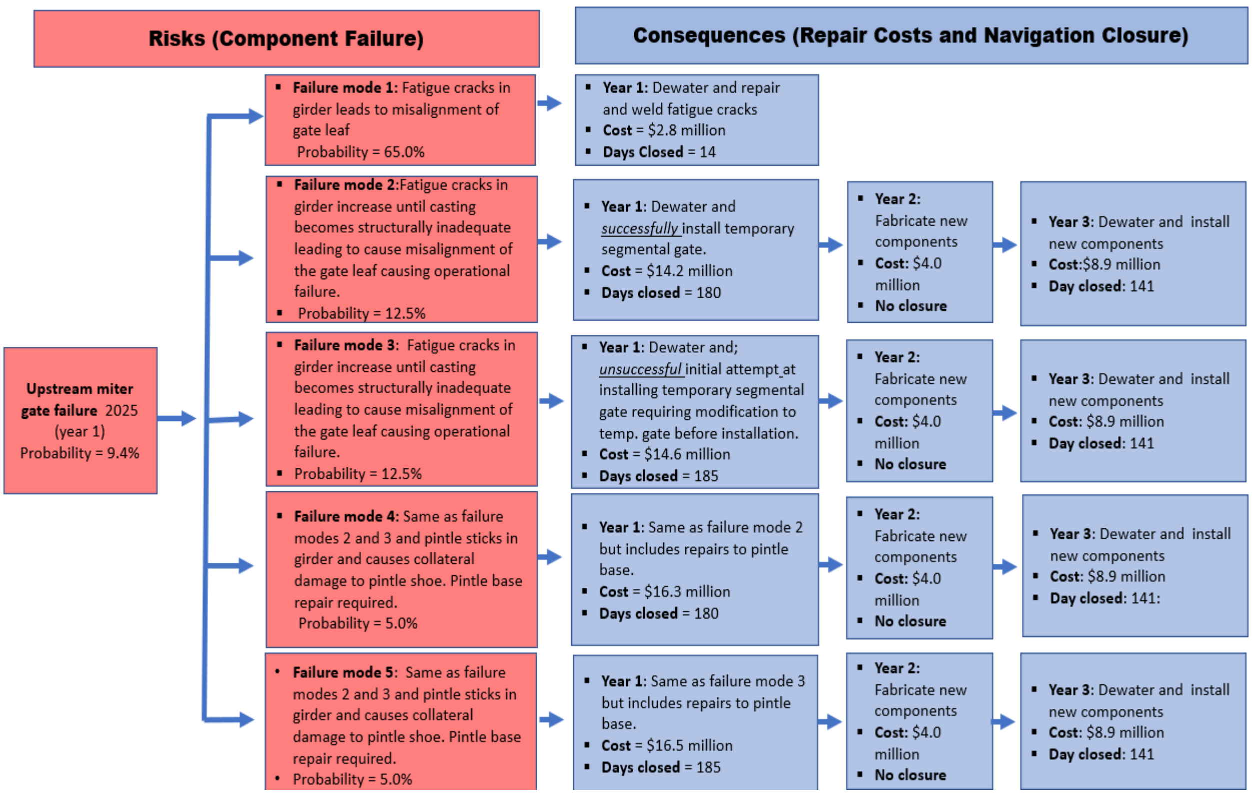
When USACE built the MKARNS in the late 1960s, dewatering was done by using a center post receiver and 50-foot stoplogs rather than 110-foot stoplogs, which is more common today. The only lock and dam on the MKARNS equipped for 110-foot stoplogs is Montgomery Point L&D, built in the 2004 versus the remaining MKARNS locks completed in 1970. Center post anchorages at other projects are in a failed state, and those not in a failed state are in poor condition thereby posing serious safety concerns to work crews during a dewater.

SWL can still dewater Terry L&D via the center post receiver and 50-foot stoplogs, if and only if the receivers pass a pull (load) test within a twelve-month window prior to dewater and visual inspection immediately prior to dewater. So far, all center post receiver anchorages that have been identified as being in a failed state have been identified through visual inspection versus load testing. As a result, SWL has assumed center post anchorages at Terry L&D are near failure, and that this method is not an option for future dewatering to address emergency component failures. For the MRER and NIM modeling, the FWOP assumes the following dewater options in response to a failure mode:

- **WOPC 1: Coffer Cells Only** – Set coffer cells to dewater in all instances where a dewater is required. Each dewater would close the lock 120 days with an additional period to address the relevant component.
- **WOPC 2: Coffer Cells Followed by Planned 110-Foot Stoplog Conversion** – Set coffer cells for emergency dewatering and repairs in the first year, followed by planned closure for 110-ft stoplog conversion using 110-foot stoplogs for any subsequent dewatering needed to repair the lock. SWL would acquire the metal inserts for the 110-foot stoplog slots in the first year of the emergency closure. Cutting new slots for the 110-foot logs would be "one sided" meaning the lock would not be dewatered. Workers would cut slots on one side (land/river wall) of the lock, and then move to the other. Traffic continues but tows would be restricted to two barges in width (typically tows three barges wide can navigate MKARNS locks). After slot cutting, regular navigation would commence for several months and then the lock would close for an additional 35 days to conduct sill work.
- **WOPC 3**: **Emergency 110-Foot Stoplog Conversion** would involve dewatering with coffer cells, acquiring metal inserts, cutting slots on both sides of the lock chamber, and conducting the necessary sill work in a full closure for 365 days (at minimum).

Each WOPC scenario considered included lock closure impacts to the navigation industry with repair costs that vary by component and failure mode. A detailed description of each exceeds the limits of a report summary so, as an example, 5 shows the baseline event tree and failure modes for an unexpected failure of an upstream miter gate with a dewater option of setting coffer cells each time the chamber needs dewatering for subsequent repairs (WOPC 1). The initial node is probability of failure for a miter gate leaf in year 1 (2025) of the analysis (9.4 percent). There are potential failure modes with varying degrees of repair costs and navigation closure durations. With the exception of failure mode 1, replacement of the miter gate and other applicable components would occur over a 3-year period (2025 through 2028). Event trees for all components are available in the Engineering Appendix.

Figure 5
Baseline (2025) Event Tree and Consequences for a Failure of the Upstream Miter Gate at Terry Lock and Dam (assumes dewater method is to set coffer cells each time dewatering is required)



4.1.2 Hazard Functions

In the above example, there is a 9.4 percent chance that the upstream miter gate will fail in year 2025. Probability of failure increases through time in the FWOP as a component continues to deteriorate. Expected rates of component deterioration through time and a corresponding increase in potential component failure are measured by hazard functions, which are based on time dependent Weibull probability density functions. Hazard rate is the condition that a component has survived from time 0 to time t and fails in the next increment of time (dt), (years in the case of an MRER). Hazard functions vary by component, and were developed by SWL engineers in consultation with the RMC and INDC (see Engineering Appendix for detail).

4.1.3 Array of Alternatives Selected for NED Evaluation

The study team identified four potential alternatives to analyze and compare prior to selecting a plan: 1) No-action alterative, and 2) rehabilitation plans consisting of an immediate rehabilitation that would replace both upstream and downstream miter gates (Alternative 2A), pintles and quoins, an advanced maintenance strategy (Alternative 4A), and a scheduled repairs strategy (Alternative 5A). The main report discusses plan formulation in detail.

No-action Alternative (WOPC)

As part of this MRER study, the PDT analyzed the potential WOPC dewatering scenarios using the NIM model. Based on the results, FWOP 2 (coffer cells followed by planned 110-foot stoplog conversion) showed to be the optimized condition. NIM results showed that the annualized costs to both the navigation industry and the USACE was $381 million for WOPC 1 (dewater with coffer cells only), $273 million for WOPC 3, versus about $250 million for WOPC 2. As a result, the No-action alternative (coffer cells followed by planned 110-foot stoplog conversion) is the baseline to which all other alternatives are compared. As discussed previously, in the event of an unexpected failure of any component included in the MRER, the WOPC would set coffer cells to dewater the lock chamber and repair a component or install a temporary fix in year 1, followed by a planned closure in the second year where crews would cut slots, install metal inserts, and modify the sill. Any additional dewatering for additional component repairs would use 110-foot stop logs and would be the most economical strategy in an unplanned component failure and resultant lock closure.

Action Alternatives (WPC)

For action alternatives, plans vary based on dewatering approach and timing. Before discussing alternatives, it is important to explain “reset” values. Every alternative will impact the condition of components. In the case of a full rehabilitation, component conditions will restore to their original or new state meaning that the probability of failure resets to year zero (i.e., 1971 when the project came online). Reset values for scheduled repairs and advanced maintenance vary, but area lower than the immediate full rehabilitation as shown in tables 13 and 14 below.

Alternative 2A (Immediate Rehabilitation via Planned 110-Foot Stoplog Conversion) would replace upstream and downstream components including miter gates, pintles and quoins. Work would begin in 2025 (year 1) with the procurement of the metal inserts for the 110-foot stoplog slots and the design of all identified components for rehabilitation. The 110-foot stoplog conversion slot cutting would commence in 2026 (year 2) by use of the one-sided approach, which will allow 2 wide tows to navigate the lock for the 150 days required for cutting. After slot cutting, regular navigation would commence for several months and then the lock would close for an additional 35 days to conduct sill work. Starting in 2027 (year 3), the upstream and downstream miter gates and other identified components would be fabricated. In 2029 (year 5), the lock would close for 37 days during the off-peak navigation season (typically July through August) to replace all upstream components including miter gates. In 2030 (year 6), the lock would again close for 37 days during the off-peak navigation season to replace all downstream components including miter gates. All required fabrication and acquisition of materials would occur in years 3 through 5. This alternative would reset the hazard function for all components to their original state (approximately zero).

Alternative 2B (Immediate Rehabilitation via Coffer Cells Dewater) would replace all components and work would begin in 2025 with component design and fabrication. Dewatering and construction installation would occur in 2028 with a 157-day full closure of the lock. This alternative would reset the hazard function for all components to their original state (approximately zero).

Alternative 4A Advanced Maintenance would repair components for which expenditures are in excess of routine O&M. Repairs focus on reducing the likelihood of some emergency repairs, temporary service losses, and/or the rate of service degradation. This alternative starts in 2025 with design, followed by the 110-foot stoplog conversion (defined in Alternative 2A) in 2026, and then the first iteration of repair work starts in 2028. Advanced Maintenance would occur every 10 years starting in year 2028 and would include the following tasks: repair cracked welds, replace grease lines, apply belzona (quoins) and replace bubblers (miter gates). Advanced maintenance interval 1 (year 2028) would reset the probability of failure by 2 years and would close the lock for 14 days. Advanced maintenance interval 2 (year 2038) would also reset the probability failure by 2 years but would close the lock for 16 days. The increase in days is due to only resetting the probability of failure by 2 years in interval 1. This means that more repairs are likely to be needed each time it is dewatered for advanced maintenance since the components are not replaced with new components. The reset value and duration of closure for iterations 1 through 5 are depicted in Table 14.

Table 14
Alternative 4A Advanced Maintenance Reset Values and Closure Durations

Iteration	Year	Reset Value	Closure Duration
1	2028	2	14 days
2	2038	2	16 days
3	2048	1	18 days
4	2058	1	20 days
5	2068	0	22 days

Based on engineering judgment coupled with historical data collected from Terry L&D, the reset value is set to decrease as the number of iterations of advanced maintenance are executed (i.e., the reliability of the components decreases over time even with advance maintenance). Reliability decreases over time cause an increase in time needed to conduct repairs due to increased complexity of the repairs, which ultimately increases the cost.

Alternative 5A Scheduled Repair would involve repairing cracked welds, replacing bent members (miter gates), and sand blast and paint components every 20 years starting in year 2028. This alternative starts in 2025 with design, followed by the 110-foot stoplog conversion (defined in Alternative 2A) in 2026, and then the first iteration of repair work starts in 2028. The first scheduled repair interval would reset the probability failure by 4 years. Each scheduled repair interval after would have a probability failure of one less than the previous iteration. The maintenance period for the first iteration of scheduled repairs would close the lock for 21 days. The reset value and duration of closure for iterations 1 to 3 are depicted in the Table 15.
As is the case with Alternative 4A, reset values decrease through time, while closure durations increase.

Table 15
Alternative 5A Scheduled Repair Reset Values and Closure Durations

Iteration	Year	Reset Value	Closure Duration
1	2028	4	21 days
2	2048	3	26 days
3	2068	2	31 days

4.2 National Economic Development Cost Benefit Analysis

NED is an important metric in selecting an MRER plan. The PDT relied on the NIM model to estimate NED benefits for each plan. Figures are in FY22 dollars, and the planning period runs from 2024 through 2080 and benefits would begin to accrue in 2030. Costs and benefits are annualized using the FY22 discount rate of 2.25 percent. Price levels and the relevant current discount rate for the recommended plan will be updated prior to publication of the final report.

4.2.1 Alternative Plan Costs

Project first costs for the final array of plans vary in terms of funding source and timing of implementation. Construction of Alternative 2A (Immediate Rehab with 110-foot Slot Conversion) has five key tasks involving design, fabrication, and installation of upstream and downstream lock components beginning in 2025 and ending in 2030 (Table 16). Funding would be Construction General (CG). Alternative 2B (Immediate Rehab with Coffer Cells) is similar to 2A, but does include the 110-foot slot conversion (Table 17). Coffer dams would dewater the lock. Implementation of both Alternatives 4A and 5A would rely on Operations and Maintenance (OM) funding, and would include the 110 stoplog conversion in 2025 and 2026. Additional expenditures for maintenance activities and scheduled repairs occur at different intervals over the period of analysis (Tables 18 and 19). Table 20 summarizes average annual equivalent costs including interest during construction for all alternative plans.

Table 16
Construction Costs Alternative 2A (Immediate Rehab 110 Slot Conversion, $millions)

Activity	2025	2026	2027	2028	2029	2030	Total by activity
Design slot conversion and immediate rehab.	$3.87	$2.59	-	-	-	-	$6.46
110-foot stoplog conversion [1]	-	$10.43	-	-	-	-	$10.43
Fabricate miter gates	-	-	$9.79	$4.90	$4.90	-	$19.58
Install components	-	-	-	-	-	$25.02	$25.02
Total by year	$3.87	$13.02	$9.79	$4.90	$4.90	$25.02	$61.49

[1] Fabricate and install metal inserts, cut slots, and modify sills.

Table 17
Implementation Costs Alternative 2B (Immediate Rehab 110 Coffer Cells, $millions)

Activity	2025	2026	2027	2028	Total by activity
Design and fabricate components for rehab.	$11.72	$6.19	$4.90	-	$22.81
Install components	-	-	-	$25.02	$25.02
Total by year	$11.72	$6.19	$4.90	$25.02	$47.83

Table 18
Implementation Costs Alternative 4A (Advanced Maintenance, $millions)

Activity	2025	2026	2028	2038	2048	2058	2068	Total by activity
110-foot stoplog design	$1.50	-	-		-	-	-	$1.50
110-foot stoplog conversion [1]	-	$9.50	-		-	-	-	$9.50
Advanced maintenance activities	-	-	$2.30	$2.83	$3.48	$4.28	$5.27	$18.16
Total by year	$1.50	$9.50	$2.30	$2.83	$3.48	$4.28	$5.27	$29.16

[1] Fabricate and install metal inserts, cut slots, and modify sills.

Table 19
Implementation Costs Alternative 5A (Scheduled Repairs, $millions)

Activity	2025	2026	2028	2038	2048	Total by activity
110-foot stoplog design	$1.50	-	-		-	$1.50
110-foot stoplog conversion [1]	-	$9.50	-		-	$9.50
Advanced maintenance activities	-	-	$5.59	$8.47	$12.83	$26.89
Total by year	$1.50	$9.50	$5.59	$8.47	$12.83	$37.89

[1] Fabricate and install metal inserts, cut slots, and modify sills.

Table 20
With-project Condition First Costs and Average Annual Equivalent Costs for the Final Array of Alternatives
($millions)

Alternative 2A (Immediate Rehab 110 Slot Conversion)	
Construction general funds	$61.49
Operations and maintenance funds	-
Interest during construction	$2.68
Total implementation cost	$64.17
Total average annual construction costs	$2.15
Alternative 2B (Immediate Rehab with Coffer Cells)	
Construction general funds	$47.83
Operations and maintenance funds	-
Interest during construction	$1.09
Total implementation cost	$48.92
Total average annual construction costs	$1.64
Alternative 4A (Advanced Maintenance)	
Construction general funds	-
Operations and maintenance funds	$29.16
Interest during construction[1]	($5.44)
Total implementation cost	$23.71
Total average annual implementation costs	$0.79
Alternative 5A (Scheduled Repairs)	
Construction general funds	-
Operations and maintenance funds	$37.89
Interest during construction[1]	($8.69)
Total implementation cost	$29.21
Total average annual implementation costs	$0.98

1. Some expenditures occur after the project on-line year (i.e., negative IDC). Negative IDC is considered a negative cost rather than a cost in the benefit-to-cost ratio calculation per USACEHQ direction.

4.2.2 Alternative Plan Benefits

As discussed previously, alternative benefits primarily consist of avoided costs associated with unscheduled loss of service due to component failure. In Table 21 below, these impacts are reported as dis-benefits (i.e., negative) given that they reduce the total annual NED benefits of full operation of lock and dam that accrue to the nation including shippers, carriers, and U.S. consumers (transportation surplus benefits). Unscheduled repair costs are the costs to the U.S Treasury in terms of repairing components that fail. These costs are the lowest for Alternatives 2A and 2B since these plans would buy down the greatest amount of risk over the period of analysis. In other words, SWL would install brand new components.

Table 21
With-project Average Annual Equivalent Costs for Final Array of Alternatives ($millions)

	Without Project (Coffer Cells then Slot Cutting)	Alternative 2A (Immediate Rehab 110 Conversion)	Net Benefits
Transportation surplus benefits			
Full operations annual benefits (no service disruption)	$535.29	$534.29	($0.996)
Unscheduled over capacity diversions to land	($0.0017)	($0.0005)	$0.001
Unscheduled failure repair service disruptions	($13.07)	($3.52)	$9.554
Total average annual transportation surplus benefits	$522.22	$530.77	$8.559
Other annual benefits	-	-	-
Unscheduled repair costs (avoided costs versus WOPC)	$3.11	$1.21	$1.903
Total average annual benefits	-	-	$10.462
	Without Project (Coffer Cells then Slot Cutting)	**Alternative 2B (Immediate Rehab Coffer Cells)**	**Net Benefits**
Transportation surplus benefits			
Full operations annual benefits (no service disruption)	$535.29	$534.29	($0.996)
Unscheduled over capacity diversions to land	($0.001)	($0.002)	($0.001)
Unscheduled failure repair service disruptions	($13.64)	($61.80)	($48.16)
Total average annual transportation surplus benefits	$521.65	$472.49	($49.16)
Other annual benefits			
Unscheduled repair costs (avoided costs versus WOPC)	$3.03	$2.74	$0.29
Total average annual benefits	-	-	($48.87)
	Without Project (Coffer Cells then Slot Cutting)	**Alternative 4A (Advanced Maintenance)**	**Net Benefits**
Transportation surplus benefits			
Full operations annual benefits (no service disruption)	$535.29	$534.60	($0.69)
Unscheduled over capacity diversions to land	($0.002)	($0.001)	$0.001
Unscheduled failure repair service disruptions	($13.074)	($8.442)	$4.632
Total average annual transportation surplus benefits	($13.07)	($8.44)	$4.63
Other annual benefits			
Unscheduled repair costs (avoided costs versus WOPC)	$3.11	$1.69	$1.42
Total average annual benefits	-	-	$5.36
	Without Project (Coffer Cells then Slot Cutting)	**Alternative 5A (Advanced Maintenance)**	**Net Benefits**
Transportation surplus benefits			
Full operations annual benefits (no service disruption)	$535.29	$534.53	($0.76)
Unscheduled over capacity diversions to land	($0.002)	($0.001)	$0.001
Unscheduled failure repair service disruptions	($13.074)	($8.980)	$4.094
Total average annual transportation surplus benefits	($13.07)	($8.98)	$4.09
Other annual benefits			
Unscheduled repair costs (avoided costs versus WOPC)	$3.11	$1.98	$1.13
Total average annual benefits	-	-	$4.47

4.2.3 National Economic Development Plan

The plan with the highest net benefits is Alternative 2A (immediate rehabilitation with one sided slot cutting and 110-foot stop logs for dewatering) (Table 22).

Table 22
National Economic Development Metrics for Final Array of MRER Alternatives for Terry Lock and Dam MRER* (monetary figures in $millions)

Metrics (annualized)	**Alternative 2A** (Immediate Rehabilitation with 110-ft Stoplog Conversion)	**Alternative 2B** (Immediate Rehabilitation with Coffer Cells)	**Alternative 4A** (Advanced Maintenance with110-ft Stoplog Conversion)	**Alternative 5A** (Scheduled Repair with 110-ft Stoplog Conversion)
Plan benefits	$10.46	($48.87)	$5.36	$4.47
Plan costs	$2.15	$1.64	$0.79	$0.98
Net benefits	$8.31	($50.51)	$4.56	$3.49
Benefit to cost ratio	4.9	(29.8)	6.7	4.56

* FY 2022 dollars, planning period 2024-2080 with base year 2030 and annualized at the FY discount rate of 2.25 percent. Price levels and the relevant current discount rate for the recommended plan will be updated prior to publication of the final report.

4.2.4 Recommended NED Plan

Based on alternatives screening and NED analysis, the MRER PDT recommends Alternative 2A as the TSP based on NED benefits. At a total cost of $61.5 million, the plan would restore upstream, and downstream components (miter gates pintles, quoins and miter gate anchorages) selected for the MRER to their original condition thereby greatly reducing the risk of component failure over the period of analysis. The BCR for Alternative 2A is 4.9 indicating a economically justified project.

5.0 NED Benefits Sensitivity Analysis

Sensitivity analyses in MRERs can include a wide array of metric such as hazard functions, closure durations, component composition of alternatives plans, but the amount of traffic a lock processes is a major variable when estimating NED benefits.[5] As such, traffic is a common

[5] A comment from the focused ATR conducted in 2022 suggested that the PDT consider a component level sensitivity analysis where individual components are dropped from the NIM modeling in a stepwise manner to determine their affect on the overall NED metrics. Based on discussions, the PDT opted not to conduct this analysis given that it would not affect the decision or recommended TSP. The immediate rehabilitation plan recommended involves the miter gates that are subsystems of the lock and dam. The

metric for sensitivity analysis in an MRER. Reasonable assumed or estimated variation in other metrics such as hazard rates (risk) or closure durations and costs (consequences) will generally fall within the range of NED metrics for traffic projection bounds (Table 23). Traffic forecasts are stochastic with the lower bound set at a 95 percent chance of exceedance in any given year over the period of analysis. Net benefits at the lower bound are still positive at $5.62 million with a BCR of 2.6.

Table 23
National Economic Development Metrics for the Range of Projected Traffic Levels Estimated for Terry Lock and Dam MRER

Metric	95 Percent Chance of Exceeding	75 Percent Chance of Exceeding	50 Percent Chance of Exceeding	25 Percent Chance of Exceeding	5 Percent Chance of Exceeding
Average annual tonnage over period of analysis	7.05	8.96	10.43	12.11	13.92
Net benefits	$5.62	$7.14	$10.46	$12.15	$13.97
BCR	2.6	3.3	4.9	5.6	6.5

6.0 Comprehensive Benefits Analysis

USACE Policy Directive memorandum from the Assistant Secretary of the Army (Civil Works) entitled *Comprehensive Documentation of Benefits in Decision Document* (January 2021) supplements the Planning Guidance Notebook (ER 1105-2-100) by requiring project teams to analyze and consider “comprehensive” project benefits (and dis-benefits if applicable) in addition to NED including regional development, environmental, and other social effects. Total benefits can be monetized and/or quantified benefits if possible or cost feasible with project budgets, along with an accounting of qualitative benefits for final arrays of project alternatives.

6.1 Regional Economic Development Benefits

Regional economic impacts are measured as changes in economic output, jobs, and income resulting from project construction and operation. The USACE Regional Economic System (RECONS) is a certified regional economic impact model, designed to provide accurate and defensible estimates of regional economic impacts and contributions associated with USACE

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components making up the miter gates (gates, quoins, and pintles) were constructed and installed when the project was originally built, and are in similar physical states. In other words, gates cannot function if any one component fails, and not replacing one component while replacing the others is not logical.

projects, programs, and infrastructure. RECONS generates estimates simultaneously for three levels of geographic impact area: local, state, and national level.

RECONS is an input output model and social accounting matrix, which are the standard tools to conduct economic impact analysis and model the structure of regional and national economies. RECONS estimates interlinkages between consumption sectors and supply chains among different private sectors such as business, industry, and government. The end result is model that measures how expenditures or consumption in one economic sector affect other sectors. For example, if the USACE rehabilitates a lock, they would hire a construction contractor. The construction contractor would use the revenue to pay their employees and company owners or shareholders, and they would purchase materials and services from other business in a region. Thus, the original dollars spent on construction circulate through the economy via multiplier effects. Construction impacts are transitory and end when the construction is complete. On the other hand, maintenance expenditures may be recurring on a periodic basis as is the case with two alternative plans (Alternative 4A Advanced Maintenance and Alternative 5A Scheduled Repairs).

Users can specify geography for local economic impacts. Generally, local economies consist of groups of counties that form a functional economic region. Terry L&D is in the Little Rock Conway Combined Statistical Area (Figure 5). Combined Statical Areas (CSAs) represent multiple metropolitan or micropolitan areas that have an employment interchange of at least 15 percent, and are good representations of regional or local economies.

- **Output**: Total production measured by sales revenues with the exception of retail sales, which is not physical production of goods or services, but rather mercantile transactions.

- **Jobs**: Number of full-time equivalents (FTE) jobs (annual average) required by a given industry including self-employment measure on annual basis.

- **Labor Income**: Payroll cost for a given industry including annual employee compensation and benefits.

- **Value Added (Gross Domestic Product)**: Labor income as described above and corporate income, rental income, interest payments, and taxes pr fees paid by an industry to local, state and federal government. Value Added or Gross Domestic Product (GDP) is a common measure of the size of an economy. Basically, GDP is money created by regional economic sectors that stays in the region, and does not flow out in the form of expenditures on imported goods and services or other transfers of capital outside an economy's geographic boundaries.

Table 24 displays project expenditures for the final array of alternatives less Alternative 2B that has substantial negative net NED benefits and a BCR of (-34.0) and resultant economic impacts at a local, state and national level. As discussed above, regional economic impacts capture leakages from each impact area, and multiplier effects that capture circulation of project expenditures through supply chains from purchases of goods and services needed to operate businesses and industries and spending by employees in each area. The recommended plan (Immediate Rehabilitation) maximizes regional economic benefits.

Figure 5
Little Rock Conway Combined Statistical Area (local impact area used for regional economic development benefit analysis)

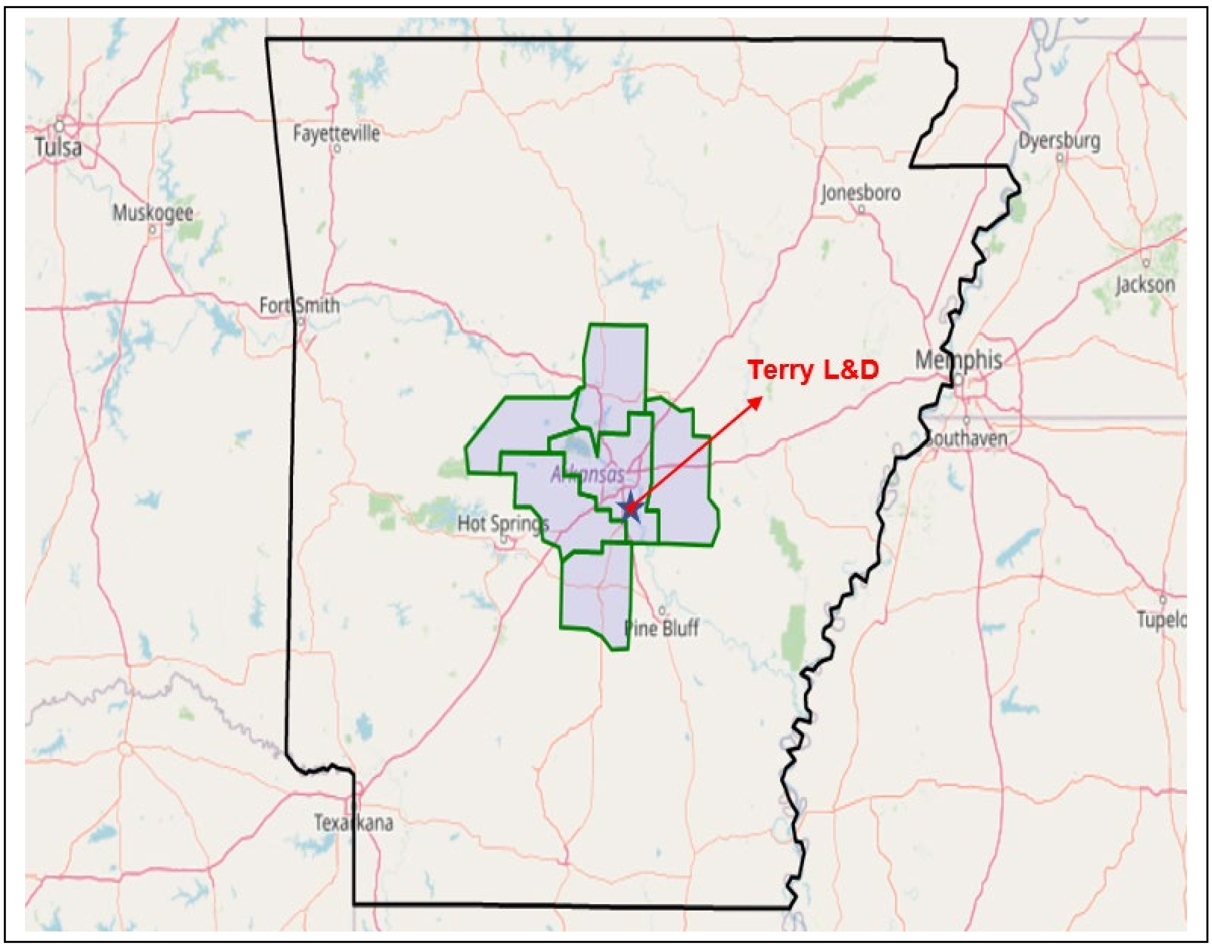

Table 24
Regional Economic Impacts of Plan Implementation of Final Alternatives Arrays
(Monetary figures in millions, job impacts measured in full-time annual equivalents)

Impact Area	Plan Expenditures	Regional Economic Impacts			
		Output	Jobs	Labor Income	GDP
Tentatively Selected Plan (Immediate Rehabilitation)					
Little Rock-Conway CSA	$61.5	$78.5	112	$41.7	$49.5
Arkansas	$61.5	$82.2	119	$42.8	$51.2
U.S.	$61.5	$164.2	172	$69.7	$93.6
Alternative 4A Advanced Maintenance					
Little Rock-Conway CSA	$31.2	$30.9	15	$16.2	$19.9
Arkansas	$31.2	$33.1	15	$16.9	$21.0
U.S.	$31.2	$82.9	19	$32.1	$45.5
Alternative 5A (Scheduled Repairs)					
Little Rock-Conway CSA	$39.9	$39.9	19	$20.8	$25.5
Arkansas	$39.9	$42.3	19	$21.6	$26.8
U.S.	$39.9	$106.1	24	$41.2	$58.2

6.2 Environmental Quality and Other Social Effects

For each alternative plan, study teams are required to analyze and tabulate positive and negative environmental impacts consistent with current ecosystem restoration or environmental compliance guidance. At the time of appendix preparation, environmental impacts are negligible given the small project footprint; and as result, the recommended plan is expected to qualify for a categorical exclusion under NEPA. Other social effects are often less tractable and include range of factors such as environmental justice, urban impacts, and rural community impacts; life, health, and safety factors; displacement; and long-term productivity.

From a social standpoint, any alternative would benefit communities on a local, regional, and even national level. Alternatives would help ensure efficient navigation by reducing the risk of unplanned project closures due to mechanical failure. In the absence of a plan to reduce failure risks, the MKARNS will experience ongoing closures, some of which would be substantial, resulting in lost business activity for ports and terminals, tow companies and the businesses that support them via supply chains. These businesses employ thousands of people in Arkansas and Oklahoma, and when revenues from shipping on the MKARNS fall, the navigation industry and employees suffer. Over the long term an unreliable system would also lower shipper demand as businesses who pay to have cargo moved on the river may look for more efficient and reliable routes elsewhere. So basically, a reliable waterway sustains a significant economic engine in the region, that provides jobs and income to regional workers and business owners.

APPENDIX C

Environmental Considerations

David. D Terry Lock and Dam
Major Rehabilitation Evaluation Report

April 2023

US Army Corps
of Engineers
Little Rock District

DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
POST OFFICE BOX 867
LITTLE ROCK, ARKANSAS 72203-0867
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Little Rock District

MEMORANDUM FOR Little Rock District Operations Division (CESWL-OP), P.O. 867, Little Rock, Arkansas 72203-0867.

SUBJECT: Environmental Compliance for the David D. Terry Lock and Dam Major Rehabilitation Evaluation Report, Pulaski County, Arkansas.

1. David D. Terry Lock and Dam (Terry L&D) is one of 16 locks and dams on the McClellan-Kerr Arkansas River Navigation System (MKARNS) in Oklahoma and Arkansas designed, constructed, and operated by the U.S Army Corps of Engineers (USACE). USACE Tulsa District (SWT) operates MKARNS locks and dams in Oklahoma, and the Little Rock District (SWL) operates facilities in Arkansas including Terry L&D, located at Navigation Mile (NM) 108.1 on the Arkansas River. Historically, Terry L&D has had continual impacts to navigation due to a lack of maintenance on aging structural and mechanical components of the lock and dam. As a result, SWL leadership initiated a Major Rehabilitation Evaluation Report (MRER) to assess potential solutions.

An MRER identifies the most economical strategy to address deficiencies and improve L&D reliability. Methods applied are consistent with Engineering Regulation (ER) 1130-2-500, supplemented by Engineering Pamphlet (EP) 1130-2-500 (December 1996), and include incorporating risk and uncertainty and probabilistic reliability analyses of project components. Engineering reliability and risk follow guidelines in Engineering Circular (EC) 1110-2-6062 (February 2011).

The Water Resources Development Act of 1992 (P.L. 102-2580), Section 205; as amended by Water Resources Reform and Development Act of 2014 (P.L. 113-121), Section 2006 authorizes the USACE to conduct the Terry L&D MRER.

2. The Regional Planning and Environmental Center (RPEC), Environmental Branch (CESWF-PEE) evaluated and documented environmental compliance of the proposed rehabilitation of failing lock components in accordance with 33 CFR Part 230, Procedures for Implementing NEPA (ER 200-2-2); 40 CFR Parts 1500-1508, Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA; and all other applicable laws, regulations, and policies in this memorandum.

3. Proposed Action: Immediate Rehabilitation via Planned 110-Foot Stoplog Conversion. Under the proposed action, all lock components selected for the MRER (downstream and upstream) would be replaced. Work would begin in 2025 (year 1) with the procurement of metal inserts for the 110-foot stoplog slots and the design of all

identified components for rehabilitation. Note that in the case of replacing the existing two 55-foot stoplogs to one 110-foot stoplog, conversion is used interchangeably with replacement. The 110-foot stoplog conversion slot cutting would commence in 2026 (year 2) by use of the one sided approach, which does not require dewatering and will allow two-wide tows to navigate the lock for the 150 days required for cutting. After slot cutting, regular operations of the lock and dam would resume without restriction for several months, then the lock would close for an additional 35 days to conduct sill work. Starting in 2027 (year 3), the upstream and downstream miter gates and other identified components would be fabricated. In 2029 (year 5), the lock would close for 37 days during the off-peak navigation season (typically July through August) to replace all upstream components including miter gates. In 2030 (year 6), the lock would again close for 37 days during the off-peak navigation season to replace all downstream components including miter gates. All required fabrication and acquisition of materials would occur in years 3 through 5. This alternative would reset the hazard function for all components to their original state (approximately zero).

The project footprint lies mostly within previously disturbed areas (Enclosure 1). David D. Terry East Park will be used for vehicular access and staging. This area is mowed frequently and can be accessed along existing roads. Two existing boat ramps located within the park will be utilized for water access to the lock both upstream and downstream of the dam for transportation of personnel, supplies, and small equipment. Several Best Management Practices (BMPs) will be implemented to avoid and minimize impacts to navigation as well as regulated and trust resources prior to, during, and after construction. The full list of BMPs to be implemented to avoid and minimize impacts to sensitive environmental resources, both physical and human, can be found in Enclosure 2.

The frequency and duration of lock closures will be minimized to the greatest extent practicable. Typically, three-wide barge tows can navigate MKARNS locks, but using the one-sided approach during 110-foot stoplog conversion slot cutting in year two will allow for two-wide barge traffic and avoid full lock closure for the 150-day required period. After the stoplog conversion slot cutting is completed, traffic will return to normal operations for several months, then the lock will be closed for 35 days to conduct sill work. One 35-day and two 37-day closures will be required for sill work and both upstream and downstream component replacement to include miter gates; however, these closures will be timed and temporary and will occur during the off-peak navigation season so as to minimize impacts to navigation.

Affected parties will be coordinated with and notified early and often so plans can be made in response to the barge width limitations and full lock closures. As soon as the lock closure schedule is defined, any outages or foreseen impacts to the navigation industry will be communicated through the issuance of navigation notices. Recipients of these notices include but are not limited to the Arkansas-Oklahoma Port Operations Association, U.S. Coast Guard, state transportation agencies, and various carriers, ports, and terminals. Navigation notices will be provided 6-12 months in advance to give stakeholders ample time to plan their shipments around the outage(s). Various annual meetings with stakeholders and industry parties are also held each year where the construction schedule will be shared. To minimize cumulative impacts to industry from closures at other locks along the MKARNS, the closures required in the proposed action will be aligned concurrently with others to the greatest extent practicable.

David D. Terry East Park is open to public access for recreation and water access via two boat ramps: one upstream of the lock and dam, and one downstream. To minimize impacts from the proposed action on recreation, the two boat ramps will remain open to the public with safety BMPs in place to the greatest extent practicable. Boat ramps will remain open on the weekends to public access, and limited, well-planned closures may occur on weekdays only when necessary. To ensure public safety, construction areas will be clearly delineated and separated from public access areas. Parking areas will be designated and appropriately marked for public use. When dropping watercrafts into the river for construction-related use, contractor personnel will be onsite to guide the construction-related trailering efforts and ensure typical safety measures are being employed. Further BMPs will be developed as additional construction and timeline specifications are established.

4. Categorical Exclusion. The proposed action has been reviewed in accordance with 33 CFR Part 230, Procedures for Implementing NEPA (ER 200-2-2); and 40 CFR Parts 1500-1508, Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA. The proposed action would constitute maintenance, repair, rehabilitation, and/or replacement of existing lock components to maintain the authorized project purpose of navigation. The BMPs listed in Enclosure 2 would avoid and minimize to the greatest extent practicable all impacts to navigation user groups, as well as terrestrial and aquatic resources. There would be no adverse, permanent impacts as a result of the MRER efforts. There are no extraordinary circumstances which would dictate the need to prepare an Environmental Assessment or Environmental Impact Statement. The proposed project would meet the conditions for a Categorical Exclusion from the need to prepare NEPA documentation according to ER 200-2-2 (9) Categorical Exclusions (a):

"*Activities at completed Corps projects which carry out the authorized project purposes. Examples include routine operation and maintenance actions, general administration, equipment purchases, custodial actions erosion control, painting, repair, rehabilitation, replacement of existing structures, and facilities such as buildings, roads, levees, groins and utilities, and installation of new buildings utilities, or roadways in developed areas.*"

5. Clean Air Act (CAA). According to the Arkansas Department of Environmental Quality (ADEQ), the entirety of the State of Arkansas meets all Federal air quality standards for criteria pollutants. As the state is in attainment, no air pollutant control strategies are required.

Trucks, trailers, heavy equipment, work barges, and other necessary equipment may be utilized to complete the proposed action. It is anticipated that a limited amount of greenhouse gases (GHGs) would be emitted by these vehicles and equipment during rehabilitation efforts. Due to the tiered construction schedule and limited project footprint, emissions are considered minimal and would not impact attainment status. Therefore, the MRER efforts would be in compliance with the CAA and would not require a General Conformity Determination.

6. Section 7 of the Endangered Species Act (ESA). The CESWF-PEE requested an official species list pursuant to Section 7 of the ESA through the U.S. Fish and Wildlife Service (USFWS) online Information for Planning and Consultation (IPaC) system. The IPaC generated an official species lists for the project area (Enclosure 3). The listed species for the project area are identified in Table 1.

Table 1 – USFWS list of Threatened and Endangered Species that may occur within the project area according to the IPaC Official Species List.

Common Name	Scientific Name	Federal Status	Habitat Type	Occurrence
Eastern Black Rail	*Laterallus jamaicensis ssp. jamaicensis*	Threatened	Found in salt, brackish, and freshwater marshes with dense herbaceous cover as well as upland areas of these marshes.	These habitats do not occur within the project area.
Piping Plover	*Charadrius melodus*	Threatened	Transiently found feeding along shorelines, marshes, or flooded fields in Arkansas during migration periods.	These habitats do not occur within the project area.
Red Knot	*Calidris canutus rufa*	Threatened	Transiently found feeding along shorelines, marshes, or flooded fields in Arkansas during migration periods.	These habitats do not occur within the project area.
Alligator Snapping Turtle	*Macrochelys temminckii*	Proposed Threatened	Found in deeper water of large rivers and their major tributaries, selecting structure over open water and sites with greater canopy cover.	These habitats occur near project area, but boat traffic likely deters them from waterways implicated in construction and access under proposed action.
Monarch Butterfly	*Danaus plexippus*	Candidate	Prairies, meadows, grasslands, and roadsides with herbaceous vegetative groundcover.	Terrestrial lands included in the project area are primarily mowed grasses with limited herbaceous species, no preferred monarch habitat.

The proposed action lies primarily within previously disturbed areas. The project area consists of the David D. Terry lock structure itself, the adjacent David D. Terry East public park, access roads, boat ramps, and portions of the river needed to access the lock. While no explicit ground disturbing activities are planned in the proposed action, the grass fields of the park will be utilized for equipment and project component staging. Small boat and work barges will be utilized within the river and lock channel to access the failed components requiring rehabilitation. The proposed action would require three iterations of lock dewatering using the 110-foot stoplogs to access the components needing maintenance, rehabilitation, repair, or replacement as they are typically underwater. Each of these closures for dewatering will last roughly 35 days. To avoid impacts to aquatic species during dewatering, qualified USACE biologists will be onsite to deter fish and other aquatic species from the dewatering zone; any remaining in the lock will be removed and relocated to a location outside of the project area within the same watercourse.

No critical habitat for any of the listed species exists within the project area according to the IPaC report. The eastern black rail, piping plover, and red knot may utilize shoreline and wetlands along the Arkansas River during migration; however, the primary project area consists of previously disturbed navigation and recreation features instead of shoreline habitat that typically occurs along the river and is preferred by these species. Alligator snapping turtles are generally found in deep waters of large rivers with structure and a high canopy cover. Because of the high traffic of navigation vessels and water level fluctuations, the alligator snapping turtle is not expected to exist within the lock area; however, they may occur in the backwater upstream and to the east of the lock where there is more availability of large woody debris and other cover. Contractor watercrafts may utilize the upstream backwaters as part of the proposed action to transport materials, equipment, and personnel, to the lock; however, construction-related watercraft use will be limited to necessary trips only, with landside access utilized when practicable. Any use of the natural shoreline for construction purposes to include access, mooring, and staging is strictly prohibited. Permitted watercrafts will be the size of those typical for public recreation, and a maximum speed of five miles per hour with no wake will be enforced to avoid waves contributing to turbidity and shoreline erosion. Any project-related boat access in this area will by aligned with what is typical of preexisting public recreation, and with these BMPs in place the proposed action is expected to avoid any impacts to the alligator snapping turtle. The USACE has concluded that the proposed action will have No Effect on the federally listed threatened or endangered species.

7. Migratory Bird Treaty Act (MBTA). The MBTA prohibits among other activities the taking or destruction of migratory birds, eggs, and nests. The proposed action does not entail ground disturbing activities, the removal of vegetation outside of regular mowing, or efforts impacting the natural shoreline near the project area. Construction efforts under the proposed action are limited predominantly to previously disturbed areas. Vegetated and natural areas that could potentially provide habitat for migratory birds will

be clearly marked and avoided. As such, the taking or destruction of migratory birds, eggs, nests, and any potential habitat would not occur under the proposed action. Therefore, there would be no impacts to migratory birds, and the proposed action would be in compliance with the MBTA.

8. Clean Water Act (CWA). Section 404 of the CWA established a program to regulate the discharge of dredged or fill material into waters of the United States (WOTUS). The CESWF-PEE reviewed the National Wetlands Inventory (NWI) database of wetlands and waters of the U.S. within the proposed project area. The proposed action uses a one-sided approach to the 110-foot stoplog conversion slot cutting with no dewatering, and three periods of 35 to 37 day lock closures for the dewatering of the lock using existing stoplogs to access the miter gates and other lock components needing repair or replacement. Replacing the miter gates, stoplogs, and other lock components is considered a form of filling WOTUS, as materials are being placed within WOTUS. However, this addition of fill would replace the existing features and would not extend beyond the previously coordinated footprints; therefore, there will be no additional volume of fill being added to WOTUS.

While there will be no net increase in volume of fill in WOTUS, the proposed action does involve instream construction efforts in which materials will be removed from WOTUS then replaced with new components. Because of this, a CWA Section 404(b)(1) short form (Enclosure 4) with a full water quality analysis and list of BMPs (Enclosure 2) to minimize impacts to water quality have been prepared. All appropriate and practicable steps have been taken to ensure minimal adverse impacts of the proposed discharge, including containing all dewatering efforts and consecutive construction efforts within the lock channel to minimize impacts to turbidity in the surrounding waters. Therefore, there would be no change to WOTUS when compared to the existing condition and the project is compliant with the Section 404 of the CWA. Section 401 of the CWA requires state water quality certifications to ensure proposed projects will not violate state water quality standards. As efforts will take place within the Arkansas River, a Section 401 Water Quality Certification will be obtained from ADEQ to allow for instream work prior to entering waters of the State.

Construction materials to be utilized and considered fill material will be free of any chemicals or sealants that could be harmful to the environment. Additionally, because the fill material would not exceed the previous project footprint, there are no anticipated changes to the project site and/or size of mixing zones. Construction efforts implemented via additional work barge traffic may temporarily increase localized turbidity; however, these impacts would be temporary in nature and would return to normal conditions shortly after construction ceases as particulates would be quickly dissipated by waterflow.

9. Section 10 of the Rivers and Harbors Act. The USACE responsibility under Section 10 of the Rivers and Harbors Act of 1899 is to regulate any work in, or affecting,

navigable WOTUS. While Terry L&D is located on the Arkansas River and falls under this authority, the proposed action is not creating a permanent obstruction to the navigable capacity of waters of the United States. Navigation may be disrupted during construction periods; however, these periods will be temporary, tiered, and timed during the slow navigation months and affected parties will be made aware of these closures well in advance to plan. The proposed action would be in compliance with Section 10 of the Rivers and Harbors Act.

10. Storm Water Pollution Prevention Plan (SWPPP). The Contractor will be responsible for preparing a SWPPP prior to commencement of construction activities and implementing the SWPPP and all applicable conditions prior to, during, and after construction efforts. To reduce erosion and the impact of non-point source pollution during construction activities, additional site-specific BMPs must be implemented as described in the SWPPP.

11. National Historic Preservation Act (NHPA). Federal agencies are required under Section 106 of the National Historic Preservation Act to “take into account the effects of their undertakings on historic properties” and consider alternatives “to avoid, minimize or mitigate the undertaking’s adverse effects on historic properties” [(36 CFR 800.1(a-c)] in consultation with the State Historic Preservation Officer (SHPO) and appropriate federally recognized Indian Tribes (Tribal Historic Preservation Officers - THPO) [(36 CFR 800.2(c)]. In accordance with this and other applicable regulations, including the National Environmental Policy Act of 1969 (NEPA), the Native American Graves Protection and Repatriation Act (NAGPRA), and Engineer Regulation (ER) 1105-2-100, USACE has reviewed of the Arkansas Archeological Survey’s Automated Management of Archeological Sites Data in Arkansas (AMASDA) database to better determine the existing conditions and potential risks of encountering cultural resources.

The review of the AMASDA database revealed that no archeological sites have been identified in the area, but only very minimal cultural resources survey work has been performed in the vicinity. In addition, a review of the Arkansas Historic Preservation Program’s Structure Database was performed and did not indicate any previously recorded historic buildings, structures, or objects other than the facility itself. Terry L&D is over 50 years in age, and thus must be evaluated for eligibility for listing on the National Register of Historic Places, in consultation with the SHPO and THPOs, before this action would be in compliance with the National Historic Preservation Act. SHPO provided concurrence on a No Adverse Effect Determination on April 27, 2023 (AHPP Tracking Number: 111004).

12. Executive Order (EO) 11988, Floodplain Management. EO 11988 requires federal agencies to avoid “to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative.” USACE Engineering Regulation (ER) 1165-2-26 contains the USACE’s policy and

guidance for implementing EO 11988. Per ER 1165-2-26, the USACE must first determine whether there are practicable alternatives to placing a proposed project in a floodplain and specifies that all reasonable factors should be taken into consideration when determining practicability. Because the proposed action seeks to repair and replace existing features within the existing lock, no new construction will take place within the Arkansas River floodplain, the proposed action is therefore in compliance with EO 11988.

13. Executive Order 13112, Invasive Species. Under this Executive Order, Federal agencies are directed to "not authorize, fund or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States…and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions." The spread of invasive and noxious weeds is an issue in projects that involve ground disturbances. Earth moving activities contribute to the spread of weeds, as does the use of contaminated fill, seed, or erosion-control products. Ground disturbance can create bare soil allowing invasive species to establish in new areas, where they are often very aggressive and fast growing allowing them to outcompete native species. The proposed action does not consist of ground disturbance activities that could provide opportunities for the expansion of invasive species. BMPs to prevent the introduction of invasive species, including the cleaning of all equipment and vehicles to be brought into both terrestrial and aquatic components of the project footprint, will be implemented. Therefore, the proposed action would be compliant with EO 11988.

14. Executive Order 11990, Protection of Wetlands. Under this Executive Order, federal agencies are to avoid to the extent possible the long and short term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative.

The National Wetlands Inventory mapping tool identifies the immediate project area as lake habitat. The river upstream both upstream and downstream of the dam to include the lock is classified as lacustrine, limnetic deepwater habitat situated in a dammed river with a riverbed composed of at least 25% cover of particles smaller than stones (less than 6-7 cm) and covered less than 30% by vegetation. Additional wetland systems exist along the banks of the Arkansas River around the project area (Enclosure 4).

Under the proposed action, construction efforts will occur instream within the lock, David D. Terry East Park will be used for land access and staging, and existing boat ramps will be used for water access to the lock. The proposed action does not entail any activities that will adversely impact the waterway itself, nor the adjacent wetland complexes. The proposed action would be in compliance with EO 11990.

15. Hazardous, Toxic, and Radioactive Waste (HTRW). The subject property currently occupies approximately 58 acres of land at the Terry L&D complex in Pulaski County, Arkansas. The site is partially developed with structures used for navigation on the Arkansas River. A review of historic aerial imagery has not revealed a recognized environmental condition. Water quality sampling by the USGS in the David D. Terry Lake revealed the presence of Flubendiamide, an EPA registered pesticide with a Per- and Polyfluoroalkyl Substances (PFAS) functional group in the surface water which could be related to local agricultural processes and was not related to a reported spill therefore this is not a recognized environmental condition.

The subject property was classified into one of seven standard Environmental Condition of Property (ECP) area types (categories) as required by ASTM D6008 (2014) Standard Practice for Conducting Environmental Baseline Surveys. The seven categories are listed in ASTM D5746-98 (Reapproved 2016) Standard Classification of Property Area Types for Defense Base Closure and Realignment Facilities define the property type. Given these seven categories, the subject property is categorized as Type 1, an area or parcel of real property where no release, or disposal of hazardous substances or petroleum products or their derivatives has occurred, including no migration of these substances from adjacent properties. See Enclosure 6 for more information.

16. Conclusions and Record of Environmental Consideration. The CESWF-PEE has evaluated and documented the environmental compliance of the proposed Terry L&D MRER actions with applicable laws, regulations, and policies in this memorandum. The proposed action of maintenance, repair, rehabilitation, and/or replacement of existing lock components would have no adverse impact on known resources. MRER actions on Terry L&D meet the USACE conditions for a Categorical Exclusion from the need to prepare NEPA documentation according to ER 200-2-2 (9) Categorical Exclusions (a) as no environmental resources would be adversely impacted by the action. Impacts to cultural resources are pending, and coordination will be completed prior to the start of any project-related construction efforts. For further questions or concerns, please contact Ms. Elizabeth Knapp, Lead NEPA Biologist, Regional Planning and Environmental Center, at 817-946-6055 or Elizabeth.J.Knapp@usace.army.mil.

Christopher B. Roark
Chief, Operations Division
Little Rock District

6 Enclosures
1. Project Area Map
2. Best Management Practices
3. IPaC Species Lists
4. Evaluation of Section 404(b)(1) Guidelines (Short Form)
5. SHPO Coordination (pending)
6. HTRW Information
7. Table of Other Applicable Laws

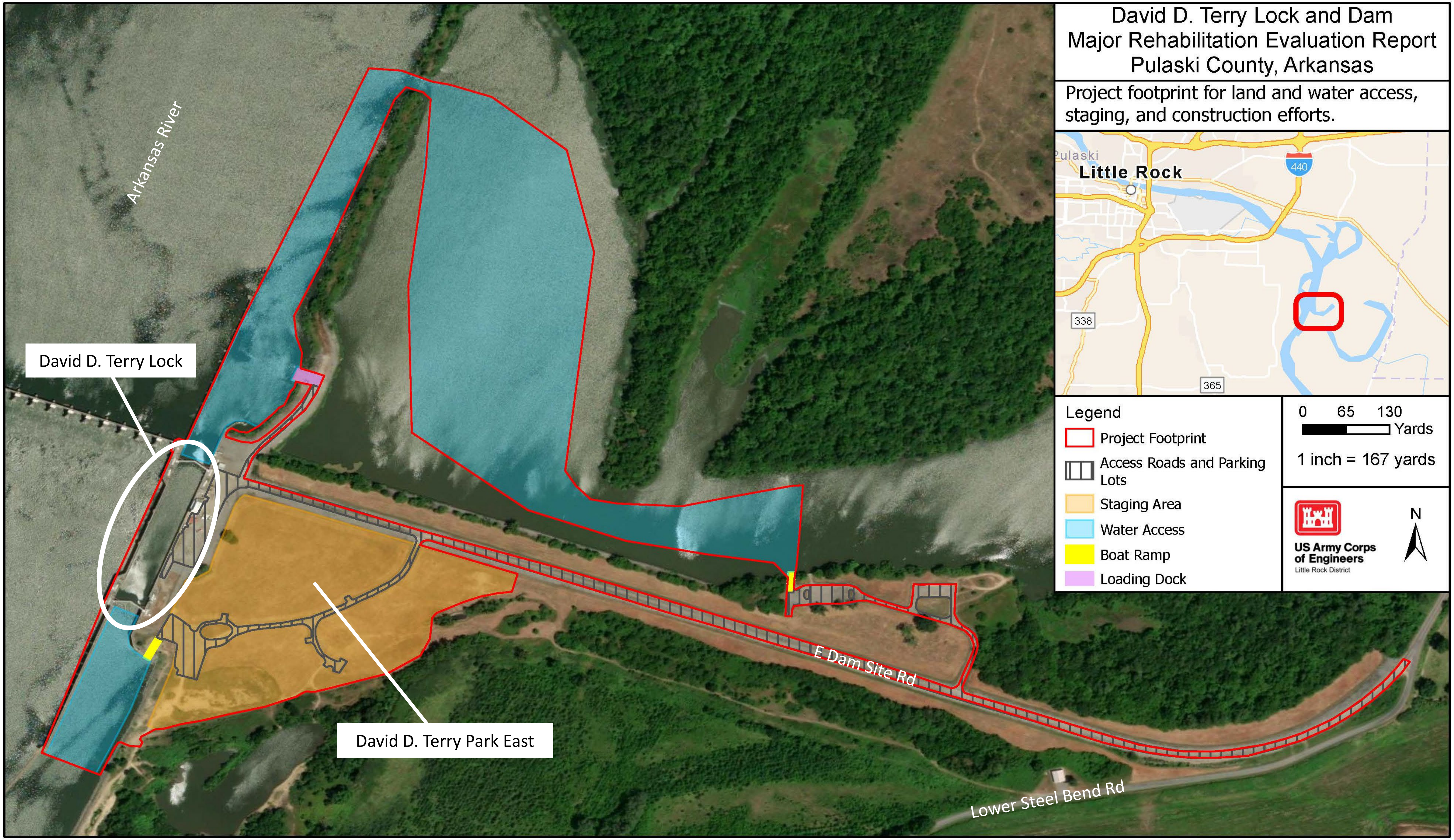
Enclosure 1

Project Area Map

David. D Terry Lock and Dam
Major Rehabilitation Evaluation Report

May 2023

US Army Corps of Engineers
Little Rock District



David D. Terry Lock and Dam
Major Rehabilitation Evaluation Report
Pulaski County, Arkansas
Project footprint for land and water access, staging, and construction efforts.
Pulaski
Little Rock
440
338
365
Legend
Project Footprint
Access Roads and Parking Lots
Staging Area
Water Access
Boat Ramp
Loading Dock
0 65 130 Yards
1 inch = 167 yards
US Army Corps of Engineers
Little Rock District
N
Arkansas River
David D. Terry Lock
David D. Terry Park East
E Dam Site Rd
Lower Steel Bend Rd

Enclosure 2

Best Management Practices

David. D Terry Lock and Dam
Major Rehabilitation Evaluation Report

May 2023

US Army Corps
of Engineers
Little Rock District

David D. Terry Lock and Dam
Major Rehabilitation Evaluation Report

Best Management Practices

General Construction Activities

a. Implement U.S. Army Corps of Engineers (USACE) BMPs during all construction activities, including proper handling, storage, and disposal of hazardous and/or regulated materials. Collect and store all fuels, waste oils, and solvents in tanks and/or drums within a secondary containment system. Secondary containment systems must consist of an impervious floor and earthen dike capable of containing 125 % of the container's volume. Remove these materials from the site during demobilization, and dispose of these materials in accordance with local, state, and Federal regulations. Refuel machinery following accepted guidelines.

b. The contractor must prepare and implement a Government-approved Spill Protection Plan at the construction site to ensure that toxic substances are properly handled, stored, and disposed. Contain spills immediately using an absorbent (e.g., granular, pillow, sock). Immediately report any spill of a hazardous and/or regulated substance to the USACE Contracting Officer and Environmental Team. Place drip pans beneath equipment when, staged in a stationary position, not in use (parked one (1) hour or longer), and/or when parked for the night. Use containment zones when equipment is not being used, or when refueling vehicles and equipment. No refueling or storage is to take place within 100-feet of an active drainage channel, wetland, or other surface waters.

c. Collect non-hazardous solid waste (trash and waste construction materials) and deposit in on-site receptacles. Maintain solid waste receptacles and dispose as required to prevent overflow.

d. Only authorized contractors and Government personnel are allowed within the construction site. No pets owned or under the care of any construction workers are permitted inside the project's construction boundaries, adjacent native habitats, or other associated work areas.

e. If construction or maintenance work activities occur during nighttime hours, all lights must be shielded to direct light only onto the work site, the minimum wattage needed is to be used, and the number of lights must be minimized.

f. Vehicular traffic associated with the construction activities must remain on designated and established roads to the maximum extent practicable. No off-road vehicle activity is to occur outside of the project footprint. Construction traffic must obey all speed limits posted within the construction area, as well as, Park, Refuge, Monument, (etc.) boundaries to minimize vehicle and animal collisions during construction.

g. A Stormwater Pollution Prevention Plan (SWPPP) must be prepared prior to commencement of construction activities. To reduce erosion and the impact of non-point source pollution during construction activities, additional site-specific BMPs, which should address highly erodible soils, installation of waterbars to slow water flow, and installation of buffers around washes, must be implemented as described in the SWPPP.

h. Maintain existing roads during construction and return the existing roads to pre-construction conditions, if requested by the Government, once construction is complete. The widening of existing or created roadbeds beyond the design parameters due to improper maintenance and use must be avoided or minimized.

i. Utilize designated area for staging, parking, and equipment and material storage as these areas are already disturbed by past activities.

j. The construction contractor must restore all staging areas and access roads created and/or cleared for the project to pre-construction conditions. The contractor must provide a Restoration Plan to the Government outlining procedures and techniques for restoring all access roads and laydown areas not planned to be utilized after the completion of construction. Site restoration of staging areas and construction access routes must be monitored by the construction contractor until restoration is approved by the Government.

k. All unpaved disturbed soils that must not be landscaped or otherwise permanently stabilized by construction must be seeded using species native to the project vicinity. The Contracting Officer's Representative will contact the USACE EV Team and will provide a list of the appropriate seed mixes to each project area.

l. To prevent the introduction of invasive species' seeds, all hauling and construction equipment, including work and personal vehicles, must be free of all attached soil, mud, vegetation, and other debris prior to entering the construction site.

m. To prevent invasive species from leaving the site, inspect all construction equipment and remove all attached plant and/or vegetation and soil and/or mud debris prior to leaving the construction site at the designated wash area.

n. If vegetation must be removed, use hand tools, mowing, trimming, or other removal methods that allow root systems to remain intact to prevent disturbance that encourages establishment of invasive plant species. This BMP does not apply to any non-native, invasive vegetation control that may occur.

o. The use of herbicides must not occur in wetlands, streams, any waterbodies, or within habitat suitable to threatened or endangered plant species. Herbicides must be used according to label directions. Herbicide application must be conducted by a licensed applicator to ensure all chemical applications on federally managed public lands are accurate reported.

p. During follow-up monitoring of any restoration areas, invasive plants that appear on the site must be removed. Removal must be conducted in a way that eliminates the entire plant and removes all plant parts to a disposal area. The monitoring period must be defined in the site restoration plan.

q. Notify USACE 5-days before entering areas where work will occur.

r. Appropriate techniques to restore the original grade, replace original soils, and restore proper drainage must be implemented in all restoration areas (e.g., temporary staging areas, access routes). Site restoration of staging areas and construction access routes must be monitored by the contractor for a period of 90-days to ensure survival of plants.

s. After grading activities are completed, implement routine road maintenance practices to avoid making windrows with the soils. Use any excess soils on site to raise and shape the road surface.

Biological Resources

a. Prior to beginning any construction activity (e.g. equipment mobilization, tree-trimming, road grading), the contractor must stake and flag the perimeter of the work area, access routes, laydown yards, staging areas, turnarounds, and other areas approved for use. Flagging and staking must occur as appropriate to prevent unauthorized impacts outside of the approved work areas and provide for safe use of adjacent public recreation facilities. Provide photo documentation to the Government when established.

b. Areas hydro-seeded for temporary erosion-control measures must use only native plant species appropriate to surrounding habitat types. A list of appropriate seed mixes will be provided by the Contracting Officer.

c. Tree removal is not permitted within the designated project area. Do not clear any vegetation along the natural shoreline, as this ensures no impacts to habitat and protects riparian habitat from sedimentation. Vegetation removal is limited to mowing grass areas needed for laydown within the designated areas identified for staging and material storage.

d. If federally listed species are found in the contractor's delineated project area, the contractor must immediately notify the USACE Resident Engineer Contracting Officer's Representative, and USACE Environmental Team. Any species requiring relocation will be relocated by a qualified biological monitor (provided by the Government), in accordance with accepted species handling protocols to a safe location outside the impact area.

e. Temporary light poles and other pole-like structures used for construction activities must have anti-perch devices to discourage roosting by birds.

f. Ensure sensitive habitats that support aquatic, avian, and/or terrestrial wildlife are flagged, or identified on maps for avoidance where appropriate, to prevent wildlife interactions. Avoid areas where active nesting, breeding, spawning, and/or foraging occurs unless clearance is provided by USACE Environmental Team.

g. Prior to ground disturbing activities, the onsite Government-provided Environmental Monitor will present an environmental awareness program to all personnel who will be working on-site, including USACE employees, contractor, contractor employees, supervisors, inspectors, and subcontractors. The program must contain, at a minimum, information regarding migratory bird species, federally listed threatened and endangered species, other special status species, species of concern, and sensitive habitats. This must include general identification of the species, description of habitat, sensitivity of the species to human activity and describe measures for avoidance and protection of the species during construction. Protection of species and suitable habitat must be stressed in environmental education for contractors involved in construction or maintenance of facilities. Following the education program, the photograph of the species must be posted in the office of the contractor and RE, where they must remain through the duration of the project. The contractor is responsible for ensuring that all employees and subcontractors are aware of the listed species.

h. Check visible space beneath all heavy equipment for wildlife prior to moving the equipment.

i. All food-related trash items, such as wrappers, cans, bottles, and food scraps, must be disposed of in closed containers and removed daily from the project site to eliminate attracting wildlife to the project site.

j. Do not withdraw water from natural surface water sources for construction purposes.

k. Do not begin work prior to the completion of the pre-construction environmental awareness training. Notify USACE Environmental Team 20-days prior to the scheduled construction start date, to include any dewatering efforts, to ensure environmental staff are available for any relocations of fish and wildlife that may be necessary.

l. If surface waters are present in the work area, including during dewatering, any listed or native fish, reptile, or amphibian within the work area must be removed and relocated, by a qualified biologist with the appropriate permits, to a location outside of the project area, preferably within the same watercourse, as identified by USACE and the appropriate resource agency.

m. Install and maintain staking and flagging to designate the work areas associated with construction until work is completed.

n. Avoid areas of riparian vegetation, the project work area must be minimized to areas already disturbed.

o. For all in-water work, avoid excessive boating speeds to avoid downstream effects of turbidity and sedimentation.

Air Quality

a. Mitigation measures must be incorporated to ensure that PM10 emission levels do not rise above the de minimus threshold as required per 40 CFR 51.853(b)(1). Measures will include dust suppression methods to minimize airborne particulate matter that must be created during construction activities. Standard construction BMPs, such as routine watering of the access roads, must be used to control fugitive dust during the construction phases of the proposed project. All construction equipment and vehicles are required to be kept in good operating condition to minimize exhaust emissions. If a contractor expects significant dust and/or emissions on their specific site, they must provide methods to reduce airborne particulate matter for their site.

Water Resources

a. Implement standard construction procedures to minimize the potential for erosion and sedimentation during construction. Suspend all work during heavy rains and do not resume until conditions are suitable for the movement of equipment, as directed by the USACE Contracting Officer's Representative.

b. All equipment maintenance, staging, laydown, and dispensing of fuel, oil, or any other such activities, must occur in designated areas. The designated areas must be located so that they prevent any runoff from entering waters of the intermittent, perennial, and/or open surface water, as well as, wetlands.

c. Waste water (i.e. water used for project purposes that is contaminated with construction materials or was used for cleaning equipment, and thus carries oils, toxic materials, or contaminants, in accordance with state regulations) must be stored in closed containers on site until removed for disposal. Concrete washout generated from pressure washing, including chute washout, must be collected and retained. Washout and wastewater must not be discharged onto the ground surface or into any surface water. Contractors are either to keep washout within the confines of their site or dispose of in an appropriate offsite location.

d. No fill material will be placed into or removed from any stream, gully, arroyo, channel, wash, or water crossing without permission granted by the Government or the USACE Environmental team.

e. If soaps or detergents are used, the wastewater and solids must be pumped, cleaned out, and disposed of in an approved facility. If no soaps or detergents are used, the wastewater must first be filtered or screened to remove solids before being allowed to flow off site. Detergents and cleaning solutions must not be sprayed over or discharged into surface waters. Avoid contaminating natural aquatic and wetland systems with runoff by limiting all equipment maintenance, staging, laydown, and dispensing hazardous liquids (e.g., fuel and oil) to designated upland areas.

f. Water to be used for construction purposes must be from a USACE-approved source.

Cultural Resources

a. Construction activities must be kept within areas previously impacted and identified for access, staging, laydowns to avoid cultural resources. The contractor must not conduct ground disturbing activities in any area that has not been previously approved by USACE Archaeologist.

b. If any cultural or historic resources are discovered during any action, the action must cease immediately and the USACE Resident Engineer, Contracting Officer's Representative, and USACE Archaeologist must be contacted.

c. Previously identified cultural resources, including archaeological sites (both historic and prehistoric) or sensitive tribal areas, will be identified during the environmental awareness program and must be avoided by construction activities. On-site users must not enter or disturb the area on foot or with vehicles. Any inadvertently discovered artifacts, to include human remains, found must not be moved or collected and the USACE COR and Archaeologist notified

Noise

a. Adhere to all Occupational Safety and Health Administration (OSHA) requirements to minimize noise impacts on local communities during construction. Maintain all equipment and vehicle exhaust systems to minimize vehicle-related noise impacts.

b. Noise levels for construction (any time of day or night) and maintenance should be minimized for all projects affecting federally listed animals. Place generators in baffle boxes, use an attached muffler, or use other noise-abatement methods, in accordance with industry standards.

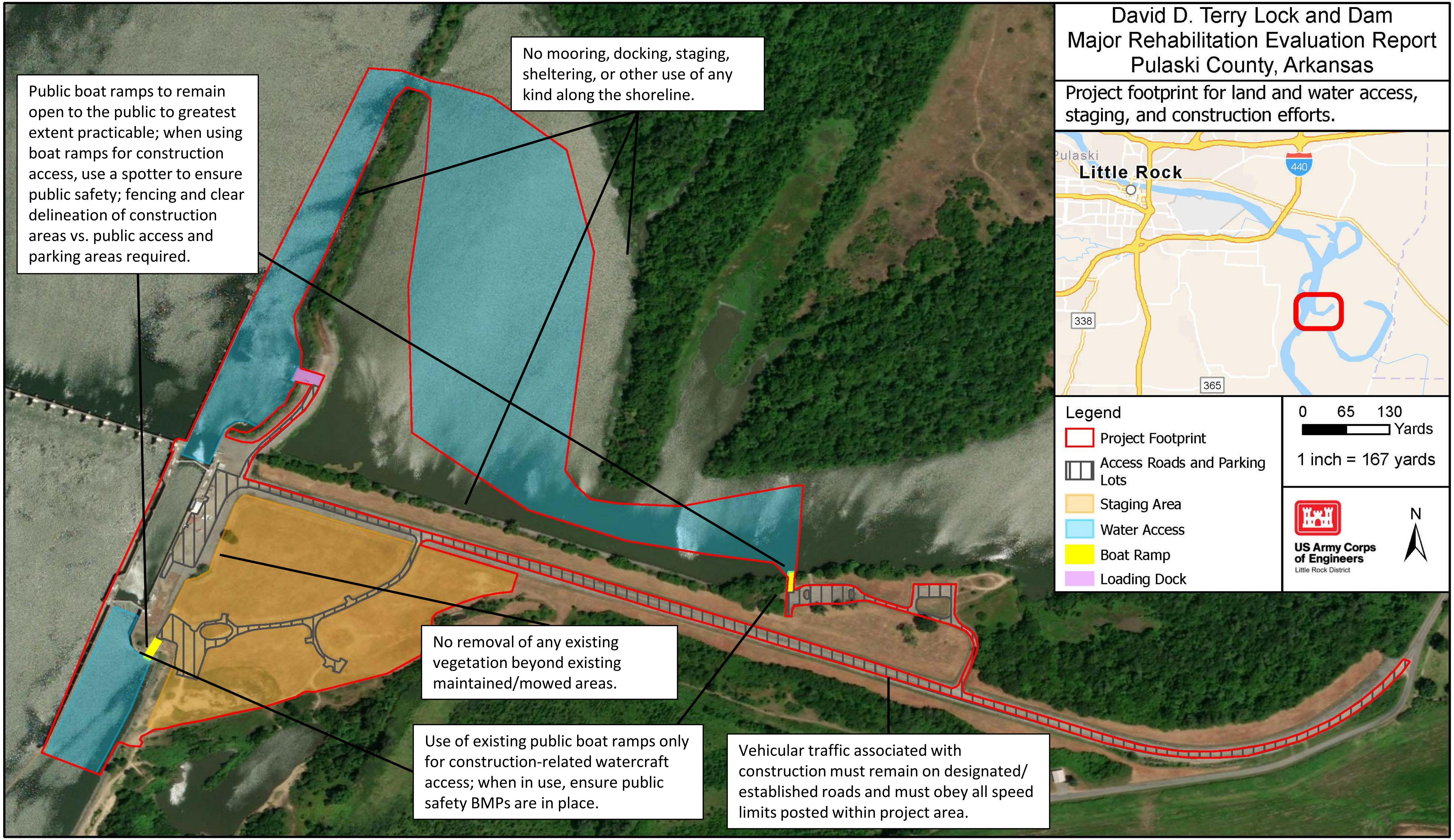
Water Access, Recreation, and Public Safety

a. David D. Terry East Park will remain open to the public for recreation and water access to the greatest extent practicable throughout the entirety of the construction period. To ensure public safety, clearly delineate designated construction area using flagging, staking, fencing, or other appropriate methods. Public parking areas must be designated and appropriately marked for public use.

b. Boat ramps will remain open to public access on weekends, and limited, well-planned closures may occur on weekdays only when deemed necessary and approved by the Chief Recreation Natural Resource Specialist, Operations Division, Little Rock District, USACE to ensure public safety.

c. When trailering watercrafts around the park, down the boat ramp, and into the river for construction-related purposes, contractor must provide onsite personnel to guide trailering efforts and ensure typical safety measures are being employed. Construction-related watercrafts must not block the use of boat ramps for more than 20 minutes at a time to allow for continued public access.

d. The use of non-navigation watercrafts for construction-related access to the lock is permitted via the use of the two boat ramps located in David. D. Terry East Park, one to access upstream and one to access downstream. Watercraft access may be used to transport personnel, materials, or small equipment only when landside access is not possible. Watercraft access must be kept to a minimum to prevent unnecessary turbidity and wave impacts to the shoreline. Watercrafts must operate under a speed of five miles per hour, and no wake may be produced to avoid erosion from increased wave action on the shoreline. Construction-related watercrafts must not utilize the natural shoreline for any reason, including mooring and staging, to avoid impacts to habitat. Watercraft size must be that of what is typical of recreation boats and must fit within the preexisting boat ramp width when entering the water.


David D. Terry Lock and Dam
Major Rehabilitation Evaluation Report
Pulaski County, Arkansas
Project footprint for land and water access, staging, and construction efforts.
Little Rock
Pulaski
440
338
365
Legend
Project Footprint
Access Roads and Parking Lots
Staging Area
Water Access
Boat Ramp
Loading Dock
0 65 130 Yards
1 inch = 167 yards
US Army Corps of Engineers
Little Rock District
N
Public boat ramps to remain open to the public to greatest extent practicable; when using boat ramps for construction access, use a spotter to ensure public safety; fencing and clear delineation of construction areas vs. public access and parking areas required.
No mooring, docking, staging, sheltering, or other use of any kind along the shoreline.
No removal of any existing vegetation beyond existing maintained/mowed areas.
Use of existing public boat ramps only for construction-related watercraft access; when in use, ensure public safety BMPs are in place.
Vehicular traffic associated with construction must remain on designated/ established roads and must obey all speed limits posted within project area.

Enclosure 3

IPaC Species Lists

David. D Terry Lock and Dam
Major Rehabilitation Evaluation Report

May 2023

US Army Corps of Engineers
Little Rock District

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Arkansas Ecological Services Field Office
110 South Amity Suite 300
Conway, AR 72032-8975
Phone: (501) 513-4470 Fax: (501) 513-4480

In Reply Refer To:
Project Code: 2023-0058127
Project Name: David D. Terry L&D Project Extent

March 21, 2023

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2) (c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see https://www.fws.gov/birds/policies-and-regulations.php.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures see https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds.php.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/birds/policies-and-regulations/executive-orders/e0-13186.php.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

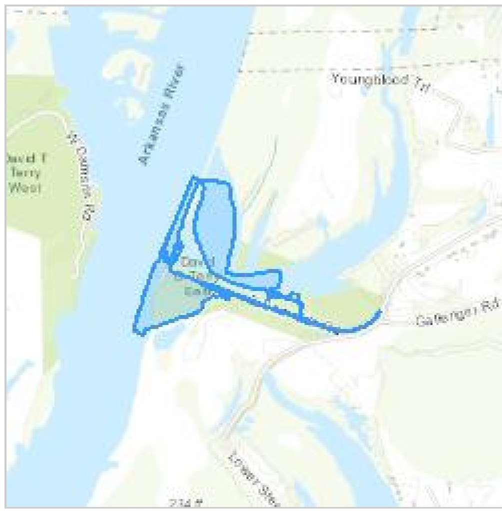
This species list is provided by:

Arkansas Ecological Services Field Office
110 South Amity Suite 300
Conway, AR 72032-8975
(501) 513-4470

PROJECT SUMMARY

Project Code: 2023-0058127
Project Name: David D. Terry L&D Project Extent
Project Type: Dam - Maintenance/Modification
Project Description: Major Rehabilitation Evaluation Report, David D. Terry Lock and Dam, Pulaski County, Arkansas
Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@34.6659325,-92.15476445971153,14z



Counties: Pulaski County, Arkansas

ENDANGERED SPECIES ACT SPECIES

There is a total of 5 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

BIRDS

NAME	STATUS
Eastern Black Rail *Laterallus jamaicensis ssp. jamaicensis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/10477	Threatened
Piping Plover *Charadrius melodus* Population: [Atlantic Coast and Northern Great Plains populations] - Wherever found, except those areas where listed as endangered. There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6039	Threatened
Red Knot *Calidris canutus rufa* There is **proposed** critical habitat for this species. Species profile: https://ecos.fws.gov/ecp/species/1864	Threatened

REPTILES

NAME	STATUS
Alligator Snapping Turtle *Macrochelys temminckii* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4658	Proposed Threatened

INSECTS

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

CRITICAL HABITATS

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

IPAC USER CONTACT INFORMATION

Agency:	Army Corps of Engineers
Name:	Elizabeth Knapp
Address:	819 Taylor St
Address Line 2:	Rm 3A12
City:	Fort Worth
State:	TX
Zip:	76102
Email	elizabeth.j.knapp@usace.army.mil
Phone:	7135911178

Enclosure 4

Evaluation of Section 404(b)(1) Guidelines
(Short Form)

David. D Terry Lock and Dam
Major Rehabilitation Evaluation Report

May 2023

US Army Corps
of Engineers
Little Rock District

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Acronyms

ADEQ	Arkansas Department of Energy and Environment, Division on Environmental Quality
BMPs	Best Management Practices
CWA	Clean Water Act
EPA	Environmental Protection Agency
MKARNS	McClellan-Kerr Arkansas River Navigation System
MRER	Major Rehabilitation Evaluation Report
NEPA	National Environmental Policy Act
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service

1. Introduction

David D. Terry Lock and Dam (Terry L&D) is one of 16 locks and dams on the McClellan-Kerr Arkansas River Navigation System (MKARNS) in Oklahoma and Arkansas designed, constructed, and operated by the U.S Army Corps of Engineers (USACE). USACE Tulsa District operates MKARNS locks and dams in Oklahoma, and the Little Rock District operates facilities in Arkansas including Terry L&D, located at Navigation Mile (NM) 108.1 on the Arkansas River (Figure 1). Terry L&D has substantial problems with aging structural and mechanical components that could fail and halt navigation. As a result, SWL leadership initiated a Major Rehabilitation Evaluation Report (MRER) to assess potential solutions.

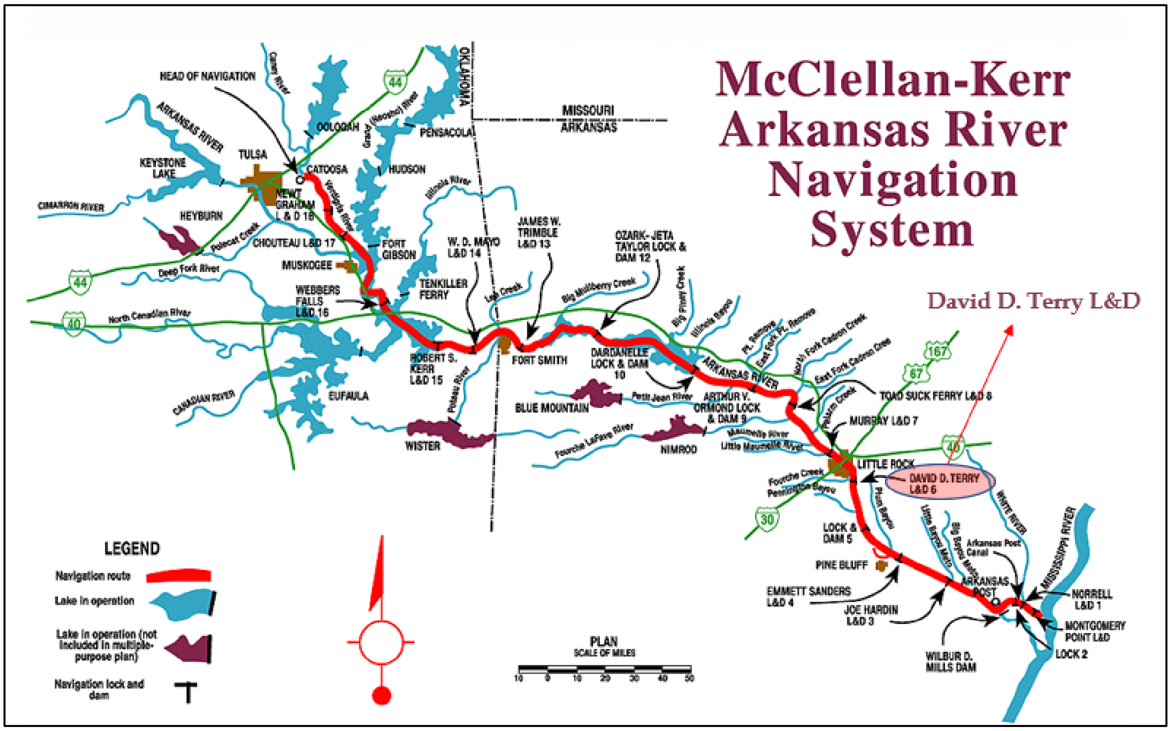

Figure 1. McClellan-Kerr Arkansas River Navigation System

An MRER identifies the most economical strategy to address deficiencies and improve L&D reliability. Methods applied are consistent with Engineering Regulation 1130-2-500, supplemented by Engineering Pamphlet 1130-2-500 (December 1996), and include incorporating risk and uncertainty and probabilistic reliability analyses of project components. Engineering reliability and risk follow guidelines in Engineering Circular 1110-2-6062 (February 2011).

The Water Resources Development Act of 1992 (P.L. 102-2580), Section 205; as amended by Water Resources Reform and Development Act of 2014 (P.L. 113-121), Section 2006 authorizes the USACE to conduct the Terry L&D MRER.

1.1 Alternatives Formulation

Working through the USACE six-step plan formulation process, four strategies for investment were evaluated to formulate alternatives: immediate rehabilitation, scheduled rehabilitation, advance maintenance, and scheduled repair. Within these four strategies, seven alternatives were developed:

1. No-Action Alternative – future without project, expected failures and predicted response
2. Immediate Rehabilitation
    a. Immediate Rehabilitation via Planned 110-Foot Stoplog Conversion
    b. Immediate Rehabilitation via Coffer Cells Dewater
3. Scheduled Rehabilitation
4. Advanced Maintenance
    a. Advanced Maintenance via Planned 110-Foot Stoplog Conversion
    b. Advanced Maintenance via Coffer Cells Dewater
5. Scheduled Repair
    a. Scheduled Repair via Planned 110-Foot Stoplog Conversion
    b. Scheduled Repair via Coffer Cells Dewater
6. Mixed Alternative – combining two alternative strategies from alternatives 2 to 5
7. Economic Optimization – measures producing the most net benefits while optimizing timing of the component repairs or replacements within the entire 50-year period of analysis

1.2 Proposed Action

Alternative 2a, immediate rehabilitation via planned 110-foot stoplog conversion, was selected as the proposed action as it produces the highest net benefits. Alternative 2a involves replacing all lock components selected for the MRER (downstream and upstream). Work would begin in 2025 (year 1) with the procurement of the metal inserts for the 110-foot stoplog slots and the design of all identified components for rehabilitation. The 110-foot stoplog conversion slot cutting would commence in 2026 (year 2) by use of the one sided approach which will allow 2 wide tows to navigate the lock for the 150 days required for cutting. After slot cutting, regular navigation would commence for several months and then the lock would close for an additional 35 days to conduct sill work. Starting in 2027 (year 3), the upstream and downstream miter gates and other identified components would be fabricated. In 2029 (year 5), the lock would close for 37 days during the off-peak navigation season (typically July through August) to replace all upstream components including miter gates. In 2030 (year 6), the lock would again close for 37 days during the off-peak navigation season to replace all downstream components including miter gates. All required fabrication and acquisition of materials would occur in years 3 through 5. This alternative would reset the hazard function for all components to their original state (approximately zero).

The project footprint lies mostly within previously disturbed areas (Enclosure 1). David D. Terry East Park will be used for vehicular access and staging. This area is mowed frequently and can be accessed using existing roads. Two existing boat ramps located within the park will be utilized for construction-related water access to the lock both upstream and downstream of the dam for transportation of personnel, supplies, and small equipment. Several Best Management Practices (BMPs) will be implemented to avoid and minimize impacts to navigation as well as regulated and trust resources prior to, during, and after construction. The full list of BMPs to be implemented to avoid and minimize impacts to sensitive environmental resources, both physical and human, can be found in Enclosure 2 to the Environmental Compliance Memorandum.

The frequency and duration of lock closures will be minimized to the greatest extent practicable. Typically, three-wide barge tows can navigate MKARNS locks, but using the one-sided approach during 110-foot stoplog conversion slot cutting in year two will allow for two-wide barge traffic and avoid full lock closure for the 150-day required period. After the stoplog conversion slot cutting is completed, traffic will return to normal operations for several months, then the lock will be closed for 35 days to conduct sill work. One 35-day and two 37-day closures will be required for sill work and both upstream and downstream component replacement to include miter gates; however, these closures will be temporary in nature and will occur during the off-peak navigation season so as to minimize impacts to navigation.

Affected parties will be notified early and often so plans can be made in response to the barge width limitations and full lock closures. As soon as the lock closure schedule is defined, any outages or foreseen impacts to the navigation industry will be communicated through the issuance of navigation notices. Recipients of these notices include but are not limited to the Arkansas-Oklahoma Port Operations Association, U.S. Coast Guard, state transportation agencies, and various carriers, ports, and terminals. Navigation notices will be provided 6-12 months in advance to give stakeholders ample time to plan their shipments around the outage(s). Various annual meetings with stakeholders and industry parties are also held each year where the construction schedule will be shared. To minimize cumulative impacts to industry from closures at other locks along the MKARNS, the closures required in the proposed action will be aligned concurrently with others to the greatest extent practicable.

David D. Terry East Park is open to public access for recreation and water access via two boat ramps: one upstream of the lock and dam, and one downstream. To minimize impacts from the proposed action on recreation, the two boat ramps will remain open to the public with safety BMPs in place to the greatest extent practicable. Boat ramps will remain open on the weekends to public access, and limited, well-planned closures may occur on weekdays only when necessary. To ensure public safety, construction areas will be clearly delineated and separated from public access areas. Parking areas will be designated and appropriately marked for public use. When dropping watercrafts into the river for construction-related use, personnel will be onsite to guide the trailering efforts and ensure typical safety measures are being employed. Further BMPs may be developed as additional construction and timeline specifications are established.

1.3 NEPA Considerations

The proposed action has been reviewed in accordance with 33 CFR Part 230, Procedures for Implementing NEPA (ER 200-2-2); and 40 CFR Parts 1500-1508, Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA. The proposed action would constitute maintenance, repair, rehabilitation, and/or replacement of existing lock components to maintain the authorized project purpose of navigation. The BMPs listed in Enclosure 2 to the Environmental Compliance Memorandum would avoid and minimize to the greatest extent practicable all temporary impacts to navigation user groups, as well as terrestrial and aquatic resources. There would be no adverse, permanent impacts as a result of the MRER efforts. There are no extraordinary circumstances which would dictate the need to prepare an Environmental Assessment or Environmental Impact Statement. The proposed project would meet the conditions for a Categorical Exclusion from the need to prepare NEPA documentation according to ER 200-2-2 (9) Categorical Exclusions (a):

"*Activities at completed Corps projects which carry out the authorized project purposes. Examples include routine operation and maintenance actions, general administration, equipment purchases, custodial actions erosion control, painting, repair, rehabilitation, replacement of existing structures, and facilities such as buildings, roads, levees, groins and utilities, and installation of new buildings utilities, or roadways in developed areas.*"

2. Environmental Resources

Terry L&D is situated along the Arkansas River south of Little Rock, Arkansas and operates as part of the MKARNS. The lock and dam are located just within the Delta ecoregion where it meets the Arkansas River Valley and Gulf Coastal Plain ecoregions.

2.1 Water Quality

Section 305(b) of the Clean Water Act (CWA) requires states to perform a comprehensive assessment of the State's water quality to be reported to the Environmental Protection Agency (EPA) every two years. Section 303(d) of the CWA requires each state to identify waters where existing pollution controls are not stringent enough to achieve state water quality standards and establish a priority ranking of these waters. In the State of Arkansas, this responsibility falls to the Arkansas Department of Energy and Environment, Division of Environmental Quality (ADEQ). The portion of the Arkansas River on which Terry L&D is located is along planning segment 3C delineated in the ADEQ's 2020 Draft 303(d) List – Streams. Based on information provided in this document, the best available data from the responsible agency, planning segment 3C is not listed as an impaired water body based on the screening criteria considered (ADEQ 2022). A hazardous, toxic, and radioactive waste (HTRW) desktop review was conducted for the project area. Water quality sampling conducted by the U.S. Geological Survey approximately one mile upstream of Terry L&D found the presence of Flubendimide, an EPA registered pesticide with a PFAS functional group in the surface water, likely from local agricultural practices; however, the proposed MRER efforts would have no effect on the increase or further distribution of the pollutant.

Increased barge and boat traffic as well as dewatering using both the one-sided and stoplog approaches may increase turbidity; however, these impacts will be localized and temporary in nature. Any agitated sediment is expected to dissipate quickly. Dewatering will be contained fully within the lock channel to limit turbidity impacts on adjacent aquatic habitats. Materials used during OMRR&R efforts will be free of any chemicals and sealants that could be harmful to the aquatic environment, preventing the possible leaching of hazardous chemicals into the water. Landside access will be used over watercraft access when possible, and barge and boat traffic will be limited to the fewest trips practicable for material, equipment, and personnel transport.

2.2 Aquatic Resources

The Arkansas River is home to diverse fish species, and pools formed by the MKARNS locks and dams are stocked by the Arkansas Game and Fish Commission. Aquatic species of the Arkansas River include blue catfish (*Ictalurus furcatus*), channel catfish (*Ictalurus punctatus*), flathead catfish (*Pylodictis olivaris*), sauger, largemouth bass (*Micropterus salmoides*), striped bass (*Morone saxatilis*), white bass (*Morone chrysops*), redear sunfish (*Lepomis microlophus*) and other sunfish species, crappie (*Pomoxis spp.*), sauger (*Sander canadensis*), carp (*Cyprinidae spp.*), buffalofish (*Ictiobus spp.*), gar (*Lepisosteidae spp.*), and paddlefish (*Polyodontidae spp.*). Non-game species include a variety of minnows, shad, and silversides, as well as several mussel species. Various turtle species can also be found along the Arkansas River (USACE 2022).

At Terry L&D, aquatic species may be present within the lock; however, BMPs will be employed during dewatering and construction efforts to minimize effects on these species. When dewatering begins, qualified biologists will be onsite to deter fish and other aquatic species from the dewatering zone, and remove and relocate to a location outside of the project area within the same watercourse.

2.3 Wetlands

The National Wetlands Inventory mapping tool (Figure 2) identifies the immediate project area as lake habitat. The river upstream, channel downstream, and lake just west of the dam to include the lock are classified as lacustrine, limnetic deepwater habitat situated in a dammed river with a riverbed composed of at least 25% cover of particles smaller than stones (less than 6-7 cm) and covered less than 30% by vegetation. The right shoreline approximately 0.5 miles downstream of the dam is composed of littoral lake habitats to a depth of 2.5 meters characterized by an unconsolidated, beach-like shoreline that experiences temporary flooding. The left shoreline approximately 0.5 miles downstream of the dam has approximately 12.16 acres of freshwater forested/shrub wetland, a palustrine wetland characterized by broad-leaved, deciduous vegetation over six meters tall and temporarily flooded (USFWS 2023b).

South of David D. Terry East Park is a roughly 4.5-acre manmade freshwater pond surrounded by approximately 5 acres of freshwater forested/shrub wetland, which is dominated by broad-leaved deciduous vegetation less than 6 meters tall (USFWS 2023b).

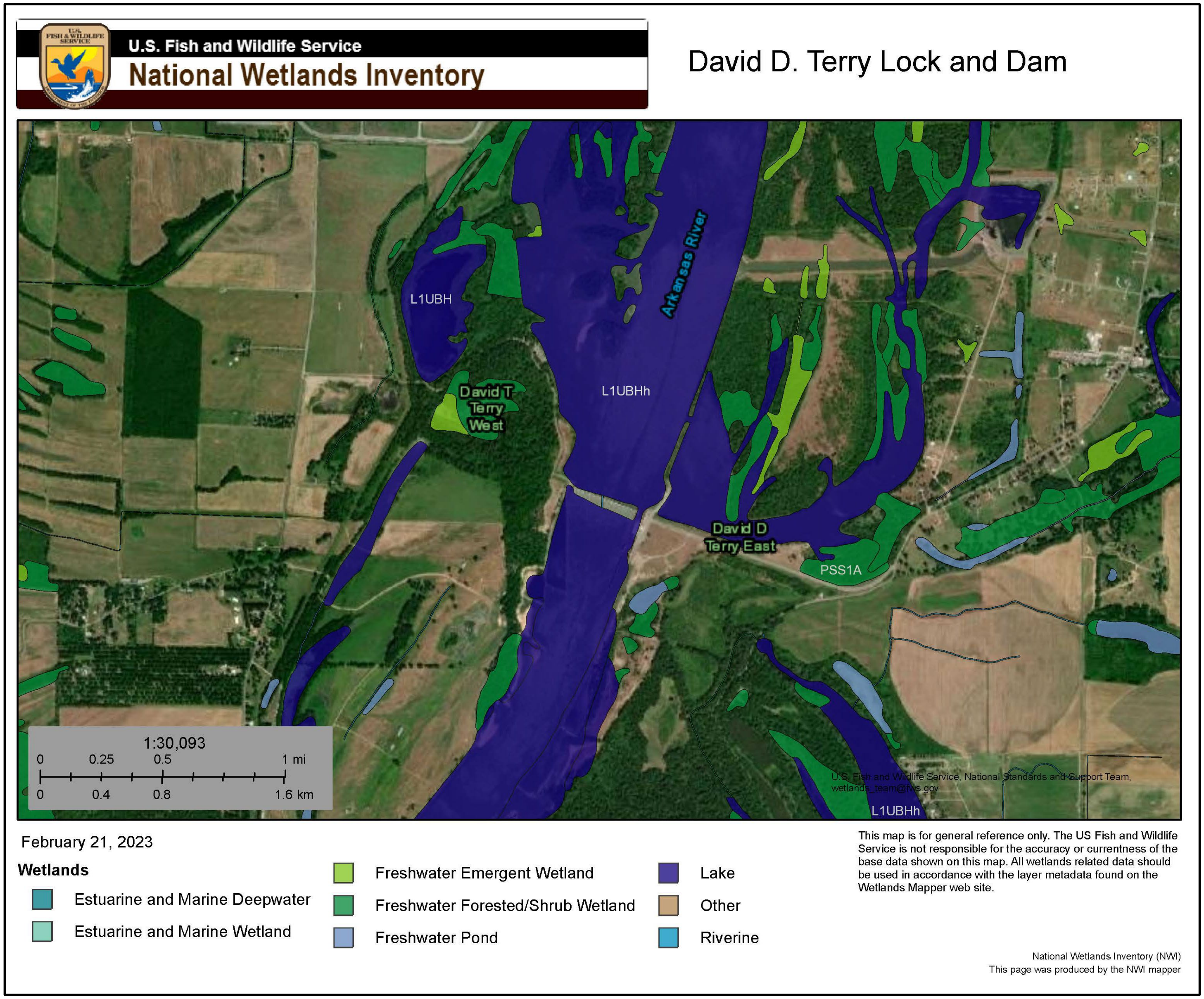

Figure 2. National Wetlands Inventory Map of Terry L&D

2.4 Vegetation

Predominant evergreen species along the Arkansas River include eastern red cedar (*Juniperus virginiana*) and short leaf pine (*Pinus echinate*), while dominant hardwood species include include eastern cottonwood (*Populus deltoides*), sweetgum (*Liquidambar styraciflua*), box elder (*Acer negundo*), elm species (*Ulmus*), green ash (*Fraxinus pennsylvanica*), willow oak (*Quercus phellos*), and water oak (*Quercus nigra*) (USACE 2022). David D. Terry Park East consists of grassy field areas that are mowed periodically. To minimize impacts to vegetation from the proposed action, the removal of vegetation will be prohibited, and trees within the park area will be fenced, flagged, or otherwise visible marked and excluded from the construction area. No access or use of the shoreline will be allowed by contractor vessels to prevent adverse impacts to shoreline vegetation and any habitat it might provide for species. The grassy areas in the park are to be used for staging and laydown; however, these areas are to be reseeded upon construction completion to restore any impacts caused by the proposed action.

2.5 Endangered Species Act

The U.S. Department of the Interior, Fish and Wildlife Service's Information for Planning and Consultation online tool was utilized to obtain a list of threatened and endangered species, critical habitat, and migratory birds that may be impacted by the proposed project, depicted in Table 1 (USFWS 2023a).

Table 1. Federally Listed Species

Common Name	Scientific Name	Status
Eastern Black Rail	*Laterallus jamaicensis ssp. jamaicensis*	Threatened
Piping Plover	*Charadrius melodus*	Threatened
Rufa Red Knot	*Calidris canutus rufa*	Threatened
Alligator Snapping Turtle	*Machrochelys temminckii*	Proposed Threatened
Monarch Butterfly	*Danaus plexippus*	Candidate

Federally-listed bird species known to migrate through the project area include the eastern black rail, piping plover, and rufa red knot. While these bird species may occur in the area, there are no known occurrences or critical habitat within the footprint of this project. A No Effect determination has been made for these avian species. The monarch butterfly is also expected to be unaffected by the project due to lack of resources and critical habitat.

The alligator snapping turtle (*Macrochelys temminckii*) is proposed to be listed as a Federally threatened species and may occur within the study area. Alligator snapping turtles are generally found in deeper water of large rivers and their major tributaries. The species prefers structure (i.e. tree root masses, stumps, submerged trees, etc.) over open water, and may select sites with a high percentage of canopy cover. Alligator snapping turtles may be present in the backwaters upstream and to the east of Terry L&D; however, this aquatic area will only be used for access from the preexisting boat ramp to the upstream lock entrance, similar to recreational boat traffic. Watercraft use will be limited to necessary trips only for transporting materials, equipment, and personnel, with landside access utilized when practicable. A maximum speed of five miles per hour with no wake will be enforced to avoid waves contributing to turbidity and shoreline erosion. Contractor use of the shoreline for mooring, staging, or any other use outside of the preexisting designated boat ramps is prohibited. With these BMPs in place, the proposed action is expected to avoid any impacts to the alligator snapping turtle. The USACE has determined there will be No Effect on any federally listed threatened or endangered species from the proposed action.

3. Conclusion

Overall, negligible impacts to water quality and aquatic resources can be expected as a result of the proposed action. Construction efforts to take place within the lock will be replacing or repairing components within the existing lock footprint. Replacing the miter gates, replacing the two 55-foot stoplogs with one 110-foot stoplog, and repairing and/or replacing other lock components is a form of filling a water of the United States. However, this addition of fill would replace the existing features and would not extend beyond the existing footprints, therefore there would be no net increase of fill entering waters of the United States. No new or additional dredge and/or fill activities will be implemented under the proposed action. Due to the nature of the material used for the structures and their protective coatings, the proposed fill material is free of any chemicals or sealants that could be harmful to the environment. Additionally, because the fill material would not exceed the previous placement area, there are no anticipated changes to the placement site and/or size of mixing zones. Construction efforts implemented via additional work barge traffic may temporarily increase local turbidity; however, these activities would occur intermittently, and the particulates would be quickly dissipated by water flowing through the lock and dam.

Adverse impacts from increased turbidity may occur as a result of barge and boat traffic as well as dewatering efforts; however, these impacts will be localized and temporary in nature. Watercraft use for access will be utilized minimally for transportation of materials, equipment, and personnel, with landside access preferred when practicable. All dewatering efforts will occur within the lock channel itself to prevent adverse impacts from turbidity to adjacent aquatic habitats.

Section 401 of the CWA requires state-issued water quality certifications to ensure proposed projects will not violate state water quality standards. As construction efforts on Terry L&D will take place within the Arkansas River, a Section 401 Water Quality Certification and Short Term Activity Authorization may need to be obtained from ADEQ to allow for instream work prior to entering waters of the state.

Other locks along the MKARNS will also undergo MRER efforts to prevent future failures. The efforts determined for other locks may occur within the same window as the Terry L&D MRER construction efforts. Closures will be coordinated to maximize navigation access to the greatest extent practicable and minimize cumulative impacts to navigation.

4. Guideline Compliance

1. Review of Compliance (230.10(a)-(d))		
A review of the proposed project indicates that:	**Yes**	**No***
a. The placement represents the least environmentally damaging practicable alternative and, if in a special aquatic site, the activity associated with the placement must have direct access or proximity to, or be located in the aquatic ecosystem, to fulfill its basic purpose (if no, see section 2 and information gathered for EA alternative).	**X**	
b. The activity does not appear to:		
1) Violate applicable state water quality standards or effluent standards prohibited under Section 307 of the Clean Water Act;	**X**	
2) Jeopardize the existence of Federally-listed endangered or threatened species or their habitat; and	**X**	
3) Violate requirements of any Federally-designated marine sanctuary (if no, see section 2b and check responses from resource and water quality certifying agencies).	**N/A**	
c. The activity will not cause or contribute to significant degradation of waters of the U.S. including adverse effects on human health, life stages of organisms that are dependent on the aquatic ecosystem, ecosystem diversity, productivity and stability, and recreational, aesthetic, and economic values (if no, see values, Section 2)	**X**	
d. Appropriate and practicable steps have been taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem (if no, see Section 5)	**X**	

2. Technical Evaluation Factors (Subparts C-F)			
	Not Applicable	**Not Significant**	**Significant***
a. Physical and Chemical Characteristics of the Aquatic Ecosystem (Subpart C)			
1) Substrate impacts		**X**	
2) Suspended particulates/turbidity impacts		**X**	
3) Water column impacts		**X**	
4) Alteration of current patterns and water circulation		**X**	
5) Alteration of normal water fluctuation/ hydroperiod		**X**	

2. Technical Evaluation Factors (Subparts C-F)			
	Not Applicable	**Not Significant**	**Significant***
6) Alteration of salinity gradients	**X**		
b. Biological Characteristics of the Aquatic Ecosystem (Subpart D)			
1) Effect on threatened/endangered species and their habitat		**X**	
2) Effect on the aquatic food web		**X**	
3) Effect on other wildlife (mammals, birds, reptiles and amphibians)		**X**	
c. Special Aquatic Sites (Subpart E)			
1) Sanctuaries and refuges	**X**		
2) Wetlands		**X**	
3) Mud flats	**X**		
4) Vegetated shallows		**X**	
5) Coral reefs	**X**		
6) Riffle and pool complexes		**X**	
d. Human Use Characteristics (Subpart F)			
1) Effects on municipal and private water supplies		**X**	
2) Recreational and commercial fisheries impacts		**X**	
3) Effects on water-related recreation		**X**	
4) Aesthetic impacts		**X**	
5) Effects on parks, national and historical monuments, national seashores, wilderness areas, research sites, and similar preserves		**X**	

*** Where a 'Significant' category is checked, add explanation below.**

3. Evaluation of Dredged or Fill Material (Subpart G)	
a. The following information has been considered in evaluating the biological availability of possible contaminants in dredged or fill material (check only those appropriate)	
1) Physical characteristics	**X**
2) Hydrography in relation to known or anticipated sources of contaminants	**X**
3) Results from previous testing of the material or similar material in the vicinity of the project	**N/A**
4) Known, significant sources of persistent pesticides from land runoff or percolation	**X**

3. Evaluation of Dredged or Fill Material (Subpart G)	
5) Spill records for petroleum products or designated (Section 311 of Clean Water Act) hazardous substances	**X**
6) Other public records of significant introduction of contaminants from industries, municipalities, or other sources	**X**
7) Known existence of substantial material deposits of substances which could be released in harmful quantities to the aquatic environment by man-induced discharge activities	**X**

List appropriate references: Enclosure 6 – HTRW

3. Evaluation of Dredged or Fill Material (Subpart G) (continued)	Yes	No
b. An evaluation of the appropriate information in 3a above indicates that there is reason to believe the proposed dredged or fill material is not a carrier of contaminants, or that levels of contaminants are substantively similar at extraction and placement sites and not likely to degrade the placement sites, or the material meets the testing exclusion criteria.	**X**	

4. Placement Site Delineation (230.11(f))	
a. The following factors as appropriate, have been considered in evaluating the placement site:	**N/A**
1) Depth of water at placement site	
2) Current velocity, direction, and variability at placement site	
3) Degree of turbulence	
4) Water column stratification	
5) Discharge vessel speed and direction	
6) Rate of discharge	
7) Fill material characteristics (constituents, amount, and type of material, settling velocities)	
8) Number of discharges per unit of time	
9) Other factors affecting rates and patterns of mixing (specify)	

List appropriate references: N/A

4. Placement Site Delineation (230.11(f)) (continued)	Yes	No
b. An evaluation of the appropriate factors in 4a above indicates that the placement site and/or size of mixing zone are acceptable.	**N/A**	

5. Actions to Minimize Adverse Effects (Subpart H)	Yes	No
All appropriate and practicable steps have been taken, through application of recommendations of 230.70-230.77 to ensure minimal adverse effects of the proposed discharge.	X	

List actions taken: See Enclosure 2: Best Management Practices.

6. Factual Determination (230.11)	Yes	No*
A review of appropriate information as identified in items 2-5 above indicates that there is minimal potential for short- or long-term environmental effects of the proposed discharge as related to:		
a. Physical substrate at the placement site (review Sections 2a, 3, 4, and 5 above)	X	
b. Water circulation, fluctuation and salinity (review Sections 2a. 3, 4, and 5)	X	
c. Suspended particulates/turbidity (review Sections 2a. 3, 4, and 5)	X	
d. Contaminant availability (review Sections 2a. 3, and 4)	X	
e. Aquatic ecosystem structure and function (review Sections 2b and c, 3, and 5)	X	
f. Placement site (review Sections 2, 4, and 5)	X	
g. Cumulative impacts on the aquatic ecosystem	X	
h. Secondary impacts on the aquatic ecosystem	X	

7. Evaluation Responsibility	
a. This evaluation was prepared by: Position:	**Elizabeth Knapp** **Biologist,** **Regional Planning & Environmental Center**

8. **Findings (Select One)**	
a. The proposed placement site for discharge of or fill material complies with the Section 404(b)(1) Guidelines.	**X**
b. The proposed placement site for discharge of dredged or fill material complies with the Section 404(b)(1) Guidelines with the inclusion of the following conditions: N/A	
c. The proposed placement site for discharge of dredged or fill material does not comply with the Section 404(b)(1) Guidelines for the following reason(s): 1) There is a less damaging practicable alternative 2) The proposed discharge will result in significant degradation of the aquatic ecosystem 3) The proposed discharge does not include all practicable and appropriate measures to minimize potential harm to the aquatic ecosystem	

____________________ Date	____ Jeffery F. Pinsky Chief, Environmental Branch

5. Sources

Arkansas Department of Energy and Environment, Department on Environmental Quality (ADEQ). 2023. "AquaView." Little Rock, AR. Accessed 11 April 2023.

ADEQ. 2022. "Assessment Methodology For the Preparation of: The 2022 Integrated Water Quality Monitoring and Assessment Report." Little Rock, AR. Accessed 11 April 2022.

U.S. Army Corps of Engineers (USACE). 2022. "Draft Environmental Assessment, Little Rock District Master Plan Revision, McClellan-Kerr Arkansas River Navigation System." Little Rock, AR. Accessed 10 April 2023.

U.S. Fish and Wildlife Service (USFWS). 2023a. "List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project." U.S. Department of the Interior. Conway, AR. Accessed 21 March 2023.

USFWS. 2023b. "National Wetlands Inventory." Washington, D.C. Accessed 21 February 2023.

Enclosure 5

Cultural Resources

David. D Terry Lock and Dam
Major Rehabilitation Evaluation Report

May 2023

US Army Corps
of Engineers
Little Rock District

DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
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April 17, 2023

Regional Planning and Environmental Center

Mr. Scott Kaufman
Deputy State Historic Preservation Officer
Arkansas Historic Preservation Program
1100 North Street
Little Rock, AR 72203

Dear Mr. Kaufman:

The U.S. Army Corps of Engineers, Little Rock District (USACE), plans to perform maintenance on the Terry Lock and Dam located at navigation mile 108.1 on the Arkansas River about 11 miles southeast of Little Rock, Arkansas. The facility's components exhibit an increased risk of failure, which may result in unanticipated lock closures, repair costs, vessel delays, and congestion on the McClellan–Kerr Arkansas River Navigation System (MKARNS). The project's current emergency dewatering method, utilizing 55-foot stop logs joined with a center post, is considered structurally deficient due to the center post anchorage, which potentially increases workers' life safety risk during inspections and repairs.

The likely selected alternative (Immediate Rehabilitation via Planned 110-Foot Stoplog Conversion) would replace all lock components chosen for the MRER (downstream and upstream). Work would begin in 2025 (year 1) with procuring the metal inserts for the 110-foot stop log slots and designing all identified components for rehabilitation. The 110-foot stop log conversion slot cutting would commence in 2026 (year 2) using the one-sided approach, allowing two wide tows to navigate the lock for the 150 days required for cutting. After slot cutting, regular navigation would commence for several months, and then the lock would close for 35 days to conduct sill work. Starting in 2027 (year 3), the upstream and downstream miter gates and other identified components will be fabricated. In 2029 (year 5), the lock would close for 37 days during the off-peak navigation season (typically July through August) to replace all upstream components, including miter gates. In 2030 (year 6), the lock would again close for 37 days during the off-peak navigation season to return all downstream components, including miter gates. All required fabrication and acquisition of materials would occur in years 3 through 5. This alternative would reset the hazard function for all components to their original state (approximately zero).

The USACE had also requested your participation in a Programmatic Agreement (PA) for the MKARNS 12-foot Navigation Channel Project on August 18, 2021. That PA remains under development, but a new draft will be forthcoming in the near future. The study area includes the entire MKARNS in Arkansas and Oklahoma, including

approximately 445 miles of river from the Mississippi River to the Port of Catoosa near Tulsa, Oklahoma. A series of 18 locks and dams (**including Terry Lock and Dam**), 13 in Arkansas and 5 in Oklahoma provide for commercial navigation throughout the MKARNS. If the MKARNS, completed in 1971, is determined eligible for listing on the National Register of Historic Places, one likely outcome or mitigation measure from that PA and study is a comprehensive Historic Property Management Plan that integrates operations with Section 106 compliance and streamlines the Section 106 process for all parties. That plan would encompass future operations at Terry Lock and Dam.

The entirety of the Area of Potential Effect (APE) lies within an area extensively disturbed from the construction of the facility and impacts to any archeological resources are not anticipated. These proposed modifications will not be readily discernable to anyone visiting the facility, nor would they alter any characteristics that could qualify it for inclusion in the National Register of Historic Places. The USACE respectfully requests comments concerning our finding of **no adverse effect on historic properties** within 30 days of receipt of this letter. We look forward to working closely with you throughout this undertaking. If you have any questions or require further information, please contact Mr. Christopher G. Davies, Cultural Resources Manager, Regional Planning and Environmental Center, at (501)-324-7134 or christopher.g.davies@usace.army.mil.

Sincerely,

Kenneth Shingleton

Kenneth Shingleton
Chief, Cultural and Environmental Programs
Support Section
Regional Planning and Environmental Center

Enclosure

DEPARTMENT OF THE ARMY
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April 17, 2023

Regional Planning and Environmental Center

Ms. Devon Frazier
Absentee-Shawnee Tribe of Indians of Oklahoma
2025 South Gordon Cooper Drive
Shawnee, Oklahoma 74801

Dear Ms. Frazier:

The U.S. Army Corps of Engineers, Little Rock District (USACE), plans to perform maintenance on the Terry Lock and Dam located at navigation mile 108.1 on the Arkansas River about 11 miles southeast of Little Rock, Arkansas. The facility's components exhibit an increased risk of failure, which may result in unanticipated lock closures, repair costs, vessel delays, and congestion on the McClellan–Kerr Arkansas River Navigation System (MKARNS). The project's current emergency dewatering method, utilizing 55-foot stop logs joined with a center post, is considered structurally deficient due to the center post anchorage, which potentially increases workers' life safety risk during inspections and repairs.

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Sincerely,

Kenneth Shingleton

Kenneth Shingleton
Chief, Cultural and Environmental Programs
Support Section
Regional Planning and Environmental Center

Enclosure

DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
POST OFFICE BOX 867
LITTLE ROCK, ARKANSAS 72203-0867
www.swl.usace.army.mil/

April 17, 2023

Regional Planning and Environmental Center

Ms. Samantha Robinson
Tribal Historic Preservation Officer
Alabama-Quassarte Tribal Town
Post Office Box 187
Wetumka, Oklahoma 74883

Dear Ms. Robinson:

The U.S. Army Corps of Engineers, Little Rock District (USACE), plans to perform maintenance on the Terry Lock and Dam located at navigation mile 108.1 on the Arkansas River about 11 miles southeast of Little Rock, Arkansas. The facility's components exhibit an increased risk of failure, which may result in unanticipated lock closures, repair costs, vessel delays, and congestion on the McClellan–Kerr Arkansas River Navigation System (MKARNS). The project's current emergency dewatering method, utilizing 55-foot stop logs joined with a center post, is considered structurally deficient due to the center post anchorage, which potentially increases workers' life safety risk during inspections and repairs.

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Kenneth Shingleton

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Support Section
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www.swl.usace.army.mil/

April 17, 2023

Regional Planning and Environmental Center

Mr. Jonathon Rohrer
Caddo Nation of Oklahoma
Post Office Box 487
Binger, Oklahoma 73009

Dear Mr. Rohrer

The U.S. Army Corps of Engineers, Little Rock District (USACE), plans to perform maintenance on the Terry Lock and Dam located at navigation mile 108.1 on the Arkansas River about 11 miles southeast of Little Rock, Arkansas. The facility's components exhibit an increased risk of failure, which may result in unanticipated lock closures, repair costs, vessel delays, and congestion on the McClellan–Kerr Arkansas River Navigation System (MKARNS). The project's current emergency dewatering method, utilizing 55-foot stop logs joined with a center post, is considered structurally deficient due to the center post anchorage, which potentially increases workers' life safety risk during inspections and repairs.

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Sincerely,

Kenneth Shingleton

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Chief, Cultural and Environmental Programs
Support Section
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www.swl.usace.army.mil/

April 17, 2023

Regional Planning and Environmental Center

Ms. Elizabeth Toombs
Cherokee Nation
Post Office Box 948
Tahlequah, Oklahoma 74465

Dear Ms. Toombs:

The U.S. Army Corps of Engineers, Little Rock District (USACE), plans to perform maintenance on the Terry Lock and Dam located at navigation mile 108.1 on the Arkansas River about 11 miles southeast of Little Rock, Arkansas. The facility's components exhibit an increased risk of failure, which may result in unanticipated lock closures, repair costs, vessel delays, and congestion on the McClellan–Kerr Arkansas River Navigation System (MKARNS). The project's current emergency dewatering method, utilizing 55-foot stop logs joined with a center post, is considered structurally deficient due to the center post anchorage, which potentially increases workers' life safety risk during inspections and repairs.

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Sincerely,

Kenneth Shingleton

Kenneth Shingleton
Chief, Cultural and Environmental Programs
Support Section
Regional Planning and Environmental Center

Enclosure

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www.swl.usace.army.mil/

April 17, 2023

Regional Planning and Environmental Center

Ms. Karen Brunso
The Chickasaw Nation
Post Office Box 1548
Ada, Oklahoma 74821-1548

Dear Ms. Brunso:

The U.S. Army Corps of Engineers, Little Rock District (USACE), plans to perform maintenance on the Terry Lock and Dam located at navigation mile 108.1 on the Arkansas River about 11 miles southeast of Little Rock, Arkansas. The facility's components exhibit an increased risk of failure, which may result in unanticipated lock closures, repair costs, vessel delays, and congestion on the McClellan–Kerr Arkansas River Navigation System (MKARNS). The project's current emergency dewatering method, utilizing 55-foot stop logs joined with a center post, is considered structurally deficient due to the center post anchorage, which potentially increases workers' life safety risk during inspections and repairs.

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Kenneth Shingleton

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Support Section
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Enclosure

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POST OFFICE BOX 867
LITTLE ROCK, ARKANSAS 72203-0867
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April 17, 2023

Regional Planning and Environmental Center

Dr. Ian Thompson
Tribal Historic Preservation Officer
The Choctaw Nation of Oklahoma
Post Office Drawer 1210
Durant, Oklahoma 74701

Dear Dr. Thompson:

The U.S. Army Corps of Engineers, Little Rock District (USACE), plans to perform maintenance on the Terry Lock and Dam located at navigation mile 108.1 on the Arkansas River about 11 miles southeast of Little Rock, Arkansas. The facility's components exhibit an increased risk of failure, which may result in unanticipated lock closures, repair costs, vessel delays, and congestion on the McClellan–Kerr Arkansas River Navigation System (MKARNS). The project's current emergency dewatering method, utilizing 55-foot stop logs joined with a center post, is considered structurally deficient due to the center post anchorage, which potentially increases workers' life safety risk during inspections and repairs.

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Chief, Cultural and Environmental Programs
Support Section
Regional Planning and Environmental Center

Enclosure

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LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
POST OFFICE BOX 867
LITTLE ROCK, ARKANSAS 72203-0867
www.swl.usace.army.mil/

April 17, 2023

Regional Planning and Environmental Center

Mr. Larry Heady
Tribal Historic Preservation Officer
Delaware Tribe of Indians
Roosevelt Hall, Room 212, 1200 Commercial Street
Emporia, Kansas 66801

Dear Mr. Heady:

The U.S. Army Corps of Engineers, Little Rock District (USACE), plans to perform maintenance on the Terry Lock and Dam located at navigation mile 108.1 on the Arkansas River about 11 miles southeast of Little Rock, Arkansas. The facility's components exhibit an increased risk of failure, which may result in unanticipated lock closures, repair costs, vessel delays, and congestion on the McClellan–Kerr Arkansas River Navigation System (MKARNS). The project's current emergency dewatering method, utilizing 55-foot stop logs joined with a center post, is considered structurally deficient due to the center post anchorage, which potentially increases workers' life safety risk during inspections and repairs.

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Support Section
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Enclosure

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LITTLE ROCK, ARKANSAS 72203-0867
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April 17, 2023

Regional Planning and Environmental Center

Mr. Paul Barton
Tribal Historic Preservation Officer
Eastern Shawnee Tribe of Oklahoma
70500 East 128 Road
Wyandotte, Oklahoma 74370

Dear Mr. Barton:

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Kenneth Shingleton

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Chief, Cultural and Environmental Programs
Support Section
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LITTLE ROCK, ARKANSAS 72203-0867
www.swl.usace.army.mil/

April 17, 2023

Regional Planning and Environmental Center

Mr. David Cook
Tribal Administrator
Kialagee Tribal Town
Post Office Box 332
Wetumka, Oklahoma 74883

Dear Mr. Cook:

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Sincerely,

Kenneth Shingleton

Kenneth Shingleton
Chief, Cultural and Environmental Programs
Support Section
Regional Planning and Environmental Center

Enclosure

DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
POST OFFICE BOX 867
LITTLE ROCK, ARKANSAS 72203-0867
www.swl.usace.army.mil/

April 17, 2023

Regional Planning and Environmental Center

Mr. Turner Hunt
Tribal Historic Preservation Officer
The Muscogee (Creek) Nation
Post Office Box 580
Okmulgee, Oklahoma 74447

Dear Mr. Hunt:

The U.S. Army Corps of Engineers, Little Rock District (USACE), plans to perform maintenance on the Terry Lock and Dam located at navigation mile 108.1 on the Arkansas River about 11 miles southeast of Little Rock, Arkansas. The facility's components exhibit an increased risk of failure, which may result in unanticipated lock closures, repair costs, vessel delays, and congestion on the McClellan–Kerr Arkansas River Navigation System (MKARNS). The project's current emergency dewatering method, utilizing 55-foot stop logs joined with a center post, is considered structurally deficient due to the center post anchorage, which potentially increases workers' life safety risk during inspections and repairs.

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April 17, 2023

Regional Planning and Environmental Center

Dr. Andrea Hunter
Tribal Historic Preservation Officer
The Osage Nation
627 Grandview Avenue
Pawhuska, Oklahoma 74056

Dear Dr. Hunter:

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Support Section
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LITTLE ROCK, ARKANSAS 72203-0867
www.swl.usace.army.mil/

April 17, 2023

Regional Planning and Environmental Center

Mr. Everett Bandy
Tribal Historic Preservation Officer
Quapaw Nation
Post Office Box 765
Quapaw, Oklahoma 74363-0765

Dear Mr. Bandy:

The U.S. Army Corps of Engineers, Little Rock District (USACE), plans to perform maintenance on the Terry Lock and Dam located at navigation mile 108.1 on the Arkansas River about 11 miles southeast of Little Rock, Arkansas. The facility's components exhibit an increased risk of failure, which may result in unanticipated lock closures, repair costs, vessel delays, and congestion on the McClellan–Kerr Arkansas River Navigation System (MKARNS). The project's current emergency dewatering method, utilizing 55-foot stop logs joined with a center post, is considered structurally deficient due to the center post anchorage, which potentially increases workers' life safety risk during inspections and repairs.

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Sincerely,

Kenneth Shingleton

Kenneth Shingleton
Chief, Cultural and Environmental Programs
Support Section
Regional Planning and Environmental Center

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POST OFFICE BOX 867
LITTLE ROCK, ARKANSAS 72203-0867
www.swl.usace.army.mil/

April 17, 2023

Regional Planning and Environmental Center

Mr. Ted Underwood
Tribal Historic Preservation Officer
The Seminole Nation of Oklahoma
Post Office Box 1498
Wewoka, Oklahoma 74884

Dear Mr. Underwood:

The U.S. Army Corps of Engineers, Little Rock District (USACE), plans to perform maintenance on the Terry Lock and Dam located at navigation mile 108.1 on the Arkansas River about 11 miles southeast of Little Rock, Arkansas. The facility's components exhibit an increased risk of failure, which may result in unanticipated lock closures, repair costs, vessel delays, and congestion on the McClellan–Kerr Arkansas River Navigation System (MKARNS). The project's current emergency dewatering method, utilizing 55-foot stop logs joined with a center post, is considered structurally deficient due to the center post anchorage, which potentially increases workers' life safety risk during inspections and repairs.

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www.swl.usace.army.mil/

April 17, 2023

Regional Planning and Environmental Center

Ms. Tonya Tipton
Tribal Historic Preservation Officer
Shawnee Tribe
Post Office Box 189
Miami, Oklahoma 74355

Dear Ms. Tipton:

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Kenneth Shingleton

Kenneth Shingleton
Chief, Cultural and Environmental Programs
Support Section
Regional Planning and Environmental Center

Enclosure

DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
POST OFFICE BOX 867
LITTLE ROCK, ARKANSAS 72203-0867
www.swl.usace.army.mil/

April 17, 2023

Regional Planning and Environmental Center

Mr. Galen Cloud
Tribal Historic Preservation Officer
Thlopthlocco Tribal Town
Post Office Box 188
Okemah, Oklahoma 74859

Dear Mr. Cloud:

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POST OFFICE BOX 867
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April 17, 2023

Regional Planning and Environmental Center

Mr. Earl J. Barbry, Jr.
Tribal Historic Preservation Officer
Tunica-Biloxi Indian Tribe
Post Office Box 1589
Marksville, Louisiana 71351

Dear Mr. Barbry:

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Kenneth Shingleton

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Chief, Cultural and Environmental Programs
Support Section
Regional Planning and Environmental Center

Enclosure

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POST OFFICE BOX 867
LITTLE ROCK, ARKANSAS 72203-0867
www.swl.usace.army.mil/

April 17, 2023

Regional Planning and Environmental Center

Mr. Acee Watt.
Section 106 Coordinator
United Keetoowah Band of Cherokee Indians in Oklahoma
Post Office Box 746
Tahlequah, Oklahoma 74465

Dear Mr. Watt:

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April 17, 2023

Regional Planning and Environmental Center

Mr. Gary McAdams
Tribal Historic Preservation Officer
Wichita and Affiliated Tribes (Wichita, Keechi, Waco & Tawakonie)
Post Office Box 729
Anadarko, Oklahoma 73005

Dear Mr. McAdams:

The U.S. Army Corps of Engineers, Little Rock District (USACE), plans to perform maintenance on the Terry Lock and Dam located at navigation mile 108.1 on the Arkansas River about 11 miles southeast of Little Rock, Arkansas. The facility's components exhibit an increased risk of failure, which may result in unanticipated lock closures, repair costs, vessel delays, and congestion on the McClellan–Kerr Arkansas River Navigation System (MKARNS). The project's current emergency dewatering method, utilizing 55-foot stop logs joined with a center post, is considered structurally deficient due to the center post anchorage, which potentially increases workers' life safety risk during inspections and repairs.

The likely selected alternative (Immediate Rehabilitation via Planned 110-Foot Stoplog Conversion) would replace all lock components chosen for the MRER (downstream and upstream). Work would begin in 2025 (year 1) with procuring the metal inserts for the 110-foot stop log slots and designing all identified components for rehabilitation. The 110-foot stop log conversion slot cutting would commence in 2026 (year 2) using the one-sided approach, allowing two wide tows to navigate the lock for the 150 days required for cutting. After slot cutting, regular navigation would commence for several months, and then the lock would close for 35 days to conduct sill work. Starting in 2027 (year 3), the upstream and downstream miter gates and other identified components will be fabricated. In 2029 (year 5), the lock would close for 37 days during the off-peak navigation season (typically July through August) to replace all upstream components, including miter gates. In 2030 (year 6), the lock would again close for 37 days during the off-peak navigation season to return all downstream components, including miter gates. All required fabrication and acquisition of materials would occur in years 3 through 5. This alternative would reset the hazard function for all components to their original state (approximately zero).

The USACE had also requested your participation in a Programmatic Agreement (PA) for the MKARNS 12-foot Navigation Channel Project on August 18, 2021. That PA remains under development, but a new draft will be forthcoming in the near future. The study area includes the entire MKARNS in Arkansas and Oklahoma, including

approximately 445 miles of river from the Mississippi River to the Port of Catoosa near Tulsa, Oklahoma. A series of 18 locks and dams (**including Terry Lock and Dam**), 13 in Arkansas and 5 in Oklahoma provide for commercial navigation throughout the MKARNS. If the MKARNS, completed in 1971, is determined eligible for listing on the National Register of Historic Places, one likely outcome or mitigation measure from that PA and study is a comprehensive Historic Property Management Plan that integrates operations with Section 106 compliance and streamlines the Section 106 process for all parties. That plan would encompass future operations at Terry Lock and Dam.

The entirety of the Area of Potential Effect (APE) lies within an area extensively disturbed from the construction of the facility and impacts to any archeological resources are not anticipated. These proposed modifications will not be readily discernable to anyone visiting the facility, nor would they alter any characteristics that could qualify it for inclusion in the National Register of Historic Places. The USACE respectfully requests comments concerning our finding of **no adverse effect on historic properties** within 30 days of receipt of this letter. We look forward to working closely with you throughout this undertaking. If you have any questions or require further information, please contact Mr. Christopher G. Davies, Cultural Resources Manager, Regional Planning and Environmental Center, at (501)-324-7134 or christopher.g.davies@usace.army.mil.

Sincerely,

Kenneth Shingleton

Kenneth Shingleton
Chief, Cultural and Environmental Programs
Support Section
Regional Planning and Environmental Center

Enclosure

ARKANSAS DEPARTMENT OF PARKS, HERITAGE AND TOURISM
ARKANSAS HERITAGE

Sarah Huckabee Sanders
Governor
Mike Mills
Secretary

April 27, 2023

Kenneth Shingleton
Chief, Cultural and Environmental Programs
Support Section
Regional Planning and Environmental Center
Post Office Box 867
Little Rock, AR 72203-0867

Re: Pulaski County – General
Section 106 Review – COE-LR
Proposed Undertaking – Component Replacement at Terry Lock and Dam, Pulaski County, AR
AHPP Tracking Number 111004

Dear Mr. Shingleton:

The staff of the Arkansas Historic Preservation Program (AHPP) reviewed the proposed undertaking at the Terry Lock and Dam, Pulaski County, AR. As described, the undertaking entails gradually replacing all the lock components over a span of years.

Based on the provided information, the AHPP concurs with a finding of **no adverse effects pursuant to 36 CFR § 800.5(b)** for the proposed undertaking.

We appreciate the opportunity to review this undertaking. If you have any questions, please contact George Burson at (501) 324-9270 or at George.Burson@arkansas.gov. Please refer to the AHPP Tracking Number above in any correspondence.

Sincerely,

for
Scott Kaufman
AHPP Director and State Historic Preservation Officer

From:	Madison D. Currie
To:	Davies, Christopher G CIV USARMY CESWF (USA)
Cc:	Lindsey Bilyeu
Subject:	[Non-DoD Source] Terry Lock and Dam Maintenance – Arkansas River
Date:	Wednesday, May 17, 2023 1:47:03 PM
Attachments:	image001.png

Halito Christopher Davies,

The Choctaw Nation of Oklahoma thanks you for the correspondence regarding the above referenced project. Pulaski County, Arkansas lies within our area of historic interest. The Choctaw Nation Historic Preservation Department concurs with the finding of "no effect". However, we ask that work be stopped and our office contacted immediately in the event that Native American artifacts or human remains are encountered.

If you have any questions, please contact me.

Yakoke,

Maddie Danielle Currie
NHPA Compliance Review Specialist
Historic Preservation Department
Choctaw Nation of Oklahoma
P.O. Box 1210
Durant, OK 74702
Office: 580-642-8467
Cell: 580-740-9537

Enclosure 6

Hazardous, Toxic, and Radioactive Waste

David. D Terry Lock and Dam
Major Rehabilitation Evaluation Report

May 2023

US Army Corps of Engineers
Little Rock District

HTRW David D. Terry Lock and Dam MRER

1.1 Aerial Photography Analysis

Aerial photographs were obtained from an Environmental Risk Information Services (ERIS) report for the years 1937, 1943, 1955, 1960, 1970, 1983, 1994, 2001, 2006, 2009, 2010, 2013, 2015, 2017, 2019 and 2021.

The earliest aerial photograph from 1937 is of moderate quality and shows minimal development around the adjacent properties and no development in the Arkansas River. In 1960 several formations jut out into the river channel from the east bank of the river. The 1970 aerial show Terry LD fully constructed. No major site changes occur until 2015, when some erosion appears on the east bank of the downstream side of Terry LD. The erosion is filled in by 2017.

1.2 Fire Insurance Map Review

Fire Insurance Maps were not available for this location.

1.3 Topographic Map Review

Historical topographic maps were obtained from ERIS for the years 1935, 1945, 1954, 1961, 1970, 1975, 1986, 1994, 2014, 2017, and 2020. The topographic maps show that the Terry LD project site is surrounded by minimal development dating back to 1935. The topography shows a river valley with gradual elevation gains to the southeast and northwest of the project area. Levees appear to run adjacent to the river as far back as the 1935 topographic map but are first labeled on the 1961 topographic map.

1.4 Records Review

1.4.1 Standard Environmental Record Sources

A search of federal and state environmental databases was conducted on 17 March 2023 by ERIS. The search included the subject property and nearby properties up to 1.5 miles from the project area. Findings are listed in Section 2.1 of this report. The full results of the database search are presented in Appendix.

1.4.2 Other ASTM Supplemental Records

The ERIS environmental record database search included supplemental records which are not typically considered standard environmental records, such as a drycleaner database, a clandestine drug laboratory list, and a database containing air quality permits, among others. The full list of databases searched can be found in Appendix C. Findings are discussed in Section 2.1.

A physical settings report (PSR) was obtained from ERIS which included a search for water, oil, and gas wells in the project vicinity. The report identified one water well on the subject property, and two wells adjacent to the property to the East Southeast. These three wells are USGS water wells. An additional 6 active water wells are in the surrounding area.

The complete PSR including well maps and data can be found in the appendix.

1.5 Adjacent Properties

As part of the ECP process, adjacent properties are assessed for environmental conditions, and those discovered conditions are evaluated based on the potential to affect the subject property. Findings from adjacent properties are discussed in Section 2.0. The full records search can be found in the appendix.

2.0 Environmental Conditions

2.1 Standard Environmental Record Sources

The ECP report includes a review of all reasonably ascertainable information about the subject property to identify conditions indicating a release or threatened release of hazardous substances and petroleum at the site, or at an adjacent property which would threaten the real property under consideration. Review of this information is accomplished by an Environmental Professional conducting an inquiry into industry-standard environmental record sources which are identified in the paragraphs below. Record sources and search distances listed are consistent with the "all appropriate inquiries" provisions of ASTM E1527-21.

2.1.1 Lists of Federal National Priority List (NPL) Superfund Sites

There are no NPL sites or proposed NPL sites within 1 mile of the subject property.

2.1.2 Lists of Federal Delisted NPL Sites

There are no delisted or deleted NPL sites within 0.5 mile of the subject property.

2.1.3 Lists of Federal Sites Subject to Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Removals and CERCLA Orders

No currently- or formerly active sites subject to CERCLA removals or orders were identified within 0.5 miles of the subject property.

2.1.4 Lists of Federal CERCLA sites with No Further Remedial Action Planned (NFRAP)

No CERCLA NFRAP sites were found within 0.5 miles of the subject property.

2.1.5 Lists of Federal Resource Conservation and Recovery Act (RCRA) Facilities Undergoing Corrective Action

There are no RCRA Corrective Actions on-going at facilities within 1 mile of the subject property.

2.1.6 Lists of Federal RCRA Transportation, Storage, and Disposal (TSD) Facilities

No RCRA TSD facilities were found within 0.5 mile of the subject property.

2.1.7 Lists of Federal RCRA Generators

No RCRA generators were found within 0.25 mile of the subject property.

2.1.8 Federal Institutional Control/Engineering Control (IC/EC) Registries

No Federal IC/EC sites were identified within 0.5 mile of the subject property.

2.1.9 Federal Emergency Response Notification System (ERNS) list

There are no ERNS list entries for the subject or adjacent properties.

2.1.10 Federal Facility Registry Service/Facility Index

There are two FINDS/FRS list entries for the subject property. The subject property is listed as well as McGeorge Contracting Co, Inc located 0.5 miles southwest of the property on the opposite bank of the Arkansas River and down gradient of the project site. The presence on the Facility Registry Service list does not indicate a release or an environmental condition exists and therefore is not considered a REC.

2.1.11 State and Tribal "Superfund" Equivalent Sites

No State or Tribal Superfund-equivalent sites were identified within 1 mile of the subject property.

2.1.12 State and Tribal Lists of Hazardous Waste Sites
No State or Tribal hazardous waste sites were identified for investigation or remediation within 0.5 mile of the subject properties.

2.1.13 State and Tribal Landfills and Solid Waste Disposal Facilities
No State or Tribal landfills or solid waste disposal facilities were found within 0.5 mile of the subject properties.

2.1.14 State and Tribal Leaking Storage Tanks
The environmental database search yielded no State or Tribal records for leaking storage tanks within 0.5 mile of the subject property.

2.1.15 State and Tribal Registered Storage Tanks
A review of ADEQ records in the ERIS environmental database report indicates the presence of 1 aboveground storage tanks (ASTs) at the Terry LD facility; the AST is listed as “permanently out of use” as of 24 January 1995. Based on available information, the AST closure was presumably conducted in accordance with applicable environmental regulations in effect at the time. There is no record of petroleum product spills or releases associated with any of the former AST at the subject properties.

State records indicate the presence one registered Above-ground Storage Tank (AST) at the Terry LD facility on subject property. Records show no enforcement actions related to this tank, and there is nothing in the records to suggest a release from the tank has occurred or is imminent. The mere presence of a registered petroleum storage tank is not adequate justification for a recognized environmental condition; therefore, the AST at the adjacent property will not be carried forward as a REC.

2.1.16 State and Tribal IC/EC Registries
The subject property was not identified on any State or Tribal IC/EC registries.

2.1.17 State and Tribal Voluntary Cleanup Sites
No State or Tribal voluntary cleanup sites were found within 0.5 mile of the subject property.

2.1.18 State and Tribal Brownfield Sites
No State or Tribal brownfield sites were identified within 0.5 mile of the subject property.

2.2 Other Regulated Materials or Conditions
In addition to the ASTM E1527 standard sources, additional environmental databases were searched for available information on the subject and adjacent properties. A Perfluorinated Alkyl Substances (PFAS) Water Quality report for a location 0.75 to 1.0 miles north of the subject property stated the detection of Flubendiamide. Further review of the records indicates the listing is a result of routine sampling by the USGS of surface water in David D. Terry Lake which is formed by Terry LD upstream of the project site. The chemical reported by the USGS was Flubendiamide at 2.71 ng/L (2016) and 0.93 ng/L (2018), Flubendiamide is an insecticide which contains a Perfluorinated functional group. The presence of Flubendiamide in David D. Terry Lake does not impact the anticipated work at the project site and therefore is not considered a REC.

2.2.1 Asbestos
Suspect asbestos-containing building materials (ACBM) was identified at the Terry LD project site through a Notice of Intent No: ASB-NOI10050 for a renovation on 25 February 2017. The ACBM at these buildings are typical for 1960s-era construction and are not present in a form which constitutes dumping or an uncontrolled release to the environment. Any existing site structures which are planned for

demolition or renovation will need an updated asbestos building inspections to identify potential ACBM. Removal and disposal of ACBM shall take place by licensed personnel in accordance with applicable federal and state regulations.

2.2.2 Lead and Lead-Based Paint (LBP)

Paint containing lead at or above the regulatory threshold of 1.0mg/cm^2 shall be identified by X-Ray Fluorescence (XRF) testing prior to any demolition or renovation work. LBP was applied as a surface coating in accordance with standard construction industry practices at the time of application and was not identified in this records review in a form which represents a release to the environment. Additionally, no child-occupied or other target housing is present at the BRFG site. However, OSHA regulations for worker protection and sampling requirements to determine proper waste characterization and disposal shall be followed during any demolition and construction work at the facility.

2.2.3 Radioactive Material

No radioactive material assessments were found during the ECP process. The presence of radioactive materials on the subject property is considered unlikely.

2.2.4 Landfills/Dumps

There were two solid waste illegal dumps (SWID) located between 0.75 and 1.0 miles northeast from the project site. The two listings for SWID were described as the same location once in October 2005 and again in May 2009. In 2005 the site indicated burning activity, while the 2009 site notes did not specify. Aerial imagery does not show evidence of environmental conditions and therefore is not considered a REC.

2.2.5 Munitions and Explosives of Concern and/or Unexploded Ordnance

No suspected munitions, explosives, or unexploded ordinance were identified on the subject properties. There is no record of the subject properties being used for ordinance storage, disposal, or military maneuvers.

2.2.6 Radon

The subject properties are located in Pulaski County, which is in the Environmental Protection Agency (EPA) Radon Zone 3. Counties in Radon Zone 3 are counties with predicted average indoor radon screening levels of less than 2 pCi/L (EPA-402-R-071). No site-specific radon assessments were found for the subject properties during the records search.

2.2.7 Pesticides

A Perfluorinated Alkyl Substances (PFAS) Water Quality was reported for a location 0.75 to 1.0 miles north of the subject property. Further review of the records indicates the listing is a result of routine sampling by the USGS of surface water in David D. Terry Lake which is formed by Terry LD upstream of the project site. The chemical reported by the USGS was Flubendiamide at 2.71 ng/L (2016) and 0.93 ng/L (2018), Flubendiamide is an insecticide which contains a Perfluorinated functional group. The presence of Flubendiamide in David D. Terry Lake does not impact the anticipated work at the project site and therefore is not considered a REC. Modern pest control services performed by a licensed applicator using approved formulations and application methods, and limited use of COTS products in compliance with manufacturer’s labelling are not RECs. During this investigation, no records were found to indicate the use, storage, or disposal of banned pesticides on the subject property.

2.2.8 Spills Database

The ERIS database report identified three spills reported as unplottable on the current map. The three sites were located upstream of the project site, located at river mile 108. Two spills were reported at river mile

125 and river mile 126, both of which were reported as closed. The third spill was reported at river mile 109 which is within one mile of the project site. The spill reported up to 15 gallons of bilge material was spilled to the river while transferring to the slop tank. The size of this spill is *de minimis* and therefore is not considered a REC for the project.

2.2.9 Other Identified Concerns

No additional concerns were identified through this records review.

3.0 Evaluation and Conclusions

3.1 Summary of ECP

The subject property currently occupies approximately 58 acres of land at the David D. Terry Lock and Dam complex in Pulaski County, Arkansas. The site is partially developed with structures used for navigation on the Arkansas River. Review of historic aerial imagery has not revealed a recognized environmental condition. Water quality sampling by the USGS in the David D. Terry Lake revealed the presence of Flubendiamide an EPA registered pesticide with a PFAS functional group in the surface water which could be related to local agricultural processes and was not related to a reported spill therefore this is not a recognized environmental condition.

This ECP report was prepared to characterize the existing environmental conditions at the subject property and is intended to be an aid in support of construction activities on site. The ECP findings are based on the available sources of information concerning both past and present uses of the subject properties. Information included readily available data associated with adjacent property records, aerial photography, environmental programs, and associated documentation. In addition, record sources were reviewed to determine if there have been spills, leaks, discharges, leaching, underground injections, dumping, abandonments, or storage of hazardous substances or petroleum products at the properties.

3.2 Conclusions

The subject property was classified into one of seven standard ECP area types (categories) as required by ASTM D6008 (2014) *Standard Practice for Conducting Environmental Baseline Surveys*. The seven categories are listed in ASTM D5746-98 (Reapproved 2016) *Standard Classification of Property Area Types for Defense Base Closure and Realignment Facilities* define the property type. Given these seven categories, the subject property is categorized as Type 1, an area or parcel of real property where no release, or disposal of hazardous substances or petroleum products or their derivatives has occurred, including no migration of these substances from adjacent properties.

4.0 Certification

I declare that, to the best of my professional knowledge and belief, I meet the definition of *Environmental Professional* as defined in Part 312.10 of 40 CFR 312. I have the specific qualifications based on education, training, and experience to assess a property of the nature, history and setting of the subject property. I have developed and performed this as a cursory desktop survey for HTRW and does not constitute a full ESA according to ASTM all appropriate inquiries in conformance with the standards and practices set forth in 40 CFR Part 312. All information/documentation provided accurately reflects the condition of the subject properties. This report meets the DoD requirements for completion of an ECP Report.

Certified by:

This document is released for the purpose of internal agency review by:
Gerjen Slim, P.E.
OK License No. 32627

____ _5 May 2023__________

Gerjen Slim, P.E. Date
Environmental Engineer
Regional Planning and Environmental Center
U.S. Army Corps of Engineers

This report was prepared by the Southwestern Division Regional Planning and Environmental Center of the U.S. Army Corps of Engineers. The initials or signatures and registration designations of individuals appear on these project documents within the scope of their employment as required by ER 1110-1-8152.

ERIS

DATABASE REPORT

Project Property:	*David D Terry Lock and Dam* *David D Terry Lock and Dam* *Little Rock AR 72142*
Project No:	*W45XMA30722547*
Report Type:	*Database Report*
Order No:	*23031500632*
Requested by:	*US Army Corps of Engineers*
Date Completed:	*March 17, 2023*

Environmental Risk Information Services
A division of Glacier Media Inc.
1.866.517.5204 | info@erisinfo.com | erisinfo.com

Table of Contents

Executive Summary

Property Information:

Project Property:		*David D Terry Lock and Dam* *David D Terry Lock and Dam Little Rock AR 72142*
Project No:		*W45XMA30722547*
Coordinates:		
	Latitude:	*34.66531858*
	Longitude:	*-92.15346911*
	UTM Northing:	*3,836,255.10*
	UTM Easting:	*577,561.55*
	UTM Zone:	*UTM Zone 15S*
Elevation:		*235 FT*

Order Information:

Order No:	*23031500632*
Date Requested:	*March 15, 2023*
Requested by:	*US Army Corps of Engineers*
Report Type:	*Database Report*

Historicals/Products:

Aerial Photographs	*Historical Aerials (with Project Boundaries)*
City Directory Search	*CD - 2 Street Search*
ERIS Xplorer	*ERIS Xplorer*
Excel Add-On	*Excel Add-On*
Fire Insurance Maps	*US Fire Insurance Maps*
Physical Setting Report (PSR)	*Physical Setting Report (PSR)*
Topographic Map	*Topographic Maps*

Executive Summary: Report Summary

Database	Searched	Search Radius	Project Property	Within 0.62mi	0.625mi to 0.75mi	0.75mi to 1.00mi	1.00mi to 1.50mi	Total
Standard Environmental Records								
Federal								
DOE FUSRAP	Y	1.5	0	0	0	0	0	0
NPL	Y	1.5	0	0	0	0	0	0
PROPOSED NPL	Y	1.5	0	0	0	0	0	0
DELETED NPL	Y	1	0	0	0	0	-	0
SEMS	Y	1	0	0	0	0	-	0
SEMS ARCHIVE	Y	1	0	0	0	0	-	0
ODI	Y	1	0	0	0	0	-	0
CERCLIS	Y	1	0	0	0	0	-	0
IODI	Y	1	0	0	0	0	-	0
CERCLIS NFRAP	Y	1	0	0	0	0	-	0
CERCLIS LIENS	Y	0.5	0	-	-	-	-	0
RCRA CORRACTS	Y	1.5	0	0	0	0	0	0
RCRA TSD	Y	1	0	0	0	0	-	0
RCRA LQG	Y	0.75	0	0	0	-	-	0
RCRA SQG	Y	0.75	0	0	0	-	-	0
RCRA VSQG	Y	0.75	0	0	0	-	-	0
RCRA NON GEN	Y	0.75	0	0	0	-	-	0
RCRA CONTROLS	Y	1	0	0	0	0	-	0
FED ENG	Y	1	0	0	0	0	-	0
FED INST	Y	1	0	0	0	0	-	0
LUCIS	Y	1	0	0	0	0	-	0
NPL IC	Y	1	0	0	0	0	-	0
ERNS 1982 TO 1986	Y	0.5	0	-	-	-	-	0
ERNS 1987 TO 1989	Y	0.5	0	-	-	-	-	0
ERNS	Y	0.5	0	-	-	-	-	0
FED BROWNFIELDS	Y	1	0	0	0	0	-	0
FEMA UST	Y	0.75	0	0	0	-	-	0

Database	Searched	Search Radius	Project Property	Within 0.62mi	0.625mi to 0.75mi	0.75mi to 1.00mi	1.00mi to 1.50mi	Total
FRP	Y	0.75	0	0	0	-	-	0
DELISTED FRP	Y	0.75	0	0	0	-	-	0
HIST GAS STATIONS	Y	0.75	0	0	0	-	-	0
REFN	Y	0.75	0	0	0	-	-	0
BULK TERMINAL	Y	0.75	0	0	0	-	-	0
SEMS LIEN	Y	0.5	0	-	-	-	-	0
SUPERFUND ROD	Y	1.5	0	0	0	0	0	0
State								
SHWS	Y	1.5	0	0	0	0	0	0
DELISTED SHWS	Y	1.5	0	0	0	0	0	0
SWF/LF	Y	1	0	0	0	0	-	0
SWID	Y	1	0	0	0	**2**	-	**2**
RECYCLING	Y	1	0	0	0	0	-	0
LST	Y	1	0	0	0	0	-	0
DELISTED LST	Y	1	0	0	0	0	-	0
UST	Y	0.75	0	0	0	-	-	0
AST	Y	0.75	**1**	0	0	-	-	**1**
TANKS	Y	0.75	0	0	0	-	-	0
DELISTED TANK	Y	0.75	0	0	0	-	-	0
ENG	Y	1	0	0	0	0	-	0
INST	Y	1	0	0	0	0	-	0
VCP	Y	1	0	0	0	0	-	0
BROWNFIELDS	Y	1	0	0	0	0	-	0
Tribal								
INDIAN LUST	Y	1	0	0	0	0	-	0
INDIAN UST	Y	0.75	0	0	0	-	-	0
DELISTED INDIAN LST	Y	1	0	0	0	0	-	0
DELISTED INDIAN UST	Y	0.75	0	0	0	-	-	0

County *No County standard environmental record sources available for this State.*

Additional Environmental Records

Federal

Database	Searched	Search Radius	Project Property	Within 0.62mi	0.625mi to 0.75mi	0.75mi to 1.00mi	1.00mi to 1.50mi	Total
FINDS/FRS	Y	0.5	**1**	**1**	-	-	-	**2**
TRIS	Y	0.5	0	-	-	-	-	0

Database	Searched	Search Radius	Project Property	Within 0.62mi	0.625mi to 0.75mi	0.75mi to 1.00mi	1.00mi to 1.50mi	Total
PFAS NPL	Y	1	0	0	0	0	-	0
PFAS FED SITES	Y	1	0	0	0	0	-	0
PFAS SSEHRI	Y	1	0	0	0	0	-	0
ERNS PFAS	Y	1	0	0	0	0	-	0
PFAS NPDES	Y	1	0	0	0	0	-	0
PFAS TRI	Y	1	0	0	0	0	-	0
PFAS WATER	Y	1	0	0	0	**1**	-	**1**
HMIRS	Y	0.625	0	0	-	-	-	0
NCDL	Y	0.625	0	0	-	-	-	0
TSCA	Y	0.625	0	0	-	-	-	0
HIST TSCA	Y	0.625	0	0	-	-	-	0
FTTS ADMIN	Y	0.5	0	-	-	-	-	0
FTTS INSP	Y	0.5	0	-	-	-	-	0
PRP	Y	0.5	0	-	-	-	-	0
SCRD DRYCLEANER	Y	1	0	0	0	0	-	0
ICIS	Y	0.5	0	-	-	-	-	0
FED DRYCLEANERS	Y	0.75	0	0	0	-	-	0
DELISTED FED DRY	Y	0.75	0	0	0	-	-	0
FUDS	Y	1.5	0	0	0	0	0	0
FORMER NIKE	Y	1.5	0	0	0	0	0	0
PIPELINE INCIDENT	Y	0.5	0	-	-	-	-	0
MLTS	Y	0.5	0	-	-	-	-	0
HIST MLTS	Y	0.5	0	-	-	-	-	0
MINES	Y	0.75	0	0	0	-	-	0
SMCRA	Y	1.5	0	0	0	0	0	0
MRDS	Y	1.5	0	0	0	0	0	0
LM SITES	Y	1.5	0	0	0	0	0	0
ALT FUELS	Y	0.75	0	0	0	-	-	0
CONSENT DECREES	Y	0.75	0	0	0	-	-	0
AFS	Y	0.5	0	-	-	-	-	0
SSTS	Y	0.75	0	0	0	-	-	0
PCBT	Y	1	0	0	0	0	-	0
PCB	Y	1	0	0	0	0	-	0
State								
SPILLS	Y	0.625	0	0	-	-	-	0

Database	Searched	Search Radius	Project Property	Within 0.62mi	0.625mi to 0.75mi	0.75mi to 1.00mi	1.00mi to 1.50mi	Total
HISTORIC SPILLS	Y	0.625	0	0	-	-	-	0
DRYCLEANERS	Y	0.75	0	0	0	-	-	0
DELISTED DRYCLEANERS	Y	1	0	0	0	0	-	0
AIR PERMITS	Y	0.75	0	0	0	-	-	0
PFAS	Y	1	0	0	0	0	-	0
CDL	Y	0.625	0	0	-	-	-	0
FEEDLOTS	Y	1	0	0	0	0	-	0
ASBESTOS	Y	0.625	0	**1**	-	-	-	**1**

Tribal — ***No Tribal additional environmental record sources available for this State.***

County — ***No County additional environmental record sources available for this State.***

Total:	**2**	**2**	0	**3**	0	**7**

**** PO – Property Only***
**** 'Property and adjoining properties' database search radii are set at 0.25 miles.***

Executive Summary: Site Report Summary - Project Property

Map Key	DB	Company/Site Name	Address	Direction	Distance (mi/ft)	Elev Diff (ft)	Page Number
1	FINDS/FRS	DAVID D. TERRY LOCK & DAM	10100 E DAM SITE RD SCOTT AR 72142 ***Registry ID:*** *110025054624*	WNW	0.00 / 0.00	4	17
1	AST	DAVID D. TERRY LOCK & DAM	10100 E. DAM SITE RD SCOTT AR 72142 ***Facility ID | Active Site:*** *60001832 |* ***Tank No | Tank Status | Tank Status Date:*** *1 | Permanently Out Of Use |*	WNW	0.00 / 0.00	4	17

Executive Summary: Site Report Summary - Surrounding Properties

Map Key	DB	Company/Site Name	Address	Direction	Distance (mi/ft)	Elev Diff (ft)	Page Number
2	ASBESTOS		10100 East Dam Site Scott AR 72142	E	0.29 / 1,513.88	17	20
3	FINDS/FRS	MCGEORGE CONTRACTING CO, INC	.5M SW OF DAVID D TERRY DAM LITTLE ROCK AR 72201 ***Registry ID:*** 110042200105	W	0.48 / 2,525.65	1	20
4	SWID	Grant Youngblood	12000 Youngblood Trail Scott AR 72142	NE	0.87 / 4,603.40	0	21
4	SWID	Grant Youngblood	12000 Youngblood Trail Scott AR 72142	NE	0.87 / 4,603.40	0	21
5	PFAS WATER		AR ***Monitoring Location Identifier:*** USGS-07263620	N	0.88 / 4,626.25	-14	21

Executive Summary: Summary by Data Source

Standard

State

SWID - Solid Waste Illegal Dumps Database

A search of the SWID database, dated Feb 2, 2023 has found that there are 2 SWID site(s) within approximately 1.00 miles of the project property.

Lower Elevation	Address	Direction	Distance (mi/ft)	Map Key
Grant Youngblood	12000 Youngblood Trail Scott AR 72142	NE	0.87 / 4,603.40	4
Grant Youngblood	12000 Youngblood Trail Scott AR 72142	NE	0.87 / 4,603.40	4

AST - Aboveground Storage Tanks

A search of the AST database, dated Dec 5, 2022 has found that there are 1 AST site(s) within approximately 0.75 miles of the project property.

Equal/Higher Elevation	Address	Direction	Distance (mi/ft)	Map Key
DAVID D. TERRY LOCK & DAM	10100 E. DAM SITE RD SCOTT AR 72142	WNW	0.00 / 0.00	1
	***Facility ID | Active Site**: 60001832 |* ***Tank No | Tank Status | Tank Status Date**: 1 | Permanently Out Of Use |*			

Non Standard

Federal

FINDS/FRS - Facility Registry Service/Facility Index

A search of the FINDS/FRS database, dated Aug 18, 2022 has found that there are 2 FINDS/FRS site(s) within approximately 0.50 miles of the project property.

Equal/Higher Elevation	Address	Direction	Distance (mi/ft)	Map Key
DAVID D. TERRY LOCK & DAM	10100 E DAM SITE RD SCOTT AR 72142	WNW	0.00 / 0.00	1
	***Registry ID**: 110025054624*			
MCGEORGE CONTRACTING CO, INC	.5M SW OF DAVID D TERRY DAM LITTLE ROCK AR 72201	W	0.48 / 2,525.65	3
	***Registry ID**: 110042200105*			

PFAS WATER - Perfluorinated Alkyl Substances (PFAS) Water Quality

A search of the PFAS WATER database, dated Jul 20, 2020 has found that there are 1 PFAS WATER site(s) within approximately 1.00 miles of the project property.

Lower Elevation	Address	Direction	Distance (mi/ft)	Map Key
	AR	N	0.88 / 4,626.25	5

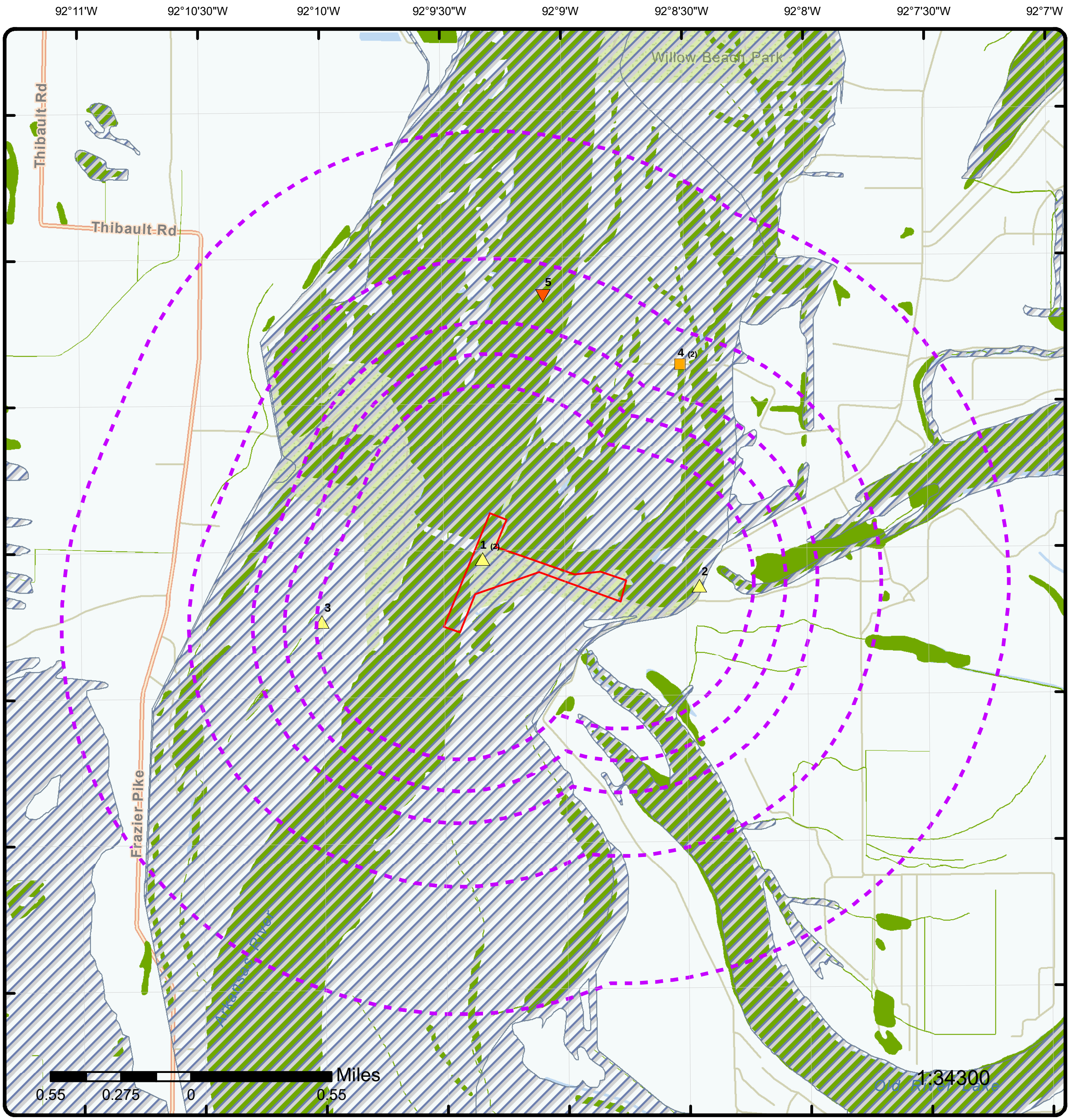
***Monitoring Location Identifier**: USGS-07263620*

State

ASBESTOS - Asbestos Notification of Intent Database

A search of the ASBESTOS database, dated Nov 11, 2022 has found that there are 1 ASBESTOS site(s) within approximately 0.62 miles of the project property.

Equal/Higher Elevation	Address	Direction	Distance (mi/ft)	Map Key
	10100 East Dam Site Scott AR 72142	E	0.29 / 1,513.88	2



Map: 1.5 Mile Radius

Order Number: 23031500632

Address: David D Terry Lock and Dam, Little Rock, AR

Project Property

Buffer Outline

Sites with Higher Elevation

Sites with Same Elevation

Sites with Lower Elevation

Sites with Unknown Elevation

Areas with Higher Elevation

Areas with Same Elevation

Areas with Lower Elevation

Areas with Unknown Elevation

Freeways; Highways

Traffic Circle; Ramp

Major & Minor Arterial

Traffic Circle; Ramp

Local Road

Rail

State

Country

National Wetland

Indian Reserve Land

Plume

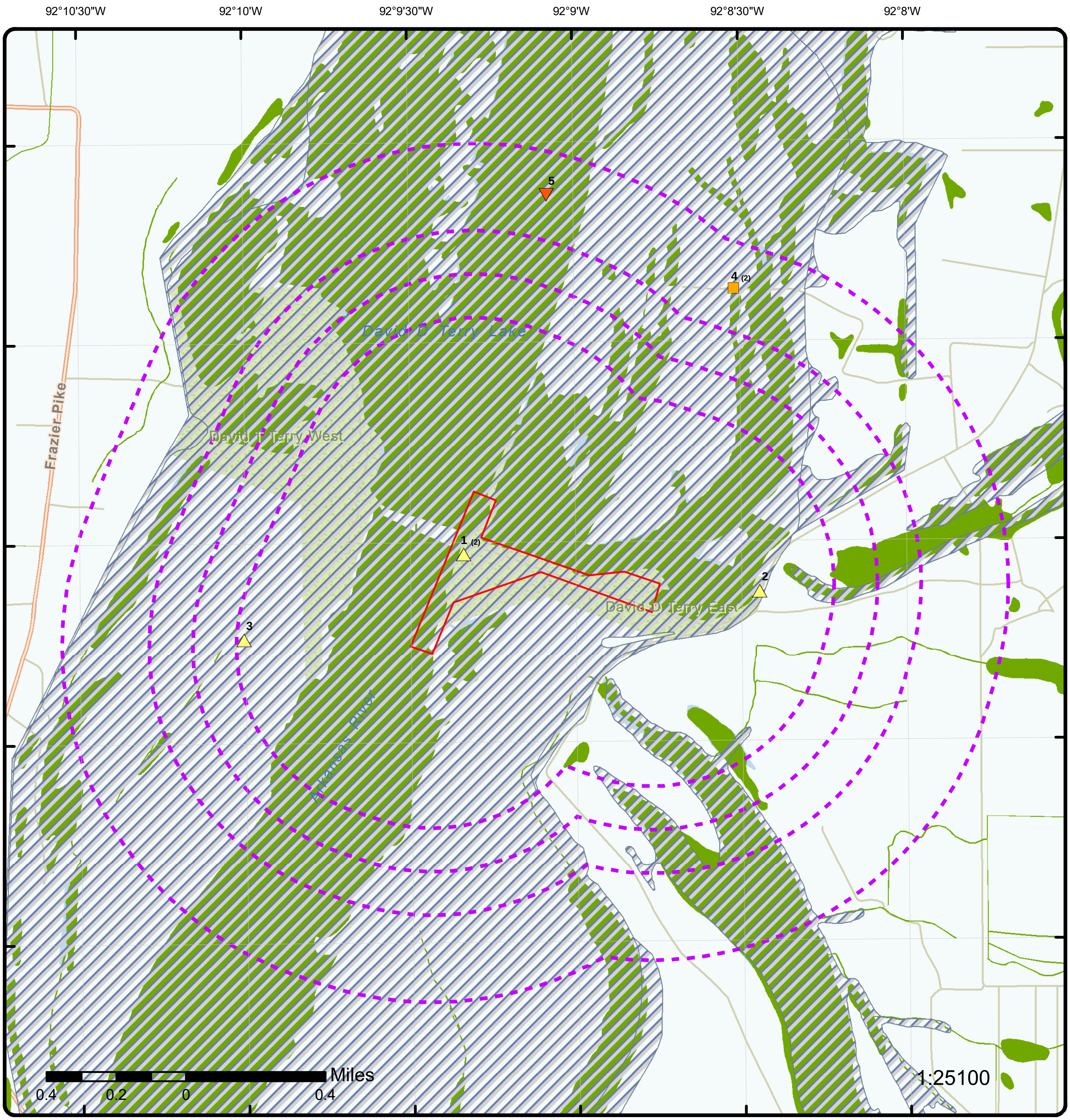
100 Year Flood Zone

500 Year Flood Zone

FWS Special Designation Areas

National Priorities List (Active, Delisted, Proposed, Institutional Control)

Source: © 2021 ESRI StreetMap Premium



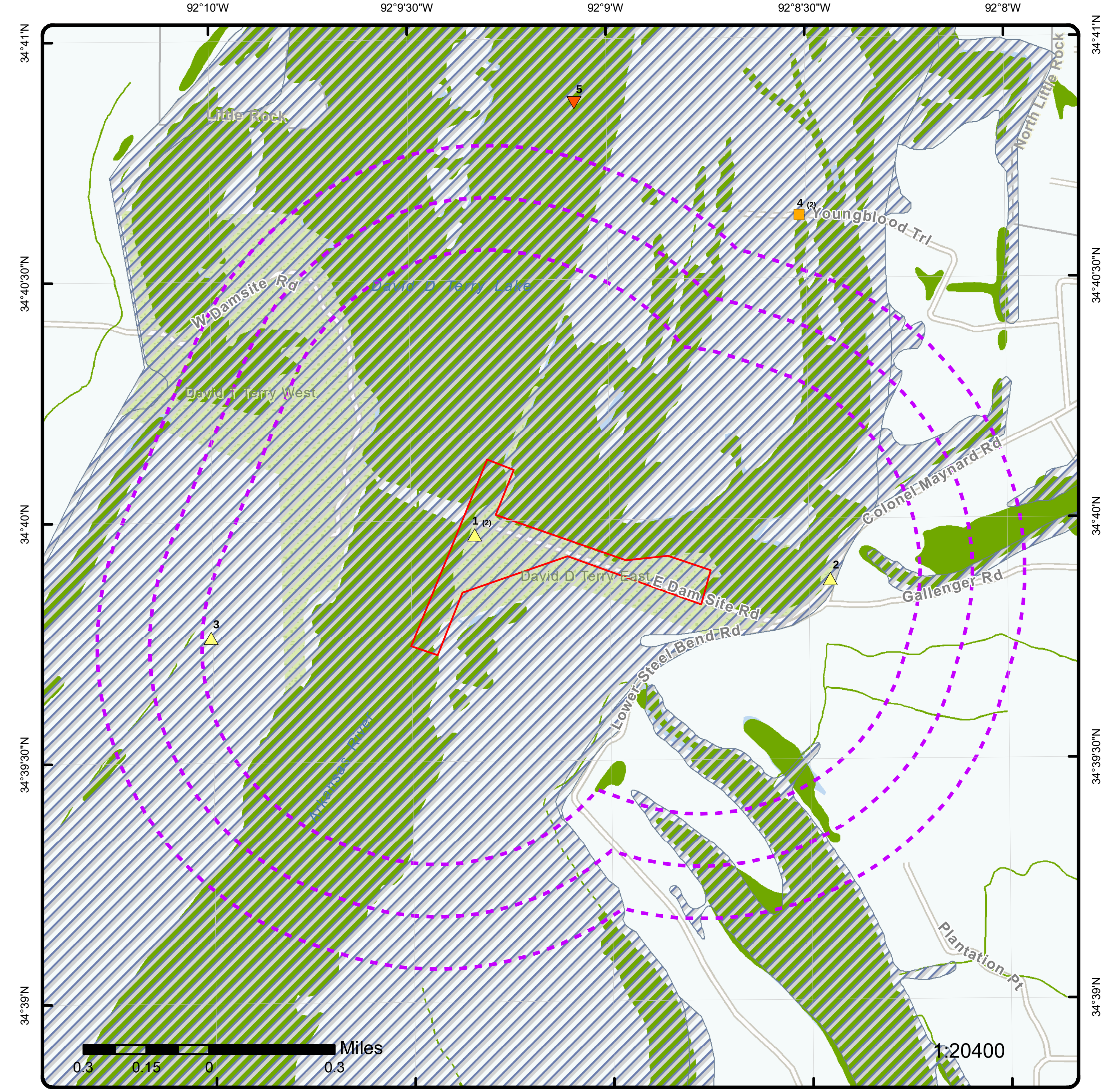
Map: 1.0 Mile Radius

Order Number: 23031500632

Address: David D Terry Lock and Dam, Little Rock, AR

Project Property
Buffer Outline
Sites with Higher Elevation
Sites with Same Elevation
Sites with Lower Elevation
Sites with Unknown Elevation
Areas with Higher Elevation
Areas with Same Elevation
Areas with Lower Elevation
Areas with Unknown Elevation
Freeways; Highways
Traffic Circle; Ramp
Major & Minor Arterial
Traffic Circle; Ramp
Local Road
Rail
State
Country
National Wetland
Indian Reserve Land
Plume
100 Year Flood Zone
500 Year Flood Zone
FWS Special Designation Areas
National Priorities List (Active, Delisted, Proposed, Institutional Control)

Source: © 2021 ESRI StreetMap Premium



Map: 0.75 Mile Radius

Order Number: 23031500632

Address: David D Terry Lock and Dam, Little Rock, AR

ERIS

Project Property
Buffer Outline

- Sites with Higher Elevation
- Sites with Same Elevation
- Sites with Lower Elevation
- Sites with Unknown Elevation
- Areas with Higher Elevation
- Areas with Same Elevation
- Areas with Lower Elevation
- Areas with Unknown Elevation
- Freeways; Highways
- Traffic Circle; Ramp
- Major & Minor Arterial
- Traffic Circle; Ramp
- Local Road
- Rail
- State
- Country
- National Wetland
- Indian Reserve Land
- Plume
- 100 Year Flood Zone
- 500 Year Flood Zone
- FWS Special Designation Areas
- National Priorities List (Active, Delisted, Proposed, Institutional Control)

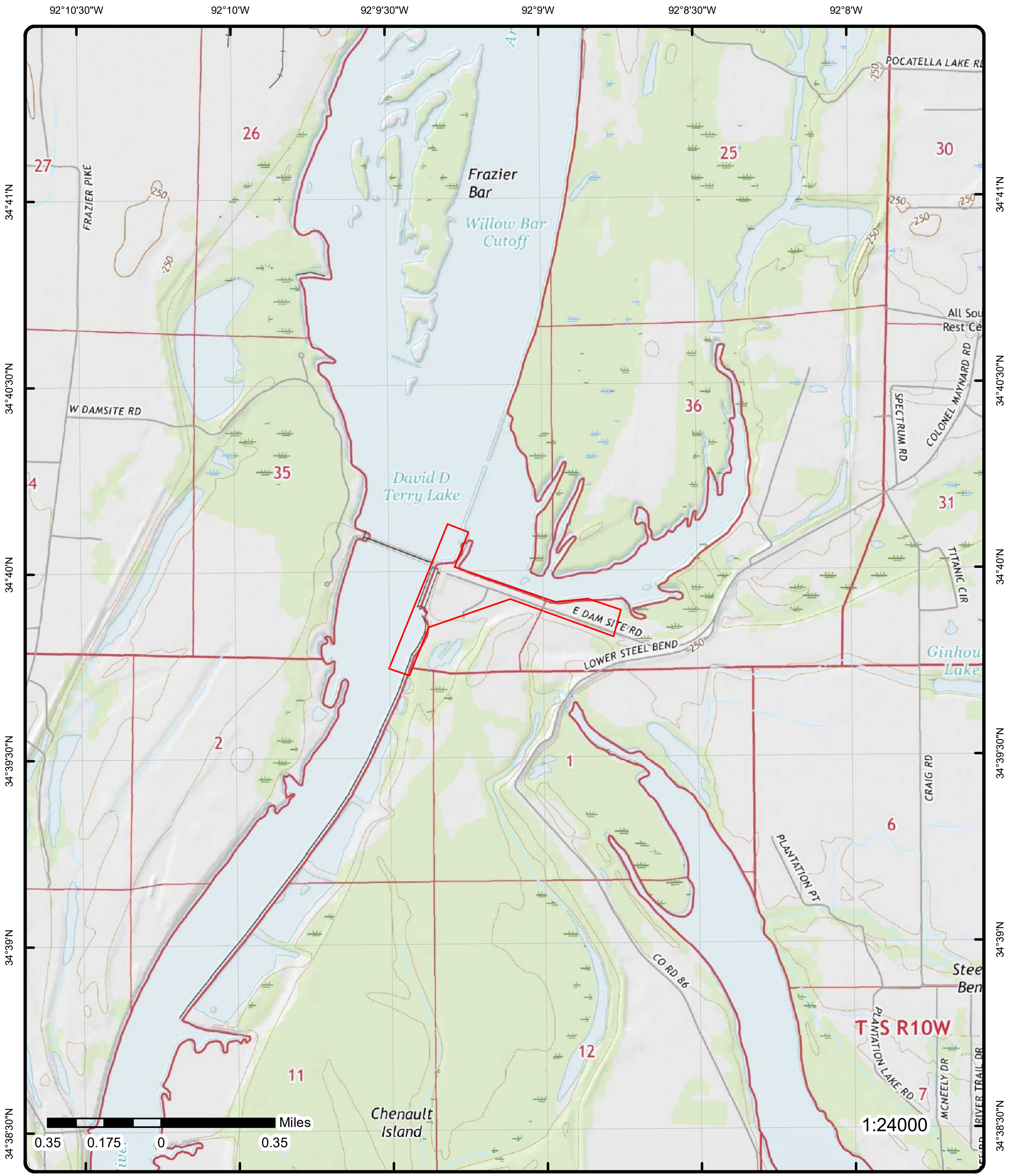
Source: © 2021 ESRI StreetMap Premium

Aerial **Year: 2022**

Order Number: 23031500632

Address: David D Terry Lock and Dam, Little Rock, AR

Source: ESRI World Imagery



Topographic Map

Year: 2017

Order Number: 23031500632

Address: David D Terry Lock and Dam, AR

Quadrangle(s): Keo, AR; Woodson, AR; Sweet Home, AR; Scott, AR

Source: USGS Topographic Map

Detail Report

Map Key	Number of Records	Direction	Distance (mi/ft)	Elev/Diff (ft)	Site	DB
1	1 of 2	WNW	0.00 / 0.00	239.32 / 4	DAVID D. TERRY LOCK & DAM 10100 E DAM SITE RD SCOTT AR 72142	FINDS/FRS

Registry ID:	110025054624
FIPS Code:	05119
HUC Code:	11110207
Site Type Name:	FACILITY
Location Description:	NEW RST; RST CONVERSION PROJECT 05/15/2005
Supplemental Location:	
Create Date:	25-JUL-06
Update Date:	30-OCT-14
Interest Types:	STATE MASTER
SIC Codes:	
SIC Code Descriptions:	
NAICS Codes:	
NAICS Code Descriptions:	
Conveyor:	FRS-GEOCODE
Federal Facility Code:	Yes
Federal Agency Name:	
Tribal Land Code:	
Tribal Land Name:	
Congressional Dist No:	02
Census Block Code:	051190039002116
EPA Region Code:	06
County Name:	PULASKI
US/Mexico Border Ind:	
Latitude:	34.66617
Longitude:	-92.15567
Reference Point:	CENTER OF A FACILITY OR STATION
Coord Collection Method:	ADDRESS MATCHING-HOUSE NUMBER
Accuracy Value:	30
Datum:	NAD83
Source:	
Facility Detail Rprt URL:	https://ofmpub.epa.gov/frs_public2/fii_query_detail.disp_program_facility?p_registry_id=110025054624
Data Source:	Facility Registry Service - Single File
Program Acronyms:	

PDS:6002743

Map Key	Number of Records	Direction	Distance (mi/ft)	Elev/Diff (ft)	Site	DB
1	2 of 2	WNW	0.00 / 0.00	239.32 / 4	DAVID D. TERRY LOCK & DAM 10100 E. DAM SITE RD SCOTT AR 72142	AST

Facility ID:	60001832	**Date Signed:**	4/28/2003
Afin Dash:	60-02743	**Entry Clerk:**	PEEK
Active Site:		**Entry Date:**	1/24/1995
UST/AST Tem.Out:		**Update Clerk:**	MARSH
UST Temp. Out:		**Update Date:**	5/5/2003
AST Temp. Out:		**No Bill:**	
UST Perm. Out:		**Date Reg Crt R:**	5/28/1998
AST Perm. Out:	X	**Date Received:**	5/1/2003
AST in Use:		**County No:**	60
UST in Use:		**County:**	PULASKI
Fed:		**Loc SIC:**	
LUST:		**Latitude:**	

Leak ID:		**Longitude:**	
Inspec Pictures:		**Owner ID:**	006666
Inspection Rpts:		**Owner Name:**	US ARMY CORPS OF ENGINEERS
Date Notice Rcvd:	6/4/2014	**Owner Addr 1:**	PO BOX 7835
Inactive:	No	**Owner Addr 2:**	
Inactive By:		**Owner City:**	PINE BLUFF
Inactive Date:		**Owner State:**	AR
CERT Name:	KENNETH E. BUCK	**Owner ZIP:**	71611-7835
CERT Title:	RESIDENT ENGINR	**Owner Country:**	
Amended:	No	**Owner County:**	JEFFERSON
ABG:	X	**Owner Phone:**	5013401297
BLG:		**Owner Type:**	4
Rec Created By:	PEEK	**Owner Type Desc:**	Federal Government
Rec Modified By:	SCHENK	**Contact Name:**	NOT LISTED
Rec Created Date:	1/24/1995	**Contact Title:**	NOT LISTED
Rec Modified Date:	6/6/2014	**Contact Phone:**	5015340451
Comment:			

Tank Information

Tank No:	1	**Inactive?:**	No
GIS Loc ID:		**Inactive By:**	
Capacity:	5000	**Inactive Date:**	
No of Compt.:	1	**Install Date:**	01-Jan-1974
Tank Status Typ Cd:	PO	**Entry Clerk:**	PEEK
Tank Status:	Permanently Out Of Use	**Update Clerk:**	MARSH
Tank Status Date:		**Last Used Date:**	
Tank Comment:		**Entry Date:**	24-Jan-1995
Removed?:		**Update Date:**	05-May-2003
Gallons Remaining:		**Rec Created By:**	STAIR
Tank Mtl Steel:	TRUE	**Rec Created Date:**	5/15/2005 11:21:14 AM
Tank Mtl Concrete:	FALSE	**Rec Modified By:**	
Tank Mtl Plastic:	FALSE	**Rec Modified Date:**	
Tank Mtl Unk.:	FALSE	**Tank Mtl Other:**	

Int Corrosion Prot Cathodic:	FALSE
Int Corrosion Prot Lining:	FALSE
Int Corrosion Prot None:	FALSE
Int Corrosion Prot Unknown:	TRUE
Int Corrosion Prot Other:	
Ext Corrosion Prot Cathodic:	FALSE
Ext Corrosion Prot Painted:	TRUE
Ext Corrosion Prot Plastic:	FALSE
Ext Corrosion Prot None:	FALSE
Ext Corrosion Prot Unknown:	FALSE
Ext Corrosion Prot Other:	
Piping Info Bare Steel:	FALSE
Piping Info Galvanized Steel:	TRUE
Piping Info Plastic:	FALSE
Piping Info Cathodic:	FALSE
Piping Info Unknown:	FALSE
Piping Info Other:	
Substance Stored Empty:	FALSE
Substance Stored Diesel:	TRUE
Substance Stored Kerosene:	FALSE
Substance Stored Gasoline:	FALSE
Substance Stored Used Oil:	FALSE
Substance Stored Other:	
Substance Stored Hazardous:	FALSE
Substance Stored Mixture:	
Substance Stored Unknown:	FALSE

Invoice Information

Invoice No:	ABT014627	**Late Fees Billed:**	.00
Invoice Date Billed:	1999/05/14	**Recent Payment Dt:**	07/09/1999
Invoice Due Date:	1999/06/30	**Recent Check No:**	417936
Invoice Status:		**Recent Amount Paid:**	50.00

No of Tanks Billed:	1	***Total Paid for Invoice:***	50.00
Tank Fees Billed:	50.00		
Owner Name:	U.S. ARMY CORPS OF ENGINEERS		

Invoice No:	ABT023852	***Late Fees Billed:***	.00
Invoice Date Billed:	2002/05/17	***Recent Payment Dt:***	05/28/2002
Invoice Due Date:	2002/06/30	***Recent Check No:***	1179
Invoice Status:		***Recent Amount Paid:***	50.00
No of Tanks Billed:	1	***Total Paid for Invoice:***	50.00
Tank Fees Billed:	50.00		
Owner Name:	U.S. ARMY CORPS OF ENGINEERS		

Invoice No:	ABT006239	***Late Fees Billed:***	.00
Invoice Date Billed:	1995/01/27	***Recent Payment Dt:***	03/13/1995
Invoice Due Date:	1995/03/13	***Recent Check No:***	997817
Invoice Status:		***Recent Amount Paid:***	50.00
No of Tanks Billed:	1	***Total Paid for Invoice:***	50.00
Tank Fees Billed:	50.00		
Owner Name:	U.S. ARMY CORPS OF ENGINEERS		

Invoice No:	ABT007637	***Late Fees Billed:***	.00
Invoice Date Billed:	1995/06/01	***Recent Payment Dt:***	07/12/1995
Invoice Due Date:	1995/07/16	***Recent Check No:***	1008856
Invoice Status:		***Recent Amount Paid:***	50.00
No of Tanks Billed:	1	***Total Paid for Invoice:***	50.00
Tank Fees Billed:	50.00		
Owner Name:	U.S. ARMY CORPS OF ENGINEERS		

Invoice No:	ABT018340	***Late Fees Billed:***	.00
Invoice Date Billed:	2000/05/19	***Recent Payment Dt:***	06/16/2000
Invoice Due Date:	2000/06/30	***Recent Check No:***	1078
Invoice Status:		***Recent Amount Paid:***	50.00
No of Tanks Billed:	1	***Total Paid for Invoice:***	50.00
Tank Fees Billed:	50.00		
Owner Name:	U.S. ARMY CORPS OF ENGINEERS		

Invoice No:	ABT009239	***Late Fees Billed:***	.00
Invoice Date Billed:	1996/05/17	***Recent Payment Dt:***	11/05/1996
Invoice Due Date:	1996/06/30	***Recent Check No:***	1046230
Invoice Status:		***Recent Amount Paid:***	50.00
No of Tanks Billed:	1	***Total Paid for Invoice:***	50.00
Tank Fees Billed:	50.00		
Owner Name:	U.S. ARMY CORPS OF ENGINEERS		

Invoice No:	ABT010909	***Late Fees Billed:***	.00
Invoice Date Billed:	1997/05/16	***Recent Payment Dt:***	07/14/1997
Invoice Due Date:	1997/06/30	***Recent Check No:***	20986
Invoice Status:		***Recent Amount Paid:***	50.00
No of Tanks Billed:	1	***Total Paid for Invoice:***	50.00
Tank Fees Billed:	50.00		
Owner Name:	U.S. ARMY CORPS OF ENGINEERS		

Invoice No:	ABT012651	***Late Fees Billed:***	.00
Invoice Date Billed:	1998/05/15	***Recent Payment Dt:***	06/29/1998
Invoice Due Date:	1998/06/30	***Recent Check No:***	161989
Invoice Status:		***Recent Amount Paid:***	50.00
No of Tanks Billed:	1	***Total Paid for Invoice:***	50.00
Tank Fees Billed:	50.00		
Owner Name:	U.S. ARMY CORPS OF ENGINEERS		

Invoice No:	ABT016707	***Late Fees Billed:***	.00
Invoice Date Billed:	2000/05/19	***Recent Payment Dt:***	
Invoice Due Date:	2000/06/30	***Recent Check No:***	
Invoice Status:	Void	***Recent Amount Paid:***	0.00
No of Tanks Billed:	0	***Total Paid for Invoice:***	.00
Tank Fees Billed:	.00		
Owner Name:	U.S. ARMY CORPS OF ENGINEERS		

Invoice No:	ABT020240	***Late Fees Billed:***	.00

Map Key	Number of Records	Direction	Distance (mi/ft)	Elev/Diff (ft)	Site	DB

Invoice Date Billed: 2001/04/12
Invoice Due Date: 2001/05/27
Invoice Status: Void
No of Tanks Billed: 0
Tank Fees Billed: .00
Owner Name: U.S. ARMY CORPS OF ENGINEERS
Recent Payment Dt:
Recent Check No:
Recent Amount Paid: 0.00
Total Paid for Invoice: .00

Invoice No: ABT021919
Invoice Date Billed: 2001/05/18
Invoice Due Date: 2001/07/01
Invoice Status:
No of Tanks Billed: 1
Tank Fees Billed: 50.00
Owner Name: U.S. ARMY CORPS OF ENGINEERS
Late Fees Billed: .00
Recent Payment Dt: 06/19/2001
Recent Check No: 1071
Recent Amount Paid: 50.00
Total Paid for Invoice: 50.00

Map Key	Number of Records	Direction	Distance (mi/ft)	Elev/Diff (ft)	Site	DB
2	1 of 1	E	0.29 / 1,513.88	251.98 / 17	10100 East Dam Site Scott AR 72142	ASBESTOS

NOI No: ASB-NOI10050
NOI Status: Accepted
NOI Type: Renovation
Start Date: 2/25/2017
End Date: 2/25/2017
Contractor: ENVIRONMENTAL PROTECTION ASSOCIATES (EPA)
Structure Room:

Map Key	Number of Records	Direction	Distance (mi/ft)	Elev/Diff (ft)	Site	DB
3	1 of 1	W	0.48 / 2,525.65	236.02 / 1	MCGEORGE CONTRACTING CO, INC .5M SW OF DAVID D TERRY DAM LITTLE ROCK AR 72201	FINDS/FRS

Registry ID: 110042200105
FIPS Code: 05119
HUC Code: 11110207
Site Type Name: FACILITY
Location Description: NEW MINING 8/17/10
Supplemental Location: OFF FRAZIER PIKE
Create Date: 07-OCT-10
Update Date:
Interest Types: STATE MASTER
SIC Codes:
SIC Code Descriptions:
NAICS Codes:
NAICS Code Descriptions:
Conveyor: PDS
Federal Facility Code:
Federal Agency Name:
Tribal Land Code:
Tribal Land Name:
Congressional Dist No: 02
Census Block Code: 051190040071086
EPA Region Code: 06
County Name: PULASKI
US/Mexico Border Ind:
Latitude: 34.662672
Longitude: -92.166787
Reference Point:
Coord Collection Method: INTERPOLATION-MAP
Accuracy Value:
Datum: NAD83
Source:
Facility Detail Rprt URL: https://ofmpub.epa.gov/frs_public2/fii_query_detail.disp_program_facility?p_registry_id=110042200105
Data Source: Facility Registry Service - Single File
Program Acronyms:

PDS:6004410

Map Key	Number of Records	Direction	Distance (mi/ft)	Elev/Diff (ft)	Site	DB
4	1 of 2	NE	0.87 / 4,603.40	234.75 / 0	Grant Youngblood 12000 Youngblood Trail Scott AR 72142	SWID

Complaint No: 002761
PDS Complaint ID: 002761
Web Ready Code: F
AFIN: 6000000
No of Site Visits: 1
Total Insp Score: 116
Complaint Rcvd Dt: 10/13/2005
Complaint Valid: YES
Cmplnt Waste Size: 15
Cmplnt Waste Cont: 45
Cmplnt Site Assess: 56
Cmplnt 1st Ltr Dt: 10/17/2005
Cmplnt 2nd Ltr Dt:
Cmplnt 3rd Ltr Dt:
Complainant Nm: ANONYMOUS
Complainant Addr 2:
Complainant Addr 3:
Cmplnt Site County: Pulaski
Complainant City:
Complainant State:
Complainant Zip:
Rec Inspector Name: Burks, Kenneth
Complaint Final Disposition:
Complaint Location Comment: I - 30 to I - 440 past Airport; England Hwy. exit onto Hwy. 165, go east 3 ½ miles to Colonel Maynard Rd. (David D. Terry Lock & Dam) go 2 ½ to 3 miles turn right Spectrum Road and go 2 - 3 city blocks, turn left on Youngblood Road, go a little way and cross Arkansas River levee, go straight and you should see burn areas.

Map Key	Number of Records	Direction	Distance (mi/ft)	Elev/Diff (ft)	Site	DB
4	2 of 2	NE	0.87 / 4,603.40	234.75 / 0	Grant Youngblood 12000 Youngblood Trail Scott AR 72142	SWID

Complaint No: 008787
PDS Complaint ID: 008787
Web Ready Code: F
AFIN: 6000000
No of Site Visits: 1
Total Insp Score: 22
Complaint Rcvd Dt: 5/1/2009
Complaint Valid: YES
Cmplnt Waste Size: 4
Cmplnt Waste Cont: 3
Cmplnt Site Assess: 15
Cmplnt 1st Ltr Dt: 5/5/2009
Cmplnt 2nd Ltr Dt:
Cmplnt 3rd Ltr Dt:
Complainant Nm: ANONYMOUS
Complainant Addr 2:
Complainant Addr 3:
Cmplnt Site County: Pulaski
Complainant City:
Complainant State:
Complainant Zip:
Rec Inspector Name: Burks, Kenneth
Complaint Final Disposition: Response received
Complaint Location Comment: Go East on England Hwy off of I-440. After you pass the Shell station, go about 1-1/2 miles and turn Right toward river. After you pass some grain bins, it will be the 2nd road on your Right - leads to property where waste is being dumped - complainant states that you shouldn't have any problem seeing it.

Map Key	Number of Records	Direction	Distance (mi/ft)	Elev/Diff (ft)	Site	DB
5	1 of 1	N	0.88 / 4,626.25	220.97 / -14	AR	PFAS WATER

Organization Identifier: USGS-AR
Organization Formal Name: USGS Arkansas Water Science Center
Monitoring Location Identifier: USGS-07263620
Monitoring Location Name: AR River@David D Terry L&D below Little Rock, AR
Monitoring Loc Type Name: Stream
Monitoring Location Desc:
Well Depth Measure Value:
Well Depth Measure Unit Code:
Well Hole Dpth Meas Value:
Well Hole Dpth Meas Unit Cd:
HUC Eight Digit Code: 11110207
Drainage Area Measure Value: 158429
Drain Area Measure Unit Code: sq mi
Contrib Drain Area Meas Value: 136188
Contrib Drain Area Meas Unit: sq mi
Source Map Scale Numeric:
Hor Accuracy Measure Value: 10

Hor Accuracy Meas Unit Code:	seconds
Hor Collection Method Name:	Mapping grade GPS unit (handheld accuracy range 12 to 40 ft)
Hor Crd Ref Sys Datum Name:	NAD83
Vertical Measure Value:	
Vertical Measure Unit Code:	
Vert Accuracy Measure Value:	
Vert Accuracy Meas Unit Code:	
Vert Collection Method Name:	
Vert Crd Ref Sys Datum Name:	
Aquifer Name:	
Formation Type Text:	
Aquifer Type Name:	
Construction Date Text:	
Provider Name:	NWIS
Country Code:	US
State Code:	05
State:	AR
County Code:	119
Latitude:	34.68111110000000
Longitude:	-92.1513889000000

Sample Results

Organization Identifier:	USGS-AR
Organization Formal Name:	USGS Arkansas Water Science Center
Characteristic Name:	Flubendiamide
Detect Quantitation Limit Type:	
Detect Quantitation Limit Meas:	
Detect Quantitation Limit Unit:	
Result Detect Condition:	
Result Sample Fraction Text:	Dissolved
Result Measure Value:	2.71
Result Measure Unit Code:	ng/l
Measure Qualifier Code:	
Result Status Identifier:	Accepted
Statistical Base Code:	
Result Value Type Name:	Actual
Result Weight Basis Text:	
Result Time Basis Text:	
Result Temperature Basis Text:	
Result Particle Size Basis Txt:	
Precision Value:	
Result Comment:	
Activity Identifier:	nwisar.01.01700002
Activity Type Code:	Sample-Routine
Activity Media Name:	Water
Activity Media Subdiv Name:	Surface Water
Activity Start Date:	2016-10-13
Activity Start Time:	09:30:00
Activity Start Time Time Zone:	CDT
Activity End Date:	
Activity End Time:	
Activity End Time Time Zone:	
Act Depth Hght Meas Value:	
Act Depth Hght Meas Unit:	
Act Dpth Altitude Ref Point:	
Act Top Dpth Hght Meas Value:	
Activ Top Dpth Hght Meas Unit:	
Activity Bttm Dpth Meas Value:	
Activity Bttm Dpth Meas Unit:	
Project Identifier:	
Activity Conducting Org:	U.S. Geological Survey-Water Resources Discipline
Activity Comment Text:	
Sample Aquifer:	
Hydrologic Condition:	Stable, normal stage
Hydrologic Event:	Routine sample
Sample Collec Meth Identifier:	40.00
Sample Collect Meth Context:	USGS parameter code 82398

Sample Collect Method Name:	Multiple verticals
Sample Collect Equip Name:	Weighted-bottle sampler
USGSP Code:	68606
Result Depth Measure Value:	
Result Dpth Meas Unit Code:	
Result Dpth Altitude Ref Point:	
Subject Taxonomic Name:	
Sample Tissue Anatomy Name:	
Result Analytical Methd ID:	LCM60
Result Analytical Meth Context:	USGS
Result Analytical Meth Name:	Pesticides, wf, dir inj LC/MS/MS
Method Description:	USGS TMR 5-B11
Laboratory Name:	USGS-National Water Quality Lab, Denver, CO
Analysis Start Date:	
Result Laboratory Comment:	
Preparation Start Date:	
Provider Name:	NWIS

Sample Results

Organization Identifier:	USGS-AR
Organization Formal Name:	USGS Arkansas Water Science Center
Characteristic Name:	Flubendiamide
Detect Quantitation Limit Type:	
Detect Quantitation Limit Meas:	
Detect Quantitation Limit Unit:	
Result Detect Condition:	
Result Sample Fraction Text:	Dissolved
Result Measure Value:	0.93
Result Measure Unit Code:	ng/l
Measure Qualifier Code:	
Result Status Identifier:	Preliminary
Statistical Base Code:	
Result Value Type Name:	Actual
Result Weight Basis Text:	
Result Time Basis Text:	
Result Temperature Basis Text:	
Result Particle Size Basis Txt:	
Precision Value:	
Result Comment:	
Activity Identifier:	nwisar.01.01602186
Activity Type Code:	Sample-Routine
Activity Media Name:	Water
Activity Media Subdiv Name:	Surface Water
Activity Start Date:	2016-08-18
Activity Start Time:	10:00:00
Activity Start Time Time Zone:	CDT
Activity End Date:	
Activity End Time:	
Activity End Time Time Zone:	
Act Depth Hght Meas Value:	
Act Depth Hght Meas Unit:	
Act Dpth Altitude Ref Point:	
Act Top Dpth Hght Meas Value:	
Activ Top Dpth Hght Meas Unit:	
Activity Bttm Dpth Meas Value:	
Activity Bttm Dpth Meas Unit:	
Project Identifier:	
Activity Conducting Org:	U.S. Geological Survey-Water Resources Discipline
Activity Comment Text:	MM-48704A
Sample Aquifer:	
Hydrologic Condition:	Stable, normal stage
Hydrologic Event:	Routine sample
Sample Collec Meth Identifier:	40
Sample Collect Meth Context:	USGS parameter code 82398
Sample Collect Method Name:	Multiple verticals
Sample Collect Equip Name:	Weighted-bottle sampler
USGSP Code:	68606

Result Depth Measure Value:	
Result Dpth Meas Unit Code:	
Result Dpth Altitude Ref Point:	
Subject Taxonomic Name:	
Sample Tissue Anatomy Name:	
Result Analytical Methd ID:	LCM60
Result Analytical Meth Context:	USGS
Result Analytical Meth Name:	Pesticides, wf, dir inj LC/MS/MS
Method Description:	USGS TMR 5-B11
Laboratory Name:	USGS-National Water Quality Lab, Denver, CO
Analysis Start Date:	2016-08-30
Result Laboratory Comment:	value extrapolated at low endbelow the detection level
Preparation Start Date:	2016-08-25
Provider Name:	NWIS

Unplottable Summary

Total: 3 Unplottable sites

DB	Company Name/Site Name	Address	City	Zip	ERIS ID
HISTORIC SPILLS		ARKANSAS RIVER, MI. 109	LITTLE ROCK AR		819838241
SPILLS		Arkansas River MM126 ***Event No | Event Status:*** 130268 | Closed	Little Rock AR		819845047
SPILLS		River mile 125, Arkansas River ***Event No | Event Status:*** 110538 | Closed	Little Rock AR		819843666

Unplottable Report

Site:

ARKANSAS RIVER, MI. 109 LITTLE ROCK AR HISTORIC SPILLS

Case NO:	96-6269	***Duty Officer:***	MCDUFFEE, RICHARD
Case Status:		***C Discharger:***	X
NRC NO:	357416	***C Public:***	
NRC:	X	***C Local:***	
DOT NO:	UN1270	***C State:***	
Cas Number:	0	***C Federal:***	
Chris Code:	OMT	***D Private:***	X
Amount in Units:	15	***D Public:***	
Measureable Units:	G	***D Local:***	
Material Type:	OIL	***D State:***	
Unknown Material:		***D Federal:***	
Highway:		***Name of Spiller:***	MISSISSIPPI-ALABAMA TOWING
Airtrans:		***Spiller Street:***	P.O. BOX 1043
Railway:		***Spiller City:***	VICKSBURG
Vessel:	X	***Spiller County:***	WARREN
Fixed Fac:		***Spiller State:***	MS
Pipeline:		***Spiller Zip:***	39180
UST:		***Spiller Phone:***	601-636-2454
Unknown Source:		***Spill Date:***	8/19/1996
Vehicle ID:	UNKNOWN	***Spill Time:***	1100
Air:		***1st Material N:***	OILS,MISC:MOTOR
Land:		***2nd Material N:***	
Water:	X	***2nd Dot NO:***	
Ground Water:		***2nd Cas NO:***	
Within Facility:		***2nd Chris Code:***	
Waterway:	ARKANSAS RIVER	***2nd Amt in Units:***	0
Transport Accident:		***2nd Measur Units:***	
Equipment Failure:		***3rd Material Name:***	
Operator Error:	X	***3rd Dot NO:***	
Natural:		***3rd Cas Number:***	
Dumping:		***3rd Chris Code:***	
Unknown:		***3rd Amnt in Units:***	0
Other Cause:		***3rd Measur Units:***	
NO of Deaths:	0	***Comment 1:***	
NO of Injuries:	0	***Comment 2:***	
Damage Dollars:	No	***Additional Info:***	X
Evacuation:	No	***2nd Responder:***	ADPC&E
Notifi State Local:	X	***3rd Responder:***	NATIONAL RESPONSE CENTER
Notifi Discharger:		***Fourth Responder:***	
Notified USCG:	X	***1st Resp Agency:***	State
Notified Other:		***2nd Resp Agency:***	Federal
Notified Unknown:		***3rd Resp Agency:***	
Report Date:	8/19/1996	***4th Responder:***	
Time Reported:	1230	***Comments:***	
Caller:	SMITH, JAMES		

SPL Occured County: PULASKI
Spill Information: BARGE TRANSFERRING BILGE MATERIAL TO SLOP TANK, SPILLED 15 GAL. TO RIVER
Primary Responder Name: ADPC&E, NRC
Response Action: RELEASE STOPPED AND SORBENTS APPLIED
Info on Cause of SPL: SPILLED BILGE MATERIAL WHILE TRANSFERRING TO SLOP TANK

Site:

Arkansas River MM126 Little Rock AR SPILLS

Event No:	130268	***Suspected RP Name:***	Kimberly Jane #539140
Action Case ID:		***Suspect RP Addr 2:***	

Facility Name:	UNKNOWN (PULASKI COUNTY)	***Suspect RP Addr 3:***	
Facility Site City:		***Suspect RP City:***	
Facility County:	Pulaski	***Suspect RP State:***	
Event NRC No 1:	1043942	***Suspect RP Zip:***	
Event NRC No 2:		***Suspect RP Phone:***	
Event AFIN Dash:	60-00000	***Suspect RP Ph Ext:***	
Event Reported Dt:	14-Apr-2013	***Suspect RP Fax:***	
Event Report Time:	09:59 PM	***Suspect RP Rpt Due:***	
Event Date:	14-Apr-2013	***Susp RP Rpt Rcvd:***	
Event Time:	09:00 PM	***Cleanup by:***	
Event Status:	Closed	***Cleanup Completed:***	
Event Type:	Transport	***Cleanup Contr Name:***	Not Provided
Event Report Cause:		***Contractor Addr2:***	
Event Priority:		***Contractor Addr3:***	
Event Category:	Petroleum	***Contractor City:***	
Event Catego Other:		***Contractor State:***	
Event Closure Reco:		***Contractor Zip:***	
Event Loc Cnty Cd:	60	***Contractor Ph:***	
Event Loc County:	Pulaski	***Contractor Ext:***	
Event Loc State:	AR	***Contractor Fax:***	
Evacuated No:		***Medium Affect Air:***	
Evac from Release:		***Med Affected HW:***	
Fatalities:		***Med Affect Mining:***	
Injuries:		***Med Affected RST:***	
No. Related Injury:		***Med Affected SW:***	
No. Related Fatal:		***Med Affected Water:***	
No. Unrelate Inj.:		***Insp Supervisor Nm:***	
No. Unrelated Fata:		***Insp Rpt Staff Nm:***	
ADEQ Rpt Date Due:		***Insp Air Staff Nm:***	
ADEQ Rpt Date Rcvd:		***Insp HW Staff Name:***	
Rptr Rqst ADEQ Rsp:		***Insp Mine Staff Nm:***	
Prim Media Divis:		***Insp RST Staff Nm:***	
Reporter Name:	Kirby Inland Marine	***Insp SW Staff Name:***	
Reporter Phone No:	7134351301	***Insp Wtr Staff Nm:***	
Reporter Phone Ext:		***Latitude:***	
Time Sheet Code:		***Longitude:***	
Suspected RP AFIN:	6000000		

Landfill or Water Body Name:
Contractor Email:
Suspect RP Email:
Responders Comment:
Event Location Comment:
Event Narrative:

Discharge from a vessel due to unknown causes. ADEM: #12822; Responsible Party Contact Information: Not Provided; Status: No ER Action; AFIN: 60-00000;

Event Materials

Matl No:	1
Matl Name:	Oil, Crude
Matl CERCLA:	
Matl Qty Reported:	30.00
Matl Qty Reported Un:	Gallons
Matl Qty Reported 2:	30.00 Gallons
Matl Qty Actual:	10.00
Matl Qty Actual Unit:	Gallons
Matl Qty Actual 2:	10.00 Gallons
Matl Qty Recovered:	
Matl Qty Recover Un:	
Matl Qty Recovered 2:	
Matl Qty in Water:	
Matl Qty in Water Un:	
Matl Qty in Water 2:	
Matl Source:	
Matl Comment:	

Site:

SPILLS

River mile 125, Arkansas River   Little Rock AR

Event No:	110538	***Suspected RP Name:***	Unknown
Action Case ID:		***Suspect RP Addr 2:***	
Facility Name:	UNKNOWN (PULASKI COUNTY)	***Suspect RP Addr 3:***	
Facility Site City:		***Suspect RP City:***	
Facility County:	Pulaski	***Suspect RP State:***	
Event NRC No 1:	981622	***Suspect RP Zip:***	
Event NRC No 2:		***Suspect RP Phone:***	
Event AFIN Dash:	60-00000	***Suspect RP Ph Ext:***	
Event Reported Dt:	03-Jul-2011	***Suspect RP Fax:***	
Event Report Time:		***Suspect RP Rpt Due:***	
Event Date:	03-Jul-2011	***Susp RP Rpt Rcvd:***	
Event Time:		***Cleanup by:***	
Event Status:	Closed	***Cleanup Completed:***	
Event Type:	Transport	***Cleanup Contr Name:***	None
Event Report Cause:		***Contractor Addr2:***	
Event Priority:		***Contractor Addr3:***	
Event Category:	Petroleum	***Contractor City:***	
Event Catego Other:		***Contractor State:***	
Event Closure Reco:		***Contractor Zip:***	
Event Loc Cnty Cd:	60	***Contractor Ph:***	
Event Loc County:	Pulaski	***Contractor Ext:***	
Event Loc State:	AR	***Contractor Fax:***	
Evacuated No:		***Medium Affect Air:***	
Evac from Release:		***Med Affected HW:***	
Fatalities:		***Med Affect Mining:***	
Injuries:		***Med Affected RST:***	
No. Related Injury:		***Med Affected SW:***	
No. Related Fatal:		***Med Affected Water:***	
No. Unrelate Inj.:		***Insp Supervisor Nm:***	
No. Unrelated Fata:		***Insp Rpt Staff Nm:***	
ADEQ Rpt Date Due:		***Insp Air Staff Nm:***	
ADEQ Rpt Date Rcvd:		***Insp HW Staff Name:***	
Rptr Rqst ADEQ Rsp:		***Insp Mine Staff Nm:***	
Prim Media Divis:		***Insp RST Staff Nm:***	
Reporter Name:	PCSO	***Insp SW Staff Name:***	
Reporter Phone No:		***Insp Wtr Staff Nm:***	
Reporter Phone Ext:		***Latitude:***	
Time Sheet Code:		***Longitude:***	
Suspected RP AFIN:	6000000		

Landfill or Water Body Name:
Contractor Email:
Suspect RP Email:
Responders Comment: Emailed Water - Johnson
Event Location Comment:
Event Narrative:

Report that two inebriated individuals struck a rock jetty in the Arkansas River. Both individuals ejected from vessel that lodged on the jetty, discharging gas into the river. Both injured, transported to hosp.; Reported Time: 2356; Event Time: 2341; Released Material: Gasoline; Amount Reported: Unk; Unit: G; Actual Amount: Unk; AFIN: None;

Appendix: Database Descriptions

Environmental Risk Information Services (ERIS) can search the following databases. The extent of historical information varies with each database and current information is determined by what is publicly available to ERIS at the time of update. ERIS updates databases as set out in ASTM Standard E1527-13 and E1527-21, Section 8.1.8 Sources of Standard Source Information:

"Government information from nongovernmental sources may be considered current if the source updates the information at least every 90 days, or, for information that is updated less frequently than quarterly by the government agency, within 90 days of the date the government agency makes the information available to the public."

Standard Environmental Record Sources

Federal

Formerly Utilized Sites Remedial Action Program: DOE FUSRAP

The U.S. Department of Energy (DOE) established the Formerly Utilized Sites Remedial Action Program (FUSRAP) in 1974 to remediate sites where radioactive contamination remained from the Manhattan Project and early U.S. Atomic Energy Commission (AEC) operations. The DOE Office of Legacy Management (LM) established long-term surveillance and maintenance (LTS&M) requirements for remediated FUSRAP sites. DOE evaluates the final site conditions of a remediated site on the basis of risk for different future uses. DOE then confirms that LTS&M requirements will maintain protectiveness.

Government Publication Date: Mar 4, 2017

National Priority List: NPL

Sites on the United States Environmental Protection Agency (EPA)'s National Priorities List of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial action under the Superfund program. The NPL, which EPA is required to update at least once a year, is based primarily on the score a site receives from EPA's Hazard Ranking System. A site must be on the NPL to receive money from the Superfund Trust Fund for remedial action. Sites are represented by boundaries where available in the EPA Superfund Site Boundaries maintained by the Shared Enterprise Geodata and Services (SEGS). Site boundaries represent the footprint of a whole site, the sum of all of the Operable Units and the current understanding of the full extent of contamination; for Federal Facility sites, the total site polygon may be the Facility boundary. Where there is no polygon boundary data available for a given site, the site is represented as a point.

Government Publication Date: Nov 3, 2022

National Priority List - Proposed: PROPOSED NPL

Sites proposed by the United States Environmental Protection Agency (EPA), the state agency, or concerned citizens for addition to the National Priorities List (NPL) due to contamination by hazardous waste and identified by the EPA as a candidate for cleanup because it poses a risk to human health and/or the environment. Sites are represented by boundaries where available in the EPA Superfund Site Boundaries maintained by the Shared Enterprise Geodata and Services (SEGS). Site boundaries represent the footprint of a whole site, the sum of all of the Operable Units and the current understanding of the full extent of contamination; for Federal Facility sites, the total site polygon may be the Facility boundary. Where there is no polygon boundary data available for a given site, the site is represented as a point.

Government Publication Date: Nov 3, 2022

Deleted NPL: DELETED NPL

Sites deleted from the United States Environmental Protection Agency (EPA)'s National Priorities List. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate. Sites are represented by boundaries where available in the EPA Superfund Site Boundaries maintained by the Shared Enterprise Geodata and Services (SEGS). Site boundaries represent the footprint of a whole site, the sum of all of the Operable Units and the current understanding of the full extent of contamination; for Federal Facility sites, the total site polygon may be the Facility boundary. Where there is no polygon boundary data available for a given site, the site is represented as a point.

Government Publication Date: Nov 3, 2022

SEMS List 8R Active Site Inventory: SEMS

The U.S. Environmental Protection Agency's (EPA) Superfund Program has deployed the Superfund Enterprise Management System (SEMS), which integrates multiple legacy systems into a comprehensive tracking and reporting tool. This inventory contains active sites evaluated by the Superfund program that are either proposed to be or are on the National Priorities List (NPL) as well as sites that are in the screening and assessment phase for possible inclusion on the NPL. The Active Site Inventory Report displays site and location information at active SEMS sites. An active site is one at which site assessment, removal, remedial, enforcement, cost recovery, or oversight activities are being planned or conducted. This data includes SEMS sites from the List 8R Active file as well as applicable sites from the SEMS GIS/REST file layer obtained from EPA's Facility Registry Service.

Government Publication Date: Jan 25, 2023

SEMS List 8R Archive Sites: SEMS ARCHIVE

The U.S. Environmental Protection Agency's (EPA) Superfund Enterprise Management System (SEMS) Archived Site Inventory displays site and location information at sites archived from SEMS. An archived site is one at which EPA has determined that assessment has been completed and no further remedial action is planned under the Superfund program at this time. This data includes sites from the List 8R Archived site file.

Government Publication Date: Jan 25, 2023

Inventory of Open Dumps, June 1985: ODI

The Resource Conservation and Recovery Act (RCRA) provides for publication of an inventory of open dumps. The Act defines "open dumps" as facilities which do not comply with EPA's "Criteria for Classification of Solid Waste Disposal Facilities and Practices" (40 CFR 257).

Government Publication Date: Jun 1985

Comprehensive Environmental Response, Compensation and Liability Information System - CERCLIS: CERCLIS

Superfund is a program administered by the United States Environmental Protection Agency (EPA) to locate, investigate, and clean up the worst hazardous waste sites throughout the United States. CERCLIS is a database of potential and confirmed hazardous waste sites at which the EPA Superfund program has some involvement. It contains sites that are either proposed to be or are on the National Priorities List (NPL) as well as sites that are in the screening and assessment phase for possible inclusion on the NPL. The EPA administers the Superfund program in cooperation with individual states and tribal governments; this database is made available by the EPA.

Government Publication Date: Oct 25, 2013

EPA Report on the Status of Open Dumps on Indian Lands: IODI

Public Law 103-399, The Indian Lands Open Dump Cleanup Act of 1994, enacted October 22, 1994, identified congressional concerns that solid waste open dump sites located on American Indian or Alaska Native (AI/AN) lands threaten the health and safety of residents of those lands and contiguous areas. The purpose of the Act is to identify the location of open dumps on Indian lands, assess the relative health and environment hazards posed by those sites, and provide financial and technical assistance to Indian tribal governments to close such dumps in compliance with Federal standards and regulations or standards promulgated by Indian Tribal governments or Alaska Native entities.

Government Publication Date: Dec 31, 1998

CERCLIS - No Further Remedial Action Planned: CERCLIS NFRAP

An archived site is one at which EPA has determined that assessment has been completed and no further remedial action is planned under the Superfund program at this time. The Archive designation means that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the National Priorities List (NPL). This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.

Government Publication Date: Oct 25, 2013

CERCLIS Liens: CERCLIS LIENS

A Federal Superfund lien exists at any property where EPA has incurred Superfund costs to address contamination ("Superfund site") and has provided notice of liability to the property owner. A Federal CERCLA ("Superfund") lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. This database is made available by the United States Environmental Protection Agency (EPA). This database was provided by the United States Environmental Protection Agency (EPA). Refer to SEMS LIEN as the current data source for Superfund Liens.

Government Publication Date: Jan 30, 2014

RCRA CORRACTS-Corrective Action: RCRA CORRACTS

RCRA Info is the U.S. Environmental Protection Agency's (EPA) comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. At these sites, the Corrective Action Program ensures that cleanups occur. EPA and state regulators work with facilities and communities to design remedies based on the contamination, geology, and anticipated use unique to each site.

Government Publication Date: Jan 23, 2023

RCRA non-CORRACTS TSD Facilities: RCRA TSD

RCRA Info is the U.S. Environmental Protection Agency's (EPA) comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. This database includes Non-Corrective Action sites listed as treatment, storage and/or disposal facilities of hazardous waste as defined by RCRA.

Government Publication Date: Jan 23, 2023

RCRA Generator List: RCRA LQG

RCRA Info is the U.S. Environmental Protection Agency's (EPA) comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. RCRA Info replaces the data recording and reporting abilities of the Resource Conservation and Recovery Information System (RCRIS) and the Biennial Reporting System (BRS). A hazardous waste generator is any person or site whose processes and actions create hazardous waste (see 40 CFR 260.10). Large Quantity Generators (LQGs) generate 1,000 kilograms per month or more of hazardous waste or more than one kilogram per month of acutely hazardous waste.

Government Publication Date: Jan 23, 2023

RCRA Small Quantity Generators List: RCRA SQG

RCRA Info is the U.S. Environmental Protection Agency's (EPA) comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. RCRA Info replaces the data recording and reporting abilities of the Resource Conservation and Recovery Information System (RCRIS) and the Biennial Reporting System (BRS). A hazardous waste generator is any person or site whose processes and actions create hazardous waste (see 40 CFR 260.10). Small Quantity Generators (SQGs) generate more than 100 kilograms, but less than 1,000 kilograms, of hazardous waste per month.

Government Publication Date: Jan 23, 2023

RCRA Very Small Quantity Generators List: RCRA VSQG

RCRA Info is the U.S. Environmental Protection Agency's (EPA) comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. A hazardous waste generator is any person or site whose processes and actions create hazardous waste (see 40 CFR 260.10). Very Small Quantity Generators (VSQG) generate 100 kilograms or less per month of hazardous waste, or one kilogram or less per month of acutely hazardous waste. Additionally, VSQG may not accumulate more than 1,000 kilograms of hazardous waste at any time.

Government Publication Date: Jan 23, 2023

RCRA Non-Generators: RCRA NON GEN

RCRA Info is the U.S. Environmental Protection Agency's (EPA) comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. RCRA Info replaces the data recording and reporting abilities of the Resource Conservation and Recovery Information System (RCRIS) and the Biennial Reporting System (BRS). A hazardous waste generator is any person or site whose processes and actions create hazardous waste (see 40 CFR 260.10). Non-Generators do not presently generate hazardous waste.

Government Publication Date: Jan 23, 2023

RCRA Sites with Controls: RCRA CONTROLS

List of Resource Conservation and Recovery Act (RCRA) facilities with institutional controls in place. RCRA gives the U.S. Environmental Protection Agency (EPA) the authority to control hazardous waste from the "cradle-to-grave." This includes the generation, transportation, treatment, storage, and disposal of hazardous waste. RCRA also set forth a framework for the management of non-hazardous solid wastes. The 1986 amendments to RCRA enabled EPA to address environmental problems that could result from underground tanks storing petroleum and other hazardous substances.

Government Publication Date: Jan 23, 2023

Federal Engineering Controls-ECs: FED ENG

This list of Engineering controls (ECs) is provided by the United States Environmental Protection Agency (EPA). ECs encompass a variety of engineered and constructed physical barriers (e.g., soil capping, sub-surface venting systems, mitigation barriers, fences) to contain and/or prevent exposure to contamination on a property. The EC listing includes remedy component data from Superfund decision documents issued in fiscal years 1982-2020 for applicable sites on the final or deleted on the National Priorities List (NPL); and sites with a Superfund Alternative Approach (SAA) Agreement in place. The only sites included that are not on the NPL; proposed for NPL; or removed from proposed NPL, are those with an SAA Agreement in place.

Government Publication Date: Dec 22, 2022

Federal Institutional Controls- ICs: FED INST

This list of Institutional controls (ICs) is provided by the United States Environmental Protection Agency (EPA). ICs are non-engineered instruments, such as administrative and legal controls, that help minimize the potential for human exposure to contamination and/or protect the integrity of the remedy. Although it is EPA's expectation that treatment or engineering controls will be used to address principal threat wastes and that groundwater will be returned to its beneficial use whenever practicable, ICs play an important role in site remedies because they reduce exposure to contamination by limiting land or resource use and guide human behavior at a site. The IC listing includes remedy component data from Superfund decision documents issued in fiscal years 1982-2020 for applicable sites on the final or deleted on the National Priorities List (NPL); and sites with a Superfund Alternative Approach (SAA) Agreement in place. The only sites included that are not on the NPL; proposed for NPL; or removed from proposed NPL, are those with an SAA Agreement in place.

Government Publication Date: Dec 22, 2022

Land Use Control Information System: LUCIS

The LUCIS database is maintained by the U.S. Department of the Navy and contains information for former Base Realignment and Closure (BRAC) properties across the United States.

Government Publication Date: Sep 1, 2006

Institutional Control Boundaries at NPL sites: NPL IC

Boundaries of Institutional Control areas at sites on the United States Environmental Protection Agency (EPA)'s National Priorities List, or Proposed or Deleted, made available by the EPA's Shared Enterprise Geodata and Services (SEGS). United States Environmental Protection Agency (EPA)'s National Priorities List of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial action under the Superfund program. Institutional controls are non-engineered instruments such as administrative and legal controls that help minimize the potential for human exposure to contamination and/or protect the integrity of the remedy.

Government Publication Date: Nov 3, 2022

Emergency Response Notification System: ERNS 1982 TO 1986

Database of oil and hazardous substances spill reports controlled by the National Response Center. The primary function of the National Response Center is to serve as the sole national point of contact for reporting oil, chemical, radiological, biological, and etiological discharges into the environment anywhere in the United States and its territories.

Government Publication Date: 1982-1986

Emergency Response Notification System: ERNS 1987 TO 1989

Database of oil and hazardous substances spill reports controlled by the National Response Center. The primary function of the National Response Center is to serve as the sole national point of contact for reporting oil, chemical, radiological, biological, and etiological discharges into the environment anywhere in the United States and its territories.

Government Publication Date: 1987-1989

Emergency Response Notification System: ERNS

Database of oil and hazardous substances spill reports made available by the United States Coast Guard National Response Center (NRC). The NRC fields initial reports for pollution and railroad incidents and forwards that information to appropriate federal/state agencies for response. These data contain initial incident data that has not been validated or investigated by a federal/state response agency.

Government Publication Date: Nov 6, 2022

The Assessment, Cleanup and Redevelopment Exchange System (ACRES) Brownfield Database: FED BROWNFIELDS

Brownfields are real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleaning up and reinvesting in these properties protects the environment, reduces blight, and takes development pressures off greenspaces and working lands. This data is provided by the United States Environmental Protection Agency (EPA) and includes Brownfield sites from the Cleanups in My Community (CIMC) web application.

Government Publication Date: Sep 13, 2022

FEMA Underground Storage Tank Listing: FEMA UST

The Federal Emergency Management Agency (FEMA) of the Department of Homeland Security maintains a list of FEMA owned underground storage tanks.

Government Publication Date: Dec 31, 2017

Facility Response Plan: FRP

List of facilities that have submitted Facility Response Plans (FRP) to EPA. Facilities that could reasonably be expected to cause "substantial harm" to the environment by discharging oil into or on navigable waters are required to prepare and submit Facility Response Plans (FRPs). Harm is determined based on total oil storage capacity, secondary containment and age of tanks, oil transfer activities, history of discharges, proximity to a public drinking water intake or sensitive environments.

Government Publication Date: Dec 31, 2021

Delisted Facility Response Plans: DELISTED FRP

Facilities that once appeared in - and have since been removed from - the list of facilities that have submitted Facility Response Plans (FRP) to EPA. Facilities that could reasonably be expected to cause "substantial harm" to the environment by discharging oil into or on navigable waters are required to prepare and submit Facility Response Plans (FRPs). Harm is determined based on total oil storage capacity, secondary containment and age of tanks, oil transfer activities, history of discharges, proximity to a public drinking water intake or sensitive environments.

Government Publication Date: Dec 31, 2021

Historical Gas Stations: HIST GAS STATIONS

This historic directory of service stations is provided by the Cities Service Company. The directory includes Cities Service filling stations that were located throughout the United States in 1930.

Government Publication Date: Jul 1, 1930

Petroleum Refineries: REFN

List of petroleum refineries from the U.S. Energy Information Administration (EIA) Refinery Capacity Report. Includes operating and idle petroleum refineries (including new refineries under construction) and refineries shut down during the previous year located in the 50 States, the District of Columbia, Puerto Rico, the Virgin Islands, Guam, and other U.S. possessions. Survey locations adjusted using public data.

Government Publication Date: Aug 30, 2022

Petroleum Product and Crude Oil Rail Terminals: BULK TERMINAL

List of petroleum product and crude oil rail terminals made available by the U.S. Energy Information Administration (EIA). Includes operable bulk petroleum product terminals located in the 50 States and the District of Columbia with a total bulk shell storage capacity of 50,000 barrels or more, and/or the ability to receive volumes from tanker, barge, or pipeline; also rail terminals handling the loading and unloading of crude oil that were active between 2017 and 2018. Petroleum product terminals comes from the EIA-815 Bulk Terminal and Blender Report, which includes working, shell in operation, and shell idle for several major product groupings. Survey locations adjusted using public data.

Government Publication Date: Jun 29, 2022

LIEN on Property: SEMS LIEN

The U.S. Environmental Protection Agency's (EPA) Superfund Enterprise Management System (SEMS) provides Lien details on applicable properties, such as the Superfund lien on property activity, the lien property information, and the parties associated with the lien.

Government Publication Date: Jan 25, 2023

Superfund Decision Documents: SUPERFUND ROD

This database contains a list of decision documents for Superfund sites. Decision documents serve to provide the reasoning for the choice of (or) changes to a Superfund Site cleanup plan. The decision documents include completed Records of Decision (ROD), ROD Amendments, Explanations of Significant Differences (ESD) for active and archived sites stored in the Superfund Enterprise Management System (SEMS), along with other associated memos and files. This information is maintained and made available by the U.S. Environmental Protection Agency.

Government Publication Date: Dec 22, 2022

State

Hazardous Substance Remedial Action Trust Fund Priority List: SHWS

The Arkansas Department of Environmental Quality (ADEQ)'s Remedial Action Trust Fund Hazardous Substances Site Priority List (SPL) identifies those hazardous substance sites for which expenditures are authorized from the Hazardous Substances Remedial Action Trust Fund pursuant to the provisions of the Arkansas Code, Annotated, § 8-7-509(d)(2) and (d)(3). A site's position on the list is not relative to its hazard ranking or degree of risk or potential risk. This database is state equivalent NPL.

Government Publication Date: Sep 19, 2022

Delisted Hazardous Substance Remedial Action Trust Fund Priority List: DELISTED SHWS

This database contains a list of closed hazardous substance release sites that were removed from the Arkansas Department of Environmental Quality (ADEQ)'s Remedial Action Trust Fund Hazardous Substances Site Priority List (SPL).

Government Publication Date: Sep 19, 2022

Solid Waste Facility Permit Database: SWF/LF

A listing of permitted solid waste and landfill facilities registered with Arkansas Department of Environmental Quality(ADEQ).

Government Publication Date: Feb 6, 2023

Solid Waste Illegal Dumps Database: SWID

A listing of solid waste illegal dumps (SWID), made available by Arkansas Department of Environmental Quality (ADEQ). SWIDs are places where solid waste is placed, deposited, abandoned, dumped, or otherwise disposed of in a manner that is prohibited by state statutes, rules or regulations.

Government Publication Date: Feb 2, 2023

Recycling Marketing Directory: RECYCLING

The Arkansas Recycling Marketing Directory is made available by the Arkansas Division of Environmental Quality (ADEQ), providing essential information about facilities accepting recyclables. The directory is continually updated and maintained by ADEQ and includes details about materials accepted by facilities.

Government Publication Date: Nov 16, 2022

Leaking Storage Tank Data: LST

A list of aboveground and underground storage tank release incidents reported to Regulated Storage Tanks (RST) Division of Arkansas Department of Environmental Quality (ADEQ).

Government Publication Date: Dec 5, 2022

Delisted Leaking Storage Tanks: DELISTED LST

This database contains a list of closed leaking storage tank sites that were removed from the Arkansas Department of Environmental Quality (ADEQ), Regulated Storage Tank (RST) Division.

Government Publication Date: Dec 5, 2022

Underground Storage Tanks: UST

A listing of underground petroleum storage tanks facilities, made available by Arkansas Department of Environmental Quality (ADEQ). The ADEQ Regulated Storage Tank (RST) Division drafts, administers and enforces state regulations pertaining to underground petroleum storage tanks.

Government Publication Date: Dec 5, 2022

Aboveground Storage Tanks: AST

A listing of aboveground petroleum storage tanks facilities, made available by Arkansas Department of Environmental Quality (ADEQ). The ADEQ Regulated Storage Tank (RST) Division drafts, administers and enforces state regulations pertaining to aboveground petroleum storage tanks.

Government Publication Date: Dec 5, 2022

Tank Facilities: TANKS

A list of petroleum storage tank facilities in the petroleum storage tanks data made available by Arkansas Department of Environmental Quality (ADEQ), at which there are no associated underground or aboveground tanks. The ADEQ Regulated Storage Tank (RST) Division drafts, administers and enforces state regulations pertaining to aboveground petroleum storage tanks.

Government Publication Date: Dec 5, 2022

Delisted Storage Tanks: DELISTED TANK

This database contains a list of closed storage tank sites that were removed from the Arkansas Department of Environmental Quality (ADEQ), Regulated Storage Tank (RST) Division.

Government Publication Date: Dec 5, 2022

Engineering Controls Sites Listing: ENG

A listing of engineering controls at facilities in the Arkansas Record of Brownfields Projects, available on the Arkansas Department of Environmental Quality (ADEQ) website.

Government Publication Date: Jan 16, 2023

Institutional Control/Land Use Restriction Sites: INST

A listing of institutional controls at facilities in the Arkansas Record of Brownfields Projects, available on the Arkansas Department of Environmental Quality (ADEQ) website. Arkansas does not have a system to monitor or enforce long-term stewardship and institutional controls.

Government Publication Date: Jan 16, 2023

Voluntary Cleanup Program Sites: VCP

A listing of voluntary cleanup sites made available by Arkansas Department of Environmental Quality (ADEQ). ADEQ administers an Elective Site Clean-up Program (ESCP) which allows responsible parties to enter into an agreement with ADEQ which will govern the clean-up of sites. The ESCP does not offer a release of liability but does offer participants a means to address historic contamination on their site without penalty and with known objectives.

Government Publication Date: Oct 5, 2022

Brownfields Projects: BROWNFIELDS

A list of brownfield sites, made available by Arkansas Department of Environmental Quality (ADEQ). A brownfield is a parcel of property where commercial, industrial, or agricultural use may have contaminated the site with a hazardous substance, thereby complicating prospects for expansion, redevelopment, or reuse.

Government Publication Date: Jan 16, 2023

Tribal

Leaking Underground Storage Tanks (LUSTs) on Indian Lands: INDIAN LUST

This list of leaking underground storage tanks (LUSTs) on Tribal/Indian Lands in Region 6, which includes Arkansas, is made available by the United States Environmental Protection Agency (EPA). There are no federally recognized Tribes in Arkansas, according to the U.S. Department of Interior, Bureau of Indian Affairs.

Government Publication Date: Oct 6, 2017

Underground Storage Tanks (USTs) on Indian Lands: INDIAN UST

This list of underground storage tanks (USTs) on Tribal/Indian Lands in Region 6, which includes Arkansas, is made available by the United States Environmental Protection Agency (EPA). There are no federally recognized Tribes in Arkansas, according to the U.S. Department of Interior, Bureau of Indian Affairs.

Government Publication Date: Oct 6, 2017

Delisted Tribal Leaking Storage Tanks: DELISTED INDIAN LST

Leaking Underground Storage Tank (LUST) facilities which once appeared on - and have since been removed from - the Regional Tribal/Indian LUST lists made available by the United States Environmental Protection Agency (EPA).

Government Publication Date: Nov 23, 2022

Delisted Tribal Underground Storage Tanks: DELISTED INDIAN UST

Underground Storage Tank (UST) facilities which once appeared on - and have since been removed from - the Regional Tribal/Indian UST lists made available by the United States Environmental Protection Agency (EPA).

Government Publication Date: Nov 23, 2022

County

No County standard environmental record sources available for this State.

Additional Environmental Record Sources

Federal

Facility Registry Service/Facility Index: FINDS/FRS

The Facility Registry Service (FRS) is a centrally managed database that identifies facilities, sites, or places subject to environmental regulations or of environmental interest. FRS creates high-quality, accurate, and authoritative facility identification records through rigorous verification and management procedures that incorporate information from program national systems, state master facility records, and data collected from EPA's Central Data Exchange registrations and data management personnel. This list is made available by the Environmental Protection Agency (US EPA).

Government Publication Date: Aug 18, 2022

Toxics Release Inventory (TRI) Program: TRIS

The EPA's Toxics Release Inventory (TRI) is a database containing data on disposal or other releases of over 650 toxic chemicals from thousands of U. S. facilities and information about how facilities manage those chemicals through recycling, energy recovery, and treatment. One of TRI's primary purposes is to inform communities about toxic chemical releases to the environment.

Government Publication Date: Aug 24, 2021

PFOA/PFOS Contaminated Sites: PFAS NPL

List of National Priorities List (NPL) and related Superfund Alternative Agreement (SAA) sites where PFOA or PFOS contaminants have been found in water and/or soil. The site listing is provided by the Federal Environmental Protection Agency (EPA).

Government Publication Date: Oct 4, 2022

Federal Agency Locations with Known or Suspected PFAS Detections: PFAS FED SITES

List of Federal agency locations with known or suspected detections of Per- and Polyfluoroalkyl Substances (PFAS), made available by the U.S. Environmental Protection Agency (EPA) in their PFAS Analytic Tools data. EPA outlines that these data are gathered from several federal entities, such as the Federal Superfund program, Department of Defense (DOD), National Aeronautics and Space Administration, Department of Transportation, and Department of Energy. Sites on this list do not necessarily reflect the source/s of contamination and detections do not indicate level of risk or human exposure at the site. Agricultural notifications in this data are limited to DOD sites only. At this time, the EPA is aware that this list is not comprehensive of all Federal agencies.

Government Publication Date: Jun 30, 2022

SSEHRI PFAS Contamination Sites: PFAS SSEHRI

This PFAS Contamination Site Tracker database is compiled by the Social Science Environmental Health Research Institute (SSEHRI) at Northeastern University. According to the SSEHRI, the database records qualitative and quantitative data from each known site of PFAS contamination, including timeline of discovery, sources, levels, health impacts, community response, and government response. The goal of this database is to compile information and support public understanding of the rapidly unfolding issue of PFAS contamination. All data presented was extracted from government websites, news articles, or publicly available documents, and this is cited in the tracker. Disclaimer: The source conveys this database undergoes regular updates as new information becomes available, some sites may be missing and/or contain information that is incorrect or outdated, as well as their information represents all contamination sites SSEHRI is aware of, not all possible contamination sites. This data is not intended to be used for legal purposes. Limited location details are available with this data. Access the following for the most current informations https://pfasproject.com/pfas-contamination-site-tr acker/

Government Publication Date: Dec 12, 2019

National Response Center PFAS Spills: ERNS PFAS

National Response Center (NRC) calls from 1990 to the most recent complete calendar year where there is indication of Aqueous Film Forming Foam (AFFF) usage. NRC calls may reference AFFF usage in the "Material Involved" or "Incident Description" fields. Data made available by the US Environmental Protection Agency (EPA). Disclaimer: dataset may include initial or misidentified incident data not yet validated or investigated by a federal/state response agency.

Government Publication Date: Feb 23, 2022

PFAS NPDES Discharge Monitoring: PFAS NPDES

This list of National Pollutant Discharge Elimination System (NPDES) permitted facilities with required monitoring for Per- and Polyfluoroalkyl (PFAS) Substances is made available via the U.S. Environmental Protection Agency (EPA)'s PFAS Analytic Tools. Any point-source wastewater discharger to waters of the United States must have a NPDES permit, which defines a set of parameters for pollutants and monitoring to ensure that the discharge does not degrade water quality or impair human health. This list includes NPDES permitted facilities associated with permits that monitor for Per- and Polyfluoroalkyl Substances (PFAS), limited to the years 2007 - present. EPA further advises the following regarding these data: currently, fewer than half of states have required PFAS monitoring for at least one of their permittees, and fewer states have established PFAS effluent limits for permittees. For states that may have required monitoring, some reporting and data transfer issues may exist on a state-by-state basis.

Government Publication Date: Feb 19, 2023

Perfluorinated Alkyl Substances (PFAS) from Toxic Release Inventory: PFAS TRI

List of Toxics Release Inventory (TRI) facilities at which the reported chemical is a Per- or polyfluorinated alkyl substance (PFAS) included in the Environmental Protection Agency (EPA)'s consolidated PFAS Master List of PFAS Substances. The EPA's Toxics Release Inventory (TRI) is a database containing data on disposal or other releases of over 650 toxic chemicals from thousands of U.S. facilities and information about how facilities manage those chemicals through recycling, energy recovery, and treatment.

Government Publication Date: Aug 24, 2021

Perfluorinated Alkyl Substances (PFAS) Water Quality: PFAS WATER

The Water Quality Portal (WQP) is a cooperative service sponsored by the United States Geological Survey (USGS), the Environmental Protection Agency (EPA), and the National Water Quality Monitoring Council (NWQMC). This listing includes records from the Water Quality Portal where the characteristic (environmental measurement) is in the Environmental Protection Agency (EPA)'s consolidated PFAS Master List of PFAS Substances.

Government Publication Date: Jul 20, 2020

<u>Hazardous Materials Information Reporting System:</u> HMIRS

US DOT - Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA) Incidents Reports Database taken from Hazmat Intelligence Portal, U.S. Department of Transportation.

Government Publication Date: Sep 1, 2020

<u>National Clandestine Drug Labs:</u> NCDL

The U.S. Department of Justice ("the Department"), Drug Enforcement Administration (DEA), provides this data as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy.

Government Publication Date: Aug 30, 2022

<u>Toxic Substances Control Act:</u> TSCA

The Environmental Protection Agency (EPA) is amending the Toxic Substances Control Act (TSCA) section 8(a) Inventory Update Reporting (IUR) rule and changing its name to the Chemical Data Reporting (CDR) rule.

The CDR enables EPA to collect and publish information on the manufacturing, processing, and use of commercial chemical substances and mixtures (referred to hereafter as chemical substances) on the TSCA Chemical Substance Inventory (TSCA Inventory). This includes current information on chemical substance production volumes, manufacturing sites, and how the chemical substances are used. This information helps the Agency determine whether people or the environment are potentially exposed to reported chemical substances. EPA publishes submitted CDR data that is not Confidential Business Information (CBI).

Government Publication Date: Apr 11, 2019

<u>Hist TSCA:</u> HIST TSCA

The Environmental Protection Agency (EPA) is amending the Toxic Substances Control Act (TSCA) section 8(a) Inventory Update Reporting (IUR) rule and changing its name to the Chemical Data Reporting (CDR) rule.

The 2006 IUR data summary report includes information about chemicals manufactured or imported in quantities of 25,000 pounds or more at a single site during calendar year 2005. In addition to the basic manufacturing information collected in previous reporting cycles, the 2006 cycle is the first time EPA collected information to characterize exposure during manufacturing, processing and use of organic chemicals. The 2006 cycle also is the first time manufacturers of inorganic chemicals were required to report basic manufacturing information.

Government Publication Date: Dec 31, 2006

<u>FTTS Administrative Case Listing:</u> FTTS ADMIN

An administrative case listing from the Federal Insecticide, Fungicide, & Rodenticide Act (FIFRA) and Toxic Substances Control Act (TSCA), together known as FTTS. This database was obtained from the Environmental Protection Agency's (EPA) National Compliance Database (NCDB). The FTTS and NCDB was shut down in 2006.

Government Publication Date: Jan 19, 2007

<u>FTTS Inspection Case Listing:</u> FTTS INSP

An inspection case listing from the Federal Insecticide, Fungicide, & Rodenticide Act (FIFRA) and Toxic Substances Control Act (TSCA), together known as FTTS. This database was obtained from the Environmental Protection Agency's (EPA) National Compliance Database (NCDB). The FTTS and NCDB was shut down in 2006.

Government Publication Date: Jan 19, 2007

<u>Potentially Responsible Parties List:</u> PRP

Early in the site cleanup process, the U.S. Environmental Protection Agency (EPA) conducts a search to find the Potentially Responsible Parties (PRPs). The EPA looks for evidence to determine liability by matching wastes found at the site with parties that may have contributed wastes to the site. This listing contains PRPs, Noticed Parties, at sites in the EPA's Superfund Enterprise Management System (SEMS).

Government Publication Date: Jan 25, 2023

<u>State Coalition for Remediation of Drycleaners Listing:</u> SCRD DRYCLEANER

The State Coalition for Remediation of Drycleaners (SCRD) was established in 1998, with support from the U.S. Environmental Protection Agency (EPA) Office of Superfund Remediation and Technology Innovation. Coalition members are states with mandated programs and funding for drycleaner site remediation. Current members are Alabama, Connecticut, Florida, Illinois, Kansas, Minnesota, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Wisconsin. Since 2017, the SCRD no longer maintains this data, refer to applicable state source data where available.

Government Publication Date: Nov 08, 2017

Integrated Compliance Information System (ICIS): ICIS

The U.S. Environmental Protection Agency's Enforcement and Compliance History Online system incorporates data from the Integrated Compliance Information System - National Pollutant Discharge Elimination System (ICIS-NPDES). ICIS-NPDES is an information management system maintained by the Office of Compliance to track permit compliance and enforcement status of facilities regulated by the NPDES under the Clean Water Act. This data includes permit, inspection, violation and enforcement action information for applicable ICIS records.

Government Publication Date: Oct 15, 2022

Drycleaner Facilities: FED DRYCLEANERS

A list of drycleaner facilities from Enforcement and Compliance History Online (ECHO) online search. The Environmental Protection Agency (EPA) tracks facilities that possess NAIC and SIC codes that classify businesses as drycleaner establishments.

Government Publication Date: Jun 25, 2022

Delisted Drycleaner Facilities: DELISTED FED DRY

List of sites removed from the list of Drycleaner Facilities (sites in the EPA's Integrated Compliance Information System (ICIS) with NAIC or SIC codes identifying the business as a drycleaner establishment).

Government Publication Date: Jun 25, 2022

Formerly Used Defense Sites: FUDS

Formerly Used Defense Sites (FUDS) are properties that were formerly owned by, leased to, or otherwise possessed by and under the jurisdiction of the Secretary of Defense prior to October 1986, where the Department of Defense (DOD) is responsible for an environmental restoration. The FUDS Annual Report to Congress (ARC) is published by the U.S. Army Corps of Engineers (USACE). This data is compiled from the USACE's Geospatial FUDS data layers and Homeland Infrastructure Foundation-Level Data (HIFLD) FUDS dataset.

Government Publication Date: Jul 12, 2022

Former Military Nike Missile Sites: FORMER NIKE

This information was taken from report DRXTH-AS-IA-83A016 (Historical Overview of the Nike Missile System, 12/1984) which was performed by Environmental Science and Engineering, Inc. for the U.S. Army Toxic and Hazardous Materials Agency Assessment Division. The Nike system was deployed between 1954 and the mid-1970's. Among the substances used or stored on Nike sites were liquid missile fuel (JP-4); starter fluids (UDKH, aniline, and furfuryl alcohol); oxidizer (IRFNA); hydrocarbons (motor oil, hydraulic fluid, diesel fuel, gasoline, heating oil); solvents (carbon tetrachloride, trichloroethylene, trichloroethane, stoddard solvent); and battery electrolyte. The quantities of material a disposed of and procedures for disposal are not documented in published reports. Virtually all information concerning the potential for contamination at Nike sites is confined to personnel who were assigned to Nike sites. During deactivation most hardware was shipped to depot-level supply points. There were reportedly instances where excess materials were disposed of on or near the site itself at closure. There was reportedly no routine site decontamination.

Government Publication Date: Dec 2, 1984

PHMSA Pipeline Safety Flagged Incidents: PIPELINE INCIDENT

A list of flagged pipeline incidents made available by the U.S. Department of Transportation (US DOT) Pipeline and Hazardous Materials Safety Administration (PHMSA). PHMSA regulations require incident and accident reports for five different pipeline system types.

Government Publication Date: Mar 31, 2021

Material Licensing Tracking System (MLTS): MLTS

A list of sites that store radioactive material subject to the Nuclear Regulatory Commission (NRC) licensing requirements. This list is maintained by the NRC. As of September 2016, the NRC no longer releases location information for sites. Site locations were last received in July 2016.

Government Publication Date: May 11, 2021

Historic Material Licensing Tracking System (MLTS) sites: HIST MLTS

A historic list of sites that have inactive licenses and/or removed from the Material Licensing Tracking System (MLTS). In some cases, a site is removed from the MLTS when the state becomes an "Agreement State". An Agreement State is a State that has signed an agreement with the Nuclear Regulatory Commission (NRC) authorizing the State to regulate certain uses of radioactive materials within the State.

Government Publication Date: Jan 31, 2010

Mines Master Index File: MINES

The Master Index File (MIF) is provided by the United State Department of Labor, Mine Safety and Health Administration (MSHA). This file, which was originally created in the 1970's, contained many Mine-IDs that were invalid. MSHA removes invalid IDs from the MIF upon discovery. MSHA applicable data includes the following: all Coal and Metal/Non-Metal mines under MSHA's jurisdiction since 1/1/1970; mine addresses for all mines in the database except for Abandoned mines prior to 1998 from MSHA's legacy system (addresses may or may not correspond with the physical location of the mine itself); violations that have been assessed penalties as a result of MSHA inspections beginning on 1/1/2000; and violations issued as a result of MSHA inspections conducted beginning on 1/1/2000.

Government Publication Date: Aug 3, 2022

Surface Mining Control and Reclamation Act Sites: SMCRA

An inventory of land and water impacted by past mining (primarily coal mining) is maintained by the Office of Surface Mining Reclamation and Enforcement (OSMRE) to provide information needed to implement the Surface Mining Control and Reclamation Act of 1977 (SMCRA). The inventory contains information on the location, type, and extent of Abandoned Mine Land (AML) impacts, as well as information on the cost associated with the reclamation of those problems. The inventory is based upon field surveys by State, Tribal, and OSMRE program officials. It is dynamic to the extent that it is modified as new problems are identified and existing problems are reclaimed.

Government Publication Date: Aug 18, 2022

Mineral Resource Data System: MRDS

The Mineral Resource Data System (MRDS) is a collection of reports describing metallic and nonmetallic mineral resources throughout the world. Included are deposit name, location, commodity, deposit description, geologic characteristics, production, reserves, resources, and references. This database contains the records previously provided in the Mineral Resource Data System (MRDS) of USGS and the Mineral Availability System/Mineral Industry Locator System (MAS/MILS) originated in the U.S. Bureau of Mines, which is now part of USGS. The USGS has ceased systematic updates of the MRDS database with their focus more recently on deposits of critical minerals while providing a well-documented baseline of historical mine locations from USGS topographic maps.

Government Publication Date: Mar 15, 2016

DOE Legacy Management Sites: LM SITES

The U.S. Department of Energy (DOE) Office of Legacy Management (LM) currently manages radioactive and chemical waste, environmental contamination, and hazardous material at over 100 sites across the U.S. The LM manages sites with diverse regulatory drivers (statutes or programs that direct cleanup and management requirements at DOE sites) or as part of internal DOE or congressionally-recognized programs, such as but not limited to: Formerly Utilized Sites Remedial Action Program (FUSRAP), Uranium Mill Tailings Radiation Control Act (UMTRCA Title I, Tile II), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Resource Conservation and Recovery Act (RCRA), Decontamination and Decommissioning (D&D), Nuclear Waste Policy Act (NWPA). This site listing includes data exported from the DOE Office of LM's Geospatial Environmental Mapping System (GEMS). GEMS Data disclaimer: The DOE Office of LM makes no representation or warranty, expressed or implied, regarding the use, accuracy, availability, or completeness of the data presented herein.

Government Publication Date: Dec 1, 2022

Alternative Fueling Stations: ALT FUELS

This list of alternative fueling stations is sourced from the Alternative Fuels Data Center (AFDC). The U.S. Department of Energy's Office of Energy Efficiency & Renewable Energy launched the AFDC in 1991 as a repository for alternative fuel vehicle performance data, which provides a wealth of information and data on alternative and renewable fuels, advanced vehicles, fuel-saving strategies, and emerging transportation technologies. The data includes Biodiesel (B20 and above), Compressed Natural Gas (CNG), Electric, Ethanol (E85), Hydrogen, Liquefied Natural Gas (LNG), Propane (LPG) fuel type locations.

Government Publication Date: Jan 3, 2023

Superfunds Consent Decrees: CONSENT DECREES

This list of Superfund consent decrees is provided by the Department of Justice, Environment & Natural Resources Division (ENRD) through a Freedom of Information Act (FOIA) applicable file. This listing includes Consent Decrees for CERCLA or Superfund Sites filed and/or as proposed within the ENRD's Case Management System (CMS) since 2010. CMS may not reflect the latest developments in a case nor can the agency guarantee the accuracy of the data. ENRD Disclaimer: Congress excluded three discrete categories of law enforcement and national security records from the requirements of the FOIA; response is limited to those records that are subject to the requirements of the FOIA; however, this should not be taken as an indication that excluded records do, or do not, exist.

Government Publication Date: Jan 11, 2023

Air Facility System: AFS

This EPA retired Air Facility System (AFS) dataset contains emissions, compliance, and enforcement data on stationary sources of air pollution. Regulated sources cover a wide spectrum; from large industrial facilities to relatively small operations such as dry cleaners. AFS does not contain data on facilities that are solely asbestos demolition and/or renovation contractors, or landfills. ECHO Clean Air Act data from AFS are frozen and reflect data as of October 17, 2014; the EPA retired this system for Clean Air Act stationary sources and transitioned to ICIS-Air.

Government Publication Date: Oct 17, 2014

Registered Pesticide Establishments: SSTS

List of active EPA-registered foreign and domestic pesticide-producing and device-producing establishments based on data from the Section Seven Tracking System (SSTS). The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) Section 7 requires that facilities producing pesticides, active ingredients, or devices be registered. The list of establishments is made available by the EPA.

Government Publication Date: Mar 30, 2022

Polychlorinated Biphenyl (PCB) Transformers: PCBT

Locations of Transformers Containing Polychlorinated Biphenyls (PCBs) registered with the United States Environmental Protection Agency. PCB transformer owners must register their transformer(s) with EPA. Although not required, PCB transformer owners who have removed and properly disposed of a registered PCB transformer may notify EPA to have their PCB transformer de-registered. Data made available by EPA.

Government Publication Date: Oct 15, 2019

Polychlorinated Biphenyl (PCB) Notifiers: PCB

Facilities included in the national list of facilities that have notified the United States Environmental Protection Agency (EPA) of Polychlorinated Biphenyl (PCB) activities. Any company or person storing, transporting or disposing of PCBs or conducting PCB research and development must notify the EPA and receive an identification number.

Government Publication Date: Nov 3, 2022

State

Emergency Response Incidents: SPILLS

A list of petroleum product or hazardous material releases reported to Arkansas Department of Emergency Management (ADEM). This list is made available by Arkansas Department of Environmental Quality (ADEQ).

Government Publication Date: Jan 17, 2023

Historic Spills: HISTORIC SPILLS

A list of petroleum product or hazardous material releases reported to Arkansas Department of Emergency Management (ADEM). This list only contains records prior to January 2008. It is made available by Arkansas Department of Environmental Quality (ADEQ).

Government Publication Date: Dec 31, 2007

Dry Cleaning Facilities: DRYCLEANERS

A list of dry cleaning facilities in the Arkansas Department of Environmental Quality (ADEQ) Facility and Permit Summary Permit Data System made available by the ADEQ.

Government Publication Date: Feb 6, 2023

Delisted Dry Cleaning Facilities: DELISTED DRYCLEANERS

A list of sites which once appeared on - and have since been removed from - the list of dry cleaning facilities in the Arkansas Department of Environmental Quality (ADEQ) Facility and Permit Summary Permit Data System made available by the ADEQ.

Government Publication Date: Feb 6, 2023

Office of Air Quality Monitoring and Certification: AIR PERMITS

A list of sites with air permits made available by Arkansas Department of Environmental Quality (ADEQ).

Government Publication Date: Feb 13, 2023

Per- and Polyfluoroalkyl Substances (PFAS): PFAS

A list of sites in Arkansas that are investigating PFA/PFOS. Made available by the Arkansas Department of Environmental Quality (ADEQ), Office of Land Resources.

Government Publication Date: May 2, 2022

Methamphetamine Contaminated Properties: CDL

List of properties believed to be contaminated by the illegal manufacture of drugs, reported to Arkansas Department of Environemntal Quality (ADEQ). Ten (10) days after ADEQ has determined that a property has been decontaminated, it will be removed from this list.

Government Publication Date: Jan 25, 2023

Confined Animal Feeding Operation Permits: FEEDLOTS

The Arkansas Department of Environmental Quality maintains this list of facilities with Confined Animal Feeding Operation Permits. These facilities require a Regulation 5 permit for managing hog, poultry or dairy farms or other confined animal operations using liquid animal waste management systems.

Government Publication Date: Apr 9, 2013

Asbestos Notification of Intent Database: ASBESTOS

This database, made available by the Arkansas Department of Environmental Quality, contains information on Regulation 21, the Arkansas Asbestos Abatement Regulation. This regulation was developed in 1990 to regulate work practices during demolitions and renovations of facilities, as well as to license asbestos supervisors and workers. The regulation was revised in 1997 to regulate work practices during demolitions, renovations, and response actions; certify contractor/supervisors, inspectors, management planners, project designers, air monitors, and workers; license asbestos training providers, contractors, and consultants; and establish a fee system.

Government Publication Date: Nov 11, 2022

Tribal

No Tribal additional environmental record sources available for this State.

County

No County additional environmental record sources available for this State.

Definitions

Database Descriptions: This section provides a detailed explanation for each database including: source, information available, time coverage, and acronyms used. They are listed in alphabetic order.

Detail Report: This is the section of the report which provides the most detail for each individual record. Records are summarized by location, starting with the project property followed by records in closest proximity.

Distance: The distance value is the distance between plotted points, not necessarily the distance between the sites' boundaries. All values are an approximation.

Direction: The direction value is the compass direction of the site in respect to the project property and/or center point of the report.

Elevation: The elevation value is taken from the location at which the records for the site address have been plotted. All values are an approximation. Source: Google Elevation API.

Executive Summary: This portion of the report is divided into 3 sections:

'Report Summary'- Displays a chart indicating how many records fall on the project property and, within the report search radii.

'Site Report Summary'-Project Property'- This section lists all the records which fall on the project property. For more details, see the 'Detail Report' section.

'Site Report Summary-Surrounding Properties'- This section summarizes all records on adjacent properties, listing them in order of proximity from the project property. For more details, see the 'Detail Report' section.

Map Key: The map key number is assigned according to closest proximity from the project property. Map Key numbers always start at #1. The project property will always have a map key of '1' if records are available. If there is a number in brackets beside the main number, this will indicate the number of records on that specific property. If there is no number in brackets, there is only one record for that property.

The symbol and colour used indicates 'elevation': the red inverted triangle will dictate 'ERIS Sites with Lower Elevation', the yellow triangle will dictate 'ERIS Sites with Higher Elevation' and the orange square will dictate 'ERIS Sites with Same Elevation.'

Unplottables: These are records that could not be mapped due to various reasons, including limited geographic information. These records may or may not be in your study area, and are included as reference.

HISTORICAL AERIALS

Project Property: David D Terry Lock and Dam
David D Terry Lock and Dam
Little Rock AR 72142

Project No: W45XMA30722547

Requested By: US Army Corps of Engineers

Order No: 23031500632

Date Completed: March 17,2023

Environmental Risk Information Services
A division of Glacier Media Inc.
1.866.517.5204 | info@erisinfo.com | erisinfo.com

Date	Source	Scale	Comments
2021	MAXAR TECHNOLOGIES	1" = 600'	
2019	United States Department of Agriculture	1" = 600'	
2017	United States Department of Agriculture	1" = 600'	
2015	United States Department of Agriculture	1" = 600'	
2013	United States Department of Agriculture	1" = 600'	
2010	United States Department of Agriculture	1" = 600'	
2009	United States Department of Agriculture	1" = 600'	
2006	United States Department of Agriculture	1" = 600'	
2001	United States Geological Survey	1" = 600'	
1994	United States Geological Survey	1" = 600'	
1983	United States Geological Survey	1" = 600'	
1970	United States Geological Survey	1" = 600'	
1960	United States Geological Survey	1" = 600'	
1955	Agricultural Stabilization & Conserv. Service	1" = 600'	
1943	United States Geological Survey	1" = 600'	
1937	Agricultural Stabilization & Conserv. Service	1" = 600'	

Year: 2021
Source: MAXAR
Scale: 1" = 600'
Comment:

Address: David D Terry Lock and Dam, Little Rock, AR
Approx Center: -92.15346911,34.66531858

Order No: 23031500632

ERIS

Year: 2019
Source: USDA
Scale: 1" = 600'
Comment:

Address: David D Terry Lock and Dam, Little Rock, AR
Approx Center: -92.15346911,34.66531858

Order No: 23031500632

ERIS

Year: 2017
Source: USDA
Scale: 1" = 600'
Comment:

Address: David D Terry Lock and Dam, Little Rock, AR
Approx Center: -92.15346911,34.66531858

Order No: 23031500632

ERIS

Year: 2015
Source: USDA
Scale: 1" = 600'
Comment:

Address: David D Terry Lock and Dam, Little Rock, AR
Approx Center: -92.15346911,34.66531858

Order No: 23031500632

ERIS

Year: 2013
Source: USDA
Scale: 1" = 600'
Comment:

Address: David D Terry Lock and Dam, Little Rock, AR
Approx Center: -92.15346911,34.66531858

Order No: 23031500632

ERIS

Year: 2010
Source: USDA
Scale: 1" = 600'
Comment:

Address: David D Terry Lock and Dam, Little Rock, AR
Approx Center: -92.15346911,34.66531858

Order No: 23031500632

ERIS

Year: 2009
Source: USDA
Scale: 1" = 600'
Comment:

Address: David D Terry Lock and Dam, Little Rock, AR
Approx Center: -92.15346911,34.66531858

Order No: 23031500632

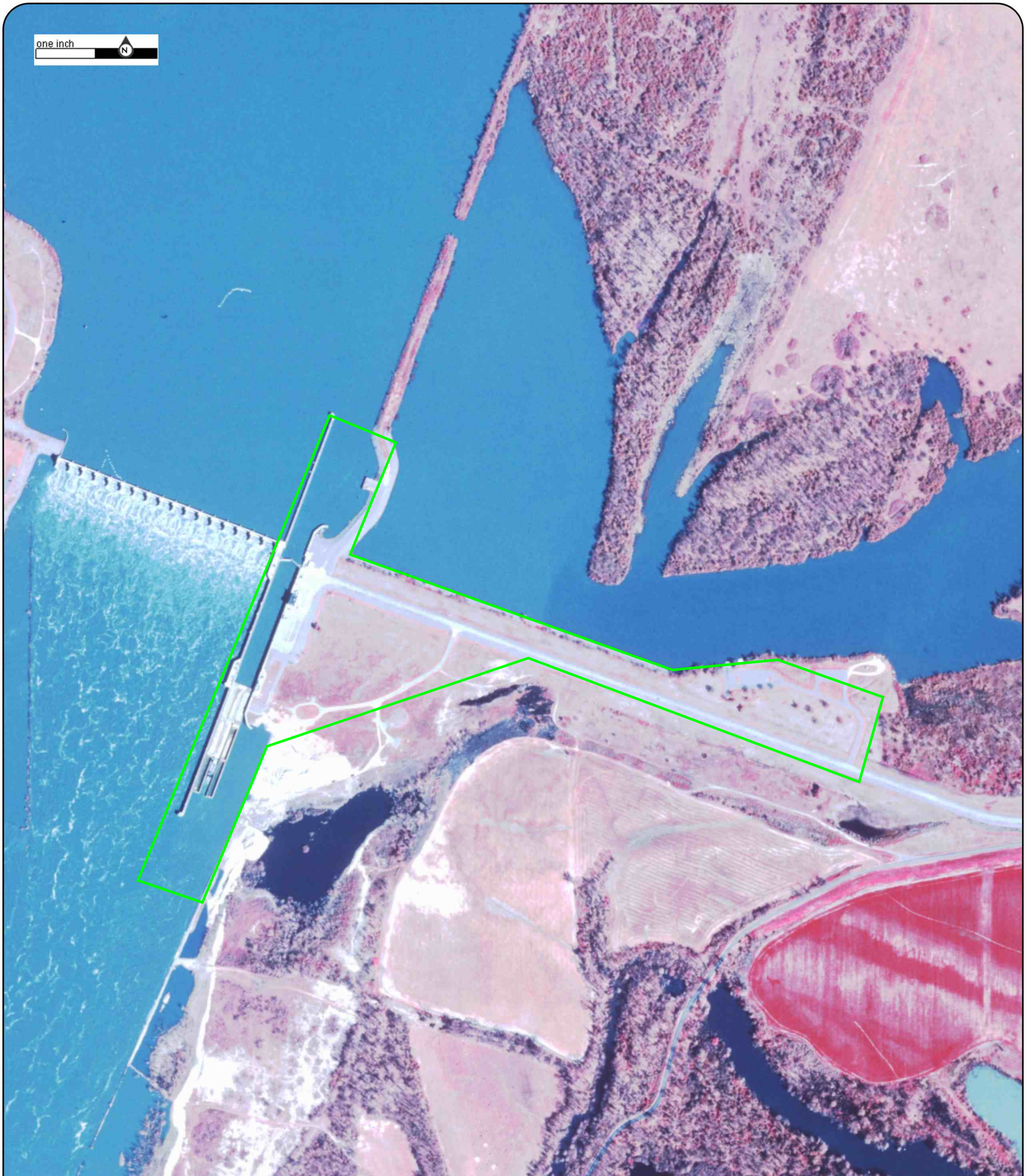
ERIS

Year: 2006
Source: USDA
Scale: 1" = 600'
Comment:

Address: David D Terry Lock and Dam, Little Rock, AR
Approx Center: -92.15346911,34.66531858

Order No: 23031500632

ERIS



Year: 2001
Source: USGS
Scale: 1" = 600'
Comment:

Address: David D Terry Lock and Dam, Little Rock, AR
Approx Center: -92.15346911,34.66531858

Order No: 23031500632

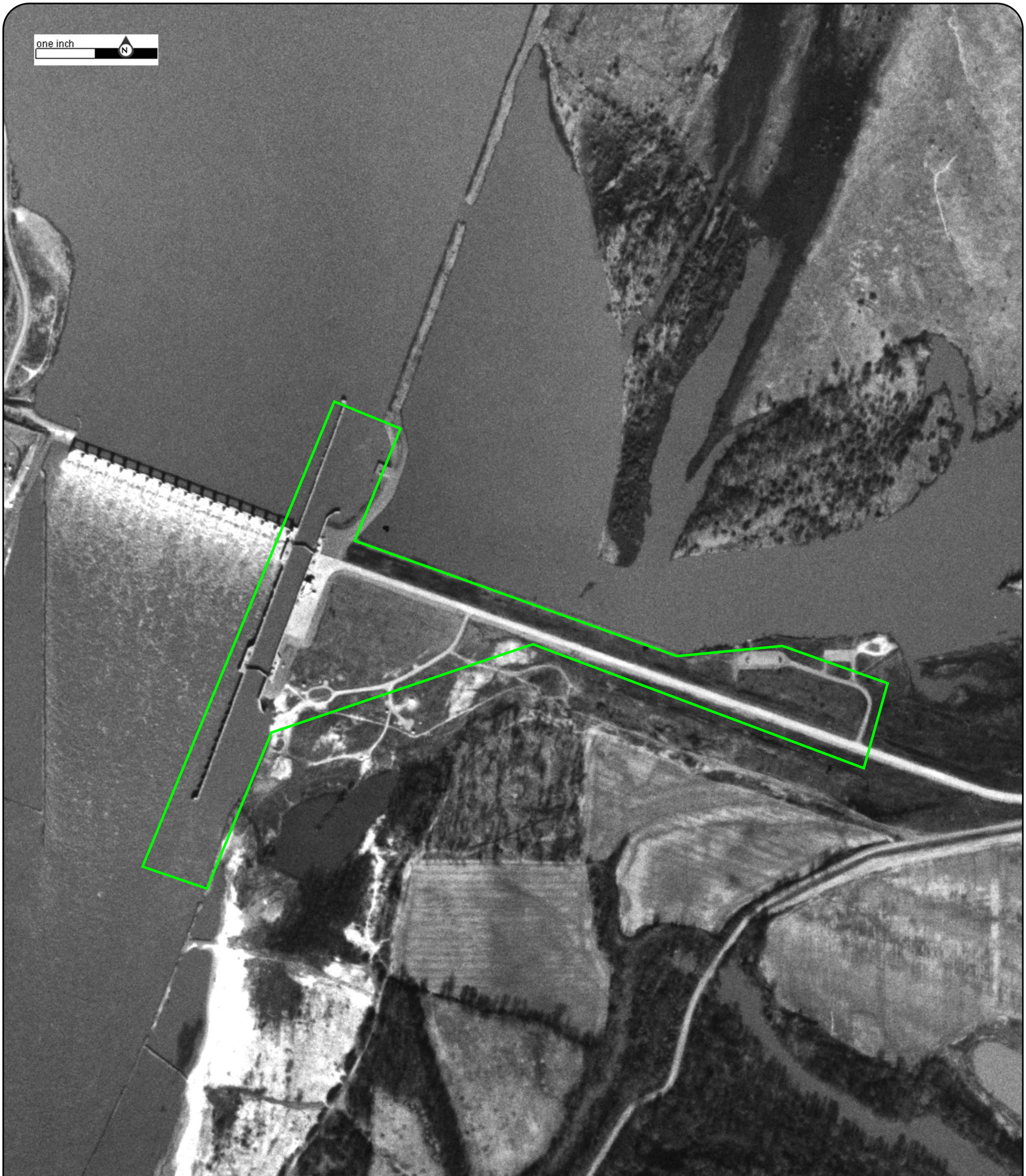
ERIS

Year: 1994
Source: USGS
Scale: 1" = 600'
Comment:

Address: David D Terry Lock and Dam, Little Rock, AR
Approx Center: -92.15346911,34.66531858

Order No: 23031500632

ERIS



Year: 1983
Source: USGS
Scale: 1" = 600'
Comment:

Address: David D Terry Lock and Dam, Little Rock, AR
Approx Center: -92.15346911,34.66531858

Order No: 23031500632

ERIS

Year: 1970
Source: USGS
Scale: 1" = 600'
Comment:

Address: David D Terry Lock and Dam, Little Rock, AR
Approx Center: -92.15346911,34.66531858

Order No: 23031500632

ERIS

Year: 1960
Source: USGS
Scale: 1" = 600'
Comment:

Address: David D Terry Lock and Dam, Little Rock, AR
Approx Center: -92.15346911,34.66531858

Order No: 23031500632

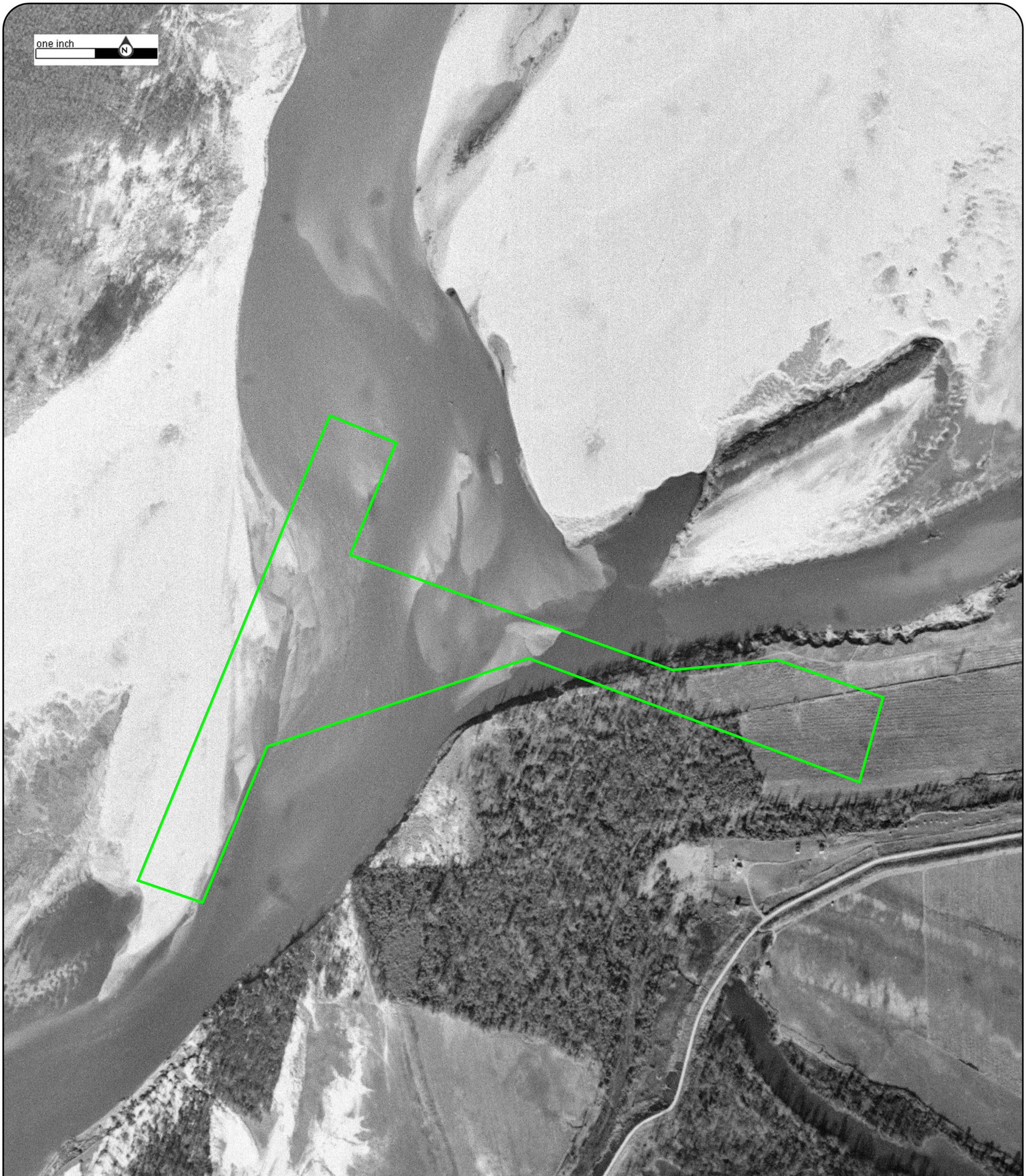
ERIS

Year: 1955
Source: ASCS
Scale: 1" = 600'
Comment:

Address: David D Terry Lock and Dam, Little Rock, AR
Approx Center: -92.15346911,34.66531858

Order No: 23031500632

ERIS



Year: 1943
Source: USGS
Scale: 1" = 600'
Comment:

Address: David D Terry Lock and Dam, Little Rock, AR
Approx Center: -92.15346911,34.66531858

Order No: 23031500632

ERIS

Year: 1937
Source: ASCS
Scale: 1" = 600'
Comment:

Address: David D Terry Lock and Dam, Little Rock, AR
Approx Center: -92.15346911,34.66531858

Order No: 23031500632

ERIS

ERIS

TOPOGRAPHIC MAPS

Project Property:	David D Terry Lock and Dam David D Terry Lock and Dam Little Rock AR 72142
Project No:	W45XMA30722547
Requested By:	US Army Corps of Engineers
Order No:	23031500632
Date Completed:	March 16, 2023

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We have searched USGS collections of current topographic maps and historical topographic maps for the project property. Below is a list of maps found for the project property and adjacent area. Maps are from 7.5 and 15 minute topographic map series, if available.

Year	**Map Series**
2020	7.5
2017	7.5
2014	7.5
1994	7.5
1986	7.5
1975	7.5
1970	7.5
1961	7.5
1954	7.5
1945	7.5
1935	7.5

Topographic Map Symbology for the maps may be available in the following documents:

Pre-1947

Page 223 of 1918 Topographic Instructions

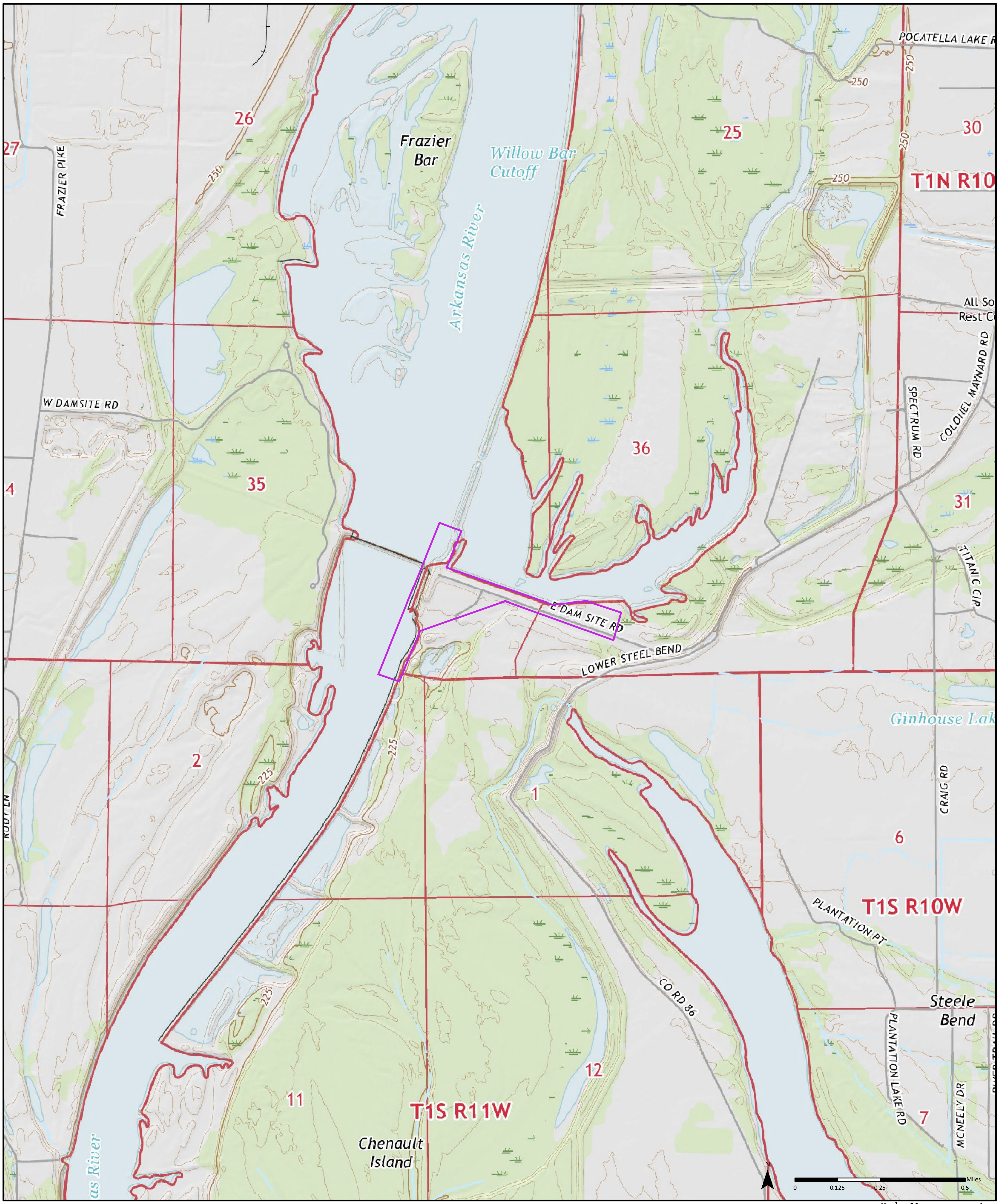
Page 130 of 1928 Topographic Instructions

1947-2009

Topographic Map Symbols

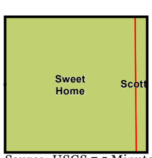
2009-present

US Topo Map Symbols



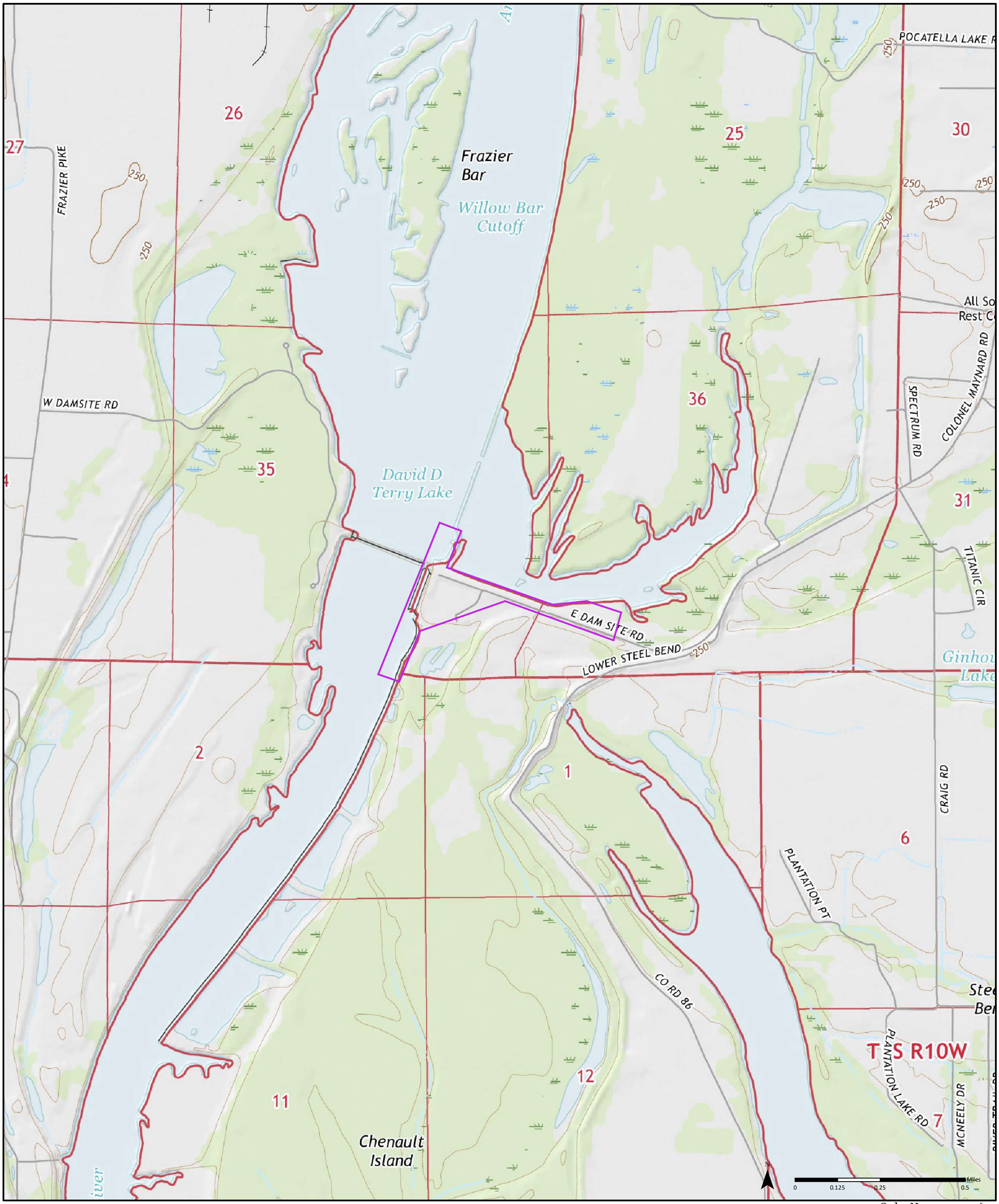
Order No. 23031500632

2020



Available Quadrangle(s): Sweet Home, AR

Source: USGS 7.5 Minute Topographic Map



Order No. 23031500632

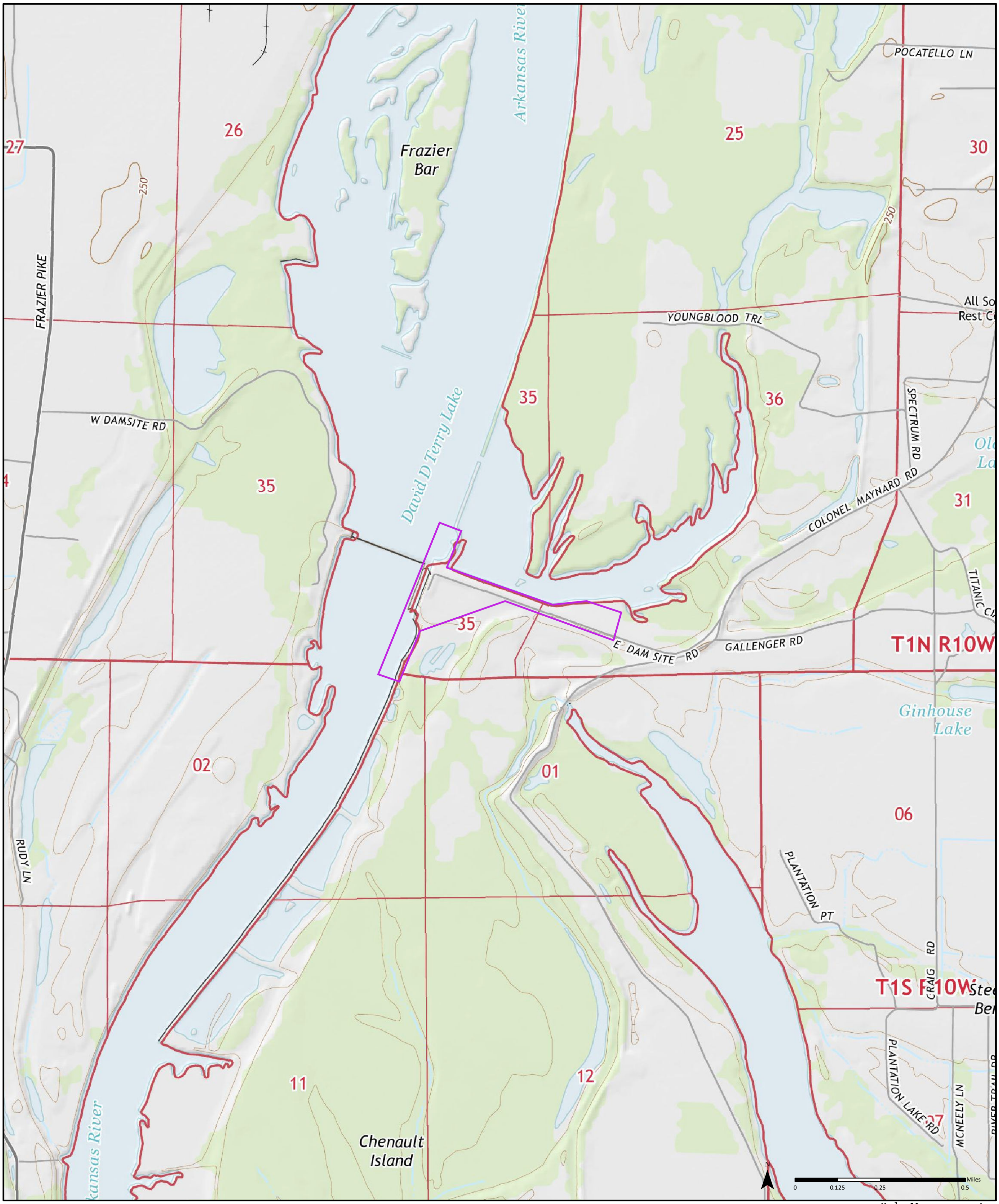
2017

Available Quadrangle(s): Sweet Home, AR

Sweet Home

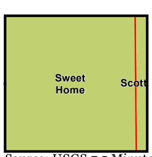
Scott

Source: USGS 7.5 Minute Topographic Map



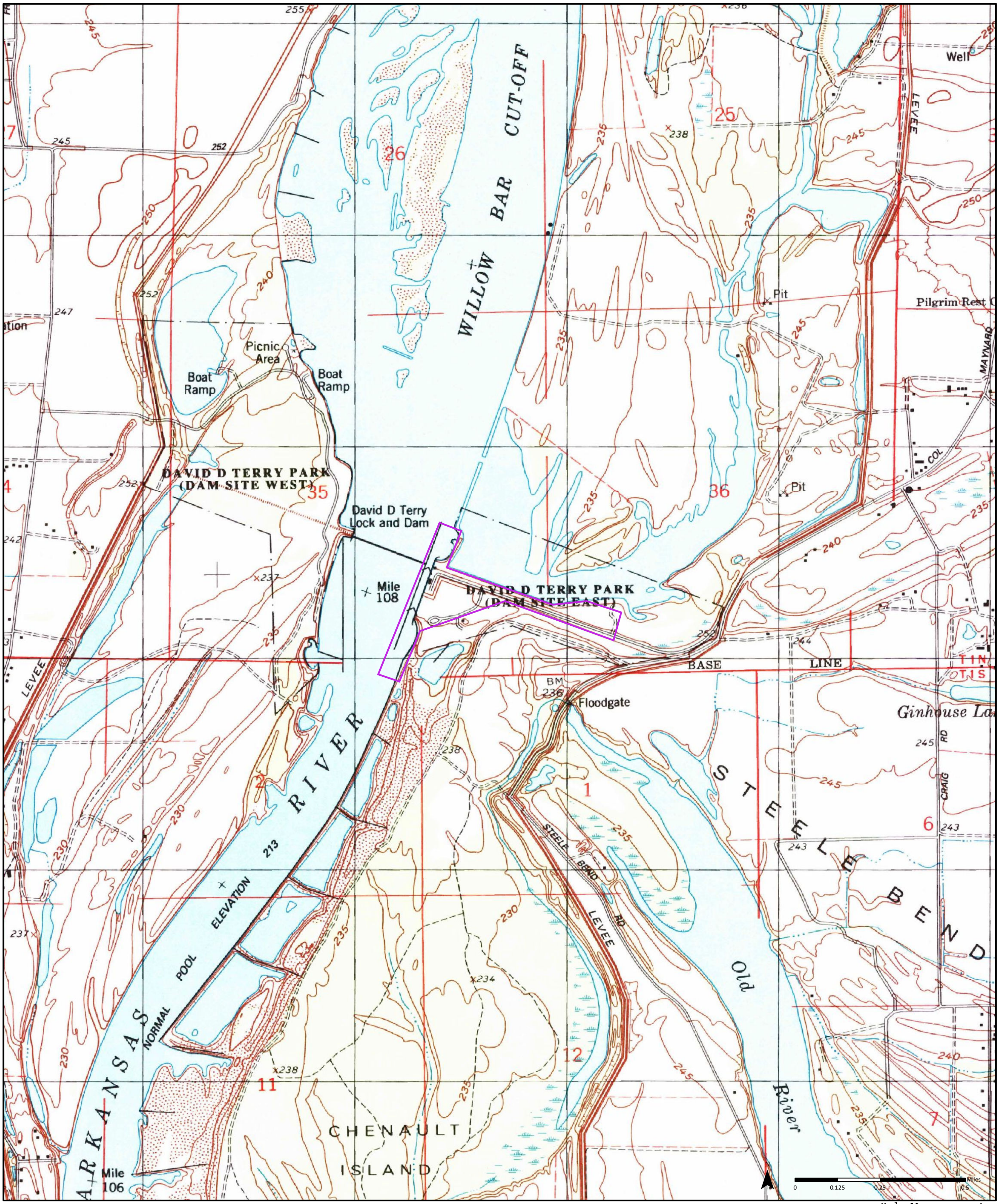
Order No. 23031500632

2014



Available Quadrangle(s): Sweet Home, AR

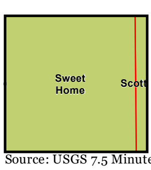
Source: USGS 7.5 Minute Topographic Map



Order No. 23031500632

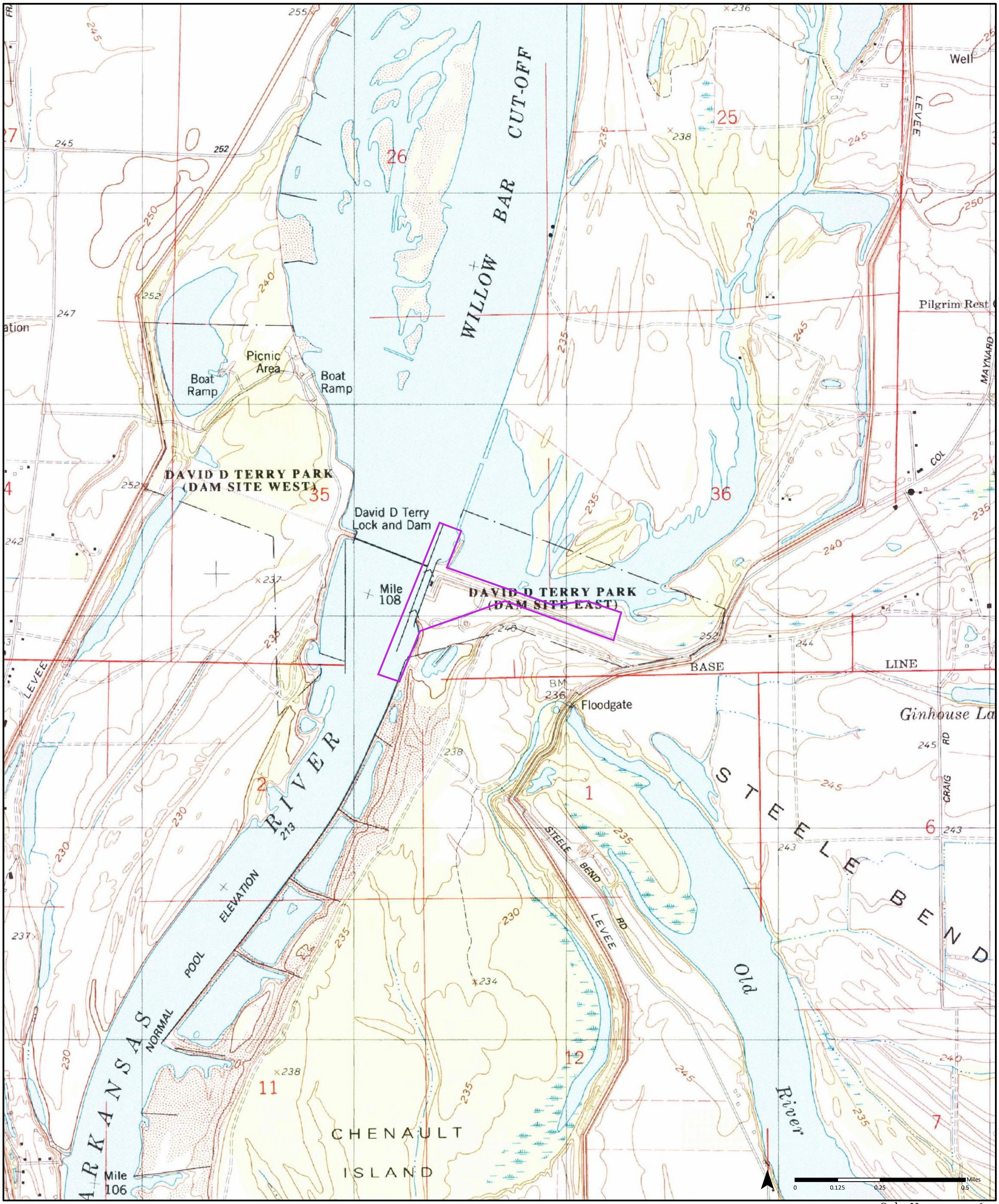
1994

(1-1994)
Aerial Photo Year: 1994



Available Quadrangle(s): Sweet Home, AR(1-1994)

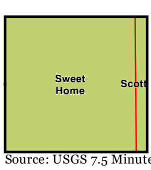
Source: USGS 7.5 Minute Topographic Map



1986

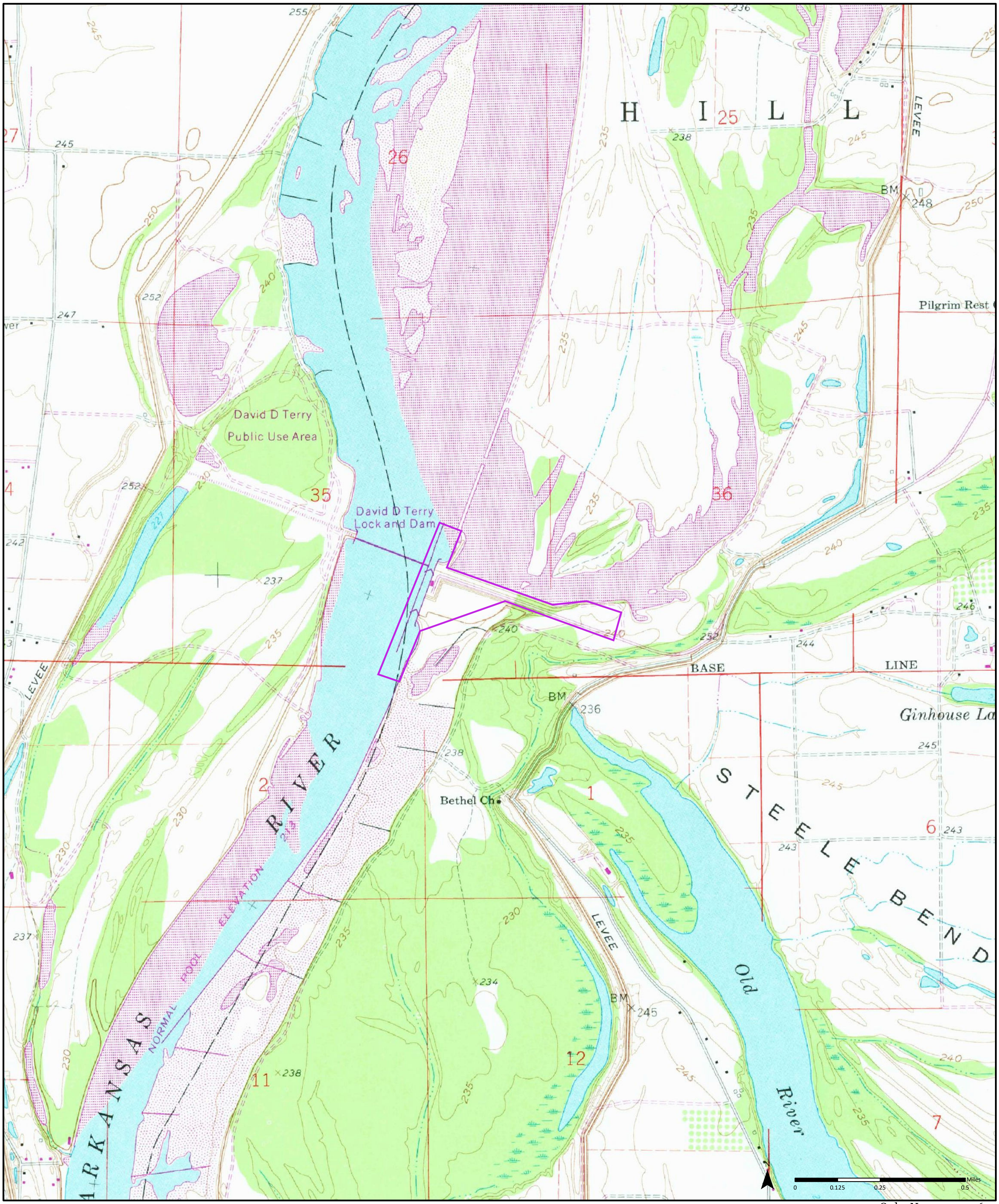
(1-1986)
Aerial Photo Year: 1984

Order No. 23031500632



Available Quadrangle(s): Sweet Home, AR(1-1986)

Source: USGS 7.5 Minute Topographic Map

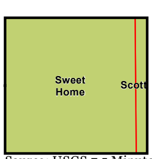


1975

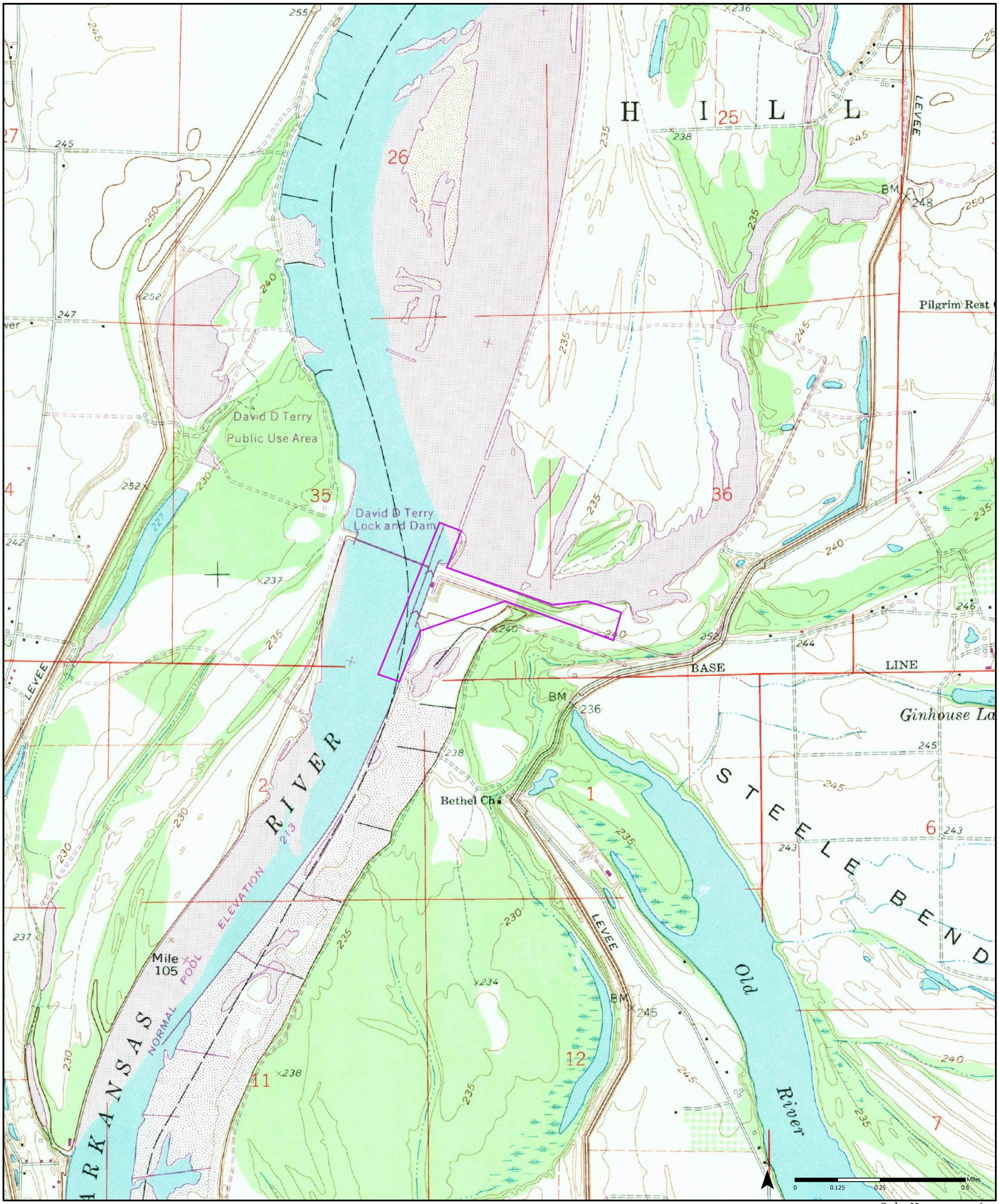
(1-1975)
Aerial Photo Year: 1975
Photo Revision Year: 1975

Order No. 23031500632

Available Quadrangle(s): Sweet Home, AR(1-1975)



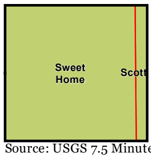
Source: USGS 7.5 Minute Topographic Map



1970

(1-1970)
Aerial Photo Year: 1970
Photo Revision Year: 1970

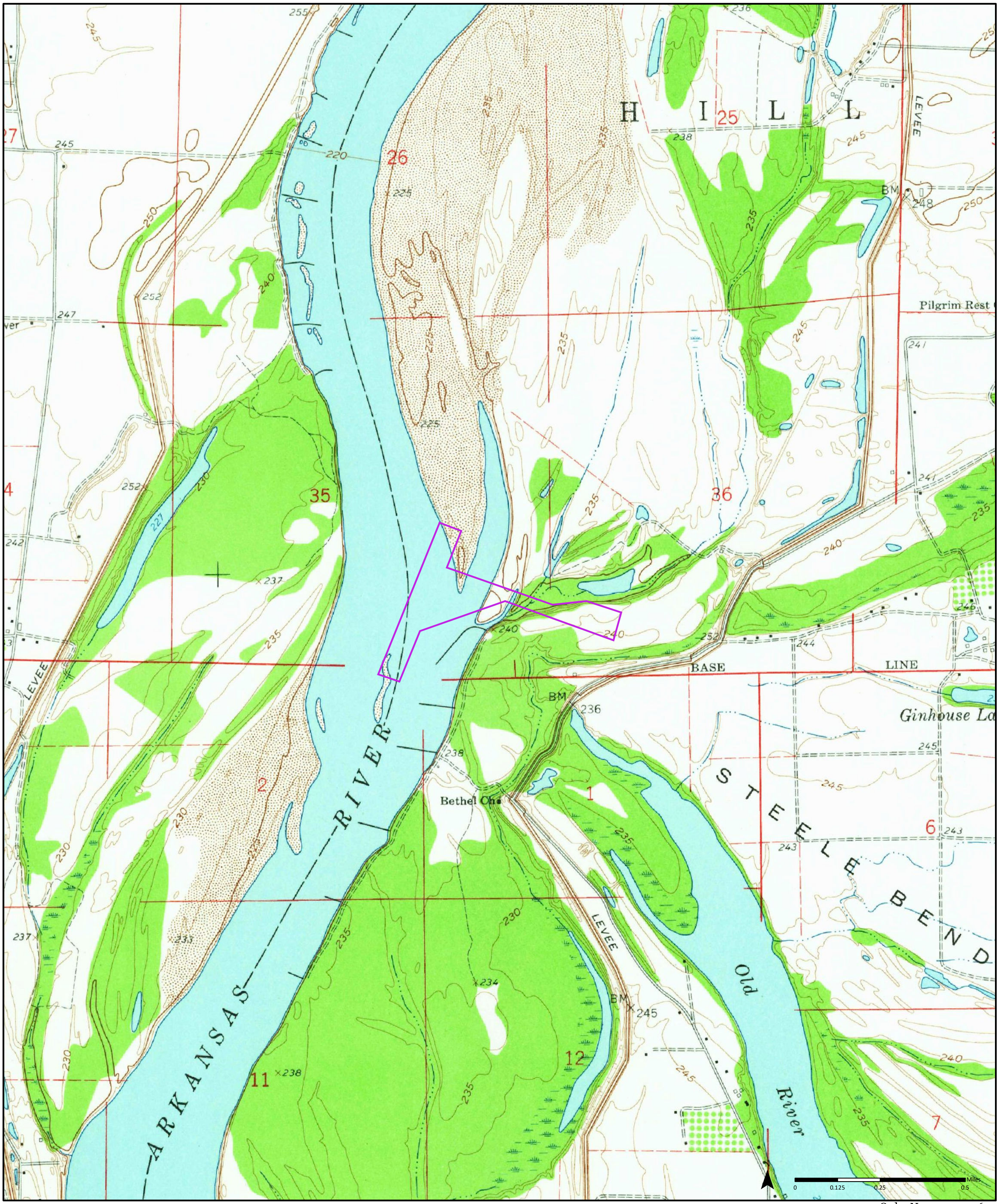
Order No. 23031500632



Available Quadrangle(s): Sweet Home, AR(1-1970)

ERIS

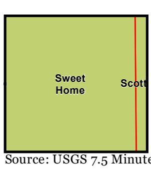
Source: USGS 7.5 Minute Topographic Map



1961

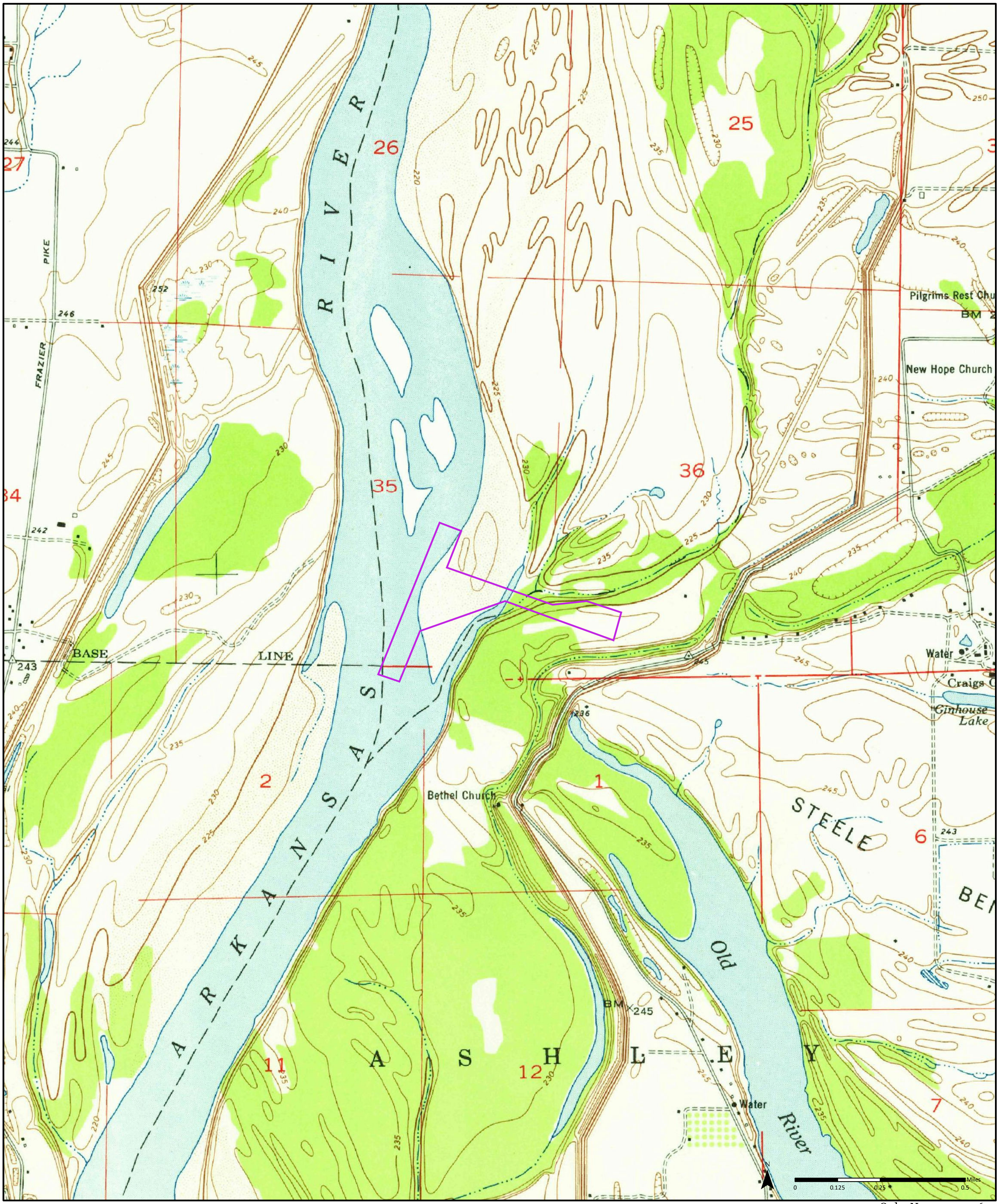
(1-1961)
Aerial Photo Year: 1960

Order No. 23031500632



Available Quadrangle(s): Sweet Home, AR(1-1961)

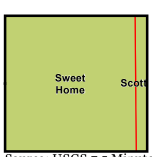
Source: USGS 7.5 Minute Topographic Map



1954

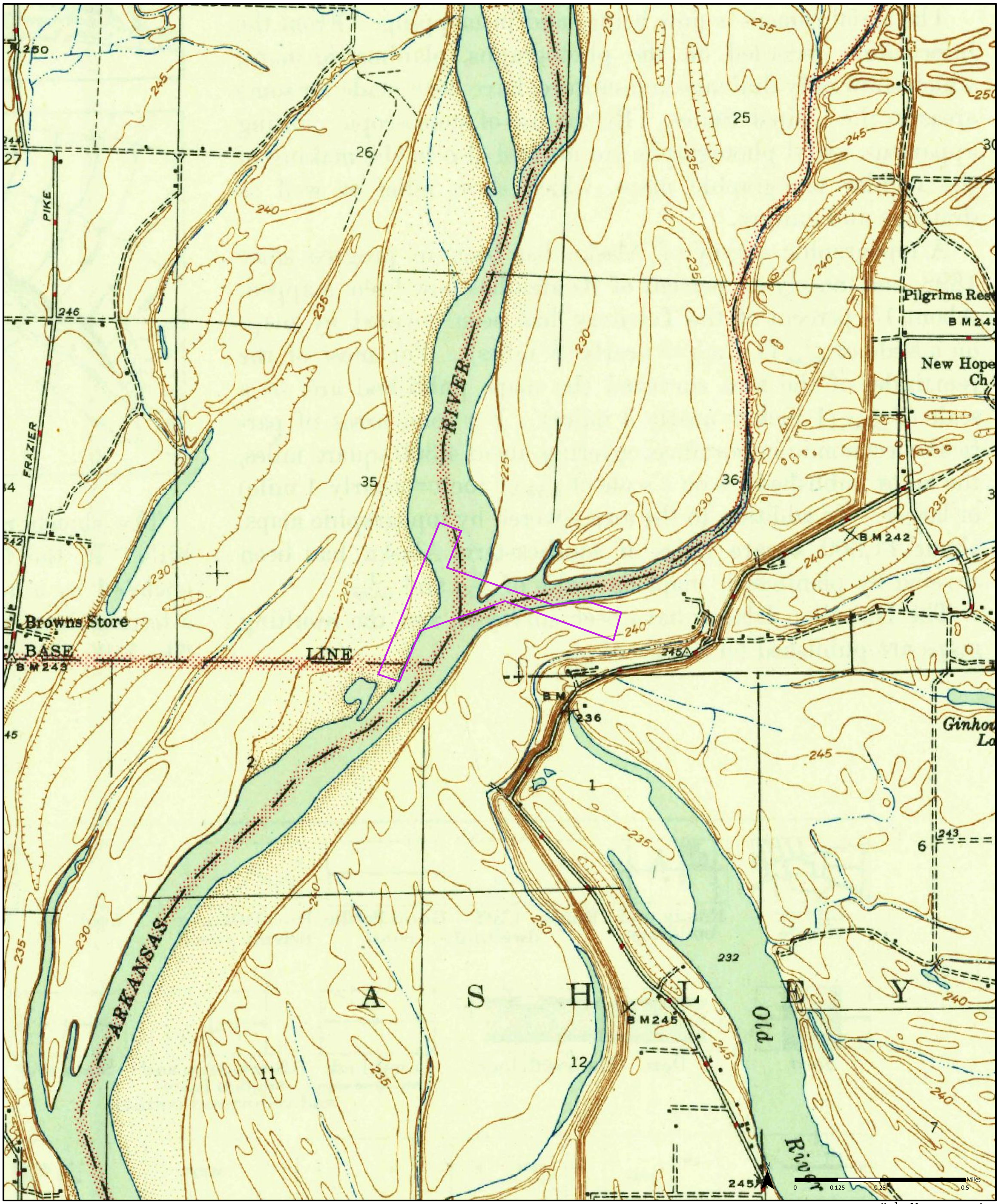
(1-1954)
Aerial Photo Year: 1954

Order No. 23031500632



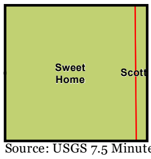
Available Quadrangle(s): Sweet Home, AR(1-1954)

Source: USGS 7.5 Minute Topographic Map



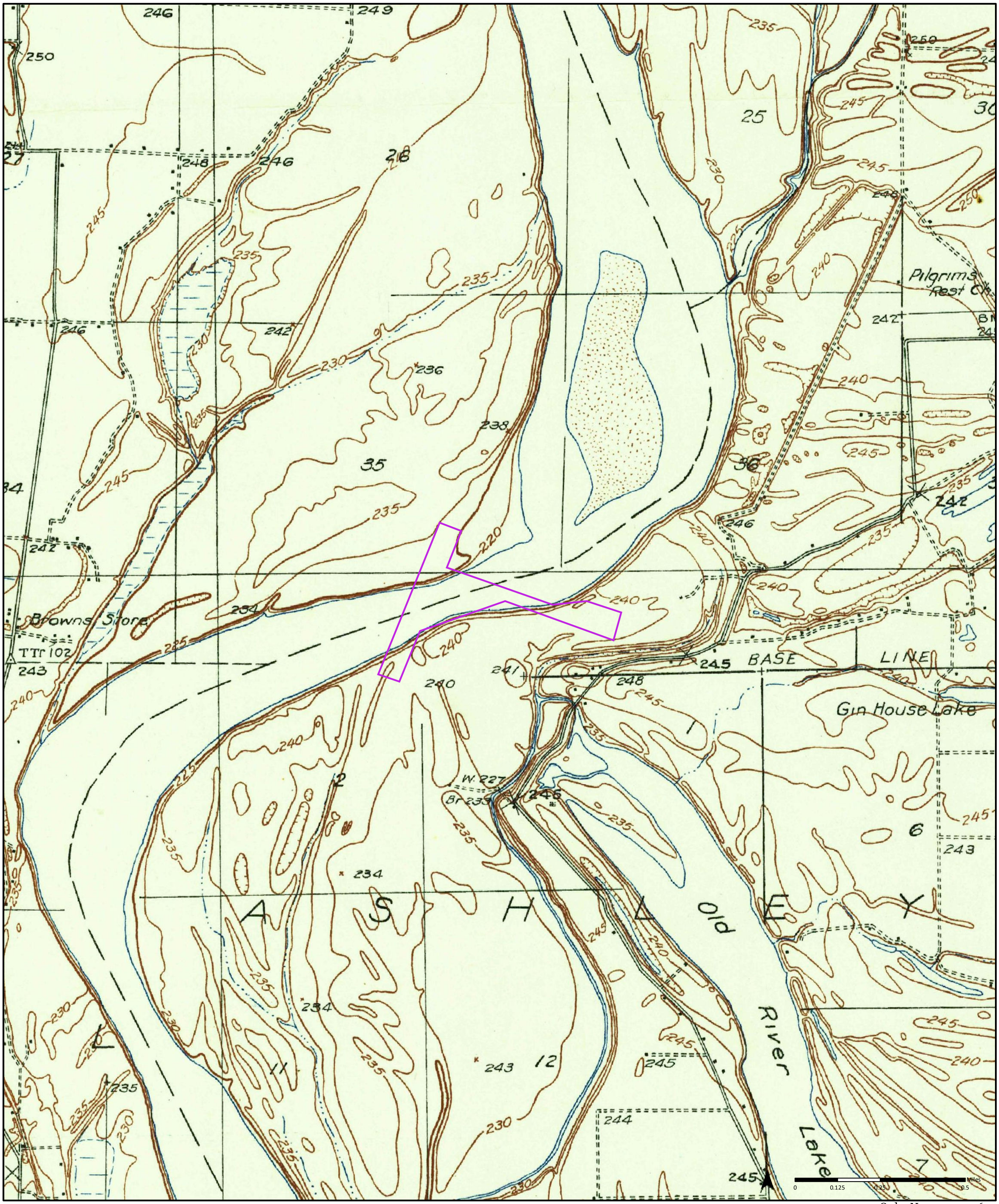
Order No. 23031500632

1945



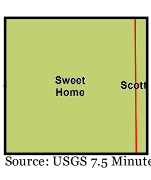
Available Quadrangle(s): Sweet Home, AR

Source: USGS 7.5 Minute Topographic Map



Order No. 23031500632

1935



Available Quadrangle(s): Sweet Home, AR

Source: USGS 7.5 Minute Topographic Map

Property Information

Order Number:	23031500632p
Date Completed:	March 16, 2023
Project Number:	W45XMA30722547
Project Property:	David D Terry Lock and Dam David D Terry Lock and Dam Little Rock AR 72142
Coordinates:	
Latitude:	34.66531858
Longitude:	-92.15346911
UTM Northing:	3836255.10303 Meters
UTM Easting:	577561.554991 Meters
UTM Zone:	UTM Zone 15S
Elevation:	234.95 ft
Slope Direction:	SSW

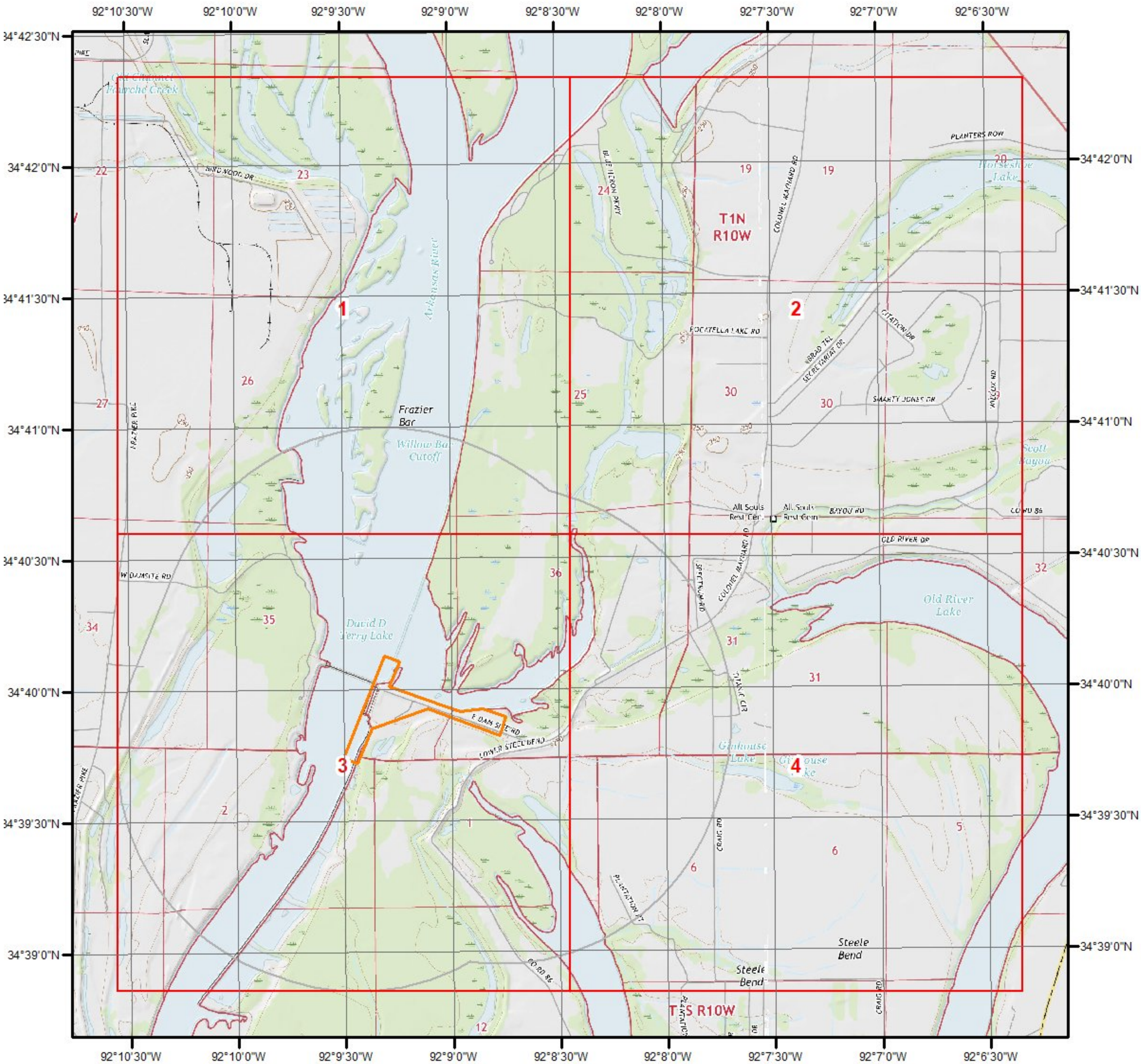
The ERIS ***Physical Setting Report - PSR*** provides comprehensive information about the physical setting around a site and includes a complete overview of topography and surface topology, in addition to hydrologic, geologic and soil characteristics. The location and detailed attributes of oil and gas wells, water wells, public water systems and radon are also included for review.

The compilation of both physical characteristics of a site and additional attribute data is useful in assessing the impact of migration of contaminants and subsequent impact on soils and groundwater.

Disclaimer

This Report does not provide a full environmental evaluation for the site or adjacent properties. Please see the terms and disclaimer at the end of the Report for greater detail.

Topographic Information



0 0.2 0.4 0.8 1.2 1.6 Miles

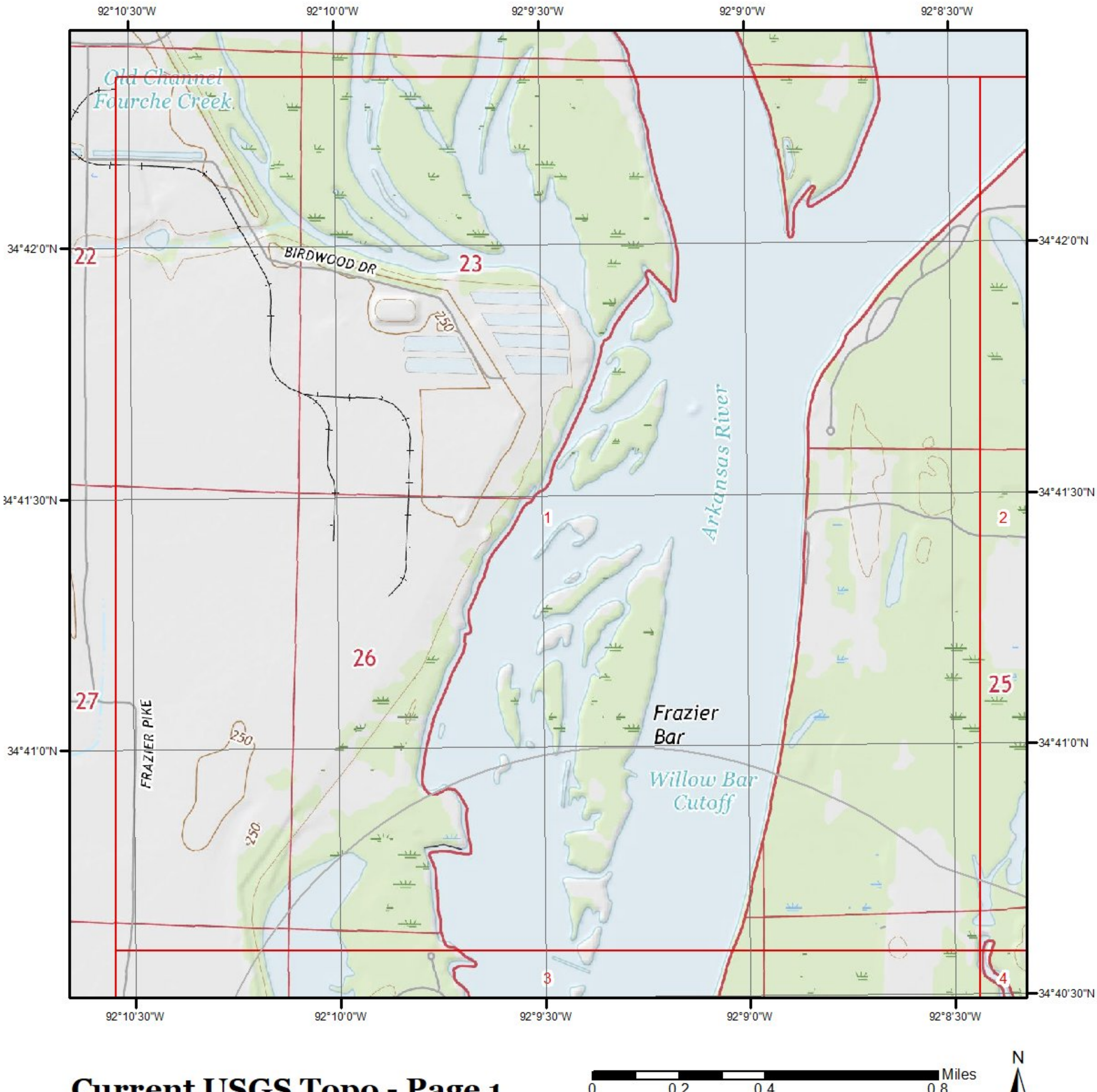
N

Current USGS Topo (2017)

Quadrangle(s): Keo,AR; Scott,AR; Sweet Home,AR; Woodson,AR

Source: USGS 7.5 Minute Topographic Map

Topographic Information

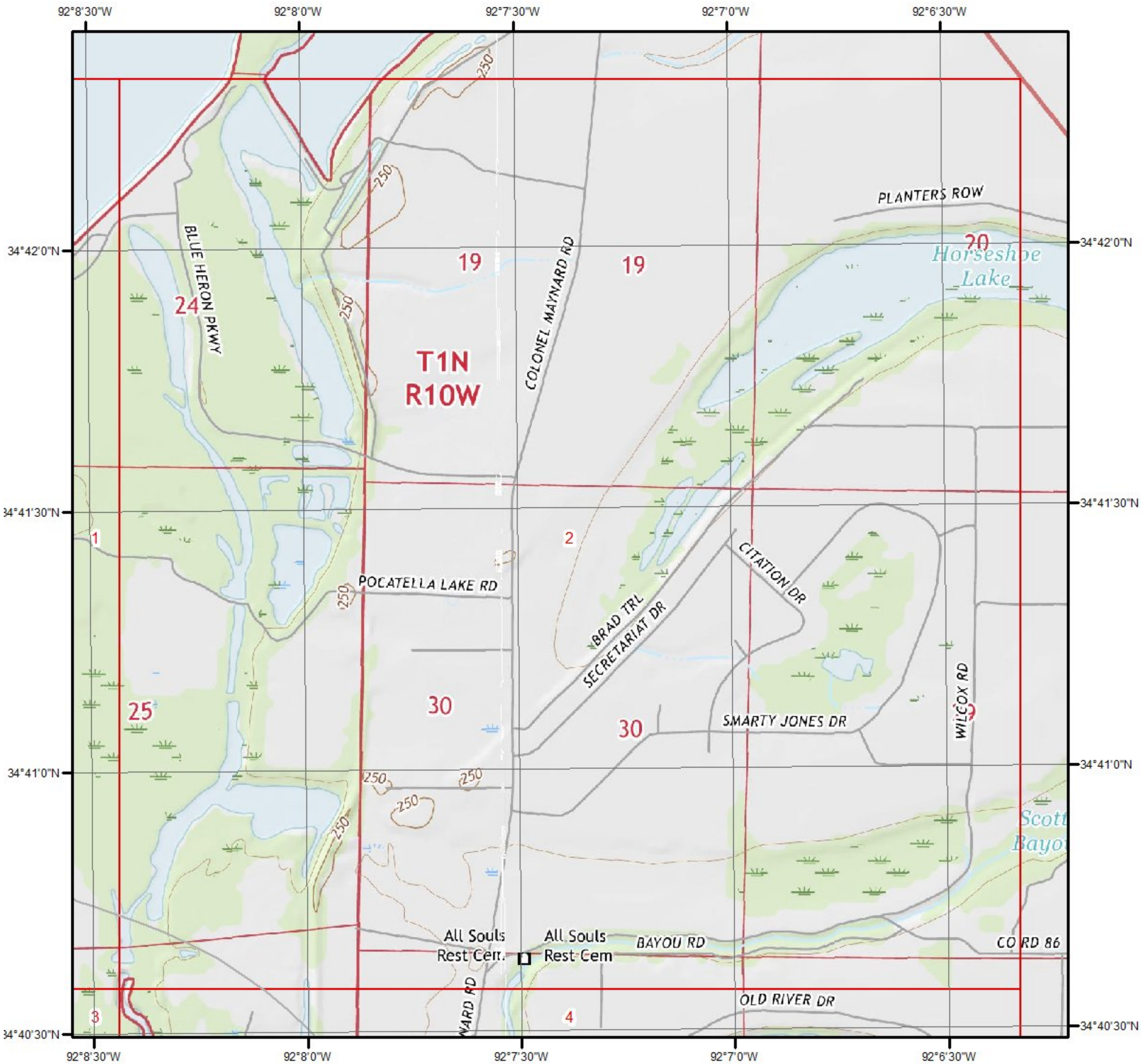


Current USGS Topo - Page 1

Quadrangle(s): Sweet Home,AR

Source: USGS 7.5 Minute Topographic Map

Topographic Information



Current USGS Topo - Page 2

0 0.2 0.4 0.8 Miles

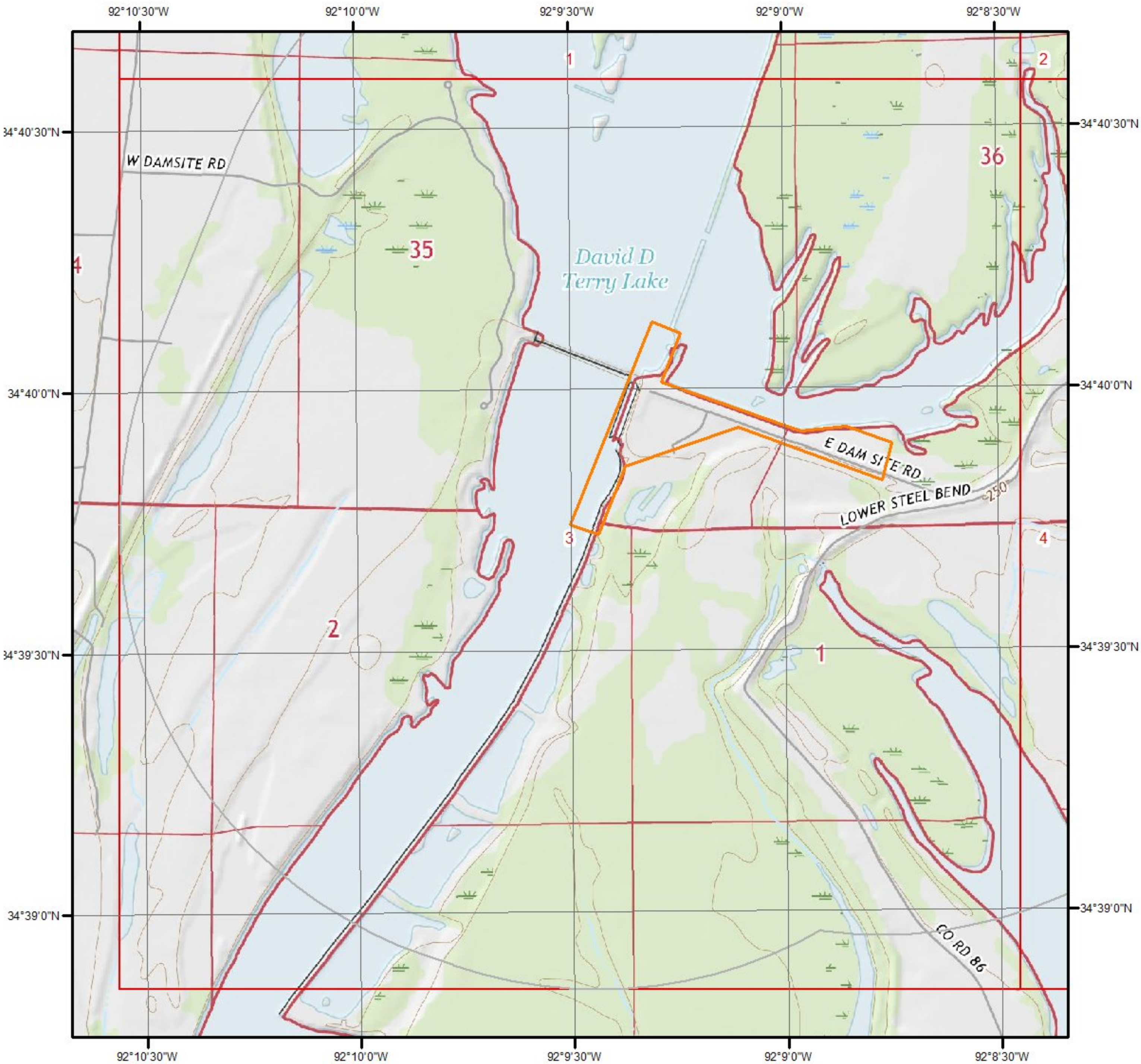
N

Quadrangle(s): Scott,AR; Sweet Home,AR

Source: USGS 7.5 Minute Topographic Map

ERIS

Topographic Information



0 0.2 0.4 0.8 Miles

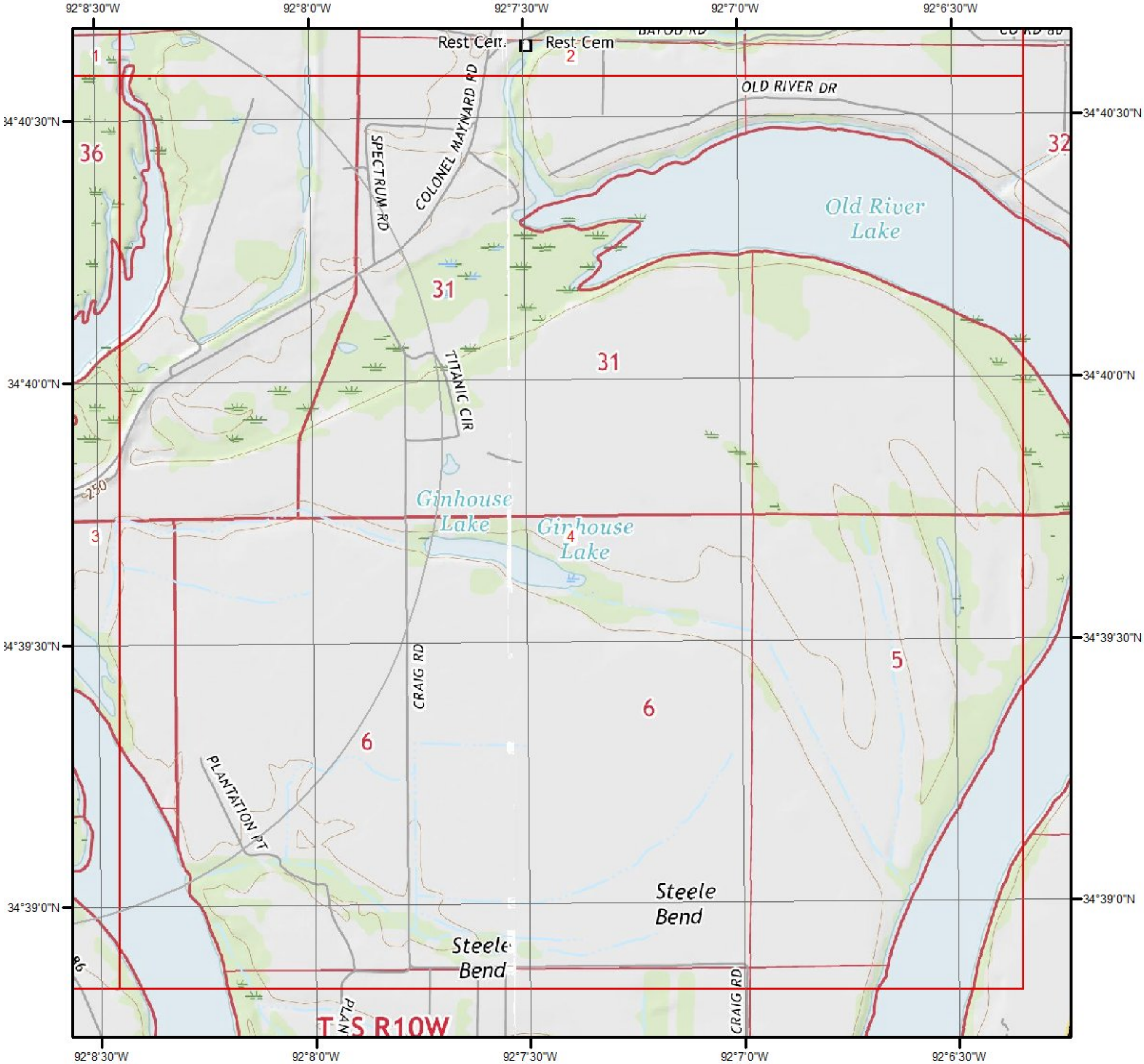
N

Current USGS Topo - Page 3

Quadrangle(s): Sweet Home,AR

Source: USGS 7.5 Minute Topographic Map

Topographic Information



Current USGS Topo - Page 4

Quadrangle(s): Scott,AR; Sweet Home,AR

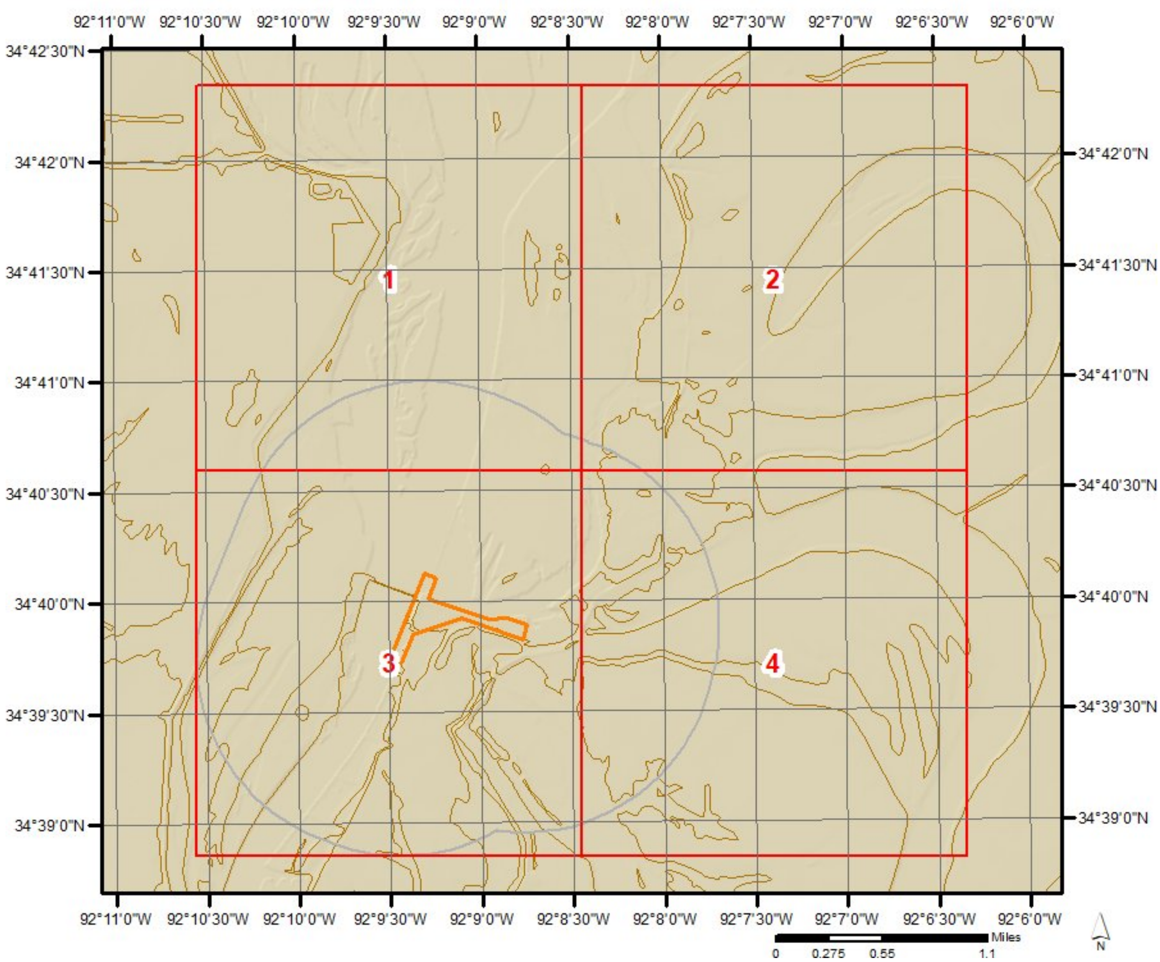
Source: USGS 7.5 Minute Topographic Map

Topographic Information

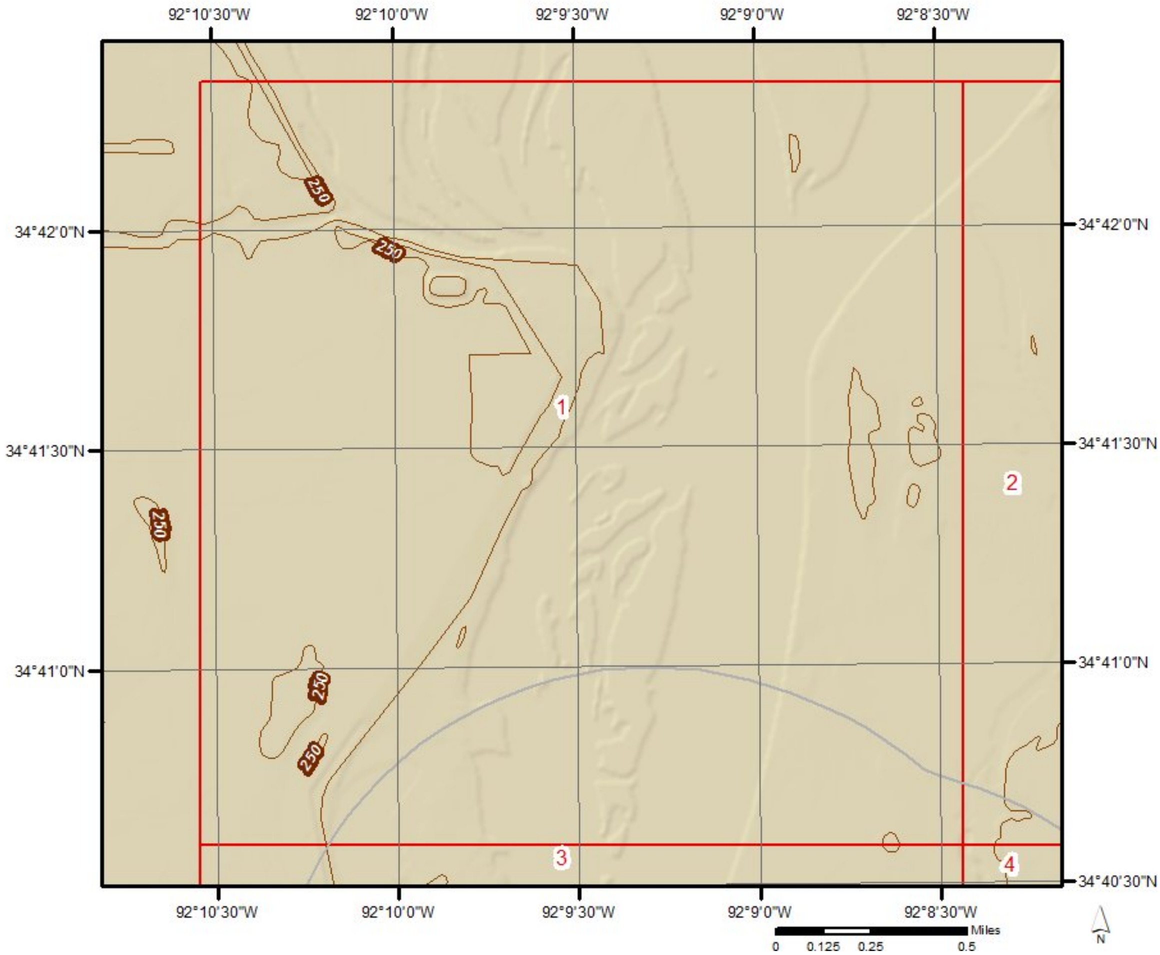
The previous topographic map(s) are created by seamlessly merging and cutting current USGS topographic data. Below are shaded relief map(s), derived from USGS elevation data to show surrounding topography in further detail.

Topographic information at project property:

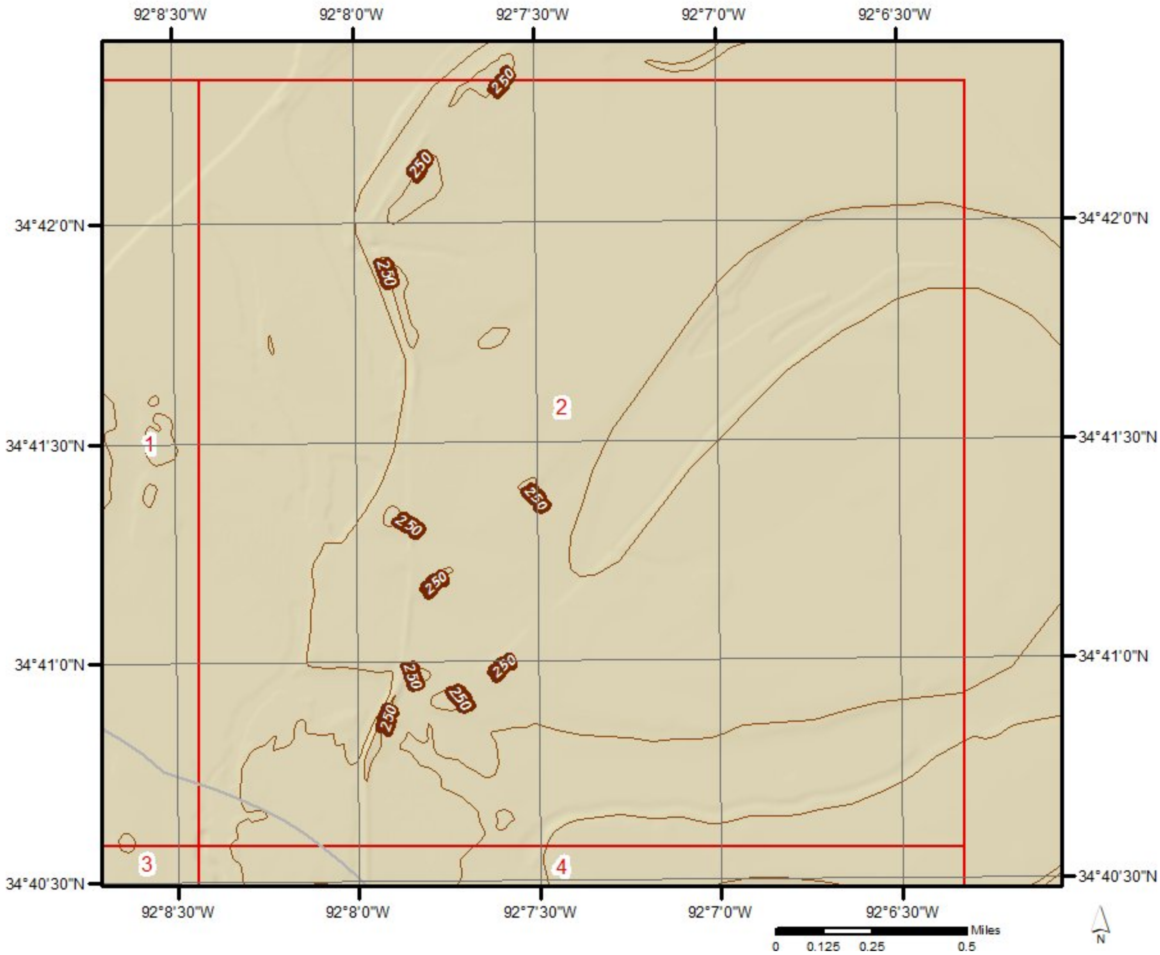
Elevation:	234.95 ft
Slope Direction:	SSW



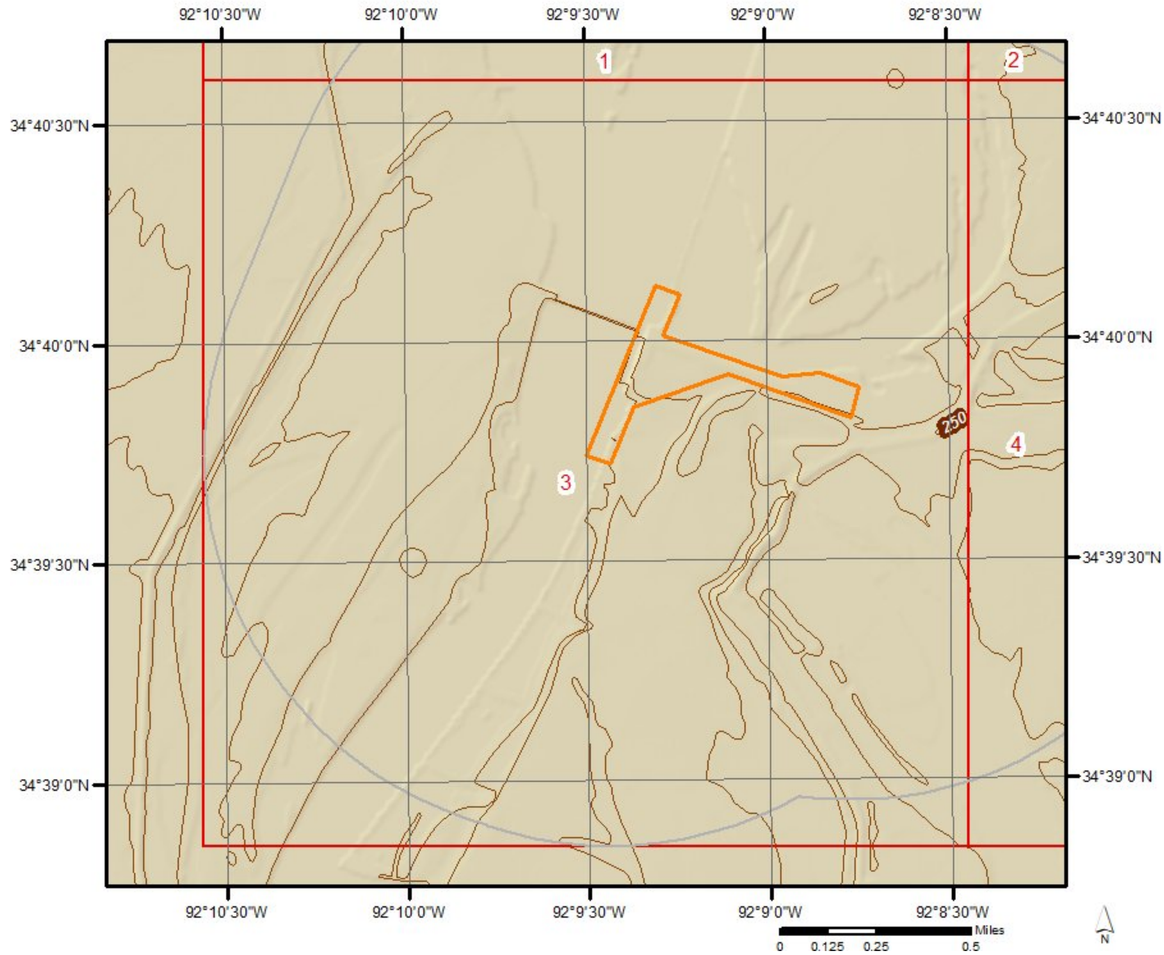
Topographic Information



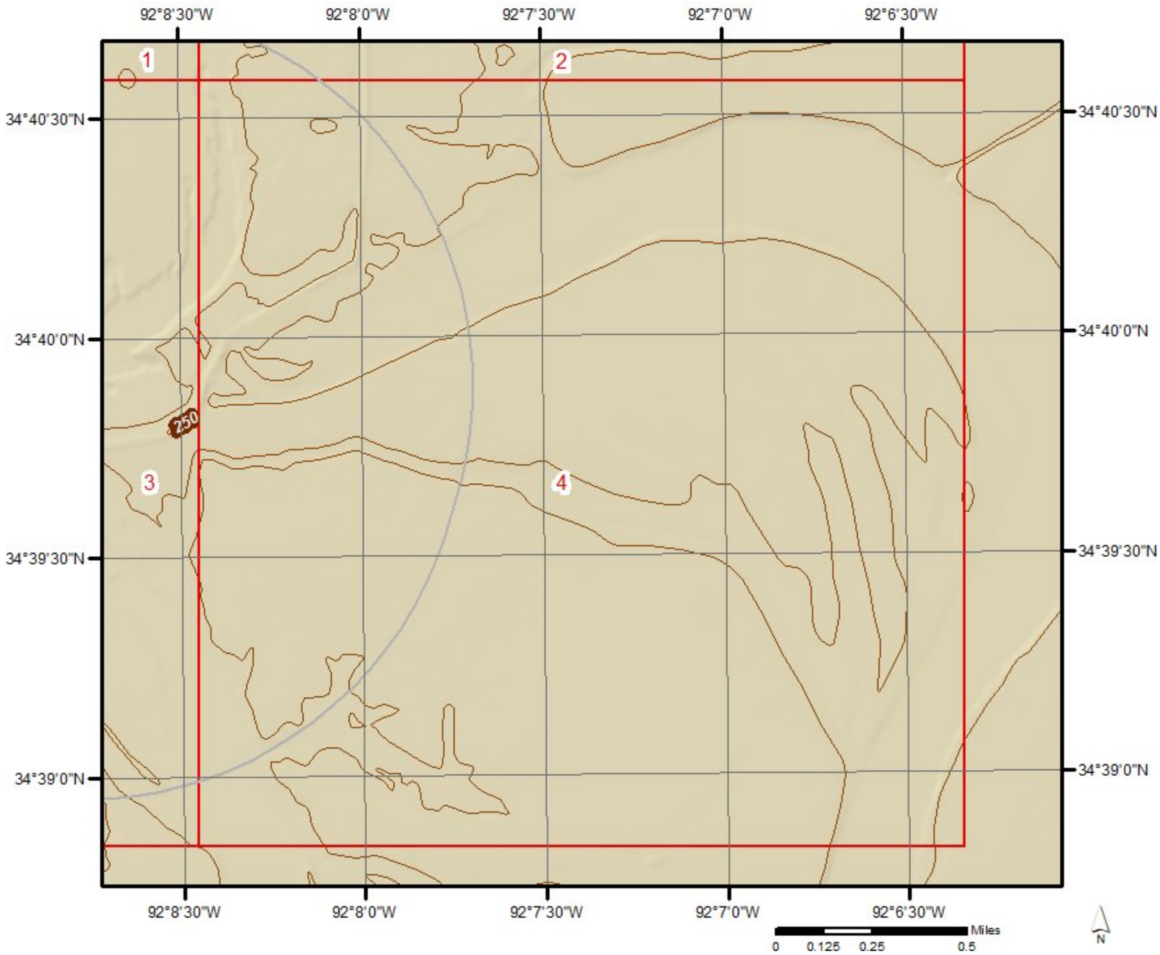
Topographic Information



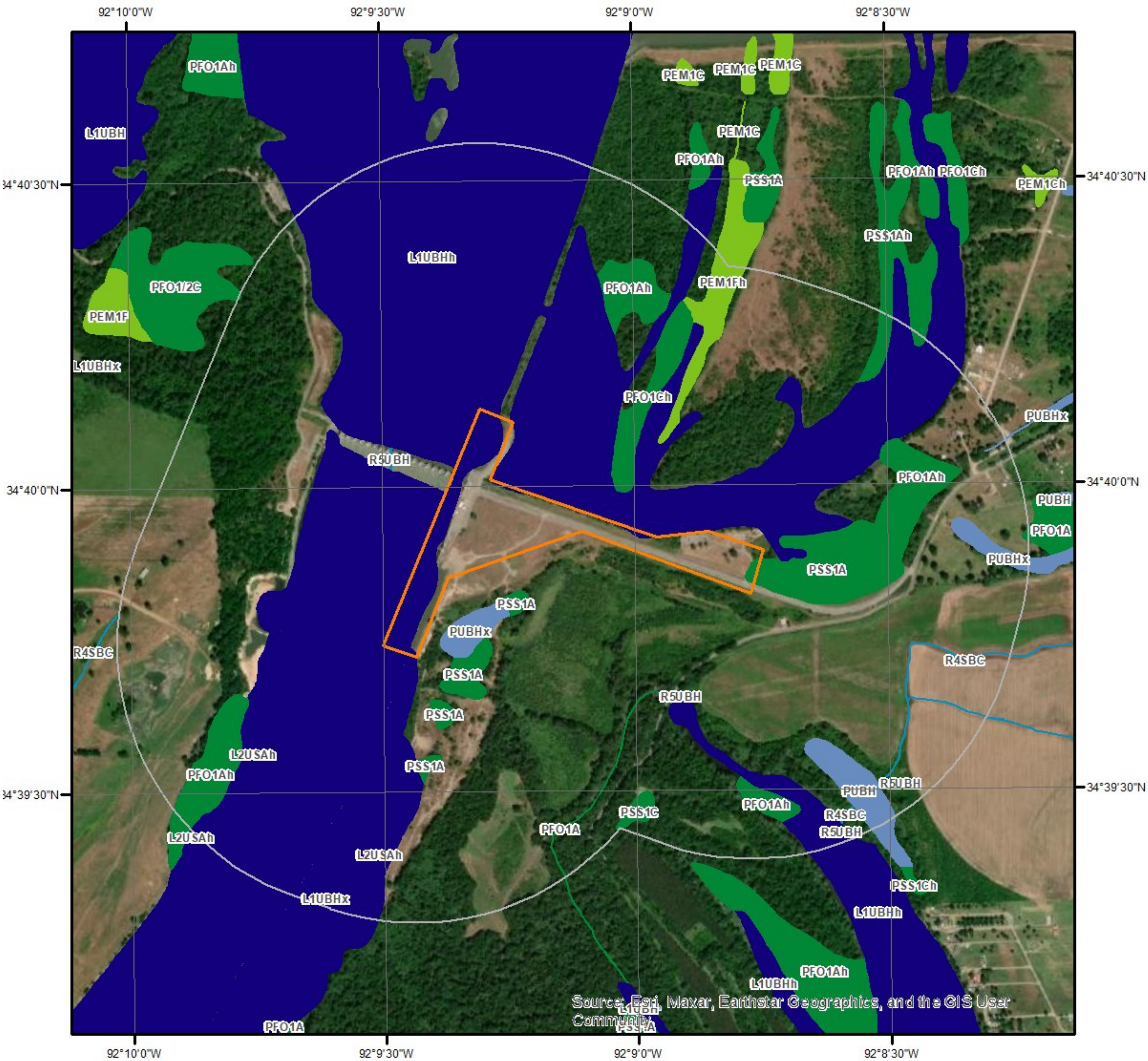
Topographic Information



Topographic Information



Hydrologic Information



Wetland

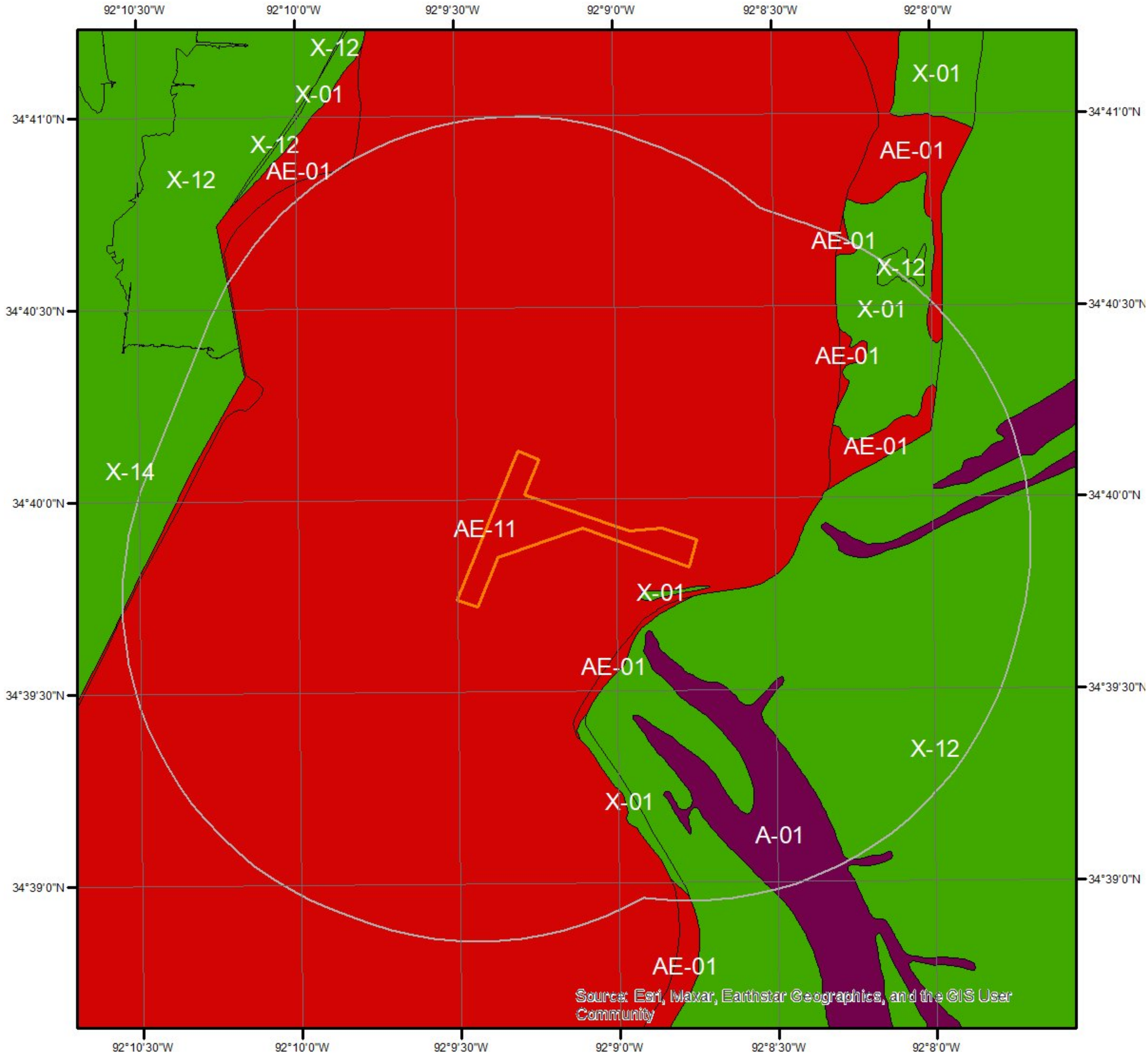
0 0.125 0.25 0.5 Miles

N

This map shows wetland existence using data from US Fish & Wildlife.
Data coverage is shown to the right. Gray indicates no data available in the area.

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

Hydrologic Information



Flood Hazard Zones

0 0.2 0.4 Miles

This map shows FEMA flood hazard zones. FIRM panels are shown to the right, and blank indicates no data is available.

- A
- A99
- AE
- AH
- AO
- V
- VE
- D
- X
- OPEN WATER
- NOT POPULATED
- AREA NOT INCLUDED

N

Quadrangle(s): Keo,AR; Scott,AR; Sweet Home,AR; Woodson,AR

Hydrologic Information

The Wetland Type map shows wetland existence overlaid on an aerial imagery. The Flood Hazard Zones map shows FEMA flood hazard zones overlaid on an aerial imagery. Relevant FIRM panels and detailed zone information is provided below.
For detailed Zone descriptions please click the link: https://floodadvocate.com/fema-zone-definitions

Available FIRM Panels in area:	05119C0495G(effective:2015-07-06)

Flood Zone A-01

Zone:	A
Zone subtype:	

Flood Zone AE-01

Zone:	AE
Zone subtype:	

Flood Zone AE-11

Zone:	AE
Zone subtype:	FLOODWAY

Flood Zone X-01

Zone:	X
Zone subtype:	0.2 PCT ANNUAL CHANCE FLOOD HAZARD

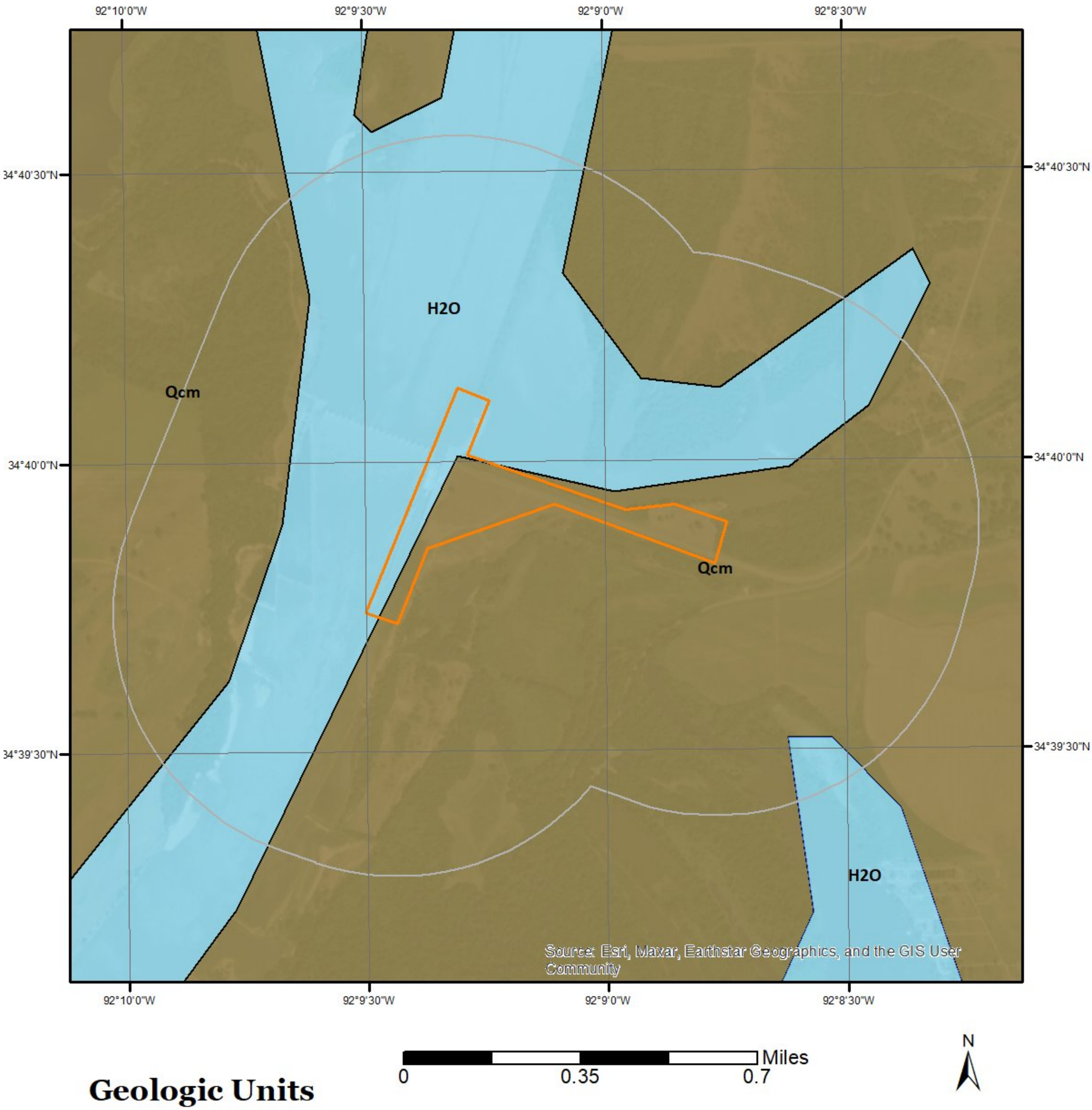
Flood Zone X-12

Zone:	X
Zone subtype:	AREA OF MINIMAL FLOOD HAZARD

Flood Zone X-14

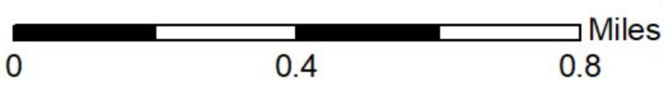
Zone:	X
Zone subtype:	AREA WITH REDUCED FLOOD RISK DUE TO LEVEE

Geologic Information



Geologic Units

This maps shows geologic units in the area. Please refer to the report for detailed descriptions.



Geologic Information

The previous page shows USGS geology information. Detailed information about each unit is provided below.

Geologic Unit H2O

Unit Name:	Water
Unit Age:	None
Primary Rock Type:	water
Secondary Rock Type:	
Unit Description:	No description available.

Geologic Unit Qcm

Unit Name:	Alluvium - Alluvial deposits in major stream channels or in mappable meanders of major streams
Unit Age:	Phanerozoic | Cenozoic | Quaternary | Holocene
Primary Rock Type:	alluvium
Secondary Rock Type:	
Unit Description:	Alluvial deposits in major stream channels or in mappable meanders of major streams - Includes alluvial deposits in natural levees in some areas.

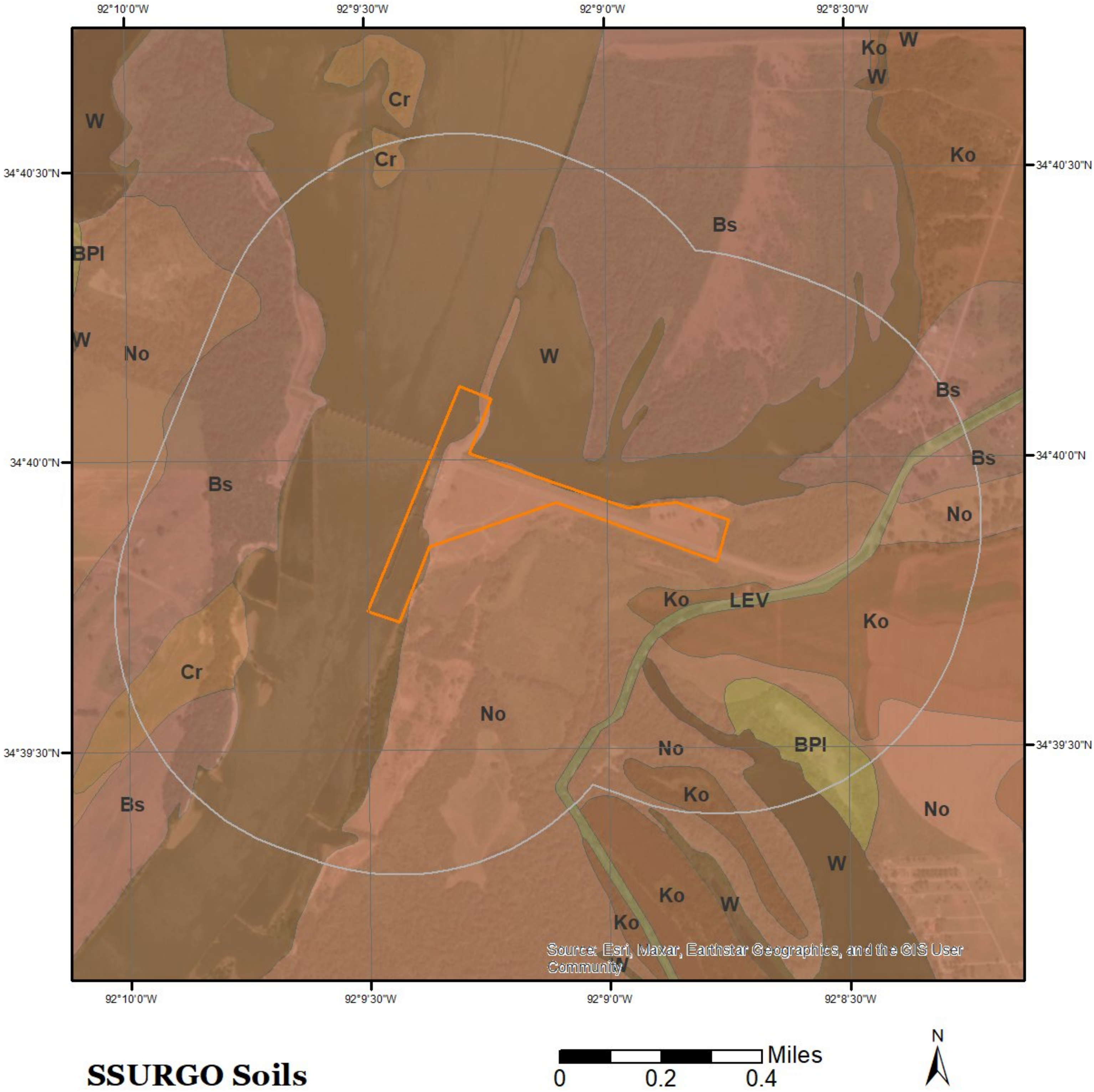
Geologic Unit Qcm

Unit Name:	Alluvium - Alluvial deposits in major stream channels or in mappable meanders of major streams
Unit Age:	Phanerozoic | Cenozoic | Quaternary | Holocene
Primary Rock Type:	alluvium
Secondary Rock Type:	
Unit Description:	Alluvial deposits in major stream channels or in mappable meanders of major streams - Includes alluvial deposits in natural levees in some areas.

Geologic Unit H2O

Unit Name:	Water
Unit Age:	None
Primary Rock Type:	water
Secondary Rock Type:	
Unit Description:	No description available.

Soil Information



SSURGO Soils

This maps shows SSURGO soil units around the target property. Please refer to the report for detailed soil descriptions.

Soil Information

The previous page shows a soil map using SSURGO data from USDA Natural Resources Conservation Service. Detailed information about each unit is provided below.

Map Unit BPI (0.14%)

Map Unit Name:	Pits, borrow

No more attributes available for this map unit

Component Description:

Minor map unit components are excluded from this report.

Map Unit: BPI - Pits, borrow

Component: Pits (100%)
Generated brief soil descriptions are created for major soil components. The Pits is a miscellaneous area.

Map Unit Bs (5.75%)

Map Unit Name:	Bruno fine sandy loam
Bedrock Depth - Min:	null
Watertable Depth - Annual Min:	153cm
Drainage Class - Dominant:	Excessively drained
Hydrologic Group - Dominant:	A - Soils in this group have low runoff potential when thoroughly wet. Water is transmitted freely through the soil.

Major components are printed below

Bruno(90%)

horizon A(0cm to 15cm)	Sandy loam
horizon C(15cm to 183cm)	Loamy fine sand

Component Description:

Minor map unit components are excluded from this report.

Map Unit: Bs - Bruno fine sandy loam

Component: Bruno (90%)
The Bruno component makes up 90 percent of the map unit. Slopes are 0 to 2 percent. This component is on natural levees, river valleys. The parent material consists of sandy alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is occasionally flooded. It is not ponded. A seasonal zone of water saturation is at 60 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 1 percent. This component is in the F131BY002AR Sandy Floodplain ecological site. Nonirrigated land capability classification is 3s. This soil does not meet hydric criteria.

Component: Aquents (10%)
Generated brief soil descriptions are created for major soil components. The Aquents soil is a minor component.

Map Unit Cr (0.18%)

Map Unit Name:	Crevasse fine sand
Bedrock Depth - Min:	null
Watertable Depth - Annual Min:	145cm
Drainage Class - Dominant:	Excessively drained

Soil Information

Hydrologic Group - Dominant:	A - Soils in this group have low runoff potential when thoroughly wet. Water is transmitted freely through the soil.

Major components are printed below

Crevasse(90%)

horizon A(0cm to 38cm)	Fine sand
horizon C(38cm to 183cm)	Sand

Component Description:

Minor map unit components are excluded from this report.

Map Unit: Cr - Crevasse fine sand

Component: Crevasse (90%)
The Crevasse component makes up 90 percent of the map unit. Slopes are 0 to 2 percent. This component is on natural levees, river valleys. The parent material consists of sandy alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is rarely flooded. It is not ponded. A seasonal zone of water saturation is at 57 inches during January, February, March, November, December. Organic matter content in the surface horizon is about 1 percent. This component is in the F131BY002AR Sandy Floodplain ecological site. Nonirrigated land capability classification is 4s. This soil does not meet hydric criteria.

Component: Aquents (10%)
Generated brief soil descriptions are created for major soil components. The Aquents soil is a minor component.

Map Unit Ko (6.44%)

Map Unit Name:	Keo silt loam
Bedrock Depth - Min:	null
Watertable Depth - Annual Min:	null
Drainage Class - Dominant:	Well drained
Hydrologic Group - Dominant:	B - Soils in this group have moderately low runoff potential when thoroughly wet. Water transmission through the soil is unimpeded.

Major components are printed below

Keo(90%)

horizon Ap(0cm to 25cm)	Silt loam
horizon Bw(25cm to 97cm)	Silt loam
horizon 2Ab(97cm to 104cm)	Very fine sandy loam
horizon 3C(104cm to 132cm)	Silt loam
horizon 4Ab(132cm to 152cm)	Silt loam

Component Description:

Minor map unit components are excluded from this report.

Map Unit: Ko - Keo silt loam, 0 to 1 percent slopes, rarely flooded

Component: Keo (95%)
The Keo component makes up 95 percent of the map unit. Slopes are 0 to 1 percent. This component is on flood plains, river valleys. The parent material consists of loamy alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is low. This soil is rarely flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. This component is in the F131BY003AR Loamy Floodplain ecological site. Nonirrigated land capability classification is 1. This soil does not meet hydric criteria. There are no saline horizons within 30 inches of the soil surface.

Component: Unnamed (5%)
Generated brief soil descriptions are created for major soil components. The Unnamed, hydric soil is a minor component.

Soil Information

Map Unit LEV (2.03%)

Map Unit Name:	Levee

No more attributes available for this map unit

Component Description:

Minor map unit components are excluded from this report.

Map Unit: LEV - Levee

Component: Levees (90%)
Generated brief soil descriptions are created for major soil components. The Levees is a miscellaneous area.

Component: Unnamed (10%)
Generated brief soil descriptions are created for major soil components. The Unnamed soil is a minor component.

Map Unit No (12.66%)

Map Unit Name:	Norwood silty clay loam
Bedrock Depth - Min:	null
Watertable Depth - Annual Min:	null
Drainage Class - Dominant:	Well drained
Hydrologic Group - Dominant:	B - Soils in this group have moderately low runoff potential when thoroughly wet. Water transmission through the soil is unimpeded.

Major components are printed below

Norwood(90%)

horizon A(0cm to 20cm)	Silty clay loam
horizon C1(20cm to 89cm)	Silty clay loam
horizon C2(89cm to 145cm)	Silt loam

Component Description:

Minor map unit components are excluded from this report.

Map Unit: No - Norwood silty clay loam

Component: Norwood (90%)
The Norwood component makes up 90 percent of the map unit. Slopes are 0 to 1 percent. This component is on natural levees, river valleys. The parent material consists of loamy alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is low. This soil is rarely flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This component is in the F131BY003AR Loamy Floodplain ecological site. Nonirrigated land capability classification is 1. Irrigated land capability classification is 1 This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 15 percent.

Component: Aquents (10%)
Generated brief soil descriptions are created for major soil components. The Aquents soil is a minor component.

Map Unit W (72.78%)

Map Unit Name:	Water

No more attributes available for this map unit

Component Description:

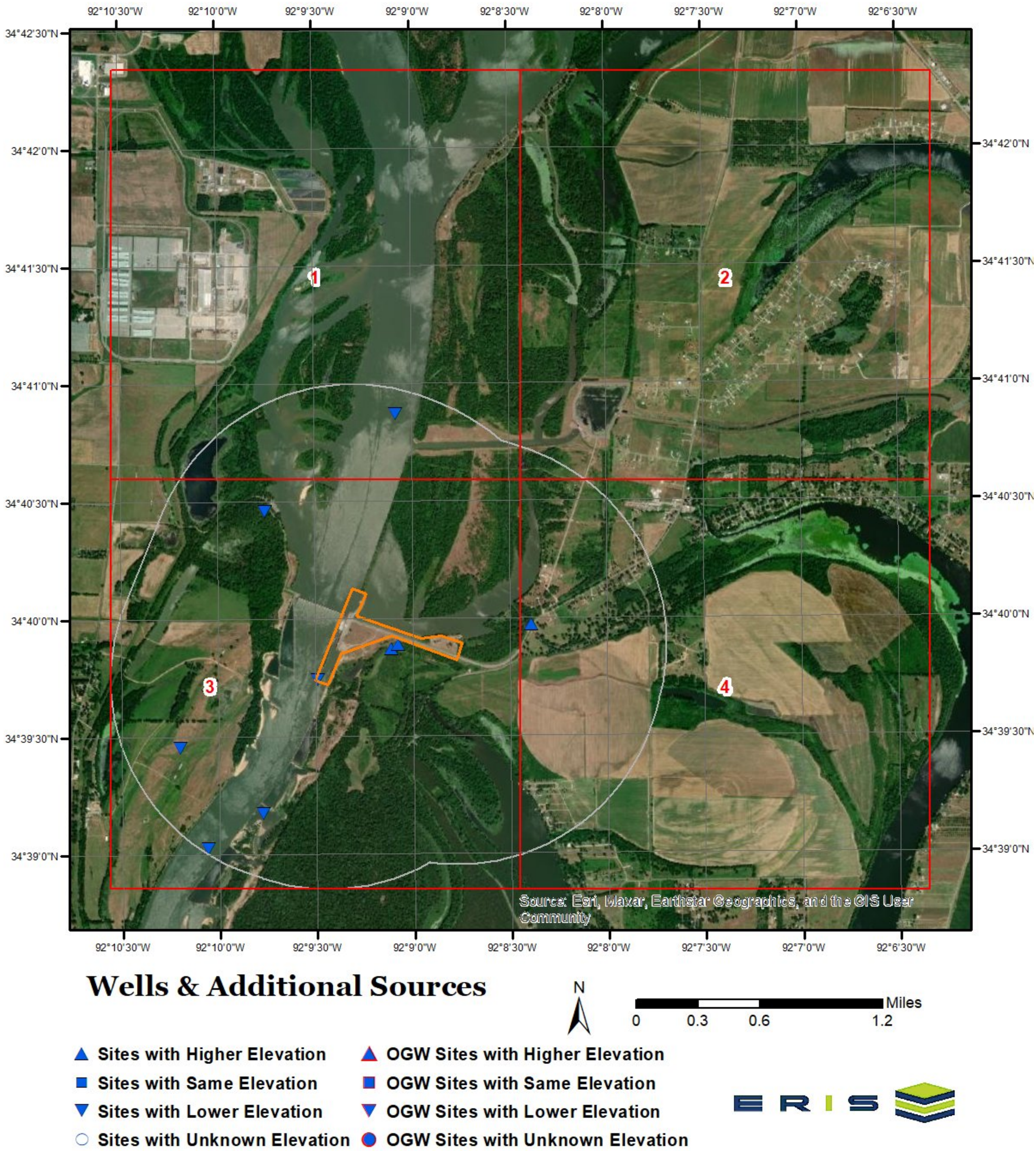
Minor map unit components are excluded from this report.

Map Unit: W - Water

Soil Information

Component: Water (100%)
Generated brief soil descriptions are created for major soil components. The Water is a miscellaneous area.

Wells and Additional Sources



Wells and Additional Sources

Wells & Additional Sources - Page 1

N

0 0.15 0.3 0.6 Miles

- Sites with Higher Elevation
- Sites with Same Elevation
- Sites with Lower Elevation
- Sites with Unknown Elevation
- OGW Sites with Higher Elevation
- OGW Sites with Same Elevation
- OGW Sites with Lower Elevation
- OGW Sites with Unknown Elevation

ERIS

Wells and Additional Sources

Wells & Additional Sources - Page 2

N

Miles
0 0.15 0.3 0.6

- ▲ Sites with Higher Elevation
- ■ Sites with Same Elevation
- ▼ Sites with Lower Elevation
- ○ Sites with Unknown Elevation
- ▲ OGW Sites with Higher Elevation
- ■ OGW Sites with Same Elevation
- ▼ OGW Sites with Lower Elevation
- ● OGW Sites with Unknown Elevation

ERIS

Wells and Additional Sources

Wells & Additional Sources - Page 3

N

0 0.15 0.3 0.6 Miles

- Sites with Higher Elevation
- Sites with Same Elevation
- Sites with Lower Elevation
- Sites with Unknown Elevation
- OGW Sites with Higher Elevation
- OGW Sites with Same Elevation
- OGW Sites with Lower Elevation
- OGW Sites with Unknown Elevation

ERIS

Wells and Additional Sources

Wells & Additional Sources - Page 4

N

0 0.15 0.3 0.6 Miles

- ▲ Sites with Higher Elevation
- ■ Sites with Same Elevation
- ▼ Sites with Lower Elevation
- ○ Sites with Unknown Elevation
- ▲ OGW Sites with Higher Elevation
- ■ OGW Sites with Same Elevation
- ▼ OGW Sites with Lower Elevation
- ● OGW Sites with Unknown Elevation

ERIS

Wells and Additional Sources Summary

Federal Sources

Public Water Systems Violations and Enforcement Data

Map Key	ID	Distance (ft)	Direction
	No records found		

Safe Drinking Water Information System (SDWIS)

Map Key	ID	Distance (ft)	Direction
	No records found		

USGS National Water Information System

Map Key	Site Number	Distance (ft)	Direction
1	USGS-343952092090601	298.89	ESE
2	USGS-343953092090401	146.00	ESE
3	USGS-343944092092901	0.00	-
4	USGS-343958092082301	1853.12	E
5	USGS-344027092094502	3006.81	NW
5	USGS-344027092094501	3006.81	NW
6	USGS-343910092094601	3704.92	SSW
8	USGS-07263620	4626.26	N
9	USGS-343901092100301	5167.61	SW

Wells from NWIS

Map Key	ID	Distance (ft)	Direction
	No records found		

State Sources

Oil and Gas Wells

Map Key	ID	Distance (ft)	Direction
	No records found		

Public Water System List

Map Key	ID	Distance (ft)	Direction
	No records found		

Well Construction Reports

Map Key	Well ID	Distance (ft)	Direction
7	921012343927	3908.17	WSW

Wells and Additional Sources Detail Report

USGS National Water Information System

Map Key	Direction	Distance (mi)	Distance (ft)	Elevation (ft)	DB
1	ESE	0.06	298.89	241.86	FED USGS

Reporting Agency:	USGS Arkansas Water Science Center
Site Number:	USGS-343952092090601
Station Name:	01N11W35DDD1
Site Type:	Well
Latitude:	34.66453698000000
Longitude:	-92.1518126000000
Date Drilled:	19760311
Well Depth:	421
Well Depth Unit:	ft
Well Hole Depth:	421
W Hole Depth Unit:	ft
Formation Type:	Eocene Series

Map Key	Direction	Distance (mi)	Distance (ft)	Elevation (ft)	DB
2	ESE	0.03	146.00	240.65	FED USGS

Reporting Agency:	USGS Arkansas Water Science Center
Site Number:	USGS-343953092090401
Station Name:	01N11W36CCC1
Site Type:	Well
Latitude:	34.66481475000000
Longitude:	-92.1512570000000
Date Drilled:	19640728
Well Depth:	41.0
Well Depth Unit:	ft
Well Hole Depth:	
W Hole Depth Unit:	
Formation Type:	Quaternary Alluvium

Map Key	Direction	Distance (mi)	Distance (ft)	Elevation (ft)	DB
3	-	0.00	0.00	210.80	FED USGS

Reporting Agency:	USGS Arkansas Water Science Center
Site Number:	USGS-343944092092901
Station Name:	Ark R @ MM 107.75 in Pool 5 bl Dam 6 nr Higgins
Site Type:	Stream
Latitude:	34.66231480000000
Longitude:	-92.1582017000000
Date Drilled:	

Wells and Additional Sources Detail Report

Well Depth:	
Well Depth Unit:	
Well Hole Depth:	
W Hole Depth Unit:	
Formation Type:	

Map Key	Direction	Distance (mi)	Distance (ft)	Elevation (ft)	DB
4	E	0.35	1,853.12	250.48	FED USGS

Reporting Agency:	USGS Arkansas Water Science Center
Site Number:	USGS-343958092082301
Station Name:	01N11W36DCB1
Site Type:	Well
Latitude:	34.66620359000000
Longitude:	-92.1398677900000
Date Drilled:	18991231
Well Depth:	45.5
Well Depth Unit:	ft
Well Hole Depth:	
W Hole Depth Unit:	
Formation Type:	Quaternary Alluvium

Map Key	Direction	Distance (mi)	Distance (ft)	Elevation (ft)	DB
5	NW	0.57	3,006.81	234.74	FED USGS

Reporting Agency:	USGS Arkansas Water Science Center
Site Number:	USGS-344027092094502
Station Name:	01N11W35BAC2
Site Type:	Well
Latitude:	34.67425910000000
Longitude:	-92.1626463000000
Date Drilled:	19640409
Well Depth:	116
Well Depth Unit:	ft
Well Hole Depth:	
W Hole Depth Unit:	
Formation Type:	Quaternary Alluvium

Map Key	Direction	Distance (mi)	Distance (ft)	Elevation (ft)	DB
5	NW	0.57	3,006.81	234.74	FED USGS

Reporting Agency:	USGS Arkansas Water Science Center
Site Number:	USGS-344027092094501
Station Name:	01N11W35BAC1
Site Type:	Well

Latitude:	34.67425910000000
Longitude:	-92.1626463000000
Date Drilled:	19740816
Well Depth:	293
Well Depth Unit:	ft
Well Hole Depth:	310
W Hole Depth Unit:	ft
Formation Type:	Sparta Sand

Map Key	Direction	Distance (mi)	Distance (ft)	Elevation (ft)	DB
6	SSW	0.70	3,704.92	215.73	FED USGS

Reporting Agency:	USGS Arkansas Water Science Center
Site Number:	USGS-343910092094601
Station Name:	Ark River @ MM 107L in Pool no. 5 nr Higgins
Site Type:	Stream
Latitude:	34.65287049000000
Longitude:	-92.1629241000000
Date Drilled:	
Well Depth:	
Well Depth Unit:	
Well Hole Depth:	
W Hole Depth Unit:	
Formation Type:	

Map Key	Direction	Distance (mi)	Distance (ft)	Elevation (ft)	DB
8	N	0.88	4,626.26	220.97	FED USGS

Reporting Agency:	USGS Arkansas Water Science Center
Site Number:	USGS-07263620
Station Name:	AR River@David D Terry L&D below Little Rock, AR
Site Type:	Stream
Latitude:	34.68111110000000
Longitude:	-92.1513889000000
Date Drilled:	
Well Depth:	
Well Depth Unit:	
Well Hole Depth:	
W Hole Depth Unit:	
Formation Type:	

Map Key	Direction	Distance (mi)	Distance (ft)	Elevation (ft)	DB
9	SW	0.98	5,167.61	210.80	FED USGS

Reporting Agency:	USGS Arkansas Water Science Center

Wells and Additional Sources Detail Report

Site Number:	USGS-343901092100301
Station Name:	Ark River @ MM 106.7 in Pool no. 5 nr Higgins
Site Type:	Stream
Latitude:	34.65037053000000
Longitude:	-92.1676465000000
Date Drilled:	
Well Depth:	
Well Depth Unit:	
Well Hole Depth:	
W Hole Depth Unit:	
Formation Type:	

Well Construction Reports

Map Key	Direction	Distance (mi)	Distance (ft)	Elevation (ft)	DB
7	WSW	0.74	3,908.17	233.87	WATER WELLS

Well ID:	921012343927	Pump Installer No:	4390
Status:	New Well	Pump Installer Name:	BILLY SHERMAN
Date Well Completed:	05/23/2000	County:	PULASKI (119)
Use Type:	IR	Fraction:	¼ of ¼
Well Depth:	65	Section:	01S
Yield:	2000	Township:	2
Contractor No:	1056	Range:	11W
Contractor Name:	HARDWICK WELL SUPPLY INC.	Longitude:	92-10-12
Driller No:	2562	Latitude:	34-39-27
Driller Name:	CHARLES REINHART		
Remarks:			
Report URL:	https://wise.er.usgs.gov/driller_dbdev/view.php?well_id=921012343927&dated=23-MAY-00		

Radon Information

This section lists any relevant radon information found for the target property.

Federal EPA Radon Zone for *PULASKI* County: **3**

Zone 1: Counties with predicted average indoor radon screening levels greater than 4 pCi/L
Zone 2: Counties with predicted average indoor radon screening levels from 2 to 4 pCi/L
Zone 3: Counties with predicted average indoor radon screening levels less than 2 pCi/L

Federal Area Radon Information for *PULASKI* County

No Measures/Homes:	127
Geometric Mean:	0.6
Arithmetic Mean:	0.9
Median:	0.6
Standard Deviation:	1.4
Maximum:	15.2
% >4 pCi/L:	2
% >20 pCi/L:	0
Notes on Data Table:	TABLE 1. Screening indoor radon data from the EPA/State Residential Radon Survey of Arkansas conducted during 1990-91. Data represent 2-7 day charcoal canister measurements from the lowest level of each home tested.

Federal Sources

FEMA National Flood Hazard Layer — **FEMA FLOOD**

The National Flood Hazard Layer (NFHL) data incorporates Flood Insurance Rate Map (FIRM) databases published by the Federal Emergency Management Agency (FEMA), and any Letters Of Map Revision (LOMRs) that have been issued against those databases since their publication date. The FIRM Database is the digital, geospatial version of the flood hazard information shown on the published paper FIRMs. The FIRM Database depicts flood risk information and supporting data used to develop the risk data. The FIRM Database is derived from Flood Insurance Studies (FISs), previously published FIRMs, flood hazard analyses performed in support of the FISs and FIRMs, and new mapping data, where available.

Indoor Radon Data — **INDOOR RADON**

Indoor radon measurements tracked by the Environmental Protection Agency(EPA) and the State Residential Radon Survey.

Public Water Systems Violations and Enforcement Data — **PWSV**

List of drinking water violations and enforcement actions from the Safe Drinking Water Information System (SDWIS) made available by the Drinking Water Protection Division of the US EPA's Office of Groundwater and Drinking Water. Enforcement sensitive actions are not included in the data released by the EPA. Address information provided in SWDIS may correspond either with the physical location of the water system, or with a contact address.

Radon Zone Level — **RADON ZONE**

Areas showing the level of Radon Zones (level 1, 2 or 3) by county. This data is maintained by the Environmental Protection Agency (EPA).

Safe Drinking Water Information System (SDWIS) — **SDWIS**

The Safe Drinking Water Information System (SDWIS) contains information about public water systems as reported to US Environmental Protection Agency (EPA) by the states. Addresses may correspond with the location of the water system, or with a contact address.

Soil Survey Geographic database — **SSURGO**

The Soil Survey Geographic database (SSURGO) contains information about soil as collected by the National Cooperative Soil Survey at the Natural Resources Conservation Service (NRCS). Soil maps outline areas called map units. The map units are linked to soil properties in a database. Each map unit may contain one to three major components and some minor components.

U.S. Fish & Wildlife Service Wetland Data — **US WETLAND**

The U.S. Fish & Wildlife Service Wetland layer represents the approximate location and type of wetlands and deepwater habitats in the United States.

USGS Current Topo — **US TOPO**

US Topo topographic maps are produced by the National Geospatial Program of the U.S. Geological Survey (USGS). The project was launched in late 2009, and the term "US Topo" refers specifically to quadrangle topographic maps published in 2009 and later.

USGS Geology — **US GEOLOGY**

Seamless maps depicting geological information provided by the United States Geological Survey (USGS).

USGS National Water Information System — **FED USGS**

The U.S. Geological Survey (USGS)'s National Water Information System (NWIS) is the nation's principal repository of water resources data. This database includes comprehensive information of well-construction details, time-series data for gage height, streamflow, groundwater level, and precipitation and water use data.

Wells from NWIS — **FED USGS**

The U.S. Geological Survey's National Water Information System (NWIS) is the nation's principal repository of water resources data. The NWIS includes comprehensive information of well-construction details, time-series data for gage height, streamflow, groundwater level, and precipitation and water use data. This NWIW dataset contains select Site Types from the overall NWIS Sites data, limited to the following Group Site Types only: Groundwater Group Site Types: Well, Collector or Ranney type well, Hyporheic-zone well, Interconnected Wells, Multiple wells; Spring Group Site Type: Spring; and Other Group Site Types: Aggregate groundwater use, Cistern.

State Sources

Oil and Gas Wells **OGW**

This dataset represents the location and description of oil and gas wells within the State of Arkansas. All information contained within this file was extracted from the Arkansas Oil and Gas Commisions online database. The information is updated as they receive the data from the Arkansas Oil and Gas Commission.

Public Water System List **PWS**

A list of Public Water Systems reported to Arkansas Department of Health (ADH). Information for each water system includes: Public Water System ID number, Contact Name, Mailing Address, Phone Number, Source Type(s), Email Address (when available), Web Site Address (when available). It also provides a list of sources for this sytem and the status of its source water protection documents. This list is made available by Arkansas Department of Environmental Quality (ADEQ). For security reasons, the ADH cannot disclose geographic information of water systems.

Well Construction Reports **WATER WELLS**

This database contains a list of water well records from Construction Reports database, maintained by Water Well Construction Commission, State of Arkansas.

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Enclosure 7

Table of Other Applicable Laws

David. D Terry Lock and Dam
Major Rehabilitation Evaluation Report

May 2023

US Army Corps
of Engineers
Little Rock District

Findings of the Record

Laws, Executive Orders, and Policies, in addition to those described in the Memorandum, for which all USACE projects must be in compliance with despite using a categorical exclusion.

Laws, Executive Orders, Policies	Rationale	Actions Result in Adverse Impact(s)		
		Yes	No	N/A
Human Environment				
Executive Order 12898 – Environmental Justice	Minority and low-income populations would not be disproportionately affected by the proposed action.		X	
Executive Order 13045 – Protection of Children	The project area does not provide food or water for people nor does the area experience a substantial use by children. Children would not be disproportionately affected by the proposed action.		X	
Executive Order 14008 – Tackling the Climate Crisis at Home and Abroad	Disadvantaged communities were identified using the CEQ's Climate and Environmental Justice Screening Tool along the west bank of the Arkansas River at the Terry L&D site. The proposed action would not affect the disadvantaged communities identified.		X	
Non-Living Resources				
Clean Air Act	Construction equipment may contribute negligible emissions, but state is in attainment and no General Conformity Determination is needed.		X	
Land and Water Conservation Fund Act of 1965, as amended	The proposed action area of interest does not contain or abut any Land and Water Conservation Fund (LWCF) projects. The proposed action does not use LWCF money to fund the project.			X
Farmland Protection Policy Act of 1981	The project area does not contain prime and unique farmland and does not include any ground disturbance that would result in land use changes.		X	

Laws, Executive Orders, Policies	Rationale	Actions Result in Adverse Impact(s)		
		Yes	No	N/A
Water Resources				
Clean Water Act	The proposed action does not permanently impact waters of the United States or involve the use of dredging or fill.		X	
Rivers and Harbors Act of 1899	The proposed action is not creating a permanent obstruction to the navigable capacity of WOTUS.		X	
EO 11988, Floodplain Management	The proposed action involves repair, rehabilitation, and replacement efforts on existing infrastructure and will not introduce new structures within the floodplain.		X	
EO 11990, Protection of Wetlands	The proposed action does not implicate any wetlands.			
Federal Water Project Recreation Act, as amended	The proposed action does not permanently impact any recreational opportunities.		X	
Wild and Scenic Rivers Act	The proposed action is not in or near a designated or proposed for designation wild or scenic river.			X
Coastal Zone Management Act, as amended	The proposed action would not occur in or near any coastal zones or coastal waters.			X
Marine Protection Research & Sanctuaries Act of 1972, PL 92-532	The proposed action would not occur in or near any oceans and does not propose dumping of any materials into any water body.			X
Wildlife Resources				
Endangered Species Act	The proposed action would result in No Effect on listed threatened and endangered species.		X	
Migratory Bird Treaty Act	The proposed action does not entail ground disturbance or vegetation removal, therefore will cause no impact to species protected under this act.			X

Laws, Executive Orders, Policies	Rationale	Actions Result in Adverse Impact(s)		
		Yes	No	N/A
Fish and Wildlife Coordination Act, as amended	The proposed action does not propose modifications to watercourses.			X
EO 13112, Invasive Species	The proposed action would not result in the distribution nor furthering of invasive species.		X	
Marine Mammal Protection Act	The proposed action would not occur in or near any marine environments.			X
The Magnuson-Stevens Fisheries Conservation and Management Act, as amended	The proposed action would not occur in or near any delineated essential fish habitat.			X

DAVID D. TERRY LOCK AND DAM
ARKANSAS RIVER, ARKANSAS
P2 Number: 485534

MAJOR REHABILITATION
EVALUATION REPORT

Appendix D
COST ESTIMATE

1. GENERAL

This appendix contains the detailed construction cost estimate prepared for the David D. Terry Lock and Dam Major Rehabilitation Evaluation Report for the Terry Lock and Dam at McClellan-Kerr Arkansas River Navigation System (MKARNS) in Oklahoma and Arkansas. The study period was 50 years starting in 2025 and analyzed the 5 alternatives including 1 without project condition and 4 with project conditions, each with two dewatering methods. Excel and Micro-Computer Aided Cost Estimating System (MCACES), incorporating local unit costs and historical data from local and neighboring USACE districts was used to develop the construction cost estimates. The estimates were developed after review of existing project plans, discussion with the design team members, and review of similar construction projects. A spreadsheet was developed to show the Current Working Estimate (CWE) for each alternative strategy; which includes construction costs; contingency amounts; planning, engineering, and design; and construction management. The TPCS spreadsheet also shows the fully funded estimate (FFE) for the selected plan. Costs, including appropriate contingencies, are presented in accordance with ER 1110-1-1300, Cost Engineering Policy and General Requirements; ER 1110-2-1302, Civil Works Cost Engineering.

2. PRICE LEVEL

The CWE is based on June 2022 prices. The latest available costbook, labor library, and equipment library were used to determine construction costs. These costs are considered fair and reasonable to a well-equipped and capable contractor and include overhead and profit where necessary. Calculation of the FFE was done in accordance with guidance from EM 1110-2-1304, Civil Works Construction Cost Index System (CWCCIS), updated September 2022.

3. CONTINGENCIES

The construction cost estimates were prepared using existing plans and is comprised of construction, design, and oversight/management costs. After review of project documents and discussion with personnel involved in the project, cost contingencies were developed that reflect the uncertainty associated with each cost item and were added to the cost estimate spreadsheet. These contingencies are based on qualified cost engineering judgment of available design data, type of work involved, and uncertainties associated with the work. Costs were not added to contingency amounts to cover items that are not identified as project requirements. Generally, the project features can be constructed using conventional methods and are similar to previous local projects as well as to projects in other USACE districts. Initial contingencies were determined using the abbreviated risk analysis (ARA) and a cost and schedule risk analysis (CSRA) will be completed for the selected plan and will be used in developing the FFE.

4. CONSTRUCTION METHODS AND ASSUMPTIONS

a. Feature 05, Locks.

The Design and Cost Engineering Branches of Engineering Division developed the quantities for this work based on the scope of work associated with the project features and existing plans for lock components. Historical data from SWL operations division for previous repairs, dewater costs, and daily fleet costs for required labor were also used where applicable.

Hazardous, Toxic, and Radioactive Wastes are not anticipated and no costs of hazardous material handling or disposal has been accounted for. Impacts to Cultural Resources are not anticipated. Operation and Maintenance (OM) estimates were not performed on the alternatives or the selected plan.

b. Feature 30, Planning, Engineering, and Design.

The planning, engineering and design for this project includes all planning and design work necessary to complete the RER and prepare construction plans and specifications. This cost also includes engineering support during construction and preparation of as-built drawings and operation and maintenance manuals. The design effort for the project was analyzed to determine the man-year effort required. This estimate is based upon monies expended to date; and an estimation of remaining planning, engineering and design cost based on discussions between the project engineer and project manager, and historical data gained on other projects of similar nature in the Little Rock District.

c. Feature 31, Construction Management.

Construction management includes the following: 1) biddability, constructability, and operability reviews; 2) the review of shop drawings, manuals, catalog cuts, and other information submitted by the construction contractor's assurance of specifications; 3) evaluating compliance provided through the supervision and inspection of construction work, and through the conferences with the contractors to coordinate various features of the project and to enforce compliance with schedules; 4) administration of construction contract including preparing, reviewing, and approving contract payments; 5) review and approval of construction schedules and progress charts; 6) preparation of progress and completion reports; 7) project management and administration not otherwise identified. The guideline rate of 7% of the construction cost was used to estimate the construction management costs.

5. ALTERNATIVES

a. General Costs Used for all Alternatives

i. Dewater Costs

Historical dewater costs were provided by SWL operations division. These costs include 1) mobilization, transportation, and setup of all required tools and access equipment from the local base/storage site to the lock chamber. 2) Dewatering the lock chamber including placing the bulkheads and closing the dewatering gates, initial pump down, continued draw down, and cleaning the lock, gate, and surrounding areas. 3) Demobilization including the teardown of all required tools and access equipment from the lock chamber and their transportation to the local base/storage site.

ii. USACE Repair Fleet Costs

Most work items in all the alternative strategies assume the repair or replacement work will be performed by the USACE SWL fleets. Current fleet daily costs were provided by SWL operations division. This cost covers all labor and equipment required to operate the fleet and perform required repairs or replacement of lock components.

iii. 110' Conversion Costs

For all alternatives a 110' bulkhead conversion will be necessary to safely dewater the lock due to centerpost anchorage failures and will need to be executed prior to any repair or replacement work. A similar conversion from 50' bulkheads with centerposts to 110' bulkheads was recently awarded at Norrell Lock and Dam in Arkansas. It was determined by the PDT that this project would be very similar in scope to Norrell and therefore the Independent Government Estimate (IGE) in conjunction with bid data for the Norrell lock and dam was used and adjusted based on relational gate dimensions for estimating the 110' conversion cost at Terry Lock and Dam. The scope of this work includes building a coffer box to work on one lock wall at a time where new bulkhead recess slots will be cut and embedded armoring steel installed and followed by modification of the bottom sill to accommodate the 110' bulkheads.

b. Without-Project Condition

The without project condition costs were determined assuming the USACE SWL fleets would perform the repair work. While the weld repairs will vary due to crack development and growth, the extent of repairs was assumed to be similar to previous repairs done within the district for each respective failure branch. Repairs were typically assumed to include crack weld repair, minor repairs to the gate, or minor component replacement such as pintle socket, bushing, & ball except in extreme failure scenarios that involved gate failure which would require replacement of the miter gate. Historical cost data from SWL operations division was used to estimate repair costs for each component when a similar repair had been performed in the past. For those failure events the historical average material cost was used together with the repair duration determined by the PDT and daily fleet costs as well as dewater costs to determine the total cost for repair for each respective failure branch in the event trees.

For failure scenarios in which no previous similar repair has been performed, MII was used in conjunction with discussions with design engineers to develop appropriate quantities from existing lock plans and estimate repair or replacement costs. For failure scenarios that required a new miter gate, it was assumed that the existing temporary segmental gate would be installed while the new miter gate was fabricated by a contractor and delivered to the site, and then the new gate would be installed by USACE fleets. Fabrication, painting, and delivery costs were based on historical cost average for similar geometry miter gates on recent INDC projects. This cost was used in conjunction with the current gate weights on these failure scenarios due to no new design available yet therefore future gate weights are unknown.
For all event tree branches a markup was applied due to the required expedited nature of repairs to get the MKARNS navigation system operational as quickly as possible in the event of an unexpected failure. This markup includes overtime, any increased material price based on availability, expedited delivery, etc.

c. With-Project Condition

i. Immediate Rehabilitation

This alternative strategy includes replacement of all lock components. MII was utilized to develop the estimated costs for each component. Historical data from SWL operations division was used for minor components being replaced including the quoin blocks and pintle ball and bushing. For components without historical data, discussions with the design engineers and review of the existing as built plans was used to develop estimated quantities and required crews if necessary. Most items were assumed to be installed by the USACE fleets except for the removal and replacement of the miter gate anchorages and embedded wall quoins. Costs for new miter gates were developed using historical average cost for fabrication, painting, and delivery based on similar geometry miter gates on recent INDC projects. This price per weight was used in conjunction with the current gate weights due to no new design available yet and therefore future gate weights being unknown. Duration for replacement of all components of 60 days was determined by the PDT and it was determined that 2 fleets would be required to accomplish the work in that timeframe. These determinations were used together with the daily fleet costs to develop the install cost.

It was determined that starting in 2025 design would commence, and that would be followed by the 110' conversion, then miter gates would be fabricated in 2027-2029 and all other required materials would be procured in this time as well. Then in 2030 there would be one 60 day closer for replacement of all the components.

ii. Scheduled Rehabilitation

This alternative was not considered due to the deteriorated state of multiple lock components and resulting hazard and risk levels. The engineering and economic determination was that work should be initiated as soon as possible and that a scheduled rehabilitation to be started at a later time was not feasible.

iii. Advanced Maintenance

Advanced maintenance would start in 2025 with design and would be followed by the 110' conversion. After the 110' conversion was completed, repairs would occur every 10 years starting in year 2028 and would include the following tasks: repair cracked welds, replace grease lines, apply Belzona (quoins) and replace bubblers (miter gates). Historical data from SWL operations division was used based on averages of similar previous repairs to estimate repair costs for the first iteration. Extent of weld repairs and durations were based on assumed crack growth over the 10-year interval period relative to the previous dewater cycles and associated crack growth observed in the past. It was also assumed by the PDT that as the component ages and iterations of repairs are done the crack growth and therefore required repair time and repair cost would increase approximately 2% per iteration. See summary below in Table 4.

iv. Scheduled Repair

Scheduled repairs would start in 2025 with design and would be followed by the 110' conversion. After the 110' conversion was completed, repairs would occur every 20 years starting in year 2028 and involve repairing cracked welds, replacing bent members (miter gates), and sand blast and paint components. Historical data from SWL operations division was used based on averages of similar previous repairs to estimate repair costs for the first iteration. Extent of weld repairs and durations were based on assumed crack growth over the 20-year interval period relative to the previous dewater cycles and associated crack growth observed in the past. It was also assumed by the PDT that as the component ages and iterations of repairs are done the crack growth and therefore required repair time and repair cost would increase approximately 2% per iteration.

No-action (WOPC) Alternative Costs Summary

	Component repair costs					Rehab Costs (just components)									
	Failure Mode					Year or Repair					Lock Closure Estimates				
Component	1	2	3	4	5	Year 1	Year 2	Year 3	Year 4	Total	Year 1	Year 2	Year 3	Year 4	Notes
US Pintle	x					$4,099	$0	$0	$0	$4,099	21				
US Pintle		x				$5,574	$0	$0	$0	$5,574	35				
US Pintle			x			$7,699	$3,439	$0	$0	$11,138	60	21			
US Pintle				x		$7,824	$3,439	$0	$0	$11,263	65	21			
DS Pintle	x					$4,099	$0	$0	$0	$4,099	21				
DS Pintle		x				$5,574	$0	$0	$0	$5,574	35				
DS Pintle			x			$7,699	$3,439	$0	$0	$11,138	60	21			
DS Pintle				x		$7,824	$3,439	$0	$0	$11,263	65	21			
US Quoin	x					$2,439	$0	$0	$0	$2,439	21				
US Quoin		x				$4,249	$0	$0	$0	$4,249	45				
DS Quoin	x					$2,439	$0	$0	$0	$2,439	21				
US Quoin		x				$4,924	$0	$0	$0	$4,924	45				
US MG	x					$2,964	$0	$0	$0	$2,964	14				
US MG		x				$6,546	$1,999	$1,999	$2,464	$13,007	60			21	
US MG			x			$6,827	$1,999	$1,999	$2,464	$13,288	65			21	
US MG				x		$10,731	$1,999	$1,999	$2,464	$17,192	60			21	
US MG					x	$11,012	$1,999	$1,999	$2,464	$17,473	65			21	
DS MG	x					$2,964	$0	$0	$0	$2,964	14				
DS MG		x				$8,796	$3,023	$3,023	$3,464	$18,305	60			21	
DS MG			x			$9,077	$3,023	$3,023	$3,464	$18,586	65			21	
DS MG				x		$10,956	$3,023	$3,023	$3,464	$20,465	60			21	
DS MG					x	$11,237	$3,023	$3,023	$3,464	$20,746	65			21	
MG Anchor	x					$844	$0	$0	$0	$844	7				
MG Anchor		x				$10,461	$0	$0	$0	$10,461	30				
MG Anchor			x			$19,201	$0	$0	$0	$19,201	45 + 21				45 days emergency + 21 days planned
MG Anchor				x		$19,482	$0	$0	$0	$19,482	50 + 21				45 days emergency + 21 days planned

*note that all failures would require 110ft conversion or coffer cells before repair/replacement

Immediate Rehab Summary

Cost in Today's 2022 Dollars							
Description	2025	2026	2027	2028	2029	2030	Total
Design Immediate Rehab (110' Conversion, Miter Gates, Pintles, Quoins, & Anchorages)	$ 3,866,700.00	$ 2,591,000.00					$ 6,457,700.00
Fabricate/Install Metal Inserts/Cut Slots, Sill Modifications		$ 10,430,300.00					$ 10,430,300.00
Fabricate Miter Gates (US & DS)			$ 9,790,900.00	$ 4,895,500.00	$ 4,895,500.00		$ 19,581,900.00
Install US & DS MG, Pintles, Quoins, & MG Anchorages						$ 25,022,100.00	$ 25,022,100.00
	$ 3,866,700.00	$ 13,021,300.00	$ 9,790,900.00	$ 4,895,500.00	$ 4,895,500.00	$ 25,022,100.00	$ 61,492,000.00
Nav Impact	0	5 months reduced traffic & 5 weeks of full closure	0	0	0	60	

4A - Scheduled Repair Alternatives Summary & 5A - Advanced Maintenance

Alternative	Work Description		2025	2026	2027	2028	2038	2048	2058	2068
4A Scheduled Repair via Planned 110ft Stop-Log Conversion	Design, 110ft Conversion, replace pintle grease lines, fix quoin cracks/apply belzona, repair miter gate cracks, repair bubblers at intervals of every 10 years		$1,276	$10,430	-	$2,295	$2,825	$3,477	$4,281	$5,270
Lock Closure (days)				5 months reduced traffic & 5 weeks of full closure	-	14	14	14	14	14
5A Advanced Maintenance via Planned 110ft Stop-Log Conversion	Design, 110ft conversion, replace pintle grease lines, pintle ball bushing, machine fix quoin cracks/level, repair miter gate cracks, replace bent members, sand blast and paint, repair bubblers, repair anchorage cracks at intervals of every 20 years		$1,276	$10,430	-	$5,589	-	$8,469	-	$12,834
Lock Closure (days)				5 months reduced traffic & 5 weeks of full closure	-	21		21		21

* 2025 = fabricate metal inserts, 2026 = cut slots and complete sill work, 2028 = rehab components.

**all cost in FY22 dollars, assumed repair cost increase 2.1% per year for increased scope and associated duration of repairs only

David D. Terry Lock & Dam, MKARNS, Scott, Arkansas

MAJOR REHABILITATION EVALUATION REPORT

APPENDIX E
REAL ESTATE PLAN

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Contents

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MAJOR REHABILITATION EVALUATION REPORT APPENDIX G REAL ESTATE PLAN

1 PURPOSE

The David D. Terry Lock and Dam is located at river mile 108 on the Arkansas River. As the components continue to exceed their design life, additional degradation will result in unanticipated lock closures, repair costs, vessel delays, and congestion on the McClellan–Kerr Arkansas River Navigation System (MKARNS) due to the single lock design of all the MKARNS L&Ds.

The Tentatively Selected Plan (TSP), Alternative 2A, is based on alternatives screening and NED analysis using the NIM model. Immediate Rehabilitation via Planned 110-ft Stoplog Conversion is recommended. At a total cost of $61.5 million, the plan would restore upstream and downstream components (miter gates pintles, quoins and miter gate anchorages) to their original condition thereby greatly reducing the risk of component failure over the period of analysis.

2 AUTHORITY

This Real Estate Plan is in support of the David D. Terry MRER. The MRER provides feasibility level evaluation under the Major Rehabilitation Program, for completed USACE projects, to determine if there are rehabilitation needs sufficient to qualify for funding in the Civil Works Construction General appropriations. The project was authorized by the River and Harbor Act of 24 July 1946 and constructed to provide navigation depth within its pool. It is a unit of the McClellan-Kerr Arkansas River Navigation System (MKARNS). The original locks were placed in operation in 1969.

This Real Estate Plan is being submitted in accordance with Chapter 12 of ER 405-1-12 for approval. This REP is to be considered tentative in nature and for planning purposes only. Real estate requirements and cost are subject to change, even after the approval of this report. A non-federal sponsor has not been identified because the operation and maintenance of the David D. Terry Lock and Dam is the responsibility of the US Army Corps of Engineers (USACE). However, construction costs for major rehabilitation will be cost shared with Inland Waterway Trust Funds (IWTF) in accordance with WRDA 1986, as amended. Current project design requires all work to take place on federally owned fee land managed by USACE. However, if any changes to the project require LERRD acquisition it would be the responsibility of USACE.

3 LER REQUIRED FOR CONSTRUCTION, OPERATION, AND MAINTENANCE

It is anticipated that the land required for the project will be within the bounds of existing federally owned fee land managed by USACE. For the fee Simple tracts near the dam, the United States of America acquired “all tenements, appurtenances, and hereditaments thereunto belonging or in anywise appertaining free, clear, and discharged of and from all former grants, taxes, judgements, mortgages, mineral rights, easements, restrictions, leases, assessments, liens, encumbrances and claims of any and every kind and nature. Subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.”

4 LER ACQUIRED FOR, OR WITH USE OF FUNDS FROM, ANOTHER FEDERAL PROGRAM OR PROJECT

There is no LER within the proposed project limits acquired for, or with use of funds from, another Federal Program or project.

5 NON-STANDARD ESTATES

Non-standard estates are not proposed for this project.

6 EXISTING FEDERAL PROJECTS

There is no other existing Federal project.

7 FEDERAL OWNED LAND OR INTEREST IN THE PROJECT AREAS

It is anticipated that the project will be located entirely on federally owned property. The United States, under the jurisdiction of the U.S. Army Corps of Engineers, owns fee at the lock and dam site. Flowage easements for the purpose of maintaining the David D. Terry Lock and Dam pool up to the elevation of 234 feet mean sea level could also be within the project area.

8 NAVIGATION SERVITUDE

Navigation servitude is the dominant right of the Government under the Commerce Clause to use, control, and regulate the navigable waters of the U.S. and the submerged lands for various commerce regulated purposes including navigation and flood control. Once the work limits are identified, the use of navigational servitude will be determined.

9 PROJECT MAP

See Exhibit A on page 6.

10 INDUCED FLOODING
At this stage of the project, no induced flooding is anticipated in the project area or because of the project.

11 BASELINE COST ESTIMATE
It is not anticipated that there will be any LERRD creditable costs associated with the project.

12 RELOCATION ASSISTANCE
Public Law 91-646, Uniform Relocation Assistance, provides entitlements for various payments associated with Federal participation in the acquisition of real property. It is anticipated that the Project will not require displacement of persons or businesses.

13 MINERALS
No present or anticipated mineral activity is within the Project area and it is expected that mineral acquisition will not be required for this project.

14 CAPABILITY ASSESSMENT
Not applicable.

15 ZONING
It is anticipated that there is not an application or enactment of a zoning ordinance proposed in lieu of, or to facilitate, any acquisition in connection with the Project.

16 ACQUISITION SCHEDULE
There will be no land acquisition required for this project.

Any removal or installation of real property improvements or components must be coordinated with the SWL Real Property Accountability Officer (RPAO). This plan will be updated as more design and implementation information is made available.

The REP will be reviewed and updated if necessary during the PED phase of this project.

17 FACILITY OR UTILITY RELOCATIONS
No known facility or utility relocations currently required for this project.

18 ENVIRONMENTAL
As required by the National Environmental Policy Act of 1969 (NEPA), the Corps of Engineers will assess the environmental impacts of the Project. A draft Categorical Exclusion has been developed for this project.

In accordance with established Corps of Engineers Hazardous, Toxic and Radioactive Waste (HTRW) policies (ER1165-2-132), a HTRW report will be prepared if necessary.

19 PROJECT SUPPORT
No formal public scoping meetings have been held at this early stage in the project.

20 RISK NOTIFICATION
Not applicable.

21 OTHER RELEVANT ISSUES
No other real estate issues are known at this time.

Prepared By:

Ashley Knight
Realty Specialist

Date

Approved By:

Chief, Real Estate Division
Little Rock District

Date

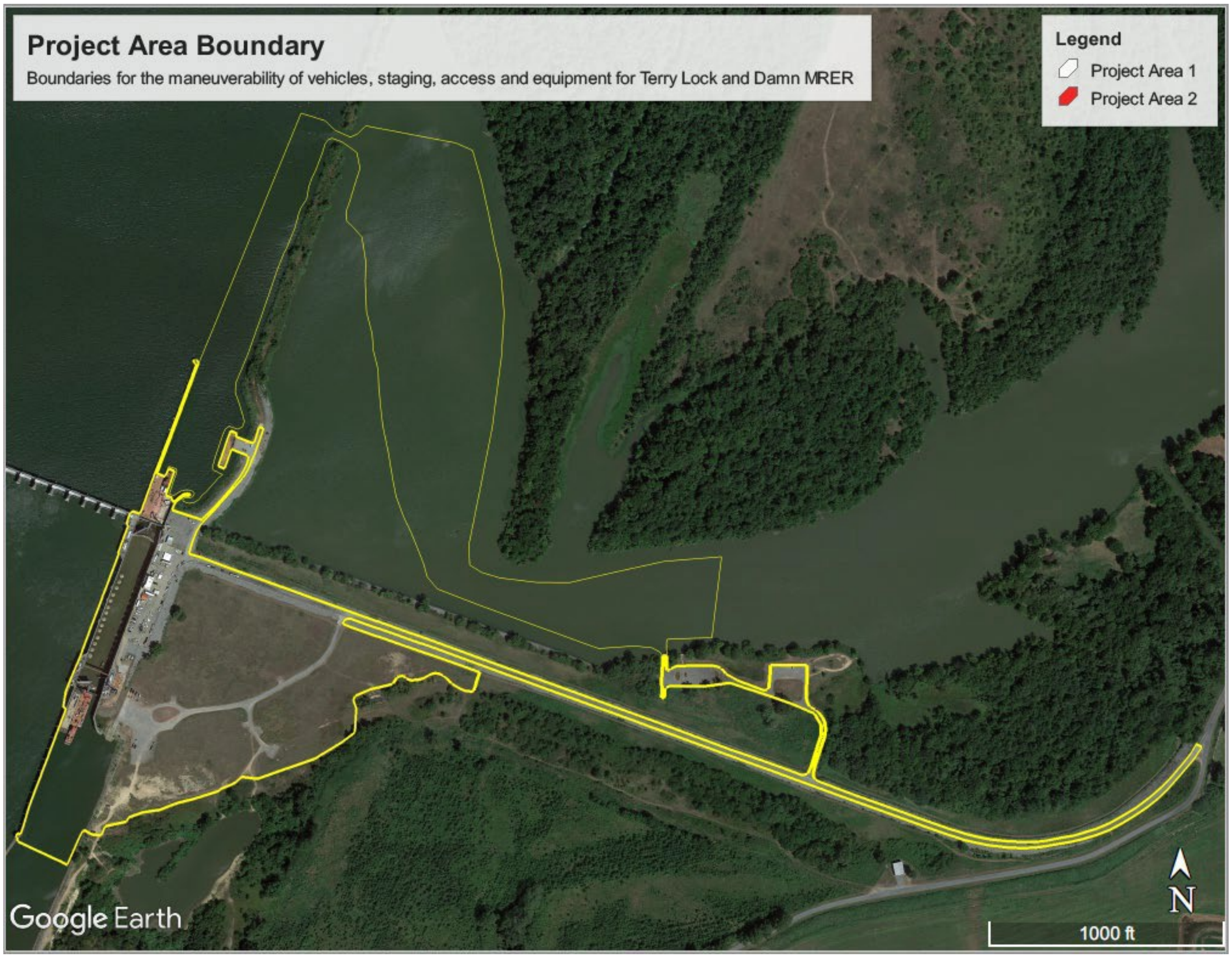
Project Area Boundary
Boundaries for the maneuverability of vehicles, staging, access and equipment for Terry Lock and Damn MRER
Legend
Project Area 1
Project Area 2
Google Earth
N
1000 ft

Exhibit A