Lower Osage River Protection and Enhancement Program

2020 Annual Report

Prepared by the
U.S. Fish and Wildlife Service

For:
Ameren Missouri

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Cover Photo: Anna Roberts, a U.S. Fish and Wildlife Service volunteer, records data for freshwater mussel monitoring efforts during the pandemic.

U.S. Fish and Wildlife Service

LOWER OSAGE RESTORATION PARTNERS

The following is a list of current and past partners responsible for the continued restoration of lower Osage River:

Ameren Missouri

Missouri Department of Conservation

U.S. Fish and Wildlife Service

HDR Engineering, Inc

Iowa State University

Kansas City Zoo

Missouri State University

Inter-Fluve

U.S. Army Corps of Engineers, Kansas City District

Missouri Department of Natural Resources

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INTRODUCTION

The Lower Osage River Protection and Enhancement Program (LORPEP) was established by Ameren Missouri, the Missouri Department of Conservation (MDC), and the U.S. Fish and Wildlife Service (USFWS) as part of a Settlement Agreement filed with the Federal Energy Regulatory Commission (FERC) on May 18, 2005. The terms of the Settlement Agreement were written into Ameren Missouri's new project license issued by FERC on March 30, 2007 for the operation of Bagnell Dam. The new license articles included major environmental enhancements for the Lower Osage River (LOR) including improved minimum flows, dissolved oxygen, ramp-down rates, fish protection measures at the dam, fish propagation funding, and the LORPEP (Article 412). On January 9, 2009, Ameren Missouri submitted a plan to FERC for the implementation of the LORPEP program that was coordinated with USFWS and MDC.

The purpose of the LORPEP is to implement adaptive management actions to improve aquatic habitat, protect and enhance aquatic resources, and contribute to the recovery of federally endangered freshwater mussels in the lower Osage River. These projects will maintain the scope established in Section 4.0 of the revised Lower Osage Protection and Enhancement Plan accepted by FERC on January 12, 2009, the Joint Explanatory Statement (2005), the Settlement Agreement (2005), and the operating license (2007). As of 2019, $1,440,554.82 were established for LOR projects.

Section 6 of the operating license requires Ameren to fund ($175,000 a year, adjusted pursuant to the methodology set forth in Section 7) LOR protection, enhancement, and aquatic habitat restoration projects. These funds would be provided to the USFWS and would support, at a minimum, projects designed to restore/create back and side channel aquatic habitat, monitor the effectiveness of measures implemented in accordance with Section 6 of the operating license, and prevent or reduce erosion that affects these initiatives. In addition, the funds would be used to develop and implement a freshwater propagation program for the LOR. The program is funded annually by Ameren Missouri and was initiated in 2008. Funding for the LORPEP is limited considering the number of habitat enhancement opportunities in the LOR. Therefore, implementation of the program will follow a habitat management model similar to the USFWS's process called Strategic Habitat Conservation (SHC) (https://www.fws.gov/landscape-conservation/). SHC is an adaptive resource management framework for making management decisions considering where and how to deliver conservation efficiently to achieve specific biological outcomes. Such a framework will help ensure the LORPEP is successful in maximizing ecological benefits to aquatic resources in the LOR. The process of SHC includes several elements that occur in an ongoing, adaptive management loop including 1) biological planning, 2) conservation design, 3) delivery of conservation actions, and 4) monitoring and research. Within this framework, there will be a decision-making process by which proposed projects are evaluated for their potential for success and prioritized according to a set of criteria to ensure LORPEP funds are used to maximize ecological benefits. Further, the LORPEP

describes the need for the USFWS and MDC to evaluate the enhancements provided through operational changes prior to implementation of habitat restoration projects.

With respect to habitat improvement projects, LORPEP is now in the conservation design and delivery stage (see Project 10-2 below). The planning stage was important to complete before habitat improvement projects were considered. Most efforts have been aimed to gather information needed for the project decision-making process. Going forward, this procedure will be utilized to help ensure that informed decisions will be made on the identification, development, and prioritization of feasible enhancement projects. Projects related to habitat enhancement will be planned and implemented in cooperation with Ameren Missouri and other partners as annual funding accumulates in a protected account designated for the LORPEP.

REPORT FORMAT

This annual report is provided to Ameren Missouri as required by the January 14, 2007 Memorandum of Understanding between Ameren Missouri, the MDC, and the USFWS. The purpose of this document is to report on the status of LORPEP projects and describe accomplishments made during the past year. Ongoing, completed, and new projects are listed under the "Current LORPEP Projects" section of this report. A brief description and history is provided for each project followed by the status and estimated timeline for completion. All projects are numbered by the year each was initiated (first two digits) followed by a sequential numerical identifier (digits following the dash) for that year (e.g., "Project 08-1" = project 1 initiated in 2008, "Project 10-1" = project 1 initiated in 2010). Interim and final reports are provided in the referenced appendices of this report when appropriate. All active LORPEP projects will be included under the "Current LORPEP Project" section until they have been completed (including any required final reporting). Completed projects continue to be listed in Appendix I. Previous annual reports are available at the USFWS, Missouri Field Office, 101 Park DeVille Drive, Suite A, Columbia, Missouri 65203.

CURRENT LORPEP PROJECTS

Project 08-5. Propagation efforts for freshwater mussels

> Description: As required by the September 15, 2006 Biological Opinion issued by the USFWS for the Osage Project and incorporated in the Project License as Article 412, a mussel propagation program was developed and implemented for the LOR for the federally endangered Pink Mucket (*Lampsilis abrupta*), Scaleshell (*Leptodea leptodon*), and other select species. A propagation plan, also referenced as a conservation restoration plan, will be developed as required by the USFWS's propagation policy (65 FR 56916). The goals of the project are to: 1) augment existing populations of select rare, state-listed, and federally-listed species; 2) reintroduce extirpated species; and 3) re-establish select faunal representative species into restored habitats (USFWS 2006 Biological Opinion for FERC Project 459-128).

In 2009, the USFWS fostered partnerships with Missouri State University and the Kansas City Zoo to utilize existing mussel propagation and rearing systems for Osage River propagation. In subsequent years, the USFWS helped expand both facilities to increase productivity, which included the fabrication of several innovative aquatic systems. A new technique to efficiently tag mussel shells was developed using a computer-controlled laser engraving machine to etch the shells of animals to be released into the LOR. In 2009, a pilot propagation study involving the Pink Mucket was initiated. Between 2011 and 2013, over 14,000 propagated sub-adult Pink Mucket were released into test plots at 2 sites in the LOR. These sites have been sampled intermittently between 2012 and 2020 to monitor mussel survivorship and growth. Results to date indicate that the releases into these test plots were successful and survivorship of the released animals remains high.

Status: Currently, the USFWS is evaluating several potential facilities to carry out the next phase of mussel propagation, which will include multiple species. There is a need to transfer or expand the operation to facilities that would reduce travel time, simplify logistics, increase security, and maintain quality control. A mussel conservation and restoration plan is in development. No mussel propagation will occur until access to adequate propagation facilities are secured and a LOR propagation plan is completed and coordinated with MDC. Efforts in 2021 will include contacting additional potential cooperators in Kansas and Missouri to solicit interest in participating in a collective, watershed approach that could expand restoration benefits to the mussel community throughout the Osage River Basin beyond LORPEP actions currently planned in the LOR. Both Pink Mucket release sites were sampled in 2020 to resume monitoring of the 2011-2013 releases. The results are described in a progress report in Appendix II.

Proposed timeline: In 2021, we plan to continue investigating and securing suitable locations for propagation facilities, contact additional potential cooperators in Kansas and Missouri, and continue working to finalize the Osage River Basin freshwater mussel conservation and restoration plan.

Project 10-2: Investigate potential Article 412 restoration opportunities within the lower Osage River.

Description: The implementation of habitat restoration projects under Article 412 will require the cooperation and involvement of multiple partners including Ameren Missouri, resource agencies, and private landowners. Once an opportunity is identified, it must be assessed to determine if the potential project is feasible, can attain the goals of the LORPEP, and can be supported by the parties involved. Efforts to investigate restoration opportunities may involve meetings with potential partners, site visits, habitat assessments, and survey work to determine existing conditions so that potential projects can be evaluated. In general, no formal annual reporting is planned for these actions. However, results of on-site assessments or surveys may be provided in future annual reports as necessary.

Since 2008, the MDC and USFWS have conducted various field studies to gain a better understanding of what habitat enhancements would be most beneficial to aquatic resources in the LOR. Because there are finite LORPEP funds, the number of habitat enhancement projects is expected to be limited. Therefore, it is important to inform the selection process and identify the most cost-effective projects. Results of these studies have been included in past LORPEP annual reports. Through this process, we have developed a list of possible LOPREP habitat enhancement opportunities while the necessary funds to implement such projects were accrued via Ameren Missouri's annual Article 412 payments.

Status: In 2019, the LORPEP working group ranked potential habitat restoration projects based on an assessment and scoring matrix developed by Inter-fluve (Inter-fluve 2019, Appendix I). Subsequently, the USFWS and MDC met with all landowners for the potential projects to discuss results of Inter-fluve's assessment, the benefits of potential projects, and incentive packages. Through this process, the LORPEP working group identified one potential project with an interested landowner that scored as a top priority. In January 2020, the MDC, the USFWS, and the Ozark Land Trust met with the interested landowner determined in 2019. This landowner was interested in the project, which included tree plantings, a conservation easement, and the removal of an island crossing. During this meeting, it was determined approximately one acre of the island was owned by another landowner. Further progress on this potential project was delayed by the Covid 19 pandemic until late in 2020. On December 8, 2020, the MDC and USFWS met with the landowner of that parcel to resume discussions. On December 9, 2020, the landowner informed the USFWS that the parcel would be transferring to another person who subsequently declined to participate in the project (per the current landowner).

The U.S. Army Corps of Engineers (USACE) is finalizing a Planning Assistance to States (PAS) report that is focused on the hydraulic, riparian, and aquatic conditions in the LOR. LORPEP funds were used to partially fund this study to evaluate the potential feasibility of side channel crossings at select locations and bank stabilization techniques. Under the PAS, the USACE will investigate design criteria, feasibility, effectiveness, and long-term stability of side channel crossings and the ecological benefit to aquatic organisms, feasibility, and long-term effectiveness of several bank stabilization techniques, including bioengineering. Locations included the next highest ranked projects on the LORPEP list to help inform a path forward for restoration possibilities.

Proposed Timeline: Early in 2021, the LORPEP working group will review the USACE's PAS report, determine the feasibility of an island crossing, and meet again to select and pursue the next highest ranked project.

Activities related to investigating potential projects will occur for the remainder of the project license. When projects are proposed and executed, they will be listed under this project category (e.g., "Project 10-2.1, 10-2.2," etc.).

Project 15-1: Freshwater mussel monitoring

Description: Monitoring freshwater mussel populations in the LOR is required by Article 412 of the current Osage Project license. Preliminary fieldwork to find and delineate monitoring sites was conducted between 2010 and 2012. Methods and protocols for the project were completed in 2013 (Project 08-6) and monitoring began in 2014 (Project 15-1). The goals of this project are to track population dynamics of mussel communities in the LOR and track survival of propagated animals that are released into monitoring sites. Eighteen monitoring sites were established at locations where significant mussel beds are present. These sites are being sampled regularly (based on a schedule described in the protocol) so that each site is sampled at least once every five years. Zebra Mussel populations will also be assessed at all sites over time.

Status: As of 2018, all 18 monitoring sites in the LOR have been sampled at least once. A comprehensive report summarizing the data from the first five years of monitoring is in Appendix III. This five-year summary report supersedes previous annual reporting for this project.

No mussel monitoring was completed in 2019 due to extended high water. Sampling resumed in 2020 as we completed the next four sites on the sampling schedule. These data are discussed briefly in the progress report in Appendix IV. This effort represents the beginning of the second round of sampling of the 18 monitoring sites.

We have revised the monitoring protocol for this project. In addition to providing the mussel bed polygons for each site and an improved description of methods, we have updated the sampling schedule and site names. The new version of the protocol is provided in Appendix V and noted in Appendix I under Project 08-6.

Proposed Timeline: This project will continue until the expiration of the current FERC license in 2047. Progress reports will be provided annually with a more detailed data summary following a complete round of sampling (approximately every five years, pending adequate sampling conditions). The second round of sampling is scheduled to be completed in 2025 and therefore, a report summarizing the second five years of sampling should be included in the 2025 LORPEP annual report provided to Ameren Missouri in January 2026. A more detailed analysis will be completed when all sites have been sampled three times. The sampling protocol may continue to be revised as necessary, reviewed as a draft document, and published in annual reports under Project 15-1.

APPENDIX I

Summaries of Completed Projects of the Lower Osage River Protection and Enhancement Program

The following information is a compilation of project summaries that are considered completed under the LORPEP. The entries are organized by project number, which depicts the year the project began (first two digits) followed by a numerical identifier (digits following the dash). Annual and final reporting for completed and ongoing projects have been provided in previous LORPEP reports (published annually from 2008 to the present) and can be obtained from the U.S. Fish and Wildlife Service at: 101 Park DeVille Drive, Suite A, Columbia, Missouri 65203 (Phone: 573-234-2132). Ongoing projects are listed in the main body of this annual report.

Project 08-1. Develop a Geographic Information System (GIS) database (using ArcMap software) to map major aquatic habitat features, land use, and existing/ongoing restoration efforts with respect to the distribution of aquatic resources in the LOR.

> Summary: The GIS database was created by the USFWS and the MDC and will be used for future planning and prioritization of proposed restoration projects on the LOR. This database will also be used to track completed restoration efforts in the future. GIS Layers include: islands and side channels, flow conveyance around islands, island access, island vegetation type, location of training structures, floodplain features, water willow beds, gravel bars, bank erosion, mussel survey data, fish survey data, fish habitat, Natural Heritage Data (including federally and state-listed species), designated natural areas, propagated mussel release sites, long-term monitoring sites, gravel mines, National Pollutant Discharge Elimination System permit sites, landfills, and hazardous waste sites, land cover, land use, transportation system, soil types, public lands, aerial photography, topographical maps, National Wetland Inventory, and river miles. This database is updated as new information becomes available and restoration projects are completed. It is maintained by the USFWS in the Missouri Field Office.

Project 08-2. Conduct field surveys to collect data needed to create GIS layers that are not currently available.

> Summary: The baseline field surveys were completed between 2010 and 2012. The final report was submitted to the USFWS on January 30, 2013 and attached to the 2012 LORPEP report in Appendix II (Lobb and Lueckenhoff 2013). The main objectives of this project were to: 1) Collect information on low-flow macrohabitat availability in the river, 2) determine locations and configurations of training structures, 3) assess training structure influence on hydraulic connectivity between the main channel and secondary habitats at low-flows, and 4) perform limited testing of methods for evaluating effects of training structures on aquatic habitat. These surveys are being used to inform and expedite our decisions regarding LORPEP expenditures and future management activities, measures, and monitoring.

Project 08-3. Create new GIS layers using field collected data.

> Summary: Using field data from Project 08-2, new and remaining data layers were incorporated into the GIS database in 2013 in the appropriate format. Layers currently include mussel beds, river-wide fish macrohabitat features, rock crossings, training structures, and their hydraulic affects to habitat connectivity at various flows. GIS data will continue to be collected in future years as a monitoring or management tool for a variety of LORPEP projects. These data layers are maintained by the USFWS in the Missouri Field Office.

Project 08-4. Develop and describe ranking criteria and a process that will be used to prioritize future proposed restoration projects.

> Summary: A framework for evaluating and selecting potential habitat improvement projects on the LOR was developed and included in the LORPEP 2013 annual report. It was created to provide a general planning and decision-making process by which potential habitat protection, enhancement or improvement projects can be identified, prioritized, and pursued based on their feasibility and ecological benefits within the LOR. This project selection method will help maintain transparency between partners and ensure that sponsored research and relevant spatial data are being used to make informed, well-reasoned decisions. This tool will significantly enhance our abilities to prioritize and pursue projects from the vast restoration and protection opportunities and effectively utilize the limited funding available for the LOR. The most recent framework for evaluating and selecting potential habitat improvement projects is found in Appendix II of the 2013 Annual LORPEP Report.

Project 08-6. Develop and initiate long-term monitoring methods and protocols for freshwater mussels.

> Summary: Long-term monitoring of freshwater mussel populations in the LOR is required by Article 412 of the current Osage Project license. Developing appropriate sampling methods for the Osage River is essential to produce data that is unbiased, consistent, and statistically comparable over time. The goal of long-term monitoring in the LOR is to track the metapopulation dynamics of mussel communities over time with a focus on understanding the status of federally listed and other species of conservation concern. During the monitoring period, data regarding habitat, population status, and recruitment of mussel species will be collected at multiple sites in the LOR.
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> The prerequisite field work for this project was completed in 2014, including reconnaissance searches for mussel beds and the establishment (i.e., delineation) of 18 long-term monitoring sites (Roberts *et al.* 2014). Preliminary quantitative sampling was also conducted at established monitoring sites to determine if the delineation process was successful (Roberts *et al.* 2014). The monitoring protocol was completed in 2014 and updated in 2015 (Simmons *et al.* 2015). A second update has been completed in 2021 (Simmons *et al.* 2021). This plan may be further updated in the future as changes are needed based on new information. Reporting from the implementation of this plan will be provided annually under Project 15-1.

Project 10-1: Conduct a genetic study on the federally endangered Scaleshell and Pink Mucket mussel to inform future propagation efforts.

Summary: Molecular genetic techniques are valuable tools to inform mussel conservation and address genetic concerns in propagation plans. The genetic structure of a population is an important consideration when establishing brood stock for propagation and developing plans to release artificially propagated animals into a receiving wild population. In this study, microsatellites were used to develop a fine-scale picture of genetic variation and estimate the degree of genetic differentiation and interchange between populations of Scaleshell and Pink Mucket mussels. The primary objective was to estimate both within and between population genetic structure, as well as other demographic parameters such as effective population size using non-invasive techniques and species-specific microsatellite markers. Only partial LORPEP funding was used because this study was also needed for other recovery work outside of the Osage River. However, it is an important component of the LORPEP mussel propagation program (Project 08-5). This project was completed by Iowa State University and is entitled "Determination of population genetic and ecological variation in the Scaleshell (*Leptodea leptodon*) and Pink Mucket (*Lampsilis abrupta*)."

The final report for this project (Roe and Chong 2015) was included in Appendix III of the 2015 Annual LORPEP report. A summary of the findings and recommendations are detailed below. Analysis of mitochondrial DNA (mtDNA) and microsatellites data have suggested that all Scaleshell samples examined comprise a single population that displays slight differentiation at the river basin level. The distribution of mtDNA haplotypes supports the general pattern observed using nuclear microsatellites. Based on our data, the gene flow among Scaleshell populations was substantial, and the recent discovery of adult Scaleshell in Illinois and Arkansas, where it was considered extirpated, might be evidence of dispersal of glochidia by the host fish. This interpretation is also supported by the fact that Scaleshell from Arkansas and Illinois both exhibited the same haplotype that was common in the Missouri populations. High dispersal ability due to a highly mobile host fish provides Scaleshell with the potential capability to naturally repopulate regions where it has been locally extirpated. A small number of Scaleshell populations surveyed included juvenile mussels indicating recent reproductive success. If propagation and restoration projects are undertaken for Scaleshell within Missouri, broodstock should be sourced from populations located within the same drainages as the restoration site. Restoration strategies should also seek to increase the genetic diversity of broodstock mussels used for propagation and should avoid using closely related individuals as broodstock to avoid activities that negatively affect the effective population size. Additional conservation activities should focus on identifying environmental factors that appear to be limiting the spread of Scaleshell populations (i.e., habitat requirements).

The genetic data examined for Pink Mucket populations reveals higher genetic diversity at both mtDNA and nuclear loci than was seen in Scaleshell. Within Missouri, the presence of several shared haplotypes appears to indicate weak to modest gene flow between the sample sites. The microsatellite (nuclear) data suggest a similar pattern.

Overall, the data indicate substantial gene flow between sample populations of Pink Mucket, and even the degree of genetic differentiation observed between the Tennessee and Missouri populations was quite low. Presumably this level of connectivity is largely due to the dispersal of glochidia by the host fish(es). The generally high levels of genetic diversity (intermediate between Scaleshell and Fragile Papershell, *Leptodea fragilis*), and low inbreeding (FIS = 0.15) observed can be interpreted as populations that are not at immediate risk of loss of genetic diversity. Populations of Pink Mucket should be monitored to determine if recruitment is occurring, as lack of recruitment could eventually result in a loss of populations due to eventual senescence and death. Additional research should be conducted to determine the degree of connectivity between all extant populations because Pink Mucket populations are in several other drainages. Such information should be viewed as important for identifying potential sites for re-introduction that would facilitate maintaining connectivity between all remaining populations of Pink Mucket.

Project 10-2.1: Lower Osage River Lock and Dam #1 Pallid Sturgeon Monitoring Project

Summary: The intent of this work was to determine if Pallid Sturgeon (*Scaphirhynchus albus*) were utilizing the Osage River above the confluence of the Missouri River and assess the level of fish passage at Lock and Dam #1. Sampling was conducted between river km 8.8 and 19.5 (RM 5.5 to 12.2) in 2010 and between river km 15 to 19 (RM 9.9 to 12.1) in 2011. Trotlines baited with nightcrawlers were the focused sampling method used during mid-April through mid-May with 12-24 hour soak times. Data from all captured fish were recorded. Trotlines were reset at Pallid Sturgeon capture locations. Three hatchery stock Pallid Sturgeon and one Pallid Sturgeon/Shovelnose Sturgeon hybrid were captured in 2010. Eleven Pallid Sturgeon were collected in 2011. Three bore hatchery markings, the remaining eight are presumed wild as genetic analysis did not match any parental lineages on file. Two of the eight unmarked Pallid Sturgeon were deemed Pallid Sturgeon/Shovelnose Sturgeon hybrids. Other captures of note were 46 Lake Sturgeon and two American Eel. The final report was included in Appendix VI of the 2011 Annual LORPEP report (Herman and Hill 2012).

Project 10-2.2: Evaluation of Bank Erosion within Selected Reaches of the Lower Osage River.

This study was conducted by MDC in 2017 to generate data to help prioritize and select potential habitat improvement projects. Bank erosion was evaluated based on Ameren's existing LiDAR data of erosion rates in the LOR. Knowing the location of the most active bank erosion and stream deposition may influence what habitat projects will be considered in the future and the prioritization of those projects. Results from this analysis were included in Appendix II of the 2018 LORPEP annual report.

Project 10-2.3: Lower Osage River Protection and Enhancement Program, Project Prioritization Report.

In 2018, the USFWS entered into a MOU with Ameren Missouri to contract Inter-fluve, a river restoration and water resources engineering company, to assess the physical conditions of the LOR and prioritize previously identified potential aquatic habitat

restoration projects. Because there are finite LORPEP funds, the number of habitat enhancement projects will be limited. Therefore, it is important to identify and select the most beneficial and cost effective projects. This cost/benefit analysis was performed to determine the feasibility, costs, and to help the LORPEP working group prioritize each of the potential LORPEP projects. Inter-fluve used existing and field collected data on habitat conditions at the sites and gathered information from informal meetings with several landowners to better describe site characteristics, identify impairments, and develop engineering solutions. A scoring matrix was developed for ecological benefit and feasibility at each potential project site along with a conceptual opinion of probable construction cost. The final report for this project was included in Appendix III of the 2018 LORPEP annual report.

Project 11-1: Evaluation of Habitat for Mussels and Their Fish Hosts in the Lower Osage River.

Summary: This project provided information on the characteristics of habitat for mussels and their obligate fish hosts in the LOR to help identify and prioritize measures needed to protect, restore, and create fish and mussel habitat. Work included: mapping habitat availability and monitoring fluctuations in river level, temperature, and dissolved oxygen at selected sites and sampling for presence of mussel fish hosts at selected mussel beds and reintroduction/augmentation locations. This project began on August 12, 2011 as a five-year cooperative agreement between the USFWS and MDC. The final report for this project was included in Appendix II of the 2017 LORPEP annual report.

Project 14-1: Develop a GIS data repository accessible to primary LORPEP partners.

Summary: A repository for GIS spatial data pertinent to LORPEP was pursued to make this information easily available to LORPEP partners. This data includes aerial photography, topography, results from pertinent research (i.e., erosion assessments), and riverine faunal and habitat inventories. After investigating the feasibility of data sharing between LORPEP partners, no viable option was found. It was decided that as coordination of potential habitat enhancement projects between LORPEP partners continues under Project 10-2, alternative methods of disseminating this information will be used. Currently, information related to LORPEP is available and posted to the FERC e-library website at: www.ferc.gov/docs-filing/elibrary.asp. Some spatial data layers are only available in digital format at the USFWS in Columbia, Missouri.

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