Electronically Filed

Rye Development

100 South Olive Ave., West Palm Beach, Florida 33401

September 30, 2024

VIA E-FILING

Debbie-Anne A. Reese, Acting Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, DC 20426

Re: Lewis Ridge Pumped Storage Project, FERC Project No. 15249
Draft Application for License for a Major Unconstructed Project

Dear Secretary Reese:

Lewis Ridge Pumped Storage, LLC (LRPS or Applicant) is pleased to file with the Federal Energy Regulatory Commission (FERC or Commission) the enclosed Draft License Application (DLA) for an original license for the Lewis Ridge Pumped Storage Project (Lewis Ridge Project) (FERC No. 15249). The Lewis Ridge Project is a proposed pumped storage project in Bell County, Kentucky with an anticipated total installed capacity of 287 megawatts (MW) of renewable energy storage.

LRPS has prepared this DLA in accordance with 18 CFR Subchapter B, Part 4 of FERC's regulations. The DLA conforms with the content requirements of 18 CFR § 4.41 and 18 CFR § 4.32 and includes the following:

Initial Statement	
Exhibit A	Project Description
Exhibit B	Project Operation and Resource Utilization
Exhibit C	Project Schedule
Exhibit D	Project Cost and Financing
Exhibit E	Environmental Report
Exhibit F	General Design Drawings
Exhibit G	Project Boundary Map

An Exhibit F Supporting Design Report will be provided with the Final License Application. Exhibit F General Design Drawings and Supporting Design Report will be filed with the Commission as Critical Energy/Electric Infrastructure Information (CEII).

LRPS is providing a copy of the DLA to appropriate federal and state agencies, Native American tribes, local governments, landowners, and members of the public interested in the proceeding, as set forth on the attached Distribution List. In accordance with the Commission's regulations at 18 CFR §4.38(c)(4)(iii), LRPS is requesting review and comment on the DLA. Comments are due within 90 days of this distribution, or by December 29, 2024.

The engineering design for the Lewis Ridge Project is still in its preliminary phase, and the information presented in this DLA reflects the initial specifications. As the design advances, LRPS will refine these specifications and develop more detailed, site-specific plans.

LRPS looks forward to working with Commission staff, federal and state regulators, Native American tribes, landowners, and other licensing participants. Please direct any questions pertaining to the Lewis Ridge Project to Sandy Slayton by phone at (503) 341-1425 or email at sandy@ryedevelopment.com.

Sincerely,

Sandra J Slayton

Sandy Slayton
Vice President
Rye Development

Attachments: Distribution List; Draft Application for License for the Lewis Ridge Pumped Storage Project, FERC Project No. 15249

Lewis Ridge Pumped Storage Project, FERC P-15249
Distribution List

Elected Officials

Office of Senator Mitch McConnell
Lexington Office
771 Corporate Drive, Suite 108
Lexington, Kentucky 40503

Office of Senator Rand Paul
Main State Office
1029 State Street
Bowling Green, Kentucky 42101

Office of Representative Harold “Hal” Rogers
Somerset Office
551 Clifty Street
Somerset, Kentucky 42503

Johnnie Turner
Kentucky State Senator (29th District)
P.O. Box 351
Harlan, Kentucky

Adam Bowling
Kentucky House of Representatives (87th District)
P.O. Box 2928
Middlesboro, Kentucky 40965

Federal Agencies

Darryl LaCounte
Director
Bureau of Indian Affairs
U.S. Department of the Interior
1849 C Street NW MS - 4606
Washington, DC 20240

Kim Amendola
Deputy Regional Administrator
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701-01930

Commanding Officer
United States Coast Guard
95 Peyton Street
Barboursville, West Virginia 25504

Mso Paducah
United States Coast Guard
225 Tully Street
Paducah, Kentucky 42003-0170

U.S. Army Corps of Engineers
Eastern Regulatory Division
Nashville District
501 Adesa Parkway, Suite B 250
Lenoir City, Tennessee 37771

Casey Ehorn
Deputy Chief, Regulatory Division
U.S. Army Corps of Engineers
3701 Bell Road
Nashville, Tennessee 37214-2660

Cara Beverly
U.S. Army Corps of Engineers
3701 Bell Road
Nashville, Tennessee 37214-2660

Marian R. Rubin
Biologist, East Branch
Regulatory Division
U.S. Army Corps of Engineers
Nashville District
3701 Bell Road
Nashville, Tennessee 37214

Joseph M. Oloriz
Project Manager
U.S. Department of Energy
Office of Clean Energy Demonstrations
1000 Independence Avenue SW
Washington, DC 20585

Andrew L. Raddant
Regional Environmental Officer
U.S. Department of the Interior
Office of Environmental Policy and Compliance
15th State Street, 8th Floor
Boston, Massachusetts 02109

Jeaneanne Gettle
Regional Administrator
U.S. Environmental Protection Agency
Region IV
61 Forysth Street, S.W.
Atlanta, Georgia 30303

Mike Oetker
Regional Director, Southeast Region
U.S. Fish and Wildlife Service
Ecological Services
1875 Century Boulevard
Atlanta, Georgia 30345

John Faustini
Regional Hydrologist and FERC Hydropower Coordinator, Southeast Region
U.S. Fish and Wildlife Service
Ecological Services
1875 Century Boulevard
Atlanta, Georgia 30345

Lee Andrews
Field Supervisor
U.S. Fish and Wildlife Service
Kentucky Field Office
Interior Region 2 -- South Atlantic-Gulf
330 West Broadway, Room 265
Frankfort, Kentucky 40601

Michael Floyd
Fish and Wildlife Biologist
JC Watts Federal Building
330 West Broadway, Room 265
Frankfort, Kentucky 40601

Karah Jaffe
Fish and Wildlife Biologist – Consultation
JC Watts Federal Building
330 West Broadway, Room 265
Frankfort, Kentucky 40601

Jeff Duncan
Regional Hydropower Coordinator
U.S. National Park Service
Southeast Region, 1924 Building
100 Alabama Street SW
Atlanta, Georgia 30303

<u>Tribes</u>

Chuck Hoskin, Jr.
Principal Chief
Cherokee Nation
P.O. Box 948
Tahlequah, Oklahoma 74465
Elizabeth Toombs

Tribal Historic Preservation Officer
Cherokee Nation
P.O. Box 948
Tahlequah, Oklahoma 74465

Deborah Dotson
President
Delaware Nation
P.O. Box 825
Anadarko, Oklahoma 73005

Richard Sneed
Principal Chief
Eastern Band of Cherokee Indians
Qualla Boundary
P.O. Box 455
Cherokee, North Carolina 28719

Stephen Yerka
Tribal Historic Preservation Officer
Eastern Band of Cherokee Indians
P.O. Box 455
Cherokee, North Carolina 28719

Douglas Lankford
Chief
Miami Tribe of Oklahoma
P.O. Box 1326
Miami, Oklahoma 74355-1326

David Hill
Principal Chief
Muscogee (Creek) Nation
P.O. Box 580
Okmulgee, Oklahoma 74447

Turner Hunt
Tribal Historic Preservation Officer
Muscogee (Creek) Nation
P.O. Box 580
Okmulgee, Oklahoma 74447

Craig Harper
Chief
Peoria Tribe of Indians of Oklahoma
118 South Eight Tribes Trail
Miami, Oklahoma 74355

Roger "Bear" Brock
Chief
Southern Cherokee Nation of Kentucky
P.O. Box 481
Allen, Kentucky 41601

Joe Bunch
Chief
United Keetoowah Band of Cherokee
Indians in Oklahoma
P.O. Box 746
Tahlequah, Oklahoma 74465

Roger Cain
Tribal Historic Preservation Officer
United Keetoowah Band of Cherokee
Indians in Oklahoma
P.O. Box 1425
Tahlequah, Oklahoma 74465

State Agencies

Louanna Aldrige
Office of Commissioner
Kentucky Department for Environmental
Protection
300 Fair Oaks Lane
Frankfort, Kentucky 40601

Shawn Hokanson
Kentucky Department of Environmental
Protection
Division of Water
300 Sower Boulevard
Frankfort, Kentucky 40601

Samantha Vogeler
Kentucky Department of Environmental Protection
Division of Water
300 Sower Boulevard
Frankfort, Kentucky 40601

Beth Trent
Kentucky Department for Environmental Protection
Division of Water
London Regional Office
875 South Main Street
London, Kentucky 40741

Glen Alexander
Kentucky Department for Environmental Protection
Division of Water
300 Sower Boulevard
Frankfort, Kentucky 40601

Allan Shingleton
Kentucky Department of Environmental Protection
Division of Water
300 Sower Boulevard
Frankfort, Kentucky 40601

Gordon R. Slone
Commissioner
Kentucky Department for Natural Resources
300 Sower Boulevard, 2nd Floor
Frankfort, Kentucky 40601

Jay Cunningham
Environmental Scientist Consultant, Senior
Kentucky Department for Natural Resources
300 Sower Boulevard, 2nd Floor
Frankfort, Kentucky 40601

Barry Butcher
Environmental Scientist
Kentucky Department of Natural Resources
Division of Abandoned Mine Lands
300 Sower Boulevard 2nd Floor
Frankfort, Kentucky 40601

Lonis Morgan
Environmental Control Manager
Kentucky Division of Mine Reclamation and Enforcement
1804 E. Cumberland Avenue
Middlesboro, Kentucky 40965

Thomas Barbour
Environmental Scientist Consultant
Kentucky Division of Mine Permits
300 Sower Boulevard
Frankfort, Kentucky 40601

Matthew Catron
Regional Biologist
Kentucky Department of Fish & Wildlife Resources
#1 Sportsman's Lane
Frankfort, Kentucky 40601

Craig Potts
Executive Director and State Historic Preservation Officer
Kentucky Heritage Council
The Barstow House
410 High Street
Frankfort, Kentucky 40601

Patricia Hutchins
Archaeology Review Coordinator
Kentucky Heritage Council
410 High Street
Frankfort, Kentucky 40601

Mona Juett
Office of the Secretary
Kentucky Tourism, Arts, and Heritage Cabinet
500 Mero Street, Fifth Floor
Frankfort, Kentucky 40601

Kenya Stump
Executive Director
Kentucky Office of Energy Policy
300 Sower Boulevard
Frankfort, Kentucky 40601

Kentucky Chamber of Commerce
464 Chenault Road
Frankfort, Kentucky 40601

Kentucky Coal & Marketing & Export Council
Cabinet for Economic Development
300 West Broadway
Frankfort, Kentucky 40601

Linda Bridwell
Executive Director
Kentucky Public Service Commission
P.O. Box 615
211 Sower Boulevard
Frankfort, Kentucky 40602

Patrick Morrisey
Attorney General
West Virginia Office of Attorney General
Building 1, Room E-26
State Capitol Complex
1900 Kanawha Boulevard E
Charleston, West Virginia 25305

Russell Coleman
Attorney General
Office of the Attorney General
700 Capital Avenue, Suite 118
Frankfort, Kentucky 40601-3449

Local Governments

Debbie Gambrel
County Clerk
Bell County
101 Courthouse Square
P.O. Box 157
Pineville, Kentucky 40977

Albey Brock
Judge / Executive
Bell County
101 Courthouse Square
P.O. Box 339
Pineville, Kentucky 40977

Bell County Conservation District
10581 US Highway 25E
P.O. Box 822
Pineville, Kentucky 40977

Sandra Wilson
City Clerk
City of Middlesboro
City Hall
221 N. 21st Street
Middlesboro, Kentucky 40965

Scott Madon
Mayor
City of Pineville
300 Virginia Avenue
Pineville, Kentucky 40977

Non-Governmental Organizations

Ashley Wilmes
Director
Kentucky Resource Council
P.O. Box 1070
Frankfort, Kentucky 40602

Tom Fitzgerald
Kentucky Resource Council
P.O. Box 1070
Frankfort, Kentucky 40602

Kentuckians for the Commonwealth
Catherine Clement
P.O. Box 1450
London, Kentucky 40743

Mountain Association
Josh Bills
420 Main Street
Hazard, Kentucky 41701

Landowners

Hoskins Irene Life Estate
Bonnie, Barbara, & Otis Hoskins
1495 Peach Blossom Road
Kettle Island, Kentucky 40958

Sylvia Price
3446 Blue Rock Road
Cincinnati, Ohio 45239

Carl, Lonnie, Jesse Dale & Kimberly Saylor
312 Molus Hollow
Coldiron, Kentucky 40817

William & Elizabeth Johnson
81 Campbell Lane
Pineville, Kentucky 40977

Brenda (Ramsey) Brock
220 Mathel Church Road
Pineville, Kentucky 40977

John Matt & Maude Pursifull
c/o Hugh Delk
c/o Lee Warren Jr.
115 Chestnut Hill Lane
Flat Lick, Kentucky 40935

Commonwealth of Kentucky Transportation
Cabinet Department
501 High Street
Frankfort, Kentucky 40601

Lonnie & Jamie Wilder
177 Mason Hill
Pineville, Kentucky 40977

William Jr. & Frank Stewart
P.O. Box 160
Pineville, Kentucky 40977

James L. & Elsie Franks
98 Balkan Road
Pineville, Kentucky 40977

Ernie Campbell
120 Balkan Road
Pineville, Kentucky 40977

Henry Gray
7673 Highway 217
Miracle, Kentucky 40856

James Rector
c/o Thelma Davison
1888 Main Street
Goshen, Ohio 45122

Bell County
P.O. Box 366
Pineville, Kentucky 40977

Johnny Earl & Zelma Hunley
40 E. Hunley Road
Pineville, Kentucky 40977

I N Creech Heirs
c/o Jack Campbell
5800 Ridgeview Drive
Mayville, Michigan 48744

Lee McGeorge
c/o Kenneth McGeorge
334 Cory Lane
Butler, Kentucky 41006

A B & Judy Hoskins
c/o Albert Hoskins
5200 Boulder Court
Louisville, Kentucky 40207

Michael Gambrel
General Manager
Asher Land and Mineral, LLLP
P.O. Box 463
Pineville, Kentucky 40977

Applicant

Sandy Slayton
Vice President
Rye Development
1455 SW Broadway Street, Suite 290
Portland, Oregon 97201

Erik Steimle
Chief Development Officer
Rye Development
1455 SW Broadway Street, Suite 290
Portland, Oregon 97201

Lesley Brotkowski
Senior Licensing Coordinator
Kleinschmidt Associates
233403 Stettin Ridge Court
Wausau, Wisconsin 54401

LEWIS RIDGE PUMPED STORAGE PROJECT
FERC NO. 15249

DRAFT INITIAL STATEMENT

BEFORE THE
UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Lewis Ridge Pumped Storage Project **FERC Project No. 15249**

DRAFT APPLICATION FOR LICENSE FOR A MAJOR UNCONSTRUCTED PROJECT

INITIAL STATEMENT

(Pursuant to 18 CFR § 4.41)

1. Lewis Ridge Pumped Storage, LLC (Applicant or LRPS) applies to the Federal Energy Regulatory Commission (FERC or Commission) for an original license for the Lewis Ridge Pumped Storage Project, FERC No. P-15249 (Lewis Ridge Project) as described in the attached exhibits.

2. The location of the Lewis Ridge Project is:

State:	Kentucky
County:	Bell County
Township or nearby town:	Blackmont, Tejay, Balkan, and Callaway
Stream or body of water:	Pumped storage with initial fill and recharge water sourced from Tom Fork[1]

3. The exact name and business address of the Applicant are:

Lewis Ridge Pumped Storage, LLC
100 South Olive Avenue
West Palm Beach, Florida 33401

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[1] Recharge water is to replace water from evaporation and seepage. For the initial fill, it is anticipated that the water source will be natural inflows from Tom Fork and potentially supplemental water pumped from the Cumberland River and/or pumped groundwater from wells that would be installed adjacent to the lower reservoir site.

The Applicant requests that all correspondence and service of documents related to this notification and subsequent proceedings be addressed to:

Sandy Slayton
Vice President
Rye Development
1455 SW Broadway Street, Suite 290
Portland, Oregon 97201
Phone: (503) 341-1425
Email: sandy@ryedevelopment.com

4. The Applicant is a limited liability company organized and existing pursuant to the laws of the Commonwealth of Kentucky, and is not claiming preference under Section 7(a) of the Federal Power Act.

5. (i) The statutory or regulatory requirements of the Commonwealth of Kentucky in which the Lewis Ridge Project would be located that affect the project as proposed, with respect to bed and banks, and to the appropriation, diversion and use of water for power purposes, and with respect to the right to engage in the business of developing, transmitting and distributing power, and in any other business necessary to accomplish the purposes of the license under the Federal Power Act are:

    a. Lewis Ridge Pumped Storage, LLC is a limited liability company organized under the laws of the Commonwealth of Kentucky, and, as such, can engage in the activities set forth in its organizational documents, which include the generation, transmission, and distribution of electricity from the Lewis Ridge Project.

    b. Section 401 (a)(1) of the Clean Water Act requires that an applicant for a federal license or permit to conduct an activity that will or may result in discharge into waters of the United States (as defined in the Clean Water Act) must present the federal authority with either a Water Quality Certification (WQC) that the discharge would not violate water quality standards from the applicable state, or evidence of waiver thereof. In Kentucky, the 401 WQC is administered by the Kentucky Department for Environmental Protection (Kentucky DEP) Division of Water.[2] A Section 401 WQC or waiver thereof will be required for the Lewis Ridge Project.

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[2] The Kentucky DEP is under the Kentucky Energy and Environment Cabinet.

c. Section 402 of the Clean Water Act requires that a discharge of any pollutant or combination of pollutants to surface waters that are deemed waters of the United States be regulated by a National Pollutant Discharge Elimination System (NPDES) permit. In Kentucky, the Environmental Protection Agency (EPA) has delegated authority to issue NPDES permits to the Kentucky Energy and Environment Cabinet. Kentucky DEP Division of Water administers the Kentucky Pollutant Discharge Elimination System (KPDES) program.

d. Section 404 of the Clean Water Act establishes a program to regulate the discharge of dredged or fill material into waters of the United States, including wetlands. Section 404 requires a permit before dredged or fill material may be discharged into waters of the United States. In Kentucky, the U.S. Army Corps of Engineers (USACE) administers the permit program associated with Section 404.

e. Section 14 of the Rivers and Harbors Appropriation Act of 1899, as amended, and codified in 33 U.S. Code § 408 (Section 408) applies to permanent or temporary actions that build upon, alter, improve, move, occupy, or otherwise could affect authorized USACE Civil Works projects. A Section 408 permit is required for work in navigable waters of the U.S. where USACE Civil Works projects are located. The USACE administers the permit program associated with Section 408 permits in Kentucky.

f. The Surface Mining Control and Reclamation Act of 1977 (SMCRA) governs mining and reclamation of surface coal mines in the United States. The SMCRA includes federal guidelines intended to regulate (permit) mining activities by setting enforceable standards. The Office of Surface Mining Reclamation and Enforcement is the agency which oversees the program. The Kentucky Department for Natural Resources (Kentucky DNR)[3] is responsible for implementing the SMCRA through the Kentucky Revised Statutes (KRS) 350.020. The Division of Mine Reclamation and Enforcement (DMRE) is one of three agencies within the Kentucky DNR responsible for administering Kentucky's mining, reclamation, and abandoned mine land laws. The DMRE is responsible for inspecting all surface and underground coal mining permits in the state to assure compliance with the SMCRA.

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[3] The Kentucky DNR is under the Kentucky Energy and Environment Cabinet.

(ii) The steps the applicant has taken or plans to take to comply with each of the laws cited above are:

a. The Applicant has complied with the requirements of the laws of the Commonwealth of Kentucky with respect to the right to engage in the business of developing and transmitting power.

b. The Applicant will file an application for a 401 WQC to Kentucky DEP Division of Water within 60 days following FERC's notification of its acceptance of the license application being ready for environmental analysis.

c. The Applicant will obtain a Clean Water Act Section 402 KPDES General Stormwater Permit from Kentucky DEP Division of Water.

d. The Applicant will obtain, as appropriate, a Section 404 permit from the USACE for work along or across a stream or within jurisdictional wetlands.

e. The Applicant will consult with USACE regarding potentially applicable actions associated with the Cumberland River and will request a Section 408 review to determine if a permit from the USACE is required.

f. The Applicant will continue to consult with Kentucky DNR regarding existing permits at the project site under Kentucky DNR jurisdiction. The Applicant will comply with the permits or seek SMCRA permit exemption for the Lewis Ridge Project, construction materials and associated permitting needs, and post-mining land use commitments (mine reclamation requirements, protection enhancement plans) associated with existing permits.

INFORMATION REQUIRED BY 18 CFR § 4.32

1. *Identify every person, citizen, association of citizens, domestic corporation, municipality, or state that has or intends to obtain and will maintain any proprietary right necessary to construct, operate, or maintain the project:*

   Lewis Ridge Pumped Storage, LLC
   100 South Olive Avenue
   West Palm Beach, Florida 33401

2. *Identify (providing names and mailing addresses):*

   (i) *Every county in which any part of the project, and any Federal facilities that would be used by the project, would be located;*

   Bell County Clerk
   101 Courthouse Square
   P.O. Box 157
   Pineville, Kentucky 40977

   There are no federal facilities proposed to be used by the Lewis Ridge Project.

   (ii) *Every city, town, or similar local political subdivision:*

   (A) In which any part of the project, and any Federal facilities that would be used by the project, would be located; or

   The nearest communities to the proposed Lewis Ridge Project site are Blackmont, Tejay, Balkan, and Callaway, which are all unincorporated communities with no mailing address.

   (B) That has a population of 5,000 or more people and is located within 15 miles of the project dam;

   City of Middlesboro
   City Hall
   221 N. 21st Street
   Middlesboro, Kentucky 40965

(iii) Every irrigation district, drainage district, or similar special purpose political subdivision:

(A) In which any part of the project, and any Federal facilities that would be used by the project, would be located; or

Bell County Conservation District
10581 US Highway 25E
P.O. Box 822
Pineville, Kentucky 40977

(B) That owns, operates, maintains, or uses any project facilities that would be used by the project;

There are no known irrigation districts, drainage districts, or other special purpose political subdivisions that own, operate, maintain, or use any project facilities or any federal facilities that would be used by the Lewis Ridge Project.

(iv) Every other political subdivision in the general area of the project that there is reason to believe would likely be interested in, or affected by, the application; and

City of Pineville
300 Virginia Avenue
Pineville, Kentucky 40977

(v) All Indian tribes that may be affected by the project.

The Applicant is not aware that the proposed project would affect any Native American tribes. The following Native American tribes may have some level of interest in the surrounding area and have been included in the distribution list for the Lewis Ridge Project.

Cherokee Nation
P.O. Box 948
Tahlequah, Oklahoma 74465

Delaware Nation
P.O. Box 825
Anadarko, Oklahoma 73005

Eastern Band of Cherokee Indians
P.O. Box 455
Cherokee, North Carolina 28719

Miami Tribe of Oklahoma
P.O. Box 1326
Miami, Oklahoma 74355-1326

Muscogee (Creek) Nation
P.O. Box 580
Okmulgee, Oklahoma 74447

Peoria Tribe of Indians of Oklahoma
118 South Eight Tribes Trail
Miami, Oklahoma 74355

Southern Cherokee Nation of Kentucky
P.O. Box 481
Allen, Kentucky 41601

United Keetoowah Band of Cherokee Indians in Oklahoma
P.O. Box 746
Tahlequah, Oklahoma 74465

3. *(i) For a license (other than a license under section 15 of the Federal Power Act) state that the applicant has made, either at the time of or before filing the application, a good faith effort to give notification by certified mail of the filing of the application to:*

    (A) Every property owner of record of any interest in the property within the bounds of the project, or in the case of the project without a specific boundary, each such owner of property which would underlie or be adjacent to any project works including any impoundments:

    All property owners that lie within the proposed Project Boundary have been added to the Distribution List and will be notified by certified mail concurrent with the Final License Application filing.

(B) *The entities identified in paragraph 2 of this section, as well as any other Federal, state, municipal or other local government agencies that there is reason to believe would likely be interested in or affected by such application.*

A Certificate of Service will be attached to the transmittal letter for the Final License Application.

(C) *Such notification must contain the name, business address, and telephone number of the applicant and a copy of the Exhibit G contained in the application, and must state that a license application is being filed with the Commission.*

The notification will contain the name, business address, and telephone number of the Applicant. The notification will also include a copy of Lewis Ridge Project Boundary depicted on Exhibit G and statement that the license application is being filed with the Commission.

4. *(i) As to any facts alleged in the application or other materials filed, be subscribed and verified under oath in the form set forth in paragraph (a)(3)(B) of this section by the person filing, an officer thereof, or other person having knowledge of the matters set forth. If the subscription and verification is by anyone other than the person filing or an officer thereof, it must include a statement of the reasons therefor.*

   The subscription for this application is signed by a person authorized to act as agent for the Applicant.

5. *Contain the information and documents prescribed in the following Sections of this chapter, except as provided in paragraph (b) of this Section, according to the type of application.*

   The draft application is for an original license for a major unconstructed project and contains the following information per 18 CFR § 4.41:

Initial Statement

Exhibit A	Project Description
Exhibit B	Project Operation and Resource Utilization
Exhibit C	Project Schedule
Exhibit D	Project Cost and Financing
Exhibit E	Environmental Report
Exhibit F	General Design Drawings
Exhibit G	Project Boundary Map

Exhibit F General Design Drawings are filed with the Commission as Critical Energy/Electric Infrastructure Information (CEII). The Exhibit F Supporting Design Report will be provided with the Final License Application and will be filed as CEII.

6. The Applicant does not intend to exercise its rights under Section 210(e) of the Public Utility Regulatory Policies Act of 1978 (PURPA). The Applicant reserves the right to exercise any additional rights available to it under PURPA in the future.

SUBSCRIPTION

[**To be completed in the Final License Application**]

This Application for an original License for the Lewis Ridge Pumped Storage Project, FERC Project No. 15249, is executed in the State of ___________________, County of ____________________, by Signee of Lewis Ridge Pumped Storage, LLC (100 South Olive Avenue West Palm Beach, Florida 33401) being duly sworn, deposes and says that the contents of this application are true to the best of their knowledge or belief. The undersigned has signed the application this ______ day of _____________________, 20_____.

Lewis Ridge Pumped Storage, LLC

By: ____________________________________

Name: ________________________________

Title: __________________________________

VERIFICATION

Subscribed and sworn to before me, a Notary Public of the State of ________________, this ________ day of _____________________, 20_____.

____
(Notary Public)

(My Commission Expires ________________)/seal

LEWIS RIDGE PUMPED STORAGE PROJECT
FERC NO. 15249

DRAFT EXHIBIT A
PROJECT DESCRIPTION

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

DEFINITIONS OF TERMS, ACRONYMS, AND ABBREVIATIONS

ADAS	automated data acquisition system
AIS	air insulated
Applicant	Lewis Ridge Pumped Storage, LLC
CFR	Code of Federal Regulations
cfs	cubic feet per second
Commission	Federal Energy Regulatory Commission
DLA	Draft License Application
FERC	Federal Energy Regulatory Commission
FLA	Final License Application
ft/s	feet per second
GSU	Generator Step-Up
GWh	gigawatt hour
HAC	Hydraulic Asphalt Concrete
kV	kilovolt
LRPS	Lewis Ridge Pumped Storage, LLC
Lewis Ridge Project	Lewis Ridge Pumped Storage Project, FERC P-15249
MVA	megavolt-amperes
MW	megawatt
NAVD 88	North American Vertical Datum of 1988
TLP	Traditional Licensing Process

1.0 GENERAL PROJECT DESCRIPTION

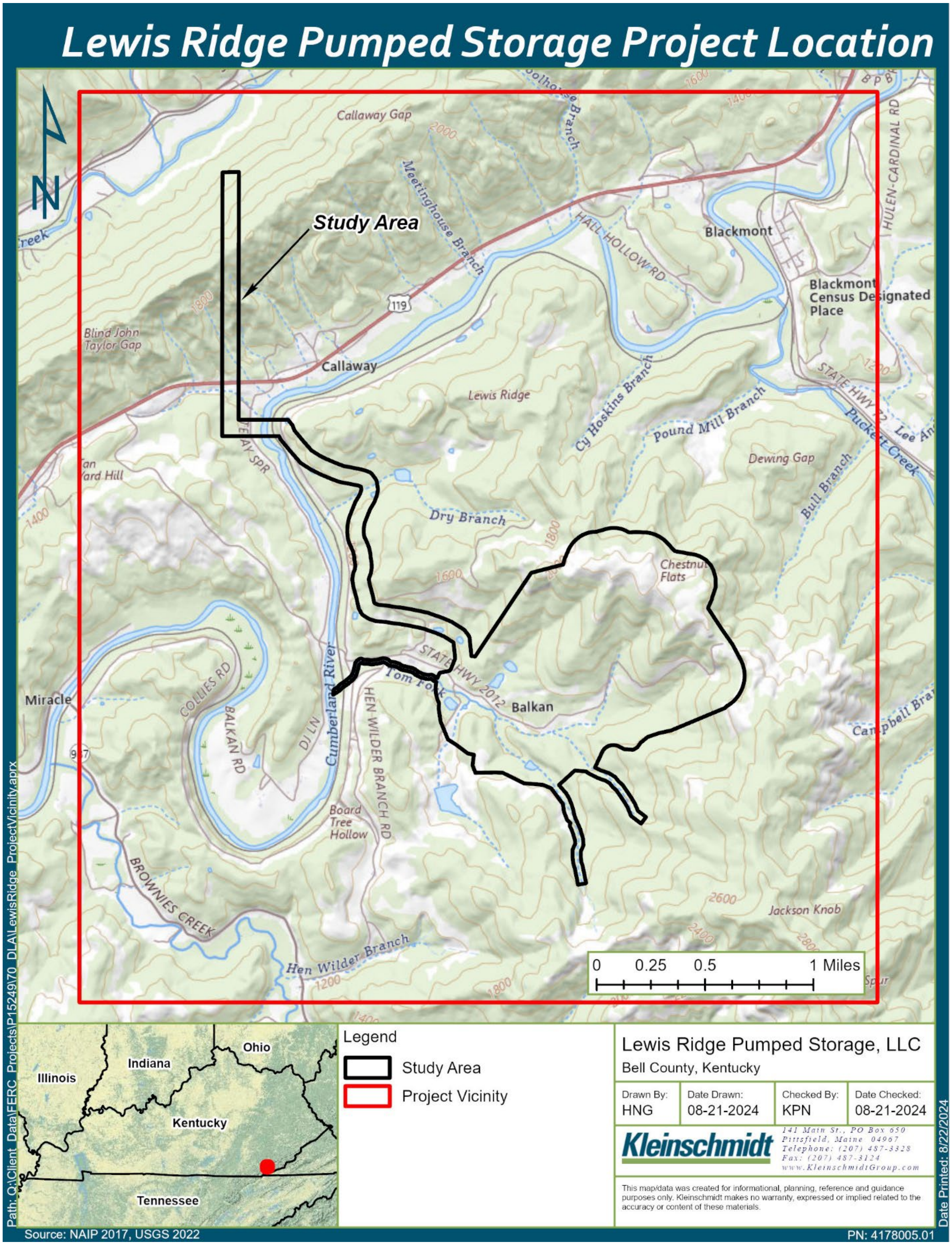
Lewis Ridge Pumped Storage, LLC (Applicant or LRPS) is filing with the Federal Energy Regulatory Commission (FERC or Commission) its Draft License Application (DLA) for the Lewis Ridge Pumped Storage Project (FERC No. 15249) (Lewis Ridge Project). LRPS is using FERC's Traditional Licensing Process (TLP) as established in FERC regulations, Title 18 of the US Code of Federal Regulations (CFR), Part 4. This Project Description (Exhibit A) has been prepared in accordance with 18 CFR § 4.41, contents for an Application for License for Major Unconstructed Project.

The Lewis Ridge Project is an unconstructed, pumped storage hydroelectric project that is anticipated to have an installed capacity of 287 megawatts (MW). The Lewis Ridge Project would be located on land that has been used for underground and surface mining and would involve the construction of new water storage, water conveyance, and electric generation facilities. The Lewis Ridge Project would use electricity to store potential energy by moving water between a lower and upper reservoir, connected by a penstock and powerhouse that contains two reversible pump-turbines. During periods of peak electricity demand, this water would be released, generating power, and delivering it to the grid. The Lewis Ridge Project would require an initial fill of the reservoirs with recharge water required on an annual basis.

1.1 Lewis Ridge Project Location

The proposed site for the Lewis Ridge Project is in Bell County, Kentucky, near the borders of Tennessee and Virginia. The proposed site is located near the communities of Blackmont, Tejay, Balkan, and Callaway, near river mile 659 of the Cumberland River (Figure 1-1).

Figure 1-1: Lewis Ridge Project Location

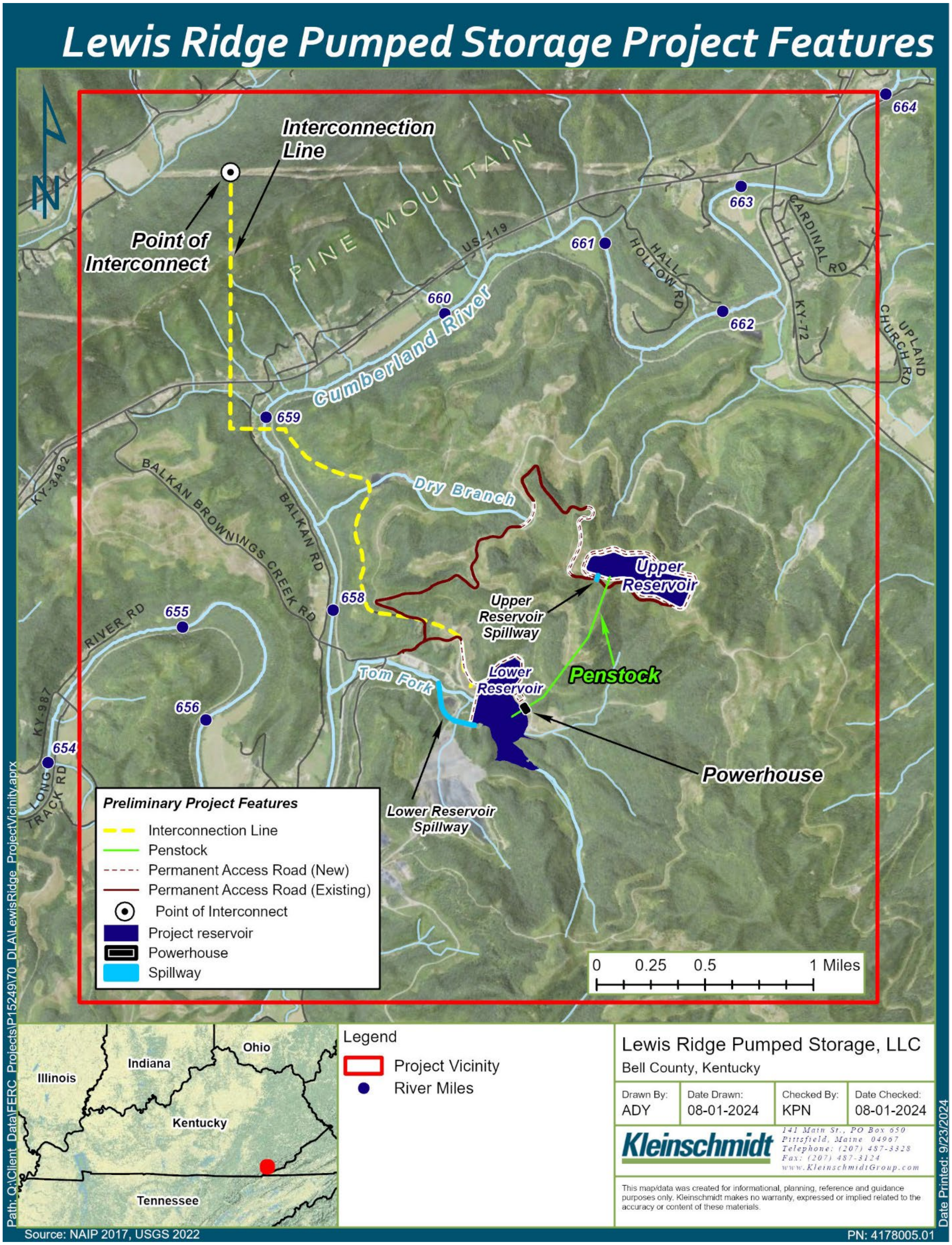


2.0 PROPOSED PROJECT STRUCTURES (18 CFR SECTION 4.41(B)(1)-(B)(5))

The unconstructed Lewis Ridge Project is currently in early stages of design, permitting, and licensing and exact specifications and site-specific locations of the project features have not been finalized. The Lewis Ridge Project specifications described herein are considered preliminary and may change for reasons such as engineering and geotechnical feasibility, environmental concerns, or site agreements and contracts.

As proposed, the Lewis Ridge Project would consist of the following: (1) a 5,450-foot-long, 135-foot-high hardfill dam for the upper reservoir with an integrated overflow emergency spillway; (2) an upper reservoir with a surface area of 39.7 acres and an active storage capacity of approximately 2,600 acre-feet; (3) a 4,757-foot-long steel penstock with a 16-foot-diameter upper section and a lower extent bifurcating into two 12-foot diameter steel sections; (4) a 150-foot-diameter circular shaft powerhouse located 250 feet below the ground containing two 143.5 MW reversible pump-turbines with a total installed capacity of 287 MW; (5) an 908-foot-long, 120-foot-high earthfill embankment dam at the lower reservoir with an integrated overflow emergency spillway; (6) a 48.3 acre lower reservoir with an active storage capacity of approximately 2,600 acre-feet; and (7) a 3.6-mile-long, 161 kilovolt overhead interconnection line. Proposed Lewis Ridge Project structures are shown on Figure 2-1.

Figure 2-1: Proposed Project Structures



2.1 Upper Reservoir and Dam

The proposed upper reservoir dam is a 5,450-foot-long, 135-foot-high ring dike hardfill dam with an integrated overflow emergency spillway. The upper reservoir hardfill dam would have upstream and downstream slopes of 0.6H:1V and the dam crest would be at elevation 2,210 feet.[1] The upper reservoir dam would include a low-level outlet works for use related to emergency drawdown requirements.[2] The upper reservoir's integrated overflow emergency spillway along the hardfill dam crest would be designed to provide protection from overtopping the dam during extreme floods or a potential over-pumping event.

The proposed upper reservoir is located on top of a ridge. The upper reservoir would have a surface area of 39.7 acres at the normal maximum water surface elevation of 2,200 feet and a surface area of 33.5 acres at the normal minimum water surface elevation of 2,129 feet. The upper reservoir would have a gross storage capacity of 2,732 acre-feet at the normal maximum water surface elevation and an active storage capacity of approximately 2,600 acre-feet.[3] The change in water surface elevation in the upper reservoir during normal operations is anticipated to be 71 feet. The upper reservoir would be lined with Hydraulic Asphalt Concrete (HAC) to prevent seepage and stability issues.

2.2 Conveyance System

The proposed conveyance system is 4,757-foot-long. A 16-foot-diameter steel penstock would be trenched into the ground and backfilled with approximately 5 feet of soil above the top of the penstock. The upper reservoir intake structure would be located within the dam on the south side of the upper reservoir, facing the powerhouse. Approximately 250 feet upstream of the powerhouse, the penstock would include a vertical bend that would transition to a vertical shaft 313 feet down to the centerline elevation of the pump-turbine runner. The vertical shaft would then transition to a short horizontal penstock section before bifurcating into two 12-foot-diameter steel penstock sections before entering the powerhouse.

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[1] Elevations are based on the North American Vertical Datum of 1988 (NAVD 88).

[2] In an emergency situation, the powerhouse units, and possibly the penstock, may not be available for upper reservoir drawdown. As such, the reservoirs would require dedicated bottom outlets to release water via gravity drainage without requiring the power generation pumping system to provide for safety of the dams.

[3] Active storage capacity is equal to the volume at the normal maximum water surface elevation minus the volume at the normal minimum water surface elevation.

The surface penstock would have two horizontal bends and a mean slope of 26.6 percent along the ridge of the mountain. The pump-turbine units would be set at an elevation of 1,034 feet to provide adequate submergence below the minimum operating water level in the lower reservoir.

Both pump-turbine units would be connected to a Y-shape manifold, and a 150-foot-long singular low-pressure penstock would connect the powerhouse to the lower reservoir water inlet/outlet. At the exit of the units, pipes would be 12 feet in diameter and the low-pressure penstock would be 16 feet in diameter.

The lower reservoir water inlet/outlet is located on the edge of the reservoir and typical flow velocities are obtained through the structure from the low-pressure penstock to the lower reservoir.

Water intakes, steel penstock, manifolds and other parts of the conveyance system are dimensioned so that flow velocities are close to the target flow velocity range as presented in Table 2-1. The preliminary conveyance system dimensions are presented in Table 2-2.

Table 2-1: Preliminary Design Characteristics of Conveyance System

Component	Target Flow Velocity Range (feet per second [ft/s])
Water intake trash rack	0.5 to 3
Water intake structure	Transition from trash racks to conveyance system entrance
Steel penstock	Up to 20
Manifolds	Up to 20
Turbine Inlet Valve	Up to 23

Table 2-2: Preliminary Dimensions of Conveyance System

Component	Shape	Dimensions (feet)
Upper Reservoir Intake Trash Rack	Rectangular (W x H)	30 x 37
Upper Reservoir Intake Gate	Square (W x H)	16 x 16
High Pressure Penstock	Circular (Dia.)	16
High Pressure Manifold Entrance	Circular (Dia.)	16
High Pressure Manifold Exit	Circular (Dia.)	12
Turbine Inlet Valve	Circular (Dia.)	10
Low Pressure Manifold Entrance	Circular (Dia.)	12
Low Pressure Manifold Exit	Circular (Dia.)	16
Low Pressure Penstock	Circular (Dia.)	16
Lower Reservoir Intake Gate	Square (W x H)	16 x 16
Lower Reservoir Intake Trash Rack	Rectangular (W x H)	30 x 37

2.3 Lower Reservoir and Dam

The proposed lower reservoir dam would be a 908-foot-long, 120-foot-high earth embankment dam with an integrated overflow emergency spillway located in the left abutment. The lower reservoir earth embankment dam would have 3H:1V upstream and downstream slopes and the dam crest would be at an elevation of 1,244 feet. The lower reservoir dam would include a low-level outlet works for use related to emergency drawdown requirements. To prevent seepage, the entire lower reservoir footprint would be lined with HAC and the liner would extend above the max operating water surface elevation. The lower reservoir would include a concrete-lined integrated overflow emergency spillway in the left abutment of the dam designed to pass the Probable Maximum Flood flow.

As depicted in Figure 2-1, the proposed lower reservoir would be located within a valley that contains Tom Fork, a tributary to the Cumberland River. The lower reservoir would have a surface area of 48.3 acres at the normal maximum water surface elevation of 1,234 feet and a surface area of 9.5 acres at the normal minimum water surface elevation of 1,134 feet. The lower reservoir would have a gross storage capacity of 2,673 acre-feet at the normal maximum water surface elevation and an active storage capacity of approximately 2,600 acre-feet. The change in water surface elevation in the lower reservoir during normal operations is anticipated to be 100 feet.

2.4 Powerhouse and Generating Equipment

The powerhouse configuration considers the reservoir layout, conveyance system design, initial penstock diameter, manifold diameters, and pump-turbine arrangement. The proposed powerhouse is located at the eastern end of the lower reservoir and is a shaft-style powerhouse. The approximate 150-foot-diameter circular shaft powerhouse would be located 250 feet below the ground surface, allowing for the pump-turbine units runner elevation setting to have adequate submergence below the minimum operating level in the lower reservoir. Three 13.8 kilovolt (kV):161kV 150 megavolt-amperes (MVA) iso-phase bus to air-bushings generator step-up transformers (two primary and one spare) would be located in a switchyard adjacent to the powerhouse at the ground surface. Each Generator Step-Up Transformer (GSU) would be connected on its high side to a 161kV air insulated (AIS) SF6 circuit breaker, tied to a single bus. A single 161kV AIS main circuit breaker would be connected to the interconnecting transmission line. Other features that would be included in the at-grade substation include disconnect switches, surge arresters, instruments, control house with protective relaying, and a dead-end structure for connecting the transmission line.

The powerhouse would contain two 143.5 MW reversible pump-turbines with a total installed capacity of 287 MW. The Lewis Ridge Project would utilize Francis-type fixed or variable-speed pump-turbine units with an overall cycle efficiency for pumping and generating of approximately 75 percent.

Current design assumes two 143.5 MW fixed speed reversible Francis pump-turbines, with two identical units and a vertical shaft arrangement. The Lewis Ridge Project will consider the potential use of variable speed pump-turbine units as the design progresses. The generator would be either a synchronous or asynchronous machine based on the decision of fixed speed versus variable speed turbine. The generators would be totally enclosed, vertical salient-pole type.

2.5 Transmission Facilities

The Lewis Ridge Project would interconnect into the Louisville Gas and Electricity Company and Kentucky Utilities Company 161 kilovolt Pineville-Harlan #1 overhead interconnection transmission line. This would include a 3.6-mile-long overhead transmission line from the powerhouse substation to a new transmission line interception 3-breaker ring-bus switching station.

2.6 Ancillary Equipment

Main Inlet Valves:

The turbine inlet would be equipped with a spherical valve acting as a main inlet valve. The main inlet valve would allow the turbines to be dewatered and the penstock flow to be shut off in case of an emergency. The spherical valves would be equipped with maintenance and service seals. The spherical valves may be controlled in local mode, but the control would normally be incorporated in the turbine automatic control sequence. Each spherical valve would be equipped with a bypass line for the purpose of filling and/or equalizing the water pressure in the turbine and manifold before opening the spherical valve. The diameter of the valve would be confirmed considering the diameter of the penstock branch pipes.

Governor:

The pump-turbine equipment would be equipped with a governor system composed of a digital governor, governor actuator, common pressure oil system for the turbine, and the spherical valves and associated control instruments.

Main Hoisting Devices:

Two electrically operated overhead traveling cranes of equal capacity would be installed in the powerhouse, each equipped with main and auxiliary hoists. The crane's main hoists would be designed to lift the heaviest part of the generator including the lifting beam. The crane would be capable of lifting and lowering the main inlet valves and other accessories of the pump-turbine during installation. The actual capacity of the crane and its lifting height will be confirmed as site design advances.

Transformers:

In order to step up the generator voltage to the grid transmission voltage, each generating unit would be connected to generator step-up transformers (13.8 kilovolt [kV]/161 kV). The details of windings, magnetic core, transformer tank, terminals, and bushings of the transformers will be developed as site design advances.

Instrumentation and Monitoring:

Instrumentation would be included in the dam embankments and foundations, below the dams, and within the reservoirs. Instrumentation would include reservoir level sensors, survey monuments, piezometers, water level standpipes, settlement sensors, accelerographs, seepage monitoring weirs, and fiber optic cables for seepage monitoring. The instruments may be designed to connect to an automated data acquisition system (ADAS) for remote monitoring.

A summary of proposed specifications for the Lewis Ridge Project is provided in Table 2-3.

Table 2-3: Proposed Lewis Ridge Project Specifications[4]

Lewis Ridge Project Description	Specification
General Information	
FERC Number	P-15249
Operation Type	Pumped Storage Project
Location	Bell County, Kentucky
Active Storage Capacity	Approximately 2,600 acre-feet
Gross Storage Capacity	2,732 acre-feet upper reservoir, 2,673 acre-feet lower reservoir
Storage Time	8 hours (at full discharge capacity)
Maximum Gross Head	1,066 feet
Minimum Gross Head	895 feet
Average Gross Head	965 feet

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[4] Elevations are based on the North American Vertical Datum of 1988 (NAVD 88).

Lewis Ridge Project Description	Specification
Generation	
Installed Capacity	287 MW (full reservoir and total for 2 units)
Average Annual Generation	738.0 GWh
Average Monthly Generation	61.5 GWh
Upper Reservoir	
Structure Type	Hardfill Dam (0.6H:1V upstream and downstream slopes)
Location	36.768800 Latitude, -83.538000 Longitude
Minimum Water Surface Elevation and Area	Approximately 2,129 feet, 33.5 acres
Maximum Water Surface Elevation and Area	Approximately 2,200 feet, 39.7 acres
Dam Height	135 feet (crest at 2,210 feet)
Dam Length	5,450 feet
Dam Width	20 feet
Overflow Spillway	Integrated overflow emergency spillway, sized for probable maximum flood event and pumping flow
Outlet	Low-level outlet for emergency drawdown requirements
Water Conduits	
Number of penstocks	1 penstock (bifurcates to two penstocks before entering powerhouse)
Diameter of penstocks	16 feet and 12 feet respectively
Length of penstock	4,757 feet
Lower Reservoir	
Structure Type	Earthfill Embankment Dam (3H:1V upstream and downstream slopes)
Location	36.760058 Latitude, -83.551000 Longitude
Minimum Water Surface Elevation and Area	Approximately 1,134 feet, 9.5 acres
Maximum Water Surface Elevation and Area	Approximately 1,234 feet, 48.3 acres
Dam Height	120 feet (crest at 1,244 feet)

Lewis Ridge Project Description	**Specification**
Dam Length	908 feet
Dam Width	20 feet
Overflow Spillway	Integrated overflow emergency spillway, concrete chute spillway located in the left abutment, sized for probable maximum precipitation event with lower reservoir at the maximum water surface level
Outlet	Low-level outlet for emergency drawdown requirements
Powerhouse	
Location	At eastern end of lower reservoir
Dimensions	Approximately 150 feet in diameter, shaft-style powerhouse 250 feet below ground level
Pump Turbine-Generators	Two (2) 143.5 MW reversible pump-turbine units
Rated Flow	3,550 cubic feet per second (cfs) total station flow
Transformers and Interconnection Lines	
Number of Interconnection Lines	1
Length of Interconnection Line	3.6 miles
Interconnection Line Voltage	161 kilovolts
Number of Transformers	2 primary and 1 spare
Water Recharge Conveyance System	
Type	Natural inflows from Tom Fork
Access Roads	
Permanent Access Roads	4.6 miles long, 28 feet wide
Temporary Access Roads	3.9 miles, 28 feet wide

3.0 LANDS OF THE UNITED STATES (18 CFR SECTION 4.41(B)(6))

The Lewis Ridge Project would be located on private land and there is no associated Federal or Tribal land.

LEWIS RIDGE PUMPED STORAGE PROJECT
FERC NO. 15249

DRAFT EXHIBIT B
PROJECT OPERATION AND RESOURCE UTILIZATION

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DEFINITIONS OF TERMS, ACRONYMS, AND ABBREVIATIONS

Applicant	Lewis Ridge Pumped Storage, LLC
CFR	Code of Federal Regulations
Commission	Federal Energy Regulatory Commission
DLA	Draft License Application
FERC	Federal Energy Regulatory Commission
FLA	Final License Application
GWh	gigawatt-hours
HAC	Hydraulic Asphalt Concrete
Lewis Ridge Project	Lewis Ridge Pumped Storage Project, FERC P-15249
LG&E/KU	Louisville Gas & Electricity Company and Kentucky Utilities Company
LRPS	Lewis Ridge Pumped Storage, LLC
MW	megawatt
MWh	megawatt-hours
NAVD 88	North American Vertical Datum of 1988
NOAA	National Oceanic and Atmospheric Administration
PAD	Pre-Application Document
PPA	preliminary permit application
TLP	Traditional Licensing Process

1.0 PROJECT ALTERNATIVES CONSIDERED (18 CFR SECTION 4.41(C)(1) AND 4.41(C)(2))

1.1 Project Site Alternatives

The proposed Lewis Ridge Pumped Storage Project (Lewis Ridge Project) site is located in Bell County, Kentucky, near the borders of Tennessee and Virginia. The proposed site is located near the communities of Blackmont, Tejay, Balkan, and Callaway and near river mile 659 of the Cumberland River. No other sites or locations were considered. The proposed site features topography and existing conditions beneficial to a pumped storage system and provides a unique opportunity to repurpose a site historically used for mining.

1.2 Project Design Alternatives

On November 19, 2021, Lewis Ridge Pumped Storage, LLC (Applicant or LRPS) submitted an application for preliminary permit for the Lewis Ridge Project.[1] The Lewis Ridge Project as proposed in the 2021 preliminary permit application (PPA) is shown in Figure 1-1 and included a 30-acre upper reservoir with a zoned rockfill dam and 2,300 acre-feet of storage capacity, a 23-acre lower reservoir with a zoned rockfill dam and 2,300 acre-feet of storage capacity, a 987-foot-long steel and concrete conveyance structure, a 420-foot-long 80-foot-wide powerhouse located on the eastern edge of the lower reservoir with four 54-megawatt (MW) pump-turbine units, and a steel surge tower. As proposed in the PPA, the Lewis Ridge Project would have had a total capacity of 216 MW with a storage time of 8 hours at full discharge capacity.

The Lewis Ridge Project as proposed in the 2022 Pre-Application Document (PAD)[2] is shown in Figure 1-2 and consisted of: (1) a 5,450-foot-long, 135-foot-high roller compacted concrete dam for the upper reservoir with an integrated emergency overflow spillway; (2) an upper reservoir with a surface area of 24 acres and a useable storage capacity of 2,300 acre-feet; (3) a 3,850-foot-long steel penstock with a 16-foot-diameter upper section and a lower extent bifurcating into two 12-foot-diameter steel sections; (4) a steel surge tower or set of energy-dissipating pressure relief valves; (5) a 420-foot-long, 80-foot-wide powerhouse containing two 143.5-MW reversible pump-turbines with

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[1] Accession No. 20211122-5269

[2] Accession No. 20221021-5176

a total installed capacity of 287 MW; (6) an 830-foot-long, 80-foot-high roller compacted concrete dam at the lower reservoir with an integrated emergency overflow spillway; (7) a 47-acre lower reservoir with a storage capacity of 2,300 acre-feet; and (8) a 2.3-mile-long, 161-kilovolt overhead interconnection line. The upper reservoir footprint was reduced from 30 acres in the PPA to 24 acres in the PAD, and the lower reservoir location was moved and enlarged from approximately 23 acres in the PPA to 47 acres in the PAD. As proposed in the PAD, the Lewis Ridge Project was estimated to have an annual generation of 671.7 gigawatt-hours (GWh) and a daily energy storage of 2,165 megawatt-hours (MWh), with a storage time of 8 hours at full discharge capacity.

After filing the PAD, the conceptual design of the Lewis Ridge Project was modified based on updated survey data and geologic information. Preliminary calculations showed that the initial proposed active storage volume of 2,300 acre-feet (as proposed in the PAD) was not sufficient to allow the target power output of 287 MW for 8 hours and a daily energy storage of 2,165 MWh. Both the upper and lower reservoir were modified to increase active storage from approximately 2,300 acre-feet to 2,600 acre-feet. The upper reservoir footprint was moved and enlarged from approximately 24 acres as proposed in the PAD to 39.7 acres (at its maximum operating water surface elevation). The configuration of the lower reservoir was adjusted to increase the dam height and additional excavation within the lower reservoir footprint was developed to increase storage capacity. At its maximum operating water surface elevation, the lower reservoir surface area as now proposed increased to 48.3 acres as compared to 47 acres proposed in the PAD. The structure type of the upper and lower reservoir dams has also been modified since the filing of the PAD, from roller compacted concrete to a hardfill dam (for the upper reservoir dam) and earthfill dam (for the lower reservoir dam). A revised penstock configuration was also considered since the PAD, which included two alignment alternatives (Alternative A and Alternative B) depicted in Figure 1-3. Alternative A considered the initial location of the powerhouse immediately adjacent to the lower reservoir dam, while Alternative B considered a new powerhouse location along the eastern portion of the lower reservoir. Penstock alternative specifications are provided in Table 1-1.

Table 1-1: Penstock Specifications by Alternative

Penstock Alternative	Length (feet)	Diameter	Mean Slope (%)	Horizontal Bends	Elevation of Units (feet)[3]
Alternative A	5,122	16 feet bifurcating into two 12-foot sections	24.6	3	1034
Alternative B	4,757	16 feet bifurcating into two 12-foot sections	26.6	2	1034

Alternative B was selected as the preferred alternative due to a reduced length of penstock and improved hydraulic efficiency.

In addition, since the PPA and PAD design, the interconnection line has been extended north to interconnect into the existing Louisville Gas & Electricity Company and Kentucky Utilities Company (LG&E/KU) 161-kV Pineville-Harlan #1 transmission line (shown in Figure 1-3).

A Lewis Ridge Project study area was defined as the geographic area for licensing studies conducted in 2024 and includes appropriate buffers around the proposed facilities to account for further refinement of engineering design and construction activities. Preliminary locations for potential fill areas, construction laydown and parking, and permanent and temporary access roads are shown on Figure 1-3.

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[3] Elevations are based on the North American Vertical Datum of 1988 (NAVD 88).

Figure 1-1: Project Structures as Proposed in the 2021 Preliminary Permit Application

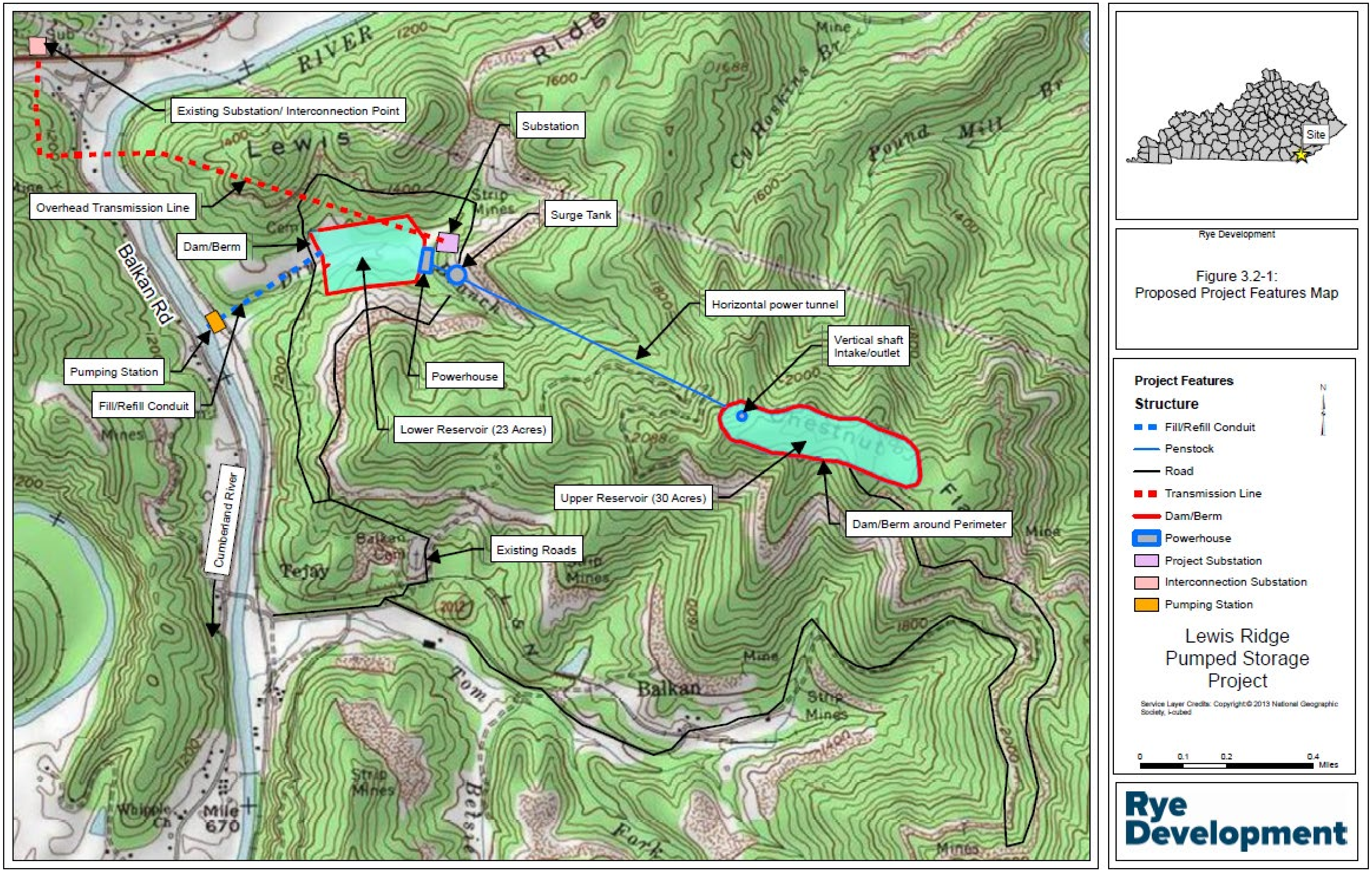
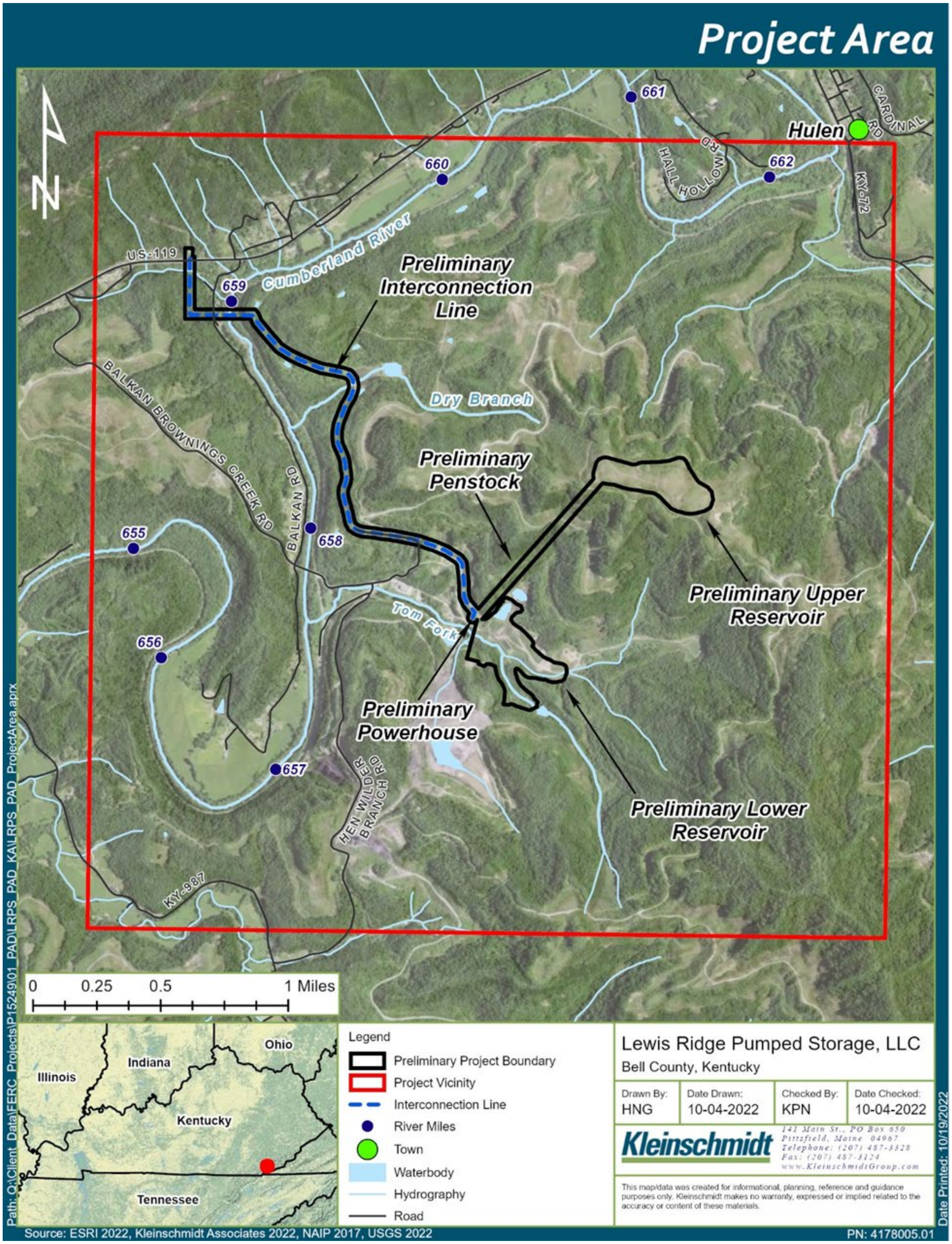
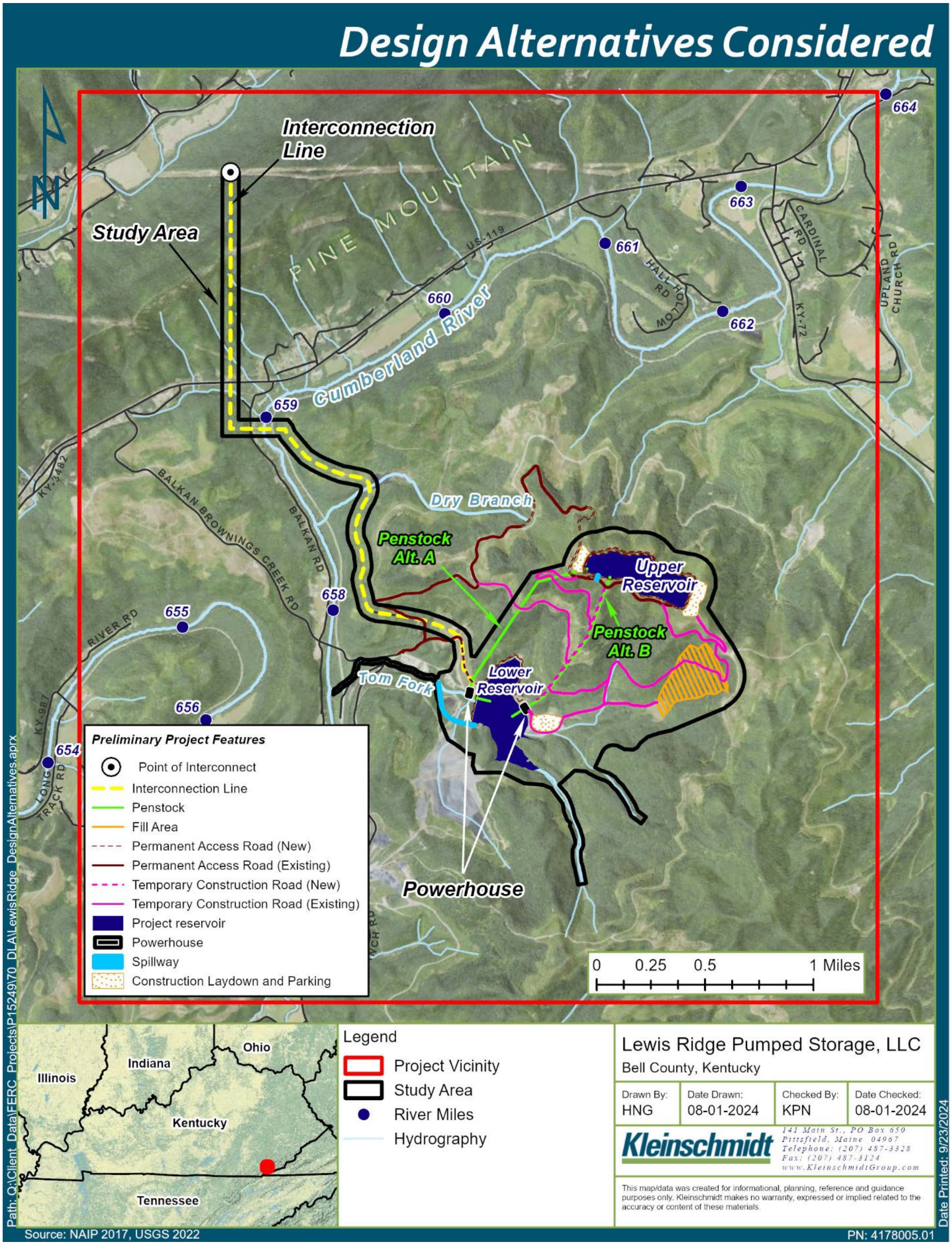


Figure 1-2: Project Structures as Proposed in the 2022 Pre-Application Document



Source: ESRI 2022, Kleinschmidt Associates 2022, NAIP 2017, USGS 2022

Figure 1-3: Project Structures Considered Since the Pre-Application Document



1.3 Proposed Project Alternative

The unconstructed Lewis Ridge Project is currently in stages of design, permitting, and licensing and exact specifications and site-specific locations of the features have not been finalized. The specifications associated with the Lewis Ridge Project as described herein are considered preliminary and may change for reasons such as engineering and geotechnical feasibility, environmental concerns, or site agreements and contracts.

The Lewis Ridge Project as proposed in this Draft License Application (DLA) would consist of the following: (1) a 5,450-foot-long, 135-foot-high hardfill dam for the upper reservoir with an integrated emergency overflow spillway; (2) an upper reservoir with a surface area of 39.7 acres and an active storage capacity of approximately 2,600 acre-feet; (3) a 4,757-foot-long steel penstock with a 16-foot-diameter upper section and a lower extent bifurcating into two 12-foot-diameter steel sections; (4) a 150-foot-diameter circular shaft powerhouse located 250 feet below the ground containing two 143.5-MW reversible pump-turbines with a total installed capacity of 287 MW; (5) an 908-foot-long, 120-foot-high earthfill embankment dam at the lower reservoir with an integrated emergency overflow spillway; (6) a 48.3-acre lower reservoir with an active storage capacity of approximately 2,600 acre-feet; and (7) a 3.6-mile-long, 161-kilovolt overhead inter-connection line. Additional specifications on the proposed Lewis Ridge Project are provided in Exhibit A of this DLA.

2.0 PROJECT OPERATION (18 CFR SECTION 4.41(C)(3))

The Lewis Ridge Project would operate as a pumped storage facility, using water stored in the upper reservoir to create energy by releasing it through pump-turbine units into the lower reservoir. Water would then be pumped back from the lower reservoir to the upper reservoir to replenish the storage. There are no inflows to the proposed upper reservoir other than pumping flows during normal Lewis Ridge Project operations and rainfall. The proposed lower reservoir is located within a valley that contains Tom Fork, a tributary to the Cumberland River. The lower reservoir is subject to naturals inflows of Tom Fork generated by rainfall. Water for the initial fill and annual recharge would flow into the lower reservoir and come from natural inflows from Tom Fork and its tributaries.

In a 24-hour operating cycle, the Lewis Ridge Project would have the capacity to generate energy for 8 hours a day at full power output (at a maximum of 273.4 MW at the point of interconnection), and pump water back from the lower reservoir to the upper reservoir for approximately 11 hours to accomplish the upper reservoir refill. The pump flow would vary from 3,162 cubic feet per second (cfs) at the beginning of the pump cycle to 2,681 cfs at the end of the pump cycle. During a 24-hour operating cycle, the upper reservoir may fluctuate up to 71 feet, from the normal maximum water surface elevation of 2,200 feet[4] to the normal minimum water surface elevation of 2,129 feet, and the lower reservoir may fluctuate up to 100 feet, from the normal maximum water surface elevation of 1,234 feet to the normal minimum water surface elevation of 1,134 feet.

2.1 Initial Fill

The duration for the initial fill is dependent on basin precipitation and streamflow, evaporation, reservoir seepage, and the Lewis Ridge Project construction schedule. It is assumed that the initial fill will be completed over a period of 1 year. Timing of the initial fill will depend on the timing of construction activities; principally, the lower reservoir construction and the completion of the inlet/outlet structure. It is anticipated that the source of the initial fill water will be natural inflows from Tom Fork and potentially pumping water from the Cumberland River and/or pumping groundwater from wells that

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[4] Elevations are based on the North American Vertical Datum of 1988 (NAVD 88).

would be installed adjacent to the lower reservoir site. Based on preliminary hydrologic calculations, the total initial fill volume is 3,273.6 acre-feet as shown in Table 2-1.

Table 2-1: Initial Fill Volume

Storage	Initial Fill Volume (acre-feet)
Inactive Storage for Both Reservoirs	653
System Active Storage	2,600
Conveyance Volume	20.6
Total	**3,273.6**

2.2 Recharge Water

The estimated total annual evaporation and seepage losses from the Lewis Ridge Project are approximately 274 acre-feet per year, representing approximately 8 percent of the active storage volume. These losses would need to be replaced by annual recharge water. The source of the annual recharge water would be from natural inflows to the lower reservoir from Tom Fork. The estimated evaporation was based on data recorded by the National Weather Service, Climate Prediction Center operated by the National Oceanic and Atmospheric Administration, which provides monthly evaporation data across different locations in the United States (NOAA National Weather Service 2024). Conveyance system and reservoir seepage is expected to be minimal as the upper and lower reservoirs would be lined with Hydraulic Asphalt Concrete (HAC).

2.3 Project Operational Control

The Lewis Ridge Project would be staffed with on-site operations staff 24 hours a day, 7 days a week.

2.4 Annual Plant Factor

Plant factor is defined as the average production for a given time divided by the total maximum production at full design capacity. The Lewis Ridge Project is designed to generate for up to 8 hours each day at maximum generating capacity, however, actual generation would be dependent on market demand. Assuming the Lewis Ridge Project was in generating mode for 8 hours each day at maximum generating capacity, the annual electrical energy production is estimated to be 738.0 GWh (including scheduled and unscheduled outages), resulting in a plant factor of approximately 31 percent.

2.5 Project Operation during Adverse, Mean, and High-Water Years

The initial fill of approximately 2,600 acre-feet of water would be supplied by gravity flow from the natural drainage above the lower reservoir from Tom Fork. Additionally, initial fill may be supplemented from pumping water from the Cumberland River to the lower reservoir and/or pumping water from groundwater wells installed adjacent to the lower reservoir site. Annual recharge water would be provided by the natural inflows into the lower reservoir from Tom Fork to replace evaporation and seepage losses from the system.

Due to the storage function of the Lewis Ridge Project and the relatively small drainage that inflows into the lower reservoir, operations would not be significantly impacted by adverse (low-water), mean, or high-water years. During adverse water years, supplemental recharge water may be required from the same source utilized to supplement initial fill. The normal operating levels in the lower reservoir would be maintained by releases of any mean or high flows through the low-level outlet works and the integrated emergency overflow spillway (during storm events with flood inflows that exceed the capacity of the low-level outlet works). The lower reservoir integrated overflow emergency spillway is designed to accommodate the Probable Maximum Flood storm event.

3.0 ESTIMATED ENERGY PRODUCTIONS AND DEPENDABLE CAPACITY (18 CFR SECTION 4.41(C)(4))

Pumped storage projects are designed to provide dependable capacity to the regional electric grid and are specifically configured based upon these anticipated grid requirements. It is projected that the annual dependable capacity electrical energy production would be 738.0 GWh based on the calculations outlined below.

3.1 Project Flow Data

There is no existing flow data available for Tom Fork and flow duration curves are not applicable for the Lewis Ridge Project. Based on preliminary estimates, approximately 274 acre-feet of net evaporation and seepage is expected to be lost from the combined reservoir and water conveyance systems each year. The initial water available to fill the reservoirs as well as any supplemental water needed on a periodic basis to replace net water losses would be replaced by gravity flow from Tom Fork flowing into the lower reservoir. For initial fill, additional supplemental water may be needed by pumping from the Cumberland River and/or from groundwater wells installed adjacent to the lower reservoir site.

3.2 Area-Capacity Curves

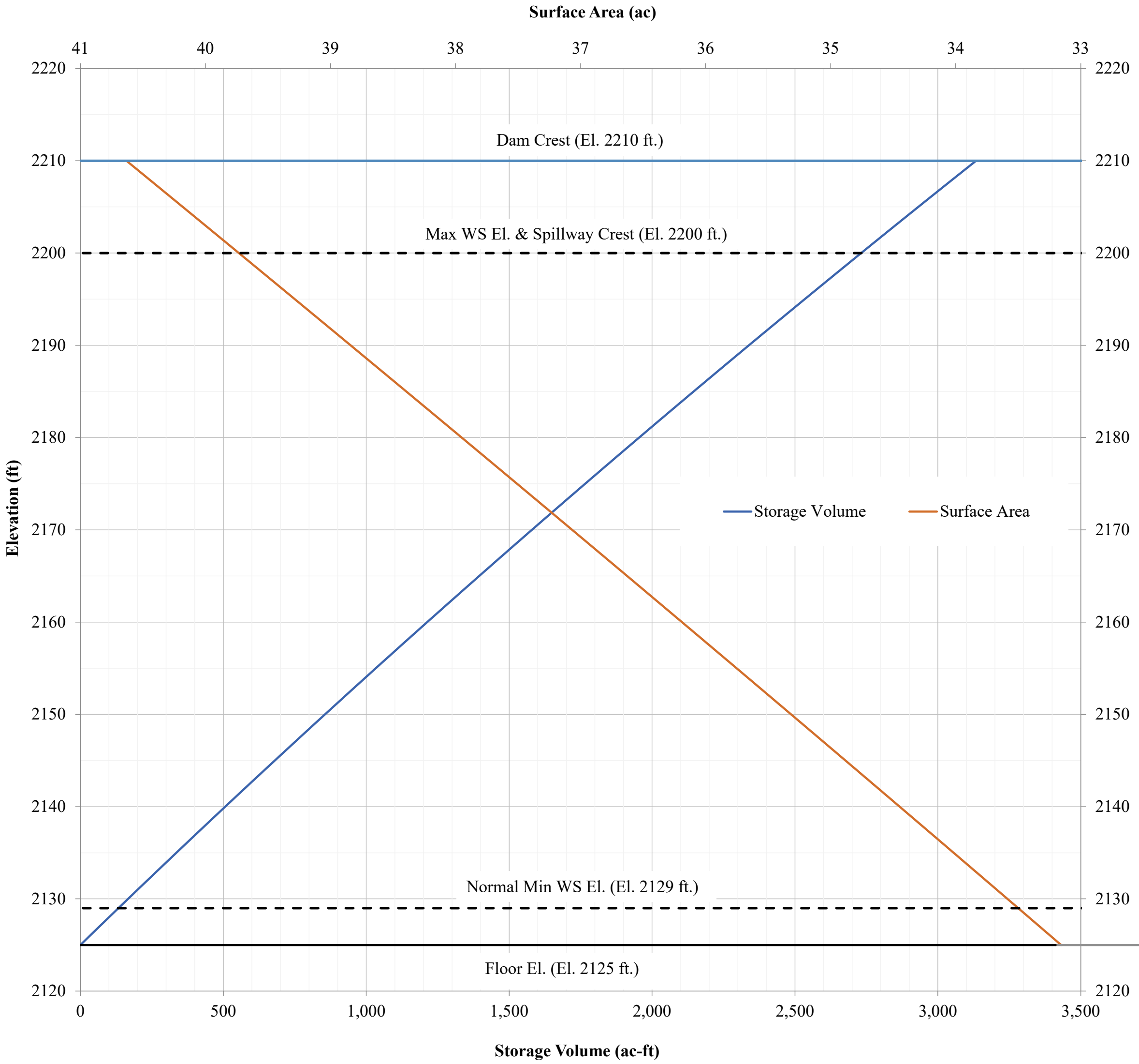
During generation mode, water stored in the upper reservoir would be released through the upper reservoir intake/outlet through the water conveyance system, pass through the pump-turbines, and discharge into the lower reservoir. The upper reservoir water surface elevation would decrease as the lower reservoir water surface elevation increases. During pumping mode, this process is reversed. The generating and pumping times would be dependent on market demand; however, during a full 8-hour generating cycle, the upper reservoir would be at its normal minimum water surface elevation after 8 hours and the lower reservoir would be at its normal maximum water surface elevation. Lewis Ridge Project operation can alternate between pumping and generating modes quickly and for different lengths of time to respond to market demand. The following sections describe the area-capacity curves for the upper and lower reservoirs.

3.2.1 Upper Reservoir

At its normal maximum water surface elevation, the upper reservoir has a surface area of 1,730,740 square feet (sq-ft) or 39.7 acres. The active storage volume is approximately 2,600 acre-feet.

A preliminary area-capacity curve for the upper reservoir is shown in Figure 3-1. The normal minimum water surface elevation of 2,129 feet in the upper reservoir would be maintained such that the vertical inlet/outlet is submerged to prevent vortices from entering the intake and vertical shaft during power generation. The normal minimum water surface elevation of 2,129 feet submerges the low-level outlet by 4 feet.

Figure 3-1: Upper Reservoir Area-Capacity Curve

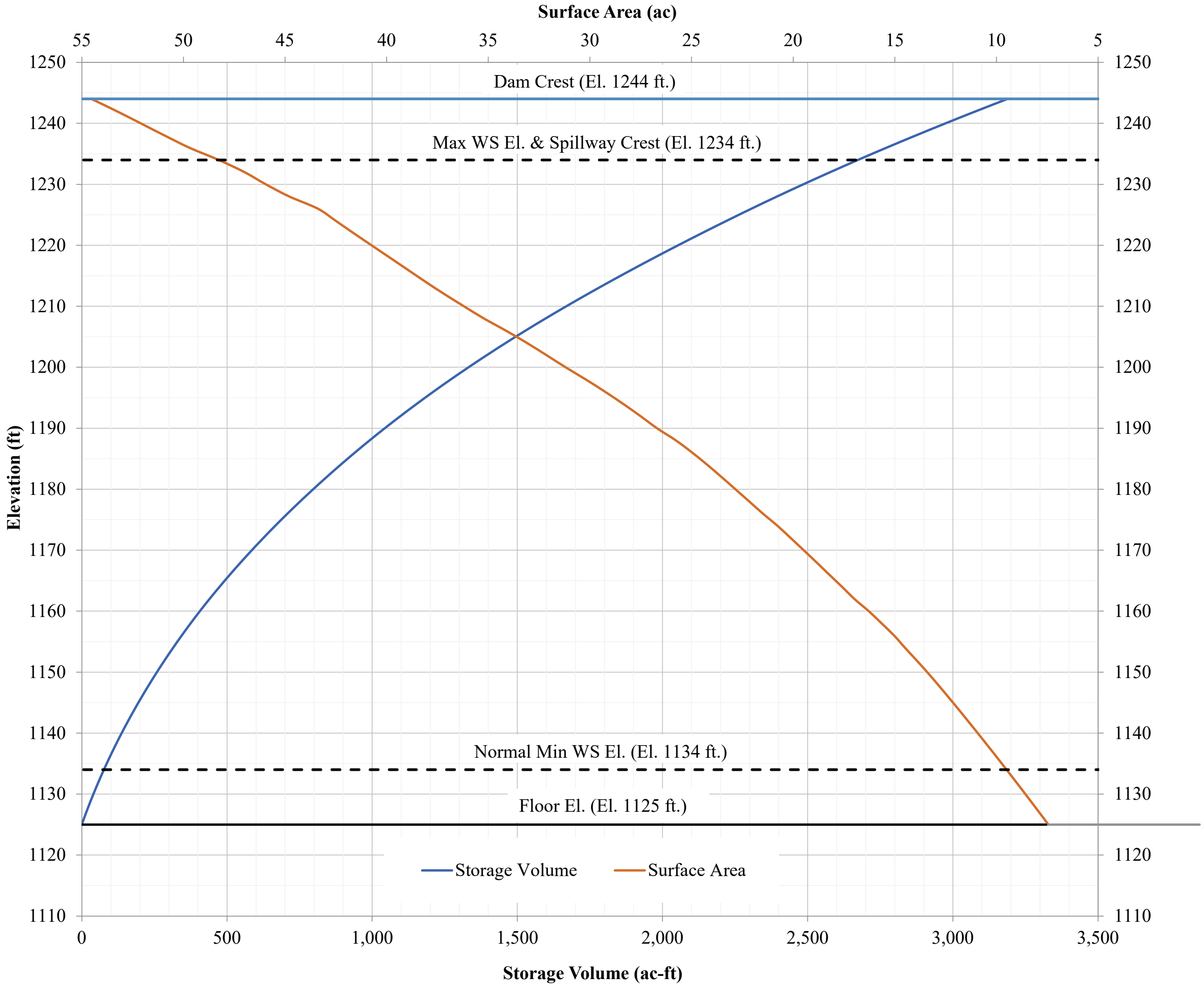


3.2.2 Lower Reservoir

The lower reservoir at its normal maximum water surface elevation has a surface area of 2,102,729 sq-ft or 48.3 acres. The active storage volume is approximately 2,600 acre-feet.

A preliminary area-capacity curve for the lower reservoir is shown in Figure 3-2. The normal minimum water surface elevation of 1,134 feet in the lower reservoir would be maintained such that the inlet/outlet is always submerged to prevent an intake vortex from forming during pumping mode of operation.

Figure 3-2: Lower Reservoir Area-Capacity Curve



3.3 Estimated Hydraulic Capacity

Table 3-1 provides the estimated hydraulic capacity data during generating mode for the Lewis Ridge Project.

Table 3-1: Estimated Hydraulic Capacity

Characteristic	Flow (cfs)	Efficiency (%)	Generator Output (kW)
Minimum Hydraulic Capacity	1,072	85	67,900
Maximum Hydraulic Capacity	4,288	90	278,200

3.4 Tailwater Rating Curves

The lower reservoir is considered the Lewis Ridge Project tailwater. The tailwater rating curve is equivalent to the lower reservoir area-capacity curve outlined in Figure 3-2 above. The lower reservoir elevation increases during the generating cycle as flow is discharged through the powerhouse into the lower reservoir.

3.5 Power Plant Capability versus Head

The following sections describe the plant capability versus head in the generating and pumping cycle. Typically, generating cycles are started at the maximum gross head while pumping cycles are started at the minimum gross head. Maximum, average, and minimum gross heads for the Lewis Ridge Project are summarized in Table 3-2.

Table 3-2: Maximum, Average, and Minimum Gross Head

Operating Level	Upper Reservoir Water Level (feet)	Lower Reservoir Water Level (feet)	Gross Head (feet)
Maximum	2,200	1,134	1,066
Average	2,166	1,201	965
Minimum	2,129	1,234	895

3.5.1 Generating Cycle

Table 3-3 provides the maximum power outputs during the generating cycle.

Figure 3-3 depicts the variation of water surface elevations for both reservoirs during the generation cycle. Figure 3-4 depicts the total power output at the point of inter-connection, the total energy produced during 8 hours of generation, and the total turbine flow. For a complete generating cycle, the total energy produced at the transformers is 2,203 MWh, while the total energy transfer at the interconnection point is 2,187 MWh.

The total annual dependable capacity energy production calculated at the interconnection point (including scheduled and unscheduled outages) is 738.0 GWh (Table 3-4).

Table 3-3: Maximum Power Outputs

Component	Output (MW)
Pump-turbine maximum shaft	282.4
Generator maximum	278.2
Step-up transformers maximum	275.4
Interconnection point maximum	273.4

Figure 3-3: Water Level Variations in Upper and Lower Reservoirs

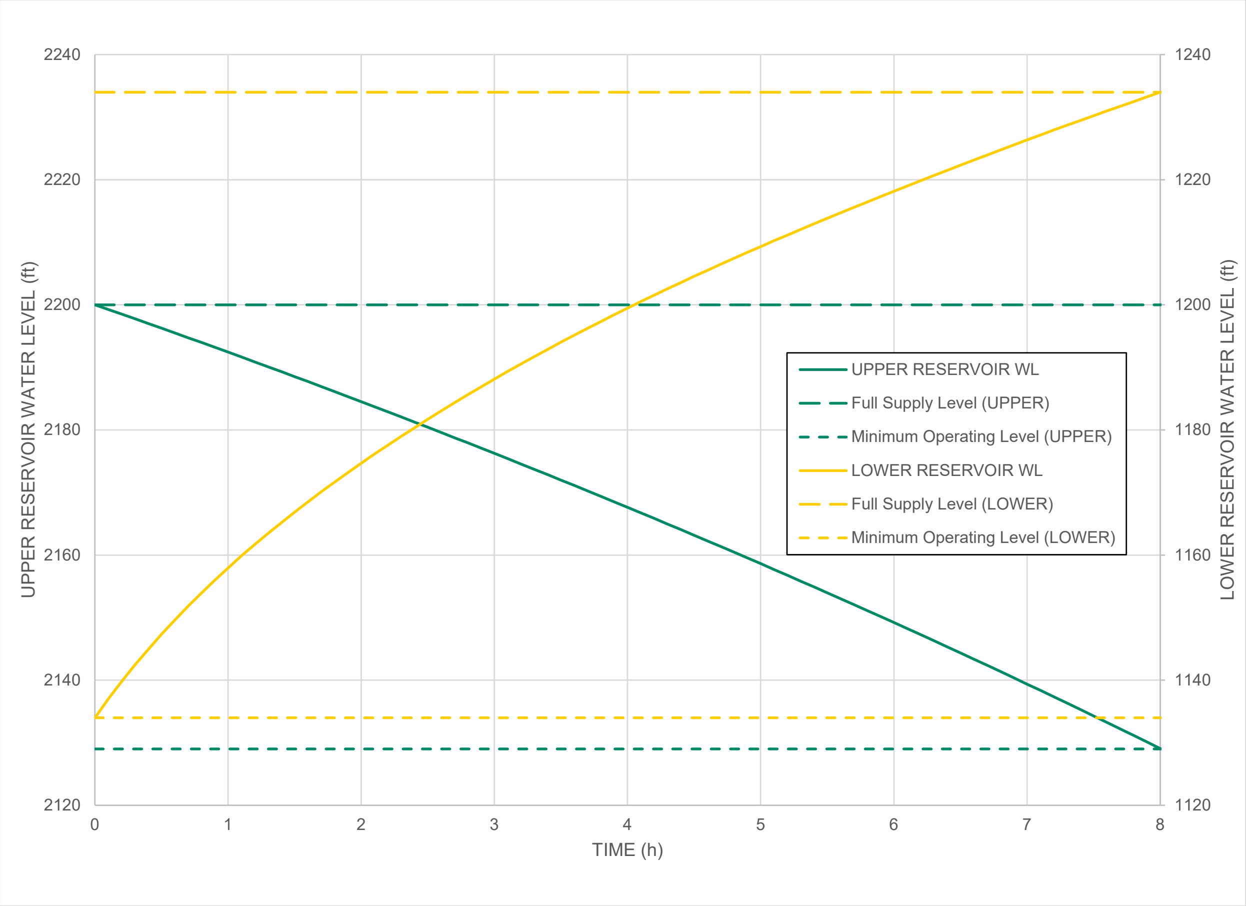


Figure 3-4: Gross Head, Turbine Flow, Power Output, and Energy Generation

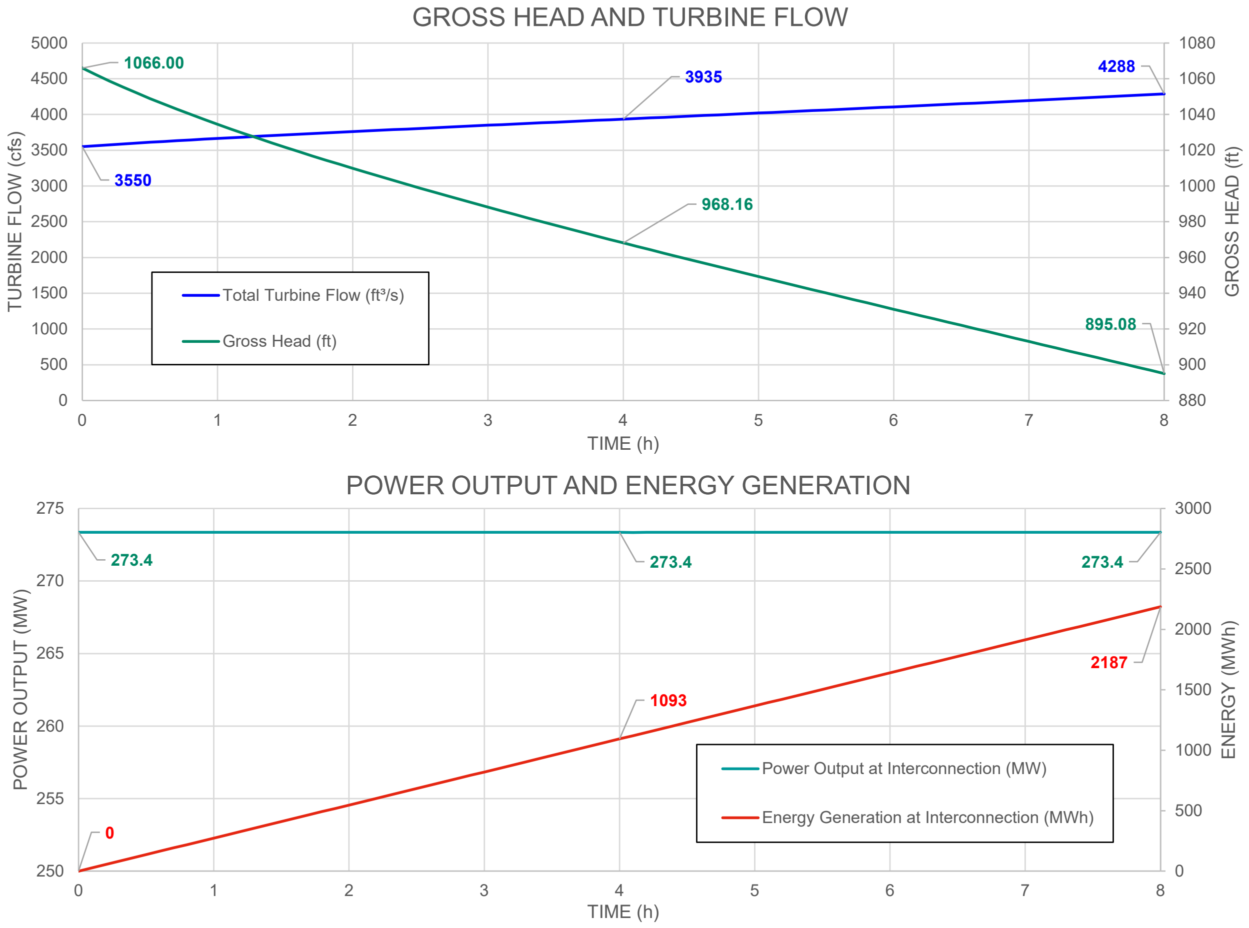


Table 3-4: Annual Dependable Capacity Calculations at Interconnection Point

Generation Scenario	Gigawatt-hours (GWh)
313.8 days of full generation	686.3
47.5 days of generation with only 1 unit (6.5% scheduled outage each unit)	51.7
3.7 days without generation (1% unscheduled outage)	0
Total	**738.0**

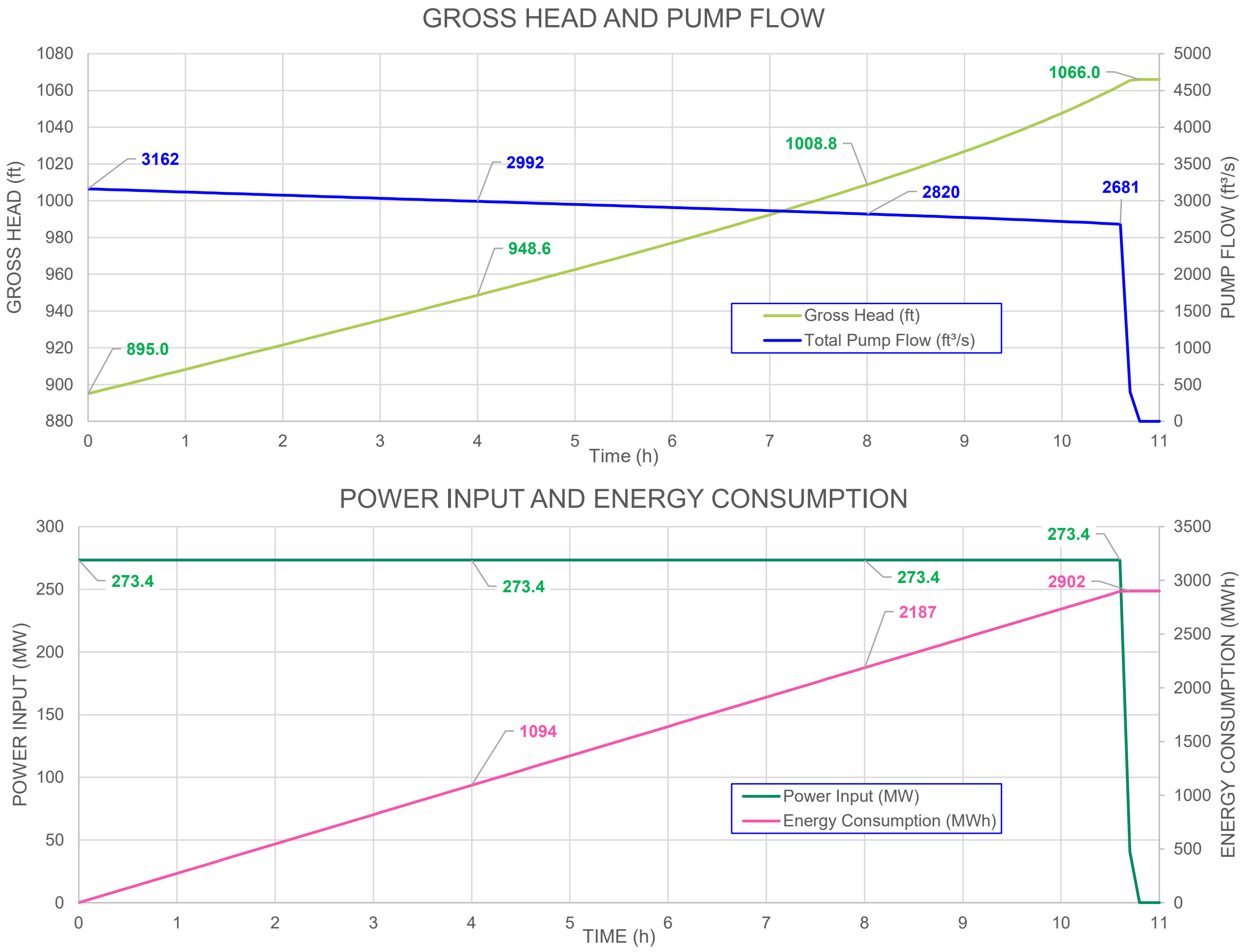
3.5.2 Pumping Cycle

Table 3-5 provides the assumed efficiencies for the pumping cycle. Figure 3-5 depicts estimates for gross head, pump flow, power input and energy consumption for the pumping cycle. The required power input is estimated to be 273.4 MW. It is estimated that it would take approximately 11 hours to pump the complete active storage volume of approximately 2,600 acre-feet from the lower reservoir to the upper reservoir. The pump flow varies from 3,162 cfs at the beginning of the pump cycle to 2,681 cfs at the end of the pump cycle. The total energy required at the interconnection point for each full pumping cycle is 2,902 MWh.

Table 3-5: Pumping Cycle Efficiencies

Component	Efficiency (%)
Step-up Transformers	99
Motor	98.5
Pump	92

Figure 3-5: Gross Head, Pump Flow, Power Input, and Energy Consumption



4.0 UTILIZATION OF PROJECT POWER (18 CFR SECTION 4.41(C)(5))

The electrical energy produced at the Lewis Ridge Project would be marketed to electric utilities servicing this region. The electrical energy used on site would include basic utilities and the energy needed to pump the water to the upper reservoir. For every 8 hours of full power generation, at a maximum of 273.4 MW, the Lewis Ridge Project is assumed to have an approximately 11-hour pumping cycle.

Kentucky and the broader region are facing unprecedented generation retirements mostly in the form of aging fossil-based resources. The need for new capacity to continue the electrical grid's reliability is critical. Lewis Ridge allows for local utilities to take advantage of excess power on the grid when available and deploy that energy when demand is high. The project also provides necessary resource diversification in times of extreme weather events.

5.0 PLANS FOR FUTURE DEVELOPMENT (18 CFR SECTION 4.41(C)(6))

The Applicant has no plans for future development of the Lewis Ridge Project or of any other existing or proposed waterpower at this site beyond what has been proposed in this application.

6.0 REFERENCES

AECOM Technical Services, Inc. 2024. Hydraulic Evaluation of Preliminary Layout. Lewis Ridge Pumped Storage Project. June 2024.

Lewis Ridge Pumped Storage, LLC (LRPS). 2021. Application for Preliminary Permit for the Lewis Ridge Pumped Storage Project. Document Accession No. 20211122-5269.

National Oceanic and Atmospheric Administration (NOAA) National Weather Service. 2024. "Monthly U.S. Evaporation" National Weather Service Climate Prediction Center – NOAA. Available online: https://www.cpc.ncep.noaa.gov/products/Soilmst_Monitoring/US/US_Evaporation-Monthly.php. Accessed August 2024.

LEWIS RIDGE PUMPED STORAGE PROJECT
FERC NO. 15249

DRAFT EXHIBIT C
PROPOSED CONSTRUCTION SCHEDULE

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1.0 CONSTRUCTION SCHEDULE (18 CFR SECTION 4.41(D)(1))

The estimated date of Notice to Proceed (NTP) for construction is April 1, 2027. Contractor mobilization to the project site would occur in summer of 2027.

A Gantt chart schedule is provided below that illustrates the complete construction schedule with task relationships and duration. The final construction schedule will be dependent on a number of factors, including approvals for all required local, state, and federal permits, outcomes of agency and stakeholder consultation, Federal Energy Regulatory Commission (FERC) approval of construction implementation plans, project financial plans, and environmental factors such as seasonal tree clearing restrictions or associated soil conditions. The final construction schedule will take into account construction windows that would need to be avoided to protect wildlife. The anticipated seasonal restrictions are included in Exhibit E of the license application.

2.0 COMMERCIAL OPERATION (18 CFR SECTION 4.41(D)(2))

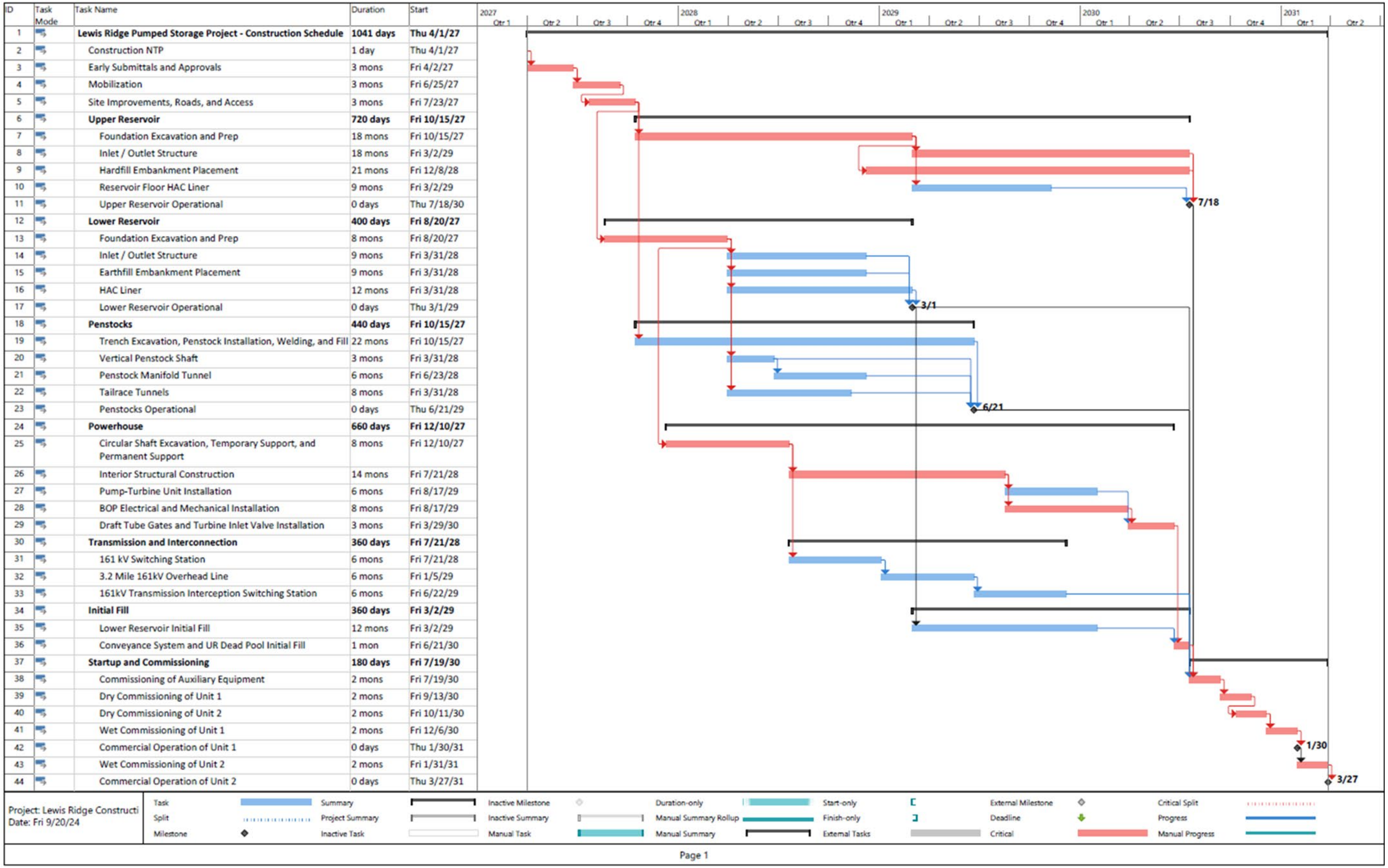
The estimated commercial operation date of the Lewis Ridge Project is March 27, 2031. Table 2-1 provides the estimated operation dates for the pump-turbine units at the Project.

Table 2-1: Pump-Turbine Estimated Operation Dates

Unit No.	Date
1	January 30, 2031
2	March 27, 2031

3.0 PREVIOUSLY CONSTRUCTED FACILITIES (18 CFR SECTION 4.41(D)(3))

There are no previously constructed facilities, unlicensed waterpower structures, or facilities at the Lewis Ridge Project site.



ID	Task Mode	Task Name	Duration	Start
1		**Lewis Ridge Pumped Storage Project - Construction Schedule**	**1041 days**	**Thu 4/1/27**
2		Construction NTP	1 day	Thu 4/1/27
3		Early Submittals and Approvals	3 mons	Fri 4/2/27
4		Mobilization	3 mons	Fri 6/25/27
5		Site Improvements, Roads, and Access	3 mons	Fri 7/23/27
6		**Upper Reservoir**	**720 days**	**Fri 10/15/27**
7		Foundation Excavation and Prep	18 mons	Fri 10/15/27
8		Inlet / Outlet Structure	18 mons	Fri 3/2/29
9		Hardfill Embankment Placement	21 mons	Fri 12/8/28
10		Reservoir Floor HAC Liner	9 mons	Fri 3/2/29
11		Upper Reservoir Operational	0 days	Thu 7/18/30
12		**Lower Reservoir**	**400 days**	**Fri 8/20/27**
13		Foundation Excavation and Prep	8 mons	Fri 8/20/27
14		Inlet / Outlet Structure	9 mons	Fri 3/31/28
15		Earthfill Embankment Placement	9 mons	Fri 3/31/28
16		HAC Liner	12 mons	Fri 3/31/28
17		Lower Reservoir Operational	0 days	Thu 3/1/29
18		**Penstocks**	**440 days**	**Fri 10/15/27**
19		Trench Excavation, Penstock Installation, Welding, and Fill	22 mons	Fri 10/15/27
20		Vertical Penstock Shaft	3 mons	Fri 3/31/28
21		Penstock Manifold Tunnel	6 mons	Fri 6/23/28
22		Tailrace Tunnels	8 mons	Fri 3/31/28
23		Penstocks Operational	0 days	Thu 6/21/29
24		**Powerhouse**	**660 days**	**Fri 12/10/27**
25		Circular Shaft Excavation, Temporary Support, and Permanent Support	8 mons	Fri 12/10/27
26		Interior Structural Construction	14 mons	Fri 7/21/28
27		Pump-Turbine Unit Installation	6 mons	Fri 8/17/29
28		BOP Electrical and Mechanical Installation	8 mons	Fri 8/17/29
29		Draft Tube Gates and Turbine Inlet Valve Installation	3 mons	Fri 3/29/30
30		**Transmission and Interconnection**	**360 days**	**Fri 7/21/28**
31		161 kV Switching Station	6 mons	Fri 7/21/28
32		3.2 Mile 161kV Overhead Line	6 mons	Fri 1/5/29
33		161kV Transmission Interception Switching Station	6 mons	Fri 6/22/29
34		**Initial Fill**	**360 days**	**Fri 3/2/29**
35		Lower Reservoir Initial Fill	12 mons	Fri 3/2/29
36		Conveyance System and UR Dead Pool Initial Fill	1 mon	Fri 6/21/30
37		**Startup and Commissioning**	**180 days**	**Fri 7/19/30**
38		Commissioning of Auxiliary Equipment	2 mons	Fri 7/19/30
39		Dry Commissioning of Unit 1	2 mons	Fri 9/13/30
40		Dry Commissioning of Unit 2	2 mons	Fri 10/11/30
41		Wet Commissioning of Unit 1	2 mons	Fri 12/6/30
42		Commercial Operation of Unit 1	0 days	Thu 1/30/31
43		Wet Commissioning of Unit 2	2 mons	Fri 1/31/31
44		Commercial Operation of Unit 2	0 days	Thu 3/27/31

Project: Lewis Ridge Constructi
Date: Fri 9/20/24

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LEWIS RIDGE PUMPED STORAGE PROJECT
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DRAFT EXHIBIT D
STATEMENT OF ESTIMATED COSTS AND FINANCING

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DEFINITIONS OF TERMS, ACRONYMS, AND ABBREVIATIONS

AACE	Advancement of Cost Engineering
Applicant	Lewis Ridge Pumped Storage, LLC
CFR	Code of Federal Regulations
Commission	Federal Energy Regulatory Commission
FERC	Federal Energy Regulatory Commission
FLA	Final License Application
LRPS	Lewis Ridge Pumped Storage, LLC
Project	Lewis Ridge Pumped Storage Project, FERC P-15249
USD	U.S. Dollar

1.0 ESTIMATED COSTS OF ANY CONSTRUCTION, MODIFICATION OR REPAIR (18 CFR SECTION 4.41(E)(1))

1.1 Land and Water Rights

Land Rights

Lewis Ridge Pumped Storage, LLC (Applicant or LRPS) has entered into a Land Option Agreement with Asher Land and Mineral, LLLP, the landowner of the Lewis Ridge Pumped Storage Project (Lewis Ridge Project) site primary area. The cost is to be determined.

Water Rights

The initial and recharge water sources are under evaluation. It is anticipated that the source of the initial fill water will be natural inflows from Tom Fork and potentially pumping water from the Cumberland River and/or pumping groundwater from wells that would be installed adjacent to the lower reservoir site. As the engineering design advances, the water source will be finalized and appropriate permitting required for the rights to the water will be obtained as necessary. Additional information will be provided in the Final License Application (FLA).

1.2 Total Costs of All Major Project Works

The total construction costs for the Lewis Ridge Project have been estimated at a Class 4 level as defined by the Association for the Advancement of Cost Engineering (AACE). Costs are provided in 2024 United States dollar (USD). Table 1-1 provides a summary of the estimated construction costs for the Lewis Ridge Project. The construction costs include direct costs, indirect costs, contractor bonds and insurance, contractor overhead and profit, and contingencies.

Table 1-1: Estimated Project Construction Costs

Component	Project Cost
General Conditions, Mobilization	$80,000,000
Site General Improvements	$10,000,000
Reservoirs and Dams	$215,000,000
Shaft, Tunnels, and Penstocks	$130,000,000

Component	**Project Cost**
Electrical, Mechanical, and Balance of Plant	$120,000,000
Powerhouse and Inlet/Outlet	$120,000,000
Subtotal Direct Construction Costs	**$675,000,000**
Site Indirects – Contractor (15%)	$101,300,000
Contractor Bonds and Insurance (4.0%)	$27,000,000
Subtotal Contractors Direct and Indirect Costs	**$803,300,000**
Contractor Overhead and Profit (15%)	$120,500,000
Contingency (25%)	$230,900,000
Construction Design and Other Miscellaneous Costs	$36,300,000
Total Project Construction Costs	**$1,191,000,000**

1.3 Indirect Construction Costs

The indirect construction costs are estimated at approximately 15 percent of the direct construction costs. Indirect construction costs include site supervision, facilities, safety, and other project support costs. Indirect costs, including project salaried supervision, has been estimated based on the understanding of the work and the level of supervisory effort anticipated.

1.4 Interest during Construction

Interest during construction is estimated based on a calculation of the Secured Overnight Financing Rate (SOFR) plus a risk margin in the context of current market conditions.

1.5 Overhead, Construction, Legal Expenses, and Contingencies

Overhead, construction, legal expenses, and contingencies are included in construction costs in Table 1-1.

2.0 PREVIOUSLY CONSTRUCTED FACILITIES (18 CFR SECTION 4.41(E)(2))

This section is not applicable. The Lewis Ridge Project is unconstructed and does not include any previously constructed waterpower structures or facilities.

3.0 ESTIMATED AMOUNT PAYABLE UPON TAKEOVER PURSUANT TO SECTION 14 OF THE FEDERAL POWER ACT (18 CFR SECTION 4.41(E)(3))

This section is not applicable. The Lewis Ridge Project is unconstructed and the Applicant is filing for an original license.

4.0 ESTIMATED AVERAGE ANNUAL COST OF THE PROJECT, AS PROPOSED (18 CFR SECTION 4.41(E)(4))

The anticipated average annual costs of the Lewis Ridge Project are provided in Sections 4.1 through 4.5. Costs shown are a 50-year average annual cost proxy, including cost escalation.

4.1 Capital Costs

The capital cost is subject to market forces between now and completion of project construction that may raise or lower this value.

4.2 Taxes

The Applicant is working closely with local and state authorities on a tax valuation of a new pumped storage project in eastern Kentucky, which will be provided in the FLA.

4.3 Depreciation and Amortization

The estimated annual depreciation and amortization costs will be determined based on an assumed useful life of 50 years.

4.4 Operation and Maintenance Expenses

The estimated annual operation and maintenance expenses for the Lewis Ridge Project are approximately $10,000,000 starting in the first year of operation.

4.5 Costs of Proposed Environmental Measures

The estimated annual costs of proposed environmental measures for the Lewis Ridge Project will be described in the FLA.

5.0 ESTIMATED ANNUAL VALUE OF PROJECT POWER (18 CFR SECTION 4.41(E)(5))

Based on the Lewis Ridge Project economics, the Applicant is expecting to sell capacity on long-term contracts to utilities in the region between $19 per kilowatt month to $27 per kilowatt month.

6.0 ENERGY ALTERNATIVES (18 CFR SECTION 4.41(E)(6))

Other energy alternatives include fossil-based generation, nuclear power, renewable resources (including solar, wind, and conventional hydropower), other pumped storage projects, and other energy storage technologies. Renewable energy projects such as wind and solar are not a good comparison to the Lewis Ridge Project, as. these types of renewable projects are non-dispatchable and are unable to provide capacity and ancillary services to the market.

7.0 CONSEQUENCES OF LICENSE APPLICATION DENIAL (18 CFR SECTION 4.41(E)(7))

If the license application is denied and the Lewis Ridge Project is not constructed as a result, the following value creations of the Lewis Ridge Project would be lost:

- Creation of low carbon and low-cost energy during peak use periods;
- Provision of ancillary services to respond to immediate needs of ramping and load following;
- Provision of regulation to manage grid stability, in particular with relation to renewable generation;
- Ability to absorb surplus energy when there is surplus generation;
- A marked reduction in carbon dioxide from fossil fuel generators;
- Diversification of dispatchable grid resources to create reliability during extreme weather events; and
- Generation of tax revenue over the life of the Lewis Ridge Project, along with thousands of employment job-years in construction and operation and associated indirect income and spending and additional community benefits.

8.0 SOURCES AND EXTENT OF FINANCING (18 CFR SECTION 4.41 (E)(8))

The Lewis Ridge Project is assumed to be financed with a combination of investments and debt financing raised from the private markets.

9.0 COST TO DEVELOP THE LICENSE APPLICATION (18 CFR SECTION 4.41(E)(9))

The estimated cost to develop the license application is approximately $15,000,000.

10.0 ON-PEAK AND OFF-PEAK VALUES OF PROJECT POWER (18 CFR SECTION 4.41(E)(10)

The future value of revenues and costs associated with operating the Lewis Ridge Project are based on market comparisons and expected value of power at peak capacity.

LEWIS RIDGE PUMPED STORAGE PROJECT
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DRAFT EXHIBIT E
ENVIRONMENTAL REPORT

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DEFINITIONS OF TERMS, ACRONYMS, AND ABBREVIATIONS

Applicant	Lewis Ridge Pumped Storage, LLC
APE	Area of Potential Effects
°C	degrees Celsius
CCD	Census County Divisions
CEII	Critical Energy Infrastructure Information
CFR	Code of Federal Regulations
cfs	cubic feet per second
cm	centimeter
CPUE	catch per unit effort
Commission	Federal Energy Regulatory Commission
DLA	Draft License Application
DO	dissolved oxygen
EFH	Essential Fish Habitat
EJ	Environmental justice
ESA	Endangered Species Act
°F	Fahrenheit
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FLA	Final License Application
FPA	Federal Power Act
IPaC	Information, Planning, and Conservation
Kentucky DEP	Kentucky Department for Environmental Protection
Kentucky DFWR	Kentucky Department of Fish and Wildlife Resources
Kentucky DNR	Kentucky Department for Natural Resources
Kentucky EEC	Kentucky Energy and Environment Cabinet
KGS	Kentucky Geologic Survey
Kentucky SHPO	Kentucky State Historic Preservation Office
KPDES	Kentucky Pollutant Discharge Elimination System
KRS	Kentucky Revised Statutes
KSS	Kentucky Speleological Survey
L	liter

Lewis Ridge Project	Lewis Ridge Pumped Storage Project, FERC P-15249
LRPS	Lewis Ridge Pumped Storage, LLC
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act
MBI	Macroinvertebrate Bioassessment Index
mg	milligrams
mg/L	milligrams per liter
ml	milliliter
mm	millimeter
MLRA	Major Land Resource Area
MTR	Mountain Top Removal Mining
MW	megawatt
MWh	megawatt hours
NEPA	National Environmental Policy Act
NHD	National Hydrography Dataset
NHPA	National Historic Preservation Act
NLCD	National Land Cover Database
NPS	National Park Service
NOI	Notice of Intent
NWI	National Wetlands Inventory
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NTU	Nephelometric Turbidity Units
OKNP	Office of Kentucky Nature Preserves
OSMRE	Office of Surface Mining Reclamation and Enforcement
PAD	Pre-Application Document
PM&E	protection, mitigation, and enhancement measures
Project Vicinity	The general geographic area in which the proposed Lewis Ridge Project would be located, as indicated on the Project Vicinity figures.
RM	river mile
SCORP	Statewide Comprehensive Outdoor Recreation Plan
Siting Board	Kentucky State Board on Electric Generation and Transmission Siting
SMCRA	Surface Mining Control and Reclamation Act of 1977

Study Area	The Study Area was used as the geographic area for licensing studies conducted in 2024 and includes appropriate buffers around the proposed facilities to account for further refinement of the Lewis Ridge Project.
TLP	Traditional Licensing Process
TMDL	total maximum daily load
TNS	terrestrial nuisance species
µS	microsiemens
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WQC	Water Quality Certification

1.0 INTRODUCTION

1.1 Overview

Lewis Ridge Pumped Storage, LLC (Applicant or LRPS) is filing with the Federal Energy Regulatory Commission (FERC or Commission) its Draft License Application (DLA) for the Lewis Ridge Pumped Storage Project (FERC No. 15249) (Lewis Ridge Project). The Lewis Ridge Project is a proposed, unconstructed pumped storage hydroelectric generating facility located in Bell County, Kentucky on land that has been used for both underground and surface mining. The Lewis Ridge Project would involve the construction of new water storage, water conveyance, and electric generation facilities. The grid-connected project would use electricity to store potential energy by moving water between a lower and upper reservoir, connected by a penstock and powerhouse that contains two reversible pump hydroelectric turbines. During periods of peak electricity demand, this same water would be released, generating power and delivering it to the grid. The Lewis Ridge Project would require an initial fill of the reservoirs with minimal recharge water required.

1.2 FERC Process and Consultation Summary

On November 19, 2021, LRPS submitted an application for preliminary permit for the Lewis Ridge Project.[1] On December 16, 2021, FERC issued Notice of Preliminary Permit Application Accepted for Filing and Soliciting Comments, Motions to Intervene, and Competing Applications.[2] FERC issued a preliminary permit for the Lewis Ridge Project on March 3, 2022.[3] LRPS is using FERC's Traditional Licensing Process (TLP) as established in FERC regulations, Title 18 of the US CFR, Part 4. Documentation of agency and stakeholder consultation is provided in Appendix A and summarized by resource area in Section 5.0.

In July of 2022, LRPS initiated consultation with resource agencies and stakeholders to introduce the Lewis Ridge Project. In August 2022, LRPS sent outreach emails to 20 entities providing an information sheet on the Lewis Ridge Project and requested meetings to learn about available resource information and discuss potential resource concerns, information gaps, and proposed studies. LRPS conducted meetings with the USFWS and

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[1] Accession No. 20211122-5269

[2] Accession No. 20211216-3054

[3] Accession No. 20220303-3084

the Kentucky Cabinet for Economic Development on September 9th, 2022, and with the Kentucky Resource Council on September 13th, 2022.

LRPS filed a Pre-Application Document (PAD) and Notice of Intent (NOI) to seek an original license for the Lewis Ridge Project on October 21, 2022.[4] LRPS held a Joint Agency and Public Meeting and site visit on January 25, 2023 to provide information about the project and licensing process, solicit information regarding existing environmental resources at the Lewis Ridge Project, and obtain agency and stakeholder opinions regarding the project and its potential effect on existing resources.

As the Applicant is utilizing the TLP, there was no requirement to prepare a formal study plan document, and therefore there was no subsequent study plan determination by FERC. Nonetheless, LRPS distributed a Draft Study Plan to FERC, resource agencies, Tribes, and stakeholders on June 13, 2024, for a 30-day review.[5] The Draft Study Plan included four proposed studies: (1) Wetland and Waterway Evaluation, (2) Blackside Dace Habitat Evaluation, (3) Bat Survey, and (4) Cultural Resources Evaluation. The Kentucky Department for Environmental Protection (Kentucky DEP)[6] and the Kentucky State Historic Preservation Office (SHPO) provided comments on the Draft Study Plan. LRPS filed a Revised Study Plan with FERC on August 16, 2024.[7]

1.3 Purpose and Organization of Exhibit E

This Environmental Report (Exhibit E) has been prepared in accordance with 18 CFR § 4.41, contents for an Application for License for Major Unconstructed Project. In addition, LRPS has included elements of 18 CFR § 5.18 to assist in the Commission staff's National Environmental Policy Act (NEPA) analysis. The purpose of the Exhibit E is to describe the existing resources at the proposed Lewis Ridge Project, describe how the proposed facilities or operations may affect those resources, and include measures for protection, mitigation, and enhancement (PM&E) with respect to each resource affected. The Report on Resources in this Exhibit E (Section 5.0) presents information on the existing environment, potential impacts of the Lewis Ridge Project, agency consultation, and the expected benefits of proposed PM&E measures by resource. This report is based on

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[4] Accession No. 20221021-5176

[5] Accession No. 20240614-5007

[6] The Kentucky DEP is part of the Kentucky Energy and Environment Cabinet (Kentucky EEC).

[7] Accession No. 20240816-5241

available information and on the results of studies conducted during the licensing process.

2.0 STATUTORY AND REGULATORY REQUIREMENTS (18 CFR § 5.18 (B)(3))

2.1 Clean Water Act

Under Section 401(a)(1) of the Clean Water Act (CWA), an applicant for a federal license or permit to conduct an activity that may result in discharge into waters of the United States must provide the licensing or permitting agency with a request for water quality certification (WQC) that the discharge would not violate water quality standards from the applicable state. As part of the TLP, LRPS consulted with the Kentucky DEP throughout the licensing process. In their April 6, 2023, comments, Kentucky DEP noted that the Project may require CWA Section 401 WQC from the Kentucky DEP Division of Water. Pursuant to Section 401 of the CWA and 18 CFR § 4.34(b)(5), the Applicant will file an application for a 401 Water Quality Certification (WQC) to Kentucky DEP Division of Water within 60 days following FERC’s notification of its acceptance of the license application being ready for environmental analysis. In addition, LRPS will obtain a CWA Section 402 Kentucky Pollutant Discharge Elimination System (KPDES) General Stormwater Permit from Kentucky DEP Division of Water.

LRPS would be required to obtain a Section 404 permit from the U.S. Army Corps of Engineers (USACE) for any work within jurisdictional streams or wetlands. In addition, LRPS would be required to request a Section 408 permit review from the USACE if the Cumberland River is used for the initial fill. It is anticipated that the source of the initial fill water would be natural inflows from Tom Fork and potentially pumping water from the Cumberland River and/or pumping groundwater from wells that would be installed adjacent to the lower reservoir site.

2.2 Endangered Species Act

Section 7(a)(2) of the Endangered Species Act (ESA) requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of federally listed threatened and endangered species or result in the destruction or adverse modification of their designated critical habitat. On October 21, 2022, LRPS requested to be designated as the Commission’s non-federal representative for the purposes of consultation under Section 7 of the ESA. FERC designated LRPS as the Commission’s non-federal representative for carrying out informal consultation in its December 21, 2022 Notice of

Intent to File License Application, Filing of Pre-Application Document, and Approving Use of the Traditional Licensing Process. LRPS conducted two studies related to rare, threatened, and endangered species (Blackside Dace Habitat Assessment and the bat survey [Listed Bat Presence/Probable Absence Survey]). Two rare bat species, tricolored bat and gray bat, were captured during the 2024 bat survey and the habitat evaluation concluded that Tom Fork is not suitable for blackside dace due to its elevated specific conductance levels. Additional information related to rare, threatened, and endangered (RTE) species is provided in Sections 5.3, 5.4, and 5.4.4.

2.3 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), first passed in 1976, fosters long-term biological and economic sustainability of the nation's marine fisheries extending to 200 nautical miles from shore. This act is the primary law governing marine fisheries management in federal waters. The Magnuson-Stevens Act requires the eight regional Fishery Management Councils, in collaboration with National Oceanic and Atmospheric Administration (NOAA), to consider essential fish habitat (EFH) in resource management decisions. Congress defines EFH as those waters and substrates necessary to fish for spawning, breeding, feeding or growth and maturity. The designation and consideration of EFH seeks to minimize adverse effects on habitat caused by fishing and non-fishing activities. There is no EFH at the Lewis Ridge Project and therefore, EFH consultation pursuant to Section 305(b) of the Magnuson-Stevens Act is not required (NOAA 2024).

2.4 Coastal Zone Management Act

Pursuant to Section 307(c)(3)(A) of the Coastal Zone Management Act (CZMA), 16 United States Code (U.S.C.) Section 1456(3)(A), FERC must receive concurrence from the state CZMA agency that the project is not within or affecting the state's coastal zone prior to issuing a license. The state of Kentucky does not have a coastal zone, and therefore does not have a CZMA agency. As such, there is no requirement for a federal consistency certification or concurrence from the state CZMA agency for the Lewis Ridge Project.

2.5 National Historic Preservation Act

Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, requires that every federal agency "take into account" how each of its undertakings could affect historic properties. Historic properties include districts, sites, buildings, structures, traditional cultural properties, and objects significant in American history, architecture, engineering, and culture that are listed in or eligible for inclusion in the National Register of Historic Places (NRHP). FERC designated LRPS as the Commission's non-federal representative for carrying out informal consultation pursuant to Section 106 of the NHPA in its notice dated December 21, 2022. Additional information related to cultural resources is provided in Section 5.6.

2.6 Wild and Scenic Rivers and Wilderness Acts

The Wild and Scenic Rivers Act was created by Congress in 1968 (Public Law 90-542; 16 U.S.C. 1271 et seq.) to preserve certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations. The Wilderness Act of 1964 (Public Law 88-577; 16 U.S.C. 23 et seq.) created the National Wilderness Preservation System. It defines wilderness as "an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain" and "an area of undeveloped federal land retaining its primeval character and influence without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions."

There are no rivers within the Project Vicinity that have been designated for inclusion in the National Wild and Scenic River System (NPS 2024a). In the Project Vicinity, there are no lands included in the National Trails System, nor are there lands designated as, or under study for inclusion as, a Wilderness Area (NPS 2024b, Southern Appalachian Wilderness Stewards 2024).

2.7 Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act was originally enacted in 1940 (16 U.S.C 668-668d) to protect eagles from human-induced alterations and human interactions. As defined in 50 CFR, Part 22, permits are required for the "taking" (meaning to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, destroy, molest, or disturb), possession, and transportation within the United States of bald eagles and golden eagles and their parts, nests, and eggs. Bald eagles are discussed in Section 5.4 of this Exhibit E.

2.8 Surface Mining Control and Reclamation Act of 1977

The Surface Mining Control and Reclamation Act of 1977 (SMCRA) governs mining and reclamation of surface coal mines in the United States. Prior to 1977, mining activities throughout the United States were not federally regulated. The SMCRA includes federal guidelines intended to regulate (permit) mining activities, by setting enforceable standards, and created the Office of Surface Mining Reclamation and Enforcement as the agency to oversee the program. The Kentucky Department for Natural Resources (Kentucky DNR)[8] is responsible for implementing the SMCRA through the Kentucky Revised Statutes (KRS) 350.020. The Division of Mine Reclamation and Enforcement (DMRE) is one of three agencies within the Kentucky DNR responsible for administering Kentucky's mining, reclamation, and abandoned mine land laws. The DMRE is responsible for inspecting all surface and underground coal mining permits in the state to assure compliance with the SMCRA. The DMRE is also responsible for regulating and enforcing the surface mining reclamation laws for non-coal mining sites in the state, including limestone, sand, gravel, shale and the surface effects of dredging river sand and gravel. The DMRE works closely with the Division of Mine Permits and the Division of Abandoned Mine Lands to ensure that established standards of operation are addressed and that the public and the environment are protected. (Kentucky EEC 2024).

There are six existing permits issued to Nally & Hamilton Enterprises, Inc. in the proposed location of the Lewis Ridge Project that are currently under Kentucky DNR jurisdiction (Permit Nos. 807-0339, 807-0345, 807-0347, 807-0353, 807-0372, and 807-5220). The existing permits related to the site are further discussed in Section 5.8.1. LRPS met with Kentucky DNR on July 24, 2024, and discussed obtaining a SMCRA permit exemption for the Lewis Ridge Project, construction materials and associated permitting needs, and post-mining land use commitments (mine reclamation requirements, protection enhancement plans) associated with existing permits at the Project site (Appendix A). LRPS will continue to consult with Kentucky DNR regarding existing permits at the project site under Kentucky DNR jurisdiction.

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[8] The Kentucky DNR is under the Kentucky Energy and Environment Cabinet (Kentucky EEC).

2.9 State and County Permitting Considerations

LRPS will continue to consult with the appropriate divisions and branches of the Kentucky DEP to ensure compliance with state permitting requirements prior to construction of the Lewis Ridge Project and consult with Bell County and the Kentucky State Board on Electric Generation and Transmission Siting (Siting Board).

The required permits and associated details will be dependent on the project's final design. In addition to permits associated with the CWA discussed in Section 2.1, the Lewis Ridge Project may require a Water Withdrawal Permit, a Stream Construction/Floodplain Permit, Stormwater Discharge Permit, and Dam Construction Permit from Kentucky DEP Division of Water. In addition, LRPS may be required to obtain a local Floodplain Permit from Bell County and certifications from the Siting Board on the powerhouse and related facilities and interconnection line.

2.10 References

Kentucky Energy and Environment Cabinet (Kentucky EEC). 2024. Mine Reclamation and Enforcement. Available online: https://eec.ky.gov/Natural-Resources/Mining/Reclamation-Enforcement/Pages/default.aspx. Accessed: June 2024.

National Park Service (NPS). 2024a. National Wild and Scenic Rivers System. Available online: https://www.rivers.gov/kentucky.php Accessed: August 2024.

NPS. 2024b. National Trails System. Available online: https://www.nps.gov/subjects/nationaltrailssystem/national-scenic-trails.htm Accessed: August 2024.

National Oceanic and Atmospheric Administration (NOAA). Essential Fish Habitat Mapper. Available online: https://www.habitat.noaa.gov/apps/efhmapper/?page=page_3. Accessed: September 2024.

Southern Appalachian Wilderness Stewards. 2024. Available online: https://www.wildernessstewards.org/kentucky Accessed: July 2024.

3.0 PROPOSED ACTION AND ALTERNATIVES (18 CFR § 5.18 (B)(5))

3.1 No-Action Alternative

Under the no-action alternative, an original FERC license for the Lewis Ridge Project would not be granted and the project would not be constructed. The potential impacts of the Lewis Ridge Project on natural and cultural resources would not occur, and the proposed PM&E measures would not be implemented. The no-action alternative is used to establish baseline environmental conditions for comparison with other alternatives.

3.2 Applicant's Proposed Action

LRPS proposes to seek an original FERC license, and subsequently construct, operate, and maintain the Lewis Ridge Project. Additional information on the applicant's proposal (specifically the proposed project location, facilities, and operations) is provided below.

3.2.1 Proposed Project Location

The proposed Lewis Ridge Project site is located in Bell County, Kentucky, which is in southeast Kentucky near the borders of Tennessee and Virginia. The proposed site is located near the communities of Blackmont, Tejay, Balkan, and Callaway and near river mile (RM) 659 of the Cumberland River. The location of the preliminary facilities and preliminary FERC Project Boundary are depicted on Figure 3-1. This preliminary Project Boundary depicts the geographic extent that is anticipated to encompass land necessary to operate the Lewis Ridge Project once construction is completed. A larger Study Area[9] was used as the geographic area for licensing studies conducted in 2024 and includes appropriate buffers around the proposed facilities to account for further refinement of the project and construction activities. The proposed Lewis Ridge Project is located entirely on private land. There are no lands of the United States in the Project Boundary. Figure 3-1 shows the delineated "Project Vicinity" for the purpose of this license application. In accordance with 18 CFR 4.41, where applicable, environmental resources were described for the area within the Project Vicinity to allow for a broader geographic context as compared to just the immediate area surrounding the proposed project.

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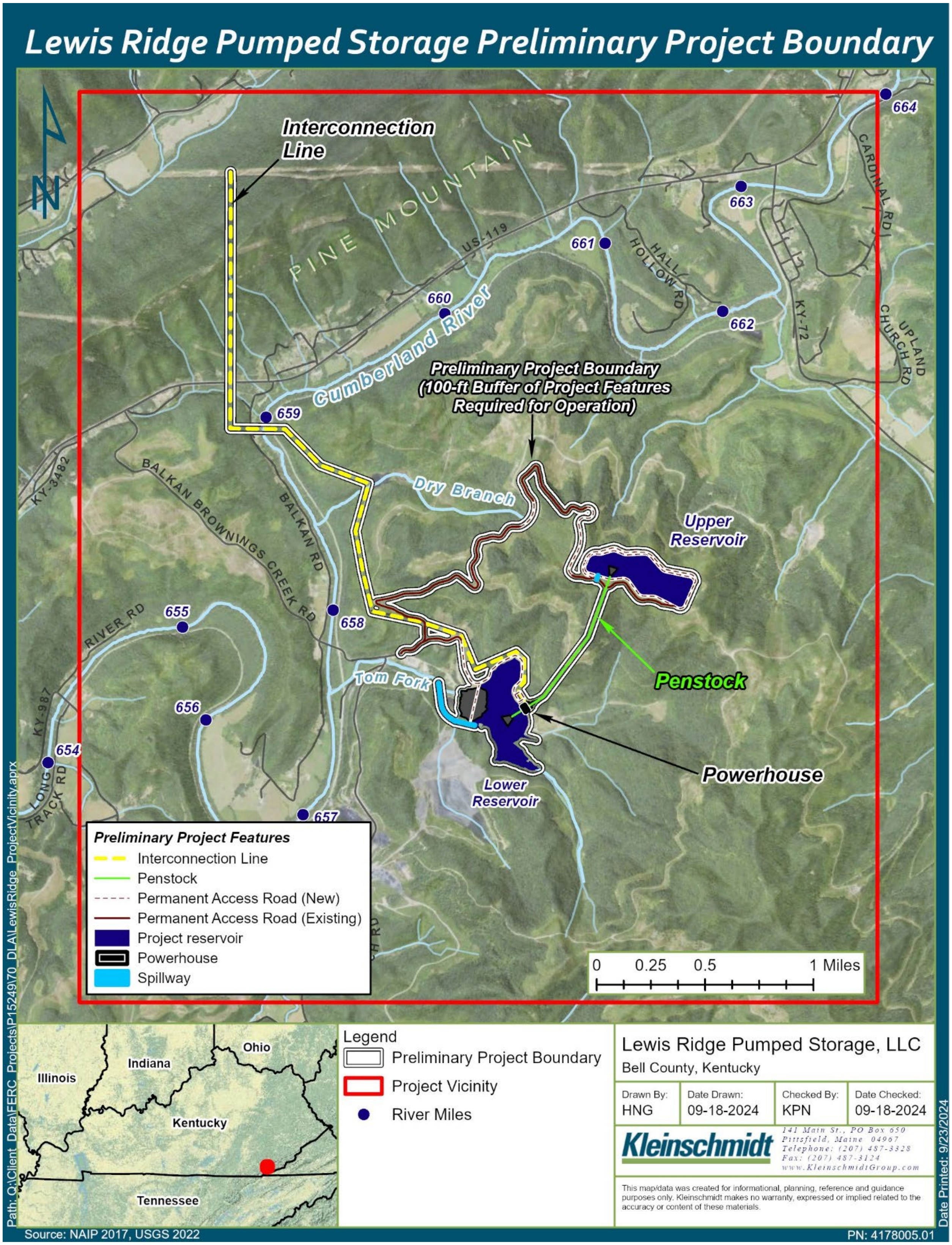
[9] The Study Area is outlined on figures within individual resource sections of this Exhibit (Sections 5.2 through 5.13).

Figure 3-1: Preliminary Project Features and Project Boundary



This map/data was created for informational, planning, reference and guidance purposes only. Kleinschmidt makes no warranty, expressed or implied related to the accuracy or content of these materials.

Source: NAIP 2017, USGS 2022

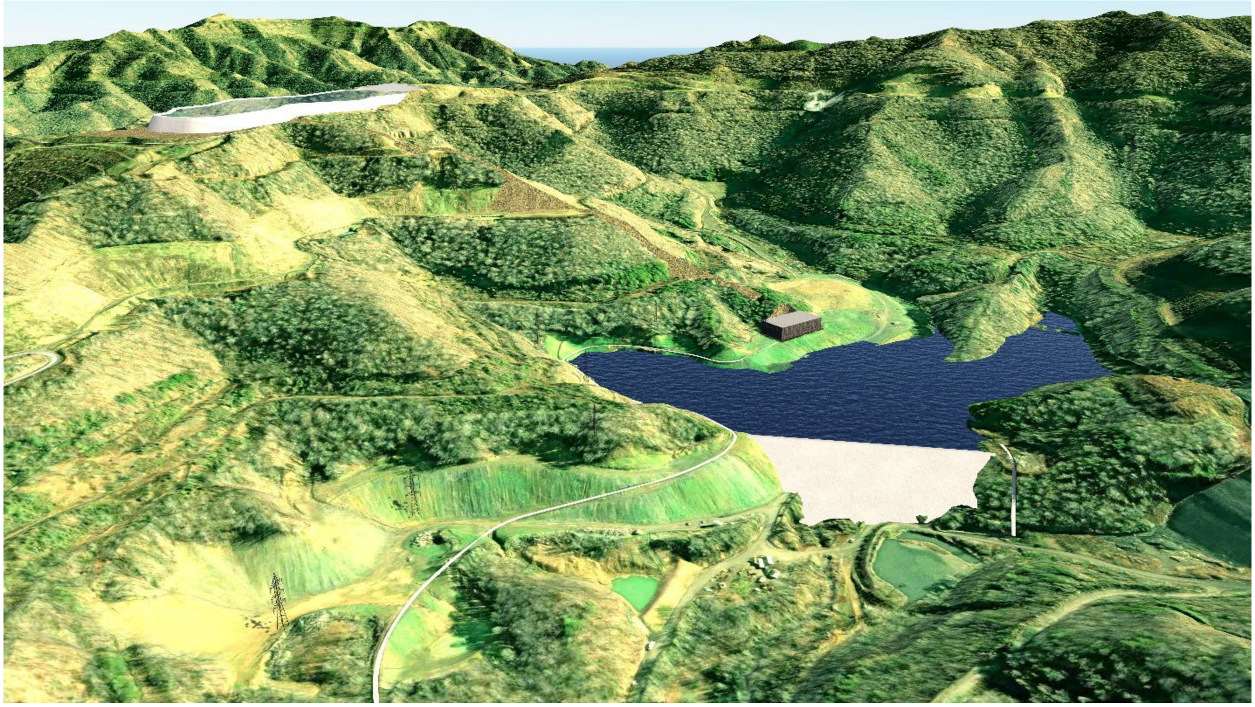
3.2.2 Proposed Project Facilities

The unconstructed Lewis Ridge Project is currently in early stages of design, permitting, and licensing and the exact specifications and site-specific locations of the project features have not been finalized. The specifications associated with the Lewis Ridge Project as described herein are considered preliminary and may change because of engineering and geotechnical feasibility, environmental concerns, or site agreements and contracts.

As proposed, the Lewis Ridge Project would consist of the following: (1) a 5,450-foot-long, 135-foot-high hardfill dam for the upper reservoir with an integrated overflow emergency spillway; (2) an upper reservoir with a surface area of 39.7 acres and an active storage capacity of approximately 2,600 acre-feet; (3) a 4,757-foot-long steel penstock with a 16-foot-diameter upper section and a lower extent bifurcating into two 12-foot-diameter steel sections; 4) a 150-foot-diameter circular shaft powerhouse located 250 feet below the ground containing two 143.5 megawatt (MW) reversible pump-turbines with a total installed capacity of 287 MW; (5) a 908-foot-long, 120-foot-high earthfill embankment dam at the lower reservoir with an integrated overflow emergency spillway; (6) a 48.3 acre lower reservoir with an active storage capacity of approximately 2,600 acre-feet; and (7) a 3.6-mile-long, 161 kilovolt overhead interconnection line. Additional specifications of the proposed Lewis Ridge Project are provided in Exhibit A of the license application.

A preliminary rendering of the Lewis Ridge Project is shown on Figure 3-2. The rendering shows the upper reservoir, lower reservoir, powerhouse, interconnection line, and trenched/backfilled area for the subsurface penstock.

Figure 3-2: Lewis Ridge Project Rendering September 2024



3.2.3 Proposed Project Operations

LRPS would use water stored in the upper reservoir to create energy by releasing that storage through the turbine-pump units to the lower reservoir. Water would then be pumped back from the lower reservoir to the upper reservoir to replenish the storage. There are no inflows to the proposed upper reservoir other than pumping flows during normal Lewis Ridge Project operations and rainfall. The proposed lower reservoir is located within a valley that contains Tom Fork, a tributary to the Cumberland River. The lower reservoir is subject to natural inflows of Tom Fork generated by rainfall. It is anticipated that the source of the initial fill water would be natural inflows from Tom Fork and potentially pumping water from the Cumberland River and/or pumping groundwater from wells that would be installed adjacent to the lower reservoir site. The source of the annual recharge water would be from natural inflows to the lower reservoir from Tom Fork.

In a 24-hour operating cycle, the Project would have the capacity to generate energy for 8 hours a day at full power output, and pump water back from the lower reservoir to the upper reservoir for approximately 11 hours to accomplish the upper reservoir refill.

Additional information on proposed operations is provided in Exhibit B of the license application.

3.2.4 Proposed Protection, Mitigation, and Enhancement Measures

Table 3-1 provides a summary of the PM&E measures proposed at this time. Proposed PM&E measures are further described in the individual resource sections of this Exhibit (Sections 5.2 through 5.13). Additional PM&E measures may be proposed based on continued consultation with resource agencies as the potential effects of construction and operation become better understood as the design advances.

Table 3-1: Proposed PM&E Measures at the Lewis Ridge Project

No.	PM&E Measure
1	**Water Quality Monitoring Plan**. Additional details are provided in Section 5.2.3.2.
2	**Stream Mitigation**. Additional details are provided in Section 5.2.3.2.
3	**Stormwater Pollution Prevention Plan (SWPPP)**. Additional details are provided in Section 5.2.3.2.
4	**Hazardous Substances Spill Prevention and Cleanup Plan**. Additional details are provided in Section 5.2.3.2.
5	**Groundwater Protection Plan**. Additional details are provided in Section 5.2.3.2.
6	**Fish Exclusion Measures**. Additional details are provided in Section 5.3.3.2.
7	**Wildlife Seasonal Restrictions and Measures**. Additional details are provided in Section 5.4.3.2.
8	**Vegetation Management Plan**. Additional details are provided in Section 5.5.3.2.
9	**Historic Properties Management Plan**. Additional details are provided in Section 5.6.3.2.
10	**Erosion and Sediment Control Plan**. Additional details are provided in Section 5.8.3.2.
11	**Landslide Mitigation Plan**. Additional details are provided in Section 5.8.3.2.
12	**Subsidence Analysis**. Additional details are provided in Section 5.8.3.2.
13	**Breakthrough Analysis**. Additional details are provided in Section 5.8.3.2.

3.3 Alternatives Considered but Eliminated (18 CFR § 4.41 (F)(10))

3.3.1 Project Site Alternatives

No other sites or locations were considered for the Lewis Ridge Project. The proposed site features topography and existing conditions beneficial to a pumped storage system and provides a unique opportunity to repurpose a site used for mining.

3.3.2 Project Design Alternatives

In addition to the design proposed in this draft license application, LRPS has considered three alternate designs: 1) as proposed in the preliminary permit application filed on November 19, 2021; 2) as proposed in the PAD filed on October 21, 2022; and 3) the design considered between the PAD filing and draft license application filing. These three design alternatives are described in Exhibit B of this DLA.

4.0 GENERAL DESCRIPTION OF THE LOCALE (18 CFR § 4.41 (F)(1))

The Lewis Ridge Project is a proposed unconstructed pumped storage project, that would be located in the Upper Cumberland River Basin, in southeast Kentucky near the borders of Tennessee and Virginia. The Cumberland River is the nearest major river and is located approximately 0.5-miles from the proposed lower reservoir at approximately RM 659. The Cumberland River flows in a western direction for approximately 688 miles from the Appalachian Mountains to the confluence with the Ohio River and the mouth of the Tennessee River (Olson 2021).

4.1 River Basin and Sub-Basins Description

The Lewis Ridge Project is within the Upper Cumberland River Watershed (HUC8 05130101), which is part of the Upper Cumberland River Basin (HUC6 051301), which is part of the larger Cumberland River Basin (HUC4 0513) (USGS 2024). These river basins and sub-basins are shown on Figure 4-1 and Figure 4-2.

The drainage area of the Cumberland River Basin (HUC4 0513) is approximately 18,000 square miles (Olson 2021) and stretches across 70 Kentucky and Tennessee counties (Cumberland River Compact 2024a). The drainage area of the Upper Cumberland River Basin (HUC6 051301) is approximately 10,688 square miles. The drainage area of the Upper Cumberland River Watershed (HUC8 05130101) is 2,336 square miles. The Upper Cumberland River Watershed (HUC8 05130101) crosses Bell, Clay, Harlan, Knox, Laurel, Leslie, Letcher, McCreary, and Whitley Counties in Kentucky, and Campbell, Claiborne, and Scott counties in Tennessee (Cumberland River Compact 2024b).

Figure 4-1: Cumberland River Basin and Sub-Basins

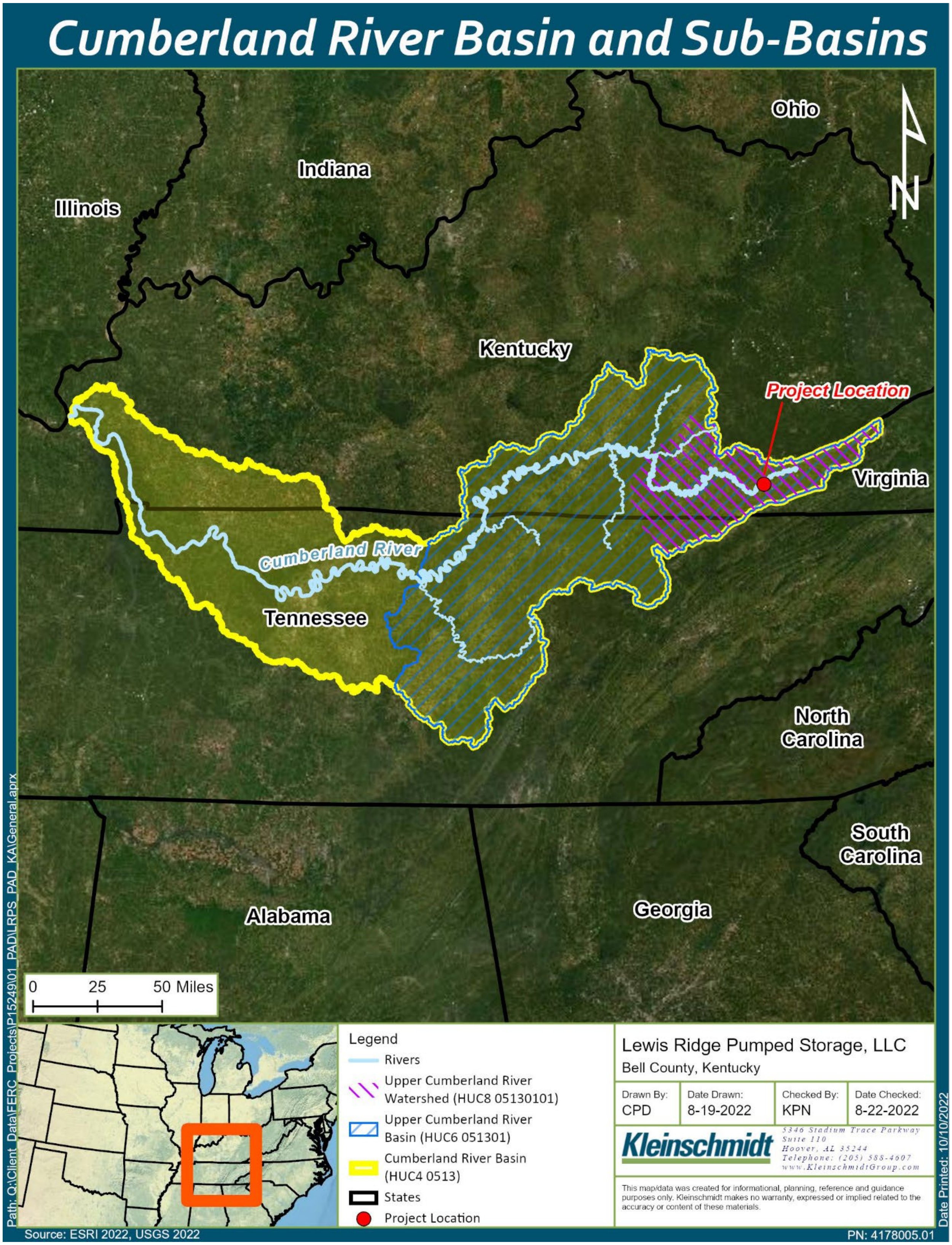
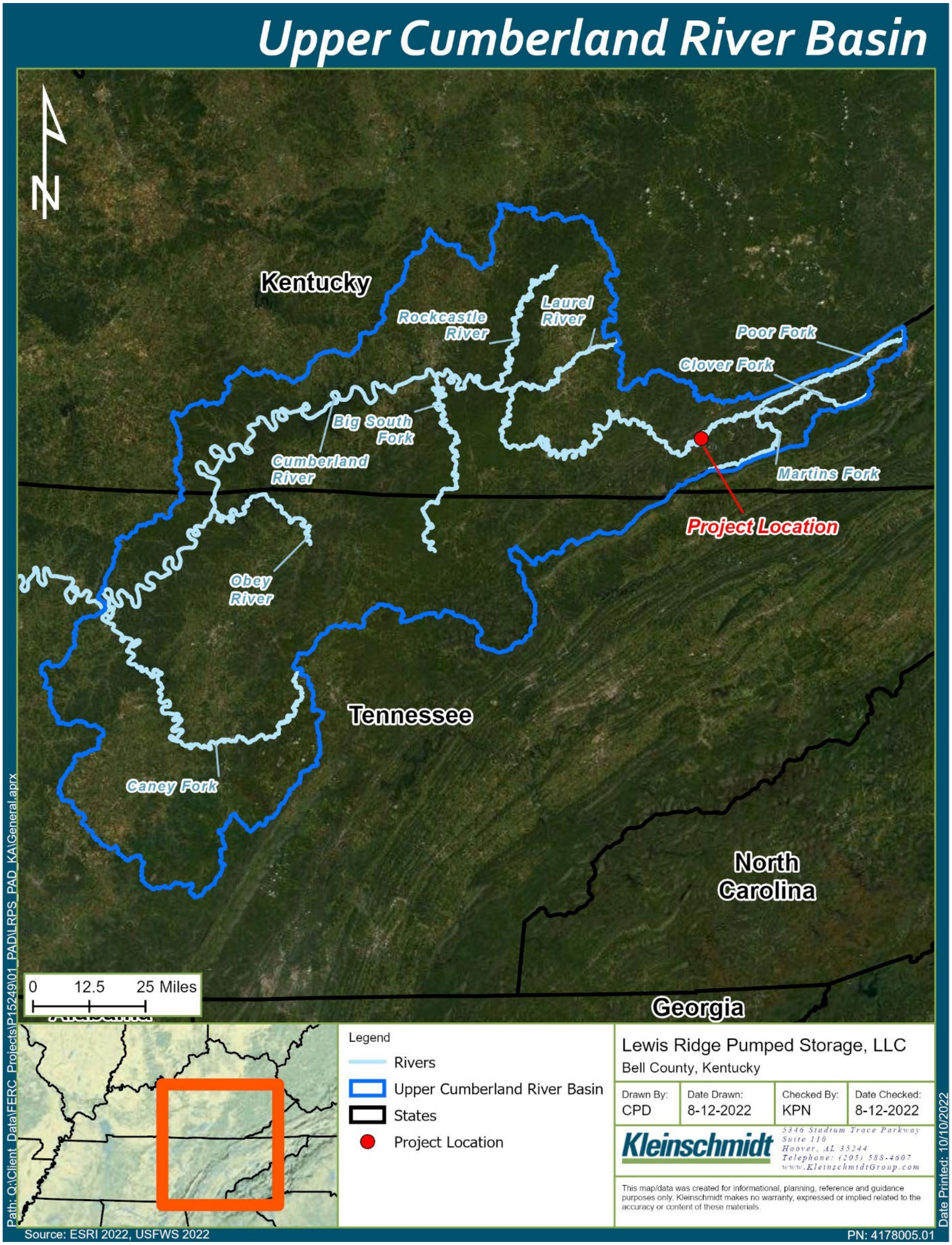


Figure 4-2: Upper Cumberland River Basin



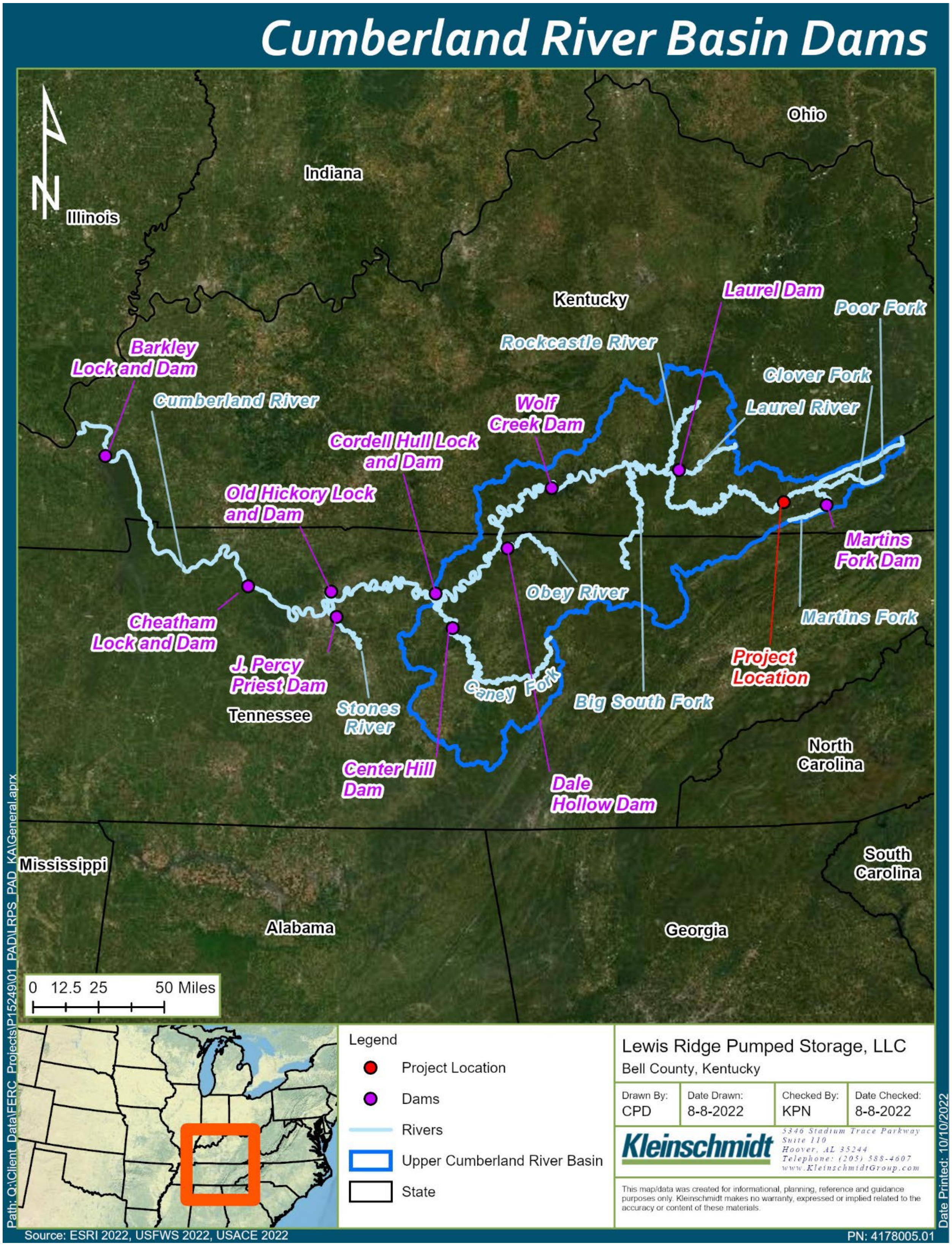
Source: ESRI 2022, USFWS 2022

4.2 River Basin Tributaries and Dams

The Cumberland River Basin (HUC4 0513) includes over 22,000 miles of streams and rivers (Cumberland River Compact 2024a). The mainstem of the Cumberland River flows in a westerly direction with its tributaries draining from the north or south (Kentucky EEC 1998). Clover Fork, Martin's Fork, and Poor Fork form the headwaters of the Cumberland River in southeast Kentucky in the city of Harlan (Olson 2021). Between Harlan, Kentucky and Celina, Tennessee, the Cumberland River flows 310 miles and drains 6,400 square miles from over 7,900 miles of tributaries and streams (Cumberland River Compact 2019). Along this stretch, the Cumberland River receives water from streams and creeks such as Rockcastle, Laurel, Big South Fork, Caney Fork, and Obey River (World Atlas 2024). The Cumberland River flows naturally for 135 miles before reaching Lake Cumberland (formed by Wolf Creek Dam). Near Celina, Tennessee, Caney Fork and Obey River join the Cumberland River and it continues through Nashville, Tennessee where the river is dammed to form Old Hickory Lake and Cordell Hull Lake (World Atlas 2024).

The USACE operates eight dams on the Cumberland River (Wolf Creek Dam, Dale Hollow Dam, Center Hill Dam, Cordell Hull Dam, Old Hickory Dam, J. Percy Priest Dam, Cheatham Dam, and Barkley Dam) and two dams on its tributaries (Martin's Fork Dam and Laurel River Dam) (USACE 2022, Olson 2021). The locations of these dams are shown on Figure 4-3. Major impoundments in the Upper Cumberland Watershed include Lake Cumberland on the mainstem of the Cumberland River, Laurel River Lake, Martins Fork Lake, Cranks Creek Reservoir, Wood Creek Lake, Lake Linville, and Cannon Creek Reservoir (Kentucky EEC 2000).

Figure 4-3: USACE Dams on the Cumberland River



4.3 Major Land Uses and Land Ownership

The proposed Lewis Ridge Project is in the Cumberland Plateau Major Land Resource Area (MLRA) 125. The area's general topography is characterized by long, steep side slopes between narrow ridgetops and narrow stream floodplains. Major land uses in the Cumberland Plateau MLRA include commercial timber production and farming (corn, hay, tobacco, and vegetable production). Extensive forested areas exist in national forests, wildlife management areas, state parks, and private tracts owned by coal and timber companies within the Cumberland Plateau MLRA (NRCS 2022).

The Lewis Ridge Project would be located on private land. No Federal or Tribal lands would be associated with the Lewis Ridge Project. The key features of the Lewis Ridge Project, except for a portion of the interconnection line, would be located at a site owned by Asher Land and Mineral, LLLP used for mining.

4.4 Major Water Uses

Public supply, livestock, and irrigation are the major water uses within the Cumberland Plateau MLRA. Total withdrawals average 915 million gallons per day with 84 percent sourced by surface water (from precipitation and perennial streams). Reservoirs within the Cumberland Plateau MLRA provide water for municipal and industrial users, while springs provide for domestic use and livestock (NRCS 2022).

4.5 Climate

Average annual precipitation for the Cumberland Plateau MLRA is 45-60 inches, and as high as 75 inches in higher elevations. Most of the rainfall occurs during summer thunderstorms with half of the annual precipitation occurring during the growing season. Annual temperatures average 50-60 degrees Fahrenheit (°F) and the freeze-free period averages 200 days (NRCS 2022).

4.6 References

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Cumberland River Compact. 2024b. Upper Cumberland Watershed. Available online: https://cumberlandriverbasin.org/watershed/upper-cumberland-watershed/ Accessed: July 2024.

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Natural Resources Conservation Service (NRCS). 2022. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. Available online: https://www.nrcs.usda.gov/sites/default/files/2022-10/AgHandbook296_text_low-res.pdf. Accessed: July 2024.

Olson, K.R. 2021. Cumberland River Resource Stewardship and Protection: Managing the Cumberland River and the Land Between the Lakes Landscapes. Journal of Water Resource and Protection. Available online: https://www.researchgate.net/publication/349400251_Cumberland_River_Resource_Stewardship_and_Protection_Managing_the_Cumberland_River_and_the_Land_Between_the_Lakes_Landscapes. Accessed: July 2024.

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World Atlas. 2024. Cumberland River. Available online: https://www.worldatlas.com/rivers/cumberland-river.html. Accessed: July 2024.

5.0 REPORT ON RESOURCES

This section provides the information required in 18 CFR § 4.41 (f)(2-9), including existing environmental conditions by resource and an analysis of potential effects of the proposed Lewis Ridge Project on each resource. Following NEPA regulations and guidelines, a project's potential effects can be categorized as direct, indirect, and cumulative. Cumulative effects are discussed in Section 5.1. Agency consultation and applicant recommendations for potentially impacted resources are described in individual resource subsections of Section 5.0.

5.1 Cumulative Effects Analysis

According to the CEQ's regulations for implementing the National Environmental Policy Act (NEPA) (40 C.F.R. § 1508.1), a cumulative effect is the effect on the environment that results from the incremental effect of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over time, including hydropower and other land and water development activities. The Applicant identified water resources and geological and soil resources as being cumulatively affected by the prior impacts from mining activities and the proposed construction and operation of the Lewis Ridge Project. The Applicant has not identified any other resources that would be cumulatively affected by the construction and operation of the Lewis Ridge Project.

5.2 Water and Wetland Resources (18 CFR § 4.41 (f)(2))

5.2.1 Existing Environment

Overview

Mapped hydrologic features and waterbodies within the Study Area[10] and Project Vicinity are depicted on Figure 5-1. Water bodies within the Study Area include the Cumberland River, Dry Branch, Tom Fork, and unnamed intermittent streams crossed by the interconnection line.

The proposed lower reservoir is located within a portion of Tom Fork. Tom Fork is a perennial stream below the proposed lower reservoir location and an intermittent stream within and above the proposed lower reservoir location. Tom Fork is approximately 1.9-miles-long. The Tom Fork drainage basin is within a narrow valley surrounded by elongated ridges (Schnabel 2023). Tom Fork flows to the northwest and west to its confluence with the Cumberland River and has a drainage area of approximately 2.6 square miles (USGS 2024a). It is anticipated that Tom Fork would pass through the lower reservoir.

The Cumberland River is mapped on the NHD as a stream/river. Approximately 9.5 river miles of the Cumberland River are within the Project Vicinity and less than 0.1 mile (approximately 406 feet) is within the Study Area. The drainage area of the Cumberland River near the Lewis Ridge Project is approximately 468 square miles.

Dry Branch is mapped as an intermittent stream (Figure 5-1). Dry Branch is approximately 1.1-miles-long and flows from east to west to its confluence with the Cumberland River. Approximately 0.1 mile (434 feet) of Dry Branch is within the Study Area. The drainage area of Dry Branch is approximately 0.7 square miles (USGS 2024a).

Additional waterbodies within the Project Vicinity include several short intermittent streams, a portion of Puckett Creek, and a portion of Brownies Creek (Figure 5-1).

The drainage area of the upper reservoir would be the size of the proposed reservoir, which is approximately 39.7 acres at the normal maximum water surface elevation of 2,200

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[10] For purposes of this DLA, the Study Area is defined as the geographic area for licensing studies conducted in 2024 and includes appropriate buffers around the proposed facilities to account for further refinement of the project and construction activities.

feet.[11] The drainage area of the lower reservoir is approximately 1.82 square miles (Kleinschmidt 2022) (Figure 5-2). USACE HEC-HMS v4.10 software was used to delineate the drainage area of the basin containing the lower reservoir. The terrain data used to delineate the watershed was KyFromAbove's 5-foot digital elevation model, which was obtained from the Kentucky Division of Geographic Information's website.

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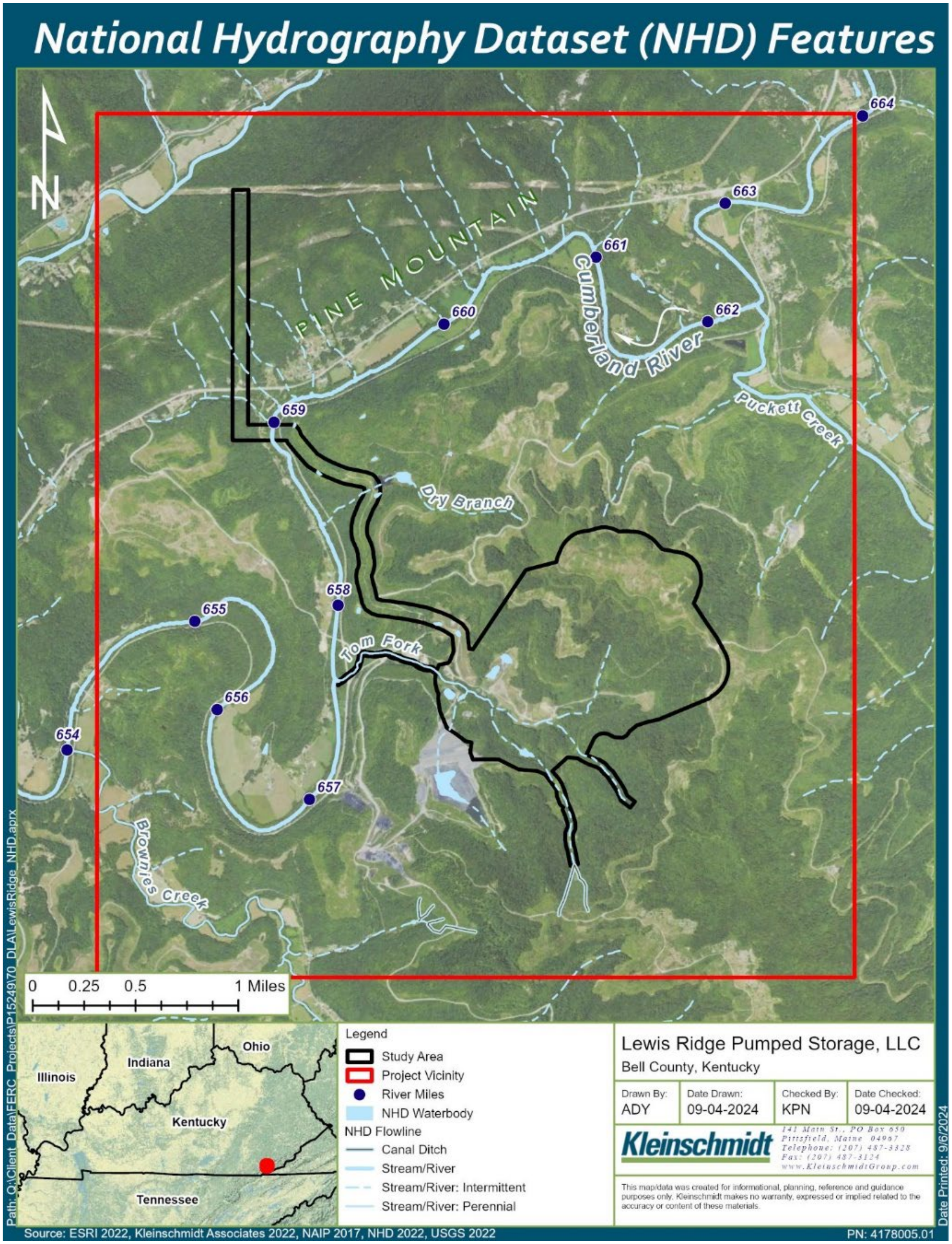
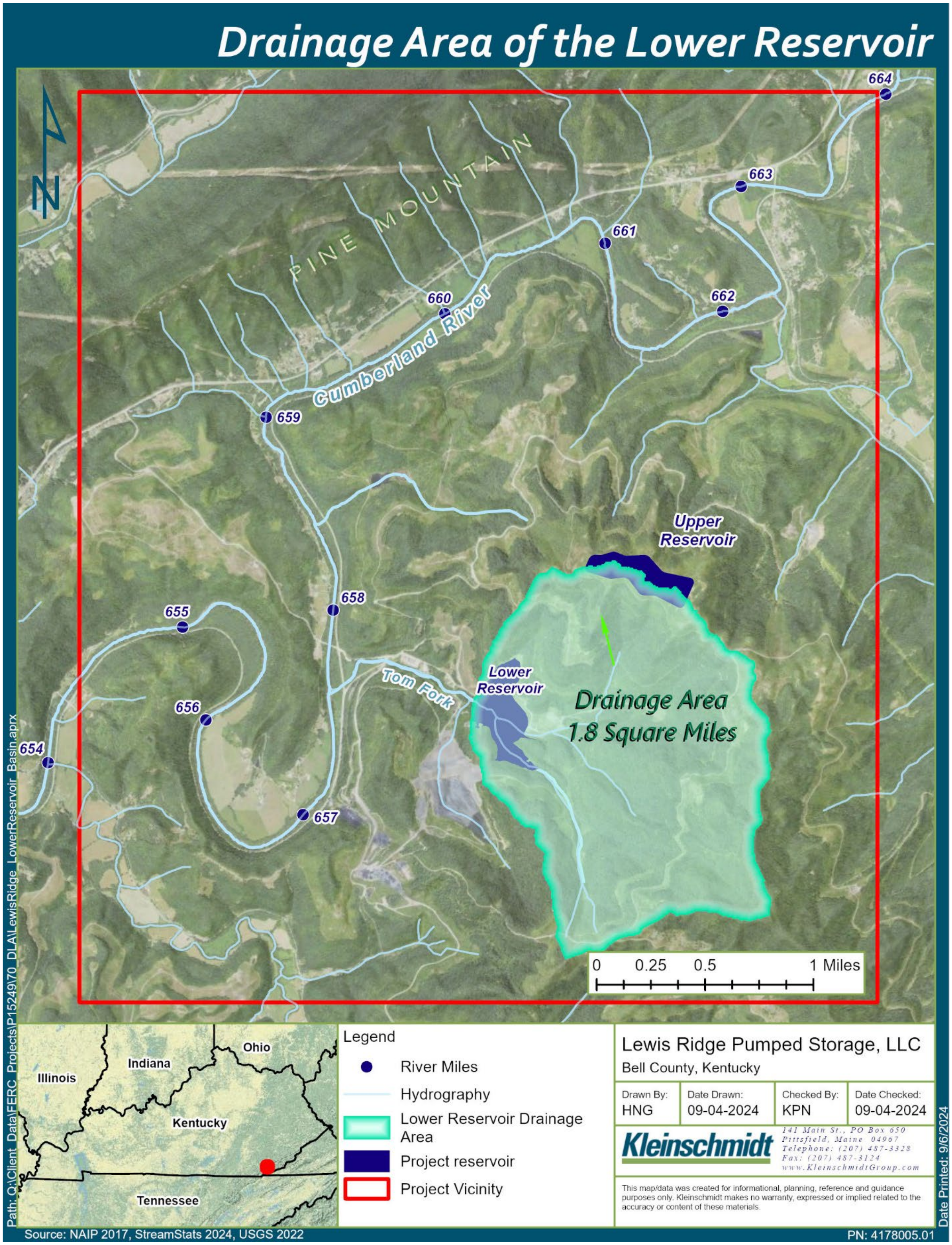
[11] Elevations are based on North American Vertical Datum of 1988 (NAVD 88).

Figure 5-1: National Hydrography Dataset Mapped Features in the Project Vicinity



Source: ESRI 2022, Kleinschmidt Associates 2022, NAIP 2017, NHD 2022, USGS 2022

Figure 5-2: Drainage Area of Lower Reservoir



5.2.1.1 Streamflow, Gage Data, and Flow Statistics

Table 5-1 provides information about two U.S. Geological Survey (USGS) gage sites on the Cumberland River located close to the Project Vicinity. USGS Gage #03401000 (Harlan gage) is located approximately 20 miles upstream of the Project Vicinity, and USGS Gage #03402900 (Pineville gage) is located approximately 15 miles downstream of the Project Vicinity. Daily average flow data for water years 1941 to 2023 were obtained for USGS #03401000 and prorated to the Project Vicinity based on the drainage areas at the gage (374 sq miles) and the Cumberland River near the Lewis Ridge Project (468 sq miles).[12]

Monthly average flows were highest in the winter months of January through March and lowest in the summer and early fall between August and October (Table 5-2). The average and median flows were estimated to be 884 cubic feet per second (cfs) and 452 cfs, respectively. The maximum daily average flow of 42,420 cfs occurred on April 4, 1977. Monthly minimum flows are approximately 100 cfs or less.

There is no historical gaged streamflow data available for Tom Fork, Dry Branch, or for the intermittent streams within the Project Vicinity. LRPS conducted a preliminary hydrologic assessment of the drainage basin at the lower reservoir, finding that the average estimated inflow into the proposed lower reservoir area was approximately 3.30 cfs (Kleinschmidt 2022). The estimated average annual flow of Tom Fork near the confluence with the Cumberland River is approximately 4 cfs (USGS 2024a).

As there is no historical streamflow data for Tom Fork, flow duration curves were not developed. Streamflow would not affect the dependable capacity of the Lewis Ridge Project because it would be a pumped storage facility.

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[12] Flows from USGS Gage #03401000 were multiplied by the ratio of the drainage areas (468/374 = 1.25).

Table 5-1: Cumberland River USGS Gage Sites near the Project Vicinity

USGS Gage Number	Description	Drainage Area (Square Miles)	Period of Record
03401000	Cumberland River near Harlan, Kentucky (approximately 20 miles upstream of Project Vicinity)	374	April 1940 - Present
03402900	Cumberland River at Pine St Bridge at Pineville, Kentucky (approximately 15 miles downstream of Project Vicinity)	770	1991 - Present

Sources: USGS 2024b, USGS 2024c

Table 5-2: Monthly Minimum, Average, Median, and Maximum Flows for the Cumberland River at the Harlan Gage (USGS Gage 03401000) Prorated to the Project Vicinity for Water Years 1941-2023 (October 1, 1940, to September 30, 2023)

Month	Minimum Flow (cfs)	Average Flow (cfs)	Median Flow (cfs)	Maximum Flow (cfs)
January	30	1,435	921	29,156
February	56	1,737	1,095	26,654
March	100	1,805	1,201	38,166
April	136	1,357	900	42,420
May	45	944	604	24,526
June	34	481	298	12,639
July	8	394	211	8,947
August	12	314	171	6,882
September	9	190	103	11,024
October	6	250	115	8,859
November	15	575	277	24,026
December	30	1,166	705	27,404
Total	**6**	**884**	**452**	**42,420**

Source: USGS 2024b

5.2.1.2 Existing and Proposed Uses of Waters

The proposed Lewis Ridge Project includes the construction of an upper and lower reservoir to store water to generate renewable energy. There are no natural inflows to the proposed upper reservoir other than rainfall directly on the footprint of the dam structure and reservoir. Initial fill water would be natural inflows from Tom Fork and potentially pumping water from the Cumberland River and/or pumping groundwater from wells that would be installed adjacent to the lower reservoir site. Reservoir recharge water would be sourced from Tom Fork to account for evaporative water loss and minimal quantities of seepage.

5.2.1.3 Existing Instream Flow Uses

There is one active water withdrawal from the Cumberland River within the Project Vicinity that is permitted to Nally & Hamilton Enterprises Inc. The withdrawal location is approximately 0.5 river miles downstream of the confluence of Tom Fork with the Cumberland River (permit number 1615) (Kentucky DEP 2024a). The permit allows a withdrawal of 0.075 million gallons per day (MGD) to 0.125 MGD depending on month. The Project Vicinity is located within the Knox County Utility Commission Source Water Protection Area Zone 3 (Kentucky DEP 2024b). The zones are defined based on the time of travel for a contaminant to the water supplier intake. Zone 3 has a 2.5-to-12.5-hour time of travel.

5.2.1.4 Federally Approved Water Quality Standards

The designated uses applicable to the Cumberland River and associated tributaries in the Project Vicinity, including Tom Fork and Dry Branch, are warm water aquatic habitat, primary contact recreation, secondary contact recreation, domestic water supply, and fish consumption (KAR 2022). Applicable water quality standards for the Cumberland River and associated tributaries are summarized in Table 5-3. This table outlines the warm water aquatic habitat water quality standards.

Table 5-3: Warm Water Aquatic Habitat Water Quality Standards Applicable to the Project Vicinity

Parameter	Standard
pH	6.0-9.0; shall not fluctuate by more than 1.0 pH unit over a 24-hour period
Temperature	<31.7 degrees Celsius (°C) (<89.0° Fahrenheit)
Dissolved Oxygen (DO) milligrams per liter (mg/L)	Minimum 5.0 mg/L daily average; Instantaneous minimum 4.0 mg/L
Alkalinity	As $CaCO_3$, shall not be reduced by more than 25 percent
Total Dissolved Solids, Total Suspended Solids, or Specific Conductance	Shall not be changed to the extent that the indigenous aquatic community is adversely affected
Settleable Solids	The addition of settleable solids that may alter the stream bottom so as to adversely affect productive aquatic communities shall be prohibited
Ammonia Un-ionized (mg/L)	<0.05 mg/L
Color	75 platinum cobalt units
Escherichia coli or Fecal Coliform	Primary Contact Recreation: From May 1 to October 31, *E. coli* content shall not exceed 130 colonies per 100 milliliters (ml) as a geometric mean based on not less than five samples taken during a thirty-day period. The *E. coli* content also shall not exceed 240 colonies per 100 ml in twenty percent or more of all samples taken during a thirty-day period. Primary Contact Recreation from November 1 to April 30 and Secondary Contact Recreation: Fecal coliform criteria applies and shall not exceed 1,000 colonies per 100 ml as a thirty-day geometric mean based on not less than five samples nor exceed 2,000 colonies per 100 ml in twenty percent or more of all samples taken during a thirty-day period.
Flow	Shall not be altered to a degree that will adversely affect the aquatic community
Iron	Acute: 4,000 µg/L (4 mg/L) Chronic: 1,000 µg/L (1 mg/L)
Sulfate	Human Health (domestic water supply): 250,000 (ug/L) (250 mg/L)

Source: KAR 2022

5.2.1.5 Water Quality Data

In accordance with Section 303(d) of the Clean Water Act, states are required to develop a list of impaired waters that do not meet water quality standards. Two reaches of the Cumberland River near the Project Vicinity are on the 303(d) list of impaired water bodies. The northeastern portion of the Project Vicinity includes approximately 1 RM of a 7.5 RM reach of the Cumberland River that is listed as partially supporting warm water aquatic habitat use because of elevated dissolved substances from small flow discharges or surface mining (Kentucky DEP 2024c,d). There is also an approximately 7 RM reach listed as not supporting the warm water aquatic habitat designated use because of elevated levels of copper and lead from mining located just downstream of the southwestern portion of the Project Vicinity. This reach is also listed as partially supporting the primary contact recreation use because of high levels of *E. coli.* This means the reach does not meet *E. coli* water quality standards and that a total maximum daily load (TMDL) is required; this reach has been identified as a high priority (Kentucky EEC 2024d).

Kentucky DEP Water Quality Data

The Kentucky DEP Division of Water monitors surface water quality throughout the state (Kentucky EEC 2022b). Water quality data for the Cumberland River near the Lewis Ridge Project are available approximately 20 river miles upstream of the Project Vicinity in the town of Harlan (21KY_WQX-CRW022) and approximately 8 miles downstream at the State Highway 1344 Bridge in Calvin (21KY_WQX-PRI086). The site in Harlan, Kentucky has been monitored approximately once each month every 5 years since 2010. The site in Calvin, Kentucky has been monitored each year approximately every other month since 2008. The ranges of water quality data collected for select parameters are summarized in Table 5-4. Time series of select parameters for Site 21KY_WQX-CRW022 are provided in Figure 5-3 to Figure 5-8 and for Site 21KY_WQX-PRI086 in Figure 5-9 to Figure 5-11.

At both monitoring sites, pH, dissolved oxygen (DO) concentration, and water temperature standards were attained throughout the monitored periods of record (Table 5-4). Overall, the range of values for each parameter were consistent year to year and between the two sites. Total alkalinity and conductivity were higher in spring through early fall and lowest in the winter. DO was lower in late spring through early fall when water temperatures were warmest. DO was highest in the winter months.

Table 5-4: Water Quality Data for Select Parameters at Two Locations in the Cumberland River

Parameter	Cumberland River at Harlan (21KY_WQX-CRW022) (2010-2011, 2015-2016, 2020-2021)	Cumberland River at 1344 Bridge (21KY_WQX-PRI086) (2008-2022)
Dissolved Oxygen (mg/L)	4.9-16.2	4.8-16.3
DO (% saturation)	73.0-124.6 (2015-2016, 2020-2021 only)	63.0-121.8 (2013-2022 only)
Total Alkalinity (mg/L)	35.4-158.0	39.1-294.0
Conductivity (microsiemens per centimeter (µS/cm))	176-615	50-864
pH	6.8-8.3	6.2-8.8
Temperature degrees °C	0.6-25.2	2.4-27.9 °C
Total suspended solids (mg/L)	1.5-1,110	2-890 mg/L
Turbidity (Nephelometric Turbidity Units (NTU)) (2015-2016, 2020-2021 only)	1.9-70.9	1.7-572
E. coli	69.7-1,553 MPN	1-1,986 MPN

Source: NWQMC 2024

Figure 5-3: Total Alkalinity (mg/L) at Site 21KY-WQX-CRW022

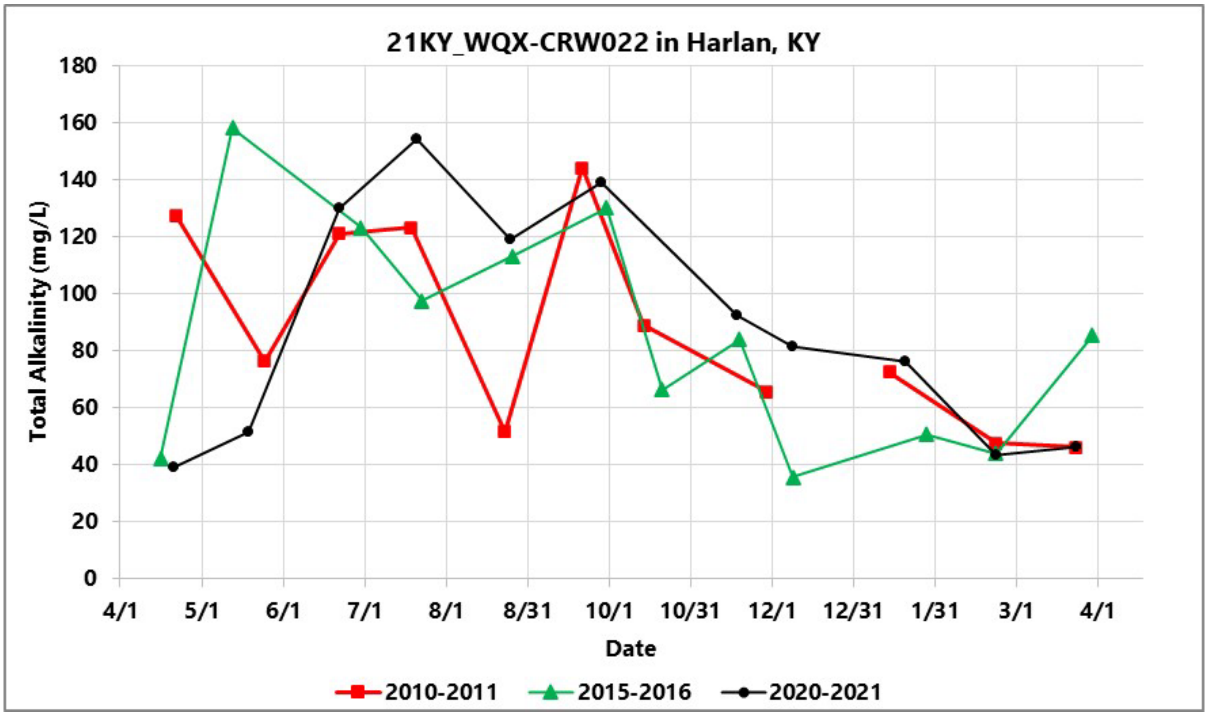


Figure 5-4: Conductivity (µS/cm) at Site 21KY-WQX-CRW022

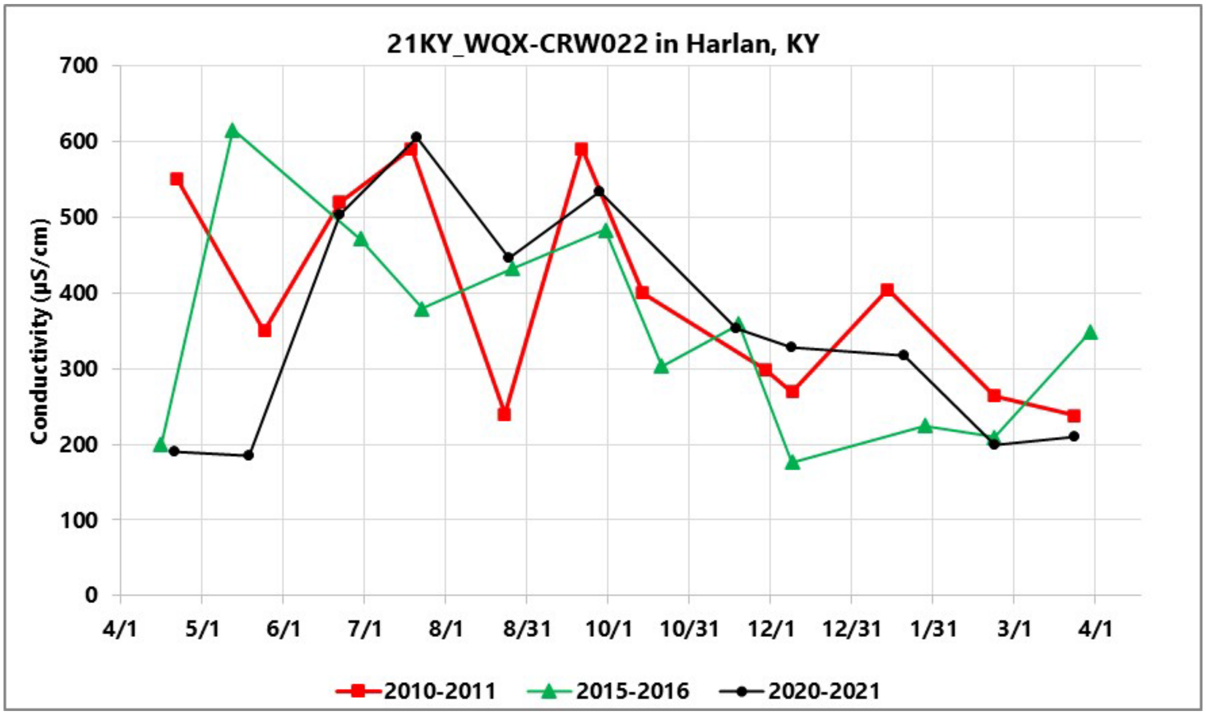


Figure 5-5: DO Concentration (mg/L) at Site 21KY-WQX-CRW022

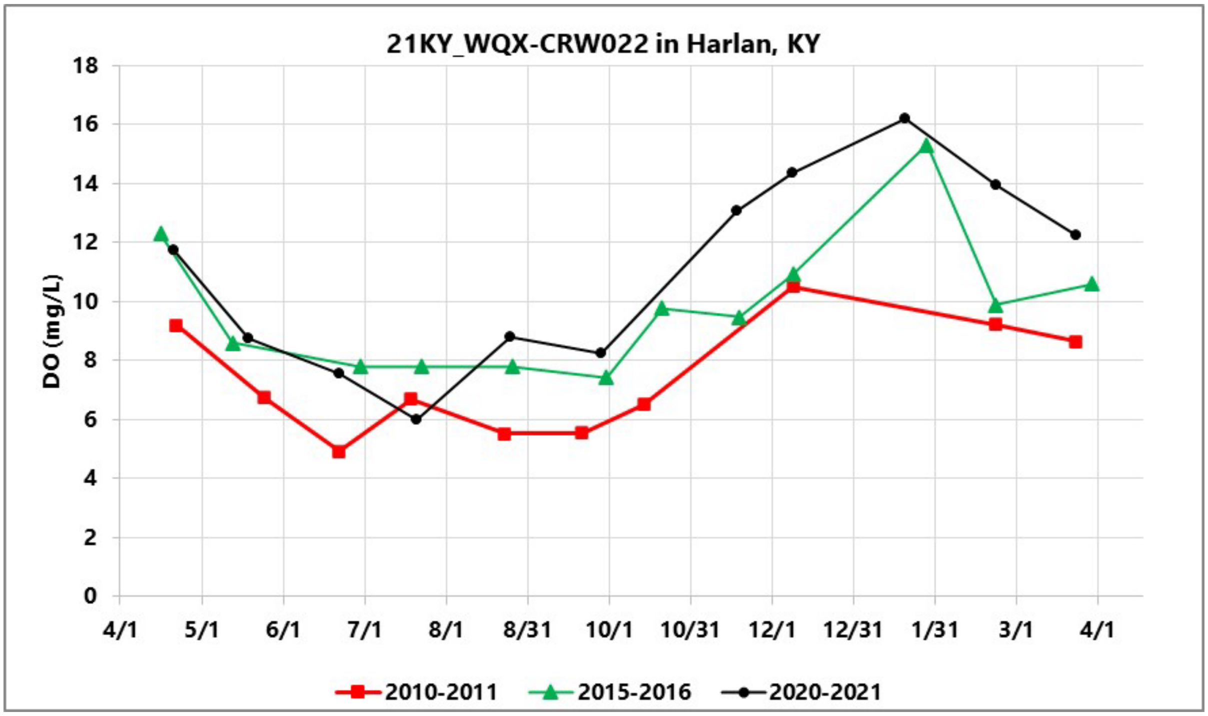


Figure 5-6: DO Percent Saturation at Site 21KY-WQX-CRW022

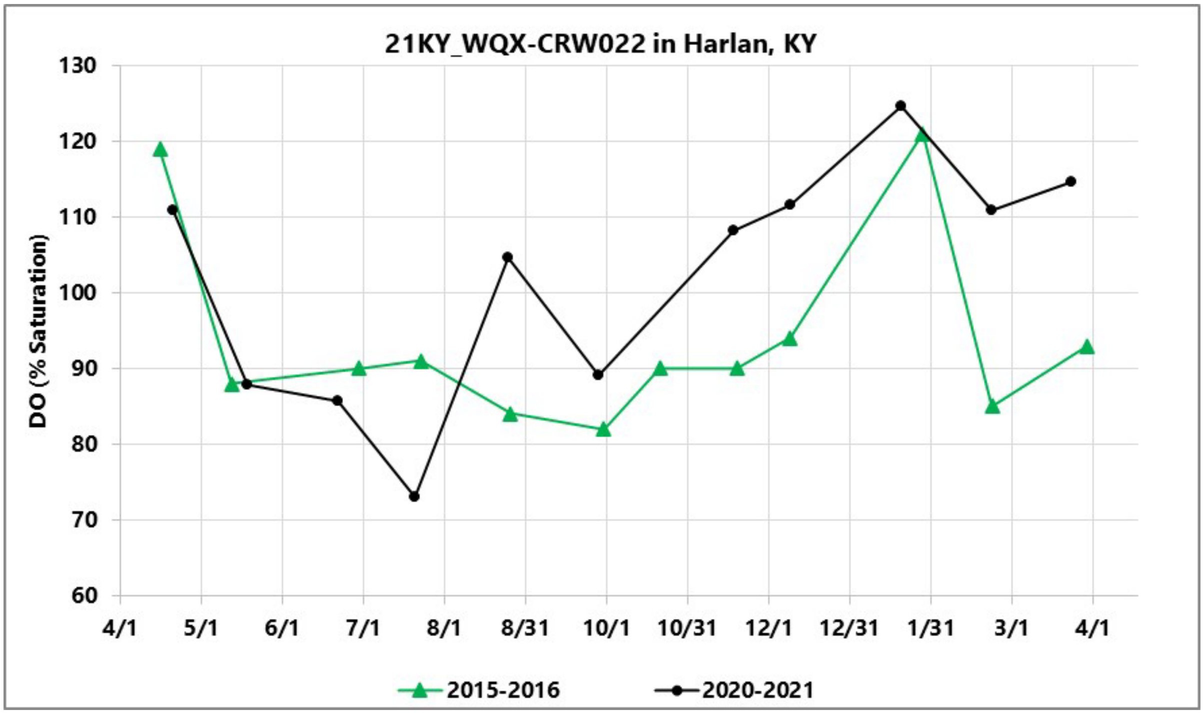


Figure 5-7: pH at Site 21KY-WQX-CRW022

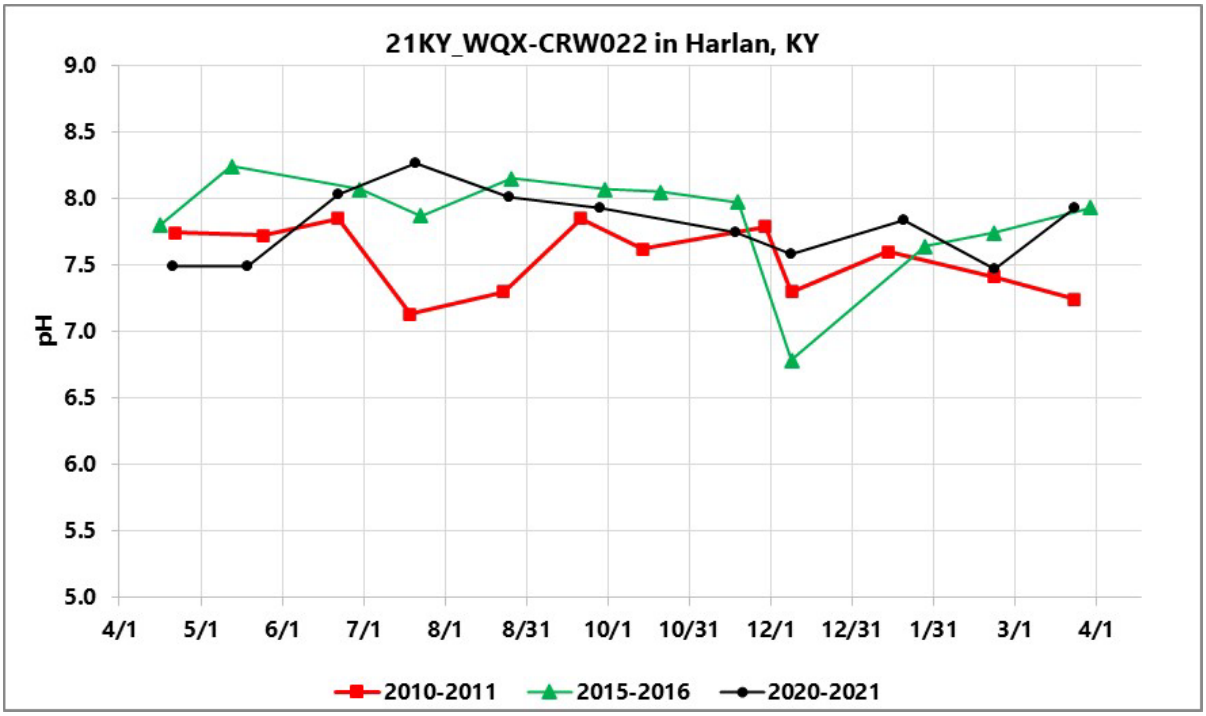


Figure 5-8: Water Temperature (°C) at Site 21KY-WQX-CRW022

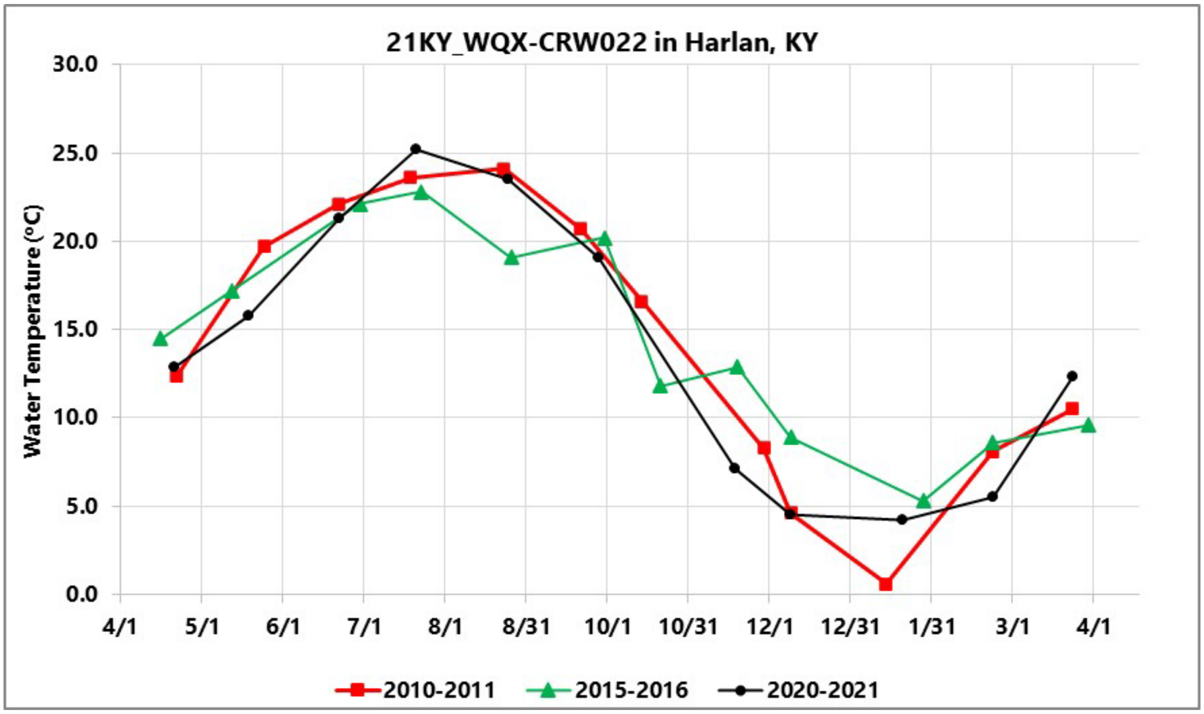


Figure 5-9: Total Alkalinity (mg/L) and Conductivity (µS/cm) at Site 21KY_WQX_PRI086

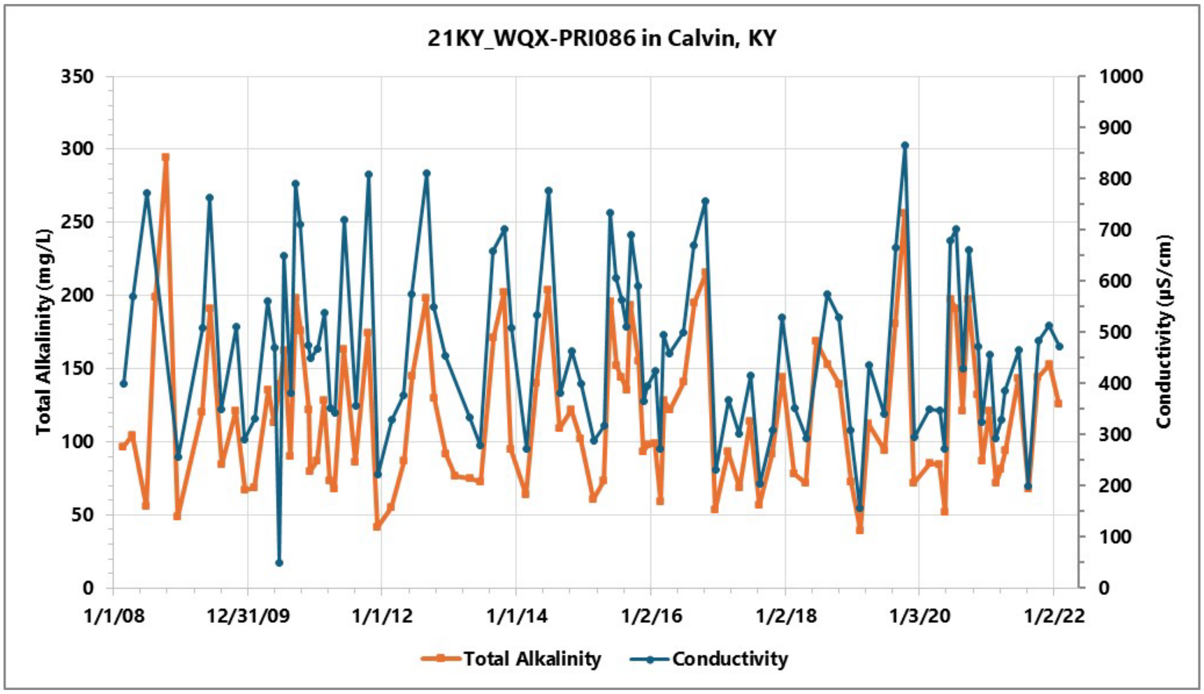


Figure 5-10: DO Concentration (mg/L) and Percent Saturation at Site 21KY_WQX-PRI086

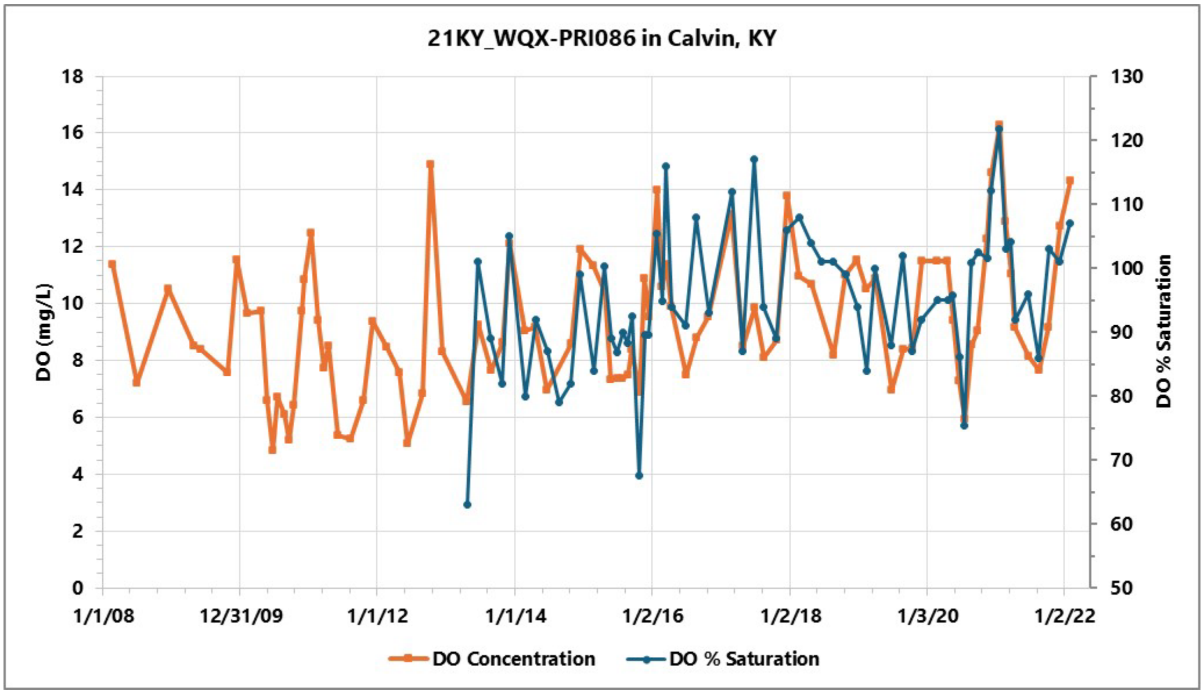
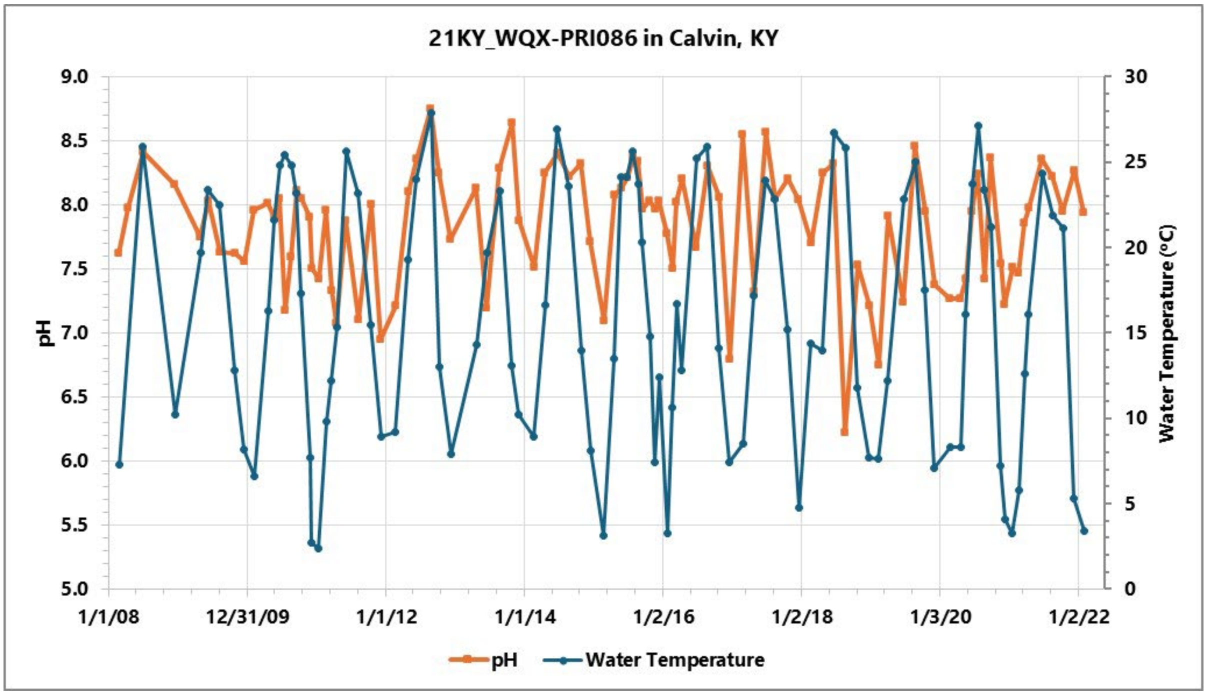


Figure 5-11: pH and Water Temperature (°C) at Site 21KY_WQX-PRI086



Blackside Dace Habitat Assessment Water Quality Data

As part of the 2024 Blackside Dace Habitat Assessment, LRPS monitored water quality at nine stations on the main stem of Tom Fork and at one site in an unnamed tributary to Tom Fork on July 25, 2024 (Figure 5-12). The DO concentration, DO percent saturation, water temperature, pH, and specific conductance were measured at each site; the results are provided in Table 5-5 (Third Rock Consultants 2024). Water temperature generally decreased from downstream to upstream in the main stem of Tom Fork. Water temperature, DO concentration, and pH met the water quality standards for warm water aquatic habitat at all 10 stations. The specific conductance at all stations exceeded the value (343 µS/cm) considered suitable for blackside dace (Hitt et al. 2016).

Table 5-5: Water Quality Data Collected in Tom Fork, July 25, 2024

Parameter	S1	S2	S3	S4	S5	S6	S7*	S8	S9	S10
Water Temperature (°C)	21.3	21.2	20.0	20.5	20.3	20.4	23.9	18.5	18.1	17.7
DO (mg/L)	8.6	8.3	11.3	8.3	8.4	8.4	7.3	8.6	9.0	8.8
DO (percent saturation)	96.7	94.9	98.8	93.6	95.7	95.2	88.4	93.9	97.4	95.7
pH	7.8	8.2	7.6	7.7	7.9	7.9	7.6	8.0	7.9	8.0
Specific Conductance (µS/cm)	888	894	746	754	684	688	581	772	774	775

* Tributary site
Source: Third Rock Consultants 2024

Tom Fork Mining Permit Water Quality Data

Water quality data have been collected at several sites in Tom Fork in accordance with mining permits (Figure 5-12).[13] Data collected in 2021 through 2024 at sites SW009 (approximately 0.4 RM upstream of confluence with Cumberland River), SW0016 (approximately 0.6 RM upstream of confluence), and SW1 (approximately 0.7 RM upstream of confluence are shown in Table 5-6 (Kentucky EEC 2024). Water quality parameter concentrations were consistent across the three sites. pH values were within the range of the standard (6.0-9.0). Total iron concentrations were well below the standards for warm water aquatic habitat. Most sulfate concentrations were above the standard for domestic water supply.

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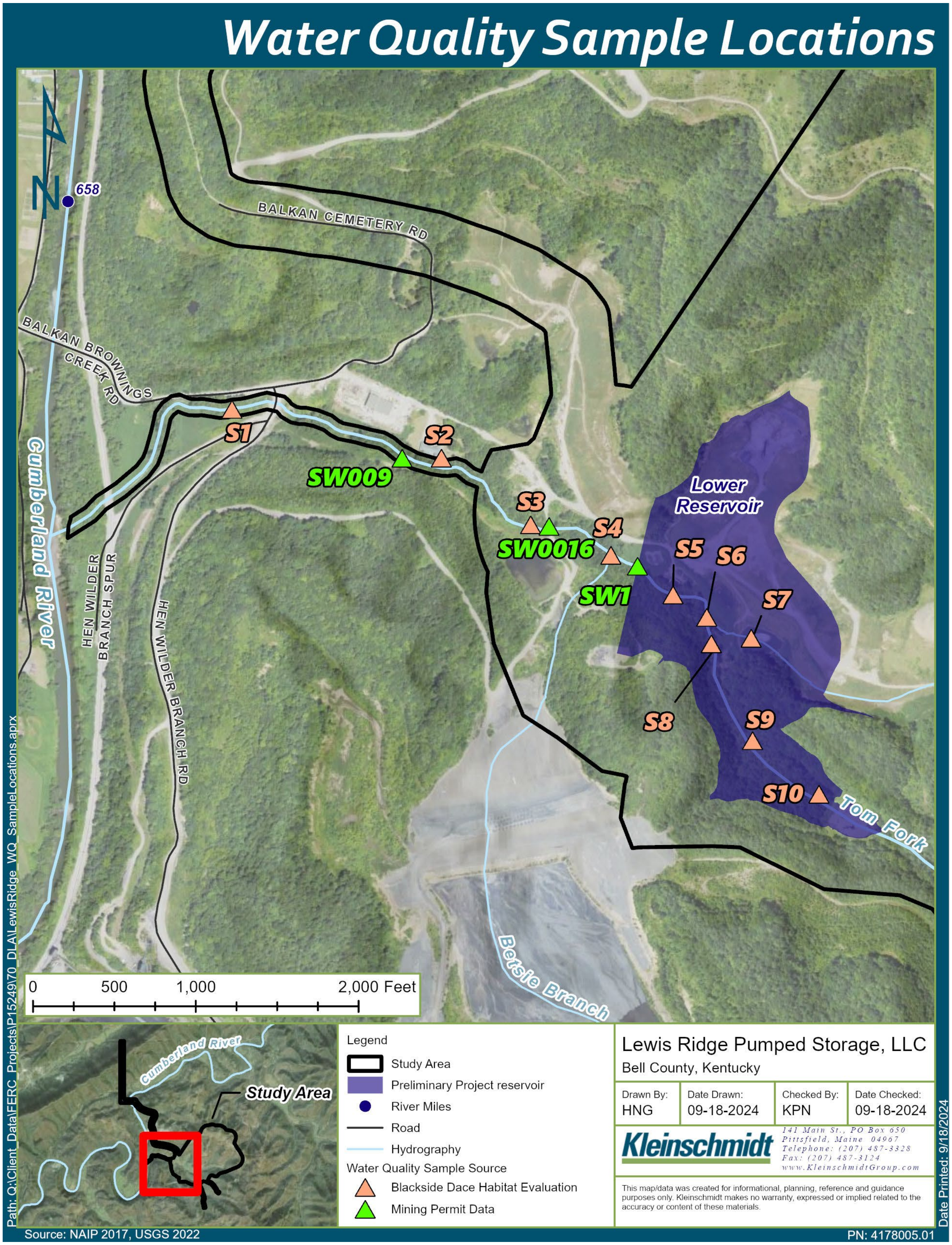
[13] Mining permits are outlined in Table 5-29 in Section 5.8.

Table 5-6: Water Quality Data Collected in Tom Fork, 2021 to 2024

Parameter	6/20/ 2024	2/5/ 2024	12/15/ 2023	8/23/ 2023	6/15/ 2023	3/26/ 2023	12/26/ 2022	8/21/ 2022	6/10/ 2022	3/11/ 2022	11/8/ 2021	9/13/ 2021	6/21/ 2021	3/2/ 2021
Site SW0016														
Acidity (mg/L)	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Alkalinity (mg/L)	187	138	158	157	189	144	195	171	174	32	224	187	193	65
Total Iron (mg/L)	0.08	0.56	0.12	0.24	0.08	0.23	0.08	0.03	0.03	0.08	0.11	0.31	0.12	0.21
Total Manganese (mg/L)	0.03	0.17	0.26	0.06	0.03	0.12	0.30	1.26	0.06	0.32	0.20	0.19	0.03	0.15
pH	7.3	7.4	7.5	7.9	7.6	7.0	7.4	7.5	7.1	7.3	6.9	7.8	8.0	7.6
Sulfate (mg/L)	374	344	358	671	428	243	274	846	1172	429	386	395	384	168
Specific Conductance (µS/cm)	937	644	945	1393	991	684	1175	1513	1630	708	1044	1124	974	417
Total Suspended Solids (mg/L)	15	16	5	5	12	23	25	5	9	5	5	6	24	27
Site SW1														
Acidity (mg/L)	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Alkalinity (mg/L)	190	138	160	158	191	135	195	175	173	200	202	189	192	68
Total Iron (mg/L)	0.08	0.53	0.10	0.18	0.10	0.09	0.05	0.03	0.05	0.03	0.25	0.36	0.08	0.21
Total Manganese (mg/L)	0.03	0.17	0.08	0.04	0.03	0.09	0.29	1.26	0.11	0.03	0.23	0.23	0.03	0.17
pH	7.3	7.4	7.5	7.9	7.6	7.0	7.4	7.5	7.1	7.2	7.1	8.0	8.1	7.7
Sulfate (mg/L)	395	383	374	719	578	260	287	895	1405	455	386	401	366	186
Specific Conductance (µS/cm)	931	675	903	1347	954	656	1110	1518	1672	724	1067	1064	971	400
Total Suspended Solids (mg/L)	13	18	6	5	86	23	26	5	6	5	5	5	5	10
Site SW009														
Acidity (mg/L)	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Alkalinity (mg/L)	172	135	134	183	172	132	182	177	175	108	193	184	182	66
Total Iron (mg/L)	0.07	0.26	0.07	0.06	0.11	0.15	0.03	0.03	0.06	0.19	0.11	0.19	0.06	0.22
Total Manganese (mg/L)	0.03	0.37	0.96	0.08	0.18	0.22	0.55	0.03	0.03	0.18	0.19	0.04	0.03	0.17
pH	7.5	7.4	7.4	7.3	7.6	7.0	7.5	7.3	7.3	7.4	7.0	8.4	8.4	7.9
Sulfate (mg/L)	516	430	536	695	540	332	367	472	401	529	524	518	398	203
Specific Conductance (µS/cm)	1065	777	1152	1237	1108	814	1259	967	946	751	1192	1157	1022	455
Total Suspended Solids (mg/L)	8	6	20	5	7	23	10	5	5	5	5	5	8	20

Source: Kentucky EEC 2024

Figure 5-12: Tom Fork Water Quality Sample Locations



5.2.1.6 Proposed Project Reservoirs

The proposed upper reservoir would have a surface area of 39.7 acres at the maximum water surface elevation of 2,200 feet[14] and a surface area of 33.5 acres at the normal minimum water surface elevation of 2,129 feet. During normal operations, the change in elevation (or water depth) would be 71 feet. The maximum water depth would be 75 feet and the average depth would be approximately 34 feet. The upper reservoir would have a gross storage capacity of 2,732 acre-feet at the normal maximum water surface elevation and an active storage capacity of approximately 2,600 acre-feet.[15] The shoreline length (dam length) of the upper reservoir would be approximately 5,450 feet. The upper reservoir would be lined with Hydraulic Asphalt Concrete (HAC) to prevent seepage and stability issues. The upper reservoir would be refilled via pumping water back from the lower reservoir. There are no natural inflows to the proposed upper reservoir other than rainfall directly on the footprint of the dam structure and reservoir.

The proposed lower reservoir would have a surface area of 48.3 acres at the normal maximum water surface elevation of 1,234 feet and a surface area of 9.5 acres at the normal minimum water surface elevation of 1,134 feet. During normal operations, the change in elevation (water depth) would be 100 feet. The maximum water depth would be 109 feet and the average depth would be approximately 33 feet. The lower reservoir would have a gross storage capacity of 2,673 acre-feet at the normal maximum water surface elevation and an active storage capacity of approximately 2,600 acre-feet. The shoreline length of the lower reservoir would be approximately 9,095 feet.

It is anticipated that the source of the initial fill water for the lower reservoir would be natural inflows from Tom Fork and potentially pumping water from the Cumberland River and/or pumping groundwater from wells that would be installed adjacent to the lower reservoir site. Based on preliminary hydrologic calculations, the total initial fill volume is approximately 3,275 acre-feet. To prevent seepage, the entire lower reservoir footprint would be lined with HAC and the liner would extend above the maximum operating water surface elevation. The approximate gradient of Tom Fork between the proposed location of the lower reservoir and the confluence with the Cumberland River is 2 percent (change

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[14] Elevations are based on North American Vertical Datum of 1988 (NAVD 88).

[15] Active storage capacity is equal to the volume at the normal maximum water surface elevation minus the volume at the normal minimum water surface elevation.

in elevation of approximately 100 feet over approximately 0.85 miles or 4,500 feet); this estimate was obtained using the Google Earth elevation profile.

5.2.1.7 Groundwater

The geology of the Project Vicinity is described in detail in Section 5.8. The Project Vicinity is underlain by the Breathitt Formation, which consists of siltstone, shale, sandstone, and coal. The predominant aquifer type in the Project Vicinity is shallow fracture flow and deep granular consolidated (Kentucky EEC 2022b). Fracture flow aquifers transmit groundwater within fractures in the bedrock.

The Breathitt Formation yields more than 500 gallons per day to more than three-quarters of the wells drilled in valley bottoms, more than 500 gallons per day to about three-quarters of the wells on hillsides, and more than 100 gallons per day to nearly all wells on ridges. Sandstones yield water to most wells; shales and coal also provide water. Near-vertical joints and openings along bedding planes yield most of the water to wells (Carey and Stickney 2002).

Groundwater flow in the Lewis Ridge Project region occurs primarily through fractures and openings along bedding planes, which permits more rapid movement of water than water flowing through the pore spaces of predominantly sandstone bedrock. The sandstone zones are sometimes associated with impermeable claystone units that occur near coal seams and shales that limit the vertical movement of water. These strata cause the water being transmitted by the sandstone and/or fractures to move laterally to the hillsides where the water flows to the surface or until it can move vertically downward again when it encounters a fracture penetrating a confining bed. Mining activities break up the strata over and under the coal seams by blasting operations and increase the permeability of the material, allowing for faster movement of groundwater. Groundwater movement is characterized by stepping movement from the ridge tops to the valley bottoms. Also, wells are generally recharged by direct connection to infiltration from the surface areas directly above and near the wells (Nally & Hamilton Enterprises, Inc. 2007).

5.2.1.8 Wetlands, Riparian, and Littoral Habitat

Wetland Habitat

The U.S. Fish and Wildlife Service (USFWS) classification scheme for wetlands serves as the national standard and is used to classify wetlands in the National Wetlands Inventory (NWI) (USFWS 2024). The NWI coverage is developed from aerial photography. USFWS defines wetlands as: "*…lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is covered by shallow water. For the purpose of the classification, wetlands must have one or more of these three attributes: (1) at least periodically, the land must support predominantly wetland plants; (2) the substrate is predominantly undrained hydric soil; and (3) rocky, gravelly, or sandy areas that are saturated with or covered by shallow water at some time during the growing season*" (USFWS 1993).

Wetlands have the potential to provide a variety of ecological functions including groundwater discharge and recharge; floodflow management; fish and shellfish habitat, sediment, toxicant, and pathogen retention; nutrient removal, retention, and transformation; production export, sediment and shoreline stabilization, and wildlife habitat. Wetlands also support human-defined values such as recreation, educational and scientific use, uniqueness and heritage, visual quality, and threatened and endangered species habitat (USACE 1999). Understanding the distribution and characteristics of wetlands on the landscape is useful for land use planning and management.

Information regarding the location and spatial extent of wetland resources in the Project Vicinity and Study Area was obtained from the NWI (USFWS 2022). The mapped NWI features in the Project Vicinity are presented in Figure 5-13 and are listed in Table 5-7. Within the Project Vicinity, there are approximately 4.3 acres mapped on the NWI as freshwater emergent wetland, 35.0 acres mapped as freshwater forested/shrub wetland, and 21.7 acres mapped as freshwater pond. Within the Study Area, there are no areas mapped as freshwater wetland and approximately 5.5 acres mapped on the NWI as freshwater pond. The 5.5 acres of freshwater pond include areas classified as PUBHh and PUBHx (palustrine, unconsolidated bottom, permanently flooded, diked/impounded or excavated).

LRPS conducted a Jurisdictional Streams and Wetlands Determination assessment in 2022 and 2024 to determine the presence of jurisdictional waters in the Study Area (Appendix

B). The assessment involved compiling background information (sources included the Bell County Soil Survey located on the U.S. Department of Agriculture (USDA) Web Soil Survey, the National Wetlands Inventory (NWI) Map, U.S. Geological Survey (USGS) topographic map, and Google Earth) and field reconnaissance. The assessment identified emergent type wetlands and streams inside and outside of the active/reclaimed mining areas. A total of 1.47 acres of wetlands were delineated of which 0.95 acres were palustrine emergent and 0.52 acres were palustrine forested (Figure 5-14). A total of 19,847 feet of streams were delineated within the Study Area of which 7,466 feet were perennial streams, 5,777 were intermittent streams, and 6,604 were ephemeral streams (EcoSource, Inc 2024).

Information regarding floodplains in the Project Vicinity were obtained using Federal Emergency Management Agency (FEMA) flood mapping and the Kentucky Flood Hazard Portal (Figure 5-15) (FEMA 2024, Kentucky DEP 2024e). As shown, FEMA mapped floodways in the Project Vicinity are primarily associated with the Cumberland River. At the proposed lower reservoir, there is a narrow section adjacent to Tom Fork that is mapped as a 1 percent annual chance flood hazard.

Table 5-7: USFWS NWI Mapped Wetlands in the Project Vicinity and Study Area

NWI Wetland Type	Acres in the Project Vicinity	Acres in the Study Area
Freshwater Emergent Wetland	4.3	0
Freshwater Forested/Shrub Wetland	35.0	0
Freshwater Pond	21.7	5.5
Riverine	208.2	9.6

Source: USFWS 2022

Figure 5-13: USFWS NWI Wetlands in the Project Vicinity

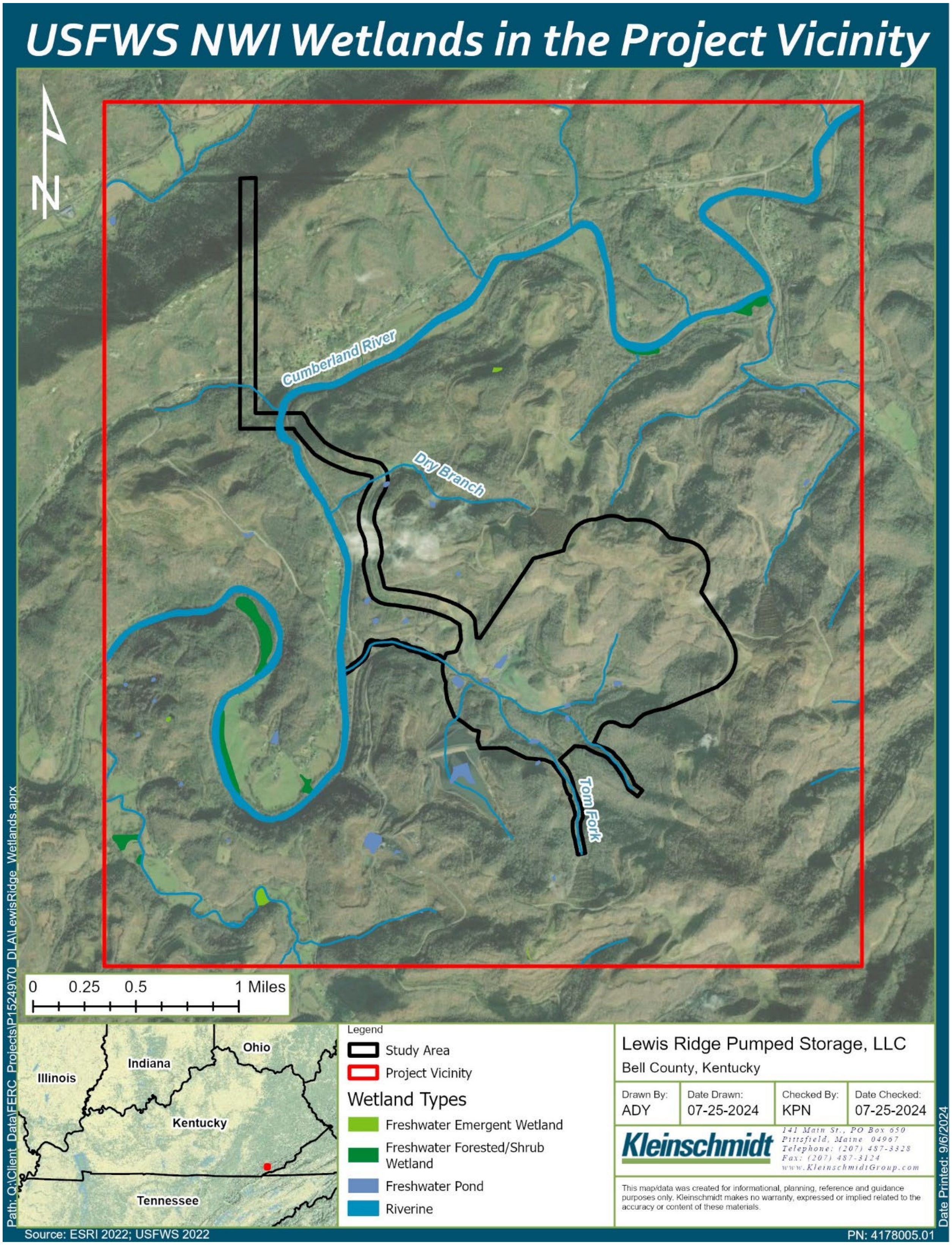


Figure 5-14: Jurisdictional Wetlands and Streams Mapped in the Study Area

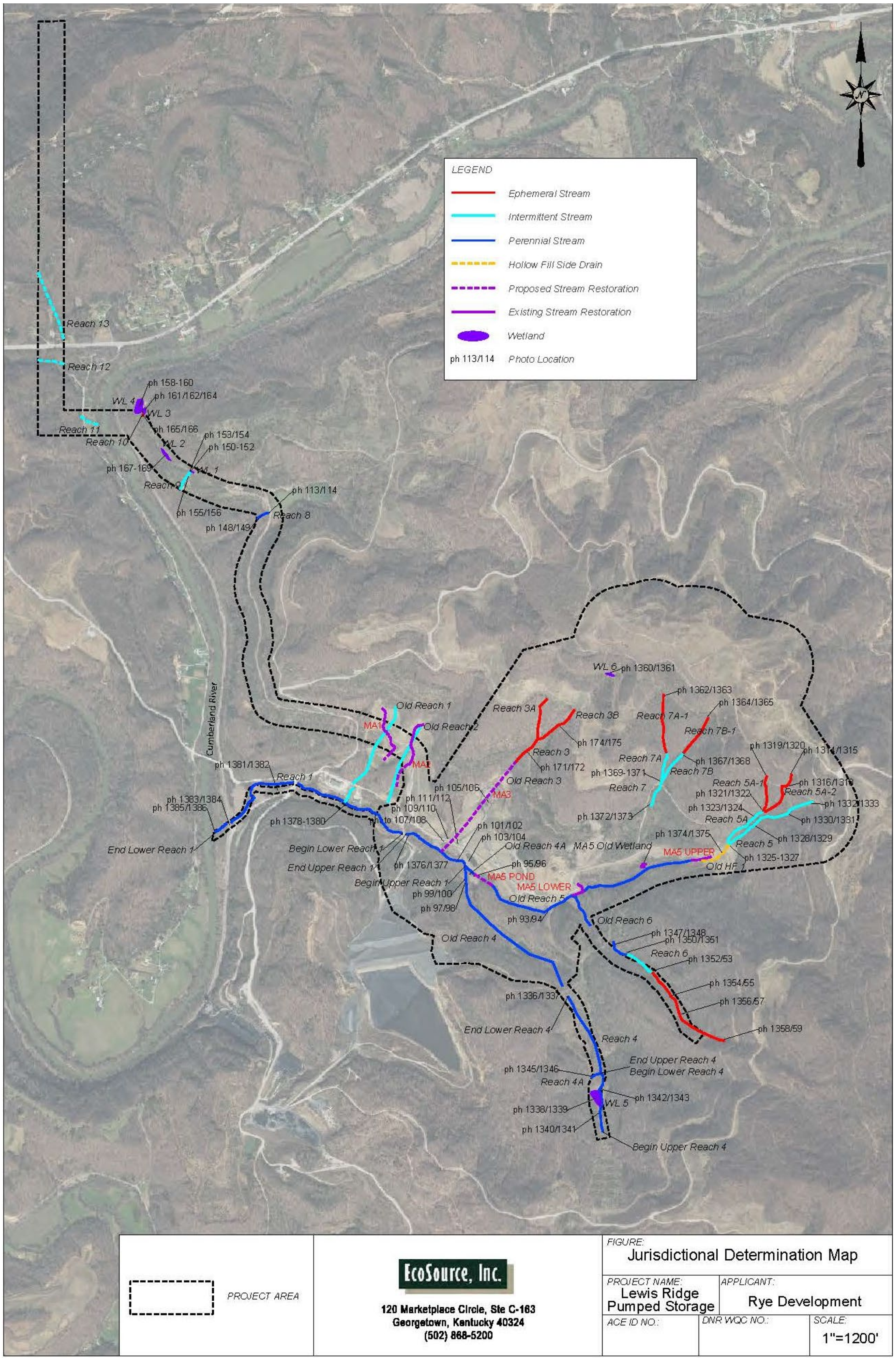
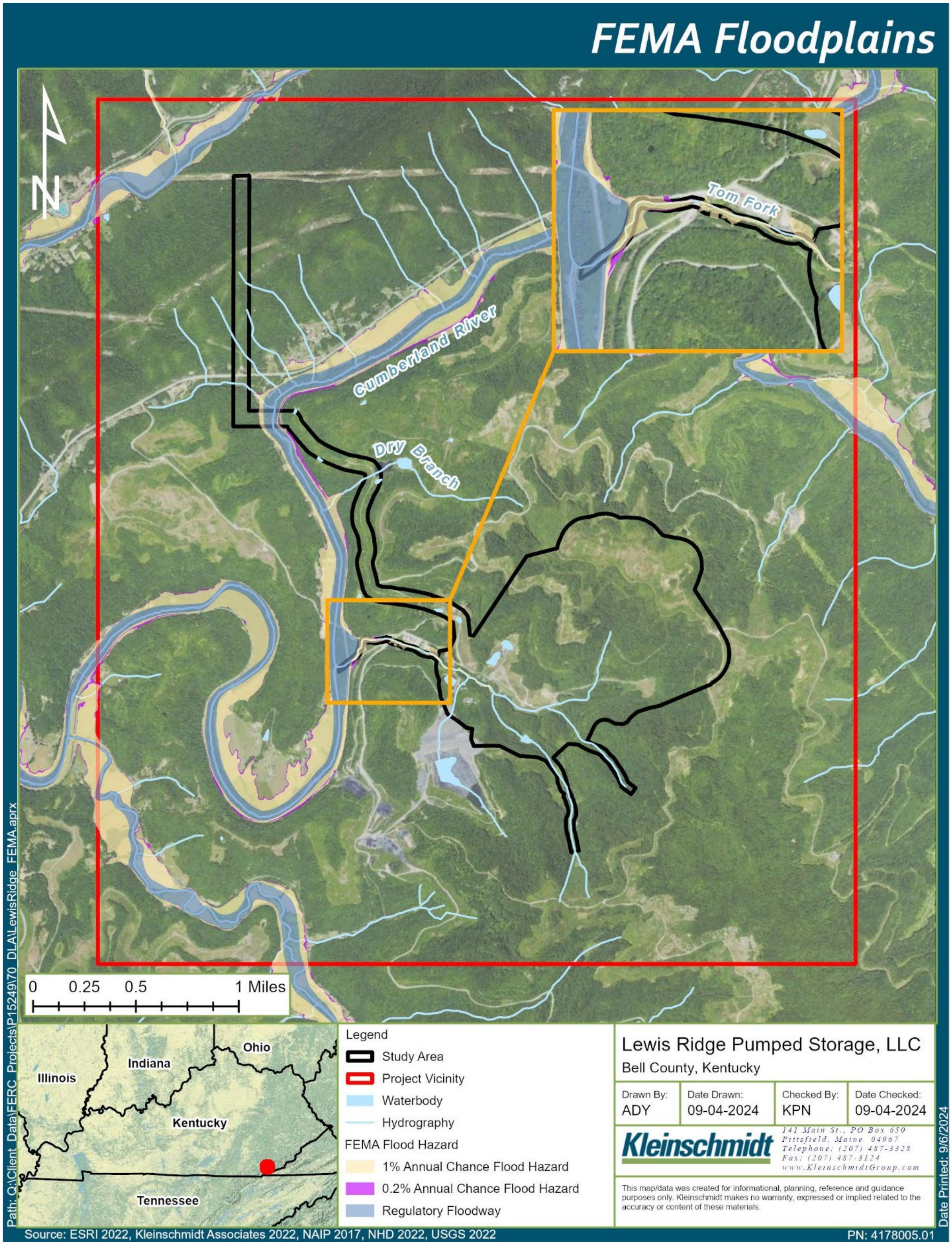


Figure 5-15: FEMA Mapped Floodplain Areas in the Project Vicinity



Source: ESRI 2022, Kleinschmidt Associates 2022, NAIP 2017, NHD 2022, USGS 2022

Riparian and Littoral Habitat

Riparian habitat is located along streams, rivers, and lakes, and provides important ecosystem functions related to hydrology and flooding, nutrient cycling, and plant and wildlife habitat (Mitsch and Gosselink 2000). The littoral zone acts as an interface between the open water aquatic environment and the terrestrial environment (Wetzel 2001). The size and extent of the littoral zone within a waterbody varies depending upon geomorphology and sedimentation within the aquatic system (Wetzel 2001).

Riparian habitat in the Project Vicinity includes land adjacent to the Cumberland River as well as several associated tributaries. These riparian habitats are found in the floodplains of the river and associated tributaries. There are two tributaries in the Study Area that are mapped on the NWI. At the lower reservoir location, there is one tributary (i.e., Tom Fork). Additionally, the proposed interconnection line crosses Dry Branch, which flows from east to west to its confluence with the Cumberland River. Dry Branch and Tom Fork are classified on the NWI as R4SBC, which indicates that the system is riverine, subsystem is intermittent, class is streambed, and water regime is seasonally flooded (USFWS 2024).

Wetland, Riparian, and Littoral Plant and Animal Species

LRPS conducted a wetland and waterway delineation, which provides detail on plant species within the Study Area. Dominant plants within the wetlands included American beech (*Fagus grandifolia*), American hornbean (*Carpinus caroliniana*), American sycamore (*Platanus occidentalis*), black willow (*Salix nigra*), Christmas fern (*Polystichum acrostichoides*), Japanese honeysuckle (*Lonicera japonica*), Japanese stiltgrass (*Microstegium vimineum*), narrowleaf cattail (*Typha angustifolia*), river birch (*Betula nigra*), winter creeper (*Euonymus fortune*), and woolgrass (*Scirpus cyperinus*). It is anticipated that a variety of animal species, including birds, insects, mammals, snakes, turtles, and amphibians such as frogs, toads, and salamanders may use the wetland, riparian, and littoral habitat.

5.2.2 Potential Impacts of the Proposed Lewis Ridge Project

The proposed Lewis Ridge Project is anticipated to have temporary and permanent impacts on water resources. During construction, Tom Fork would be rerouted around the proposed location of the lower reservoir. This would not impact the quantity of water within Tom Fork but may have a temporary impact water quality due to sediment transport. Following construction, Tom Fork would be routed through the lower reservoir. The source for the initial fill of the lower reservoir would be natural inflow from Tom Fork and potentially pumping water from the Cumberland River or groundwater. The percent of flow from Tom Fork that would be used for the initial fill is currently unknown; however, the initial fill would temporarily affect water quantity in Tom Fork. During normal operation, a small percentage of flow from Tom Fork would be used for recharge. Approximately the same amount of natural inflow to the lower reservoir would be released back to Tom Fork; however, this amount of flow is currently unknown and will be included in the FLA. LRPS is currently consulting with Kentucky DEP, Kentucky DNR, and USACE regarding permitting requirements and potential mitigation for impacts to Tom Fork.

Annual flow estimates at the location of the lower reservoir and at the confluence of Tom Fork with the Cumberland River are approximately 3 to 4 cfs; this flow is minor compared to typical flows in the Cumberland River. Rerouting Tom Fork during construction would not impact the quantity of water entering the Cumberland River. Changes in the quantity of water in Tom Fork during the initial fill or recharge would have a minor, temporary effect on water quantity entering the Cumberland River. The potential use of pumped water from the Cumberland River for the initial fill of the lower reservoir would have a temporary minor impact on water quantity in the river. As the flow in Tom Fork is low, relative to the Cumberland River flows, impacts on the quality or quantity of water in the Cumberland River during normal operation are not anticipated.

The proposed interconnection line would cross the Cumberland River, Dry Branch, and unnamed tributaries in single spans and no impacts to water quantity, water quality, nor wetland resources are anticipated.

There may be temporary impacts on the quality of water in Tom Fork during construction from runoff, erosion or potential spills; however, these impacts would be minimized or avoided through implementation of Best Management Practices (BMPs) and other PM&E measures. During normal operations, the water in Tom Fork would be slowed and have a longer residence time in the lower reservoir, which would potentially impact water temperature and other parameters, such as pH, nutrients, or DO.

During normal operations, surface water runoff and sedimentation into the upper reservoir would be minimal because the reservoir would be surrounded by a ring dike hardfill dam. During operation of the lower reservoir, natural inflows may cause sedimentation build up. The water released from the low-level outlet in the lower reservoir to Tom Fork would be at the same elevation as the reservoir floor. Thus, the quality of water released downstream to Tom Fork would reflect the conditions at the bottom of the lower reservoir. It is anticipated that the water in the lower and upper reservoirs would be well mixed because of the pump and generation cycle. The water quality and the extent of mixing or stratification in the upper and lower reservoirs would be monitored after construction in accordance with the Water Quality Monitoring Plan.

The upper reservoir and lower reservoir would be lined with HAC to prevent seepage of water from the reservoirs into the groundwater. During normal operation, no impacts on groundwater from the lower and upper reservoirs are anticipated.

Wetlands are present along the proposed interconnection line, waterways, and mine roads in the Study Area. LRPS will consider wetland locations during design and avoid and minimize impacts to wetlands to the extent practicable.

LRPS is proposing to develop and implement several PM&E measures, which would minimize and mitigate impacts to water and wetland resources, as outlined in Section 5.2.3 below.

5.2.3 Agency Consultation and Applicant Recommendations

5.2.3.1 Agency Consultation

Documentation of consultation is provided in Appendix A. Consultation specific to water resources is summarized below.

USFWS submitted preliminary comments on February 9, 2022 in response to FERC’s December 16, 2021, Notice of Preliminary Permit Application to assist FERC and LRPS in assessing the potential environmental impacts of construction and operation of the proposed project. USFWS recommended evaluating the following related to water resources:

- Potential for interception of any watercourse by the new reservoirs.
- Potential entrainment of aquatic species if the source water for the project is from surface water.
- Potential for groundwater contamination (from the development of salts and alkaline conditions within reservoirs over time due to evaporative losses).

On November 23, 2022, USEPA commented on the NOI and PAD providing recommendations and considerations for FERC to include in its draft NEPA document. USEPA recommended inclusion of the following related to water resources:

- Additional reservoir operation information, including plans for emergency releases and additional withdrawals.
- Analysis of the Cumberland River to determine potential impacts if supplemental water is needed for the proposed reservoirs, or if reduced flows from Tom Fork would have any short or long-term effects on water quality downstream.
- Evaluate the potential for eutrophication as well as maintenance activities to address eutrophication issues.
- Development of an adaptive water quality monitoring program for the proposed reservoirs to estimate the accretion of constituents (including aerial disposition) over time.
- Evaluate Kentucky water quality standards, potential impacts of reduced flows, and impacts from adjacent mining operations or mobilization of sediments from proposed construction in proposed water quality studies of Tom Fork and the Cumberland River.
- Perform water quality monitoring at representative locations at the Lewis Ridge Project to characterize existing water quality.
- Utilize groundwater observation wells to explore the possibility of installing high volume extraction wells to use in conjunction with other water resources to fill the upper reservoir.

At the January 25, 2023 Joint Agency and Public Meeting, existing water resources information from the PAD was presented. During the meeting, discussion occurred with USACE regarding the initial wetland and waterway assessment that was conducted in 2022.

LRPS distributed a Draft Study Plan on June 13, 2024. The Draft Study Plan included two studies related to water resources: Wetland and Waterway Evaluation and Blackside Dace Habitat Evaluation (which included documenting water quality parameters in Tom Fork). LRPS did not receive any comments specific to the Wetland and Waterway Evaluation or Blackside Dace Habitat Evaluation study plan. On June 20, 2024, the USACE commented on the PAD and stated that the Lewis Ridge Project would require evaluation under their standard individual permit review process. USACE provided a list of information required for the application, which includes delineation of wetlands, other special aquatic sites, and other waters, such as lakes and ponds, and perennial, intermittent, and ephemeral streams on the Lewis Ridge Project site. LRPS filed the Revised Study Plan with FERC on August 16, 2024.

The Kentucky DEP submitted comments on April 6, 2023 (following the Joint Agency and Public Meeting) and on July 9, 2024 (following the distribution of the Draft Study Plan). In its comments the Kentucky DEP provided state permitting information pertaining to water resources (discussed in Section 2.9). Kentucky DEP requested impacts to Tom Fork and the three intermittent streams that form Tom Fork be addressed with the Kentucky DEP Division of Water. In addition, the Kentucky DEP Water Resources Branch requested LRPS to determine if the Lewis Ridge Project is located in the 1% chance floodplain. Kentucky DEP Groundwater Section of the Watershed Management Branch requested that a Groundwater Protection Plan is developed for the Lewis Ridge Project.

USFWS provided preliminary information on NWI wetland types within the Study Area for the Lewis Ridge Project on July 19, 2024.

LRPS met with Kentucky DEP, Kentucky DNR, and USACE on August 12, 2024 to discuss sources of initial fill and recharge water and associated withdrawal permitting, routing and/or diversion of Tom Fork at the lower reservoir, and project design around these topics.

5.2.3.2 Applicant Recommendations

LRPS proposes to implement the following PM&E measures to minimize impacts on water resources:

- **Water Quality Monitoring Plan:**
    - LRPS proposes to develop and implement a Water Quality Monitoring Plan outlining protocols and schedules for monitoring water quality in the upper and lower reservoirs and Tom Fork. Potential parameters may include water temperature, DO, pH, and trophic state indicators, such as nutrients and water clarity. The Water Quality Monitoring Plan will be filed with the FLA.
- **Stream Mitigation:**
    - Stream mitigation would be required for the alternation of Tom Fork during and after construction. Permitting and details of stream mitigation requirements will be coordinated with the USACE and Kentucky DEP Division of Water.
- **Stormwater Pollution Prevention Plan (SWPPP):**
    - LRPS proposes to develop and implement a SWPPP to address prevention of potential erosion, scouring, and general water quality degradation during construction. The SWPPP would be filed with the Commission after license issuance and implemented at the start of construction. The SWPPP would include:
        - A description of the potential sources of stormwater pollution.
        - Maintenance measures (i.e., regular inspections, good housekeeping practices) used to control stormwater runoff and prevent contamination of stormwater during construction.
        - Control measures, such as soil stabilization, diversions or infiltration, to manage the flow of stormwater.
- **Hazardous Substances Spill Prevention and Cleanup Plan:**
    - LRPS proposes to develop and implement a Hazardous Substances Spill Prevention and Cleanup Plan to address potential issues resulting from spills of hazardous substances during construction, operations or maintenance. The plan would be filed with the Commission after license issuance and would be implemented at the start of construction. The Hazardous Substances Spill Prevention and Cleanup Plan would:

    - Specify materials handling procedures and storage requirements and identify spill cleanup procedures for areas and processes in which spills may potentially occur.
    - Standardize operations procedures and employee training to minimize accidental pollutant releases, which could contaminate surface water, groundwater, or stormwater runoff.

- **Groundwater Protection Plan:**
    - LRPS proposes to develop and implement a Groundwater Protection Plan during the construction period to meet the requirements of 401 KAR 5:037. The Groundwater Protection Plan would be filed with the Commission after license issuance and would be implemented at the start of construction.

LRPS is also proposing to develop and implement an Erosion and Sediment Control Plan (as discussed in Section 5.8.3.2) to reduce potential downstream impacts to water quality.

5.2.4 References

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5.3 Fish and Aquatic Resources (18 CFR § 4.41 (f)(3))

5.3.1 Existing Environment

The Project Vicinity includes the reach of the Upper Cumberland River approximately 654 to 664 RM upstream of its confluence with the Ohio River, as well as Tom Fork, Dry Branch, and several unnamed tributaries to the Cumberland River. Aquatic habitat in the Upper Cumberland River consists mainly of riffles, runs, and pools, with cobble, boulder, and bedrock as dominant substrates (Kentucky DFWR 2024a). LRPS conducted habitat reconnaissance surveys of streams and wetlands in 2022 and 2024 (EcoSource 2024).

Stream features and habitat quality were documented throughout Tom Fork. Reaches of Tom Fork have been impacted by previous surface mining operations, with some areas covered by silt and sediment. Rocky substrates are generally partially embedded by fine sediment throughout the reach, and some streambank erosion is present (EcoSource 2024). LRPS completed additional habitat surveys in July 2024 during the Blackside Dace Habitat Assessment. During that study, researchers documented water quality and physical habitat at ten locations in the Tom Fork watershed (Appendix C). Physical habitat was documented using the USEPA's Rapid Bioassessment Protocol (Barbour et al. 1999). General habitat ratings scored "Fair" under USEPA Mountain Bioregion protocols when accounting for habitat parameters including riparian vegetation, bank stability, flow characteristics, and sedimentation. Habitat scores less than 117 are labeled "poor," and scores greater than 159 are labeled "good." Habitat scores at the ten sites documented during 2024 ranged from 118 to 140, with minimal instream cover (e.g., undercut banks) and areas with narrow bands of riparian vegetation. The stream gradient is higher in the upstream reaches of Tom Fork. DO levels remained above 7 mg/L throughout the Tom Fork watershed, and specific conductance was high (>580 µS/cm) across all sites.

A total of 59 fish species have been documented in the Upper Cumberland River Basin (Table 5-8). Fish sampling has not been conducted in the Project Vicinity, but electrofishing surveys conducted by the Kentucky DFWR in 2017 occurred in the Cumberland River approximately 35 river miles downstream of the proposed Lewis Ridge Project location. The survey targeted sportfish species, and 66 individual fish were documented over 1.5 hours of effort (Table 5-10). Shad, sucker, and minnow species were not netted or enumerated when observed. Overall catch per unit effort (CPUE) for gamefish species was 44 fish/hour. The most abundant species captured were channel catfish (*Ictalurus punctatus*), flathead catfish (*Pylodictis olivaris*), and spotted bass (*Micropterus punctulatus*) (Kentucky DFWR 2018). Due to its proximity to the proposed Lewis Ridge Project site and similar aquatic habitat characteristics throughout the Upper Cumberland River, the sportfish community in the Cumberland River within the Project Vicinity is expected to be relatively similar to the reach sampled by the Kentucky DFWR.

The Kentucky DFWR established a conservation and management plan to conserve and enhance existing native walleye (*Sander vitreus*) populations in Kentucky (Kentucky DFWR 2014). Between 2014 and 2022, Kentucky DFWR has stocked an average of approximately 26,000 2-3 inch fingerling native strain walleye per year, totaling over 200,000 individuals, in the Upper Cumberland River as part of these conservation and management efforts (Kentucky DFWR 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022) (Table 5-10).

Table 5-8: Fish Species Known to Occur in the Upper Cumberland River Basin

Family	Common Name	Scientific Name
Acipenseridae	lake sturgeon	*Acipenser fulvescens*
Atherinopsidae	brook silverside	*Labidesthes sicculus*
Catostomidae	white sucker	*Catostomus commersonii*
	northern hog sucker	*Hypentelium nigricans*
	black redhorse	*Moxostoma duquesnei*
	golden redhorse	*Moxostoma erythrurum*
Centrarchidae	rock bass	*Ambloplites rupestris*
	redbreast sunfish	*Lepomis auritus*
	green sunfish	*Lepomis cyanellus*
	warmouth	*Lepomis gulosus*
	bluegill	*Lepomis macrochirus*
	longear sunfish	*Lepomis megalotis*
	redear sunfish	*Lepomis microlophus*
	smallmouth bass	*Micropterus dolomieu*
	spotted bass	*Micropterus punctulatus*
	largemouth bass	*Micropterus salmoides*
	white crappie	*Pomoxis annularis*
Clupeidae	gizzard shad	*Dorosoma cepedianum*
Cottidae	banded sculpin	*Cottus carolinae*
Cyprinidae	central stoneroller	*Campostoma anomalum*
	blackside dace	*Chrosomus cumberlandensis*
	southern redbelly dace	*Chrosomus erythrogaster*
	whitetail shiner	*Cyprinella galactura*

Family	Common Name	Scientific Name
	spotfin shiner	*Cyprinella spiloptera*
	steelcolor shiner	*Cyprinella whipplei*
	flame chub	*Hemitremia flammea*
	striped shiner	*Luxilus chrysocephalus*
	warpaint shiner	*Luxilus coccogenis*
	scarlet shiner	*Lythrurus fasciolaris*
	river chub	*Nocomis micropogon*
	silverjaw minnow	*Notropis buccatus*
	highland shiner	*Notropis micropteryx*
	rosyface shiner	*Notropis rubellus*
	sawfin shiner	*Notropis sp.*
	mimic shiner	*Notropis volucellus*
	bluntnose minnow	*Pimephales notatus*
	fathead minnow	*Pimephales promelas*
	western blacknose dace	*Rhinichthys obtusus*
	creek chub	*Semotilus atromaculatus*
Ictaluridae	black bullhead	*Ameiurus melas*
	yellow bullhead	*Ameiurus natalis*
	channel catfish	*Ictalurus punctatus*
	brindled madtom	*Noturus miurus*
	flathead catfish	*Pylodictis olivaris*
Moronidae	white bass	*Morone chrysops*
Percidae	emerald darter	*Etheostoma baileyi*
	greenside darter	*Etheostoma blennioides*
	rainbow darter	*Etheostoma caeruleum*
	stripetail darter	*Etheostoma kennicotti*
	redline darter	*Etheostoma rufilineatum*
	arrow darter	*Etheostoma sagitta*
	snubnose darter	*Etheostoma simoterum*
	Cumberland darter	*Etheostoma susanae*
	logperch	*Percina caprodes*
	blackside darter	*Percina maculata*
	olive darter	*Percina squamata*
	walleye	*Sander vitreus*
Petromyzontidae	least brook lamprey	*Lampetra aepyptera*
Poeciliidae	western mosquitofish	*Gambusia affinis*

Source: Natureserve 2010, Kentucky DFWR 2018

Table 5-9: Fish Captured during 2017 Survey on the Upper Cumberland River at Barbourville, Kentucky

Common Name	Number Captured	CPUE (fish/hr)
smallmouth bass	3	2.0
spotted bass	11	7.3
bluegill	1	0.7
longear sunfish	4	2.7
redbreast sunfish	1	0.7
green sunfish	1	0.7
black crappie	1	0.7
walleye	6	4.0
channel catfish	27	18.0
flathead catfish	11	7.3
Total	**66**	**44.1**

Source: Kentucky DFWR 2018

Table 5-10: Walleye Stocking Rates in the Upper Cumberland River from 2014-2022

Year	Number Stocked	Approximate Length (inches)
2014	40,681	2.0
2015	40,360	1.8
2016	27,221	2.3
2017	27,182	2.3
2018	9,870	3.2
2019	23,852	2.3
2020	13,156	2.7
2021	27,283	2.4
2022	28,834	2.2
Total	**238,439**	**-**

Sources: Kentucky DFWR 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022

5.3.1.1 Temporal and Spatial Distribution of Aquatic Communities

Most seasonal movements of fish are associated with spawning activities, foraging, or changes in water temperature that prompt movements into available seasonal refugia. Although there are no diadromous fish species present in the Upper Cumberland River, some resident fish species may exhibit seasonal movements or migrations within the river to locate foraging or spawning habitat. Examples of such species include white sucker (*Catostomus commersonii*) and walleye (Jenkins and Burkhead 1993, Etnier and Starnes 1993).

Habitat in the Cumberland River near the Lewis Ridge Project is relatively homogenous (i.e., shallow flowing riffles runs over cobble, boulder, and bedrock) (Kentucky DFWR 2022). Accordingly, the fish assemblage is expected to consist of smaller individuals and lotic species that prefer those habitats, such as minnows, suckers, and darters. Further downstream of the Project Vicinity on the Cumberland River, as habitat becomes more diverse with deeper water and more abundant pools, a more diverse range of fish species and sizes are expected, including an increased prevalence of habitat generalist and more lentic species (Jenkins and Burkhead 1993).

Habitat surveys in Tom Fork conducted in 2024 documented a mix of riffle, run, and pool habitats, with the upstream reaches characterized by steeper gradients and fewer pools (Appendix C). Riffles and runs throughout Tom Fork were generally dominated by cobble and boulder substrates, and pools were generally dominated by finer sand and gravel substrates. Survey results indicate that the reach would not be suitable for blackside dace due to high specific conductance levels (581-895 µS/cm). Blackside dace has greater occupancy in streams with conductivities below 343 µS/cm (Hitt et al. 2016). Fish, possibly creek chub (*Semotilus atromaculatus*), were observed in the lower gradient downstream reaches. No fish were observed in the higher gradient upstream reaches. Instream habitat, including undercut banks and root wads, was generally minimal (Appendix C).

5.3.1.2 Rare, Threatened, and Endangered Aquatic Species

The USFWS Information for Planning and Conservation (IPaC) tool was reviewed for the Lewis Ridge Project Study Area on July 19, 2024. The IPaC did not identify any federal listed fish or aquatic species in the Lewis Ridge Project Study Area (USFWS 2024). Although the blackside dace was not identified in the IPaC report, the USFWS noted the blackside dace is a federally threatened species that may occur in the Lewis Ridge Project area.

A request was submitted to the Office of Kentucky Nature Preserves (OKNP) on June 20, 2024, to perform review of the Kentucky Biological Assessment Tool (KY-BAT) and obtain a Standard Occurrence Report. OKNP's Standard Occurrence Report did not identify any federal or state listed fish or aquatic species within the Lewis Ridge Project Study Area (Appendix D). OKNP's Standard Occurrence Report listed one federal and state listed fish species, and four state listed aquatic species with reported occurrences within the 5-mile buffer of the Lewis Ridge Project Study Area. Species specific information is being filed with FERC as a privileged document (Appendix D).

Blackside Dace

Blackside dace is a small minnow endemic to the upper Cumberland River drainage in southeastern Kentucky and northeastern Tennessee. The species has a pointed snout, a wide, black lateral stripe on its side, and an olive to gold colored back. Spawning males are brightly colored, with yellow dorsal fins and scarlet on the lower head, nape, and belly (NatureServe 2024). Blackside dace generally reach a maximum length of three inches and are found in small upland streams with cool water temperatures, moderate flows, and minimal silt. Higher blackside dace occupancy has been documented in streams with conductivity levels below 343 µS/cm (Hitt et al. 2016). Preferred habitat consists of streams with instream cover (e.g., submerged root wads, undercut banks, woody debris, and large rocks. The spawning period is April to July, with the greatest spawning activity occurring in May and June (Floyd 2016). The blackside dace has an approved recovery plan (USFWS 1988).

Results of the Blackside Dace Habitat Assessment completed in 2024 study suggest that Tom Fork and its tributaries are uninhabitable for blackside dace, with conductivity levels two or three times higher than the specific conductance level threshold associated with occupancy by the species. Stream gradient is also likely too high for the species throughout much of Tom Fork, and instream cover was minimal throughout much of the reach.

5.3.1.3 Invasive and Nonindigenous Fish and Aquatic Species

Nonindigenous aquatic species known to occur in the Upper Cumberland River Basin (HUC6 051301) are listed in Table 5-11. Nonindigenous aquatic species are defined as an aquatic species that has entered a body of water or aquatic ecosystem outside of its historic or native range. This can include fish species that are native to surrounding watersheds and have expanded their range. Invasive species are defined as nonnative species that compete with native species for resources, alter habitat, and impact biological diversity (Kentucky DFWR 2024b) Invasive carp species (bighead carp [*Hypophthalmichthys nobilis*], black carp [*Mylopharyngodon piceus*], grass carp [*Ctenopharyngodon Idella*], and silver carp [*Hypophthalmichthis molitrix*]) are known to occur in the Cumberland River (Kentucky DFWR 2023). The species have not been documented in the reach of the Cumberland River that includes the Project Vicinity but do occur further downstream in the Cumberland River system. Silver carp have been documented as far upstream as Cordell Hull dam, which is more than 300 river miles downstream of the Lewis Ridge Project (Tennessee WRA 2024).

Table 5-11: Nonindigenous Aquatic Species Known to Occur in the Upper Cumberland River Basin

Scientific Name	Common Name	Species Origin[1]	Native Habitat
Coelenterates-Hydrozoans			
Craspedacusta sowerbyi	freshwater jellyfish	Exotic	Freshwater
Crustaceans-Crayfish			
Cambarellus shufeldtii	cajun dwarf crayfish	Native	Freshwater
Cambarus cumberlandensis	Cumberland crayfish	Native	Freshwater
Faxonius rusticus	rusty crayfish	Native	Freshwater
Fishes			
Alosa chrysochloris	skipjack herring	Native	Freshwater-Marine
Alosa pseudoharengus	alewife	Native	Freshwater-Marine
Carassius auratus	goldfish	Exotic	Freshwater
Culaea inconstans	brook stickleback	Native	Freshwater
Cyprinus carpio	common carp	Exotic	Freshwater
Dorosoma cepedianum	gizzard shad	Native	Freshwater-Marine
Dorosoma petenense	threadfin shad	Native	Freshwater-Marine
Dorosoma petenense atchafalayae	Mississippi threadfin shad	Native	Freshwater
Esox masquinongy	muskellunge	Native	Freshwater
Fundulus catenatus	northern studfish	Native	Freshwater
Gambusia affinis	western mosquitofish	Native	Freshwater
Lepomis auritus	redbreast sunfish	Native	Freshwater
Lepomis gibbosus	pumpkinseed	Native	Freshwater
Lepomis gulosus	warmouth	Native	Freshwater
Lepomis microlophus	redear sunfish	Native	Freshwater
Lepomis miniatus	redspotted sunfish	Native	Freshwater
Micropterus coosae	redeye bass (sensu lato)	Native	Freshwater
Micropterus dolomieu	smallmouth bass	Native	Freshwater
Micropterus punctulatus	spotted bass	Native	Freshwater
Micropterus salmoides	largemouth bass	Native	Freshwater
Morone saxatilis	striped bass	Native	Freshwater-Marine
Moxostoma lachneri	greater jumprock	Native	Freshwater
Notemigonus crysoleucas	golden shiner	Native	Freshwater
Oncorhynchus clarkii	cutthroat trout	Native	Freshwater
Oncorhynchus kisutch	coho salmon	Native	Freshwater-Marine
Oncorhynchus mykiss	rainbow trout	Native	Freshwater-Marine
Perca flavescens	yellow perch	Native	Freshwater

Scientific Name	Common Name	Species Origin[1]	Native Habitat
Piaractus brachypomus	pirapitinga, red-bellied pacu	Exotic	Freshwater
Pimephales promelas	fathead minnow	Native	Freshwater
Pomoxis annularis	white crappie	Native	Freshwater
Pomoxis nigromaculatus	black crappie	Native	Freshwater
Rhinichthys atratulus	blacknose dace	Native	Freshwater
Salmo trutta	brown trout	Exotic	Freshwater
Salvelinus fontinalis	brook trout	Native	Freshwater
Salvelinus namaycush	lake trout	Native	Freshwater
Sander canadensis x vitreus	saugeye	Native Hybrid	Freshwater
Sander vitreus	walleye	Native	Freshwater
Tinca tinca	tench	Exotic	Freshwater
Mollusks-Bivalves			
Corbicula fluminea	basket clam	Exotic	Freshwater
Dreissena polymorpha	zebra mussel	Exotic	Freshwater
Plants			
Acorus calamus	single-vein sweetflag	Exotic	Freshwater
Alternanthera philoxeroides	alligatorweed	Exotic	Freshwater
Egeria densa	Brazilian waterweed	Exotic	Freshwater
Lythrum salicaria	purple loosestrife	Exotic	Freshwater
Murdannia keisak	marsh dewflower	Exotic	Freshwater
Myriophyllum aquaticum	parrot feather	Exotic	Freshwater
Myriophyllum spicatum	Eurasian watermilfoil	Exotic	Freshwater-Brackish
Najas minor	brittle waternymph	Exotic	Freshwater
Nasturtium officinale	water-cress	Exotic	Freshwater
Potamogeton crispus	curly-leaf pondweed	Exotic	Freshwater
Reptiles			
Alligator mississippiensis	American alligator	Native	Freshwater
Trachemys scripta troostii	Cumberland slider	Native	Freshwater

Source: USGS 2024

[1] Native = native to the United States; Exotic = not native to the United States; Native Hybrid = hybrid of two species native to the United States.

5.3.1.4 Benthic Macroinvertebrates and Freshwater Mussels

A distribution checklist of Kentucky mussels (Cicerello et al. 1991) described 11 mussel species within the Upper Cumberland River Basin upstream of Cumberland Falls (Table 5-12). Cumberland Falls is located on the Cumberland River, approximately 110 river miles downstream of the Lewis Ridge Project.

The Kentucky DEP Division of Water monitors physical, chemical, and biological elements of waterbodies to assess the quality of the aquatic environment of waterbodies across the state, and documents algal, macroinvertebrate, and fish community structure as indicators of waterbody health. Macroinvertebrate assemblages have proven to be useful in detecting even subtle changes in habitat and water quality. The Kentucky DEP Division of Water has developed a Macroinvertebrate Bioassessment Index (MBI) based on macroinvertebrate community attributes (Pond et al. 2003). The Lewis Ridge Project is located in the mountain ecoregion. Table 5-13 presents the top 15 macroinvertebrate genera collected from reference wadable streams in the mountain ecoregion (Pond et al. 2003).

Table 5-12: Mussel Species Known to Occur in the Upper Cumberland River Basin Upstream of Cumberland Falls

Scientific Name	Common Name
Alasmidonta atropurpurea	Cumberland elktoe
Alasmidonta marginata	elktoe
Alasmidonta viridis	slippershell mussel
Anodontoides ferussacianius	cylindrical papershell
Elliptio dilatate	spike
Lampsilis cardium	plain pocketbook
Lampsilis fasciola	wavy-rayed lampmussel
Lampsilis ovata	pocketbook
Ortmanniana pectorosa	pheasantshell
Strophitus undulatus	creeper
Toxolasma parvum	lilliput

Source: Cicerello et al. 1991

Table 5-13: Top 15 Genera Collected from Reference Wadable Streams in the Mountain Bioregion

Genus	Relative Abundance	Relative Frequency	Relative Importance
Coleoptera (beetles)			
Optioservus (2 spp.)	4.0	81.1	85.1
Psephenus herricki	3.2	59.5	62.6
Diptera (true flies)			
Atherix sp.	2.5	54.1	56.5
Polypedilum (4 spp.)	2.2	62.2	64.4
Ephemeroptera (mayflies)			
Acentrella (spp.)	1.1	51.4	52.5
Baetis (4 spp.)	2.6	67.6	70.2
Isonychia sp.	10.7	89.2	99.9
Stenonema (5 spp.)	9.3	97.3	106.6
Megaloptera (alderflies, dobsonflies, and fish flies)			
Nigronia (2 spp.)	3.5	75.7	79.2
Plecoptera (stoneflies)			
Acroneuria (3 spp.)	4.4	83.8	88.2
Leuctra sp.	2.4	62.2	64.6
Trichoptera (caddisflies)			
Ceratopsyche (3 spp.)	4.8	73.0	77.8
Cheumatopsyche sp.	7.5	91.9	99.4
Chimarra (2 spp.)	5.5	56.8	62.2
Hydropsyche (3 spp.)	1.7	43.2	44.9

Source: Pond et al. 2003

5.3.1.5 Essential Fish Habitat

There are no federal management plans for fish species that occupy the freshwater, inland regions of Kentucky and Tennessee, and there is no designated EFH near the proposed Lewis Ridge Project.

5.3.2 Potential Impacts of the Proposed Lewis Ridge Project

Flow diversions and filling of the lower reservoir have the potential to impact aquatic habitat in Tom Fork. These impacts are expected to occur in areas that currently exhibit effects of past mining operations. The Lewis Ridge Project would cause temporary and permanent impacts to fish and aquatic resources in Tom Fork. The proposed lower reservoir is located within a valley that contains Tom Fork, a tributary to the Cumberland River. It is anticipated that the source of the initial fill water would be natural inflows from Tom Fork and potentially pumping water from the Cumberland River and/or pumping groundwater from wells that would be installed adjacent to the lower reservoir site. It is assumed that the initial fill would be completed over a period of 1 year.

The diversion of Tom Fork during lower reservoir construction, initial fill, and for recharge would be expected to reduce the overall quality of aquatic habitat in the reach. However, fish habitat studies conducted during 2024, with an emphasis on blackside dace, documented a limited amount of suitable habitat throughout much of the reach under current conditions. For example, conditions in Tom Fork are not suitable for intolerant species like blackside dace, and fish (likely a tolerant species) were only observed in the most downstream low-gradient reaches. Fish were not observed in the reach of Tom Fork that will include the lower reservoir site, and habitat suitability for fish is low in this reach. There is potential for fish to become entrained at the lower reservoir intake or impinged on the intake bar racks. However, given the low habitat suitability for fish species in Tom Fork, particularly in the reach that includes the lower reservoir site, the extent of potential entrainment is minimal, as the reach does not support diverse aquatic communities. Habitat changes associated with development of the HAC-lined lower reservoir are not expected to notably increase the currently minimal fish abundance and diversity at the site. Due to existing habitat conditions including high specific conductance levels, minimal instream cover, low summertime flow rates, and high gradients in upstream reaches, Tom Fork currently does not provide conditions to support a robust or diverse aquatic community of fish, invertebrates, or freshwater mussels; therefore, impacts from the proposed Lewis Ridge Project are expected to be minimal.

The interconnection line would cross the Cumberland River, Dry Branch, and unnamed tributaries in single spans, with no anticipated impacts to aquatic habitat or aquatic species.

5.3.3 Agency Consultation and Applicant Recommendations

5.3.3.1 Agency Consultation

Documentation of consultation is provided in Appendix A. Consultation specific to fish and aquatic resources is summarized below.

On February 9, 2022, USFWS submitted preliminary comments in response to FERC's December 16, 2021, notice of Preliminary Permit Application to assist FERC and LRPS in assessing the potential environmental impacts of construction and operation of the proposed project. USFWS noted the blackside dace as a federally listed (threatened) species having the potential to occur in the Lewis Ridge Project area. In addition, USFWS recommended evaluating the following related to fish and aquatic resources:

- Potential impacts of the project to aquatic resources as a result of water withdrawal from the Cumberland River.
- Potential impacts to aquatic species that could result from construction activities.
- Potential impacts to fish related recreational activities.
- Potential impacts to existing or proposed fishing access facilities such as parking lots, walkways, and riprap structures.
- Potential impacts to fish resources resulting from interconnection corridor alignment and the project's footprint.
- Potential entrainment of aquatic species if the source water for the project is from surface water.

LRPS initiated consultation in July and August 2022 with resource agencies and stakeholders. On August 26, 2022, The National Oceanic and Atmospheric Administration (NOAA) confirmed that the Lewis Ridge Project was not near any habitats where National Marine Fisheries Service (NMFS) ESA-listed species may be present. LRPS conducted a meeting with the USFWS on September 9th, 2022, during which USFWS identified blackside dace and Cumberland arrow darter as fish and aquatic species of interest.

On November 23, 2022, USEPA commented on the NOI and PAD providing recommendations and considerations for FERC to include in its draft NEPA document. USEPA recommended extended studies on fish and aquatic species habitat to include the Cumberland River, as well as Tom Fork. In addition, USEPA requested the scope of the study be expanded beyond water quality and aquatic habitat data to include sampling and analysis of the fish, mussel, and macroinvertebrate communities in Tom Fork and the Cumberland River.

LRPS held a Joint Agency and Public Meeting on January 25, 2023 at which existing fish and aquatic information from the PAD were presented. USFWS confirmed that although the blackside dace was not listed on the Lewis Ridge Project IPaC, the species is federally listed and should be considered. USFWS confirmed the Cumberland arrow darter does not have federal protection.

LRPS distributed a Draft Study Plan on June 13, 2024. The Draft Study Plan included one study related to fish and aquatic resources: the Blackside Dace Habitat Evaluation. LRPS did not receive any comments specific to the Blackside Dace Habitat Evaluation study plan. LRPS filed the Revised Study Plan with FERC on August 16, 2024.

The Kentucky DEP submitted comments on April 6, 2023 (following the Joint Agency and Public Meeting) and on July 9, 2024 (following the distribution of the Draft Study Plan). In their comments, the Kentucky DEP requested review of the OKNP’s KY-BAT to obtain a standard occurrence report for sensitive species within the Lewis Ridge Project area. LRPS obtained a standard occurrence report from OKNP on June 20, 2024 (OKNP 2024) and results are summarized in applicable sections of this Exhibit E and provided in Appendix D.

On July 19, 2024, USFWS provided an official species list for the Lewis Ridge Project identifying threatened, endangered, proposed, and candidate species that may occur in the Study Area of the Lewis Ridge Project. Results are summarized in applicable sections of this Exhibit E and provided in Appendix A.

5.3.3.2 Applicant Recommendations

LRPS proposes to implement the following PM&E measures to minimize impacts on fish and aquatic resources:

- **Fish Exclusion Measures:**
  - LRPS proposes to install and maintain fish exclusion bar racks at the lower reservoir inlet/outlet to minimize fish entrainment.
  - LRPS proposes to install fish screens with appropriately sized mesh on water pumps to minimize the intake of larval and juvenile fish.

LRPS is proposing to develop and implement an Erosion and Sediment Control Plan (as discussed in Section 5.8.3.2) to reduce potential downstream impacts. LRPS is also proposing to develop and implement a Vegetation Management Plan (further discussed in Section 5.5.3.2) with measures to enhance riparian habitat disturbed during the construction process.

5.3.4 References

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5.4 Wildlife Resources (18 CFR § 4.41 (f)(3))

5.4.1 Existing Environment

Major wildlife species in the Cumberland Plateau MLRA area include white-tailed deer (*Odocoileus virginianus*), elk (*Cervus canadensis*), red fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), cottontail (*Sylvilagus nuttallii*), muskrat (*Ondatra zibethicus*), gray squirrel (*Sciurus carolinensis*), fox squirrel (*Sciurus niger*), mink (*Mustela lutreola*), ruffed grouse (*Bonasa umbellus*), woodcock (*Scolopax minor*), bobwhite quail (*Colinus virginianus*), and mourning dove (*Zenaida macroura*) (NRCS 2022).

According to the Kentucky DFWR, wildlife with known occurrences within Bell County includes 180 birds, 47 mammals, 30 reptiles, 9 insects, and 33 amphibians. Similar to vegetative communities, wildlife occurrence and distribution varies by habitat, local aspect, and elevation. Reptile species occurring within Bell County include various turtles, snakes, skinks, and lizards. Amphibians include a variety of frogs, toads, and salamanders. Mammal species within Bell County include small mammals such as shrews (*Sorex* spp.), voles (*Microtus* spp.), mice (*Mus* spp.), rabbits and bats; medium mammals such as red fox, gray fox (*Urocyon cinereoargenteus*), river otter (*Lontra canadensis*), and beaver (*Castor canadensis*); and large mammals such as black bear (*Ursus americanus*), white-tailed deer, and elk. (Kentucky DWFR 2014).

Bell County is within the Kentucky Elk Restoration Zone, which encompasses 16 counties in the Cumberland Plateau physiographic ecoregion (Kentucky DFWR 2015). Initial research following the elk reintroduction in Kentucky demonstrated that elk favored the food resources on recently established grassland at mine sites and used the adjacent forests for cover and refuge (Kentucky DFWR 2015). However, forage quality of established grassland generally degrades over time as the newly planted wheat, rye, and clover transition to less-nutritious, competitive, or invasive species (Kentucky DFWR 2015).

Cumberland Gap National Historic Park is located approximately 10 miles from the proposed Lewis Ridge Project site and extends from 1,000 to 3,500 feet above sea level across diverse habitat types. The park currently has 371 species documented (33 mammals, 89 birds, 29 amphibians, 15 reptiles, 27 fish, and 178 insects). Visitors of the park could expect to see cottontail, gray squirrel, opossum (*Didelphis virginiana*), striped skunk (*Mephitis mephitis*), bobcat (*Lynx rufus*), white-tailed deer, raccoon, gray fox, black bear, various bats, songbirds, wild turkey (*Meleagris gallopavo*), hawks and vultures, snakes, turtles, and, less commonly, elk (NPS 2024).

Boone's Ridge is an identified eBird hotspot[16] and is located approximately 2 miles west of the Lewis Ridge Project Study Area. Over 150 species have been reported at this location since 2018 (eBird 2024). Table 5-14 provides the 47 bird species observed at Boone's Ridge from January to August 2024.

Table 5-14: Bird Species Observed at Boone's Ridge in 2024

Scientific Name	Common Name	Count
Ammodramus savannarum	grasshopper sparrow	7
Archilochus colubris	ruby-throated hummingbird	4
Asio flammeus	short-eared owl	1
Baeolophus bicolor	tufted titmouse	1
Buteo jamaicensis	red-tailed hawk	1
Buteo lineatus	red-shouldered hawk	1
Butorides virescens	green heron	1
Cardino/is cardinalis	northern cardinal	2
Cathartes aura	turkey vulture	1
Charadrius vociferus	killdeer	23
Circus hudsonius	northern harrier	3
Colinus virginianus	northern bobwhite	2
Corvus brachyrhynchos	American crow	6
Dryobates pubescens	downy woodpecker	1
Empidonax virescens	acadian flycatcher	2
Falco sparverius	American kestrel	1
Geothlypis trichas	common yellowthroat	4
Hirundo rustica	barn swallow	72
Hylocichla mustelina	wood thrush	2
Icteria virens	yellow-breasted chat	8

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[16] Hotspots are public birding locations created by eBird users and allow multiple birders to enter data into the same shared location.

Scientific Name	Common Name	Count
Melospiza melodia	song sparrow	7
Mniotilta varia	black-and-white warbler	2
Passerino cyanea	indigo bunting	70
Petrochelidon pyrrhonota	cliff swallow	1
Pipilo erythrophthalmus	eastern towhee	2
Piranga olivacea	scarlet tanager	2
Polioptila caerulea	blue-gray gnatcatcher	1
Sayornis phoebe	eastern phoebe	2
Scolopax minor	American woodcock	2
Seiurus aurocapilla	ovenbird	4
Setophaga americana	northern paruta	3
Setophaga citrina	hooded warbler	1
Setophaga discolor	prairie warbler	2
Setophaga dominica	yellow-throated warbler	5
Setophaga ruticil/a	American redstart	3
Setophaga virens	black-throated green warbler	2
Sialia sialis	eastern bluebird	1
Spinus tristis	American goldfinch	1
Spizella pusilla	field sparrow	2
Stelgidopteryx serripennis	northern rough-winged swallow	1
Tachycineta bicolor	tree swallow	40
Thryothorus ludovicianus	carolina wren	2
Tringa solitaria	solitary sandpiper	2
Vireo flavifrons	yellow-throated vireo	2
Vireo griseus	white-eyed vireo	4
Vireo olivaceus	red-eyed vireo	4
Zenaida macroura	mourning dove	120

Source: eBird 2024

5.4.1.1 Rare, Threatened, and Endangered Wildlife Resources

The OKNP KY-BAT and USFWS's IPaC tool were reviewed to identify rare, threatened, and endangered wildlife resources potentially occurring in the Project Vicinity. A request was submitted to OKNP on June 20, 2024 to review the KY-BAT and obtain a Standard Occurrence Report. OKNP's Standard Occurrence Report identified three sensitive wildlife species as having reported occurrences that intersected the Lewis Ridge Project Study Area: one insect with a reported occurrence in 1938 and two bat species each with a reported occurrence from 2007. OKNP's Standard Occurrence Report listed six bat species, two insect species, and one bird species with reported occurrences within the 5-mile buffer of the Lewis Ridge Project Study Area. Species specific information is being filed with FERC as a privileged document (Appendix D).

The USFWS IPaC tool was reviewed for the Lewis Ridge Project Study Area on July 19, 2024 (Project Code 2024-0118847). The IPaC identified six wildlife threatened, endangered, candidate, or experimental population species potentially occurring in the Lewis Ridge Project Study Area (Table 5-15). There is no designated Critical Habitat for any species within the Lewis Ridge Project Study Area.

Table 5-15: Potentially Occurring Federal Listed, Proposed, and Candidate Wildlife Species in the Study Area

Common Name	Scientific Name	Status	Critical Habitat
Mammals			
gray bat	*Myotis grisescens*	Endangered	None designated
Indiana bat	*Myotis sodalist*	Endangered	Study area does not overlap with final designated critical habitat
northern long-eared bat	*Myotis septentrionalis*	Endangered	None designated
tricolored bat	*Perimyotis subflavus*	Proposed Endangered	None designated
Birds			
whooping crane	*Grus americana*	Experimental Population, Non-essential[17]	None designated
Insects			
monarch butterfly	*Danaus plexippus*	Candidate	None designated

Source: USFWS 2024a

In 2024, LRPS conducted a bat survey (Listed Bat Presence/Probable Absence Survey for the Proposed Lewis Ridge Pumped Storage Facility Project, Bell County, KY) during the summer maternity season to determine if federally endangered bats are present within the Study Area (Appendix E). The study methodology included a mist net survey to determine the presence/probable absence of federally endangered bat species during the summer maternity season and conducting radio telemetry on up to two individuals of Indiana bat, northern long-eared bat, and tricolored bats that were captured per site (if encountered). Mist-netting occurred during the maternal roosting season in accordance with the USFWS 2024 Range-wide Indiana Bat and Northern Long-Eared Bat Survey

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[17] A population that has been established within its historical range under section 10(j) of the ESA to aid recovery of the species. The USFWS has determined a non-essential population is not necessary for the continued existence of the species. For the purposes of consultation, non-essential experimental populations are treated as threatened species on National Wildlife Refuge and National Park land (require consultation under 7(a)(2) of the ESA) and as a proposed species on private land (no Section 7(a)(2) requirements, but Federal agencies must not jeopardize their existence (section 7(a)(4))) (USFWS 2024b).

Guidelines following the level of effort recommended for detection of Indiana, northern long-eared, and tricolored bats: 10 net nights per 123 acres of suitable habitat for nonlinear projects. Forty net nights were conducted across the Lewis Ridge Project Study Area, meeting the minimum level of effort outlined in the guidelines for detection of Indiana, northern-long-eared, and tricolored bats. Surveys were completed within the first 5 hours following sunset from the 29th to 30th of July and from the 5th to 8th of August 2024. Individual mist net sites encompassed a variety of suitable bat habitat. In total, 22 individual bats of 5 species were captured: 11 big brown bats (*Eptesicus fuscus*), 7 red bats *(Lasiurus borealis*), 2 small-footed bats (*Myotis lebelii*), 1 gray bat, and 1 adult male tricolored bat that was too small to radio-tag (Appendix E, filed as privileged).

Gray Bat

The gray bat is a highly colonial species in eastern North America distinguished from other species of the genus *Myotis* by its larger size and the uniformly gray fur on its back. The primary range of the species is centered in the cave regions of Alabama, Missouri, Arkansas, Kentucky, and Tennessee, with smaller populations found in adjacent states (USFWS 2009, Ozier et al. 2020). Gray bats inhabit caves year-round, occupying cold hibernating caves or mines in winter and dispersing to warmer maternity and bachelor caves during summer. Mating occurs in the fall prior to hibernation, and females deliver a single pup after arriving at the maternity cave in late May or early June. The summer caves are almost always near a river or reservoir, where gray bats feed on night-flying aquatic and terrestrial insects. Most foraging occurs over open water near a forested shoreline, and bats forage up to 12 miles or more from roost sites. A primary threat to the gray bat is anthropogenic disturbance to their caves. Infection of gray bats by the fungus causing white-nose syndrome, a disease that infects the skin of hibernating bats and has devastated populations of other bat species, is also a possible threat. (Ozier et al. 2020). The gray bat has an approved recovery plan from 1982 (USFWS 1982). One gray bat was captured during the 2024 bat survey (Listed Bat Presence/Probable Absence Survey; Appendix E). Capture of the adult reproductive gray bat confirmed presence during the summer maternity season within the Study Area. Gray bats do not roost in trees during the summer, and therefore, radio telemetry was not performed as it is almost impossible to track them during the day to find their underground roost. The presence of gray bats on the property indicates they forage there, but forested acreage removal associated with the Lewis Ridge Project would not impact their roosting habitat. (Copperhead 2024).

Indiana Bat

The Indiana bat is a nocturnal insectivore, emerging from roosts shortly after sunset, and feeding almost exclusively on flying insects, but will consume terrestrial prey on occasion (USFWS 2007). Summer roost habitats are underneath exfoliating bark in mature trees that receive direct sunlight for more than half a day. Foraging typically occurs in semi-open to closed forested habitats with an open understory, forested edges, or riparian or wetland areas. During the winter, Indiana bats are restricted to suitable underground hibernacula. Hibernacula are predominantly caves but can include other cave-like structures such as mines and shafts. Typical hibernacula provide variable vertical relief and a range of temperatures and microclimates during the winter months (USFWS 2007). Threats to Indiana bat include human disturbance of hibernating bats, loss of summer habitat, pesticides and other contaminants, and white-nose syndrome (USFWS 2022). The Indiana bat has a draft recovery plan from 2007 (USFWS 2007).

In association with the mining facility’s permitting process, mist netting, acoustic monitoring, and habitat assessments were performed for the Indiana bat near the lower reservoir location in 2010. The report concluded that the Indiana bats were not using the then proposed permit area as summer roost or forage habitat and no portals were located that would provide potential winter habitat to bats (Biological Systems 2010). No Indiana bats were captured during the 2024 bat survey (Listed Bat Presence/Probable Absence Survey; Appendix E) indicating the species is not likely present within the Lewis Ridge Project Study Area during the maternity season or is present in numbers too low to be detected by approved USFWS protocols (Copperhead 2024).

Northern Long-eared Bat

The northern long-eared bat, distinguished from other species of *Myotis* by its long ears, is a wide-ranging species found in a variety of forested habitats in summer and hibernates in caves in winter (USFWS 2016). The species is found across eastern and north-central U.S. and southern Canada and is generally associated with old-growth forests (NatureServe 2021). Northern long-eared bats overwinter in hibernacula that include caves and abandoned mines (USFWS 2016). Rarely are there more than 100 individuals per hibernation colony (NatureServe 2021). Mating occurs in late summer or fall prior to hibernation, and each female delivers a single pup in June or early July. In summer, the bats generally are colonial but tend to be more solitary than other *Myotis* species, often roosting alone in deep cracks and crevices, under bark, or in hollows of live and dead trees. Foraging occurs within forests, along forest edges and clearings, and occasionally over ponds. Principal threats to the species include human disturbance of hibernating bats and mortality due to white-nose syndrome (USFWS 2016). No northern long-eared bats were captured during the 2024 bat survey (Listed Bat Presence/Probable Absence Survey; Appendix E) indicating the species is not likely present within the Lewis Ridge Project Study Area during the maternity season or is present in numbers too low to be detected by approved USFWS protocols (Copperhead 2024).

Tricolored Bat

The tricolored bat is found throughout the forests of the eastern United States, Canada and Mexico, and as far west as Minnesota and Texas (USFWS 2024c). The tricolored bat is found in Kentucky in the summer and during migration (Kentucky DFWR 2024). Tricolored bat maternity colonies are small, forming in hollow trees, buildings, and caves during the summer. Males are likely solitary, roosting in trees, crevices, caves, and mines (Kentucky DFWR 2024). Tricolored bats most frequently hibernate in caves, but also utilize mines, rock shelters, and quarries near the summer roosts (Kentucky DFWR 2024). White-nose syndrome continues to be the primary threat to this bat species within Kentucky. Aside from stopping the spread of white-nose syndrome, destruction of roost sites due to deforestation and disturbances to hibernacula and maternity colonies are other potential threats to the species (USFWS 2024c). One adult male tricolored bat was captured during the 2024 bat survey (Listed Bat Presence/Probable Absence Survey; Appendix E). Capture of the adult male tricolored bat confirmed presence during the summer maternity season within the Study Area. The capture of an adult male tricolored bat may limit clearing of forested habitat to occurring outside of the pup-rearing season. (Copperhead 2024). LRPS will consult with the USFWS Kentucky Field Office to confirm tree clearing limitations.

Whooping Crane

The whooping crane (*Grus americana*) occurs within Canada and the United States. The whooping crane breeds, migrates, winters, and forages in a variety of habitat, including coastal marshes and estuaries, inland marshes, lakes, open ponds, shallow bays, salt marsh, upland swales, wet meadows and rivers, and pastures/agricultural fields. The species has experienced population declines and strict legal protection, habitat preservation, captive breeding, and international cooperation between Canada and the

United States have helped promote recovery of the species (USFWS 2024d). Four populations of whooping cranes currently exist in the wild, with the Aransas-Wood Buffalo population as the only self-sustaining remnant of the original migratory population. Three additional distinct populations (Florida (non-migratory), Eastern Migratory, and Louisiana (non-migratory) populations) have been introduced within the United States and are considered experimental and nonessential to the whooping crane population as designated by the ESA (CCS 2019). The Eastern Migratory population was created and intended to breed in central Wisconsin and winter between the central Gulf Coast of Florida and southeastern United States (CCS 2019). The current estimated population size of the Eastern Migratory population is 72, with 15 individuals being wild-hatched and the remaining captive-reared. In February 2024, most birds stayed at their typical wintering grounds, but some had begun their northward migration with warmer temperatures. As of March 1, 2024, 3 individuals were in Wisconsin, 4 in Illinois, 28 in Indiana, 8 in Kentucky, 14 in Alabama, and 2 in Georgia (the remaining birds' locations had not been confirmed). (ICF 2024). While the migratory population numbers are low, it is possible a whooping crane may fly through the Project Vicinity during migration.

Monarch Butterfly

Monarch butterfly is a candidate species not yet proposed for listing under the Endangered Species Act of 1973 (USFWS 2020). The species is a large and conspicuous butterfly that exhibits long-distance migration and overwinters as adults at forested locations in Mexico and California. Adult monarch butterflies feed on nectar from a wide variety of flowers. Reproduction is dependent on the presence of milkweed (*Asclepias* spp.), the sole food source for larvae. Larvae develop and feed on the milkweed plant, sequestering chemicals as a defense against predators. Adults live up to six to nine months, and multiple generations are produced over the course of the breeding season. Monarch butterflies occur across the continental U.S., but populations have been declining over the past 20 years. Primary threats to the species include the loss and degradation of habitat from conversion of grasslands to agriculture, widespread use of herbicides, exposure to insecticides, land-clearing activities in overwintering sites, urban development, and general loss of milkweed and nectar sources across the species' range from various land development activities (USFWS 2020). Milkweed is known to occur in Bell County, Kentucky and may be present within grassland habitat in the Project Vicinity.

Given the widespread distribution of milkweed plants and Monarch butterfly, the Lewis Ridge Project Study Area may provide suitable habitat for this species.

5.4.1.2 Invasive Wildlife Species

Wild pigs (*Sus scrofa*) are a non-native invasive species known to Kentucky and have the potential to occur in the Project Vicinity. Wild pigs in Kentucky are the result of released domestic pigs and hybrids of domestic and Eurasian boar. They are highly adaptable to a variety of habitats and have a high reproductive potential, making population control difficult. In favorable habitat conditions, sows can breed as young as five to ten months old and are capable of producing litters of three to eight piglets twice a year. (Kentucky DFWR 2022).

Mute swans (*Cygnus olor*) are a non-native, bird species in Kentucky that was introduced to the United States to decorate lakes and ponds often in parks and zoos. They are known to be aggressive to other bird species, reduce availability of resources needed for other waterfowl, and cause damage by trampling nests of other bird species (USFWS 2018; Kentucky DFWR 2008). European starlings (*Sturnus vulgaris*) were also introduced in Kentucky and threaten native bird species that nest in cavities. European starlings are known to cause crop damage and are considered a nuisance bird in Kentucky nearly year around because of large flock size (Kentucky DFWR 2008).

Several invasive insect species have been reported in Kentucky including the kudzu bug (*Megacopta cribraria*), spongy moth (Lymantria dispar), imported fire ant (*Solenopsis invicta*), Asian longhorned tick (*Haemaphysalis longicornis)*, spotted lanternfly (*Lycorma delicatula*), and emerald ash borer (*Agrilus planipennis*) (Giffin 2023). Kudzu bug was first found in Bell, Christian, Laurel, Perry, and Whitley counties of Kentucky in 2015 and is a significant pest of soybean and other legume crops in the southeast (University of Kentucky 2024a). Since its discovery in 2009, the emerald ash borer has spread dramatically throughout Kentucky, and infestations have been found in Bell County, Kentucky (University of Kentucky 2024b). Emerald ash borers kill ash trees within three to five years after they become infested. Spread is caused by short-range dispersal flights of the insect and long-distance transport of infested wood, primarily firewood. (University of Kentucky 2024b).

5.4.1.3 Migratory Birds and the Bald and Golden Eagle Protection Act

Certain birds are protected under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. One migratory bird listed by the USFWS as a Bird of Conservation Concern (BCC), the wood thrush (*Hylocichla mustelina*), potentially occurs in the area associated with the Lewis Ridge Project Study Area. The wood thrush is designated as a BCC throughout its range in the continental United States and Alaska, and breeds between May 10 and August 31. The wood thrush inhabits forested areas, particularly those dominated by deciduous trees (USFWS 2024e).

The bald eagle (*Haliaeetus leucocephalus*) and golden eagle (*Aquila chrysaetos*) are protected under the Bald and Golden Eagle Protection Act and Migratory Bird Treaty Act. The IPaC report noted no documented cases of bald or golden eagles being present in the Study Area. The KDFWR conducted aerial and ground surveys of all known eagle nests, statewide from 1986 to 2019 (Kentucky DFWR 2023). Bell County, Kentucky did not have any known eagle nests during 2000-2023 (Kentucky DFWR 2023).

5.4.2 Potential Impacts of the Proposed Lewis Ridge Project

The Lewis Ridge Project features would primarily be located within areas previously disturbed for mining activities, with the exception of a portion of the interconnection line. A portion of the interconnection line would run along existing roads, thus minimizing disturbance and vegetation clearing of the area and any associated effects on wildlife. Another portion of the interconnection line would cross the Pine Mountain ridge in an area which hasn’t been disturbed and vegetation clearing would be required. This vegetation clearing would result in the alteration of habitat for the segment of the interconnection line corridor, and potentially displace wildlife. The wildlife resources in the region are well understood and it is expected that common terrestrial wildlife inhabit or use the Project Vicinity, including small and large mammals, birds, reptiles, and amphibians. The proposed penstock would not impede wildlife passage as it would be trenched into the ground and backfilled with soil above the top of the penstock, allowing wildlife to cross freely.

The Lewis Ridge Project is not anticipated to impact any caves (or associated wildlife in caves) within the Study Area.[18] Based on negative results of the mist-net survey for Indiana and northern long-eared bats, the Project may affect but is not likely to adversely affect summer populations of listed bat species. The capture of a tricolored bat, which are proposed for listing, indicates that the Lewis Ridge Project may affect summer populations of the species but is not likely to jeopardize the survival of the species. The capture of a gray bat indicates that the Lewis Ridge Project may affect but is not likely to adversely affect the species. In addition, there are no anticipated impacts to wildlife-related recreational activities as recreation is not permitted on the private property with active and reclaimed mining operations; due to the industrial nature of this land, public access is restricted for public safety.

The Lewis Ridge Project has the potential to impact terrestrial wildlife temporarily and permanently within the limits of disturbance during and after construction due to increased noise and human presence. In addition, the Lewis Ridge Project would permanently alter the habitat within the construction footprint, as approximately 88 acres of land would be inundated for the development of the upper and lower reservoirs, which would result in the permanent displacement of terrestrial wildlife habitat.

5.4.3 Agency Consultation and Applicant Recommendations

5.4.3.1 Agency Consultation

Documentation of consultation is provided in Appendix A. Consultation specific to wildlife resources is summarized below.

On February 9, 2022, USFWS submitted preliminary comments in response to FERC's December 16, 2021 notice of Preliminary Permit Application to assist FERC and LRPS in assessing the potential environmental impacts of construction and operation of the proposed project. USFWS's comments included PM&E measure recommendations. In addition, USFWS recommended evaluating the following related to wildlife resources:

- Potential impacts to wildlife related recreational activities.

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[18] LRPS submitted a data request to the Kentucky Speleological Survey (KSS) on August 1, 2024 to determine the presence of any caves within the Study Area. Search of the KSS database did not identify any cave locations within the Study Area.

- Potential impacts to wildlife resources resulting from interconnection corridor alignment and the Lewis Ridge Project's footprint.
- Potential effects of alkaline water conditions within reservoirs on waterfowl.

LRPS conducted a meeting with the USFWS on September 9th, 2022 at which USFWS identified the following wildlife species of interest: federally listed bats, yellow-spotted salamander (not currently listed under the ESA), and monarch butterfly (candidate for listing under ESA). USFWS requested LRPS to determine if the Lewis Ridge Project would impact any caves, and recommended LRPS to either conduct a bat survey or assume presence of protected bats at the Lewis Ridge Project.

On November 23, 2022, USEPA commented on the NOI and PAD providing recommendations and considerations for FERC to include in its draft NEPA document. USEPA recommended inclusion of plans to provide passages for local wildlife that may be affected by the proposed steel penstock, if the penstock structure would be attached/flushed to the ground instead of buried. As currently proposed, the penstock would be located below the surface and would not impede wildlife passage.

LRPS distributed a Draft Study Plan on June 13, 2024. The Draft Study Plan included one study related to wildlife resources, the bat survey. LRPS did not receive any comments specific to the bat survey study plan. LRPS filed the Revised Study Plan with FERC on August 16, 2024.

The Kentucky DEP submitted comments on April 6, 2023 (following the Joint Agency and Public Meeting) and on July 9, 2024 (following the distribution of the Draft Study Plan). In the comments, the Kentucky DEP requested review of the OKNP's KY-BAT to obtain a standard occurrence report for sensitive species within the Lewis Ridge Project area. LRPS obtained a standard occurrence report from OKNP on June 20, 2024, and results are summarized in applicable sections of this Exhibit E and provided in Appendix D.

USFWS provided an official species list for the Lewis Ridge Project on July 19, 2024, identifying threatened, endangered, proposed, and candidate species that may occur in the Study Area of the Lewis Ridge Project. Results are summarized in applicable sections of this Exhibit E and provided in Appendix D.

5.4.3.2 Applicant Recommendations

LRPS proposes to implement the following PM&E measures to minimize impacts on wildlife resources:

- LRPS will consult with USFWS to identify construction windows that provide for bat and wildlife protection as well as feasible construction timelines for completing the project. This would include developing manageable timing and scheduling restrictions that can accommodate the construction schedule.
- Where practicable, construction activities, infrastructure, and man-made structures (e.g., roads, parking lots, staging areas) would be concentrated on lands already altered. Implementation of this recommendation by the USFWS would conserve area-sensitive species and minimize habitat fragmentation.
- Revegetation of disturbed areas with native plant species would include species of nectar-producing plants and milkweed endemic to the area to benefit pollinator habitat. Implementation of this recommendation by the USFWS would assist in efforts underway to restore pollinator habitat with the intent to increase pollinator populations.
- Install a chain link fence around the lower reservoir to deter wildlife. Fencing would be marked with vinyl strips and/or reflective tape to reduce avian collision risks. Fencing around the upper reservoir would not be required as dam height and composition would deter terrestrial wildlife.
- If recommended, install flight diverters on the interconnection line to reduce avian collision.

5.4.4 References

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5.5 Botanical Resources (18 CFR § 4.41 (f)(3))

5.5.1 Existing Environment

The Lewis Ridge Project is located in the Cumberland Mountain Thrust Block (Level IV ecoregion 69e) within the Central Appalachians ecoregion (Level III ecoregion 69), which consists primarily of forested high, steep ridges, hills, coves, narrow valleys, and the Pine Mountain Overthrust Fault (Woods et al. 2002). In general, maximum elevations are greater in this ecoregion than elsewhere in Kentucky. Forest composition is highly variable, and is influenced by local aspect, slope position and gradient, topographic shading, soil moisture, and past land usage (Woods et al. 2002).

In general, the ecoregion was formerly dominated by American chestnut (*Castanea dentata*) on drier sites. Following logging and the disappearance of American chestnut in the mid-twentieth century, second- or third-growth forests typically contain white oak (*Quercus alba*), black oak (*Quercus velutina*), sugar maple (*Acer saccharum*), red maple (*Acer rubrum*), yellow poplar (*Liriodendron tulipifera*), black walnut (*Juglans nigra*), black locust (*Robinia pseudoacacia*), hickory (*Carya spp.*), white ash (*Fraxinus americana*), American beech (*Fagus grandifolia*), black cherry (*Prunus serotina*), buckeye (*Aesculus spp*), Eastern hemlock (*Tsuga canadensis*), and American basswood (*Tilia americana*) (Woods et al. 2002). Forests are mixed on mesic sites, dominated by American beech, yellow poplar, sugar maple, and white oak, with co-dominants of ash, black walnut, buckeye, basswood, northern red oak (*Quercus rubra*), and others. On drier sites, white oak and hickories dominate the landscape. Pines (*Pinus spp.*) tend to dominate areas with shallow, sandy soils on steep-dipping sandstone. Species composition within shady gorges features eastern hemlock and various magnolias (*Magnolia spp.*) with an understory of rhododendrons (*Rhododendron spp.*) (Woods et al. 2002).

Conversely, areas heavily impacted by anthropogenic disturbances, such as mining, are often dominated by invasive shrubs, forbs, grasses, and early-successional tree species (Kentucky EEC 2022). Invasive species are discussed in Section 5.5.1.2. Common forbs on previously disturbed sites include narrow-leaf pinweed (*Lechea tenuifolia*), Ozark tickseed sunflower (*bidens polylepis*), and Pennsylvania smartweed (*polygonum pensylvanicum*). Common grasses include fescues (*Festuca spp.*) and oatgrass (*Danthonia spp.*). Common early-successional tree species include Virginia pine (*Pinus virginiana*) and black tupelo (*Nyssa sylvatica*) (Reiss 1986).

Forest structure documented during 2024 bat survey (Listed Bat Presence/Probable Absence Survey) included a mixed deciduous hardwood composition throughout much of the Study Area, with areas of more open land associated with reseeded mining areas (Appendix E). Some diversity in age of trees was documented, with a tree diameter range of 5 to 40 inches at breast height. The most common tress species in the Study Area included box elder (*Acer negundo*), tulip poplar (*Liriodendron tulipifera)*, American sycamore *(Platanus occidentalis)*, and Virginia pine. Botanical species observed in the Lewis Ridge Project Study Area during site visits in May, October, and November 2022, and June, July, and August 2024 are included in Table 5-16.

The proposed upper reservoir location encompasses an area with a land use classification of shrub/scrub. This area was historically surface mined and reseeded, and largely consists of cool season grasses and lespedeza, with some shrubs present. The proposed penstock and lower reservoir locations largely encompass areas of mixed deciduous forest with adjacent wetland and stream habitats. Kudzu is ubiquitous throughout the vicinity of the lower reservoir. The proposed interconnection line route runs along forested land and roads that were previously cleared and disturbed for mining access. Land use classifications are discussed in Section 5.11 and depicted on Figure 5-33.

Table 5-16: Botanical Species Observed in Project Study Area

Scientific Name	Common Name	Native and/or Non-native
Acer negundo	box elder	Native
Acer rubrum	red maple	Native
Acer saccharum	sugar maple	Native
Ailanthus altissima	tree-of-heaven	Non-native
Albizia julibrissin	silktree	Non-native
Ambrosia artemisiifolia	common ragweed	Native
Ambrosia trifida	giant ragweed	Native
Arctium minus	burdock	Non-native
Betula nigra	river birch	Native
Carpinus caroliniana	American hornbeam	Native
Cercis canadensis	redbud	Native
Dactylis glomerata	orchard grass	Non-native
Daucus carota	Queen Anne’s lace	Non-native
Elaeagnus umbellata	autumn olive	Non-native
Euonymus fortune	winter creeper	Non-native
Eutrochium fistulosum	Joe-pye weed	Native
Fagus grandifolia	American beech	Native
Festuca spp.	Festuca	Both
Gleditsia triacanthos	honeylocust	Native
Impatiens capensis	jewelweed	Native
Juglans nigra	black walnut	Native
Juniperus virginiana	eastern red cedar	Native
Lespedeza spp.	Lespedeza	Both
Leucanthemum vulgare	oxeye daisy	Non-native
Liquidambar styraciflua	sweetgum	Native
Liriodendron tulipifera	tulip poplar	Native
Lonicera spp.	Honeysuckle	Both
Melilotus alba	white sweet clover	Non-native
Melilotus officinalis	yellow sweet clover	Non-native
Medicago sativa	alfalfa	Non-native
Microstegium vimineum	Japanese stilt grass	Non-native
Paulowina tomentosa	princess tree	Non-native
Penstemon spp.	Penstemon	Both
Phytolacca americana	American pokeweed	Native

Scientific Name	Common Name	Native and/or Non-native
Pinus virginiana	Virginia pine	Native
Platanus occidentalis	American sycamore	Native
Polygonum cuspidatum	Japanese knotweed	Non-native
Polystichum acrostichoides	Christmas fern	Native
Populus deltoides	cottonwood	Native
Pueraria lobata	kudzu	Non-native
Quercus alba	white oak	Native
Quercus rubra	red oak	Native
Rhus typhina	staghorn sumac	Native
Robinia pseudoacacia	black locust	Native
Rosa multiflora	multiflora rose	Non-native
Rubus spp.	raspberry	Native
Rudbeckia hirta	blackeyed Susan	Native
Salix interior	sandbar willow	Native
Salix nigra	black willow	Native
Sambucus spp.	elderberry	Native
Schoenoplectus tabernaemontani	soft-stem bulrush	Native
Scirpus atrovirens	dark-green bulrush	Native
Scirpus cyperinus	woolgrass	Native
Solidago spp.	goldenrod	Native
Trifolium pratense	red clover	Non-native
Toxicodendron radicans	poison ivy	Native
Typha angustifolia	narrowleaf cattail	Non-native
Ulmus americana	American elm	Native
Vitis spp.	wild grape	Native

Source: Kleinschmidt Associates 2022 and 2024, EcoSource 2024, Copperhead 2024. This list is based on observations from May, October, and November 2022 and June, July, and August 2024 site visits, bat survey, and wetland assessments, not comprehensive botanical surveys.

5.5.1.1 Rare, Threatened, and Endangered Botanical Resources

The USFWS IPaC tool was reviewed for the Lewis Ridge Project Study Area on July 19, 2024. The IPaC did not identify any federal listed botanical species in the Lewis Ridge Project Study Area (USFWS 2024).

A request was submitted to the OKNP on June 20, 2024 to perform review of the KY-BAT and obtain a Standard Occurrence Report. OKNP's Standard Occurrence Report identified one botanical species that intersected the Lewis Ridge Project Study Area with an observation date within the Study Area occurring in 1937 (OKNP 2024). OKNP's Standard Occurrence Report listed 13 botanical species with reported occurrences within the 5-mile buffer of the Lewis Ridge Project Study Area. Species specific information is being filed with FERC as a privileged document (Appendix D). The OKNP Rare Plant Database lists 29 endangered, threatened, or species of conservation concern plants with known occurrences in Bell County (OKNP 2018) (Table 5-17).

Table 5-17: Rare, Threatened, and Endangered Plant Species with Known Records of Occurrence in Bell County, Kentucky

Scientific Name	Common Name	Federal Status[a]	KY Status[b]	Global Rank, State Rank[c]
Adlumia fungosa	Allegheny-vine	-	H	G4, SH
Amianthium muscitoxicum	fly poison	-	T	G4G5, S1
Baptisia tinctoria	yellow wild indigo	-	T	G5, S1S2
Boykinia aconitifolia	brook saxifrage	-	T	G4, S2
Calamagrostis odali ssp. Porteri	Porter's reedgrass	-	T	G4T4, S2S3
Calopogon tuberosus var. tuberosus	tuberosus grass pink	-	E	G5T5, S1
Capnoides/Corydalis sempervirens	rock harlequin	-	S	G5, S3?
Carex austrocaroliniana	tarheel sedge	-	S	G4, S3
Castanea pumila	Allegheny chinkapin	-	T	G5, S2
Chelone obliqua var. obliqua	red turtlehead	-	E	G4T3T4Q, S1
Chrysosplenium americanum	American golden-saxifrage	-	T	G5, S2?
Convallaria montana	American lily-of-the-valley	-	E	G4?, S1
Deschampsia/Avenella flexuosa	crinkled hairgrass	-	T	G5, S2
Gentiana decora	showy gentian	-	S	G4?, S3
Houstonia serpyllifolia	Michaux's bluets	-	E	G4?, S1

Scientific Name	Common Name	Federal Status[a]	KY Status[b]	Global Rank, State Rank[c]
Lathyrus venosus	smooth veiny peavine	-	S	G5, S2S3
Liparis loeselii	Loesel's twaybay	-	T	G5, S2S3
Listera smallii	kidney-leaf twaybay	-	T	G4, S2
Melampyrum lineare var. latifolium	American cowwheat	-	T	G5T5, S2
Monotropsis odorata	sweet pinesap	-	T	G3, S2
Polytrichum pallidisetum	a hair cap moss	-	T	G5, S2?
Prosartes maculata	nodding mandarin	-	S	G4, S3?
Salvia urticifolia	nettle-leaf sedge	-	E	G5, S1
Silene ovata	ovate catchyfly	-	E	G3, S1
Solidago curtisii	Curtis' goldenrod	-	T	GNR, S3
Solidago puberula	downy goldenrod	-	S	G5, S2
Solidago roanensis	Roan Mountain goldenrod	-	T	G4G5, S1S2
Trillium undulatum	painted trillium	-	T	G5, S2
Veratrum parviflorum	Appalachian bunchflower	-	E	G4?, S1

Source: OKNP 2018

A – Federal status: LE = listed endangered; LT = listed threatened; C = candidate species, not yet listed or proposed for listing; SOMC = Species of Management Concern.

B – Kentucky state status: E = endangered; T = threatened; S = special concern; H=historic.

C – Global ranks: G1 = critically imperiled, at very high risk of extinction due to extreme rarity; G2 = imperiled, at high risk of extinction due to very restricted range; G3 = vulnerable, at moderate risk of extinction due to restricted range; G4 = apparently secure, uncommon but not rare; G5 = secure – common, widespread, abundant; G#? = denotes inexact numeric rank; GNR = unranked, conservation status not yet assessed; G#Q = questionable taxonomy that may reduce conservation priority; G#T# = T denotes rarity of a subspecies.

State ranks: S1 = critically imperiled, at very high risk of extinction due to extreme rarity; S2 = imperiled, at high risk of extinction due to very restricted range; S3 = vulnerable, at moderate risk of extinction due to restricted range; S4 = apparently secure, uncommon but not rare; S5 = secure – common, widespread, abundant; S#? = denotes inexact numeric rank; S#B = refers to breeding population in Kentucky; S#N = refers to non-breeding population in Kentucky.

5.5.1.2 Invasive Botanical Species

Lands in the Central Appalachians ecoregion have been subject to disturbance by activities such as mining, logging, fire, loss of American chestnut, and infestation of southern pine beetles, which have allowed for the spread of non-native invasive species. These previously disturbed landscapes exhibit altered vegetative communities, which are dominated by introduced species, like multiflora rose, autumn olive, princess tree, and early-successional native species such as black locust and red maple (Kentucky EEC 2022).

In 2008, the Kentucky DFWR developed a Terrestrial Nuisance Species Management Plan. As described in the plan, terrestrial nuisance species (TNS) are non-native invasive species that threaten the diversity or abundance of native terrestrial species or the ecological stability of ecosystems, or commercial, agricultural, or recreational activities dependent on such ecosystems. Kentucky DFWR produced a list of the most problematic TNS in Kentucky, which included six microorganisms, four insects, two birds, one mammal, and 39 plant species (Kentucky DFWR 2008).

In 2000, the Kentucky Invasive Plant Council was established as a state chapter of the Southeast Exotic Pest Plant Council and works to serve as a technical support resource on invasive species in Kentucky, facilitate the exchange of information concerning the management and control of invasive plant species, and support research and monitoring of those species (Kentucky IPC 2019). A list of invasive plant species of Kentucky and associated threat category is provided in Table 5-18. A total of eleven plant species included in this list have been documented in the Lewis Ridge Project Study Area.

Table 5-18: Threat Category[1] of Invasive Plants Species Known to Occur in Kentucky

Scientific Name	Common Name	On Most Problematic Kentucky TNS List?[2]
Category 1 – Severe Threat		
Achyranthes japonica	Japanese chaff flower	-
Ailanthus altissima	tree-of-heaven*	Yes
Alliaria petiolata	garlic mustard	Yes
Ampelopsis brevipedunculata	porcelain berry	-
Arthraxon hispidus	hairy jointgrass	-
Carduus nutans	musk thistle	Yes
Celastrus orbiculatus	oriental bittersweet	Yes
Cirsium arvense	Canada thistle	-
Clematis terniflora	leatherleaf clematis	-
Conium maculatum	poison hemlock	Yes
Coronilla varia	crown vetch	Yes
Dioscorea oppositifolia	Chinese yam	Yes
Elaeagnus umbellata	autumn olive*	Yes
Euonymus alatus	winged euonymus, burning bush	Yes
Euonymus fortunei	winter creeper*	Yes
Festuca arundinacea (=Lolium arundinaceum)	Kentucky 31 fescue	Yes
Glechoma hederacea	ground ivy	-
Lespedeza cuneata	sericea lespedeza*	Yes
Lespedeza stipulacea (=Kummerowia)	Korean lespedeza	Yes
Ligustrum sinense, L. vulgare	Chinese privet, European privet	Yes
Lonicera japonica	Japanese honeysuckle*	Yes
Lonicera maackii, L. fragrantissima, L. standishii	bush honeysuckles	Yes
Lysimachia nummularia	moneywort	-
Lythrum salicaria	purple loosestrife	-
Melilotus alba	white sweet clover*	Yes
Melilotus officinalis	yellow sweet clover*	Yes
Microstegium vimineum	Japanese stiltgrass*	-

Scientific Name	**Common Name**	**On Most Problematic Kentucky TNS List?[2]**
Miscanthus sinensis	Chinese silver grass	Yes
Paulownia tomentosa	Princess tree*	Yes
Phragmites australis	common reed	-
Polygonum cuspidatum	Japanese knotweed*	-
Pueraria lobata	kudzu*	Yes
Pyrus calleryana	callery pear	Yes
Ranunculus ficaria	lesser celandine	Yes
Rhamnus cathartica	European buckthorn	-
Rosa multiflora	multiflora rose*	Yes
Sorghum halepense	Johnson grass	Yes
Stellaria media	chickweed	Yes
Category 2 – Significant Threat		
Agrostis stolonifera	weeping love grass	-
Akebia quinata	akebia	-
Albizia julibrissin	mimosa	-
Alternanthera philoxeroides	alligatorweed	-
Berberis thunbergii	Japanese barberry	-
Bromus inermis	smooth bromegrass	Yes
Bromus tectorum, B. japonicus	cheatgrass	Yes
Cardiospermum halicacabum	balloon vine	-
Centaurea biebersteinii	spotted knapweed	Yes
Cirsium vulgare	bull thistle	-
Daucus carota	Queen Anne's lace*	Yes
Dipsacus sylvestris, D. laciniata	common teasel, cutleaf teasel	-
Echinochloa crus-galli	barnyard grass	-
Eleusine indica	goose grass	-
Galium pedemontanum	cleavers	-
Hedera helix	English ivy	-
Hemerocallis fulva	day lily	-
Humulus japonicus	Japanese hops	-
Hydrilla verticillata	hydrilla	-

Scientific Name	**Common Name**	**On Most Problematic Kentucky TNS List?**[2]
Lespedeza bicolor, L. thunbergii	bicolor lespedeza, shrubby lespedeza	Yes
Lespedeza striata (= Kummerowia)	Japanese clover/Kobe lespedeza	Yes
Leucanthemum vulgare	ox-eye daisy	-
Medicago lupulina	black medic	-
Mentha x piperata	peppermint	-
Morus alba	white mulberry	-
Mosla dianthera	miniature beefsteak	-
Najas minor	water nymph	-
Ornithogalum umbellatum	star-of-Bethlehem	-
Pastinaca sativa	wild parsnip	-
Perilla frutescens	beefsteak	-
Poa compressa	Canada bluegrass	-
Poa pratensis	Kentucky bluegrass	-
Polygonum cespitosum	bunchy knotweed	-
Polygonum persicaria	lady’s thumb	-
Populus alba	white poplar	-
Potamogeton crispus	curlyleaf pondweed	-
Rhodotyps scandens	Jetbead	-
Rorrippa nasturtium-aquaticum	water-cress	-
Rubus phoenicolasius	wineberry	-
Schedonorus pratensis	meadow fescue	-
Setaria faberi	giant foxtail	-
Setaria viridis	green foxtail	-
Spiraea japonica	Japanese spiraea	-
Thlaspi alliaceum	garlic peppergrass	-
Tussilago farfara	coltsfoot	-
Typha x glacua	cattail	-
Ulmus pumila	Siberian elm	-
Verbascum thapsus	common mullein	-
Vinca minor	lesser periwinkle	-

Scientific Name	**Common Name**	**On Most Problematic Kentucky TNS List?**[2]
Category 3 – Moderate Threat		
Argopyron repens	quack grass	-
Allium vineale	field garlic	-
Arctium minus	common burdock	-
Arenaria serpyllifolia	thyme-leaf sandwort	-
Barbarea vulgaris	yellow rocket	-
Bromus arvensis, B. catharcticus,B. hordeaceus, B. racemosus	field bromes	-
Buddleja davidii	orange-eye butterfly bush	-
Carduus acathoides	spiny plumeless thistle	-
Chenopodium album	lamb’s quarters	-
Cichorium intybus	chicory	-
Commelina communis	dayflower	-
Convolvulus arvensis	field bindweed	-
Duchesnea indica	Indian strawberry	-
Duetzia scabra	fuzzy deutzia	-
Elaeagnus angustifolia	Russian olive	-
Eleusine indica	goose grass	-
Fatoua villosa	hairy crabweed	-
Hesperis matronalis	dame’s rocket	-
Holcus lanatus	velvet grass	-
Hypericum perforatum	common St. John’s-wort	-
Ipomoea hederacea	ivy-leafed morning-glory	-
Ipomoea purpurea	purple morning-glory	-
Iris pseudoacorus	pale yellow iris	-
Lamium purpureum	purple deadnettle	-
Lamium amplexicaule	henbit	-
Lithospermum arvense	corn-gromwell	-
Lolium multiflorum	Italian rye	-
Lonicera x bella, L. morrowii, L. tartarica	bush honeysuckles	Yes
Lotus corniculatus	birdsfoot trefoil	-

Scientific Name	**Common Name**	**On Most Problematic Kentucky TNS List?**[2]
Mohonia bealei	leatherleaf mahonia	-
Mentha spicata	spearmint	-
Nepeta cataria	catnip	-
Oxalis stricta (= O. europea)	common yellow wood-sorrel	-
Paspalum dilatatum	dallisgrass	-
Phyllostachys aura	golden bamboo	-
Poa annua	speargrass	-
Potentilla recta	sulphur five-fingers	-
Prunus mahalab	mahalab cherry	-
Ranunculus bulbosus	bulbous buttercup	-
Rumex acetosella	dock, sheep sorrel	-
Solanum dulcamara	bitter nightshade	-
Thlaspi perfoliatum	field cress	-
Torillis arvensis, T. japonica	hedge parsley	-
Wisteria sinensis, W. floribunda, W. x formosa	exotic wisterias	-

Source: Kentucky IPC 2019

* Species documented in Study Area based on observations from Kleinschmidt, Copperhead, and Ecosource May, October, and November 2022 and June, July, and August 2024 site visits, bat survey, and wetland assessments, not comprehensive botanical surveys.

[1] Threat Categories and Descriptions (Kentucky EPPC 2013)

- Category 1 – Severe Threat: Exotic plant species which possess characteristics of invasive species and spread easily into native plant communities and displace native vegetation; includes species which are or could become widespread in Kentucky.
- Category 2 – Significant Threat: Exotic plant species which possess some invasive characteristics but have less impact of native plant communities; may have the capacity to invade natural communities along disturbance corridors, or to spread from stands in disturbed sites in undisturbed areas but have fewer characteristics of invasive species than Category 1.
- Category 3 – Moderate Threat: Exotic plant species which seem to principally spread and remain in disturbed corridors, not readily invading natural areas; also, some agronomic weeds.

[2] Most Problematic Kentucky TNS List (Kentucky DFWR 2008)

5.5.2 Potential Impacts of the Proposed Lewis Ridge Project

The Lewis Ridge Project features would primarily be located within areas previously disturbed for mining activities, or along existing access roads, with the exception of a portion of the interconnection line. Both native and non-native vegetation typical of the region are present in the Lewis Ridge Project Study Area. The construction and operation of the Lewis Ridge Project would permanently alter habitat and is anticipated to displace vegetation, including forested habitat and areas disturbed from previous mining operations. Vegetation disruption would occur over areas that have been previously disturbed from mining operations. A portion of the interconnection line would run along existing roads, thus minimizing disturbance and vegetation clearing of the area. Another portion of the interconnection line would cross the Pine Mountain ridge in an area which hasn't been disturbed and vegetation clearing would be required for the interconnection line corridor. This would result in the alteration of habitat for the segment of the interconnection line corridor. It should be noted that there are two other utility crossings less than 1 mile from the crossing of the Pine Mountain ridge at which the interconnection line is proposed. Although permanent vegetation disruption is anticipated, it is not anticipated that the Lewis Ridge Project would have long-term effects on plant communities within the Project Vicinity.

5.5.3 Agency Consultation and Applicant Recommendations

5.5.3.1 Agency Consultation

Documentation of consultation is provided in Appendix A. Consultation specific to botanical resources is summarized below.

On February 9, 2022, USFWS submitted preliminary comments in response to FERC's December 16, 2021 notice of Preliminary Permit Application to assist FERC and LRPS in assessing the potential environmental impacts of construction and operation of the proposed project. USFWS recommended evaluating the potential to utilize existing utility rights-of-way that occur near the project location to minimize impacts to terrestrial habitats.

The Kentucky DEP submitted comments on April 6, 2023 (following the Joint Agency and Public Meeting) and on July 9, 2024 (following the distribution of the Draft Study Plan). In the comments, the Kentucky DEP requested review of the OKNP's KY-BAT to obtain a standard occurrence report for sensitive species within the Lewis Ridge Project area. LRPS obtained a standard occurrence report from OKNP on June 20, 2024, and results are summarized in applicable sections of this Exhibit E and provided in Appendix D.

USFWS provided an official species list for the Lewis Ridge Project on July 19, 2024 identifying threatened, endangered, proposed, and candidate species that may occur in the Study Area of the Lewis Ridge Project. Results are summarized in applicable sections of this Exhibit E and provided in Appendix D.

5.5.3.2 Applicant Recommendations

LRPS proposes to implement the following PM&E measures to minimize impacts on botanical resources:

- **Vegetation Management Plan:**
    - LRPS proposes to develop and implement a Vegetation Management Plan. The Vegetation Management Plan would include revegetation specifications and invasive species management protocols. The Vegetation Management Plan will be filed with the FLA and would be implemented at the start of construction.
    - Per USFWS recommendation, revegetation of disturbed areas would consider use of nectar-producing plants and milkweed endemic to the area to benefit pollinator habitat.

5.5.4 References

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5.6 Historic and Archaeological Resources (18 CFR § 4.41 (f)(4))

5.6.1 Existing Environment

A summary of the prehistoric and historic context, previous historic and archaeological resource surveys, and known historic and archaeological resources within the Project Vicinity is provided below.

5.6.1.1 Prehistoric Context

The proposed Lewis Ridge Project is situated in southeast Kentucky near the borders of Tennessee and Virginia. Archaeological evidence suggests that humans have occupied the region for more than 12,000 years (Kentucky Heritage Council 2022a).

The earliest evidence of human occupation in the southeastern United States is identified as the Paleoindian Stage, which began approximately 12,000 B.C. and continued to approximately 8,000 B.C. The climate in Kentucky was much colder and wetter upon the estimated first arrival at the end of the last ice age at least 12,000 years ago. Mammoth, mastodon, and bison provided meat, and hides were used for temporary shelters and clothing. In this time frame, people lived in small groups and migrated frequently. The Paleoindian toolkit consisted of well-crafted spear points of stone. It is likely Paleoindians also made tools from wood and animal bones. (Kentucky Heritage Council 2022a).

During the Archaic period (8,000 to 1,000 B.C.), the region's climate gradually trended toward that of modern weather patterns, which led to the extinction of large animals such as the mastodon and giant bison. Hunting shifted to smaller game animals such as deer, turkey, and rabbit. Archaic groups collected wild plants for food and medicine and made baskets for collecting, transporting, and storing their food. Sedentism increased during this period compared to the Paleoindian period, but groups still migrated every few months. Archaic hunters used notched and stemmed (not fluted) stone spearpoints and used a spearthrower (atlatl) to improve velocity and accuracy. By 1,000 B.C., some Archaic groups began experimenting with growing food. (Kentucky Heritage Council 2022a).

The Woodland period (1,000 B.C. to A.D. 1,000) is marked by the introduction of pottery, which was used for cooking and food storage. During this period, gardening and cultivating plants increased and groups tended to live in larger communities. Large earthen enclosures were used in religious ceremonies and burial mounds were constructed over decades. Evidence from this period suggests that long-distance exchange networks appeared and people began to explore caves (such as Mammoth Cave in Kentucky). The bow and arrow were invented late in this period and spearpoints were replaced with arrowheads. The use of groundstone tools continued and were used for processing corn. (Kentucky Heritage Council 2022a).

The Late Prehistoric period (A.D. 1000-1750) represents the last pre-contact cultural traditions prior to the introduction of European settlers and diseases that decimated native populations. Late Prehistoric groups focused on planting, growing, and harvesting corn and beans. The toolkit was expanded to include the hoe for agricultural fields. New forms of pottery such as jars, bowls, plates, bottles, and colanders were developed. People lived in large year-round settlements and constructed rectangular houses. Communities were ruled by hereditary chiefs who lived on larger mounds near the center of the settlement. Religious and ceremonial life is depicted by the figures engraved on shell gorgets (necklace pendants) and placement of ceramic vessels with shell spoons, pipes, and shell necklaces with the deceased. (Kentucky Heritage Council 2022a).

Several Native American tribes once called Kentucky home, including the Cherokee, the Chickasaw, and the Shawnee (VisitLex 2022). From around 1650 to 1750, Native American wars ensued over control of Kentucky, or the “Great Meadow,” between the Shawnee tribes located north of the Ohio River and the Cherokee and Chickasaw tribes located south of the Cumberland River (Kentucky Department of Tourism 2024). By the 1680s or 1690s, the Shawnee had one or more villages on the upper Cumberland River; however, the Cherokee claimed the upper Cumberland River as their hunting grounds (Henderson and Pollack 2012). The Cherokee forced the Shawnee out of the area around 1714 (Henderson and Pollack 2012).

5.6.1.2 Historic Context

Dr. Thomas Walker and Christopher Gist first explored Kentucky in 1750 and 1751, but outbreaks of conflict between the British and Native Americans delayed further exploration for over a decade (Kentucky Department of Tourism 2024). By the late 1700s the newly formed United States began to put settlement pressure on the region (Kentucky Department of Tourism 2024). European settlement in the area was slower than along the East Coast of the modern United States due to the barrier of the Appalachian Mountains (VisitLex 2022). After 1775, Kentucky experienced rapid growth as the first settlements west of the Appalachian Mountains were founded with settlers primarily from Virginia, North Carolina, and Pennsylvania (accessing the area by the Cumberland and Ohio Rivers). Daniel Boone first explored Kentucky in 1767 and returned in 1769 for a two-year exploration of the area (Kentucky Department of Tourism 2024). In 1772, the Cherokee surrendered their claim to Kentucky to the colony of Virginia (VisitLex 2022). During the American Revolutionary War, indigenous Native American tribes fought with the British against American colonists. Several conflicts took place in Kentucky, including the siege of Boonesboro, attacks on Martin's and Ruddle's Station, and the Battle of Blue Licks in 1782 (VisitLex 2022). The Battle of Blue Licks was one of the last Native American battles in Kentucky, although smaller conflicts occurred until 1813 (Kentucky Department of Tourism 2024). Kentucky became a state in 1792 and the westernmost region was annexed following its purchase from the Chickasaw Indians in 1818 (Kentucky Department of Tourism 2024). With passage of the "Indian Removal Act" in 1830, Native American tribes living east of the Mississippi River were required to move west to Indian Territory. However, Native American tribes left Kentucky earlier, first in response to the events of the French and Indian War, the American Revolution, and the War of 1812 (Henderson and Pollack 2012). In addition to aiding in immigration to the area, the Cumberland Gap had strategic value during the Civil War as whoever occupied the pass controlled the railroad from Virginia to Tennessee.

The logging Industry in Bell County began after the Civil War ended in 1865, with its most active years continuing until around 1900. The coal industry in Bell County started around 1888, after the Louisville and Nashville Railroad Company built a railroad along the Cumberland River (Fusan 1939). The coal fields in eastern Kentucky peaked in 1928-1930 and maintained those production levels until the second World War (Kentucky Foundation 2007).

5.6.1.3 Previous Surveys and Known Historic and Archaeological Resources

In preparing the PAD, LRPS conducted a preliminary records review for cultural historic and archaeological resources within the Project Vicinity.[19] A Phase I survey was performed in 2007 in association with the permit submitted to the Division of Mines for a mining facility in the area of the proposed lower reservoir location. The survey identified four previously unrecorded sites: two historic cemeteries, remains of a coal camp house, and

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[19] The geographic areas reviewed have changed as the design of the Lewis Ridge Project progressed.

remains of a historic coal mining operation (McGraw 2007). Although not eligible for the NRHP individually, the Kentucky SHPO and the Division of Mines recommended Phase II investigations of the sites in the form of archival research to determine if they were eligible as a district. Due to extensive disturbance from coal mining operations and surface mining, the district was found ineligible for the NRHP.

In 2022, LRPS submitted a preliminary historic resources site check of the Project Vicinity to the Kentucky Heritage Council (KHC) to identify previously recorded sites and any properties or sites already listed on or determined eligible for the NRHP. The site check identified ten historic houses along public roadways (one of which meets NRHP criteria) and the Balkan School (meets NRHP criteria) within the Project Vicinity (Kentucky Heritage Council 2022b).

In 2022, LRPS submitted a preliminary records review for archaeological sites to the University of Kentucky to determine whether there are previously recorded archaeological sites near the Lewis Ridge Project, and if present, their NRHP status. The review identified five sites and includes the two cemeteries identified in the 2007 Phase 1 survey noted above. Three of the sites do not meet NRHP eligibility criteria; the NRHP status of the two cemeteries has not been assessed (University of Kentucky 2022). The previous mining facility did not impact the cemeteries by providing a 100-foot buffer zone.

In 2024, LRPS conducted a formal Section 106 archaeological resources evaluation under the supervision of a qualified professional.[20]Prior to the archaeological field assessment, a records review of the archaeological site files at the Kentucky Office of State Archaeology (OSA) was completed. The review indicated that 20 previous archaeological surveys and site investigations have been conducted within a 2-kilometer radius of the Study Area. Nine archaeological sites have been recorded in this area. Eight surveys fall within the boundaries of the Study Area and three sites intersect the Study Area (15Bl127, 15Bl128, and 15Bl133).

A field assessment was performed for archaeological resources to survey lands owned by Asher Land and Mineral that have not been previously mined. The survey followed

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[20] All Section 106 investigations subject to review by the Kentucky SHPO must be carried out under the direct supervision of a qualified Principal Investigator who meets or exceeds the minimum professional requirements established in the Secretary of the Interior’s Standards, as determined by the Kentucky SHPO.

standard archaeological methods and Kentucky SHPO specifications, including a pedestrian survey supplemented with screened shovel testing. Two new archaeological sites (15Bl157 and 15Bl158) and one twentieth-century oil/gas well (Non-Site Locality 1) were recorded. In addition, three previously recorded sites (15Bl127, 15Bl128, and 15Bl133) were revisited (CRA 2024). Table 5-19 summarizes identified archaeological sites and the archaeological report is provided in Appendix F, filed as privileged. Site survey forms are being prepared for each archaeological site recorded and will be submitted to the Kentucky OSA (CRA 2024a).

Table 5-19: Archaeological Sites on Asher Land and Mineral Owned Lands within the Study Area

Site Number	Site Description	NRHP Eligibility	Recommendation
15Bl127	Twentieth to the twenty-first century historic farmstead/residence	Not eligible	No further work recommended
15Bl128	Twentieth to the twenty-first century industrial site	Not eligible	No further work recommended
15Bl133	Early twentieth-century school	Not eligible	No further work recommended
15Bl157	Early twentieth-century to modern-day cemetery	Not Accessed	Avoidance
15Bl158	Early to mid-twentieth-century structural remnants of a church	Not eligible	No further work recommended
Non-Site Locality 1[21]	Mid-twentieth-century oil/gas well	Not eligible	No further work recommended

Source: CRA 2024a

In 2024, LRPS also conducted a formal Section 106 cultural historic resources evaluation under the supervision of a qualified professional to document above-ground resources 50 years of age or older on lands owned by Asher Land and Mineral or that are publicly accessible within the Study Area. Prior to the field assessment, available surveys, reports, studies, maps, and other data pertinent to the Study Area were reviewed. A records review of the historic site files maintained by the KHC identified two previous cultural historic reports that overlapped the Study Area and two resources with previously assigned KHC survey numbers (Sites 1 and 5 [BL 306 and BL 89]). In addition to the two previously

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[21] An archaeological site number was not requested from the OSA because the area lacked archaeological deposits (CRA 2024a).

surveyed properties, field assessment identified 14 previously undocumented properties (Sites 2-4 [BL 375-377] and 6-16 [BL 378-388]) (CRA 2024b). Table 5-20 summarizes identified cultural historic sites and associated effects determination (if applicable) and the historic report is provided in Appendix G, filed as privileged. KHC survey forms were completed for each property.

Table 5-20: Cultural Historic Resources within the Study Area

Site Number*	Survey Number	Site Description	NRHP Eligibility Recommendation	Effects Determination
1*	BL 306	Balkan School and associated structures	Eligible	No effect
2	BL 375	Louisville and Nashville (L&N) rail line and culvert	Not individually eligible[22]	No effect
3*	BL 376	Potential cemetery	Undetermined due to inaccessibility	No adverse effect
4*	BL 377	Barn, mobile, and associated outbuildings	Not eligible	N/A
5	BL 89	Collapsing house	Not eligible	N/A
6	BL 378	Log house	Not eligible	N/A
7*	BL 379	House and chicken coop	Not eligible	N/A
8*	BL 380	House and mobile home	Not eligible	N/A
9*	BL 381	Mobile home	Not eligible	N/A
10	BL 382	House	Not eligible	N/A
11*	BL 383	House and outbuildings	Not eligible	N/A
12*	BL 384	Chimney and outbuildings	Not eligible	N/A
13*	BL 385	House, additional residence, and associated outbuildings	Not eligible	N/A
14	BL 386	Calloway substation	Not eligible	N/A
15	BL 387	Transmission Line	Not eligible	N/A
16	BL 388	Cemetery and associated structures	Undetermined	No effect

* Indicates sites located within view of the Study Area but not within the Study Area.

Source: CRA 2024b

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[22] Historic site BL 375 was identified as a potentially contributing resource to the greater Louisville and Nashville Railroad (L&N) if it is recommended eligible for listing in the NRHP in the future (CRA 2024b).

5.6.2 Potential Impacts of the Proposed Lewis Ridge Project

Construction activities have the potential to disturb unidentified archaeological resources that may be eligible for the NRHP, if those properties exist. As long as avoidance of Site 15Bl157 is planned, no previously identified archaeological sites listed in or eligible for listing in the NRHP would be affected by the proposed Lewis Ridge Project (CRA 2024a).

The construction necessary for the completion of the proposed Lewis Ridge project would not take place in the immediate vicinity of the Balkan School (Site 1 [BL 306]), and this resource would likely only be impacted by a potential increase of flow of the waters of Tom Fork. The stretch of rail and its associated culvert at Site 2 (BL 375) would not be impacted by construction of the proposed Lewis Ridge Project. Since the proposed above-ground interconnection line would be within view from Site 3 (BL 376), the site's viewshed would be minimally impacted, but no direct impacts would occur. Near Site 16 (BL 388), the proposed Lewis Ridge Project would utilize existing electrical infrastructure and have no effect on the resource. Therefore, a finding of No Adverse Effect on cultural historic resources was recommended for the proposed Lewis Ridge Project. (CRA 2024b)

5.6.3 Agency Consultation and Applicant Recommendations

5.6.3.1 Agency Consultation

Documentation of consultation is provided in Appendix A. Consultation specific to historic and archaeological resources is summarized below.

LRPS filed a NOI and PAD to seek an original license for the Lewis Ridge Project on October 21, 2022. The Kentucky SHPO confirmed receipt of the NOI and PAD and noted their interest in continued consultation for the proposed Lewis Ridge Project.

Existing cultural resources information from the PAD was presented at the JAM. No comments were received specific to historic or archaeological resources during the JAM or in comments following the JAM.

LRPS distributed a Draft Study Plan on June 13, 2024. The Draft Study Plan included one study related to historic and archaeological resources, the Cultural Resources Evaluation. Kentucky SHPO provided comments on the draft Cultural Resources Evaluation study plan, and requested LRPS to include historic maps, soil maps, and any other relevant sources when performing file and archival research for archaeological resources. In addition, Kentucky SHPO requested the survey to include the entire Study Area, including lands not owned by Asher Land and Mineral. The key Lewis Ridge Project features, with the exception of the preliminary interconnection line, are located at a site owned by Asher Land and Mineral. LRPS will conduct additional surveys as needed when the interconnection line location is finalized. LRPS filed the Revised Study Plan with FERC on August 16, 2024.

5.6.3.2 Applicant Recommendations

LRPS proposes to continue consultation with Kentucky SHPO and Native American tribes throughout the licensing process and to implement the following PM&E measures to minimize impacts on historic and archaeological resources:

- LRPS will conduct additional archaeological survey for the proposed interconnection line after landowner permissions are obtained.
- LRPS proposes to avoid Site 15Bl157 (cemetery) when constructing and operating the Lewis Ridge Project.
- **Historic Properties Management Plan:**
    - LRPS proposes to develop and implement a Historic Properties Management Plan (HPMP), which specifies how historic properties would be managed within the Lewis Ridge Project APE. The HPMP will be filed with the FLA and will include inadvertent discovery protocol.

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5.7 Socioeconomic Resources (18 CFR § 4.41 (f)(5))

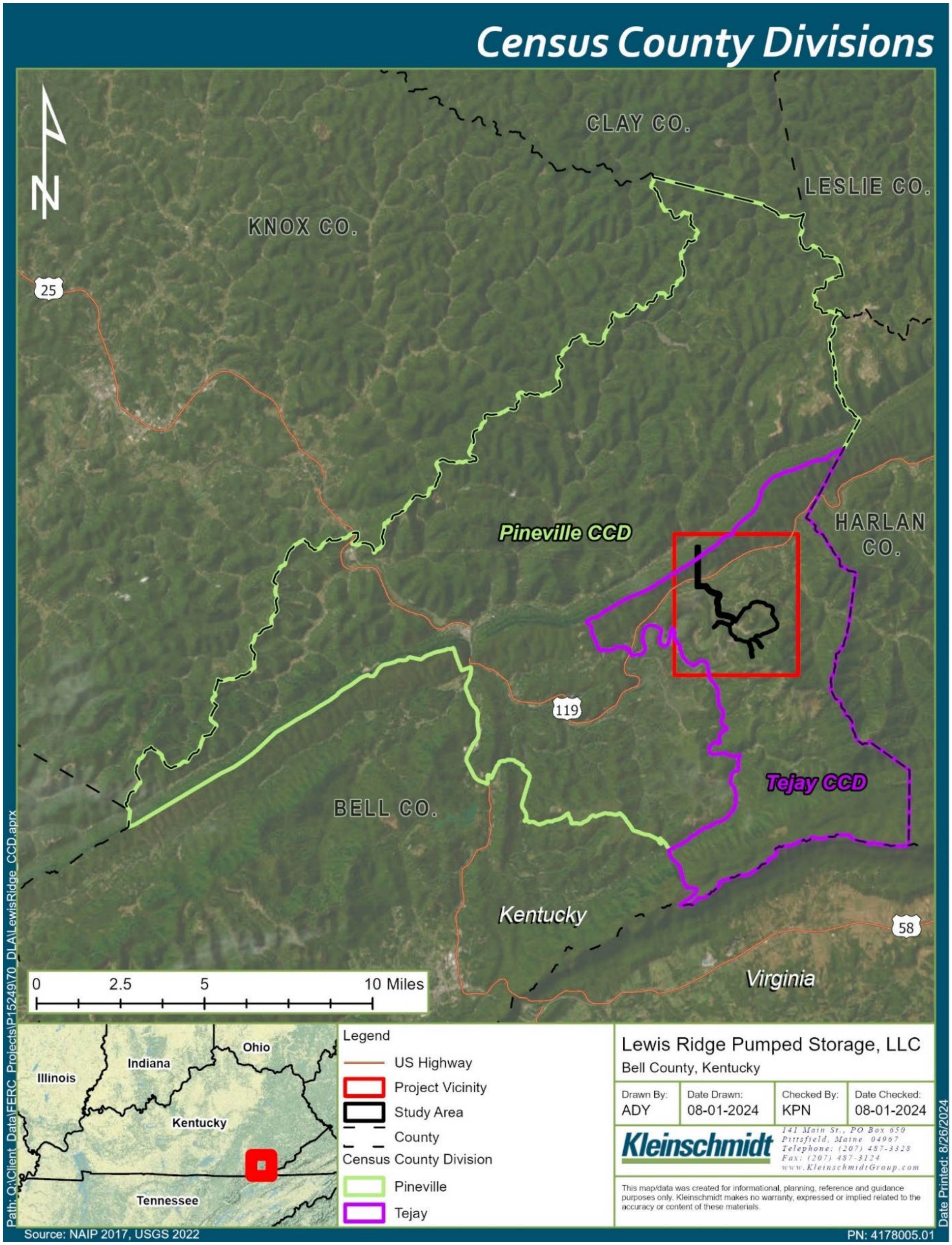
5.7.1 Existing Environment

5.7.1.1 General Land Use Patterns

The proposed Lewis Ridge Project is located in southeastern Kentucky near the borders of Tennessee and Virginia, within Bell County. The nearest communities to the proposed site are Blackmont, Tejay, Balkan, and Callaway. Compared to other counties in Kentucky, Bell County has a high number of mining, quarrying, oil and gas extraction, utilities, agriculture, forestry, fishing and hunting industries (Data USA 2022a). Bell County, Kentucky produced 302 million tons of coal from 1879 to 2004, with 108 million tons extracted by surface mining (Carey 2007). General land use in the Project Vicinity is further described in Section 5.11.

The counties of Kentucky are divided into Census County Divisions (CCD), which are sub-county statistical geographic areas representing contiguous areas of one or more communities. These CCDs are used by the U.S. Census to tabulate and present data from the decennial census (U.S. Census 2018). Due to the relatively small population in the Project Vicinity and surrounding areas, the following socioeconomic data are presented by CCD, as tabulated by the U.S. Census Bureau. CCDs covering a 5-mile radius around the Lewis Ridge Project include the Tejay CCD to the east and south, and the Pineville CCD to the west and north (Figure 5-16).

Figure 5-16: Census County Divisions within a 5-Mile Radius of the Proposed Lewis Ridge Project



5.7.1.2 Population Patterns

Table 5-21 summarizes the population estimates for Bell County, Kentucky, the Commonwealth of Kentucky, Tejay CCD, and Pineville CCD.

Table 5-21: Estimated Population and Population Changes from 2010 to 2023

Place	2010 Census	2020 Census	Percent Change 2010 - 2020	2022/2023 Estimates*	Percent Change 2020 - 2023
Kentucky	4,339,367	4,505,836	3.8%	4,526,154	0.5%
Bell County, Kentucky	28,691	24,097	-16.0%	23,317	-3.2%
Tejay CCD	1,896	1,292	-31.8%	1,862	44.2%
Pineville CCD	10,095	7,819	-22.5%	7,903	1.07%

Sources: U.S. Census 2022a, 2022b, 2022c, 2022d, 2023

* Estimates include 2023 data for the Commonwealth of Kentucky and Bell County and 2022 data for Tejay and Pineville CCDs.

The Tejay CCD (Figure 5-16) is approximately 53 square-miles and includes the communities of Tejay, Balkan, and Callaway. The Tejay CCD has an estimated population of 1,862 with a population density of 35.1 people per square-mile (U.S. Census 2022g). The Pineville CCD (Figure 5-16) is approximately 164 square-miles and has an estimated population of 7,903 with a population density of 48 people per square-mile (U.S. Census 2022g). Bell County is approximately 359 square-miles and has a population density of 67.1 people per square-mile; both of which are lower than the state average density of 114.1 people per square-mile. (U.S. Census Bureau 2023).

Ages of men and women in Bell County are relatively evenly distributed, with the largest age range for both being 55 to 59 years old (U.S. Census 2022a). The largest age ranges for men and women in Kentucky are 20 to 24 years and 60 to 64 years, respectively, with a steady decline after the age of 64 for both (U.S. Census 2022b). Tejay and Pineville CCDs are less evenly dispersed, with most women being 35 to 39 in Tejay CCD, and 65 to 69 in Pineville CCD (U.S. Census 2022d, 2022c), and most men being 60 to 64 in Tejay CCD, and 15 to 19 in Pineville CCD (U.S. Census 2022d, 2022c).

Table 5-22: Population and Land Use Statistics

	Bell County	Tejay CCD	Pineville CCD	State of Kentucky
Population	23,317	1,862	7,903	4,526,154
Land Area (Square Miles)	359.06	53	164	39,491.6
Population Per Square Mile	67.1	35.1	48	114.1

Source: US Census 2022g, 2023

5.7.1.3 Economic Indicators and Employment

The estimated median household income for Bell County was $33,658 in 2022 dollars with a poverty rate of 30.4 percent, compared to 16.5 percent in Kentucky (U.S. Census Bureau 2022a, 2022b). The poverty rate in Bell County, Kentucky, is 63 percent higher than the Kentucky average, and 110 percent higher than the United States average (Welfare Info 2022). Table 5-23 provides the household and family distribution and income for Bell County, Kentucky. In 2022, Tejay CCD had an estimated median household income of $65,625 for residents aged 25 to 44 years, $33,333 for residents aged 45 to 64, and $35,455 for residents over the age of 65 (U.S. Census 2022e). For the same year, the Pineville CCD had an estimated median household income of $51,087 for residents aged 25 to 44 years, $33,152 for residents aged 45 to 64, and $31,947 for residents over the age of 65 (U.S. Census 2022f).

Table 5-23: Household Incomes and Distribution for Kentucky and Bell County, Kentucky

	Bell County, Kentucky	State of Kentucky
2018 - 2022 Households	9,456	1,769,102
2018 - 2022 Approximate Number of Persons Per Household	2.49	2.48
2018 - 2022 Percentage of Population in Civilian Labor Force	40.9%	59.4%
2022 Persons in Poverty (%)	30.4%	16.5%
Median Earnings for Men	$35,063	$46,918
Median Earnings for Women	$24,615	$34,164
2018 - 2022 Median Household Income in 2022 Dollars	$33,658	$60,183

Sources: U.S. Census 2022a, 2022b; DataUSA 2022a, 2022b

The largest industries in Bell County, Kentucky in 2022 were educational services, and health care and social assistance; retail trade; and manufacturing (U.S. Census 2022a). The highest paying industries for men were information ($101,528); finance and insurance, real estate and rental and leasing ($67,188); and agriculture, forestry, fishing and hunting, and mining ($54,141) (Data USA 2022a). The highest paying industries for women in 2022 were manufacturing ($40,395); public administration ($35,769); and transportation and warehousing, and utilities ($34,536) (DataUSA 2022a). In comparison, the highest paying industries for men in Kentucky were finance and insurance, and real estate and rental and leasing ($68,677), public administration ($56,495), and manufacturing ($55,139) (DataUSA 2022b). The highest paying industries in Kentucky for women in 2022 were the same; however, women had lower average earnings of $47,386, $43,238, and $40,935, respectively (DataUSA 2022b).

5.7.2 Potential Impacts of the Proposed Lewis Ridge Project

The potential socioeconomic impacts of constructing the Lewis Ridge Project are expected to be beneficial. The Lewis Ridge Project is anticipated to create 1,500 family wage jobs during a 4-to-5-year construction period. Once operational, the Lewis Ridge Project would create approximately 30 permanent full-time jobs.[23]

LRPS has a strong community benefits plan and is partnered with a local non-profit, Shaping our Appalachian Region (SOAR), to help address local workforce and economic development. Community engagement associated with the Lewis Ridge Project and subsequent tax revenue generated by the Lewis Ridge Project would be used to provide direct financial support to Bell County, Kentucky and the surrounding communities.

5.7.3 Agency Consultation and Applicant Recommendations

5.7.3.1 Agency Consultation

Documentation of consultation is provided in Appendix A. Consultation specific to socioeconomic resources is summarized below.

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[23] Job number estimates are based on Rye Development's previous engineering, procurement, and construction studies performed for similar advanced pumped storage projects in Washington and Oregon.

LRPS conducted a meeting with the Kentucky Cabinet for Economic Development on September 9th, 2022, during which the Kentucky Cabinet for Economic Development noted their interest in the economic impacts of the Lewis Ridge Project and stated their support of the Lewis Ridge Project.

LRPS held a Joint Agency and Public Meeting and Site Visit on January 25, 2023. Brief discussion occurred regarding the economic impacts of the Lewis Ridge Project (temporary and permanent jobs). No comments were received specific to socioeconomics in comments following the Joint Agency and Public Meeting.

LRPS distributed a Draft Study Plan on June 13, 2024. LRPS filed the Revised Study Plan with FERC on August 16, 2024. No studies pertaining to socioeconomic resources were requested or included in the Revised Study Plan.

5.7.3.2 Applicant Recommendations

LRPS will continue to evaluate socioeconomic resources throughout the licensing process and conduct a socioeconomic study once design and construction details are further refined. Due to the beneficial impact to socioeconomic resources from construction and operation of the Lewis Ridge Project, LRPS is not proposing any PM&E measures related to socioeconomic resources.

5.7.4 References

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5.8 Geological and Soil Resources (18 CFR § 4.41 (f)(6))

5.8.1 Existing Environment

5.8.1.1 Topography

The existing ground surface elevations in the Project Vicinity range from approximately 1,100 to 2,200 feet[24], according to the Kentucky State Geographic Information System website. Mountainous topography is predominant. The sides of many of the mountain peaks and ridges are quite steep. Local relief may be as great as 1,500 feet over a horizontal distance of 1/2 mile in the area south of Pine Mountain (McGrain and Currens 1978). The Pine Mountain ridge extends southwest/northeast from Jellico, Tennessee to Elkhorn City, Kentucky and runs through the northwest corner of the Project Vicinity (Commonwealth of Kentucky 2022). The Pine Mountain Overthrust Fault Line is a 125-mile-long overthrust fault created by mountain building forces that occurred in the area roughly 230 million years ago. South of Pine Mountain, the rocks of the Breathitt Formation underlie the narrow valleys and form high, rugged hills. The tops of hills and ridges are commonly capped with sandstone. Shales form wide valleys and moderate or gentle slopes on hills (Kilburn et al. 1962). Figure 5-17 below shows the topography in the Project Vicinity.

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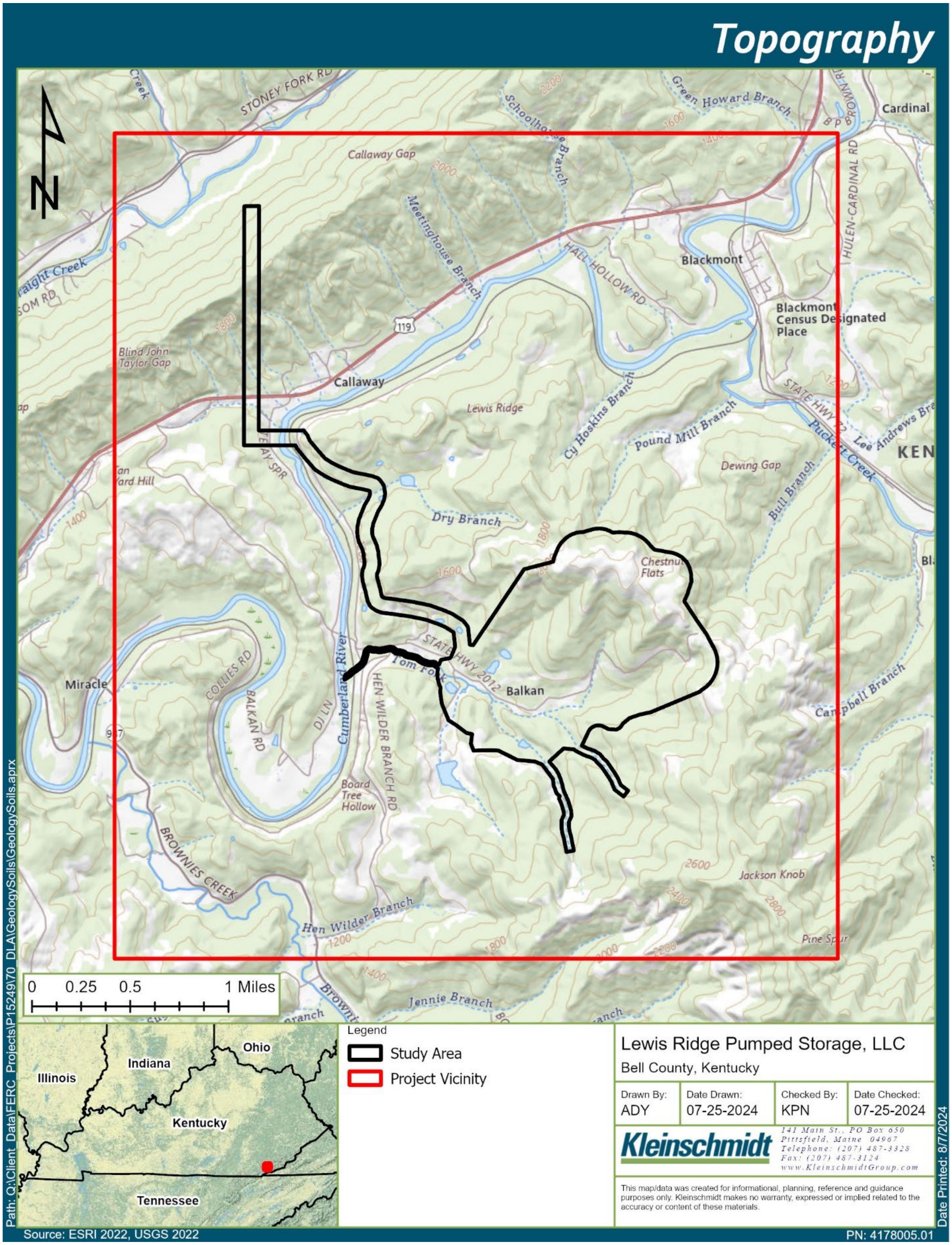
[24] Elevations are based on North American Vertical Datum of 1988 (NAVD 88).

Figure 5-17: Topography in the Project Vicinity



Lewis Ridge Pumped Storage, LLC
Bell County, Kentucky

Drawn By:	Date Drawn:	Checked By:	Date Checked:
ADY	07-25-2024	KPN	07-25-2024

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Source: ESRI 2022, USGS 2022

PN: 4178005.01

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Date Printed: 8/7/2024

5.8.1.2 Bedrock Geology

Figure 5-18 shows the geology in the Project Vicinity and the Project Study Area. As shown, the Pikeville, Grundy, and Hyden Formations of the Breathitt Group are the most common in the Study Area, which consist of siltstone, shale, sandstone, and coal. Using the Kentucky Geologic Map interactive geologic map (KGS 2024), the Pikeville Formation (mapped as the lower part of the Mingo and upper part of the Hance Formations on historic geology maps) is the most abundant in the Project Vicinity and consists of siltstone, shale, sandstone, and coal.

Appendix H contains historic geologic maps, including a geologic map of Kentucky (USGS and the Kentucky Geologic Survey 1988), a geologic map of the Balkan Quadrangle, Bell, and Harlan Counties, Kentucky (Froelich and Tazelaar 1973), a Geologic Map of a Part of the Cumberland Gap Coal Field (USGS, Not Dated), and a Geologic Map of the Middlesboro and Part of the Bristol Quadrangles, Southeastern Kentucky (KGS 2004). In these historic geologic maps, the bedrock is primarily mapped as the Breathitt Formation.

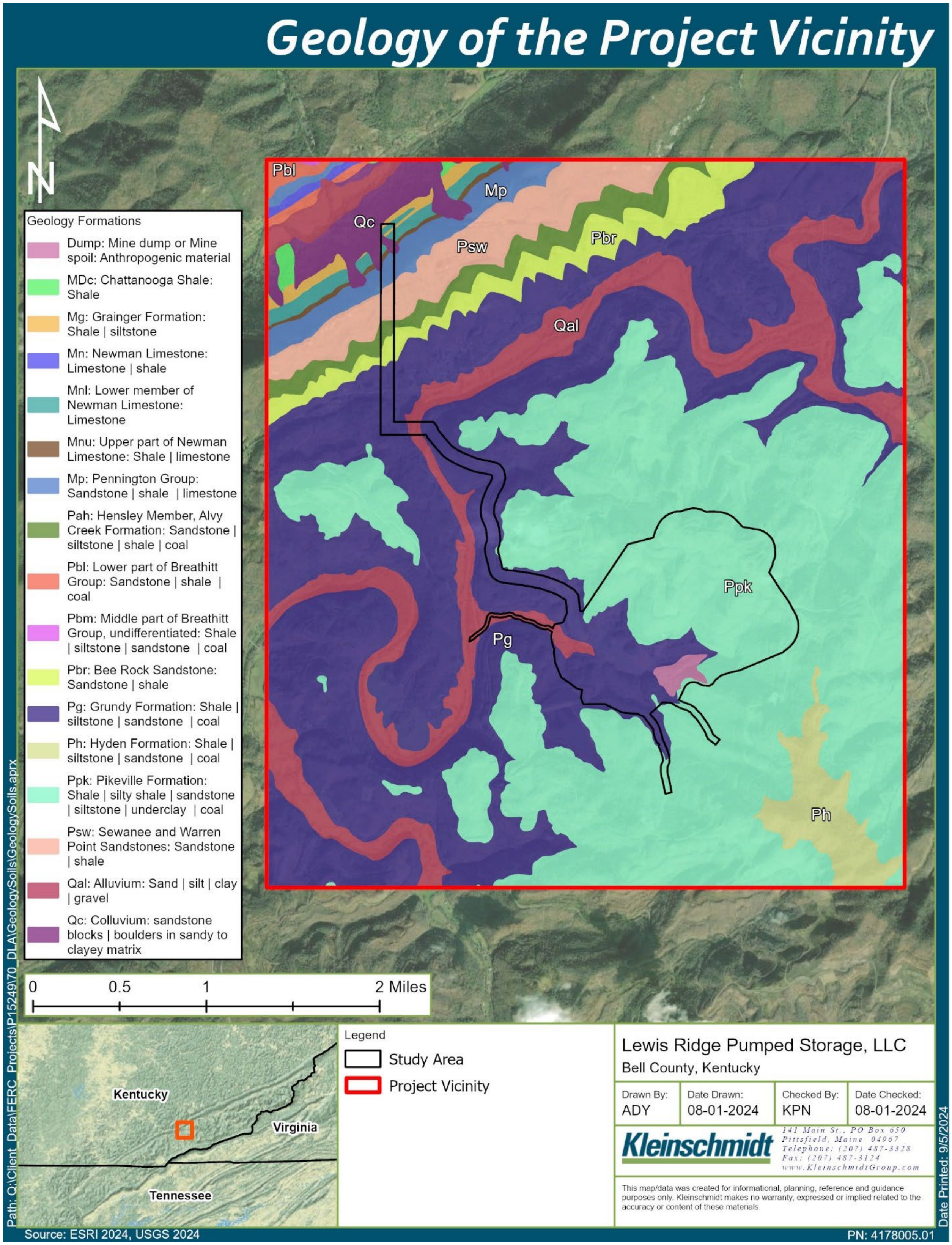
USGS and Kentucky Geologic Survey’s (KGS) Geologic Map of Kentucky (1988) confirms the presence of the upper, middle, and lower parts of the Breathitt Group. The Breathitt consists of sandy shale and coarse ferruginous sandstone with occasional coal seams. Members of the Pikeville Formation (also known as the Mingo Formation and the Hance Formation in historic maps) are located within the Breathitt Group.

A general stratigraphic section includes the Mingo formation, underlain by the Hance and Lee formations. The lithology surrounding the coal seams consists of sandstone, siltstone, and shale. The shale and siltstone are generally medium to dark gray, locally dark gray to black with ironstone nodules common in the lowest third of the unit, interbedded with thin silty sandstone beds. Sandstones are generally light to medium gray, fine to coarse grained, poorly sorted, and generally cross bedded (Nally & Hamilton Enterprises, Inc. 2007).

The Mingo Formation is described as shales, sandstones, and coals. Named coal seams of the Mingo Formation identified in the Project Vicinity include the Darby coal seam, the Kellioka coal seam, and the Harlan coal seam. Both the Darby and Kellioka seams are known to have coal seam riders (more than one elevation) in the Project Vicinity.

The Hance Formation is described as mainly shale, some sandstone, and coal. Members of the Hance Formation identified in the Project Vicinity include the Mason coal seam, the Mason Rider coal seam, coal seams in the Path Fork coal zone, and coal beds in the Hance coal zone.

Figure 5-18: Geology of the Project Vicinity



5.8.1.3 Surficial Geology and Soils

The Lewis Ridge Project site has been heavily disturbed by human activities. Coal mining operations have been performed since the 1940s. From 2007 to 2008, mountain top removal (MTR) mining was performed in the vicinity of the Upper Reservoir. Both contour mining and highwall mining have been performed in multiple coals seams up until about 2017. Deep underground mining, in the Mason seam, was ongoing until 2020. The result is that large portions of the site are now indiscriminately covered in mine spoils. Therefore, the date of publication for surface geology and soils references are important as they were likely published prior to mining.

The Kentucky Geologic Map interactive geologic map (KGS 2024) identifies two soil units, alluvium and mine dump, within the Project Vicinity. These areas are also identified in Figure 5-19. The alluvium occurs primarily proximate to the Cumberland River and is described as poorly stratified, unconsolidated sand, silt, clay, and gravel. The mine dump is located in the Study Area and is described as tailings and mine waste from coal mining operations.

Soil Survey maps provided by the Natural Resources Conservation Service (NRCS) are typically the most accurate soils maps publicly available. However, published maps do not appear to reflect recent mining activities. Available NRCS maps provide value by describing typical soil types in the Project Vicinity and Study Area, and in the locations that have not been disturbed, but should be used with caution as the extents of human impacts have not been documented at this time. Previously mapped soil types in the Project Vicinity and Study Area are tabulated in Table 5-24 and Table 5-25, respectively (USDA NRCS 2022). Previously mapped soil types in the Project Vicinity and Study Area are depicted on Figure 5-19 (USDA NRCS 2022). Appendix H provides the USDA NRCS Physical Soil Properties of Bell and Harlan Counties, Kentucky, and includes a description of physical characteristics, erodibility, and erosion factors associated with each soil type.

Table 5-24: Mapped Soils in the Project Vicinity

Map Symbol	Soil Type	Acres	% of Project Vicinity
SkF	Shelocta-Kimper-Cloverlick complex, 20 to 80 percent slopes, very stony	2,220	22
ShF	Shelocta-Highsplint-Gilpin complex, 20 to 70 percent slopes, very stony	1,578	16
GtF	Gilpin-Rayne-Sequoia complex, 25 to 55 percent slopes, very stony	1,070	11
FbF	Fairpoint and Bethesda soils, 20 to 70 percent slopes, stony	879	9
HeF	Helechawa-Varilla-Jefferson complex, 35 to 75 percent slopes, very rocky	833	8
AtF	Alticrest-Totz-Helechawa complex, rocky, 20 to 55 percent slopes	535	5
Sb	Shelbiana loam, occasionally flooded	504	5
SmF	Shelocta-Kimper-Cutshin complex, 20 to 55 percent slopes, very stony	424	4
HsF	Highsplint-Cloverlick-Guyandotte complex, 35 to 75 percent slopes, very stony	408	4
Po	Pope fine sandy loam, occasionally flooded	242	2
CgF	Cloverlick-Guyandotte-Highsplint complex, 20 to 80 percent slopes, very stony	222	2
W	Water	186	2
SgE	Shelocta-Gilpin silt loams, 20 to 35 percent slopes	137	1
KrF	Kimper-Renox-Sharondale complex, very rocky, 35 to 75 percent slopes	128	1
GsD	Gilpin-Shelocta silt loams, 12 to 20 percent slopes	114	1
VrD	Varilla very stony loam, 5 to 20 percent slopes, extremely bouldery	88	1
AgB	Allegheny loam, 2 to 6 percent slopes	76	1
FbC	Fairpoint and Bethesda soils, 2 to 20 percent slopes	58	1
Du	Dumps, Mine; tailings; and Tipples	53	1

Map Symbol	Soil Type	Acres	% of Project Vicinity
UrE	Udorthents-Urban land complex, 15 to 35 percent slopes	50	1
UrC	Udorthents-Urban land complex, 3 to 15 percent slopes	38	<1
Ud	Udorthents-Urban land complex, occasionally flooded	21	<1
Ph	Philo fine sandy loam, occasionally flooded	16	<1
SeC	Shelocta channery silt loam, 6 to 12 percent slopes	15	<1
Cr	Craigsville-Philo complex, occasionally flooded	4	<1
	Total	**9,899**	

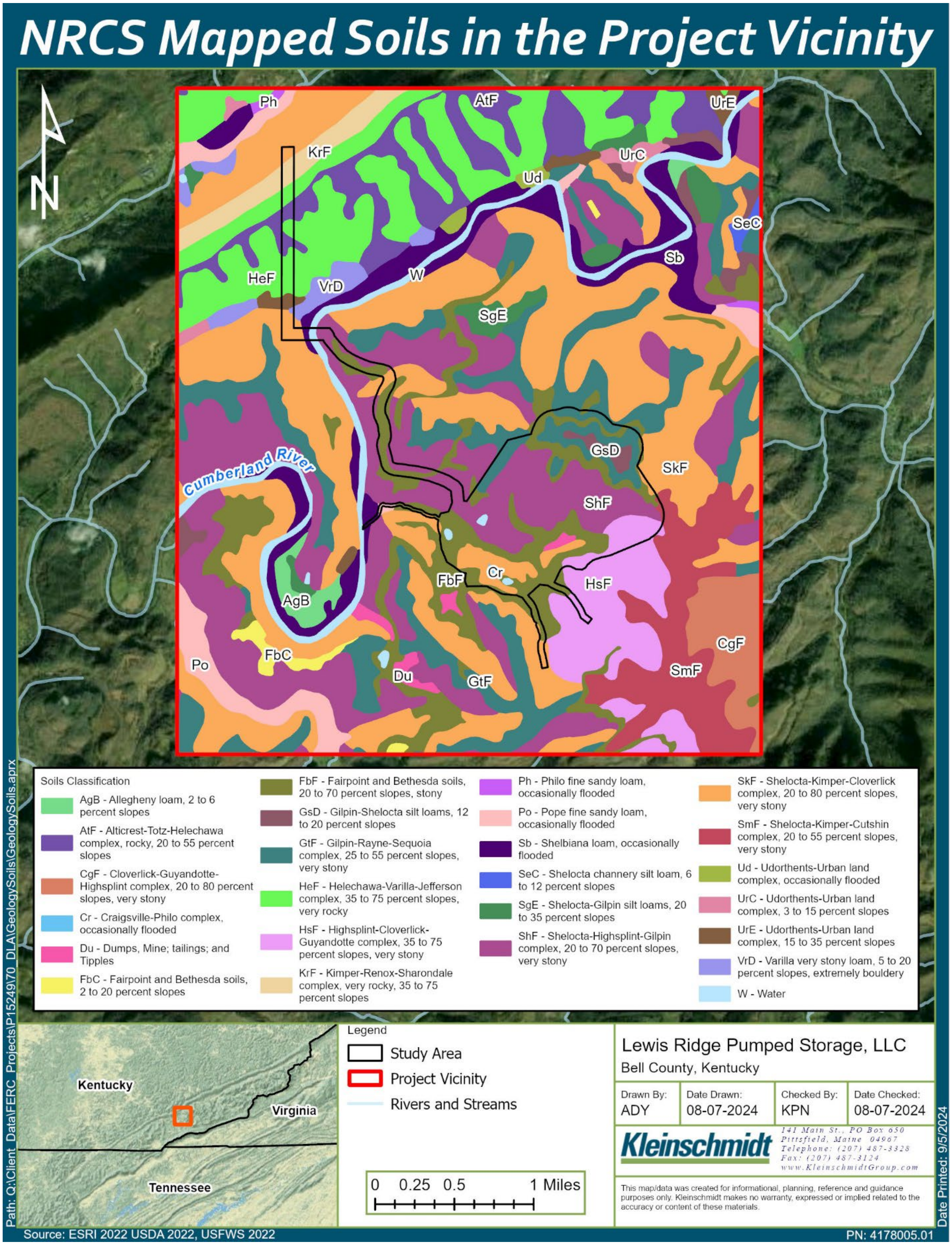
Source: USDA NRCS 2022

Table 5-25: Mapped Soils in the Study Area

Map Symbol	Soil Type	Acres	% of Study Area
FbF	Fairpoint and Bethesda soils, 20 to 70 percent slopes, stony	289	33
ShF	Shelocta-Highsplint-Gilpin complex, 20 to 70 percent slopes, very stony	275	31
GtF	Gilpin-Rayne-Sequoia complex, 25 to 55 percent slopes, very stony	88	10
SkF	Shelocta-Kimper-Cloverlick complex, 20 to 80 percent slopes, very stony	75	9
HsF	Highsplint-Cloverlick-Guyandotte complex, 35 to 75 percent slopes, very stony	52	6
GsD	Gilpin-Shelocta silt loams, 12 to 20 percent slopes	25	3
HeF	Helechawa-Varilla-Jefferson complex, 35 to 75 percent slopes, very rocky	22	3
AtF	Alticrest-Totz-Helechawa complex, rocky, 20 to 55 percent slopes	12	1
Du	Dumps, Mine; tailings; and Tipples	8	1
KrF	Kimper-Renox-Sharondale complex, very rocky, 35 to 75 percent slopes	8	1
W	Water	6	1
UrE	Udorthents-Urban land complex, 15 to 35 percent slopes	4	<1
Sb	Shelbiana loam, occasionally flooded	4	<1
Cr	Craigsville-Philo complex, occasionally flooded	3	<1
SmF	Shelocta-Kimper-Cutshin complex, 20 to 55 percent slopes, very stony	2	<1
Po	Pope fine sandy loam, occasionally flooded	2	<1
VrD	Varilla very stony loam, 5 to 20 percent slopes, extremely bouldery	<1	<1
	Total	**876**	

Source: USDA NRCS 2022

Figure 5-19: NRCS Mapped Soils in the Project Vicinity



5.8.1.4 Geological and Soil Hazards

5.8.1.4.1 Seismic Hazards

The proposed Lewis Ridge Project site is located on the northwestern margin of the Eastern Tennessee Seismic Zone (ETSZ), the primary source of seismic activity in the eastern United States. The largest recorded earthquake within the ETSZ had a magnitude of 5.1M and occurred near Sparta, North Carolina, on August 9, 2020, approximately 130 miles from the proposed Lewis Ridge Project site (USGS 2024a). The ETSZ regularly produces earthquakes with low magnitudes (less than 2.5M) with moderate quakes occurring about once per year (USGS 2020). These earthquakes have not been definitively linked to known Quaternary faults in the area (USGS 2020).

Figure 5-20 shows the seismic hazards, historical earthquakes, and Quaternary faults or fault areas within 100 miles of the proposed Lewis Ridge Project site. The types of seismic activity identified on Figure 5-18 include earthquakes, explosions, mining explosions, mine collapses, and rock bursts. Mining explosions, mine collapses, and rock bursts are all seismic hazards related to historic and current mining activities. A rock burst is defined as a violent expulsion of rock from the walls of a mine opening caused by heavy pressure on brittle rocks in deep mines where mining has deprived the rock of support on one side. A mine explosion is a sudden, intense combustion process that occurs in underground mines and surface processing facilities when flammable gas or combustible dust mixes with air and is ignited. A mine explosion releases large amounts of heat energy and pressure waves. A mine collapse, also known as mine subsidence, is when the ground surface moves due to the collapse of an underground mine. This can happen when the roof, floor, or pillars of a mine collapse.

Based on data from USGS (2024a) presented in Figure 5-18, 267 earthquakes greater than 2.5M occurred within 100 miles of the proposed Lewis Ridge Project site since 1834. This includes four earthquakes greater than 4.5M; two of these earthquakes are associated with an unknown seismic source in northern Kentucky, including the largest event which occurred 1.8 miles south-southeast of Sharpsburg, Kentucky (approximately 100 miles north-northwest of the project site) on July 27, 1980, and had a magnitude of 5.2M.

Based on data from the USGS Quaternary Fault and Fold Database (USGS 2024b) presented in Figure 5-20, there are no discrete faults of Quaternary age (<1.6 millions of years old), or younger, in the Project Vicinity and there is one "fault area" within 100 miles of the proposed Lewis Ridge Project site. Approximately 80 miles northwest of the proposed Lewis Ridge Project, there is a Quaternary fault area identified as the "Kentucky River fault system (Class B) No. 2650." This fault system is identified as a Normal-Reverse fault system, with a slip rate category of less than 0.2 millimeters/year (USGS 2024b). No recorded earthquakes with magnitudes greater than 2.5M have been associated with this fault zone (USGS 2024a).

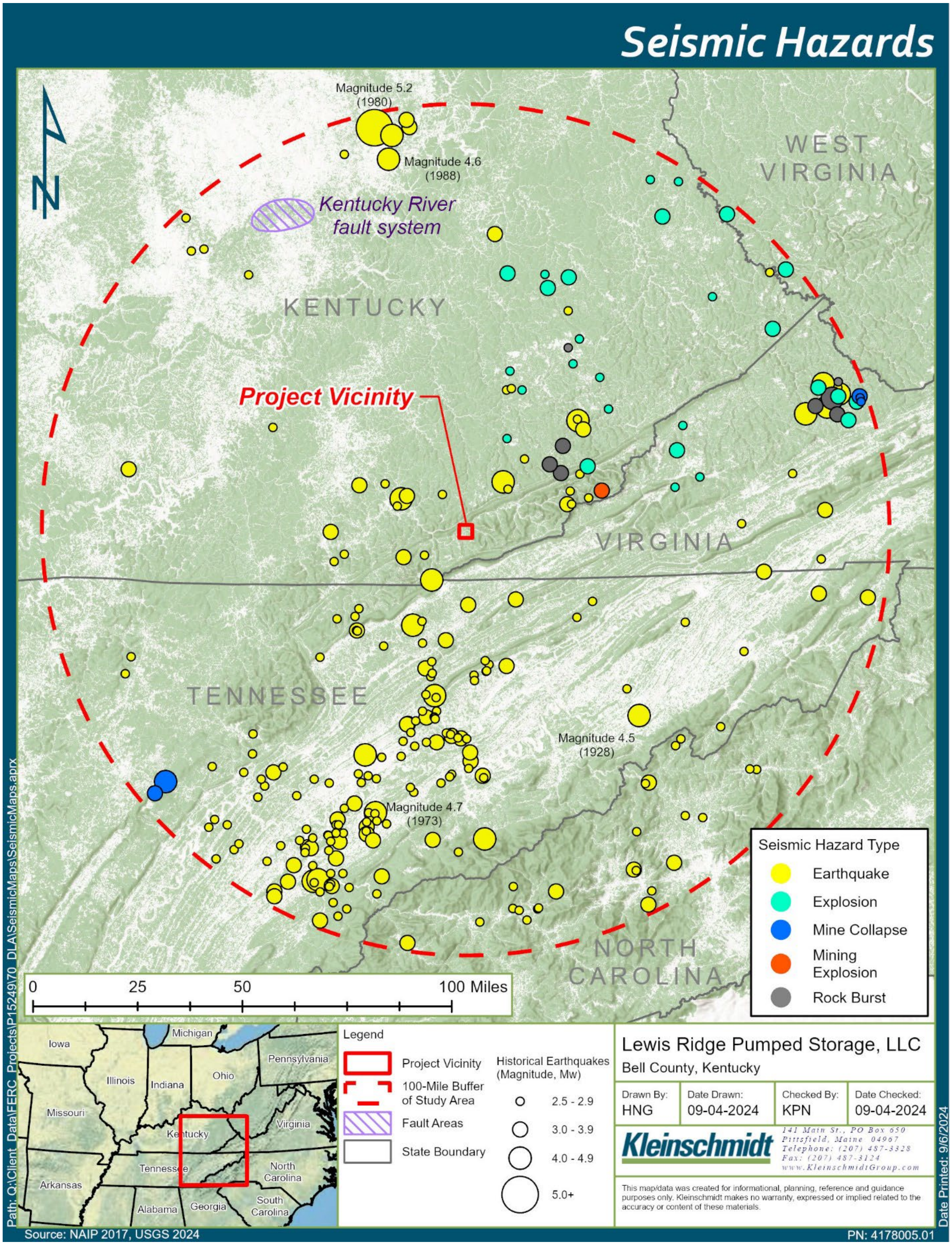
Probabilistic peak ground accelerations (PGA) for the 2,450-year, 5,000-year, and 10,000-year return period events in the vicinity are presented in Table 5-26. Calculations are for an assumed Vs30 (i.e., average shear wave velocity to a depth of 30 meters or approximately 100 feet) of 760 meters per second (2,500 feet per second). A site-specific seismic hazard analysis should be performed to verify or refine these preliminary estimates as the project concept progresses.

Table 5-26: Summary of Probabilistic Ground Motions

Return Period (Years)	PGA (g)
2,500	0.25
5,000	0.39
10,000	0.58

Source: USGS (2024c)

Figure 5-20: Seismic Hazards within 100 miles of the Study Area



5.8.1.4.2 Landslide Hazards

The Kentucky Geological Survey (KGS) developed the web-based Landslide Information Map (KGS 2024b), a compilation of landslides and landslide features mapped within the state. The dataset includes location data from recorded (historic) landslides, landslides mapped on 1:24,00-scale geologic maps from 1960 to 1978, landslide features identified from LiDAR and aerial imagery, and areas identified as susceptible to debris flows based on aerial photographs and historical records. There are multiple landslides and landslide features shown on the KGS Landslide Information Map within the Project Vicinity as shown in Figure 5-21.

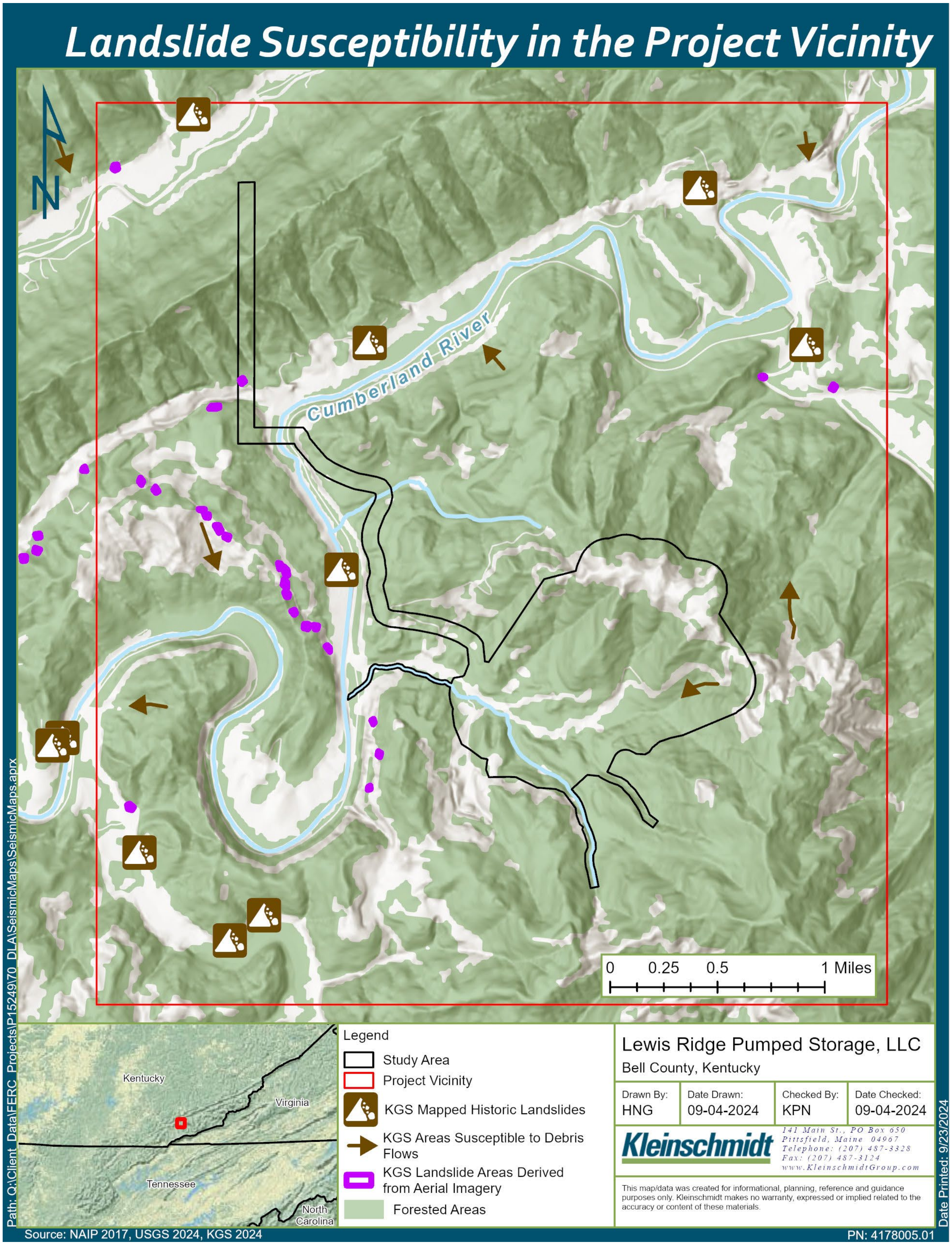
The majority of landslides and rockfalls in Kentucky occur in geologic units containing shale or in soils that develop on those formations (Crawford 2012, 2014). Shale is abundant in most parts of the state and is present within all primary geologic units at the Lewis Ridge Project site, as described in Section 5.8.1.2 Bedrock Geology (Overfield et al. 2015). Many shales absorb and hold water, causing them to weather easily, erode, and potentially create stability problems (Potter et al. 2005). Roadways constructed within the Pikeville Formation (prevalent at the Lewis Ridge Project site, including portions of the Mingo and Hance Formations), Hyden Formation, Grundy Formation, and Kope Formation require the majority of the landslide and rockfall maintenance repairs in Kentucky (Overfield et al. 2015). Notably, according to data sourced from Crawford (2023) eight landslides have been mapped in the Grundy Formation (which is a more recent stratigraphic unit name for the Hance Formation prevalent at the Lewis Ridge Project site) within 2 miles of the proposed upper and lower reservoirs, and one landslide has been mapped in the Pikeville Formation.

As described in Section 5.8.1.1, Topography, and Section 5.8.1.3, Surficial Geology and Soils, the Project Vicinity is mountainous with steep ridges. This may contribute to landslide susceptibility, as the soils above the bedrock on steep slopes may tend to be unstable resulting in soil creep and landslides. In the Project Vicinity, mine spoils have been stored or dumped in low areas including valleys and drainages. The mine spoils that have been placed without foundation preparation, compaction, or sufficient drainage are susceptible to slope movements.

Human-induced slope modification, including cut (excavating) and fill (loading) processes are common for road and building construction in steep terrains with narrow valleys in eastern Kentucky. These cuts and fills create changes in the balance of forces on a slope, which then can establish more favorable conditions for triggering landslides by heavy rainfall. Most landslides in Kentucky are rainfall-triggered, meaning that an increase in pore-water pressure (a force) occurs as rain infiltrates the soil and underlying rock. This force overcomes the strength of the soil and rock material, causing landslides (Crawford et al. 2023).

Based on the mapped landsliding surrounding the proposed Lewis Ridge Project (Figure 5-21) and published descriptions of landsliding in Kentucky as summarized above, it can be inferred that the region is susceptible to landslide activity with landslides occurring in the Project Vicinity as recently as 2019 (KGS 2024b). Ground reconnaissance, detailed on-site geologic mapping, and targeted surface geophysical and subsurface drilling investigations would be required to further assess landsliding potential at the Lewis Ridge Project site.

Figure 5-21: Recorded Landslides and Landslide Susceptibility in the Project Vicinity



5.8.1.4.3 Mining Activities

The proposed Lewis Ridge Project is located primarily on a property used for coal mining, with the exception of the interconnection line (Figure 5-22). There are active mining permits in the Project Vicinity and areas that have been reclaimed. There are six identified coal seams in the Project Vicinity. From highest to lowest elevation, the seams are Darby, Kellioka, Harlan, Upper Path Fork, Hance, and Mason. Approximate coal seam elevations at the Lewis Ridge Project are depicted on Figure 5-23. Table 5-27 provides a summary of the identified primary mine works at these coal seams in the Project Vicinity (Schnabel 2023). Drawings of the estimated mining areas of each coal seam are included in Appendix H. Additional features produced from the mining activities, including drainage corridors, sediment ponds, access roads, topsoil storage areas, and fill areas are not included in these drawings.

In their March 21, 2023, letter, Kentucky DNR reviewed the proposed Lewis Ridge Project, identified mining permits in the Study Area, and potential conflicts with existing permitted activities. Kentucky DNR noted that the proposed location of the Lewis Ridge Project has been extensively mined by both surface and underground methods, with six existing permits bonded and under the jurisdiction of Kentucky DNR. Under Kentucky's SMCRA program, permitted areas are mined and reclaimed pursuant to the approved permit application. The Kentucky DNR identified extensively mined coal seams in the locations of the proposed reservoir locations as tabulated below (Table 5-27). The existing permits bonded under Kentucky DNR jurisdiction in the location of the Lewis Ridge Project are tabulated in Table 5-29 and depicted on Figure 5-24.

In the portion of the Study Area where the proposed upper reservoir would be located, there is a large volume of mine spoils that would have to be relocated or reused as part of the project configuration (Schnabel 2023). The upper reservoir site is currently characterized by the presence of up to 70 feet of mine spoils, averaging about 47 feet thick, with a total volume of approximately 2,970,000 cubic yards that remain overlying bedrock beneath the currently proposed footprint of the upper reservoir from prior MTR mining that targeted the Darby and Kellioka coal seams. The excavated rock was presumably temporarily cast adjacent to the area of the coal seam being extracted and then placed back over the mined-out area without intentional compaction, followed by excavating, and temporarily casting aside adjacent rock to expose and extract adjacent coal. This MTR mining continued to rock underlying the largely mined-out Kellioka seam resulting in the mine spoil now present. The composition, gradation, and bulk dry density of the mine spoils are unknown pending the results of ongoing and future geotechnical investigations (AECOM 2024).

In the portion of the Lewis Ridge Study Area where the proposed lower reservoir would be located, geophysical investigations, review of historic aerial imagery, and field reconnaissance observations carried out by Schnabel in 2023 indicated that large portions of the valley have been mined and that much of the current topography in the lower reservoir consists of mine spoils placed as part of site reclamation. The Mason seam was mined on the lower valley slopes and locally beneath the valley floor, so there is potential for highwall and auger mine adits to exist along the valley floor. Associated adits are likely covered with mounds of mine spoils and would need to be identified and plugged prior to reservoir filling due to the potential impacts of fluctuating water levels (Schnabel 2023). Most of the mine spoils at the lower reservoir site are inferred as redistributed excavated overburden and rock from contour mining of the Mason coal seam, possibly intermixed with some spoils from contour mining and MTR higher on Lewis Ridge, especially in the tributary drainages in the valley associated with Tom Fork. Based on ongoing interpretation of available mine maps and geologic reconnaissance, it appears that mine workings of the Mason coal seam are present locally at the periphery of the reservoir footprint in the north tributary of Tom Fork, locally within the floor of the reservoir area near the confluence of Tom Fork and northern tributary, under the southeastern floor of the reservoir footprint, and at the right abutment of the proposed dam footprint. There are underground Mason coal seam workings roughly 600 feet south of the left abutment contact with the currently configured lower reservoir dam. There is also an apparent underground Mason coal seam workings portal in the southeastern rim of the reservoir. (AECOM 2024).

The nature of highwall mining at several coal seams/elevations have left the slopes between the proposed upper and lower reservoirs in a sawtooth shape. As a result, the proposed penstocks would pass over residual soil slopes, rock knobs left as artifacts of highwall benches, and the uncompacted fill used to reclaim/fill the highwall benches. These conditions would necessitate removal of the uncompacted fill, replacement with compacted fill, and either trenching with shallow burial and cover fill over otherwise exposed penstock (i.e., shallow burial concept), or substantial support design for an exposed (i.e., above ground) concept along the penstock alignment (Schnabel 2023).

Along the proposed penstock alignments, there are known steep to nearly vertical highwall excavations that have been reclaimed by covering some or all the highwall rock face with mine spoils up to 40 or more feet deep to meet state reclamation requirements (AECOM 2024).

Table 5-27: Summary of Mined Coal Seams in the Project Vicinity

Coal Seam	Approximate Elevation[1]	Mining Type	Comments
Darby	2,180	Mountaintop Removal	This coal seam, and the materials previously located above it, have been removed over most of Chestnut Flats (the vicinity of the upper reservoir).
Kellioka	2,110	Mountaintop Removal	This coal seam, and the materials previously located above it, have been removed over most of Chestnut Flats (the vicinity of the upper reservoir). Mountaintop removal was not performed to the Kellioka in a small location at the very eastern end of the proposed reservoir.
Harlan	1,950	Deep	Room and pillar mining with no pillars pulled.
		Highwall	Auger mining (round) and highwall mining (rectangular).
Pathfork	1,660	Deep	Room and pillar mining with some pulled pillars.
		Highwall	Auger mining (round) and highwall mining (rectangular).
Hance	1,390	Deep	Room and pillar mining, with large areas of pulled pillars.
Mason	1,140	Deep	Room and pillar mining, very limited areas with pulled pillars.

Source: Schnabel 2023

[1] The approximate mine seam elevations are based on review of existing mining records provided by Rye and their consultant RESPEC Company, LLC (RESPEC 2022). Collected data were scrutinized, as mining records are known to be inaccurate at times, or do not include the level of detail needed to accurately evaluate subsurface conditions. Mining records reviewed include the elevation of mountain top removal (MTR) mining, coal contours/elevations, mining heights for each identified coal seam, highwall mine entry width, spacing and depth, and pillar configurations (Schnabel 2023).

Table 5-28: Summary of Mined Coal Seams at the Proposed Reservoir Locations

Project Feature	Coal Seam	Approximate Mined Elevation (feet)[25]	State File No.
Upper Reservoir	Harlan	1,997 to 2,000	111674, 00381-2
	Pathfork	1,664	10383-3
	Hance	1,386 to 1,445	111474
Lower Reservoir	Mason	1,120 to 1,165	11541-127
		1,109 to 1,168	08053

Source: Kentucky DNR 2023

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[25] Elevations are based on North American Vertical Datum of 1988 (NAVD 88).

Table 5-29: Summary of Existing Mining Permits Bonded Under Kentucky DNR Jurisdiction

DNR Permit No.	Permit Holder	Permit Status	Coal Seam	Coal Seam Elevation (feet)	Permit Activities
807-0339	Nally & Hamilton Enterprises, Inc.	A-1[1]	Hance	Between 1,240 and 1,300[2]	Contour and road
807-0345	Nally & Hamilton Enterprises, Inc.	P-1[3]	Hance	1,300[2]	Area and auger
807-0347	Nally & Hamilton Enterprises, Inc.	A-1[1]	Mason	Between 1,120 and 1,165[2]	Surface contour and refuse disposal
807-0353	Nally and Hamilton Enterprises, Inc.	A-1[1]	Mason	Between 1,120 and 1,165[2]	Surface contour, auger, and underground operation
807-0372	Nally & Hamilton Enterprises, Inc.	P-1[3]	Pathfork	Between 1,580 and 1,740[2]	Surface contour, area, and auger operations
807-5220	Nally & Hamilton Enterprises, Inc.	P-1[3]	Hance	1,375[2]	Contour, underground

Sources: Kentucky EEC 2024a, Kentucky EEC 2024b, Kentucky Geography Network 2024

[1] A-1 status is defined as: The permit is actively conducting mining activities (no coal removal occurring); and/or the permit has not expired, coal reserves remain, and the future possibility of coal removal still exists; and/or all non-producing facilities will remain in A1 status until expiration of the permit (this includes preparation plants, haul roads, and impoundment facilities).

[2] Mine Seam elevations were obtained from most recently issued Mine Reclamation Plan (MRP) Map for each permit.

[3] P-1 status is defined as: Reclamation has been completed for all disturbed areas in accordance with 405 KAR 10:040 Section 2 (4)(a). The Permittee has submitted a request to the Cabinet for Phase I bond release and the request has been approved by the Cabinet. If the permit is incrementally bonded, EACH bonded increment that is disturbed must meet and be approved to Phase I standards prior to the ENTIRE permit being assigned P1 status.

Figure 5-22: Mined Areas Near the Lewis Ridge Project Study Area

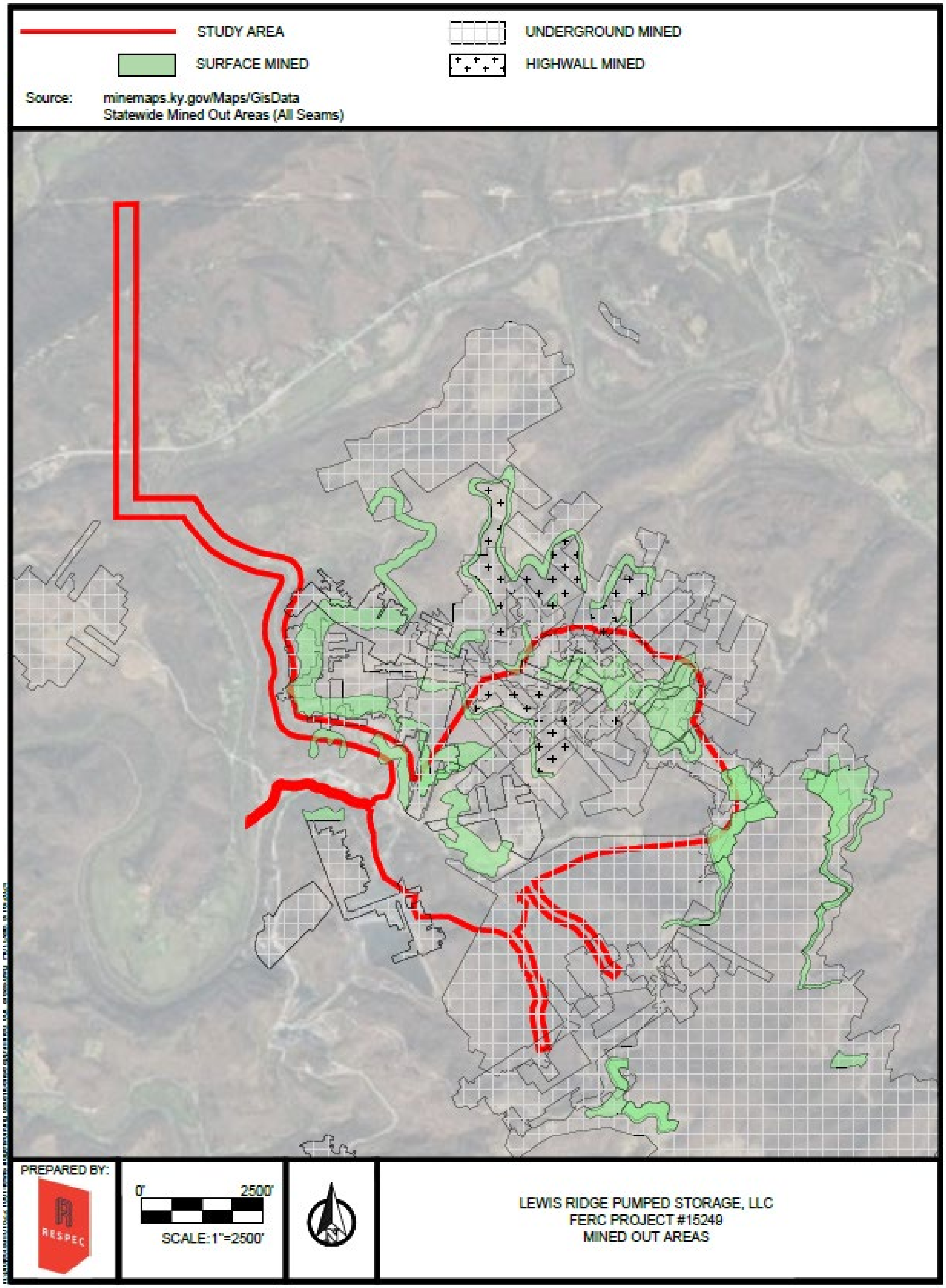
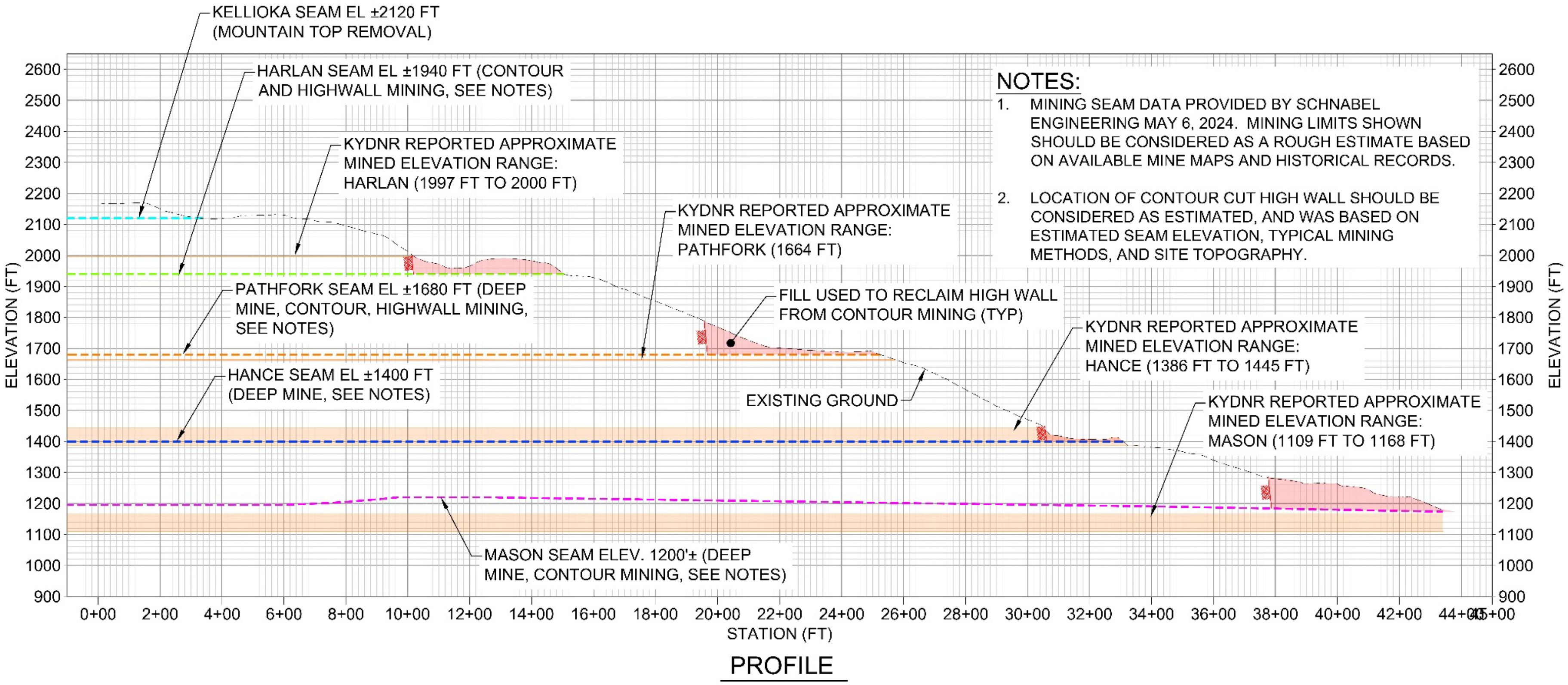


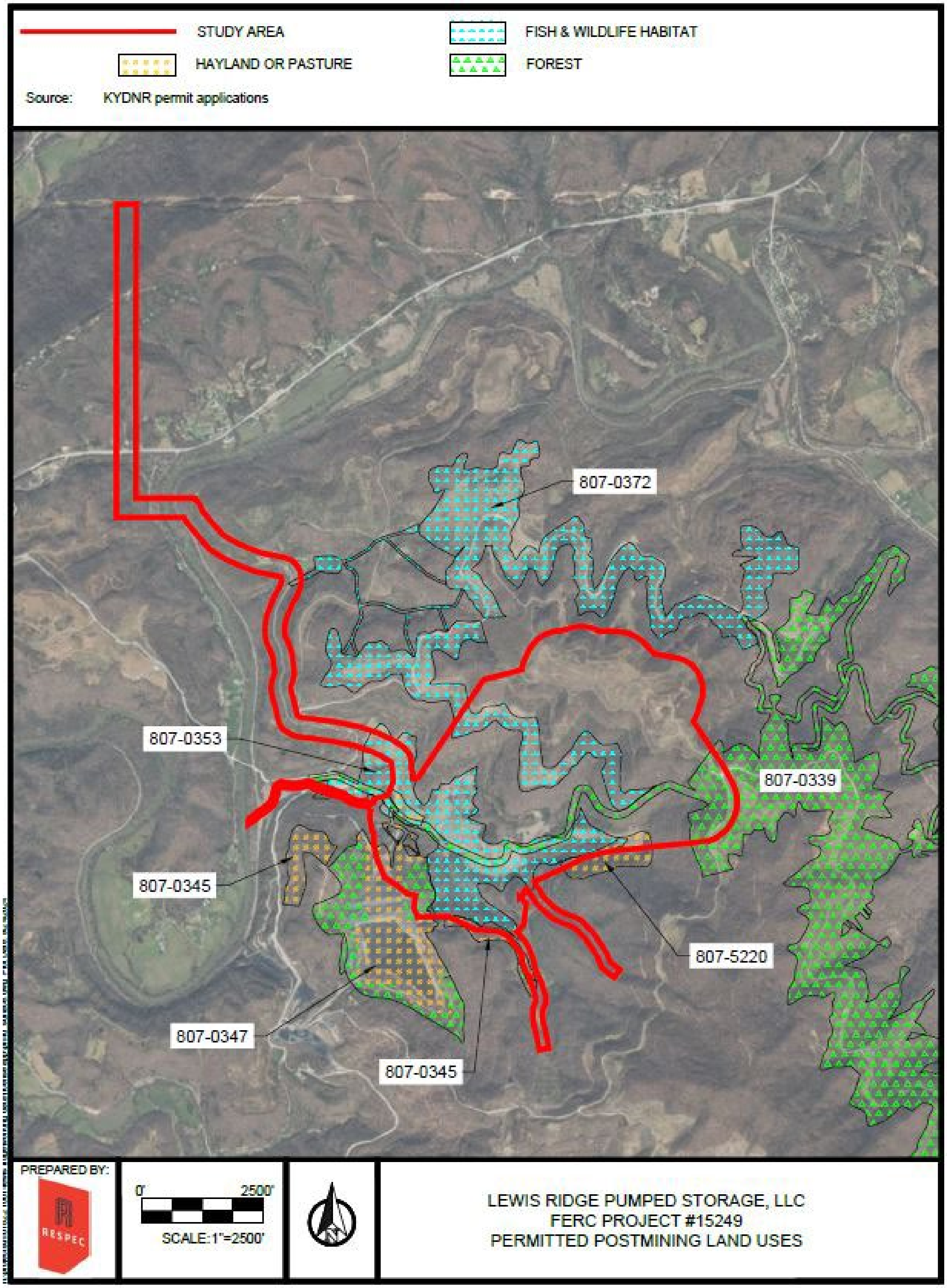
Figure 5-23: Coal Seam Elevations at the Lewis Ridge Project



NOTES:

1. MINING SEAM DATA PROVIDED BY SCHNABEL ENGINEERING MAY 6, 2024. MINING LIMITS SHOWN SHOULD BE CONSIDERED AS A ROUGH ESTIMATE BASED ON AVAILABLE MINE MAPS AND HISTORICAL RECORDS.
2. LOCATION OF CONTOUR CUT HIGH WALL SHOULD BE CONSIDERED AS ESTIMATED, AND WAS BASED ON ESTIMATED SEAM ELEVATION, TYPICAL MINING METHODS, AND SITE TOPOGRAPHY.

Figure 5-24: Existing Mining Permits Bonded under Kentucky DNR Jurisdiction



5.8.2 Potential Impacts of the Proposed Lewis Ridge Project

Lewis Ridge Project construction or final design could be complicated by historic mining features in the Project Vicinity. These mining features include the drainage corridors, sediment ponds, hollow fill or mine spoil areas, and disturbed areas with previous backfilled surficial or underground mines.

Constructing the Lewis Ridge Project over historic mining features would increase the risk for potential subsidence, surface tensile strain and associated cracking, and/or instability. One area of an underground mine for the Hance coal seam was mined in 1982 and abandoned in February 1986 by Brownies Creek Colleries, Inc. This mine used the room and pillar mining method, and it is known that many of the pillars in the deep mine have been robbed, leaving little or no roof support. This area is underneath a current hollow fill area, identified as Hollow Fill #1. There are no reports or observations of ground surface subsidence in this area, but it is still possible subsidence of these mined areas with little roof support could occur in the future. The hard rock sandstone occurring above the deep mined areas may be a factor in preventing or reducing subsidence (Nally & Hamilton Enterprises, Inc. 2010). In order to determine the stability of the hollow fill on top of some of these areas, Nally & Hamilton Enterprises, Inc. performed stability analyses for scenarios considering maximum subsidence (thickness of the deep mine seam) and the analyses indicated the fill would be stable. Construction of a new project in the area, however, may possibly disturb this fill or hard rock causing future subsidence in this area. Construction activities in other areas of the Lewis Ridge Project could also potentially disturb areas underlain by similar conditions and cause subsidence.

The Lewis Ridge Project may be subject to potential reservoir leakage/flow through fractures in the rock without appropriate geotechnical design and foundation treatment. Groundwater flow in this region occurs primarily through fractures and openings in the rock (e.g., joints, faults) or along bedding planes. Blasting due to the mining activities in the area has broken up the strata over and under the coal seams, opening more fractures and increasing the permeability of the surrounding material. There are also known locations and the potential for surface contour mining having created highwall access for underground auger or other mine adits to exist along the valley floor at the proposed lower reservoir location. Associated adits are likely covered with mounds of mine spoils as reclamation cover and would need to be identified and plugged prior to reservoir filling due to the potential impacts of fluctuating water levels (Schnabel 2023). LRPS proposes to line the upper reservoir and the upstream face (eastern side) of the lower reservoir dam and reservoir footprint to address these concerns.

According to available historic boring logs and recent geologic reconnaissance, there are varying thicknesses/volumes of overburden in the proposed Lewis Ridge Project area. Overburden within the Study Area consists of mine spoils, native alluvium, and colluvium. Construction of a perimeter dam to create the upper reservoir impoundment would require significant volumes of suitable aggregate (gravel to cobble size rock) for hardfill (cemented granular earth/rock fill) and/or an alternative roller compacted concrete dam and associated hydraulic structures. Development of local quarry and borrow areas to supply aggregate and earthfill for construction of the upper and lower reservoir impoundments, respectively, would require excavation of suitable material. For the upper reservoir, this could include significant mass rock excavation involving drilling and blasting at quarry site(s) and the at the foundation and floor of the upper dam and reservoir of the Lewis Ridge Project. The Lewis Ridge Project would also require adequate subgrade foundation conditions with appropriate treatment (over excavation and replacement, slush grout, dental concrete, grouting, etc.) to support the proposed structures.

5.8.3 Agency Consultation and Applicant Recommendations

5.8.3.1 Agency Consultation

Documentation of consultation is provided in Appendix A. Consultation specific to geological and soil resources is summarized below.

LRPS conducted a meeting with the Kentucky Resource Council on September 13th, 2022. During the September 13, 2022 meeting, the Kentucky Resource Council expressed concerns regarding site stability and existing fill and provided recommendations regarding Lewis Ridge Project feature locations as it related to site stability.

LRPS filed a NOI and PAD to seek an original license for the Lewis Ridge Project on October 21, 2022. On November 23, 2022, USEPA commented on the NOI and PAD providing recommendations and considerations for FERC to include in its draft NEPA document. USEPA requested inclusion of the results from geotechnical investigations and plans for the disposal of contaminated materials. Specifically, USEPA recommended considering other projects in the area that may need fill material such as old mines, roads, and superfund sites.

LRPS held a Joint Agency and Public Meeting and Site Visit on January 25, 2023. Existing geological and soil resources information from the PAD was presented at the JAM. During the meeting, discussion occurred with Kentucky DNR regarding deep mining that has occurred in the area and conducting a breakthrough analysis.

LRPS distributed a Draft Study Plan on June 13, 2024 and a Revised Study Plan with FERC on August 16, 2024. The study plan did not include studies related to geological and soil resources; however, LRPS is conducting extensive geotechnical studies outside of the FERC licensing process, including test pits, geophysical seismic refraction surveys, and geophysical seismic Multichannel Analysis of Surface Waves surveys, to assess and provide information to support design of geotechnical measures to address stability at the Lewis Ridge Project site. A summary of some of the findings from geological reconnaissance and geophysical investigations completed for the Schnabel 2023 Preliminary Feasibility Report is included in Section 5.8.1.4.3.

The Kentucky DEP submitted comments on April 6, 2023 (following the Joint Agency and Public Meeting) and on July 9, 2024 (following the distribution of the Draft Study Plan). In the comments, the Kentucky DEP provided state permitting information (discussed in Section 2.9). In the April 6, 2023 comments, the Kentucky DEP attached comments from the Kentucky DNR related to implementation of the SMCRA through Kentucky's Revised Statues (KRS) 350.020. Kentucky DNR provided details on three permits bonded under Kentucky DNR jurisdiction providing additional information on underground operations beneath the upper and lower reservoirs. Kentucky DNR expressed concern with the potential of breakthrough due to underground mine works, specifically with the approximate elevations of the Harlan Coal Seam in the location of the proposed upper reservoir and the Mason Coal Seam in the location of the proposed lower reservoir.

5.8.3.2 Applicant Recommendations

LRPS proposes to implement the following studies and PM&E measures to minimize impacts on geological and soil resources:

- **Erosion and Sediment Control Plan:**
    - LRPS proposes to develop and implement an Erosion and Sediment Control Plan with the purpose of limiting potential for impacts from soil erosion and sedimentation during Lewis Ridge Project construction. The Erosion and Sediment Control Plan would be filed with the Commission after license issuance and implemented immediately prior to construction. The Erosion and Sediment Control Plan would include:
        - Specific erosion prevention and control measures based on state recommended BMPs to be implemented prior to permanent stabilization of the site. Measures to avoid or minimize sediment transport may include silt fences, hay bales, etc.
        - Provisions to limit the amount of disturbed ground to the extent possible. The Vegetation Management Plan (described in Section 5.5.3) will be followed.
- **Landslide Mitigation Plan**
    - LRPS proposes to develop and implement a Landslide Mitigation Plan with the purpose of limiting potential for landslides during Lewis Ridge Project construction. The Landslide Mitigation Plan would be filed with the Commission after license issuance and implemented immediately prior to construction. The Landslide Mitigation Plan would include:
        - Special procedures and BMPs to be implemented during the construction and post-construction periods to mitigate landslide occurrence.
        - Basic mitigation strategy areas to protect against landslides and slope instability during construction such as appropriate grading controls, natural and/or cut slope stabilization, drainage improvement, and erosion and runoff control.
        - Review of landslide susceptibility of geologic soils and rock units in the Study Area.
        - A summary of slope maintenance and monitoring procedures.

- **Breakthrough Analysis**
    - Based upon the provided dimensions of both reservoirs, the Kentucky DNR has concerns related to the potential of breakthrough via the underground mine works. The Kentucky DNR requested that a breakthrough analysis be conducted. The breakthrough analysis would be performed in general accordance with Section 8.4.4 of the Engineering and Design Manual - Coal Refuse Disposal Facilities (MSHA 2010). This manual defines a mine breakthrough as an area where the load imposed by the overburden and impoundment or deterioration due to weathering, degradation or seepage forces causes collapse of overburden strata and uncontrolled release of fluid fine coal refuse and water into mine workings and beyond. This analysis is meant to calculate a factor of safety for mine breakthrough potential for a coal seam with mine working extending beneath all or a portion of an impoundment pool. Breakthrough analyses for both the upper and lower reservoirs will be completed and filed with the FLA.
- **Subsidence Analysis**
    - A preliminary subsidence analysis was performed at the upper reservoir by Schnabel in 2023 to characterize potential subsidence and strain beneath and at the subgrade of the upper dam and reservoir. The Surface Deformation Prediction System software (developed by researchers at Virginia Tech) was used to evaluate the range of possible subsidence and strain in the foundation of the upper dam and reservoir.
    - LRPS proposes to develop and implement additional analyses on potential subsidence at the upper and lower reservoirs, penstock alignment, and powerhouse locations. Additional subsidence analyses will be performed prior to submittal of the FLA, with results of the analyses integrated into field investigations. These analyses will be updated as additional data are collected, including borehole data that will characterize the current condition of subsurface workings.

5.8.4 References

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5.9 Recreational Resources (18 CFR § 4.41 (f)(7))

5.9.1 Existing Environment

5.9.1.1 Recreation at the Project

There are no existing recreation sites in the Project Study Area and there are no public recreation sites in the Project Vicinity. The Project Study Area and much of the Project Vicinity includes land with active and reclaimed mining operations. Due to industrial use of the land at the proposed Lewis Ridge Project site, public access on this privately owned property is restricted for public safety and recreation is not permitted.

5.9.1.2 Protected River Segments, National Trails System, and Wilderness Areas

There are no river segments in the Project Vicinity that have been designated for inclusion in the National Wild and Scenic River System (NPS 2024a). Kentucky has a Wild Rivers Program which was established by the Kentucky Wild Rivers Act of 1972 and is administered by the Office of Kentucky Nature Preserves. A 16.1-mile-long segment of the Cumberland River from Summer Shoals to the backwaters of Lake Cumberland, located approximately 84 river miles downstream from the Project Vicinity, is designated by Kentucky as a Wild River. Martins Fork from Kentucky Highway 987 to the eastern boundary of Cumberland Gap National Park is a state designated Wild River; this reach is approximately 8 miles from the proposed Lewis Ridge Project. There are no state-protected river segments in the Project Vicinity. (Kentucky EEC 2024a).

There are no lands included in the National Trails System, nor are there lands designated as, or under study for inclusion as, a Wilderness Area in the Project Vicinity (NPS 2024b, Southern Appalachian Wilderness Stewards 2024).

5.9.1.3 Recreation in the Region

The Upper Cumberland River supports recreational water activities including fishing, canoeing, and kayaking. There is an Upper Cumberland River public access site called the Varilla Ramp located downstream from the Project Vicinity, approximately 3 miles from the Lewis Ridge Project. The Varilla Ramp includes a boat ramp and a small, gravel parking area for approximately eight vehicles. The Varilla Ramp is used for bank anglers, wade fishing, and as a put-in for canoes and kayaks. The Varilla Ramp is managed by the Kentucky DFWR. The Kentucky DFWR lists a river mile stretch of 13.8 miles of the Upper

Cumberland River with the Varilla Ramp being the put-in access point, and the 4 Mile Ramp located just north of Pineville being the take-out location. The Kentucky DFWR does not list any boating sections on the Upper Cumberland River further upstream of the Project Vicinity. The Varilla Ramp is shown in Figure 5-25 (Kentucky DFWR 2024a).

Figure 5-25: Varilla Ramp

Source: Kentucky DFWR 2024a

There are numerous recreational opportunities in Eastern Kentucky in the region surrounding the proposed Lewis Ridge Project. Regional parks include Cumberland Gap National Historic Park, Pine Mountain State Resort Park, Kentucky Ridge State Forest and Wildlife Management Area, Daniel Boone National Forest, and Cumberland Falls State Resort Park.

Cumberland Gap National Historic Park is located approximately 10 miles south of the proposed Lewis Ridge Project. The park is located at the borders of Kentucky, Tennessee, and Virginia and consists of approximately 24,000 acres and offers 85 miles of hiking trails, camping, scenic views, unique geologic sandstone formations, and underground caverns (NPS 2024c). Cumberland Gap National Historic Park is managed by the National Park Service (NPS) (NPS 2024c). The Pine Mountain State Scenic Trail is currently being developed and once completed, will traverse 120-miles from the Breaks Interstate Park to the Cumberland Gap National Historical Park (Kentucky State Parks 2024b).

Pine Mountain State Resort Park is located approximately 10 miles west of the Lewis Ridge Project site. The Pine Mountain State Resort Park overlooks the Kentucky Ridge State Forest and offers lodging, hiking trails, and golf. The park is managed by the state and was Kentucky's first state park. (Kentucky State Parks 2024c).

Kentucky Ridge State Forest, located approximately 15 miles west of the Lewis Ridge Project site, consists of over 15,000 acres and contains the Pine Mountain State Resort Park. Kentucky Ridge State Forest is located on the south side of Pine Mountain and the north side of Log Mountain, encompassing Little Clear Creek Valley as well as Chenoa Lake. The forest is open to public hunting fishing, primitive camping, and hiking, and is managed by the state. (Kentucky EEC 2024b).

Daniel Boone National Forest, located approximately 40 miles west and northwest of the Lewis Ridge Project site, consists of more than 708,000 acres of national forest system lands across 21 counties in eastern Kentucky. Daniel Boone National Forest has over 600 miles of trails and is home to two federally recognized wilderness sites and more than 250 recreation sites. Recreation activities include hiking, hunting, camping, picnicking, off-highway vehicle riding, and fishing. Daniel Boone National Forest is managed by the United States Forest Service (USFS) (USFS 2024).

Cumberland Falls State Resort Park is located approximately 45 miles west of the Lewis Ridge Project site. The park is managed by Kentucky State Parks. Within the park is Cumberland Falls, a 125-foot-wide waterfall on the Cumberland River. In addition to camping, there is lodging available at the park. The park provides opportunities for recreation including hiking, fishing, canoeing, and picnicking (Kentucky State Parks 2024a).

Boone's Ridge is a tourism center currently under development approximately 3 miles southwest of the Lewis Ridge Project site. Boone's Ridge will include an 81,000 square foot complex called Trailblazer's Hall, which will include a restaurant, theater, gift shop, and a museum exhibit hall. Additional recreation features such as nature trails, playground, zoo, and gondola are proposed. (Boone's Ridge 2024).

5.9.2 Potential Impacts of the Proposed Lewis Ridge Project

The Lewis Ridge Project interconnection line would cross Pine Mountain ridge, which is the same ridge along which the Pine Mountain State Scenic Trail is planned to be developed (Kentucky State Parks 2024b). The Applicant is not aware of planning documents or a timeline regarding the development of the trail in this area. There are two other utility line crossings across the Pine Mountain ridge less than 1 mile away from the proposed Lewis Ridge Project crossing. As there is currently no public trail in the segment and no planned trail development in the segment in the near future, the Applicant does not anticipate impacts to the trail during Lewis Ridge Project construction. The Applicant does not anticipate that the interconnection line would interfere with the potential planned use or development of the trail.

The Applicant anticipates no other impacts to recreation resources due to construction or operation of the Lewis Ridge Project. Recreation does not occur in the Lewis Ridge Project Study Area, nor is future recreation use expected, as public access is restricted for public safety. There are no public recreation sites in the Project Vicinity. No studies related to recreation were requested and no PM&E measures pertaining to recreation resources are proposed at the Lewis Ridge Project. For these reasons, the Lewis Ridge Project is not anticipated to directly or indirectly impact recreation in the Lewis Ridge Project Study Area.

5.9.3 Agency Consultation and Applicant Recommendations

5.9.3.1 Agency Consultation

Documentation of consultation is provided in Appendix A. No comments or requests specific to recreational resources have been received.

5.9.3.2 Applicant Recommendations

Recreation is not permitted in the proposed Lewis Ridge Project area as public access is restricted for public safety due to the industrial use of the land, including active and reclaimed mining operations. As such, LRPS is not proposing PM&E measures related to recreation resources.

5.9.4 References

Boone's Ridge. 2024. Available online: https://boonesridge.com/#home Accessed: September 2024.

Kentucky Department of Fish and Wildlife Resources (Kentucky DFWR). 2024a. Upper Cumberland River. Available online: https://fw.ky.gov/Fish/Pages/Upper_Cumberland.aspx Accessed: August 2024.

Kentucky Energy and Environment Cabinet (Kentucky EEC). 2024a. Kentucky Wild Rivers Program. Available online: https://eec.ky.gov/Nature-Preserves/conserving_natural_areas/wild-rivers/Pages/default.aspx Accessed: July 2024.

Kentucky EEC. 2024b. Kentucky Ridge State Forest. Available online: https://eec.ky.gov/Natural-Resources/Forestry/ky-state-forests/Pages/Kentucky-Ridge-State-Forest.aspx Accessed: August 2024.

Kentucky State Parks. 2024a. Cumberland Falls State Resort Park. Available online: https://parks.ky.gov/corbin/parks/resort/cumberland-falls-state-resort-park Accessed: August 2024.

Kentucky State Parks. 2024b. Pine Mountain State Scenic Trail. Available online: https://parks.ky.gov/explore/pine-mountain-state-scenic-trail-7826. Accessed: August 2024.

Kentucky State Parks. 2024c. Pine Mountain State Resort Park. Available online: https://parks.ky.gov/parks/find-a-park/pine-mountain-state-resort-park-7799#things-to-do. Accessed: August 2024.

National Park Service (NPS). 2024a. National Wild and Scenic Rivers System. Available online: https://www.rivers.gov/kentucky.php Accessed: August 2024.

NPS. 2024b. National Trails System. Available online: https://www.nps.gov/subjects/nationaltrailssystem/national-scenic-trails.htm Accessed: August 2024.

NPS. 2024c. Cumberland Gap National Historical Park. Available online: https://www.nps.gov/cuga/planyourvisit/things2do.htm Accessed July 31, 2024.

Southern Appalachian Wilderness Stewards. 2024. Available online: https://www.wildernessstewards.org/kentucky Accessed: July 2024.

United States Forest Service (USFS). 2024. Daniel Boone National Forest. Available online: https://www.fs.usda.gov/dbnf Accessed: August 2024.

5.10 Aesthetic Resources (18 CFR § 4.41 (f)(8))

5.10.1 Existing Environment

Bell County, Kentucky, includes two scenic Appalachian Mountain ridges, the Pine and Cumberland Mountains, which are densely forested with streams flowing through deep valleys (Commonwealth of Kentucky 2017). The Pine Mountain ridge extends southwest/northeast from Jellico, Tennessee to Elkhorn City, Kentucky and runs through the northwest corner of the Project Vicinity (Commonwealth of Kentucky 2022). The Cumberland Mountain ridge extends west/east and is approximately 6 miles south of the Project Vicinity. Bell County is home to Kentucky's first state park (Pine Mountain State Resort Park) and the country's largest national historical park (Cumberland Gap National Historical Park). Chained Rock on Pine Mountain provides views of the city of Pineville and its surrounding mountain forests. (Kentucky Department of Tourism 2022).

Aesthetics in the Lewis Ridge Project Study Area consist of previously disturbed lands (including previous and active mining facilities) and surrounding mixed deciduous forests. Photos taken within the Project Vicinity are provided as Figure 5-26 through Figure 5-32. Figure 5-26 shows the site at which the upper reservoir would be located, while Figure 5-27 shows a northwestern view from the upper reservoir site. Figure 5-28 is a photo taken from the area on which the lower reservoir would be located. Figure 5-29 is a photo of Tom Fork downstream of the lower reservoir location. Figure 5-30 is a photo of Dry Branch near the proposed interconnection line location. Figure 5-31 is a photo of a previously mined area within the Project Vicinity. Figure 5-32 is a photo of a closed high wall mining operation in the Project Vicinity.

The Lewis Ridge Project would include the installation of an upper reservoir and associated dam, penstock,[26] lower reservoir and associated dam, underground powerhouse, interconnection line, and ancillary equipment. Except for the portion of the interconnection line that crosses the Pine Mountain ridge, the Lewis Ridge Project is not expected to create significant changes in the viewshed due to the existing topography and vegetation.

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[26] As currently proposed, the penstock would be located below the surface.

Figure 5-26: Upper Reservoir Site

Figure 5-27: Northwest View from the Upper Reservoir Site

Figure 5-28: Lower Reservoir Site

Figure 5-29: View of Tom Fork Downstream of Lower Reservoir Site

Figure 5-30: View of Dry Branch Near Interconnection Line Crossing

Figure 5-31: View of Previous Mining Area in Project Vicinity

Figure 5-32: Closed High Wall Mining Operation in Project Vicinity

5.10.2 Potential Impacts of the Proposed Lewis Ridge Project

The Lewis Ridge Project interconnection line would cross the Pine Mountain ridge, which is the same ridge along which the Pine Mountain State Scenic Trail is planned to be developed (Kentucky State Parks 2024b). Once the trail is developed, the Lewis Ridge Project interconnection line would cross the trail and would be visible from the trail. The Applicant is not aware of planning documents or timeline regarding the development of the trail in this stretch. There are two other utility line crossings across the Pine Mountain ridge less than 1 mile away from the proposed Lewis Ridge Project crossing.

The area surrounding the Lewis Ridge Project has a history of surface and subsurface mining and land in the area has been heavily disturbed. The surrounding area is rural and minimally developed, with limited numbers of residences within viewing distance of the proposed Lewis Ridge Project. Due to the topography and vegetation patterns of the area, there would be minimal visible alteration of the land.

5.10.3 Agency Consultation and Applicant Recommendations

5.10.3.1 Agency Consultation

Documentation of consultation is provided in Appendix A. No comments or requests specific to aesthetic resources have been received.

5.10.3.2 Applicant Recommendations

The Lewis Ridge Project is located at an area used for mining. The Lewis Ridge Project features would primarily be located in previously disturbed areas or along existing access roads. As such, LRPS is not proposing PM&E measures related to aesthetic resources.

5.10.4 References

Commonwealth of Kentucky. 2017. Bell County, Kentucky. Available online: Welcome - Bell County, Kentucky. Accessed: July 31, 2024.

Commonwealth of Kentucky. 2022. Pine Mountain State Scenic Trail. Available online: Pine Mountain State Scenic Trail - Kentucky Energy and Environment Cabinet. Accessed July 31, 2024.

Kentucky Department of Tourism (KY Department of Tourism). 2022. Chained Rock. Available online: Explore | Chained Rock (kentuckytourism.com). Accessed July 31, 2024.

5.11 Land Use (18 CFR § 4.41 (f)(9))

5.11.1 Existing Environment

The Project Vicinity includes lands generally considered as rural. The Project Vicinity includes lands which have been used for mining as well as forested lands and low-density residential areas. Major land use categories as mapped by the National Land Cover Database (NLCD) for the Lewis Ridge Project Study Area and Project Vicinity are presented in Table 5-30 and depicted on Figure 5-27. The major land use identified in the NLCD is undeveloped land, largely consisting of deciduous forest, shrub/scrub, and herbaceous land. Photos of the Project Vicinity are provided in Section 5.9.4. Wetlands in the area are discussed in Section 5.2.

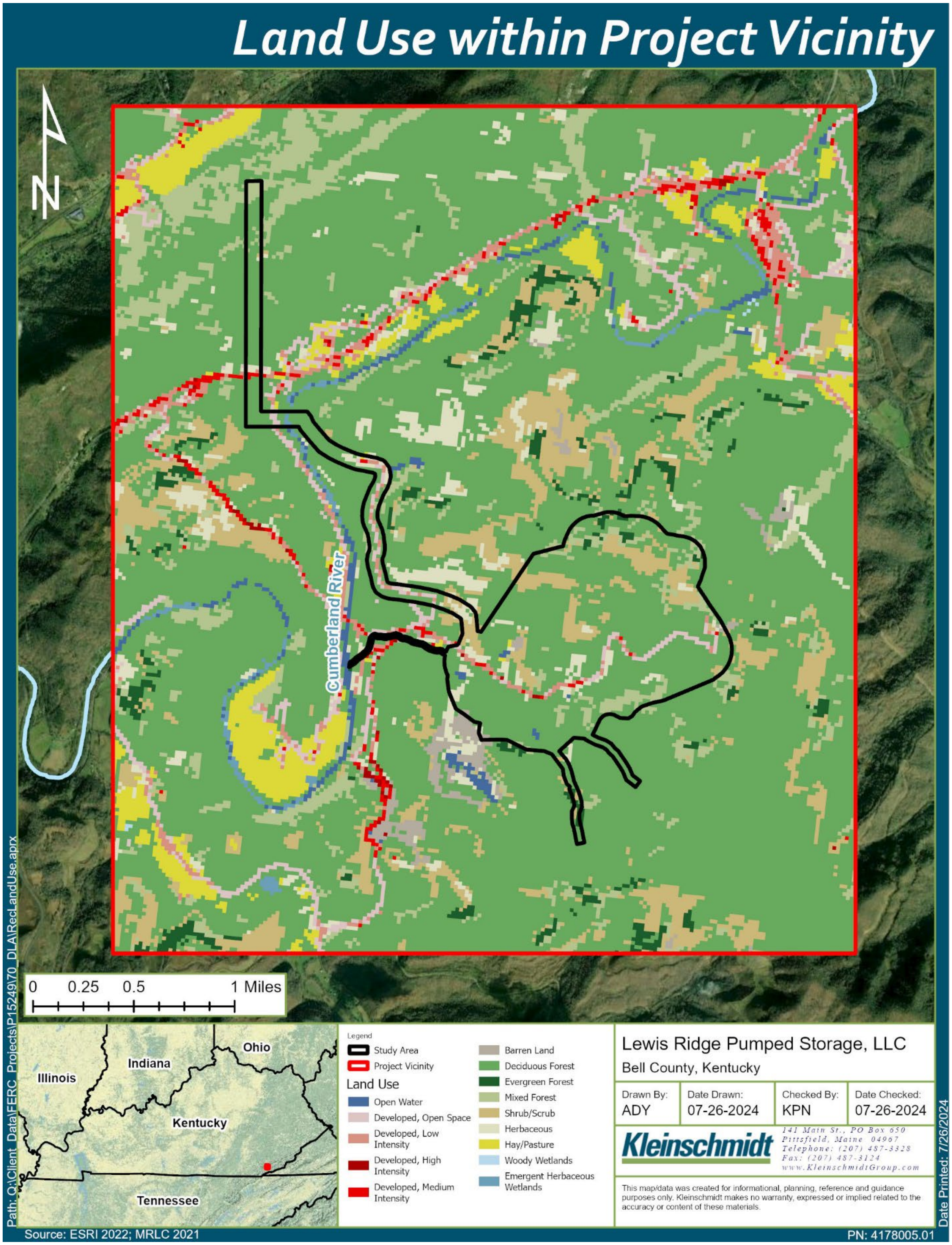
Table 5-30: Major Land Use Categories in the Project Study Area and Project Vicinity

Major Land Use	Project Study Area Acres	Project Vicinity Acres
Deciduous Forest	614.2	6,803.9
Shrub/Scrub	91.7	744.2
Mixed Forest	58.9	714.5
Hay/Pasture	1.1	366.4
Herbaceous	43.2	341.4
Developed, Open Space	25.9	247.7
Developed, Low Intensity	16.5	188.1
Evergreen Forest	9.8	160.9
Open Water	4.5	94.1
Barren Land	4.3	88.5
Developed, Medium Intensity	3.3	85.8
Emergent Herbaceous Wetlands	1.1	48.7
Developed, High Intensity	1.0	13.1
Woody Wetlands	0	2.0
Total*	**875.5**	**9,899.3**

Source: USGS 2023

* Due to rounding, the sum of the addends may not equal the total.

Figure 5-33: Land Use in the Project Vicinity



Except for portions of the preliminary interconnection line, the Lewis Ridge Project features are located at a site owned by Asher Land and Mineral and would primarily be located within areas previously disturbed for mining activities, or along existing access roads.

There are six existing mining permits issued to Nally & Hamilton Enterprises, Inc. in the proposed location of the Lewis Ridge Project that are bonded under Kentucky DNR jurisdiction (Permit Nos. 807-0339, 807-0345, 807-0347, 807-0353, 807-0372, and 807-5220). The existing permits related to the site are further discussed in Section 5.8.1.4.3 and locations of approved post mining land uses are depicted in Figure 5-24. The approved post mining land uses under Kentucky DNR Permit No. 807-0345 and Kentucky DNR Permit No. 807-0347 are pastureland and forestland. The approved post mining land use under Kentucky DNR Permit No. 807-0353 and Kentucky DNR Permit No. 807-0372 is "fish and wildlife." The approved post mining land use under Kentucky DNR Permit No. 807-0339 is forestland. The approved post mining land use under Kentucky DNR Permit No. 807-5220 is pastureland. 30 CFR § 701.5 defines the post mining land use types. Pastureland is defined as "*Land used primarily for the long-term production of adapted, domesticated forage plants to be grazed by livestock or occasionally cut and cured for livestock feed.*" Forestland is defined as "*Land used or managed for the long-term production of wood, wood fiber, or wood-derived products.*" Fish and wildlife post mining land use is defined as "*land dedicated wholly or partially to the production, protection, or management of species of fish or wildlife*." Examples of species used for revegetation of "fish and wildlife" post-mining land use types as outlined in existing mining permits include the following: permanent grass (redtop, perennial ryegrass, timothy, orchard grass), legumes (Korean or kobe lespedeza, birdsfoot trefoil, ladino clover, red clover), trees (southern red oak, pignut hickory, redbud, sugar maple, locust, short leafed pine), and temporary plants (foxtail millet, annual ryegrass, balboa rye, annual rye).

5.11.2 Potential Impacts of the Proposed Lewis Ridge Project

The construction and operation of the Lewis Ridge Project would result in temporary and permanent impacts to land use. Current land use is industrial, with forested lands, scrub/shrub, and grassland vegetation covering active and reclaimed mine lands. The proposed Lewis Ridge Project is also industrial in nature, with Lewis Ridge Project features interspersed amongst the existing forested lands, scrub/shrub, and grassland vegetation. Permanent impacts of the Lewis Ridge Project would include the conversion of existing land cover to inundated lands at the upper reservoir and lower reservoir, diversion of Tom Fork through the lower reservoir, tree clearing and ground disturbance for installation of the penstock, interconnection line, powerhouse, access roads, and ancillary facilities, and potential placement of fill generated from ground excavation. Existing mining roads would be utilized to the extent feasible to minimize ground disturbance and clearing. Amendments to the post-mining land use requirements may be required for areas under the existing Kentucky DNR mining permits impacted by the Lewis Ridge Project. LRPS will consult with the Kentucky DNR regarding alternative post mining land use types and the process to amend the permits. Additional details regarding Lewis Ridge Project construction plans and land use changes will be included in the FLA.

During construction, land would also be temporarily impacted. Temporary construction impacts related to land use are anticipated to include vegetation clearing, ground disturbance, and temporary installation of staging and laydown areas. Temporary access roads also may be required. Restoration and revegetation in temporarily impacted areas will be described in the Vegetation Management Plan. The FLA will include additional information on temporary impacts from land-disturbing construction activities as construction plans are further developed.

5.11.3 Agency Consultation and Applicant Recommendations

5.11.3.1 Agency Consultation

Documentation of consultation is provided in Appendix A. Consultation specific to land use is summarized below.

LRPS held a Joint Agency and Public Meeting and Site Visit on January 25, 2023. Existing land use information from the PAD was presented at the Joint Agency and Public Meeting. Discussion occurred with Kentucky DNR regarding post-mining land use commitments/ mine reclamation requirements associated with existing permits at the Lewis Ridge Project site under Kentucky DNR jurisdiction.

The Kentucky DEP submitted comments on April 6, 2023 following the Joint Agency and Public Meeting. In their comments, the Kentucky DEP attached comments from the Kentucky DNR related to implementation of the SMCRA through Kentucky's Revised Statues (KRS) 350.020. Kentucky DNR provided details on three permits bonded under Kentucky DNR jurisdiction highlighting potential conflicts related to sediment control, elimination of highwall to approximate original contour, and implementation of the approved post mining land use. In addition, the Kentucky DEP identified an underground storage tank (UST) and state superfund site within the area. The Kentucky DEP Superfund Branch manages sites with known or suspected releases of hazardous substances, petroleum pollutants, or contaminants into the environment that are not specifically regulated by other branches. The identified state superfund site resulted from a diesel fuel and waste oil spill on March 8, 2007. The site was documented and brought into compliance, successfully meeting Option A (No Further Action) cleanup requirements in December 2007. The identified UST is outside of the Study Area and it is not anticipated to be impacted by the Lewis Ridge Project. LRPS met with Kentucky DNR on July 24, 2024 and discussed obtaining a SMCRA permit exemption related to the potential for exposure of small amounts of coal during construction, construction materials and associated permitting needs, and post-mining land use commitments/mine reclamation requirements/protection enhancement plans associated with existing permits at the Lewis Ridge Project site.

5.11.3.2 Applicant Recommendations

The development of the Lewis Ridge Project would allow for use of previously disturbed lands. The selection of the Lewis Ridge Project site as configured minimizes permanent impacts to undisturbed lands as much of the land has been used for mining. Existing access roads would be used to the extent feasible. To minimize temporary impacts on land use, LRPS proposes to continue consultation with Kentucky DNR on post mining land use designations and develop and implement a Vegetation Management Plan and follow BMPs outlined in future construction plans.

5.11.4 References

United States Geological Survey (USGS). 2023. National Land Cover Database (NLCD) 2021 Land Cover Change Index Conterminous United States.

5.12 Tribal Resources (18 CFR § 4.38)

5.12.1 Existing Environment

Tribal consultation is required for all federal undertakings, regardless of whether the APE includes federal, tribal, state, or private lands so long as the undertaking may affect historic properties of religious and cultural significance to a Native American tribe (ACHP 2021). There are no tribal lands at the Lewis Ridge Project. Although no specific tribal interest has been identified at the Lewis Ridge Project, the tribes listed in Table 5-31 are included in LRPS's distribution list for the Lewis Ridge Project's licensing process.

Table 5-31: Tribes Included in Lewis Ridge Project's Distribution List

Tribe
Cherokee Nation
Delaware Nation
Eastern Band of Cherokee Indians
Miami Tribe of Oklahoma
Muscogee (Creek) Nation
Peoria Tribe of Indians of Oklahoma
Southern Cherokee Nation of Kentucky
United Keetoowah Band of Cherokee Indians in Oklahoma

5.12.2 Potential Impacts of the Proposed Lewis Ridge Project

Construction activities have the potential to disturb historic properties of religious and cultural significance to a Native American tribe within the APE, if those properties exist. Although no specific tribal interest has been identified at the Lewis Ridge Project, construction could result in the unanticipated discovery of previously unknown historic properties that may be of religious and cultural significance to Native American tribes.

5.12.3 Agency Consultation and Applicant Recommendations

5.12.3.1 Agency Consultation

Documentation of consultation is provided in Appendix A. Consultation specific to tribal resources is summarized below.

Many different statutes, regulations, executive orders, and federal policies direct federal agencies to consult with Native American tribes including the NHPA as amended. Section 106 of the NHPA, 54 U.S.C. 306108 and its implementing regulations at 36 CFR part 800, requires federal agencies to take into account the effects of projects they carry out, license, or financially assist (undertakings) on historic properties and provide the Advisory Council on Historic Preservation a reasonable opportunity to comment on those undertakings. The NHPA also requires that, in carrying out its responsibilities under the Section 106 review process, a federal agency must consult with any Native American tribe that attaches religious and cultural significance to historic properties that may be affected by the agency’s undertakings. (ACHP 2021).

In August 2022, LRPS sent outreach emails to 20 entities providing an information sheet on the Lewis Ridge Project and requesting meetings to learn about available resource information and discuss potential resource concerns, information gaps, and proposed studies. This email outreach included the Delaware Nation, Peoria Tribe of Indians in Oklahoma, Eastern Band of Cherokee Indians, Southern Cherokee Nation of Kentucky, and the Miami Tribe of Oklahoma. No responses were received from the tribes. LRPS invited representatives from the five aforementioned tribes to attend the Joint Agency and Public Meeting and Site Visit. No comments were received specific to tribal resources during the Joint Agency and Public Meeting or in comments following the Joint Agency and Public Meeting.

By letter dated February 14, 2023, FERC invited the Eastern Band of Cherokee Indians, United Keetoowah Band of Cherokee Indians in Oklahoma, Muscogee (Creek) Nation, and Cherokee Nation (Nation) to participate in the licensing process for the Lewis Ridge Project. FERC requested responses from the tribes stating their interest in participating. In its comments provided to FERC on March 20, 2023, the Nation stated it maintains databases and records of cultural, historic, and pre-historic resources in the area. The Nation confirmed it had not found any instances where the Lewis Ridge Project intersects or adjoins such resources. The Nation did not foresee the proposed Lewis Ridge Project impacting Cherokee cultural resources at that time, and requested that, if items of cultural significance are discovered, FERC should halt all project activities immediately and conduct further consultation.

5.12.3.2 Applicant Recommendations

LRPS proposes to continue consultation with Native American tribes throughout the licensing process and implement the following PM&E measures to minimize impacts on tribal resources:

- **Historic Properties Management Plan:**
    - As discussed further in Section 5.6.3.2, LRPS proposes to develop and implement a HPMP, which specifies how historic properties would be managed within the APE. The HPMP will be filed with the FLA and will include inadvertent discovery protocol.

5.12.4 References

Advisory Council on Historic Preservation (ACHP). 2021. Consultation with Indian Tribes in the Section 106 Review Process: The Handbook. Available online: https://www.achp.gov/sites/default/files/2021-06/ConsultationwithIndianTribesHandbook6-11-21Final_0.pdf. Accessed July 2024.

5.13 Environmental Justice

Consistent with Executive Orders 12898[27] and 14008,[28] the Applicant provides the following Environmental Justice (EJ) information for the proposed Lewis Ridge Project. This overview is meant to provide an understanding of EJ communities and non-English-speaking populations proximate to the Lewis Ridge Project.

5.13.1 Existing Environment

Consistent with FERC recommendations in recent licensing efforts, the methods outlined in the USEPA 'Promising Practices for EJ Methodologies in NEPA Reviews' (USEPA 2016) document have been applied to the geographic scope to identify EJ communities near the proposed Lewis Ridge Project. The geographic scope of analysis for this environmental justice overview is a 5-mile radius around the Lewis Ridge Project Study Area.

The thresholds used for populations meeting EJ status are as follows:

- The "meaningfully greater analysis" and the "50 percent" methods were used to determine EJ status based on race:
    - To meet EJ criteria using the "meaningfully greater analysis," a block group qualifies as having EJ communities if the total minority population percentage for a block group is at least 10 percent greater than that of the county population:
        - (County minority population) x (1.10) = threshold above which a block group minority population must be for inclusion as an environmental justice community.
    - To meet EJ criteria using the "50 percent" method, the total minority population must be greater than 50 percent to qualify as an EJ community.
- The "low-income threshold criteria" was used to identify environmental justice communities based on income level, where the block group must have a higher percentage of low-income households than the county.

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[27] Exec. Order No. 12898, 59 Fed. Reg. 7629 (Feb. 16, 1994). Federal Actions to Address Environmental Justice in Minority and Low-Income Populations.

[28] Exec. Order No. 14008, 86 Fed. Reg. 7619-7633 (Jan. 27, 2021) Tackling the Climate Change Crisis at Home and Abroad.

There are ten census block groups within a 5-mile radius around the Lewis Ridge Project Study Area, five of which meet the environmental justice threshold (Table 5-32, Figure 5-34). Of the five identified EJ communities, three meet the criteria threshold for minority populations (census tract 960200, block group 2; census tract 960300, block group 2; and census tract 971300, block group 4), while two communities meet the criteria for households in poverty (census tract 960100, block group 1; and census tract 960400, block group 2).

English proficiency alone is not a criterion for meeting EJ status but is an important factor in determining how public engagement can be effectively achieved; therefore, non-English-speaking groups are identified regardless of their block group EJ status to ensure meaningful engagement. The majority of the population proximate to the Lewis Ridge Project were identified as English speaking. Within the five-mile radius around the Lewis Ridge Project Study Area, two percent of one block group (census tract 970600, block group 2) are non-English-speaking people (Table 5-32).

The final analysis related to EJ involves sensitive receptor locations. USEPA defines sensitive receptors as locations where occupants may be more susceptible to the adverse effects of exposure to pollutants. Sensitive receptors can include hospitals, schools, elderly housing facilities, and daycare centers (USEPA 2024a). Schools are visible within 5-miles of the Lewis Ridge Project Study Area. There are no other sensitive receptors located within the 5-mile radius around the Lewis Ridge Project Study Area (USDHS 2023).

Figure 5-34: Census Block Groups within a Five-Mile Radius of the Project Study Area

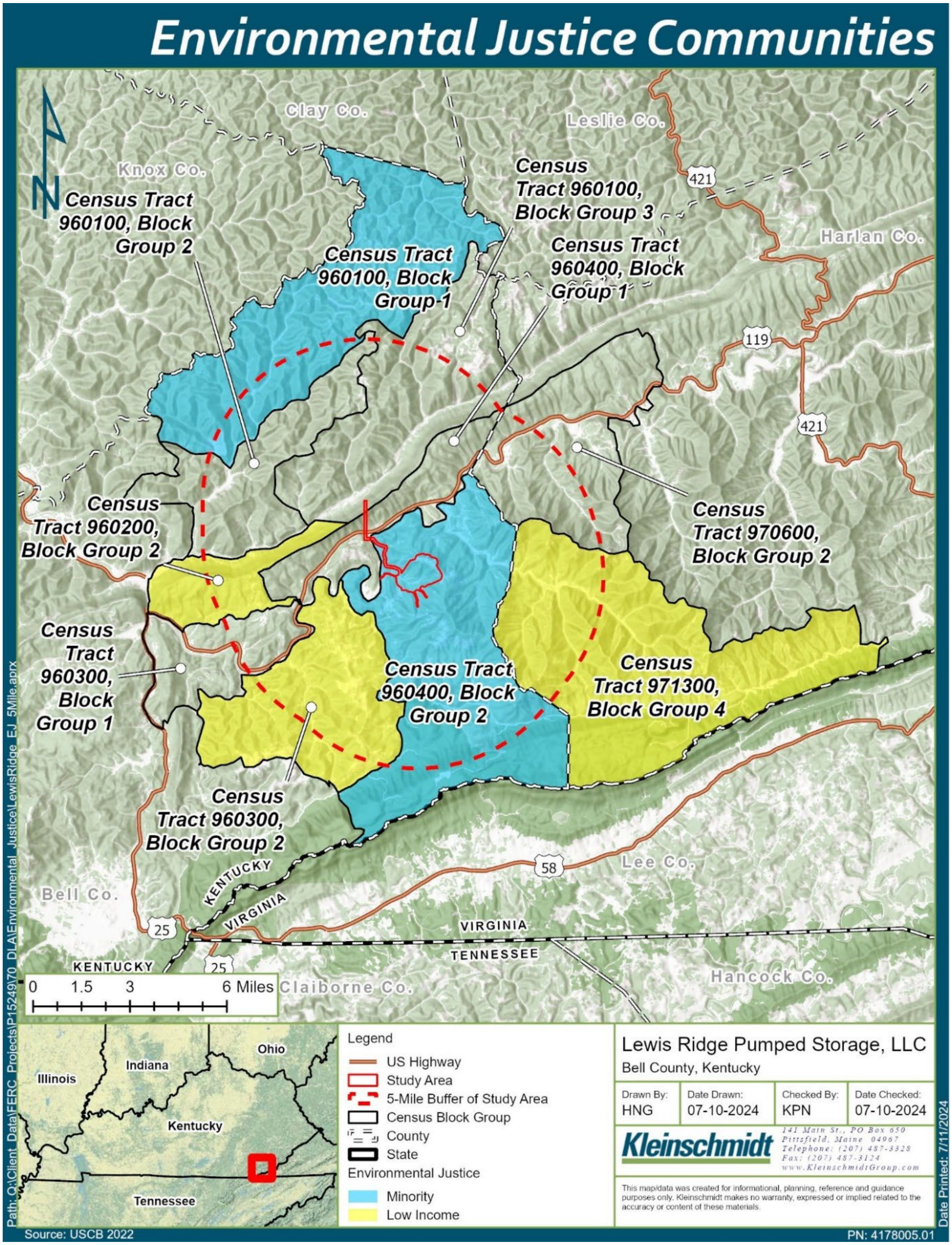

Table 5-32: Environmental Justice Data

	Race and Ethnicity Data										Low-Income Data	Language Data
Geographic Area	**Total Population (count)**	**White Alone, Not Hispanic (count)**	**African American/ Black (count)**	**Native American/ Alaska Native (count)**	**Asian (count)**	**Native Hawaiian & Other Pacific Islander (count)**	**Some Other Race (count)**	**Two or More Races (count)**	**Hispanic or Latino (count)**	**Total Minority Population (%)**	**Below Poverty Data (%)**	**Non-English Speaking Persons Aged 5 Years and Greater (%)**
Kentucky	4,502,935	3,748,657	355,368	3,902	68,569	3,167	10,744	132,047	180,481	17%	16%	0%
Bell County	24,248	22,635	469	49	28	0	48	690	329	7%	29%	0%
Census Tract 960200, Block Group 2	1,010	980	0	0	0	0	0	30	0	3%	**53%**	0%
Census Tract 960300, Block Group 2	719	694	0	0	0	0	0	0	25	3%	**30%**	0%
Census Tract 960100, Block Group 2	741	710	0	31	0	0	0	0	0	4%	25%	0%
Census Tract 960100, Block Group 1	525	473	0	0	0	0	0	11	41	**10%**	28%	0%
Census Tract 960100, Block Group 3	689	689	0	0	0	0	0	0	0	0%	4%	0%
Census Tract 960300, Block Group 1	1,260	1,260	0	0	0	0	0	0	0	0%	19%	0%

	Race and Ethnicity Data										Low-Income Data	Language Data
Geographic Area	**Total Population (count)**	**White Alone, Not Hispanic (count)**	**African American/ Black (count)**	**Native American/ Alaska Native (count)**	**Asian (count)**	**Native Hawaiian & Other Pacific Islander (count)**	**Some Other Race (count)**	**Two or More Races (count)**	**Hispanic or Latino (count)**	**Total Minority Population (%)**	**Below Poverty Data (%)**	**Non-English Speaking Persons Aged 5 Years and Greater (%)**
Census Tract 960400, Block Group 1	493	491	0	0	0	0	0	2	0	0%	27%	0%
Census Tract 960400, Block Group 2	1,369	1,246	0	0	0	0	0	110	13	**9%**	26%	0%
Harlan County	26,589	25,096	548	4	122	24	52	664	79	6%	29%	0%
Census Tract 970600, Block Group 2	1,546	1,454	0	0	58	0	28	6	0	6%	20%	2%
Census Tract 971300, Block Group 4	1,435	1,424	0	0	0	0	0	11	0	1%	**47%**	0%

Source: U.S. Census 2022

* Grey shaded cells indicate EJ community

5.13.2 Potential Impacts of the Proposed Lewis Ridge Project

The environmental justice overview for the Lewis Ridge Project spans Harlan and Bell counties and ten census block groups. Each county was used as the reference community in the analysis. Although three of the ten census block groups met the criteria threshold for households in poverty, only one census block group has a poverty rate lower than the state of Kentucky signifying the area proximate to the Lewis Ridge Project is impoverished.

In addition to resources discussed in Sections 5.2 to 5.12, erosion and sedimentation of private property, groundwater or other drinking water resources, subsistence fishing, hunting, or plant gathering, and Lewis Ridge Project construction and operation related air quality, noise, and traffic were considered in identifying effects to EJ communities. The Lewis Ridge Project, with the exception of a portion of the interconnection line, would be located on private land owned by Asher Land and Mineral, LLLP, located within environmental justice community census tract 960400, block group 2. The Asher Land and Mineral, LLLP property was used for mining and does not include residential property; therefore, construction of the Lewis Ridge Project would not cause sedimentation or erosion of private property owned by EJ communities. There are no anticipated effects to drinking water or wells due to the remote and industrial location (i.e., lack of residential properties) of the Lewis Ridge Project site. In addition, recreation and public access is restricted for public safety and would remain as such during the construction and operation of the Lewis Ridge Project. Therefore, access for subsistence hunting, fishing, or plant gathering as related to EJ communities is not applicable and would not be affected by the Lewis Ridge Project.

Lewis Ridge Project related construction and operation would occur within environmental justice community census tract 960400, block group 2 in Bell County, Kentucky. Construction-related air quality, noise, and traffic has the potential to effect EJ communities for the duration of construction by increasing the level of traffic to the site and causing noise to occur related to operation of the machinery and construction of the facilities. Construction of the Lewis Ridge Project would result in temporary emissions of criteria pollutants. These emissions generally include fugitive dust generated from ground-disturbing activities, such as soil excavation and wind erosion of disturbed areas, and vehicle traffic during construction. Operation of diesel- and gasoline-fueled construction equipment would also emit criteria pollutants such as nitrous oxide and carbon monoxide. Construction-related emissions at the Lewis Ridge Project would occur over the four-to five-year construction period and would dissipate with distance from areas of active construction, therefore likely only temporarily impacting one of the five identified environmental justice communities (census tract 960400, block Group 2). Once fully constructed, air quality impacts are expected to be minimal, as electricity from the grid would be utilized during the pumping cycle to move water into the upper reservoir. Construction activities would temporarily increase noise in the EJ community during the construction period; however, the Lewis Ridge Project site is in a sparsely populated area. Once operating, noise levels are expected to be negligible at the Lewis Ridge Project. Construction and operation of the Lewis Ridge Project would not have a disproportionately high and adverse effect to EJ communities within the scope of analysis and may have an overall benefit to local residents by providing temporary jobs during the construction phase, and permanent jobs once the Lewis Ridge Project is operational.

5.13.3 Agency Consultation and Applicant Recommendations

5.13.3.1 Agency Consultation

Documentation of consultation is provided in Appendix A. Consultation specific to environmental justice is summarized below.

On November 23, 2022, USEPA commented on the NOI and PAD providing recommendations and considerations for FERC to include in its draft NEPA document. USEPA recommended inclusion of anticipated Lewis Ridge Project impacts (construction and operation) on EJ communities in FERC’s NEPA document. In addition, USEPA recommended inclusion of best practices to reduce emissions during construction.

LRPS held a Joint Agency and Public Meeting and Site Visit on January 25, 2023 and the results of the EJ evaluation conducted for the PAD were presented. No comments were received specific to EJ during the Joint Agency and Public Meeting.

5.13.3.2 Applicant Recommendations

LRPS is not proposing any PM&E measures related to EJ.

5.13.4 References

United States Environmental Protection Agency (USEPA). 2016. Technical Guidance for Assessing Environmental Justice in Regulatory Analysis. Retrieved from https://www.epa.gov/sites/default/files/2016-06/documents/ejtg_5_6_16_v5.1.pdf on August 2, 2024.

USEPA. 2024. Environmental Issues of Concern for Urban Communities: Resources. Available online: Environmental Issues of Concern for Urban Communities: Resources | US EPA. Accessed August 28, 2024.

United States Department of Homeland Security, Geospatial Management Office (USDHS). 2023. Homeland Infrastructure Foundation-Level Data (HIFLD) database. Available online: https://gii.dhs.gov/HIFLD. Accessed January 9, 2023.

6.0 CONSISTENCY WITH COMPREHENSIVE PLANS (18 CFR § 5.18 (B)(5)(F))

Section 10(a)(2)(A) of the Federal Power Act (FPA), 16 U.S.C § 803(a)(2)(A), requires FERC to consider the extent to which a project is consistent with Federal or state comprehensive plans for improving, developing, or conserving a waterway or waterways potentially affected by the proposed project. On April 27, 1988, FERC issued Order No. 481-A revising order No. 481, issued October 26, 1987, establishing that FERC will accord FPA Section 10(a)(2)(A) comprehensive plan status to any Federal or state plan that:

- Is a comprehensive study of one or more of the beneficial uses of a waterway or waterways;
- Specifies the standards, the data, and the methodology used; and
- Is filed with the Secretary of the Commission.

FERC currently lists 18 comprehensive plans for the Commonwealth of Kentucky (FERC 2024). Of these listed plans, LRPS identified seven as potentially relevant to the Lewis Ridge Project. Table 6-1 lists the plans considered and provides a summary of the plan and its consistency with the proposed Lewis Ridge Project, if applicable.

Table 6-1: Relevant Comprehensive Plans and Consistency with the Project

Resource	Comprehensive Plan	Consistency of the Project with Plan
Recreation Resources	Kentucky Department for Local Government. Kentucky Statewide Comprehensive Outdoor Recreation Plan (SCORP). Frankfort, Kentucky. October 2019.[29]	The SCORP outlines strategies and recommendations for addressing outdoor recreation to promote healthy lifestyles and increase outdoor recreational activities and tourism. There are no recreation sites at the proposed Lewis Ridge Project and there are no public recreation sites in the Project Vicinity. Due to public safety restrictions, no recreation sites are proposed at the Lewis Ridge Project. The Lewis Ridge Project would have no impact to recreation resources and the SCORP is not applicable.
Water Resources	Kentucky Department for Natural Resources and Environmental Protection. 1979. Kentucky wild rivers statewide management plan. Frankfort, Kentucky. June 1979.	In 1972 portions of the Red, Rockcastle, Cumberland, Green, and Big South Fork of the Cumberland River were designated as Wild Rivers. In 1974, portions of Martins Fork and the Little South Fork of the Cumberland River were added to the Wild River system. The statewide plan provides recommendations for management of Kentucky's Wild Rivers. The nearest Kentucky Wild River designation is a 16.1-mile-long segment of the Cumberland River from Summer Shoals to the backwaters of Lake Cumberland (Kentucky EEC 2024). The segment is located approximately 84 river miles downstream from the Lewis Ridge Project; therefore, the plan is not applicable. However, LRPS has consulted with Kentucky DNR throughout the licensing process.
Water Resources	Kentucky Department for Natural Resources and Environmental Protection. 1980. Kentucky wild rivers: Cumberland River management plan. Frankfort, Kentucky. June 1980.	In 1972, portions of the Cumberland River were designated as Wild Rivers. In 1974, portions of the Little South Fork of the Cumberland River were added to the Wild River system. The plan provides recommendations for management of the portions of the Cumberland River eligible for Kentucky's Wild River system. The nearest Kentucky Wild River designation is a 16.1-mile-long segment of the Cumberland River from Summer Shoals to the backwaters of Lake Cumberland

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[29] FERC identified the October 2008 version of the Kentucky Statewide Comprehensive Outdoor Recreation Plan in its list of comprehensive plans, however, LRPS reviewed the updated plan from 2019.

Resource	**Comprehensive Plan**	**Consistency of the Project with Plan**
		(Kentucky EEC 2024). The segment is located approximately 84 river miles downstream from the Lewis Ridge Project; therefore, the plan is not applicable. However, LRPS has consulted with Kentucky DNR throughout the licensing process.
Water Resources	Kentucky Department for Natural Resources and Environmental Protection. 1980. Kentucky wild rivers: Martins Fork management plan. Frankfort, Kentucky. June 1980.	In 1974, portions of Martins Fork and the Little South Fork of the Cumberland River were added to Kentucky's Wild River system. The plan provides recommendations for management of the portions of Martins Fork eligible for Kentucky's Wild River system. The nearest Kentucky Wild River designation is a 16.1-mile-long segment of the Cumberland River from Summer Shoals to the backwaters of Lake Cumberland (Kentucky EEC 2024). The segment is located approximately 84 river miles downstream from the Lewis Ridge Project; therefore, the plan is not applicable. However, LRPS has consulted with Kentucky DNR throughout the licensing process.
Water Resources	Kentucky DEP Division of Water. National Park Service. 1992. Kentucky rivers assessment. Department of the Interior, Atlanta, Georgia.	The Kentucky Rivers Assessment presents the findings of a comprehensive statewide evaluation of resources associated with the state's most significant rivers. Ten categories of resource values were assessed: agricultural lands, botanical resources, corridor character, cultural resources, fish resources, geologic and scenic features, recreational boating, water quality, water resources, and wildlife resources. A total of 551 rivers were evaluated, including 1,363 individual study segments. The Cumberland River was found significant in every resource category. The Exhibit E considers Lewis Ridge Project impacts on the Cumberland River using similar resource values and the Lewis Ridge Project does not adversely affect the Cumberland River; therefore, the Lewis Ridge Project is consistent with the plan.
Water Resources	National Park Service. 1993. The Nationwide Rivers Inventory.	The Nationwide Rivers Inventory (NRI) is a listing of more than 3,200 free-flowing river segments in the United States that are believed to possess one or more "outstandingly remarkable" natural or cultural values judged to be at least regionally significant.

Resource	Comprehensive Plan	Consistency of the Project with Plan
	Department of the Interior, Washington, D.C.[30]	Under the Wild and Scenic Rivers Act section 5(d)(1) and related guidance, all federal agencies must seek to avoid or mitigate actions that would adversely affect NRI river segments. The NRI is potentially applicable to the proposed Lewis Ridge Project as it is located adjacent to waters of Kentucky (Cumberland River). There are no rivers within the Project Vicinity that have been designated for inclusion in the National Wild and Scenic River System (NPS 2024); therefore, the Lewis Ridge Project is consistent with the plan and avoids affects to NRI segments.
Fish and Aquatic Resources	U.S. Fish and Wildlife Service. n.d. Fisheries USA: the recreational fisheries policy of the U.S. Fish and Wildlife Service. Washington, D.C.	The recreational fisheries policy of the USFWS directs federal agencies to improve the quantity, function, and sustainable productivity, and distribution of U.S. aquatic resources for increased resources for recreational fishing opportunities. The Lewis Ridge Project does not impact recreational fisheries on the Cumberland River; therefore, the Lewis Ridge Project is consistent with USFWS's recreational fisheries policy.

Source: FERC 2024

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[30] FERC identified the 1993 version of the Nationwide Rivers Inventory in its list of comprehensive plans, however, LRPS reviewed the digital interactive version updated in February 2022.

6.1 References

Federal Energy Regulatory Commission (FERC). 2024, April. List of Comprehensive Plans. Office of Energy Projects, 20426. Washington, D.C. Available online: https://cms.ferc.gov/media/list-comprehensive-plans. Accessed June 2024.

Kentucky Energy and Environment Cabinet (Kentucky EEC). 2024. Kentucky Wild Rivers Program. Available online: https://eec.ky.gov/Nature-Preserves/conserving_natural_areas/wild-rivers/Pages/default.aspx Accessed: July 2024.

National Park Service (NPS). 2024. National Wild and Scenic Rivers System. Available online: https://www.rivers.gov/kentucky.php Accessed: August 2024.

APPENDIX A

DOCUMENTATION OF CONSULTATION

Consultation filed with the Pre-Application Document is not being refiled herein.

From: Sandy Slayton
To: Elizabeth Krchnavek
Cc: Lesley Brotkowski
Subject: FW: Lewis Ridge Pumped Storage Project
Date: Tuesday, January 10, 2023 12:20:04 PM
Attachments: image001.png
220598_FERC_Lewis Ridge Pumped Storage_Bell.pdf (S).pdf

FYI, also I am adding Patricia to the JAM email list.

From: Hutchins, Patricia (Heritage Council) <patricia.hutchins@ky.gov>
Sent: Monday, January 9, 2023 6:56 AM
To: Sandy Slayton <sandy@ryedevelopment.com>
Subject: Lewis Ridge Pumped Storage Project

Dear Ms. Slayton,

Attached are our comments for the proposed project, KHC # 220598. Please let us know if you have any questions.

Sincerely,
Patti

Patricia E. Hutchins
Archaeology Review Coordinator
Kentucky Heritage Council
410 High Street
Frankfort, Kentucky 40601
Email: patricia.hutchins@ky.gov

NOTE: We are **no longer accepting paper** documents for Section 106 review. **Please submit all electronic documents for Section 106 Review to khc.section106@ky.gov.** DO NOT SUBMIT ANY INITIAL SECTION 106 REVIEW MATERIALS TO AN INDEPENDENT REVIEWER. Failure to submit documents to the dedicated Section 106 email address **will** result in our staff not receiving these documents for review.

Note: We cannot accept password protected files. If you must submit large files via link, **the time-frame for us to access must be unrestricted or, at a minimum, 30 days.**

Please see www.heritage.ky.gov for information about office hours and services.

From: Sandy Slayton
To: Lesley Brotkowski; Elizabeth Krchnavek; Michael Ricci
Subject: FW: Lewis Ridge Pumped Storage Project, Bell County, KY
Date: Thursday, September 15, 2022 11:40:30 AM
Attachments: image001.png
image002.png

Hi All. Response from KY Heritage Council below.

Sandy

From: Hutchins, Patricia (Heritage Council) <patricia.hutchins@ky.gov>
Sent: Thursday, September 15, 2022 8:26 AM
To: Sandy Slayton <sandy@ryedevelopment.com>
Subject: RE: Lewis Ridge Pumped Storage Project, Bell County, KY

Dear Ms. Slayton,

Thank you for this project introduction. Once an area of potential effect (APE) has been determined, please see our guidelines for project submission, located here:
https://heritage.ky.gov/compliance/Pages/overview.aspx
If you have any questions during the process, please feel free to reach out to me at this email address or to our Site Protection Program Manager Nicole Konkol at Nicole.Konkol@ky.gov.

Thank you,
Patti

Patricia E. Hutchins
Transportation Archaeology Review Coordinator
Kentucky Heritage Council
410 High Street
Frankfort, Kentucky 40601
Email: patricia.hutchins@ky.gov

NOTE: We are **no longer requiring or accepting paper** documents for Section 106 review. **Please submit all electronic documents for Section 106 Review to khc.section106@ky.gov.** DO NOT SUBMIT ANY INITIAL SECTION 106 REVIEW MATERIALS TO AN INDEPENDENT REVIEWER. Failure to submit documents to the dedicated Section 106 email address **will** result in our staff not receiving these documents for review.

Please see www.heritage.ky.gov for information about office hours and services.

From: Konkol, Nicole N (Heritage Council) <nicole.konkol@ky.gov> **On Behalf Of** KHC Section106
Sent: Friday, August 26, 2022 4:04 PM
To: Hutchins, Patricia (Heritage Council) <patricia.hutchins@ky.gov>
Subject: Fw: Lewis Ridge Pumped Storage Project, Bell County, KY

Thank you for your Section 106 submission. Due to temporary staffing shortages and an increased workload, responses are likely to take longer than 30 days. Please continue to submit your Section 106 documents via email to khc.section106@ky.gov and we will respond as soon as we can. PLEASE DO NOT SUBMIT ANY INITIAL SECTION 106 REVIEW MATERIALS TO AN INDEPENDENT REVIEWER.

KHC Site Protection Staff

Kentucky Heritage Council

khc.section106@ky.gov

From: Potts, Craig A (Heritage Council) <craig.potts@ky.gov>
Sent: Thursday, August 25, 2022 9:09 AM
To: KHC Section106 <KHC.Section106@ky.gov>
Subject: FW: Lewis Ridge Pumped Storage Project, Bell County, KY

From: Sandy Slayton <sandy@ryedevelopment.com>
Sent: Wednesday, August 24, 2022 7:40 PM
To: Potts, Craig A (Heritage Council) <craig.potts@ky.gov>
Cc: Nathan Sandvig <Nathan@ryedevelopment.com>; Lesley Brotkowski <Lesley.Brotkowski@kleinschmidtgroup.com>

Subject: Lewis Ridge Pumped Storage Project, Bell County, KY

Mr. Potts,

Rye Development (Rye) is proposing to develop the Lewis Ridge Pumped Storage Project (Lewis Ridge Project) on reclaimed mine land in Bell County, Kentucky. Rye has initiated site evaluations and is in the process of developing documents required for a license application to the Federal Energy Regulatory Commission (FERC). We would like to set up a meeting with you to introduce the proposed Lewis Ridge Project and FERC licensing process. A preliminary description of the proposed project is attached. Rye wants to learn about available resource information and discuss potential resource concerns, information gaps, and proposed studies. If you would like to talk with us to learn more about the project or discuss existing information about the site, please let me know your availability on September 7, 8, or 9 for a virtual meeting.

Thank you for your consideration. We look forward to working with you on the proposed Lewis Ridge Project.

Sincerely,
Sandy

Sandy Slayton
Vice President, Environmental
(206) 919-3976
sandy@ryedevelopment.com
www.ryedevelopment.com

Rye
Development

100 S. Olive Street, West Palm Beach, FL 33401

OCTOBER 25, 2022

Kimberly Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, DC 20426

Subject: Lewis Ridge Pumped Storage, LLC
Lewis Ridge Pumped Storage Project, FERC Project No. 15249
Notice of Intent, Pre-Application Document, and Request to Use Traditional Licensing Process for the Lewis Ridge Pumped Storage Project

Dear [XXXX]:

This letter is to inform you that the Lewis Ridge Pumped Storage, LLC (LRPS), in accordance with the requirements of 18 Code of Federal Regulation (CFR) Section 5, has electronically filed with the Federal Energy Regulatory Commission (Commission or FERC) the Notice of Intent (NOI) and Pre-Application Document (PAD) for the licensing of the Lewis Ridge Pumped Storage Project (Project) (FERC No. 15249). These documents can be viewed on the FERC eLibrary or on the project website: lewisridgeproject.com.

The unconstructed Project is located in the Upper Cumberland River Basin in Bell County, Kentucky near the borders of Tennessee and Virginia. The Project would be a closed loop pumped storage hydroelectric generating facility located at a site historically used for mining. The Project is anticipated to provide 287 megawatts (MW) of generation capacity.

Pursuant to 18 CFR §4.38, §5.5(c), and §5.6(a), the NOI and PAD are being distributed electronically to the relevant resource agencies, Native American tribes, non-governmental organizations, and other potential interested parties included on the attached distribution list.

LRPS requests Commission approval to use the Traditional Licensing Process (TLP) for the relicensing of the Project (Attachment A). As provided in 18 CFR §5.3(d)(1), we note that comments on the request to use the TLP must be filed with the Commission within 30 days of this letter. Pursuant to 18 CFR §5.3(d)(2), LRPS has published notice of the request to use the TLP in a daily newspaper of general circulation in the one county in which the Project is located (Bell County, Kentucky); the notice contains the information required by that section.

Should the Commission approve the use of the TLP, LRPS proposes to host a joint agency and public meeting (JAM) of the Project in accordance with 18 CFR §4.38 no earlier than 30 days, but no later than 60 days, from the Commission's TLP approval.

Currently, LRPS proposes to hold the JAM in Pineville, Kentucky on January 25, 2023. The date and location of the meeting may be altered after consultation with jurisdictional agencies and other licensing participants and pending FERC's decision regarding the LRPS request to use the TLP. If FERC requires that LRPS use the Integrated Licensing Process (ILP), then FERC will hold a scoping meeting in accordance with the regulations at CFR §5.8.

Please direct any questions pertaining to the Project or process to Sandy Slayton by phone at (206) 919-3976 or email at sandy@ryedevelopment.com.

Sincerely,

Erik Steimle
Vice President
Lewis Ridge Pumped Storage, LLC

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City, State
Atlanta, GA 30345

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City, State,
100 Alabama Street SW
Atlanta, GA 30303

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Henderson, KY 42419

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United States Coast Guard
225 Tully Street
Paducah, KY 42003-0170

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City, S

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Kim Amendola, Deputy Regional Administrator
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
263 13th Avenue South
St. Petersburg, FL 33701-01930

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City, Sta

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U.S. Army Corps of Engineers, Louisville District
P.O. Box 59
Louisville, KY 40201-0059

Street and

City, State

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Extra Services & Fees *(check box, add fee as appropriate)*
- ☐ Return Receipt (hardcopy) $
- ☐ Return Receipt (electronic) $
- ☐ Certified Mail Restricted Delivery $
- ☐ Adult Signature Required $
- ☐ Adult Signature Restricted Delivery $

Postage
$ 0.57

Total Postage and Fees
$ 4.57

Sent To
Commanding Officer
United States Coast Guard
95 Peyton Street
Barboursville, WV 25504

Street an

City, Stat

PITTSFIELD, ME 04967
Postmark
Here
OCT 26 2022
USPS

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

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7018 1830 0002 0926 0463

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- ☐ Certified Mail Restricted Delivery $
- ☐ Adult Signature Required $
- ☐ Adult Signature Restricted Delivery $

Postage
$ 0.57

Total Postage and Fees
$ 4.57

Sent T
Hydropower Coordinator
U.S. Army Corps of Engineers, Nashville District
Eastern Regulatory Division
110 9th Ave S.
Nashville, TN 37203

Street

City, S

PITTSFIELD, ME 04967
Postmark
Here
OCT 26 2022
USPS

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☐ Return Receipt (hardcopy) $
☐ Return Receipt (electronic) $
☐ Certified Mail Restricted Delivery $
☐ Adult Signature Required $
☐ Adult Signature Restricted Delivery $
Postage
$ 0.57
Total Postage and Fees
$ 4.57

PITTSFIELD, ME 04967
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USPS

Sent To
U.S. Army Corps of Engineers
Street and
Nashville District
501 Adesa Parkway, Suite B 250
City, State
Lenoir City, TN 37771

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

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☐ Return Receipt (electronic) $
☐ Certified Mail Restricted Delivery $
☐ Adult Signature Required $
☐ Adult Signature Restricted Delivery $
Postage
$ 0.57
Total Postage and Fees
$ 4.57

PITTSFIELD, ME 04967
Postmark Here
OCT 26 2022
USPS

Sent To
Tom Fitzgerald
Street and A
Kentucky Resource Council
P.O. Box 1070
City, State,
Frankfort, KY 40602

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

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☐ Return Receipt (hardcopy) $
☐ Return Receipt (electronic) $
☐ Certified Mail Restricted Delivery $
☐ Adult Signature Required $
☐ Adult Signature Restricted Delivery $
Postage
$ 0.57
Total Postage and Fees
$ 4.57

PITTSFIELD, ME 04967
Postmark Here
OCT 26 2022
USPS

Sent To
U.S. Department of Energy
Street and
P.O. Box 10940
City, State,
Pittsburgh, PA 15236-0940

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☐ Return Receipt (hardcopy) $
☐ Return Receipt (electronic) $
☐ Certified Mail Restricted Delivery $
☐ Adult Signature Required $
☐ Adult Signature Restricted Delivery $
Postage
$ 0.57
Total Postage and Fees
$ 4.57

PITTSFIELD, ME 04967
Postmark Here
OCT 26 2022
USPS

Sent To
Office of Senator Rand Paul
Street and
Lexington Office
771 Corporate Drive, Suite 105
City, State,
Lexington, KY 40503

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

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Certified Mail Fee
$ 4.00
Extra Services & Fees *(check box, add fee as appropriate)*
☐ Return Receipt (hardcopy) $
☐ Return Receipt (electronic) $
☐ Certified Mail Restricted Delivery $
☐ Adult Signature Required $
☐ Adult Signature Restricted Delivery $
Postage
$ 0.57
Total Postage and Fees
$ 4.57

PITTSFIELD, ME 04967
Postmark Here
OCT 26 2022
USPS

Sent To
Andrew L. Raddant, Regional Environmental Officer
Street and
U.S. Department of the Interior
Office of Environmental Policy and Compliance
City, State
15th State Street, 8th Floor
Boston, MA 02109

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

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☐ Return Receipt (hardcopy) $
☐ Return Receipt (electronic) $
☐ Certified Mail Restricted Delivery $
☐ Adult Signature Required $
☐ Adult Signature Restricted Delivery $
Postage
$ 0.57
Total Postage and Fees
$ 4.57

PITTSFIELD, ME 04967
Postmark Here
OCT 26 2022
USPS

Sent To
Office of Senator Mitch McConnell
Street and
Lexington Office
771 Corporate Drive, Suite 108
City, State,
Lexington, KY 40503

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

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$ 4.00
Extra Services & Fees *(check box, add fee as appropriate)*
☐ Return Receipt (hardcopy) $
☐ Return Receipt (electronic) $
☐ Certified Mail Restricted Delivery $
☐ Adult Signature Required $
☐ Adult Signature Restricted Delivery $
Postage
$ 0.57
Total Postage and Fees
$ 4.57

Postmark
Here

PITTSFIELD, ME 04967
OCT 26 2022
USPS

Sent To
Deborah Dotson, President
Delaware Nation
Street anc
P.O. Box 825
City, State
Anadarko, OK 73005

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

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$ 4.00
Extra Services & Fees *(check box, add fee as appropriate)*
☐ Return Receipt (hardcopy) $
☐ Return Receipt (electronic) $
☐ Certified Mail Restricted Delivery $
☐ Adult Signature Required $
☐ Adult Signature Restricted Delivery $
Postage
$ 0.57
Total Postage and Fees
$ 4.57

Postmark
Here

PITTSFIELD, ME 04967
OCT 26 2022
USPS

Sent Tc
Adam Bowling
Street
Kentucky House of Representatives (87th District)
P.O. Box 2928
City, S
Middlesboro, KY 40965

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

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Extra Services & Fees *(check box, add fee as appropriate)*
☐ Return Receipt (hardcopy) $
☐ Return Receipt (electronic) $
☐ Certified Mail Restricted Delivery $
☐ Adult Signature Required $
☐ Adult Signature Restricted Delivery $
Postage
$ 0.57
Total Postage and Fees
$ 4.57

Postmark
Here

PITTSFIELD, ME 04967
OCT 26 2022
USPS

Sent To
Office of Representative Harold Rogers
Street and
Somerset Office
551 Clifty Street
City, State
Somerset, KY 42503

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$ 4.00
Extra Services & Fees *(check box, add fee as appropriate)*
☐ Return Receipt (hardcopy) $
☐ Return Receipt (electronic) $
☐ Certified Mail Restricted Delivery $
☐ Adult Signature Required $
☐ Adult Signature Restricted Delivery $
Postage
$ 0.57
Total Postage and Fees
$ 4.57

Postmark
Here

PITTSFIELD, ME 04967
OCT 26 2022
USPS

Sent To
Director
Street a
Bureau of Indian Affairs
U.S. Department of the Interior
City, Sta
MS – 4606, 1849 C Street NW
Washington, DC 20240

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☐ Return Receipt (hardcopy) $
☐ Return Receipt (electronic) $
☐ Certified Mail Restricted Delivery $
☐ Adult Signature Required $
☐ Adult Signature Restricted Delivery $
Postage
$ 0.57
Total Postage and Fees
$ 4.57

Postmark
Here

PITTSFIELD, ME 04967
OCT 26 2022
USPS

Sent To
Johnnie Turner
Street
Kentucky State Senator (29th District)
P.O. Box 351
City, S
Harlan, KY 40831

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

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Extra Services & Fees *(check box, add fee as appropriate)*
☐ Return Receipt (hardcopy) $
☐ Return Receipt (electronic) $
☐ Certified Mail Restricted Delivery $
☐ Adult Signature Required $
☐ Adult Signature Restricted Delivery $
Postage
$ 0.57
Total Postage and Fees
$ 4.57

Postmark
Here

PITTSFIELD, ME 04967
OCT 26 2022
USPS

Sent To
Kentucky Coal Council
Street and A
Cabinet for Economic Development
300 West Broadway
City, State,
Frankfort, KY 40601

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☐ Return Receipt (electronic) $
☐ Certified Mail Restricted Delivery $
☐ Adult Signature Required $
☐ Adult Signature Restricted Delivery $
Postage
$ 0.57
Total Postage and Fees
$ 4.57

Postmark
Here

PITTSFIELD, ME 04967
OCT 26 2022
USPS

Sent To
Kentucky Public Service Commission
Street and
211 Sower Boulevard
P.O. Box 615
City, State,
Frankfort, KY 40602

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☐ Return Receipt (hardcopy) $
☐ Return Receipt (electronic) $
☐ Certified Mail Restricted Delivery $
☐ Adult Signature Required $
☐ Adult Signature Restricted Delivery $
Postage
$ 0.57
Total Postage and Fees
$ 4.57

Postmark
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PITTSFIELD, ME 04967
OCT 26 2022

Sent To
Debbie Gambrel
Street and A
County Clerk, Bell County
101 Courthouse Square
City, State, Z
P.O. Box 157
Pineville, KY 40977

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☐ Return Receipt (hardcopy) $
☐ Return Receipt (electronic) $
☐ Certified Mail Restricted Delivery $
☐ Adult Signature Required $
☐ Adult Signature Restricted Delivery $
Postage
$ 0.57
Total Postage and Fees
$ 4.57

Postmark
Here

PITTSFIELD, ME 04967
OCT 26 2022
USPS

Sent To
Patrick Morrisey, Attorney General
Street and
West Virginia Office of Attorney General
State Capitol Complex, Bldg. 1, Room E-26
City, State,
1900 Kanawha Boulevard E.
Charleston, WV 25305

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☐ Certified Mail Restricted Delivery $
☐ Adult Signature Required $
☐ Adult Signature Restricted Delivery $
Postage
$ 0.57
Total Postage and Fees
$ 4.57

Postmark
Here

PITTSFIELD, ME 04967
OCT 26 2022
USPS

Sent To
Sandra Wilson, City Clerk
Street and A
City of Middlesboro City Hall
221 N. 21st Street
City, State,
Middlesboro, KY 40965

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☐ Adult Signature Required $
☐ Adult Signature Restricted Delivery $
Postage
$ 0.57
Total Postage and Fees
$ 4.57

Postmark
Here

PITTSFIELD, ME 04967
OCT 26 2022
USPS

Sent To
Daniel Cameron, Attorney General
Street a
Office of the Attorney General
700 Capital Avenue, Suite 118
City, St
Frankfort, KY 40601-3449

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☐ Adult Signature Required $
☐ Adult Signature Restricted Delivery $
Postage
$ 0.57
Total Postage and Fees
$ 4.57

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PITTSFIELD, ME 04967
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Sent To
Albey Brock
Street and
Bell County Judge Executive
P.O. Box 339
City, State
Pineville, KY 40977

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Postage
$ 0.57

Total Postage and Fees
$ 4.57

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PITTSFIELD, ME 04967
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Sent To
Ashley Wilmes, Director

Street and Apt
Kentucky Resource Council
P.O. Box 1070

City, State, Zi
Frankfort, KY 40602

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- ☐ Adult Signature Required $
- ☐ Adult Signature Restricted Delivery $

Postage
$ 0.57

Total Postage and Fees
$ 4.57

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PITTSFIELD, ME 04967
OCT 26 2022
USPS

Sent To
Director

Street anc
Kentucky Department for Environmental Protection
300 Fair Oaks Lane

City, State
Frankfort, KY 40601

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- ☐ Adult Signature Required $
- ☐ Adult Signature Restricted Delivery $

Postage
$ 0.57

Total Postage and Fees
$ 4.57

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PITTSFIELD, ME 04967
OCT 26 2022
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Sent To
Craig Harper, Chief

Street and Ap
Peoria Tribe of Indians of Oklahoma
118 South Eight Tribes Trail

City, State, Zi
Miami, OK 74355

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

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- ☐ Adult Signature Required $
- ☐ Adult Signature Restricted Delivery $

Postage
$ 0.57

Total Postage and Fees
$ 4.57

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PITTSFIELD, ME 04967
OCT 26 2022
USPS

Sent To
Robert Miller

Street a
Kentucky Department for Environmental Protection
Division of Water, London Regional Office
875 S. Main Street

City, St
London, KY 40741

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- ☐ Return Receipt (electronic) $
- ☐ Certified Mail Restricted Delivery $
- ☐ Adult Signature Required $
- ☐ Adult Signature Restricted Delivery $

Postage
$ 0.57

Total Postage and Fees
$ 4.57

Postmark Here

PITTSFIELD, ME 04967
OCT 26 2022
USPS

Sent To
Douglas Lankford, Chief

Street anc
Miami Tribe of Oklahoma
P.O. Box 1326

City, State
Miami, OK 74355-1326

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- ☐ Return Receipt (electronic) $
- ☐ Certified Mail Restricted Delivery $
- ☐ Adult Signature Required $
- ☐ Adult Signature Restricted Delivery $

Postage
$ 0.57

Total Postage and Fees
$ 4.57

Postmark Here

PITTSFIELD, ME 04967
OCT 26 2022
USPS

Sent To
Gordon R. Stone, Commissioner

Street ani
Kentucky Department for Natural Resources
300 Sower Boulevard, 2nd Floor

City, Stat
Frankfort, KY 40601

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

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- ☐ Return Receipt (hardcopy) $
- ☐ Return Receipt (electronic) $
- ☐ Certified Mail Restricted Delivery $
- ☐ Adult Signature Required $
- ☐ Adult Signature Restricted Delivery $

Postage
$ 0.57

Total Postage and Fees
$ 4.57

Postmark Here

PITTSFIELD, ME 04967
OCT 26 2022
USPS

Sent To
Street an
City, Stat

Lonis Morgan, Environmental Control Manager
Division of Mine Reclamation and Enforcement
1804 E. Cumberland Avenue
Middlesboro, KY 40965

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

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$ 4.00

Extra Services & Fees *(check box, add fee as appropriate)*
- ☐ Return Receipt (hardcopy) $
- ☐ Return Receipt (electronic) $
- ☐ Certified Mail Restricted Delivery $
- ☐ Adult Signature Required $
- ☐ Adult Signature Restricted Delivery $

Postage
$ 0.57

Total Postage and Fees
$ 4.57

Postmark Here

PITTSFIELD, ME 04967
OCT 26 2022
USPS

Sent To
Street and
City, State

Craig Potts
Executive Director
Kentucky Heritage Council
410 High Street
Frankfort, KY 40601

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

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- ☐ Return Receipt (hardcopy) $
- ☐ Return Receipt (electronic) $
- ☐ Certified Mail Restricted Delivery $
- ☐ Adult Signature Required $
- ☐ Adult Signature Restricted Delivery $

Postage
$ 0.57

Total Postage and Fees
$ 4.57

Postmark Here

PITTSFIELD, ME 04967
OCT 26 2022
USPS

Sent To
Street and A
City, State, Z

Matthew Catron, Regional Biologist
Kentucky Department of Fish & Wildlife Resources
#1 Sportsman's Lane
Frankfort, KY 40601

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Extra Services & Fees *(check box, add fee as appropriate)*
- ☐ Return Receipt (hardcopy) $
- ☐ Return Receipt (electronic) $
- ☐ Certified Mail Restricted Delivery $
- ☐ Adult Signature Required $
- ☐ Adult Signature Restricted Delivery $

Postage
$ 0.57

Total Postage and Fees
$ 4.57

Postmark Here

PITTSFIELD, ME 04967
OCT 26 2022
USPS

Sent To
Street an
City, Stat

Kentucky Tourism, Arts, and Heritage Cabinet
500 Mero Street, Fifth Floor
Frankfort, KY 40601

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PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

Sandra Wash

From: Sandy Slayton <sandy@ryedevelopment.com>
Sent: Tuesday, October 25, 2022 1:57 PM
To: khc.section106@ky.gov
Cc: Elizabeth Krchnavek; Lesley Brotkowski
Subject: Lewis Ridge Pumped Storage Project, Bell County - Section 106 Review
Attachments: Lewis Ridge Kentucky SHPO Section 106 Form.pdf

Craig,

Please see the attached Section 106 review form. The supporting documentation is available via the link below. Please let me know if you have any trouble with access or need any additional information.
You can view "Volume I_Lewis Ridge NOI_PAD_Final.pdf" at:
https://acrobat.adobe.com/link/track?uri=urn:aaid:scds:US:6e458fb2-7802-494a-b6e3-3384ff57caa7

Thank you.

Sandy

Rye
Development
Sandy Slayton
Vice President, Environmental
(206) 919-3976
sandy@ryedevelopment.com
www.ryedevelopment.com

Rye Development

100 S. Olive Street, West Palm Beach, FL 33401

October 26, 2022

VIA E-FILING

Kimberly Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, DC 20426

Subject: Lewis Ridge Pumped Storage Project, FERC Project No. 15249
Proof of Publication of the Notice of Intent, Pre-Application Document, and Traditional Licensing Process Request

Dear Secretary Bose:

Lewis Ridge Pumped Storage, LLC (LRPS), Permittee of the Lewis Ridge Pumped Storage Project (Project) (FERC No. 15249), is filing proof of publication of a public notice in connection with the LRPS' Notice of Intent (NOI), Pre-Application Document (PAD), and request to use Federal Energy Regulatory Commission's (FERC) Traditional Licensing Process (TLP) for licensing of the Project. The public notice was published once in the Middlesboro Daily News, newspaper in circulation in Bell County, KY, on Wednesday, October 19, 2022. The public notice conforms with FERC's regulations found at 18 C.F.R. §5.3(d)(2).

Please direct any questions concerning this matter to Sandy Slayton by phone at (206) 919-3976 or email at sandy@ryedevelopment.com.

Sincerely,

Erik Steimle
Vice President
Lewis Ridge Pumped Storage, LLC
100 S. Olive Street
West Palm Beach, Florida 33401

Attachment: Affidavit of Publication

cc: Sandy Slayton, Lewis Ridge Pumped Storage, LLC
Lesley Brotkowski, Kleinschmidt Associates

Publisher's Certificate of Publication

STATE OF KENTUCKY
COUNTY OF BELL

Kevin Smith, being duly sworn, on oath says he is and during all times herein stated has been an employee of Middlesboro-Tazewell Newsmedia publisher and printer of the The Middlesboro Daily News (the "Newspaper"), has full knowledge of the facts herein stated as follows:

1. The Newspaper printed the copy of the matter attached hereto (the "Notice") was copied from the columns of the Newspaper and was printed and published in the English language on the following days and dates:

10/19/22

2. The sum charged by the Newspaper for said publication is the actual lowest classified rate paid by commercial customer for an advertisement of similar size and frequency in the same newspaper in which the Notice was published.

3. There are no agreements between the Newspaper, publisher, manager or printer and the officer or attorney charged with the duty of placing the attached legal advertising notice whereby any advantage, gain or profit accrued to said officer or attorney

Kevin Smith, publisher

Subscribed and sworn to before me this
19th Day of October, 2022

Melanie Ann Tackett

Melanie Tackett, Notary Public
KYNP59534
My commission expires 09-27-2026

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LEWIS RIDGE PUMPED
830 NE HOLLADAY STREET
PORTLAND OR 97232

PUBLIC NOTICE

NOTICE OF FILING WITH THE FEDERAL ENERGY REGULATORY COMMISSION
LEWIS RIDGE PUMPED STORAGE, LLC
LEWIS RIDGE PUMPED STORAGE PROJECT
FERC NO. 15249

Lewis Ridge Pumped Storage, LLC (LRPS), as required by the Federal Energy Regulatory Commission (FERC or Commission), hereby gives notice and declares its intent to apply for an original license for the unconstructed Lewis Ridge Pumped Storage Project, FERC No. 15249 (Project). The unconstructed closed-loop pumped storage hydroelectric Project is located in the Upper Cumberland River Basin in Bell County, Kentucky at a site historically used for mining. The Applicant's address is 100 S. Olive Street, West Palm Beach, Florida 33401.

On or about October 21, 2022, LRPS will file with the FERC its Notice of Intent (NOI) to seek an original license for an unconstructed major project, a Pre-Application Document (PAD), and a request for Authorization to Use the Traditional Licensing Process (TLP). The NOI provides notice of LRPS intent to file a license application for the Project. The PAD summarizes relevant and available information regarding the Project's description and operation along with discussions of the potential operational effects on environmental and cultural resources.

LRPS invites resource agencies, Native American tribes, non-governmental organizations, and members of the public likely to be interested in the proceedings to participate in the licensing and to comment on this notice and related matters. The NOI and PAD and associated reference materials are available for inspection and reproduction online at https://www.ferc.gov/docs-filing/elibrary.asp Under docket number P-15249. These documents are also available during regular business hours at the Bell County Public Library, Pineville Branch, 214 Walnut Street, Pineville, Kentucky.

LRPS requests to use the TLP is based upon pre-PAD consultation with local, state, and federal agencies and other interested stakeholders and via a thorough desktop review of the site and surrounding resources. LRPS has identified areas where additional information is needed on the existing environment surrounding the Project, and has, in consultation, begun the process of developing study plans and mechanisms for fulfilling study goals. Due to this pre-PAD consultation, LRPS does not anticipate an elevated level of complexity and controversy regarding resource issues during the licensing process. LRPS believes that granting the request to use the TLP will not infringe on the ability for agencies or the public to provide comments on the Project, nor on LRPS ability to address such comments.

In accordance with 18 CFR § 5.6 (d)(2), comments on the request to use the TLP are due to the Commission no later than 30 days following the filing date of this request (i.e., by November 21, 2022 if NOI and PAD are filed on October 21, 2022). All responses must reference the FERC Project No. 15249. Comments should address, as appropriate to the circumstances of the request, the (A) likelihood of timely license issuance; (B) complexity of the resource issues; (C) level of anticipated controversy; (D) relative cost of the traditional licensing process compared to the integrated licensing process; (E) the amount of available information and potential for significant disputes over studies; and (F) other factors the commenter believes pertinent. Commenters must submit an electronic filing via FERC's website (http://www.ferc.gov/docs-filing/fercononline.asp) pursuant to 18 CFR §385.2003(c) or an original and eight copies of their comments to the Office of the Secretary, Federal Energy Regulatory Commission, 888 First Street NE, Washington, DC 20426

Middlesboro Daily News:
Oct. 19, 2022
FERC No. 15249

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Public Notices

Public Notices

PUBLIC NOTICE

NOTICE OF BOND RELEASE

In accordance with KRS 350.093, notice is hereby given that Nally & Hamilton Enterprises, Inc., P.O. Box 157, Bardstown, Kentucky 40004 has applied for a Phase I Bond Release on Increment No.'s 3 and 4 of Permit No. 861-0499 which was last issued April 22, 2021. Increment No. 1 covers an area of approximately 54.67 acres of surface area. Increment No. 2 covers an area of approximately 133.36 acres of surface area. The permit area is located approximately 0.54 mile north of Fourmile in Bell and Knox Counties, Kentucky.

The permit area is approximately 0.60 mile north from KY 2014's junction with KY 2015 and located 0.85 mile north of Fourmile Creek intersection with the Cumberland River.

The bond now in effect for Increment No. 3 is a surety and cash bond in the amount $576,300.00, of which approximately 60% of the original amount of $571,300.00 is to be included in this application for release. The bond now in effect for Increment No. 4 is a surety in the amount of $75,000.00, of which approximately 60% of the original amount of $75,000.00 is to be included in this application for release.

Reclamation work performed included: All mining area was backfilled and graded with all highwalls eliminated and the area was seeded, this work was completed in the spring of 2012.

This is the final advertisement of the application. Written comments, objection and request for a public hearing or informal conference must be filed with the Director, Division of Field Services, #2 Hudson Hollow Complex, Frankfort, Kentucky 40601 by Saturday, November 19, 2022.

A public hearing on the application has been scheduled for Tuesday November 22, 2022 at 9:00 AM, at the Department for Natural Resources, Middlesboro Regional Office, 1804 East Cumberland Avenue, Middlesboro, Kentucky 40965. This Hearing will be canceled if no request for a hearing or informal conference is received by Saturday, November 19, 2022.

Middlesboro Daily News:
Oct. 19, 2022
861-0499

PUBLIC NOTICE

NOTICE OF INTENTION TO MINE
Pursuant to Application No.
861-0500, Renewal

1. In accordance with the provisions of KRS 350.055, notice is hereby given that Nally & Hamilton Enterprises, Inc., P.O. Box 157; Bardstown, Kentucky 40004 has applied for a permit renewal for a surface coal mining and reclamation operation affecting 667.94 acres 2.17 miles northeast of Fourmile, KY in Knox and Bell Counties.

2. The operation is approximately 0.1 mile east from KY 2014 junction with Ivy Grove Road and located 0.2 miles west of Fourmile Creek.

3. The operation is located on the Pineville U.S.G.S. 7.5 minute quadrangle map. The surface area is owned by Appalachian Royalty Trust, WST, Inc. and Richard and Rebecca Saylor.

4. The application has been filed for public inspection at the Division of Mine Reclamation and Enforcement Middlesboro Regional Office, 1804 East Cumberland Avenue, Middlesboro, Kentucky 40965. Written comments, objections, or requests for a permit conference must be filed with the Director, Division of Permits, 300 Sower Blvd. Frankfort, Kentucky 40601.

Middlesboro Daily News:
Oct. 5, 12 and 19, 2022
861-0500 RN01

PUBLIC NOTICE

**CITY OF MIDDLESBORO
ORDINANCE NO. 92O22C**

AN ORDINANCE ESTABLISHING AN ENTERTAINMENT DESTINATION CENTER TO AID ECONOMIC GROWTH AND TOURISM IN THE DOWNTOWN AREA OF THE CITY OF MIDDLESBORO, KY. FURTHER DIRECTING THE APPLICATION FOR AN ENTERTAINMENT DESTINATION CENTER LICENSE FROM THE KENTUCKY DEPARTMENT OF ALCOHOLIC BEVERAGE CONTROL AND FURTHER ESTABLISHING THE REQUIREMENTS FOR A LICENSE TO SELL ALCOHOLIC BEVERAGES WITHIN THE COMMON AREAS OF THE ENTERTAINMENT DESTINATION CENTER.

Middlesboro Daily News:
Oct. 19, 2022
ORDINANCE NO. 92O22C

PUBLIC NOTICE

Notice is hereby given that Appalachian Regional Health Care, has filed an application with the Energy and Environment Cabinet to construct a box culvert along KYTC ROW and fill the floodplain of Moore Branch. The property is located approximately 4.5 miles South of Pineville, KY on the west side of US 25E ROW with Moore Branch. Any comments or objections can be submitted via email to: DOWFloodplain@ky.gov Kentucky Division of Water, Floodplain Management Section, 300 Sower Blvd. Frankfort, KY 40601. Call 502-564-3410 with questions.

Middlesboro Daily News:
Oct. 15, 19 and 22, 2022
APPLICATION

PUBLIC NOTICE

**NOTICE OF FILING WITH THE FEDERAL ENERGY REGULATORY COMMISSION
LEWIS RIDGE PUMPED STORAGE, LLC
LEWIS RIDGE PUMPED STORAGE PROJECT
FERC NO. 15249**

Lewis Ridge Pumped Storage, LLC (LRPS), as required by the Federal Energy Regulatory Commission (FERC or Commission), hereby gives notice and declares its intent to apply for an original license for the unconstructed Lewis Ridge Pumped Storage Project, FERC No. 15249 (Project). The unconstructed closed-loop pumped storage hydroelectric Project is located in the Upper Cumberland River Basin in Bell County, Kentucky at a site historically used for mining. The Applicant's address is 100 S. Olive Street, West Palm Beach, Florida 33401.

On or about October 21, 2022, LRPS will file with the FERC its Notice of Intent (NOI) to seek an original license for an unconstructed major project, a Pre-Application Document (PAD), and a request for Authorization to Use the Traditional Licensing Process (TLP). The NOI provides notice of LRPS intent to file a license application for the Project. The PAD summarizes relevant and available information regarding the Project's description and operation along with discussions of the potential operational effects on environmental and cultural resources.

LRPS invites resource agencies, Native American tribes, non-governmental organizations, and members of the public likely to be interested in the proceedings to participate in the licensing and to comment on this notice and related matters. The NOI and PAD and associated reference materials are available for inspection and reproduction online at https://www.ferc.gov/docs-filing/elibrary.asp Under docket number P-15249. These documents are also available during regular business hours at the Bell County Public Library, Pineville Branch, 214 Walnut Street, Pineville, Kentucky.

LRPS requests to use the TLP is based upon pre-PAD consultation with local, state, and federal agencies and other interested stakeholders and via a thorough desktop review of the site and surrounding resources. LRPS has identified areas where additional information is needed on the existing environment surrounding the Project, and has, in consultation, begun the process of developing study plans and mechanisms for fulfilling study goals. Due to this pre-PAD consultation, LRPS does not anticipate an elevated level of complexity and controversy regarding resource issues during the licensing process. LRPS believes that granting the request to use the TLP will not infringe on the ability for agencies or the public to provide comments on the Project, nor on LRPS ability to address such comments.

In accordance with 18 CFR § 5.6 (d)(2), comments on the request to use the TLP are due to the Commission no later than 30 days following the filing date of this request (i.e., by November 21, 2022 if NOI and PAD are filed on October 21, 2022). All responses must reference the FERC Project No. 15249. Comments should address, as appropriate to the circumstances of the request, the (A) likelihood of timely license issuance; (B) complexity of the resource issues; (C) level of anticipated controversy; (D) relative cost of the traditional licensing process compared to the integrated licensing process; (E) the amount of available information and potential for significant disputes over studies; and (F) other factors the commenter believes pertinent. Commenters must submit an electronic filing via FERC's website (http://www.ferc.gov/docs-filing/fercon-line.asp) pursuant to 18 CFR §385.2003(c) or an original and eight copies of their comments to the Office of the Secretary, Federal Energy Regulatory Commission, 888 First Street NE, Washington, DC 20426

Middlesboro Daily News:
Oct. 19, 2022
FERC No. 15249

From: Sandy Slayton
To: Lesley Brotkowski; Elizabeth Krchnavek; Nathan Sandvig
Subject: Fwd: Proposed Introductory Meeting - Rye Development & EPA
Date: Thursday, October 27, 2022 5:27:39 PM

Hi Team,

EPA is requesting a meeting, see below. Could you let me know your availability next week and the week after?

Sandy

Get Outlook for iOS

From: Clark, Maria <Clark.Maria@epa.gov>
Sent: Thursday, October 27, 2022 10:08 AM
To: Sandy Slayton
Subject: Proposed Introductory Meeting - Rye Development & EPA

Greetings Sandy Slayton:

I'm the project officer in charge of reviewing the Lewis Ridge Pumped Storage (LRPS) Project for the USEPA. I would like to propose an introductory meeting where Rye Development's team could introduce the LRPS project to our EPA team. The meeting could be an hour including a PPP from your team and a Q&A session.

Please let me know if your team would like to be a part of such introductory meeting, and feel free to contact me with any questions. Also, would you please send me your team's availability (dates/times) if you decide to join us. Thank you very much for your time.

Best,

Maria R. Clark

NEPA Section – Region 4
Strategic Programs Office
U.S. Environmental Protection Agency
61 Forsyth Street, SW
Atlanta, GA 30303
Phone# 404-562-9513

From: Sandy Slayton
To: Elizabeth Krchnavek; Lesley Brotkowski; Nathan Sandvig; Jay Anders
Subject: FW: LRN-2022-00976 (Lewis Ridge Pumped Storage, LLC)
Date: Wednesday, November 2, 2022 5:26:43 PM

FYI, below.

Sandy

From: Ehorn, Casey H CIV USARMY CELRN (USA) <Casey.H.Ehorn@usace.army.mil>
Sent: Wednesday, November 2, 2022 2:40 PM
To: Sandy Slayton <sandy@ryedevelopment.com>
Cc: Scott, Aurora C CIV USARMY CELRN (USA) <Aurora.C.Scott@usace.army.mil>
Subject: LRN-2022-00976 (Lewis Ridge Pumped Storage, LLC)

Ms. Slayton:

The U.S. Army Corps of Engineers (USACE) has received FERC NOI and Pre-Application Documentation for the licensing of the Lewis Ridge Pumped Storage project (FERC No. 15249). It has been assigned to Ms. Aurora Scott, and the file number is LRN-2022-00976 (Lewis Ridge Pumped Storage, LLC). Please refer to this number in future correspondence or discussions.

I will first review your request to ensure it is complete for public notice, and will provide you or your designated agent with a Request for Information (RAI) letter detailing any information we may need in order to place it on PN. We may also require additional information to complete our evaluation of your request, which may be included in this RAI or a subsequent RAI.

The USACE must comply with Section 7 of the Endangered Species Act and Section 106 of the National Historic Preservation Act as part of the review process for a permit decision. Compliance with these Acts may require that the USACE consider effects that are outside of jurisdictional waters. Please be aware that work conducted outside of jurisdictional waters prior to Section 7 and Section 106 consultation could potentially cause delays in the permit evaluation process if these areas are determined to be within USACE control and responsibility.

Thank you for your attention to the regulatory program, please feel free to contact me at anytime regarding this project.

v/r

Casey Ehorn
Deputy Chief, Regulatory Division
U.S. Army Corps of Engineers
3701 Bell Road
Nashville, Tennessee 37214-2660

o: 615.369.7504

c: 615.801.3601

casey.h.ehorn@usace.army.mil

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Lewis Ridge Pumped Storage Project

Meeting Summary

11/9/2022 11:00 AM Eastern Time

Attendees:

Maria Clark, U.S. Environmental Protection Agency (EPA)
Dean Kenneth, EPA
Ashley Monroe, EPA
Sandy Slayton, Rye/Lewis Ridge Pumped Storage, LLC (LRPS)
Lesley Brotkowski, Kleinschmidt Associates

Purpose:

Initial agency meeting with EPA. Provide an overview of the Lewis Ridge Pumped Storage Project (Project) and initiate consultation early in the process.

Summary:

- Sandy opened the call, and initiated introductions of all on the call.
- Maria provided information on EPA's interest in the Project, which includes the 309 program NEPA reviews. Region 4 EPA has worked on a few open loop pumped storage projects previously; none were on reclaimed mine lands. Maria noted that the EPA likes to be involved up front to provide feedback during early stages of project development.
- Sandy gave an overview of pumped storage, purpose and overview of the Project.
- Maria asked about the placement of the upper and lower reservoirs compared to the mining areas. Sandy explained that the upper reservoir would be placed on a reclaimed surface mine. Mined seams are located at various levels below the Project and engineering and Geotech evaluations will be ongoing to avoid interactions with mined areas.
- EPA noted that they will be asking for a Geotech survey. Sandy stated that Rye will be commissioning a Geotech evaluation this year, starting with geophysics and exploratory borings. EPA noted that they would like to review a draft of the study plan to provide comments.
- Sandy described the current status of the Project in the Federal Energy Regulatory Commission (FERC) Licensing Process
    - Received Preliminary Permit 3/3/2022.
    - Requesting to follow the Traditional Licensing Process (TLP).
    - Filed the Pre-Application Document (PAD) October 21, 2022.
- Sandy described the anticipated studies, which include a recently completed wetland and waterway delineation, bat survey (if needed), cultural resources study, socioeconomic assessment, and Geotech survey. Sandy hopes to review the wetland and waterway delineation results this week. Tom Fork may be used for initial and supplemental reservoir fill, but details are yet to be confirmed. EPA asked to review the wetland and waterway report.
- Maria asked if Rye will be evaluating the interconnection line as part of the Project. Sandy confirmed that the interconnection line will be evaluated and potential impacts described as part of the Project applications.

- Land disturbance will occur during construction. There are existing access roads on site and the upper reservoir will be construction above ground.
- Sandy noted that the closed loop reservoirs will be industrial in nature and wildlife interactions will not be encouraged. Maria asked if the water will be treated chemically. Sandy said the water will need to be clean to run through the turbines, but chemical inputs are not anticipated. A water quality management plan will likely be generated for the Project.
- Maria asked about potential fish entrainment during initial fill. Sandy agreed they don't want fish in the reservoirs and will be evaluating screening options to keep fish out.
- Ashley asked about the timing of consultation and permit application submittal for the 404 process. Sandy noted that 404 applications are typically filed during FERC's NEPA review, once the project is closer to receiving FERC approval. Sandy asked about recommended timing of a pre-application meeting with USACE and EPA, and Ashley said for a reservoir project, a couple years ahead of permit application filing would be reasonable. Sandy noted that the 401 application would be filed around the same time as the FERC license application filing.
- EPA reiterated their desire for early consultation, noting the FERC comment timelines don't always work well with their existing workloads. If they're familiar with the Project, they can provide feedback more efficiently.
- Maria requested a copy of the presentation; Sandy will provide a copy to the EPA.
- Sandy closed by thanking EPA their participation.

From: Elizabeth Krchnavek
To: "rdbrock@charter.net"
Cc: Lesley Brotkowski
Subject: Lewis Ridge Pumped Storage Project No. 15249
Date: Thursday, November 17, 2022 9:44:00 AM
Attachments: Lewis Ridge PAD 2022_11_16 Southern Cherokee Nation of Kentucky.pdf
image001.gif

Good Afternoon,

On behalf of Lewis Ridge Pumped Storage, LLC, I am writing to inform you of a submittal of a Notice of Intent, Pre-Application Document, and Request to Use Traditional Licensing Process for the Lewis Ridge Pumped Storage Project, Federal Energy Regulatory Commission (FERC) Project No. 15249 (Project). The Project is located in Bell County, Kentucky. Please see the attached letter regarding this matter. This letter was originally sent via certified mail to the Southern Cherokee Nation of Kentucky and was returned by USPS as undeliverable. Is there an updated mailing address for the Southern Cherokee Nation of Kentucky that we can include in the distribution list for matters related to this Project?

Thank you,

Elizabeth Krchnavek
Licensing Coordinator
Cell: 571-230-6830
Office: 984-389-1086
www.KleinschmidtGroup.com

Rye
Development

100 S. Olive Street, West Palm Beach, FL 33401

November 16, 2022

Roger "Bear" Brock
Chief
Southern Cherokee Nation of Kentucky
rdbrock@charter.net

Subject: Lewis Ridge Pumped Storage, LLC
Lewis Ridge Pumped Storage Project, FERC Project No. 15249
Notice of Intent, Pre-Application Document, and Request to Use Traditional Licensing Process for the Lewis Ridge Pumped Storage Project

To Whom It May Concern:

This letter is to inform you that the Lewis Ridge Pumped Storage, LLC (LRPS), in accordance with the requirements of 18 Code of Federal Regulation (CFR) Section 5, has electronically filed with the Federal Energy Regulatory Commission (Commission or FERC) the Notice of Intent (NOI) and Pre-Application Document (PAD) for the licensing of the Lewis Ridge Pumped Storage Project (Project) (FERC No. 15249). These documents can be viewed on the FERC eLibrary or on the project website: lewisridgeproject.com.

The unconstructed Project is located in the Upper Cumberland River Basin in Bell County, Kentucky near the borders of Tennessee and Virginia. The Project would be a closed loop pumped storage hydroelectric generating facility located at a site historically used for mining. The Project is anticipated to provide 287 megawatts (MW) of generation capacity.

Pursuant to 18 CFR §4.38, §5.5(c), and §5.6(a), the NOI and PAD are being distributed electronically to the relevant resource agencies, Native American tribes, non-governmental organizations, and other potential interested parties included on the attached distribution list.

LRPS requests Commission approval to use the Traditional Licensing Process (TLP) for the relicensing of the Project (Attachment A). As provided in 18 CFR §5.3(d)(1), we note that comments on the request to use the TLP must be filed with the Commission within 30 days of this letter. Pursuant to 18 CFR §5.3(d)(2), LRPS has published notice of the request to use the TLP in a daily newspaper of general circulation in the one county in which the Project is located (Bell County, Kentucky); the notice contains the information required by that section.

Should the Commission approve the use of the TLP, LRPS proposes to host a joint agency and public meeting (JAM) of the Project in accordance with 18 CFR §4.38 no earlier than 30 days, but no later than 60 days, from the Commission's TLP approval.

Currently, LRPS proposes to hold the JAM in Pineville, Kentucky on January 25, 2023. The date and location of the meeting may be altered after consultation with jurisdictional agencies and other licensing participants and pending FERC's decision regarding the LRPS request to use the TLP. If FERC requires that LRPS use the Integrated Licensing Process (ILP), then FERC will hold a scoping meeting in accordance with the regulations at CFR §5.8.

Please direct any questions pertaining to the Project or process to Sandy Slayton by phone at (206) 919-3976 or email at sandy@ryedevelopment.com.

Sincerely,

Erik Steimle
Vice President
Lewis Ridge Pumped Storage, LLC

Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 First Street, N.E., Room 1A
Washington, D.C. 20426

Re: EPA comments on Notice of Intent to Request to Use Traditional License Process, Filing of Pre-Application Document, Commencement of Pre-filing Process, Request for Comments on the PAD and Scoping Document, for Lewis Ridge Pumped Storage Project (FERC Project No. 15249)

Dear Secretary Bose:

The U.S. Environmental Protection Agency (EPA) has reviewed the referenced Pre-Application Document (PAD) and Notice of Intent (NOI), consistent with our responsibilities under Section 102(2)(C) of the National Environmental Policy Act (NEPA), the Council on Environmental Quality regulations (40 CFR Parts 1500-1508), and the EPA's authority under Section 309 of the Clean Air Act.

The Federal Energy Regulatory Commission (FERC) proposes to issue a new license for the proposed Lewis Ridge Pumped Storage Project (FERC docket P-15249). The Lewis Ridge Pumped Storage, LLC. proposes to construct a new pumped storage complex that includes the following: (1) a 5,450-foot-long, 135-foot-high roller compacted concrete dam for the upper reservoir with an integrated overflow spillway; (2) an upper reservoir of 24 acres; (3) a lower reservoir of 47 acres; (4) a 2.3-mile long overhead transmission line; (5) a 3,850-foot-long steel penstock with a 16-feet diameter upper section and two 12-foot diameter steel lower sections; (6) a 420-foot-long and 80-foot-wide powerhouse containing two 143.5-megawatt (MW) reversible pump-turbines, with a total installed capacity of 287 MW; (7) a 830-foot-long, 80-foot-high roller compacted concrete dam at the lower reservoir, with an integrated overflow spillway for an annual generation of 671,700 megawatt-hours (Mwh)-MW. The proposed site for the project is located in Bell County, Kentucky.

Based on our review of the NOI and PAD, the EPA is submitting recommendations regarding proposed project operations, initial fill, water resources, terrestrial wildlife and botanical resources, environmental impacts, Section 404, water quality standards, air quality, and environmental justice and community considerations to include in the draft NEPA document.

We appreciate the opportunity to comment on the PAD and NOI. If you have any questions regarding our comments, please contact Maria R. Clark at 404-562-9513, or at clark.maria@epa.gov.

U.S. EPA Comments on the Notice of Intent and Pre-Application Document for the Lewis Ridge Pumped Storage Project
FERC Project No. 15249

Based on our review of the Notice of Intent (NOI) and the Pre-Application Document **(**PAD), the EPA provides the following identified concerns and recommendations to ensure that potential impacts to public health and the environment are fully disclosed, assessed, and mitigated, where appropriate.

(1) **Section 4.4 Proposed Project Operations:** the PAD states …" *The Project would have the capacity to generate for 8 hours a day of full discharge, at a maximum of 287 MW, and pump water from the Lower Reservoir to the Upper Reservoir in about 12 hours".*

Recommendation: The EPA recommends including the amount of electricity needed to pump the water back up from the lower reservoir to the upper reservoir, where the power would come and the provider. Additionally, the EPA suggests considering the addition of floating solar arrays to mitigate evaporation and to avoid the use of other energy resources. *"With turbine pumping station connected with a solar farm (land-based or floating), solar output can be injected to the grid and used for pumping to store water (depending on the configuration of a given plant, only "excess" solar that cannot be absorbed by the grid and would be curtailed is used for pumping or solar plant can be dedicated exclusively for pumping)[1]."*

(2) **Section 4.5 Initial Fill**: The EPA understands that the PAD is still in the initial design phase and that information might change later with additional studies. Section 4.5 states …" *It has not yet been determined if initial fill from the drainage basin at the Lower Reservoir will be sufficient, or if temporary pumping from the Cumberland River will be needed to supplement the initial fill of the Project".*

Recommendation: The EPA recommends considering water withdrawals from a variety of resources, the timing, and the amount of water as to mitigate drastic impacts from a single resource, especially for the initial fill. We recommend including a matrix to visualize potential alternative sources.

(3) **Section 6.1 Geology and Soils:** The PAD states that …" *some of the subsequent borings could be converted to temporary observation wells to measure the groundwater elevations and conditions in the Project Vicinity."*

Recommendation: The EPA suggests using the groundwater observation wells to explore the possibility of installing high volume extraction wells to use in conjunction with other water resources to fill the upper reservoir. Furthermore, the high-volume extraction wells could be used when dry conditions are deemed unsuitable to withdraw water from rivers.

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[1] https://assets-global.website-files.com/5f749e4b9399c80b5e421384/61432192836f8d346bc2928e_IFPSH%20-%20Innovative%20PSH%20Configurations%20%26%20Uses_%2015%20Sept.pdf

The EPA understands that in-depth geotechnical surveys will be conducted in phases. Consequently, geological issues, such as high-in-situ stresses, might be encountered. The EPA suggests including in the draft environmental document detailed information and data, including the results from the geotechnical investigations conducted during each phase.

(4) **Section 6.2 Water Resources:** Section 6.2 of the PAD states, *"The Project would involve a one-time withdrawal of water for initial fill and routine smaller withdrawals for makeup water due to evaporation and seepage at the reservoirs."* It is unclear if there would be potential for overfilling of the reservoirs, and what capacity and systems will be in place in the event that the reservoirs need to be drained and drawn down, and the impact that draw down would have to the surrounding area (e.g., streams, wetlands, and the infrastructure). Additionally, as water is exchanged between the two proposed project reservoirs, there is potential for eutrophication. Furthermore, Section 6.2 of the PAD further states *"As the Project is proposed to be closed loop, it is not anticipated that the Project will impact water quality in Tom Fork"*; however, this appears to be inconsistent with Section 6.3, which states *"… it is anticipated the Project has the potential to cause temporary and permanent impacts to fish and aquatic resources at Tom Fork."* Two studies are proposed for Tom Fork between the lower reservoir and the Cumberland River confluence to provide information on substrate, aquatic life, habitat, and water quality impacts.

Recommendation: The EPA recommends including information of reservoir operations, including plans for emergency releases and additional withdrawals. Direct impacts from initial project construction should be analyzed separately from the ongoing effects of project operations. Water quality impacts should include downstream impacts due to reduced flows. We additionally recommend an analysis of the Cumberland River to determine potential impacts if supplemental water is needed for the proposed reservoirs, or if reduced flows from Tom Fork would have any short or long-term effects. The EPA recommends evaluating the potential for eutrophication, as well as maintenance activities to address eutrophication issues where they occur. If the evaluation finds that eutrophication may occur, consider alternatives to the project design to address these issues (e.g., nutrient loading, shading, and evaporation). The EPA also recommends developing an adaptive water quality monitoring program for the proposed reservoirs to estimate the accretion of constituents (including aerial deposition) over time. Additional information is needed to understand construction of reservoirs, if they will be sealed, and analysis of potential groundwater seepage during and after construction.

(5) **Section 6.3 Fish and Aquatic Resources:** Section 6.3 of the PAD includes a brief discussion of water quality, fish and aquatic resources in the project vicinity and states "*it is anticipated the Project has the potential to cause temporary and permanent impacts to fish and aquatic resources at Tom Fork."* On page 141, the applicant proposes two studies on Tom Fork for the purpose of providing information on fish and aquatic species habitat. In order to identify and mitigate any potential impacts to Tom Fork and the Cumberland River during and after construction, it is necessary to document the baseline structure and composition of the biological communities in the streams.

Recommendation: The EPA recommends extending the proposed studies to include the Cumberland River, as well as Tom Fork. The scope of the studies should be expanded beyond collecting water quality and aquatic habitat data to include the sampling and analysis of the fish, mussel, and macroinvertebrate communities in Tom Fork and the Cumberland River.

(6) 6.4 Terrestrial Wildlife and Botanical Resources: The PAD states that …" *The Project will permanently alter the habitat within the Project Boundary and is anticipated to displace terrestrial wildlife and vegetation due to the alteration of habitat within the Project Boundary."*

Recommendation: The EPA recommends including plans to provide passages for local wildlife that might be impacted by the proposed steel penstock if final plans show these structures to be attached/flushed to the ground instead of buried.

(7) Clean Water Act Section 404: Additional information is needed to analyze impacts that might require a Clean Water Act (CWA) Section 404 permit application, including an Approved Jurisdictional Determination (AJD) and the full analysis pertaining to the CWA 404(b)(1) Guidelines. Steps should be taken to avoid and minimize impacts, such as modifying the footprint of direct impacts or minimizing the effect of both direct and indirect impacts. Compensatory mitigation may be required for unavoidable impacts to wetlands and streams. There are limited third-party mitigation options available in this service area, so consideration of mechanisms for mitigation will need to be evaluated.

Recommendation: The EPA recommends including a full alternatives analysis with both off-site and on-site options. The alternatives analysis should include all potential scenarios for the construction of reservoirs, filling of reservoirs, diversion of flow, and ongoing operations. The currently proposed site should include an analysis of how current mining operations and earth-moving for the proposed construction on reclaimed mining lands could affect downstream aquatic resources. Jurisdictional impacts should include loss of upstream tributaries due to the impoundment and potential impacts to flow duration downstream due to water loss from impounded water.

(8) Clean Water Act Section 401: CWA regulations under the 404(b)(1) Guidelines prohibit discharges which may cause or contribute to violations of applicable State water quality standards, violate applicable toxic effluent standards, or cause or contribute to significant degradation of the waters of the U.S. Requirements include the consideration of secondary and cumulative impacts from proposed impacts, including individual or cumulative effects to fish and wildlife; ecosystem diversity, productivity and stability; and recreational, aesthetic and economic values. Impacts from the direct fill of streams or wetlands, as well as downstream effects from the impoundment should be included in the analysis. If excavation of the reclaimed mine areas is planned to occur, then impacts to water quality from relic contaminants from past mining might be released.

Recommendation: The EPA recommends a full analysis of both temporary and permanent impacts, including initial project construction with 100% diversion of Tom Fork and ongoing operations of the reservoir with any releases and/or withdrawals. A full analysis of indirect downstream affects should be evaluated based on the impoundment of water on Tom Fork.

The EPA recommends sediment sampling of any reclaimed mining areas proposed for the project to determine what contaminants have the potential to be mobilized.

(9) Water Quality Standards: State water quality standards (WQS) include designated uses, criteria to protect those uses, and an antidegradation policy (CWA Section 303(c); 40 CFR § 131). KY WQS provide the requirements for water quality and should be used as the metric for the protection of designated uses and criteria in any water body affected by the project. The default designated uses include domestic water supply, fish consumption, primary contact recreation, secondary contact recreation, and warm water aquatic habitat. For your information, the following criteria represent the minimum conditions necessary to protect surface waters for the warm water aquatic habitat designated use:

- **pH** shall not be less than six and zero-tenths (6.0) nor more than nine and zero-tenths (9.0) and shall not fluctuate more than one and zero-tenths (1.0) pH unit over a period of twenty-four (24) hours.
- **Flow** shall not be altered to a degree that will adversely affect the aquatic community.
- **Temperature** shall not exceed thirty-one and seven-tenths (31.7) degrees Celsius (eighty-nine (89) degrees Fahrenheit).
  - 1. The normal daily and seasonal temperature fluctuations that existed before the addition of heat due to other than natural causes shall be maintained.
- **Dissolved oxygen** shall be maintained at a minimum concentration of five and zero tenths (5.0) mg/L as a twenty-four (24) hour average in water with WAH use.
  - The instantaneous minimum shall not be less than four and zero-tenths (4.0) mg/L in water with Warm water Aquatic Habitat use.
- **Total suspended solids** shall not be changed to the extent that the indigenous aquatic community is adversely affected.
- **Settleable solids.** The addition of settleable solids that may alter the stream bottom so as to adversely affect productive aquatic communities shall be prohibited.

The most current version of the EPA-approved Kentucky WQS can be found at: https://www.epa.gov/sites/production/files/2014-12/documents/kywqs-standards.pdf.

There appears to be very little surface water quality monitoring data in this watershed and the tributaries in the project boundaries have never been assessed for CWA 305(b) or 303(d) reporting. Also, it is unclear whether a segment of the Cumberland River (mile 653.3 to 659.9, Assessment Unit ID#KY-2639) that might be impacted has been assessed. Given the fact of mining operations in the project area, it may be unknown whether these waterbodies are meeting their designated uses.

Recommendation: The EPA recommends the downstream water quality studies of Tom Fork and the Cumberland River evaluate Kentucky WQS and potential impacts to both reduced flows and impacts from adjacent mining operations or mobilization of sediments from proposed construction. This analysis should include impacts to stream morphology, aquatic habitat, fish and aquatic life, hydrologic flow regime and groundwater recharge.

The EPA reiterates the need for characterization of the existing communities of fish, benthic macroinvertebrates, and mussels in potentially impacted waterbodies for evaluating the effects of the project operation on aquatic habitat downstream. The EPA recommends thorough water quality monitoring at representative locations within the project boundary in order to characterize existing water quality and collecting information sufficient for analyzing the effects on all aspects of project operation and maintenance on water quality. This might include continuous monitoring of DO and temperature. In addition to parameters that might be recommended by the Kentucky Department of Water and other resource agencies, parameters to consider for monitoring would include pH, turbidity, and conductivity.

(10) Diversion of Flow: One of Kentucky's state water quality criteria states that, "[f]low shall not be altered to a degree that will adversely affect the aquatic community." Section 6.2 states *"… it is anticipated that the Project initial fill duration would be approximately 380 days, if 100% diversion of Tom Fork was used."* Section 6.2 further states, "*It has not yet been determined if supplementation will be required from the Cumberland River for the initial fill."* The reduction of normal flows in rivers and streams can have significant impacts for aquatic life, and the long-term removal of all the water in a stream can be catastrophic for aquatic communities.

<u>Recommendation:</u> The EPA recommends including a complete description of the initial fill operation and all other flow diversion operations. In addition, an analysis of the potential impacts to water quality and biological communities of Tom Fork and the Cumberland River from all proposed flow diversion scenarios should be conducted (see our #2 comment).

(11) Air Quality: The EPA recommends the environmental document identify best practices that reduce emissions during construction, such as diesel controls, clean fuels (ultra-low sulfur diesel), electrification, and construction practices for on-road and off-road equipment. This could include implementation of technologies such as diesel particulate filters or diesel oxidation catalysts. It could also include use of cleaner equipment, such as diesel engines meeting EPA's Tier 4 emission standards, which require reductions in air pollution to minimize localized impacts to nearby communities. Further detailed information on a broad range of cost-effective technologies and practices that improve operational efficiency and reduce emissions can be found through EPA's Natural Gas STAR Program. Please see the following EPA websites for additional information:

- https://www.epa.gov/dera/reducing-diesel-emissions-construction-and-agriculture
- https://www.epa.gov/regulations-emissions-vehicles-and-engines/final-rule-control-emissions-air-pollution-nonroad-diesel

(12) Climate Change and Resilience: The EPA recommends analyzing potential impacts of current climate trends and foreseeable changes to the setting of the proposed action and its alternatives. The EPA also recommends considering current and projected regional and local climate changes and the incorporation of climate resilience/adaption planning in the project design. Additionally, we recommend considering significant recent regional events (e.g., hurricanes, flooding, major storms event) in analyzing potential impacts to affected communities. The U.S. Climate Resilience Toolkit (https://toolkit.climate.gov/) serves as a repository of information related to climate resilience in the U.S., including steps to build resilience, case studies, expertise, etc. Furthermore, the EPA recommends exploring the Federal Emergency Management Agency's *National Risk Index,* a dataset and online tool to help illustrate communities most at risk of natural hazards (https://hazards.fema.gov/nri/learn-more).

(13) Environmental Justice (EJ) and Community Considerations: The EPA recommends meaningfully engaging communities with EJ concerns and including in the environmental document a discussion on the input, concerns, and engagement of communities affected by the proposed project. The EPA also recommends the environmental document describe how community concerns or recommendations have been used to develop proposed mitigation options or to further avoid or minimize impacts to human health and the environment. Additionally, the EPA wants to emphasize the importance of effective public outreach and engagement from FERC. For additional information from the Interagency Workgroup on NEPA and EJ, see "*Promising Practices for EJ Methodologies In NEPA Reviews"* (https://www.epa.gov/sites/default/files/2016-08/documents/nepa_promising_practices_document_2016.pdf).

The EPA recommends considering and disclosing in the environmental document impacts to communities with EJ concerns from this project, including impacts associated with the construction phases as well as the operation of the project.

(14) Indirect and Cumulative Impacts: Due to the nature and scope of the proposed project, the EPA recommends that indirect and cumulative impacts be identified and evaluated in the environmental document. We suggest an evaluation of the impacts of the proposed project in the context of interacting with, and potentially exacerbating, the effects of other projects within the project area. This could include, but is not limited to, the timing of the work coinciding with other human or natural disturbances that are affecting the project area (e.g., surrounding airshed/watershed). Indirect impacts should be analyzed separately from the direct impacts of the initial project construction and the ongoing effects of project operations. The EPA recommends pursuing additional innovations to help mitigate indirect and cumulative impacts. The EPA recommends exploring mitigation technologies (besides operational guidelines) that could be applied to prevent/minimize fish entrainments during water withdrawals.

(15) Disposal of Materials: The EPA recommends including plans for the disposal of excavated earth and rock and appropriate measures for the handling and disposal of contaminated materials. We recommend avoiding disposing spoil material into water bodies and wetlands, because spoil dumping could impact water quality and species. We recommend considering other projects in the area that might need fill material, such as old mines, roads, and superfund sites.

From: Sandy Slayton
To: Slone, Gordon (EEC)
Cc: Cunningham, Martin J (EEC); Elizabeth Krchnavek; Lesley Brotkowski; Nathan Sandvig
Subject: RE: Joint Agency and Public Meeting for Lewis Ridge Pumped Storage Project
Date: Thursday, December 8, 2022 11:25:46 AM
Attachments: image002.png
image003.png

Mr. Slone,

Thank you for reaching out. Yes, we will be sure to keep you on the notification list for the Joint Agency Meeting. We are still tentatively aiming for the January 25th date, assuming FERC approves the TLP in the next couple of weeks.

Sandy

Sandy Slayton
Vice President, Environmental
(206) 919-3976
sandy@ryedevelopment.com
www.ryedevelopment.com

From: Slone, Gordon (EEC) <gordonr.slone@ky.gov>
Sent: Thursday, December 8, 2022 6:00 AM
To: Sandy Slayton <sandy@ryedevelopment.com>
Cc: Cunningham, Martin J (EEC) <Jay.Cunningham@ky.gov>
Subject: Joint Agency and Public Meeting for Lewis Ridge Pumped Storage Project

Ms. Slayton,

I am writing to request notification for the Joint Agency and Public Meeting for the Lewis Ridge Pumped Storage Project that is tentatively scheduled for January 25, 2023.
My understanding is that the project is planned to be on what is a coal mine permit and several of my agencies (Division of Mine Permits, Division of Mine Reclamation and Enforcement) would be involved in the regulatory process that would be required because of the coal mine permit.

Please keep me informed of meetings where agency involvement is allowed.

Thank you,

Gordon Slone
Commissioner
Department for Natural Resources

From: Sandy Slayton <sandy@ryedevelopment.com>
Sent: Thursday, December 8, 2022 5:28 PM
To: Hutchins, Patricia (Heritage Council)
Subject: RE: Lewis Ridge Pumped Storage Project, Bell County - Section 106 Review
Attachments: P45988 KY SHPO preliminary records review_08_25_2022.pdf

Ms. Hutchins,

I apologize for the delayed response. Attached is the preliminary records review we received. You are correct that the area of potential effects is preliminary.

Sandy

Sandy Slayton
Vice President, Environmental
(206) 919-3976
sandy@ryedevelopment.com
www.ryedevelopment.com

From: Hutchins, Patricia (Heritage Council) <patricia.hutchins@ky.gov>
Sent: Wednesday, November 16, 2022 12:44 PM
To: Sandy Slayton <sandy@ryedevelopment.com>
Subject: FW: Lewis Ridge Pumped Storage Project, Bell County - Section 106 Review

Good afternoon Ms. Slayton,

Thank you for the pre-application document and cover sheet. It appears the area of potential effects is still preliminary. Is that correct? However, I see from the cover sheet that you requested a KHC and an OSA preliminary site check. Please forward the results of those site checks to this email address, and please confirm if the proposed area of potential effects is certain and is not expected to change at all.

Thank you,
Patti

Patricia E. Hutchins
Archaeology Review Coordinator
Kentucky Heritage Council
410 High Street
Frankfort, Kentucky 40601
Email: patricia.hutchins@ky.gov

NOTE: We are **no longer accepting paper** documents for Section 106 review. **Please submit all electronic documents for Section 106 Review to khc.section106@ky.gov.** DO NOT SUBMIT ANY INITIAL SECTION 106 REVIEW MATERIALS TO AN INDEPENDENT REVIEWER. Failure to submit documents to the dedicated Section 106 email address **will** result in our staff not receiving these documents for review.

Note: We cannot accept password protected files. If you must submit large files via link, **the time-frame for us to access must be unrestricted or, at a minimum, 30 days.**

Please see www.heritage.ky.gov for information about office hours and services.

From: Konkol, Nicole N (Heritage Council) <nicole.konkol@ky.gov> **On Behalf Of** KHC Section106
Sent: Thursday, October 27, 2022 11:24 AM
To: Hutchins, Patricia (Heritage Council) <patricia.hutchins@ky.gov>
Subject: Fw: Lewis Ridge Pumped Storage Project, Bell County - Section 106 Review

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Thank you for your Section 106 submission. Due to temporary staffing shortages and an increased workload, responses are likely to take longer than 30 days. Please continue to submit your Section 106 documents via email to khc.section106@ky.gov and we will respond as soon as we can. PLEASE DO NOT SUBMIT ANY INITIAL SECTION 106 REVIEW MATERIALS TO AN INDEPENDENT REVIEWER.

Note: We cannot accept password protected files. If you must submit large files via link, the time-frame for us to access must be unrestricted or, at a minimum, 30 days.

KHC Site Protection Staff

Kentucky Heritage Council

khc.section106@ky.gov

From: Sandy Slayton <sandy@ryedevelopment.com>
Sent: Tuesday, October 25, 2022 2:57 PM
To: KHC Section106 <KHC.Section106@ky.gov>
Cc: Elizabeth Krchnavek <Elizabeth.Krchnavek@kleinschmidtgroup.com>; Lesley Brotkowski <Lesley.Brotkowski@kleinschmidtgroup.com>
Subject: Lewis Ridge Pumped Storage Project, Bell County - Section 106 Review

Craig,

Please see the attached Section 106 review form. The supporting documentation is available via the link below. Please let me know if you have any trouble with access or need any additional information.
You can view "Volume I_Lewis Ridge NOI_PAD_Final.pdf" at:
https://acrobat.adobe.com/link/track?uri=urn:aaid:scds:US:6e458fb2-7802-494a-b6e3-3384ff57caa7

Thank you.

Sandy

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UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Lewis Ridge Pumped Storage, LLC		Project No. 15249-001

NOTICE OF INTENT TO FILE LICENSE APPLICATION, FILING OF PRE-APPLICATION DOCUMENT, AND APPROVING USE OF THE TRADITIONAL LICENSING PROCESS

(December 21, 2022)

a. Type of Filing: Notice of Intent to File License Application and Request to Use the Traditional Licensing Process.

b. Project No.: 15249-001

c. Dated Filed: October 21, 2022

d. Submitted By: Lewis Ridge Pumped Storage, LLC.

e. Name of Project: Lewis Ridge Pumped Storage Project

f. Location: On Tom Fork near the communities of Blackmont, Tejay, Balkan, and Callaway, in Bell County, Kentucky. The project would not occupy any federal lands.

g. Filed Pursuant to: 18 C.F.R. § 5.5 of the Commission's regulations

h. Applicant Contact: Sandy Slayton, Vice President, Lewis Ridge Pumped Storage, LLC, 830 NE Holladay Street, Portland, Oregon 97232; Phone: (206) 919-3976, Email: sandy@ryedevelopment.com

i. FERC Contact: Michael Spencer at (202) 502-6093 or michael.spencer@ferc.gov.

j. Lewis Ridge Pumped Storage, LLC. (Lewis Ridge) filed its request to use the Traditional Licensing Process on October 21, 2022. Lewis Ridge provided public notice of its request on October 19, 2022. In a letter dated December 21, 2022, the Director of the Division of Hydropower Licensing approved Lewis Ridge's request to use the Traditional Licensing Process.

k. With this notice, we are initiating informal consultation with the U.S. Fish and Wildlife Service and/or NOAA Fisheries under section 7 of the Endangered Species Act and the joint agency regulations thereunder at 50 C.F.R., Part 402; and NOAA Fisheries under section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations at 50 C.F.R. § 600.920. We are also initiating consultation with the Kentucky State Historic Preservation Officer, as required by section 106, National Historic Preservation Act, and the implementing regulations of the Advisory Council on Historic Preservation at 36 C.F.R. § 800.2.

l. With this notice, we are designating Lewis Ridge as the Commission's non-federal representative for carrying out informal consultation, pursuant to section 7 of the Endangered Species Act and section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act; and consultation pursuant to section 106 of the National Historic Preservation Act.

m. Lewis Ridge filed a Pre-Application Document (PAD; including a proposed process plan and schedule) with the Commission, pursuant to 18 C.F.R. § 5.6 of the Commission's regulations.

n. A copy of the PAD may be viewed on the Commission's website (http://www.ferc.gov), using the "eLibrary" link. Enter the docket number, excluding the last three digits in the docket number field to access the document. For assistance, contact FERC Online Support at FERCONlineSupport@ferc.gov, (866) 208-3676 (toll free), or (202) 502-8659 (TTY).

o. Register online at https://ferconline.ferc.gov/eSubscription.aspx to be notified via e-mail of new filing and issuances related to this or other pending projects. For assistance, contact FERC Online Support.

Kimberly D. Bose,
Secretary.

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, DC 20426
December 21, 2022

OFFICE OF ENERGY PROJECTS

Project No. 15249-001 – Kentucky
Lewis Ridge Pumped Storage Project
Lewis Ridge Pumped Storage, LLC

VIA FERC Service

Sandy Slayton, Vice President
Lewis Ridge Pumped Storage, LLC
30 NE Holladay Street
Portland, Oregon 97232

Reference: Authorization to Use the Traditional Licensing Process

Dear Sandy Slayton:

In a letter filed October 21, 2022, Lewis Ridge Pumped Storage, LLC (Lewis Ridge) requested to use the Traditional Licensing Process (TLP) in preparing a license application for the 287-megawatt Lewis Ridge Pumped Storage Project No. 15249. The project would be located on Tom Fork near the communities of Blackmont, Tejay, Balkan, and Callaway, in Bell County, Kentucky. On the same date, Lewis Ridge filed a notice of intent (NOI) to prepare a license application and a pre-application document (PAD) for the project.

Pursuant to section 5.3(d) of the Commission's regulations,[1] on October 27, 2022,[2] Lewis Ridge filed documentation with the Commission showing that it published a notice of the request to use the TLP in the October 19, 2022 edition of the *Middlesboro Daily News*. The notice contained the information required in section 5.3(d)(2) of the Commission's regulations, including a statement requesting that comments on the request to use the TLP be filed with the Commission within 30 days of the NOI and PAD. No comments addressing the use of the TLP were filed.

Based on the information provided that indicates the complexity of the resource issues is believed to be minor, the level of anticipated controversy is expected to be minimal, and there is a reasonable amount of available information regarding resources associated with the project, Lewis Ridge's request to use the TLP is granted.

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[1] 18 C.F.R. § 5.3(d) (2021).

[2] See FERC Accession No. 20221027-5093.

Section 4.38 of the Commission's regulations describes the pre-filing steps that need to be completed when preparing an application for a hydropower license under the TLP, including consultation and conducting necessary studies [18 C.F.R. §4.38(a)-(e)]. Specific steps that will need to be carried out during pre-filing consultation include an initial joint agency/public meeting and site visit [§4.38(b)(3)]; an opportunity for participants to request studies [§4.38(b)(5)]; preparation and participant review of a draft application [§4.38(c)(4)]; and a meeting to resolve any disputes on the draft application [§4.38(c)(6)]. Please note that the initial joint agency/public meeting, is required to be held no sooner than 30 days, nor later than 60 days, from the date of this letter [§4.38(b)(3)(ii)].

If you have any questions, please contact Michael Spencer at (202) 502-6093 or via email at michael.spencer@ferc.gov.

Sincerely,

Vince Yearick
Director
Division of Hydropower Licensing

ANDY BESHEAR
GOVERNOR

JACQUELINE COLEMAN
LT. GOVERNOR

TOURISM, ARTS AND HERITAGE CABINET
KENTUCKY HERITAGE COUNCIL
THE STATE HISTORIC PRESERVATION OFFICE
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MICHAEL E. BERRY
SECRETARY

CRAIG A. POTTS
EXECUTIVE DIRECTOR &
STATE HISTORIC PRESERVATION OFFICER

December 28, 2022

Sandy Slayton
Vice President, Environmental
Rye Development
830 NE Holladay Street
Portland, Oregon 97232
Via email: sandy@ryedevelopment.com

Re: Lewis Ridge Pumped Storage Project
Federal Energy Regulatory Commission (FERC), Bell County

Dear Ms. Slayton,

Thank you for your submission of documents related to the above-referenced project. We understand Lewis Ridge Pumped Storage, LLC (LRPS) has filed a Notice of Intent and a Pre-Application Document with FERC for the construction of a closed loop pumped storage hydroelectric generating facility in Bell County, near Blackmont, Tejay, Balkan, and Callaway and near River Mile 659 of the Cumberland River. We understand that the project is still in the initial stages, and the area of potential effect (APE) and proposed project activities are subject to change.

We understand that LRPS proposes to consult with our office to determine if any historic properties would be affected by the proposed project. LRPS has conducted a preliminary review of both architectural and archaeological resources in the vicinity of the preliminary APE, and proposes to conduct an archaeological desktop review of the project area. The desktop review will be conducted by a qualified archaeologist.

We look forward to continued consultation regarding this proposed undertaking. Please feel free to contact Patti Hutchins of my staff with any questions or concerns at patricia.hutchins@ky.gov.

Sincerely,

Craig A. Potts,
Executive Director and
State Historic Preservation Officer

KHC 220598; ref. 66139, 220208
CP/peh

Electronically Filed

Rye
Development

100 S. Olive Street, West Palm Beach, FL 33401

January 5, 2023

VIA E-FILING

Kimberly Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, DC 20426

Subject: Lewis Ridge Pumped Storage Project, FERC Project No. 15249
Notification of Joint Meeting and Site Visit

Dear Secretary Bose:

Lewis Ridge Pumped Storage, LLC (LRPS) is submitting this notice of the upcoming Joint Meeting and Site Visit for the Lewis Ridge Pumped Storage Project (Project) (FERC No. 15249), in accordance with FERC's regulations found at 18 C.F.R. §4.38(b)(3)(ii). The Joint Meeting is scheduled to be held on January 25, 2023 in the community room at the Pineville Bell County Public Library, located at 214 Walnut Street, Pineville, Kentucky 40977. To accommodate a variety of schedules, LRPS will host the meeting at two times: 10:30 AM and 6:30 PM (Eastern Standard Time). There will also be a Project site tour on January 25, 2023, initiating at 1:00 PM in the community room of the Pineville Bell County Public Library.

On October 21, 2021, LRPS filed with the Federal Energy Regulatory Commission (FERC or Commission) the Notice of Intent (NOI) to license, Pre-Application Document (PAD), and request to use the Traditional Licensing Process (TLP) for the Project. On December 21, 2021, the Commission granted the use of the TLP.

Attached is a copy of the public notice for the meeting, which will be published once in the Middlesboro Daily News, newspaper in circulation in Bell County, Kentucky, in accordance with FERC's regulations found at 18 C.F.R. §4.38(g).

Joint Meeting Agenda:
1) Welcome and introductions
2) Meeting purpose
3) Overview of Project
4) FERC licensing process overview
5) Solicitation of comments on PAD, environmental resources, and study needs
6) Closing remarks

Section 6.0 of the PAD lists issues that may need to be addressed to meet licensing requirements stipulated in 18 CFR §5.6(d)(4). Pursuant to 18 CFR §4.38(b), written comments and requests for studies must be submitted within 60 days of the Joint Meeting.

If you have any questions regarding the meeting, please contact Sandy Slayton (LRPS) by phone at (206) 919-3976 or email at sandy@ryedevelopment.com.

Sincerely,

Erik Steimle
Vice President
Lewis Ridge Pumped Storage, LLC

Attachment: Public Notice of Joint Meeting and Site Visit

cc: Lesley Brotkowski, Kleinschmidt Associates

PUBLIC NOTICE
JOINT AGENCY AND PUBLIC MEETING AND SITE VISIT
LEWIS RIDGE PUMPED STORAGE, LLC
LEWIS RIDGE PUMPED STORAGE PROJECT
(FERC No. 15249)

Lewis Ridge Pumped Storage, LLC (LRPS) will hold a Joint Agency and Public Meeting to discuss the Federal Energy Regulatory Commission (FERC) licensing of the Lewis Ridge Pumped Storage Project (FERC No. 15249) (Project). The Project would be located in Bell County, Kentucky near the communities of Blackmont, Tejay, Balkan, and Callaway.

LRPS will hold the Joint Agency and Public Meeting on January 25, 2023 in the Community Room at the Pineville Bell County Public Library, located at 214 Walnut Street, Pineville, Kentucky 40977. To accommodate a variety of schedules, LRPS will host the meeting at two times: 10:30 AM and 6:30 PM (Eastern Standard Time). LRPS invites interest parties, including agency personnel, stakeholders, and the public to attend either meeting time. The purpose of the Joint Agency and Public Meeting is to: 1) provide information about the Project and licensing process; 2) solicit information regarding the existing environmental resources associated with the Project and data that may need to be obtained; and 3) obtain agency and stakeholder opinions regarding the Project and its potential effect on existing resources.

Joint Agency and Public Meeting Agenda:
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6) Closing remarks

There will also be a Project site visit offered on January 25, 2023. Individuals that would like to attend the site visit must meet at 1:00 PM in the community room of the Pineville Bell County Public Library.

LRPS requests that attendees of the meeting and/or site visit RSVP to sandy@ryedevelopment.com by January 18, 2023 to ensure adequate accommodations.

The Notice of Intent (NOI) to license and Pre-Application Document (PAD) are available online: https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20221021-5176. Section 6.0 of the PAD lists issues that may need to be addressed to meet licensing requirements stipulated in 18 CFR §5.6(d)(4). Pursuant to 18 CFR §4.38(b), written comments on the PAD and requests for studies must be submitted within 60 days of the Joint Agency and Public Meeting.

From:	Sandy Slayton
To:	brock@bcje.com
Cc:	Elizabeth Krchnavek
Subject:	Lewis Ridge Joint Agency Meeting - January 25, 2023
Date:	Tuesday, January 10, 2023 12:35:56 PM
Attachments:	image001.png

Lewis Ridge Pumped Storage Project Stakeholder,

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Please Register for the Joint Meeting by January 18, 2023 by either:

- Filling out this form https://forms.office.com/r/5cc9tf5R28, or
- Responding to this email with your full name, title, agency or affiliation, mailing address, email address, selected meeting time, whether you'll attend the site visit, and PPE requirements.

We look forward to seeing you on January 25th.

Sandy

Sandy Slayton
Vice President, Environmental
(206) 919-3976
sandy@ryedevelopment.com
www.ryedevelopment.com

From: Sandy Slayton
To: Adam.Bowling@lrc.ky.gov
Cc: Elizabeth Krchnavek
Subject: Lewis Ridge Joint Agency Meeting - January 25, 2023
Date: Tuesday, January 10, 2023 12:36:49 PM
Attachments: image001.png

Lewis Ridge Pumped Storage Project Stakeholder,

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sandy@ryedevelopment.com
www.ryedevelopment.com

From: Sandy Slayton
To: rdbrock@charter.net
Cc: Elizabeth Krchnavek
Subject: Lewis Ridge Joint Agency Meeting - January 25, 2023
Date: Tuesday, January 10, 2023 12:36:30 PM
Attachments: image001.png

Lewis Ridge Pumped Storage Project Stakeholder,

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sandy@ryedevelopment.com
www.ryedevelopment.com

From: Sandy Slayton
To: matt.catron@ky.gov
Cc: Elizabeth Krchnavek
Subject: Lewis Ridge Joint Agency Meeting - January 25, 2023
Date: Tuesday, January 10, 2023 12:36:05 PM
Attachments: image001.png

Lewis Ridge Pumped Storage Project Stakeholder,

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From: Sandy Slayton
To: ashlstep@nc-cherokee.com
Cc: Elizabeth Krchnavek
Subject: Lewis Ridge Joint Agency Meeting - January 25, 2023
Date: Tuesday, January 10, 2023 12:36:28 PM
Attachments: image001.png

Lewis Ridge Pumped Storage Project Stakeholder,

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From: Sandy Slayton
To: ddotson@delawarenation-nsn.gov
Cc: Elizabeth Krchnavek
Subject: Lewis Ridge Joint Agency Meeting - January 25, 2023
Date: Tuesday, January 10, 2023 12:36:26 PM
Attachments: image001.png

Lewis Ridge Pumped Storage Project Stakeholder,

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From: Sandy Slayton
To: Duncan, Jeffrey R
Cc: Elizabeth Krchnavek
Subject: Lewis Ridge Joint Agency Meeting - January 25, 2023
Date: Tuesday, January 10, 2023 12:36:31 PM
Attachments: image001.png

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From: Sandy Slayton
To: econdev@ky.gov
Cc: Elizabeth Krchnavek
Subject: Lewis Ridge Joint Agency Meeting - January 25, 2023
Date: Tuesday, January 10, 2023 12:35:59 PM
Attachments: image001.png

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From: Sandy Slayton
To: Slone, Gordon (EEC); Cunningham, Martin J (EEC)
Cc: Elizabeth Krchnavek
Subject: Lewis Ridge Joint Agency Meeting - January 25, 2023
Date: Tuesday, January 10, 2023 12:36:23 PM
Attachments: image001.png

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From: Sandy Slayton
To: Miller, Robert L (EEC)
Cc: Elizabeth Krchnavek
Subject: Lewis Ridge Joint Agency Meeting - January 25, 2023
Date: Tuesday, January 10, 2023 12:36:24 PM
Attachments: image001.png

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We look forward to seeing you on January 25th.

Sandy

Sandy Slayton
Vice President, Environmental
(206) 919-3976
sandy@ryedevelopment.com
www.ryedevelopment.com

From: Sandy Slayton
To: blackman.daniel@epa.gov
Cc: Elizabeth Krchnavek
Subject: Lewis Ridge Joint Agency Meeting - January 25, 2023
Date: Tuesday, January 10, 2023 12:36:36 PM
Attachments: image001.png

Lewis Ridge Pumped Storage Project Stakeholder,

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sandy@ryedevelopment.com
www.ryedevelopment.com

From: Sandy Slayton
To: Leopoldo_Miranda@fws.gov; Faustini, John; Andrews, Lee; KentuckyES@fws.gov
Cc: Elizabeth Krchnavek
Subject: Lewis Ridge Joint Agency Meeting - January 25, 2023
Date: Tuesday, January 10, 2023 12:36:36 PM
Attachments: image001.png

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From: Sandy Slayton
To: Debbie.Gambrel@ky.gov
Cc: Elizabeth Krchnavek
Subject: Lewis Ridge Joint Agency Meeting - January 25, 2023
Date: Tuesday, January 10, 2023 12:35:54 PM
Attachments: image001.png

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sandy@ryedevelopment.com
www.ryedevelopment.com

From: Sandy Slayton
To: craig.potts@ky.gov; Hutchins, Patricia (Heritage Council)
Cc: Elizabeth Krchnavek
Subject: Lewis Ridge Joint Agency Meeting - January 25, 2023
Date: Tuesday, January 10, 2023 12:36:04 PM
Attachments: image001.png

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From: Sandy Slayton
To: Johnnie.Turner@lrc.ky.gov
Cc: Elizabeth Krchnavek
Subject: Lewis Ridge Joint Agency Meeting - January 25, 2023
Date: Tuesday, January 10, 2023 12:36:46 PM
Attachments: image001.png

Lewis Ridge Pumped Storage Project Stakeholder,

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From: Sandy Slayton
To: Kenya.Stump@ky.gov
Cc: Elizabeth Krchnavek
Subject: Lewis Ridge Joint Agency Meeting - January 25, 2023
Date: Tuesday, January 10, 2023 12:36:02 PM
Attachments: image001.png

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From: Sandy Slayton
To: info@kychamber.com
Cc: Elizabeth Krchnavek
Subject: Lewis Ridge Joint Agency Meeting - January 25, 2023
Date: Tuesday, January 10, 2023 12:35:58 PM
Attachments: image001.png

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From: Sandy Slayton
To: ashley@kyrc.org; fitzkrc@aol.com
Cc: Elizabeth Krchnavek
Subject: Lewis Ridge Joint Agency Meeting - January 25, 2023
Date: Tuesday, January 10, 2023 12:35:55 PM
Attachments: image001.png

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From: Sandy Slayton
To: br.masters@ky.gov
Cc: Elizabeth Krchnavek
Subject: Lewis Ridge Joint Agency Meeting - January 25, 2023
Date: Tuesday, January 10, 2023 12:36:04 PM
Attachments: image001.png

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From: Sandy Slayton
To: Lonis.Morgan@ky.gov
Cc: Elizabeth Krchnavek
Subject: Lewis Ridge Joint Agency Meeting - January 25, 2023
Date: Tuesday, January 10, 2023 12:36:05 PM
Attachments: image001.png

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To: Kim.Amendola@noaa.gov
Cc: Elizabeth Krchnavek
Subject: Lewis Ridge Joint Agency Meeting - January 25, 2023
Date: Tuesday, January 10, 2023 12:36:46 PM
Attachments: image001.png

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Lewis Ridge Pumped Storage, LLC (LRPS) is hosting a Joint Agency and Public Meeting to discuss the Federal Energy Regulatory Commission (FERC) licensing of the Lewis Ridge Pumped Storage Project (FERC No. 15249) (Project). The Project would be located in Bell County, Kentucky near the communities of Blackmont, Tejay, Balkan, and Callaway.

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Please Register for the Joint Meeting by January 18, 2023 by either:

- Filling out this form https://forms.office.com/r/5cc9tf5R28, or
- Responding to this email with your full name, title, agency or affiliation, mailing address, email address, selected meeting time, whether you'll attend the site visit, and PPE requirements.

We look forward to seeing you on January 25th.

Sandy

Sandy Slayton
Vice President, Environmental
(206) 919-3976
sandy@ryedevelopment.com
www.ryedevelopment.com

From: Sandy Slayton
To: chiefharper@peoriatribe.com
Cc: Elizabeth Krchnavek
Subject: Lewis Ridge Joint Agency Meeting - January 25, 2023
Date: Tuesday, January 10, 2023 12:36:27 PM
Attachments: image001.png

Lewis Ridge Pumped Storage Project Stakeholder,

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Vice President, Environmental
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sandy@ryedevelopment.com
www.ryedevelopment.com

From: Sandy Slayton
To: andrew_raddant@ios.doi.gov
Cc: Elizabeth Krchnavek
Subject: Lewis Ridge Joint Agency Meeting - January 25, 2023
Date: Tuesday, January 10, 2023 12:36:38 PM
Attachments: image001.png

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sandy@ryedevelopment.com
www.ryedevelopment.com

From: Sandy Slayton
To: Ehorn, Casey H CIV USARMY CELRN (USA); Scott, Aurora C CIV USARMY CELRN (USA)
Cc: Elizabeth Krchnavek
Subject: Lewis Ridge Joint Agency Meeting - January 25, 2023
Date: Tuesday, January 10, 2023 12:36:43 PM
Attachments: image001.png

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Vice President, Environmental
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sandy@ryedevelopment.com
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From:	Sandy Slayton
To:	Michael_Oetker@fws.gov
Cc:	Elizabeth Krchnavek
Subject:	FW: Lewis Ridge Joint Agency Meeting - January 25, 2023
Date:	Tuesday, January 10, 2023 2:52:49 PM
Attachments:	image001.png

From: Sandy Slayton
Sent: Tuesday, January 10, 2023 10:36 AM
To: Leopoldo_Miranda@fws.gov; Faustini, John <john_faustini@fws.gov>; Andrews, Lee <lee_andrews@fws.gov>; KentuckyES@fws.gov
Cc: Elizabeth Krchnavek <Elizabeth.Krchnavek@kleinschmidtgroup.com>
Subject: Lewis Ridge Joint Agency Meeting - January 25, 2023

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sandy@ryedevelopment.com
www.ryedevelopment.com

Rye Development

100 S. Olive Street, West Palm Beach, FL 33401

January 11, 2023

Subject: Notification of Joint Meeting and Site Visit for the
Lewis Ridge Pumped Storage Project, FERC Project No. 15249

Lewis Ridge Pumped Storage Project Stakeholder,

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Rye
Development
Sandy Slayton
Vice President, Environmental
(206) 919-3976
sandy@ryedevelopment.com
www.ryedevelopment.com

Lewis Ridge Pumped Storage Project (P-15249)
JAM Distribution List - Mailings

Elected Officials

Office of Senator Mitch McConnell
Lexington Office
771 Corporate Drive, Suite 108
Lexington, Kentucky 40503

Office of Senator Rand Paul
Main State Office
1029 State Street
Bowling Green, Kentucky 42101

Office of Representative Harold "Hal" Rogers
Somerset Office
551 Clifty Street
Somerset, Kentucky 42503

Federal Agencies

Director
Bureau of Indian Affairs
U.S. Department of the Interior
1849 C Street NW
MS - 4606
Washington, DC 20240

Commanding Officer
United States Coast Guard
95 Peyton Street
Barboursville, West Virginia 25504

Mso Paducah
United States Coast Guard
225 Tully Street
Paducah, Kentucky 42003-0170

Hydropower Coordinator
U.S. Army Corps of Engineers
Nashville District
110 9th Ave S
Nashville, Tennessee 37203

U.S. Department of Energy
P.O. Box 10940
Pittsburgh, Pennsylvania 15236-0940

State Agencies

Director
Kentucky Department for Environmental Protection
300 Fair Oaks Lane
Frankfort, Kentucky 40601

Kentucky Department of Fish & Wildlife Resources
Arnold Mitchell Building
#1 Game Farm Road
Frankfort, Kentucky 40601

Kentucky Public Service Commission
P.O. Box 615
211 Sower Boulevard
Frankfort, Kentucky 40602

Patrick Morrisey
Attorney General
West Virginia Office of Attorney General
Building 1, Room E-26
State Capitol Complex
1900 Kanawha Boulevard E
Charleston, West Virginia 25305

Daniel Cameron
Attorney General
Office of the Attorney General
700 Capital Avenue, Suite 118
Frankfort, Kentucky 40601-3449

Local Governments

Sandra Wilson
City Clerk
City of Middlesboro City Hall
221 N. 21st Street
Middlesboro, Kentucky 40965

From: Sandy Slayton
To: dlankford@miamination.com
Cc: Elizabeth Krchnavek
Subject: Lewis Ridge Joint Agency Meeting - January 25, 2023
Date: Wednesday, January 11, 2023 10:26:17 AM
Attachments: image001.png

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www.ryedevelopment.com

Electronically Filed

Rye Development

100 S. Olive Street, West Palm Beach, FL 33401

January 17, 2023

VIA E-FILING

Kimberly Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, DC 20426

Subject: Lewis Ridge Pumped Storage Project, FERC Project No. 15249
Proof of Publication of Joint Meeting Newspaper Notice

Dear Secretary Bose:

Lewis Ridge Pumped Storage, LLC (LRPS), Permittee for the Lewis Ridge Pumped Storage Project (Project) (FERC No. 15249), is providing proof of publication of a notice for the Joint Meeting, scheduled for January 25, 2023. The public notice was published once in the newspaper The Middlesboro Daily News on January 11, 2023. The public notice conforms with FERC's regulations found at 18 C.F.R. §4.38(g).

Please contact Sandy Slayton (LRPS) by phone at (206) 919-3976 or email at sandy@ryedevelopment.com if you have any questions concerning this matter.

Sincerely,

Erik Steimle
Vice President
Lewis Ridge Pumped Storage, LLC

Attachment: Affidavit of Publication

cc: Lesley Brotkowski, Kleinschmidt Associates

From: fitzkrc@aol.com
To: Sandy Slayton; Elizabeth Krchnavek
Cc: ashley@kyrc.org
Subject: Re: Lewis Ridge Joint Agency Meeting - January 25, 2023
Date: Monday, January 23, 2023 2:08:08 PM
Attachments: image001.png

Great. Thanks!!

-----Original Message-----
From: Sandy Slayton <sandy@ryedevelopment.com>
To: fitzkrc@aol.com <fitzkrc@aol.com>; Elizabeth.Krchnavek@kleinschmidtgroup.com
<Elizabeth.Krchnavek@kleinschmidtgroup.com>
Cc: ashley@kyrc.org <ashley@kyrc.org>
Sent: Mon, Jan 23, 2023 3:06 pm
Subject: RE: Lewis Ridge Joint Agency Meeting - January 25, 2023

Thank you! I didn't have them on my list. I'll send an outreach email to them today.

Sandy

From: fitzkrc@aol.com <fitzkrc@aol.com>
Sent: Monday, January 23, 2023 12:04 PM
To: Sandy Slayton <sandy@ryedevelopment.com>; Elizabeth.Krchnavek@kleinschmidtgroup.com
Cc: ashley@kyrc.org
Subject: Re: Lewis Ridge Joint Agency Meeting - January 25, 2023

Sandy, when we talked I mentioned outreach to Kentuckians for the Commonwealth, and Mountain Association, as being two good ideas. The contact for KFTC is Catherine Clement at cacclement@gmail.com, and at Mountain Association is Josh Bills josh@mtassociation.org,

Fitz

-----Original Message-----
From: Sandy Slayton <sandy@ryedevelopment.com>
To: fitzkrc@aol.com <fitzkrc@aol.com>; Elizabeth.Krchnavek@kleinschmidtgroup.com
<Elizabeth.Krchnavek@kleinschmidtgroup.com>
Cc: ashley@kyrc.org <ashley@kyrc.org>
Sent: Mon, Jan 23, 2023 3:01 pm
Subject: RE: Lewis Ridge Joint Agency Meeting - January 25, 2023

Thanks Fitz! Will do.

Sandy

From: fitzkrc@aol.com <fitzkrc@aol.com>
Sent: Monday, January 23, 2023 11:57 AM

To: Sandy Slayton <sandy@ryedevelopment.com>; Elizabeth.Krchnavek@kleinschmidtgroup.com
Cc: ashley@kyrc.org
Subject: Re: Lewis Ridge Joint Agency Meeting - January 25, 2023

Hi and thanks for the update on the project! I won't be able to attend the sessions but would appreciate receiving any handouts and powerpoints!

Thanks and happy new year!

Fitz

-----Original Message-----
From: Sandy Slayton <sandy@ryedevelopment.com>
To: ashley@kyrc.org <ashley@kyrc.org>; fitzkrc@aol.com <fitzkrc@aol.com>
Cc: Elizabeth Krchnavek <Elizabeth.Krchnavek@kleinschmidtgroup.com>
Sent: Tue, Jan 10, 2023 1:35 pm
Subject: Lewis Ridge Joint Agency Meeting - January 25, 2023

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FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, D.C. 20426
February 14, 2023

OFFICE OF ENERGY PROJECTS

Project No. 15249-001 - Kentucky
Lewis Ridge Pumped Storage Project
Lewis Ridge Pumped Storage, LLC

VIA USPS FIRST-CLASS MAIL

Principal Chief Richard Sneed
Eastern Band of Cherokee Indians
P.O. Box 1927
Cherokee, NC 28719

Stephen Yerka, THPO
Eastern Band of Cherokee Indians
P.O. Box 1927
Cherokee, NC 28719

Reference: Consultation with Tribes for the Lewis Ridge Pumped Storage Project No. 15249-001

To the Tribal Leaders Addressed:

The Federal Energy Regulatory Commission (Commission) invites your participation in the licensing process for the unconstructed Lewis Ridge Pumped Storage Project No. 15249 (Lewis Ridge Project). The Commission's licensing process is an opportunity for both the licensee and interested agencies, tribes, and other stakeholders to consider the project's operation and protection, mitigation, and enhancement measures, and evaluate the need for any changes or additional measures to be implemented over the term of any license issued for the project.

The proposed 287-megawatt Lewis Ridge Project would be a closed-loop pumped-storage project at a prior mining site with a lower reservoir on the Tom Fork, a tributary of the Cumberland River, and an upper reservoir on Lewis Ridge in Bell County, Kentucky. Lewis Ridge Pumped Storage, LLC (Lewis Ridge), the applicant for the project, filed a notice of intent and Pre-Application Document, and requested to use the Traditional Licensing Process (TLP) on October 21, 2022. This request was granted on December 21, 2022.

It is very important that a tribe whose interests could be affected by the proposed Lewis Ridge Project participate early in the process so that tribal issues are addressed. For this reason, please inform us if you have an interest in participating in the licensing process for the project. In addition, please indicate if you would like to meet with Commission staff to discuss the Commission's licensing process, how your tribe can participate to the fullest extent possible, your interests and concerns in the affected area, and how to establish procedures to ensure appropriate communication between Commission and tribal staffs. The meeting can be limited to Commission and your tribal staff, or can be open to other tribes or Lewis Ridge.

If at all possible, we would appreciate your response by March 15, 2023. The Commission strongly encourages electronic filing. Please file your response using the Commission's eFiling system at http://www.ferc.gov/docs-filing/efiling.asp. Commenters can submit brief comments up to 6,000 characters, without prior registration, using the eComment system at http://www.ferc.gov/docs-filing/ecomment.asp. You must include your name and contact information at the end of your comments. You may also register online at https://ferconline.ferc.gov/FERCOnline.aspx to be notified via email of new filings and issuances related to this or other pending projects. For assistance, please contact FERC Online Support at FERCOnlineSupport@ferc.gov, (866) 208-3676 (toll free), or (202) 502-8659 (TTY). In lieu of electronic filing, please send a paper copy via the U.S. Postal Service to: Kimberly D. Bose, Secretary, Federal Energy Regulatory Commission, 888 First Street, N.E., Room 1A, Washington, D.C. 20426. Submissions sent via any other carrier must be addressed to: Kimberly D. Bose, Secretary, Federal Energy Regulatory Commission, 12225 Wilkins Avenue, Rockville, Maryland 20852. The first page of any filing should include docket number P-15249-001.

If you have any questions or comments, please contact Dustin Wilson at (202) 502-6528, or at dustin.wilson@ferc.gov. Mr. Wilson will contact you shortly to follow-up on this letter.

Sincerely,

STEPHEN BOWLER
Digitally signed by STEPHEN BOWLER
Date: 2023.02.14 08:58:12 -05'00'

Stephen Bowler, Chief
South Branch
Division of Hydropower Licensing

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, D.C. 20426
February 14, 2023

OFFICE OF ENERGY PROJECTS

Project No. 15249-001 - Kentucky
Lewis Ridge Pumped Storage Project
Lewis Ridge Pumped Storage, LLC

VIA USPS FIRST-CLASS MAIL

Chief Joe Bunch
United Keetoowah Band of Cherokee Indians in Oklahoma
P.O. Box 746
Tahlequah, OK 74465

Eric Oosahwee-Vos, THPO
United Keetoowah Band of Cherokee Indians in Oklahoma
P.O. Box 1425
Tahlequah, OK 74465

Reference: Consultation with Tribes for the Lewis Ridge Pumped Storage Project No. 15249-001

To the Tribal Leaders Addressed:

The Federal Energy Regulatory Commission (Commission) invites your participation in the licensing process for the unconstructed Lewis Ridge Pumped Storage Project No. 15249 (Lewis Ridge Project). The Commission's licensing process is an opportunity for both the licensee and interested agencies, tribes, and other stakeholders to consider the project's operation and protection, mitigation, and enhancement measures, and evaluate the need for any changes or additional measures to be implemented over the term of any license issued for the project.

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STEPHEN BOWLER
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Date: 2023.02.14 09:00:47 -05'00'

Stephen Bowler, Chief
South Branch
Division of Hydropower Licensing

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, D.C. 20426
February 14, 2023

OFFICE OF ENERGY PROJECTS

Project No. 15249-001 - Kentucky
Lewis Ridge Pumped Storage Project
Lewis Ridge Pumped Storage, LLC

VIA USPS FIRST-CLASS MAIL

Principal Chief David Hill
Muscogee (Creek) Nation
P.O. Box 580
Okmulgee, OK 74447

Turner Hunt, THPO
Muscogee (Creek) Nation
P.O. Box 580
Okmulgee, OK 74447

Reference: Consultation with Tribes for the Lewis Ridge Pumped Storage Project No. 15249-001

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STEPHEN BOWLER
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Date: 2023.02.14 08:59:32 -05'00'

Stephen Bowler, Chief
South Branch
Division of Hydropower Licensing

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, D.C. 20426
February 14, 2023

OFFICE OF ENERGY PROJECTS

Project No. 15249-001 - Kentucky
Lewis Ridge Pumped Storage Project
Lewis Ridge Pumped Storage, LLC

VIA USPS FIRST-CLASS MAIL

Principal Chief Chuck Hoskin, Jr.
Cherokee Nation
P.O. Box 948
Tahlequah, OK 74465

Elizabeth Toombs, THPO
Cherokee Nation
P.O. Box 948
Tahlequah, OK 74465

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Sincerely,
STEPHEN BOWLER
Digitally signed by STEPHEN BOWLER
Date: 2023.02.14 08:56:50 -05'00'

Stephen Bowler, Chief
South Branch
Division of Hydropower Licensing

Rye Development

100 S. Olive Street, West Palm Beach, FL 33401

Via eFiling February 16, 2023

Kimberly Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, DC 20426

Subject: Lewis Ridge Pumped Storage Project, FERC Project No. 15249
Joint Meeting Audio Recording, Presentation, and Sign-in Sheets

Dear Secretary Bose:

Lewis Ridge Pumped Storage, LLC (LRPS), Permittee of the Lewis Ridge Pumped Storage Project (Project) (FERC No. 15249) hosted a Joint Meeting and Site Visit on January 25, 2023, in accordance 18 C.F.R. §4.38(b)(3). The Joint Meeting was held in the community room at the Pineville Bell County Public Library, located at 214 Walnut Street, Pineville, Kentucky 40977. To accommodate a variety of schedules, LRPS hosted the meeting at two times: 10:30 AM and 6:30 PM (Eastern Standard Time). The Site Visit began at 1:00 PM. LRPS herein files the PowerPoint presentation, the sign-in sheets, and the audio recordings of both Joint Meeting times.

If you have any questions pertaining to this filing, please contact Sandy Slayton by phone at (206) 919-3976 or email at sandy@ryedevelopment.com.

Sincerely,

Erik Steimle
Vice President
Lewis Ridge Pumped Storage, LLC
100 S. Olive Street
West Palm Beach, Florida 33401

Enclosure: Joint Meeting PowerPoint Presentation;
Joint Meeting Sign-in Sheets;
Joint Meeting Audio Recording Files

cc: Sandy Slayton, Lewis Ridge Pumped Storage, LLC
Lesley Brotkowski, Kleinschmidt Associates

Lewis Ridge Pumped Storage Project

FERC P-15249

Joint Meeting and Site Visit

January 25, 2023

In Accordance with 18 CFR §4.38

Meeting is being recorded

Agenda

1) Welcome and introductions
2) Meeting purpose
3) Overview of Project
4) FERC Licensing Process Overview
5) Solicitation of comments on Pre-Application Document, environmental resources, and study needs
6) Closing remarks

Welcome and Introductions

1) Introductions
2) Meeting is being recorded

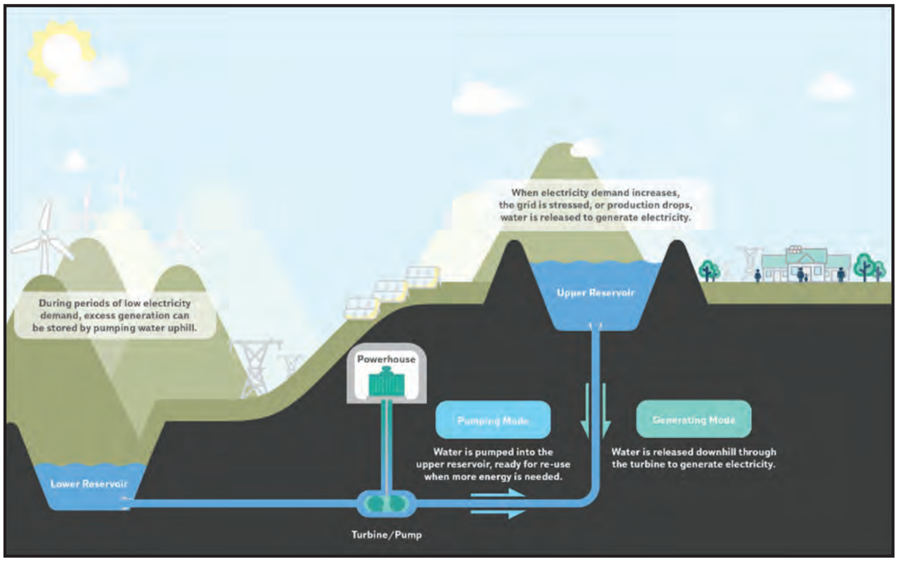
Meeting Purpose

1) Provide an overview of the proposed Lewis Ridge Pumped Storage Project
2) Provide information about the FERC licensing process
3) Discuss the available data and potential studies to support the license application
4) Receive input and feedback regarding the information presented
5) Provide a site visit

Why Pumped Storage in KY?

- ❖ Pumped storage provides reliable and dependable generation during periods of high energy use
- ❖ Pumped storage projects support a grid in transition, providing energy certainty during weather and blackout events, and capacity for variable generation sources

Pumped Storage Overview



When electricity demand increases, the grid is stressed, or production drops, water is released to generate electricity.

During periods of low electricity demand, excess generation can be stored by pumping water uphill.

Water is pumped into the upper reservoir, ready for re-use when more energy is needed.

Water is released downhill through the turbine to generate electricity.

Project Overview

- ❖ Initial stages of design
- ❖ Unconstructed 287 MW closed-loop pumped storage hydroelectric generating facility
- ❖ Provide 8 hours or 2,165 MWh (671,700 MWh annually) of cost-competitive energy storage
- ❖ Location in Bell County, in Southeastern Kentucky
- ❖ Reclaimed coal mine site

Preliminary Project Boundary and Project Vicinity

Lewis Ridge Pumped Storage Project

Preliminary
3D Rendering –
Overview

Lewis Ridge Pumped Storage Project

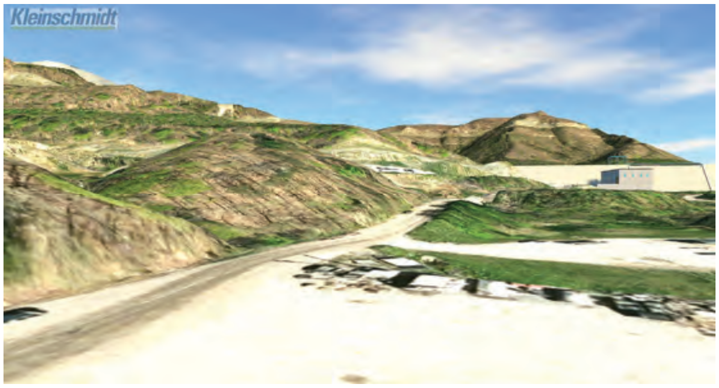
Preliminary
3D Rendering –
Upper Reservoir

Lewis Ridge Pumped Storage Project

Preliminary
3D Rendering –
Lower Reservoir

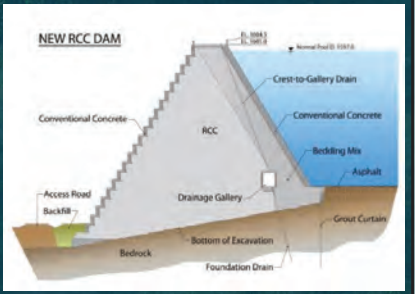
Lewis Ridge Pumped Storage Project

Preliminary
3D Rendering –
View from Ground



Preliminary Project Specifications

- Upper Reservoir:
  - 5,450-foot-long, 135-foot-high roller compacted concrete (RCC) dam
  - 24 acres
  - Useable storage capacity of 2,300 acre-feet
- Lower Reservoir:
  - 830-foot-long, 80-foot-high RCC dam at the Lower Reservoir with an integrated overflow spillway
  - 47 acres
  - Useable storage capacity of 2,300 acre-feet
- Powerhouse:
  - Two 143.5- MW reversible pump-turbines with a total installed capacity of 287 MW



Preliminary Project Specifications

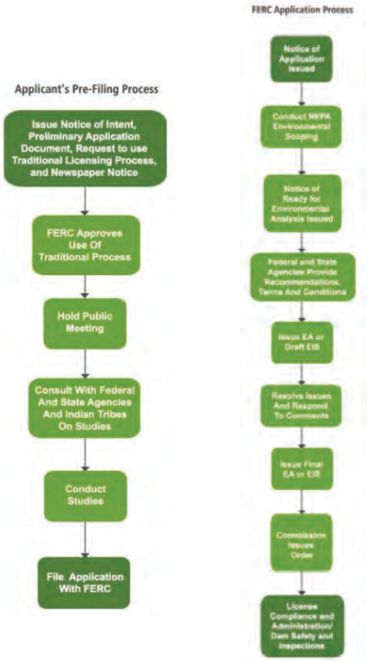
- 3,850-foot-long steel penstock
  - Upper section 16 feet in diameter
  - Lower extent bifurcating into two 12-foot diameter sections
- 2.3 mile 161 kilovolt overhead interconnection line

Preliminary Project Operations

- ❖ Closed-Loop Pumped Storage Project
  - Pump water from the Lower Reservoir to the Upper Reservoir at times when energy is in excess or in low demand. To generate energy, water would be released from the Upper Reservoir through the penstock to the powerhouse
- ❖ Recharge Fill
  - Diversion structure at Tom Fork located at Lower Reservoir
- ❖ Initial Fill
  - Tom Fork; not yet determined if supplementation from the Cumberland River will be needed

FERC Licensing Process

- ❖ FERC Preliminary Permit issued on 3/3/2022 with a term of 48 months
- ❖ LRPS filed the Notice of Intent (NOI), Pre-Application Document (PAD), and Traditional Licensing Process (TLP) request on 10/21/2022
- ❖ TLP was requested because it provides more flexibility in engaging stakeholders and stakeholder participation in the various phases
- ❖ FERC approved TLP on 12/21/2022



Traditional Licensing Process

- **First Stage**
  - Applicant issued Notice of Intent (NOI), Pre-Application Document (PAD), request to use Traditional Licensing Process (TLP) (10/21/2022)
  - FERC Approves use of TLP (12/21/2022)
  - Applicant conducts Joint Meeting and Site Visit (1/25/2023)
- **Second Stage**
  - Applicant completes studies (2023)
  - Applicant files Draft License Application (Summer 2023)
  - Interested parties comment period (2023)
- **Third Stage**
  - Applicant files Final License Application (Winter 2023 - 2024)
  - FERC conducts the final stage: application review, NEPA document issue license (2 year process after FLA is filed)

Detailed Project Schedule

Activity	Responsibility	Time Frame	Date
Joint Meeting with agencies, Tribes, and public	LRPS	30 to 60 days from FERC approval to use TLP	1/25/2023
Provide copy of meeting record to FERC and Stakeholders	LRPS	-	Promptly following the Joint Meeting
Comments and Study Requests	Stakeholders	Due 60 days after the Joint Meeting	3/26/2023
Study Plan Development	LRPS	-	Spring 2023
Conduct Studies	LRPS	-	Spring – Fall 2023
Draft License Application (DLA)	LRPS	-	Summer 2023
Agency, Tribe, interested parties comment period on DLA	Stakeholders	90-day comment period	90 days following DLA
File Final License Application (FLA) with FERC and distribute application	LRPS	-	Winter 2023-2024

Pre-Application Document & Resource Review

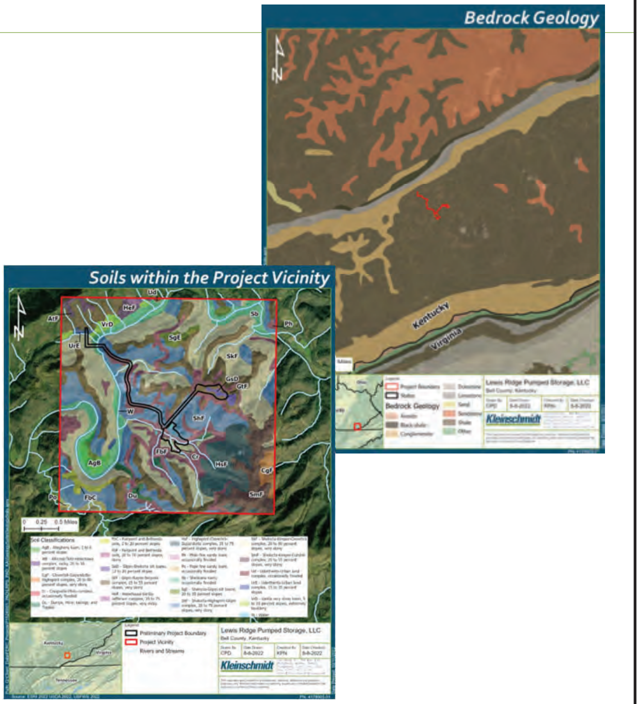
- PAD provides an overview of the Project and available resource information
- Reviews potential issues and information needs prior to preparation of a license application
- Resource information on subsequent slides

Geology and Soils

- ❖ Topography:
  - Existing ground surface elevations at the Project range from approximately 1,200 to 2,300 feet msl

Geology and Soils

- ❖ Geology:
  - Information on surficial and bedrock geology in the PAD
- ❖ Soils:
  - National Resource Conservation Service (NRCS) mapped soil types
- ❖ LRPS evaluating site stability throughout the design phase of the Project in geotechnical evaluations, engineering, and design of the Project

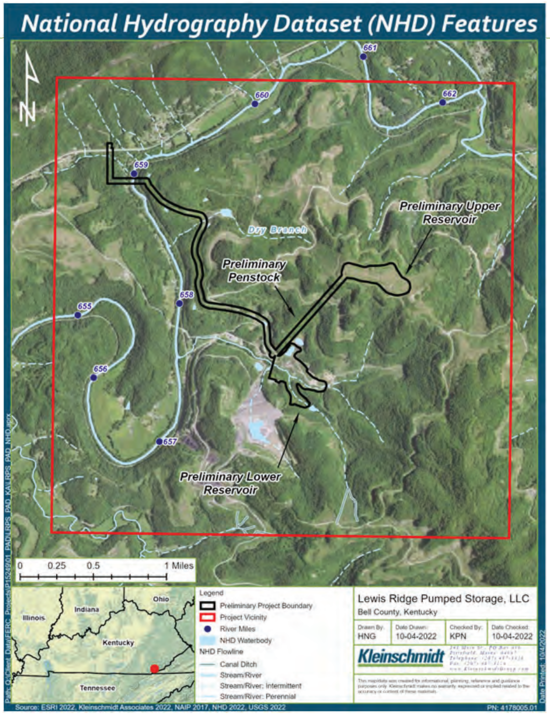


Geology and Soils

- ❖ Seismic Hazards:
  - Project is located in a seismic area with a ground peak acceleration of approximately 0.25g, with a 2 percent probability of exceedance in 50 years (2,475-year recurrence interval)
- ❖ Mining Activities:
  - Project located on a property that has historically been used for coal mining
  - All historically mined areas on which Project features will be located will be reclaimed
  - There are six identified coal seams in the Project Vicinity. From highest to lowest elevation, the seams are Darby, Kellioka, Harlan, Upper Path Fork, Hance, and Mason.

Water Resources

- ❖ Preliminary interconnection line crosses Cumberland River and Dry Branch
  - Crosses in a single span, with no anticipated impacts to water resources or aquatic habitat
- ❖ Preliminary Lower Reservoir located at Tom Fork



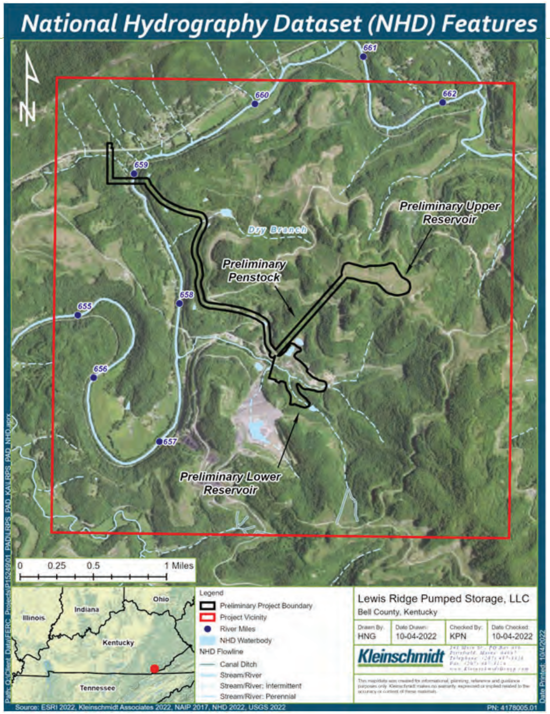
National Hydrography Dataset (NHD) Features

This map/data was created for informational, planning, reference and guidance purposes only. Kleinschmidt makes no warranty expressed or implied related to the accuracy or content of these materials.

Source: ESRI 2022, Kleinschmidt Associates 2022, NAIP 2017, NHD 2022, USGS 2022

Water Resources

- ❖ One-time withdrawal of water for initial fill and routine smaller withdrawals from Tom Fork for makeup water due to evaporation and seepage at the reservoirs
- ❖ Water source for both initial fill and recharge is anticipated to be Tom Fork
- ❖ Supplementation from Cumberland River for initial fill is TBD



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Source: ESRI 2022, Kleinschmidt Associates 2022, NAIP 2017, NHD 2022, USGS 2022

Water Resources

- ❖ Drainage area of 1.82 square miles at the preliminary Lower Reservoir
- ❖ Estimated Project initial fill duration would be approximately 380 days, if 100% diversion of Tom Fork was used
- ❖ Estimated that the average percent of diversion of Tom Fork flow required for recharge water would be approximately 8%

Drainage Area of Preliminary Lower Reservoir

Water Resources

Tom Fork Downstream of Preliminary Lower Reservoir

Fish and Aquatic Resources

- No anticipated impacts to aquatic habitat or fisheries at Cumberland River or Dry Branch
- The Project has the potential to cause temporary and permanent impacts to fish and aquatic resources at Tom Fork
- Data available on species known to occur in the Upper Cumberland River Basin in PAD

Wildlife and Botanical Resources

- Project is located at an existing highly disturbed area historically used for mining
- Both native and non-native vegetation cover the Project Vicinity
- Common terrestrial wildlife inhabit or use the Project Vicinity, including small and large mammals, birds, reptiles, and amphibians

Wildlife and Botanical Resources

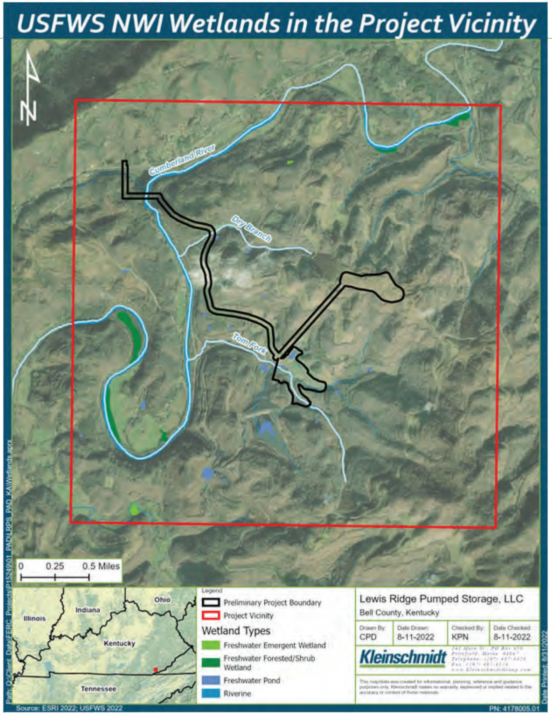
- ❖ Vegetation disruption is not anticipated to have a long-term impact on plant communities within the Project Vicinity

Reclaimed Mining Area in Project Vicinity

Wetlands, Riparian, and Littoral Habitat

- ❖ Preliminary interconnection line crosses Cumberland River and Dry Branch
- ❖ Preliminary Lower Reservoir at Tom Fork

NWI Wetland Type	Acres in the Project Vicinity	Acres in the Preliminary Project Boundary
Freshwater Emergent Wetland	3.9	0
Freshwater Forested/Shrub Wetland	30.5	0
Freshwater Pond	19.7	1.8
Riverine	139.3	2.5

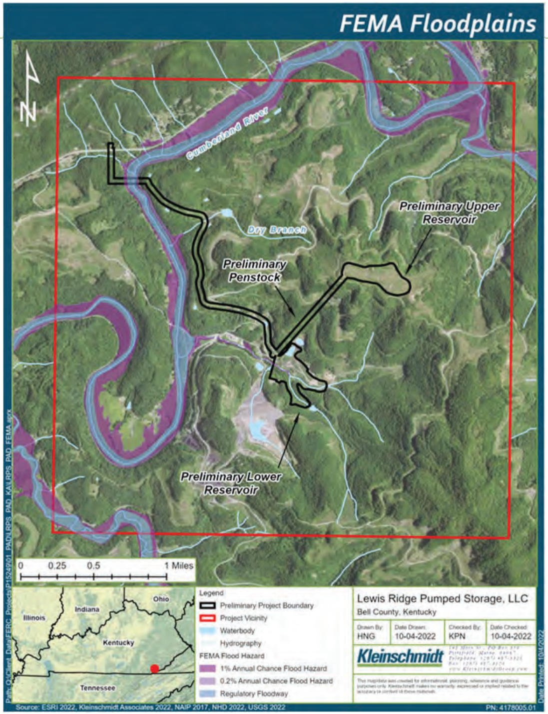


USFWS NWI Wetlands in the Project Vicinity

Source: ESRI 2022; USFWS 2022

Wetlands, Riparian, and Littoral Habitat

- ❖ Federal Emergency Management Agency (FEMA) flood mapping
    - Floodways in the Project Vicinity are primarily associated with the Cumberland River
    - Narrow section along Tom Fork mapped as a 1% annual chance flood hazard



Source: ESRI 2022, Kleinschmidt Associates 2022, NAIP 2017, NHD 2022, USGS 2022

Rare, Threatened, and Endangered (RTE) Species

- ❖ No federally designated Critical Habitat within Project Vicinity
- ❖ Federally listed and candidate species with potential to occur at or near Project:
    - – gray bat
    - – Indiana bat
    - – northern long-eared bat,
    - – monarch butterfly
    - – yellow-spotted woodland salamander
- ❖ Several state-protected species were identified as having known occurrences in Bell County, including two fish species:
    - – blackside dace
    - – Cumberland arrow darter

Recreation and Land Use

- Recreation is not permitted in the preliminary Project Boundary as it is private property with active and reclaimed mining operations
- Public access is restricted for public safety due to the industrial nature of this land
- No public recreation sites in the Project Vicinity
- No impacts to recreation/land use anticipated

Aesthetic Resources

- History of mining
- Project is not anticipated to have notably visible alteration of the use of the land
- Vegetation and topography limits the visibility of the area

Socioeconomic Resources and Environmental Justice

- The region surrounding the Project support various employment industries including health care and social assistance, manufacturing, and retail trade
- Environmental justice (EJ) communities were identified in the Project Vicinity based on the low-income threshold criteria
- Anticipated that the Project would have a positive economic impact on the region and has the potential to benefit the identified EJ communities through the creation of jobs and additional tax revenue

Cultural Resources

- A preliminary records review for historic resources sites and archaeological sites was submitted
- Architectural Review
    - In the Project Vicinity: 10 historic houses along public roadways (1 of which meets National Register of Historic Places [NRHP] criteria) and the Balkan School (meets NRHP criteria)
- Archaeological Review
    - The review identified 5 sites within a 30-meter buffer of the preliminary Project Boundary
    - Three of the sites do not meet NRHP eligibility criteria and two of the sites are cemeteries (NRHP status have not been assessed)

Tribal Resources

- The Project includes no Tribal lands
- No specific tribal interests have been identified at the Project to date

Native American Tribes included in Project Distribution List
Southern Cherokee Nation of Kentucky
Eastern Band of Cherokee Indians
Peoria Tribe of Indians of Oklahoma
Delaware Nation
Miami Tribe of Oklahoma

Proposed Studies

- Geology and Soils
  - Phased geotechnical investigation approach to obtaining the geotechnical data/information needed to support the design as it progresses
  - Early 2023, conduct geophysical geotechnical investigation
  - Purpose is to provide a general characterization of subsurface conditions at the preliminary locations of each primary Project feature, including the thickness of overburden soil, top of bedrock depth/elevation contours, presence of subsurface voids, and ease/difficulty of rock excavation
  - As the design progresses, additional phase(s) of geotechnical investigation and evaluation of subsurface conditions will be needed

Proposed Studies

- Water Resources / Fish and Aquatic Species Habitat / Wetland Resources:
  - Wetland and waterbody delineation in the preliminary Project Boundary, including information about the physical habitat at Tom Fork
  - Baseline water quality sampling in Tom Fork, including dissolved oxygen, temperature, and conductivity
  - Information collected will be used to evaluate habitat potential for blackside dace

Proposed Studies

- RTE Resources:
  - To avoid potential impacts to tree roosting bats, LRPS proposes to avoid tree-clearing between June 1 and August 15. If avoidance is not possible, a survey will be conducted.
- Socioeconomic Resources and Environmental Justice:
  - Study that examines the short-term and long-term economic impacts to the Project region

Proposed Studies

- Cultural Resources:
    - Consult with Kentucky SHPO to determine if any historic properties would be in the Project Area of Potential Effects (APE)
    - Conduct additional desktop archaeological review of the Project APE

Comments and Study Requests

- Comments on PAD and Study Requests
    - Comments welcome today during meeting
    - Written comments due March 26, 2023
    - Written comments may be filed with FERC or submitted directly to Rye
- Study Request Requirements 18 CFR 4.38(b)(5)
    - Study identification
    - Basis for the study request
    - Resource(s) involved as well as goals and objectives for these resources
    - Justification for the recommended study methodology
    - Documentation that the study method recommended conforms with generally accepted practice
    - An explanation of how the study will be used to further resource goals and objectives

Closing Remarks

Questions and Discussion

Sandy Slayton
Vice President, Environmental
Rye Development
P: 206-919-3976
E: sandy@ryedevelopment.com

Rye Development

Lesley Brotkowski
Senior Licensing Coordinator
Kleinschmidt Associates
P: 715-318-3729
E: Lesley.Brotkowski@kleinschmidtgroup.com

Kleinschmidt

Lewis Ridge Pumped Storage Project, FERC No. 15249
Joint Meeting
Pineville Bell County Public Library 10:30 AM
Sign In Sheet

Name	Representing	Email
Ushakar Jha	Rye Development	ushakar@ryedevelopment.com
Jay Anders	Rye Development	Jay@ryedevelopment.com
Michael Gambrel	Asher Land	asherlandandmineral.mg@gmail.com
Matthew Dunlap	Kleinschmidt	matt.dunlap@kleinschmidtgroup.com
Eddie Saylor	Bell Co MAG	state.
Tom Barbour	Ky Dept. for Natural Resources	Thomas.Barbour@ky.gov
BRENDA PRACHEIL	PACIFIC NORTHWEST NATL LAB	brenda.pracheil@pnnl.gov
Michael Floyd	USFWS	mike_floyd@fws.gov
Karah Jaffe	USFWS	karah_jaffe@fws.gov
Cara Beverly	USACE	cara.c.beverly@usace.army.mil
Rob Lincks	Bell CO	Lincks@BCJE.COM
Albey Brock	Bell CO	Brock@BCJE.COM
MIKE RICCI	RESPEC	MICHAEL.RICCI@RESPEC.COM
Ben Barnett	Bell PVA	ben.barnett@ky.gov
Jay Cunningham	KY DNR	Jay.Cunningham@ky.gov
LES WILLIAMS	NHE	LWILLIAMS@NHEINC.NET
Barry Butcher	AML	barry.butcher@ky.gov
Lesley Bratkowski	Kleinschmidt	Lesley.Bratkowski@kleinschmidtgroup.com
Sandy Slayton	Rye Development	Sandy@ryedevelopment.com

Lewis Ridge Pumped Storage Project, FERC No. 15249
Site Visit
Pineville Bell County Public Library 1:00 PM
Sign In Sheet

Name	Representing	Email
Ushakar Jha	Rye Dev.	ushakar@ ryedevelopment.in.
BRENDA PRACHEIL	PNNL	~~bpo~~ brenda.pracheil@pnnl.gov
Matthew Dunlap	Kleinschmidt	~~matt~~ matt.dunlap@kleinschmidtgroup.com
Lesley Bartkowski	"	lesley.bartkowski@ " " "
Michael Gambrel	Asher Land	asherlandandmineral.mg@gmail.com
Mike Ricci	RESPEC	michael.ricci@respec.com
Jay Cunningham	KY DNR	Jay.Cunningham@ky.gov
Barry Butcher	KY AML	barry.butcher@ky.gov.
Beth Trent	Ky DOW	beth.trent@ky.gov
Claudette Enriquez	SOAR	Claudette@soar-ky.org
Sandy Slayton	Rye Devel.	sandy@Ryedevelopment.com
Rob Lincks	Bell CO.	Lincks@BCJE.com
Tom Barbour	KY DNR	Thomas.Barbour@ky.gov

Lewis Ridge Pumped Storage Project, FERC No. 15249
Joint Meeting
Pineville Bell County Public Library 6:30 PM
Sign In Sheet

Name	Representing	Email
Mike Rich	RESPEC	MICHAEL.RICH@RESPEC.COM
Ushakar Jha	Rye	ushakar@ryedevelopment.com
Matthew Dunlap	Kleinschmidt	matt.dunlap@kleinschmidtgroup.com
Lesley Brotkowski	"	Lesley.brotkowski@ " " "
Sandy Slayton	Rye	sandy@Ryedevelopment.com
J R Golden	Asherland	JRGOLDENLAW@GMAIL.COM
D. Boone LOGAN	ALM	boonelogan@bellsouth.net

ANDY BESHEAR
GOVERNOR

REBECCA W. GOODMAN
SECRETARY

ANTHONY R. HATTON
COMMISSIONER

ENERGY AND ENVIRONMENT CABINET
DEPARTMENT FOR ENVIRONMENTAL PROTECTION

300 SOWER BOULEVARD
FRANKFORT, KENTUCKY 40601
TELEPHONE: 502-564-2150
TELEFAX: 502-564-4245

April 6, 2023

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E., Room 1A
Washington, D.C. 20426

RE: Lewis Ridge Pumped Storage Project--Docket No. 15249-001 (NEPA 2023-13)

Dear Sir or Madam,

The Energy and Environment Cabinet serves as the state clearinghouse for review of environmental documents generated pursuant to the National Environmental Policy Act (NEPA). Within the Cabinet, the Commissioner's Office in the Department for Environmental Protection (DEP) coordinates the review for Kentucky state agencies. We received your letter requesting an environmental review for this project. We have reviewed the document and provided comments below.

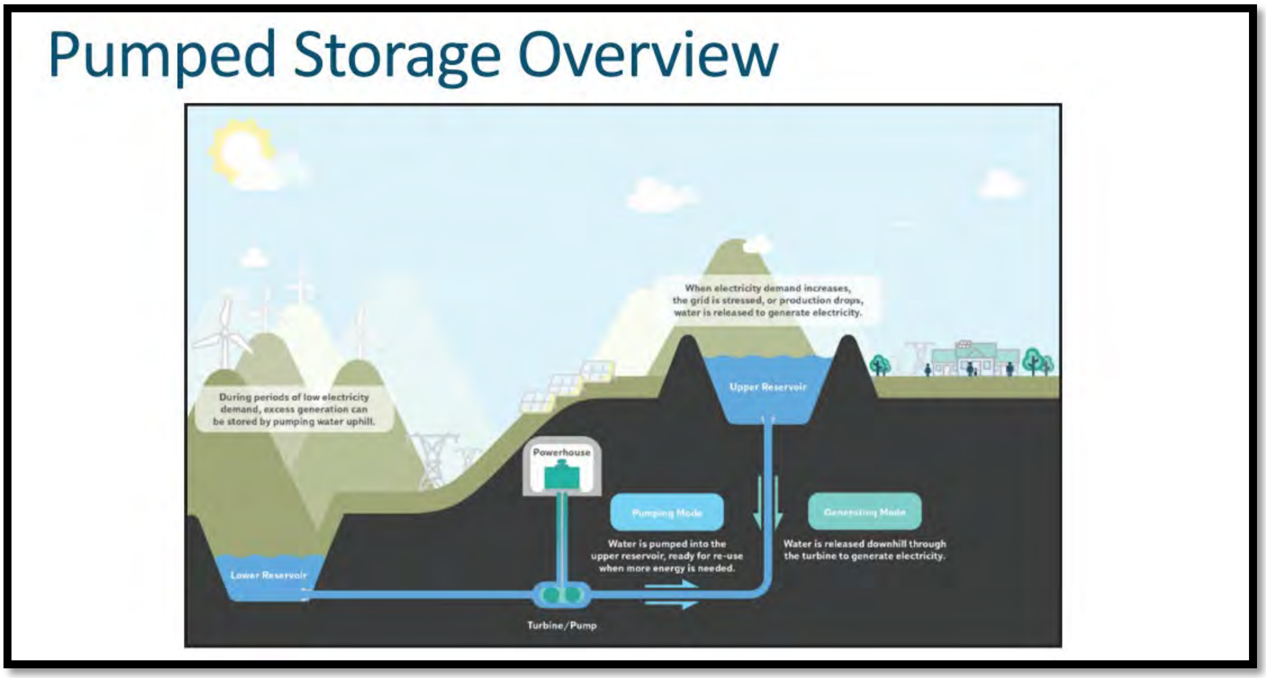
Division of Enforcement

The Division of Enforcement does not have any objections to this project. FERC needs to address SMCRA mine reclamation issues with the Department of Natural Resources (attachment). FERC needs to address impacts to Tom Fork and the three intermittent streams that form Tom Fork with Division of Water.

The Federal Energy Regulatory Commission (FERC) is exploring the construction of a pumped storage project in Bell County, KY. I pulled information for this review from the presentation slides for the "Joint Meeting and Site Visit" held on January 25, 2003.

This project involves the construction of two reservoirs, one at a higher elevation and the other at a lower elevation. During periods of low energy demand, the operator pumps water from the lower reservoir to the upper reservoir. When energy demand is higher, the operator releases water from the upper reservoir. This water flows through a turbine as it returns to the lower reservoir, generating electricity. FERC estimates that the project will provide 8 hours or 2,165 MWh of energy storage.

FERC presentation slide on a pumped storage system.



Pumped Storage Overview

During periods of low electricity demand, excess generation can be stored by pumping water uphill.

When electricity demand increases, the grid is stressed, or production drops, water is released to generate electricity.

Pumping Mode

Water is pumped into the upper reservoir, ready for re-use when more energy is needed.

Generating Mode

Water is released downhill through the turbine to generate electricity.

The project includes the following components:

- Upper Reservoir
  - 24 acres
  - Dam – 5,450 ft. long by 135 ft. high
  - Storage – 2,300 acre-ft.
- Lower Reservoir
  - 47 acres
  - Dam – 830 ft. long by 80 ft. high
  - Storage – 2,300 acre-ft.
- Powerhouse
  - Two 143.5 MW reversible pump-turbines
  - Installed capacity of 287 MW
- Penstock (Pipeline)
  - 3,850 ft.
  - 16 ft. diameter upper section
  - Split into two 12 ft. diameters sections in the lower section
- Overhead Interconnection Line
  - 2.3 miles of 161 kilovolt line

FERC 3-D rending of the proposed project from the presentation slides.

FERC states that water would come from Tom Fork, but they are studying the need to supplement with water from the Cumberland River. The project proposes to recharged from Tom Fork into the lower reservoir using a diversion structure.

The proposed project location is a former mining site located at approximately latitude 36.762741 and longitude -83.551304.

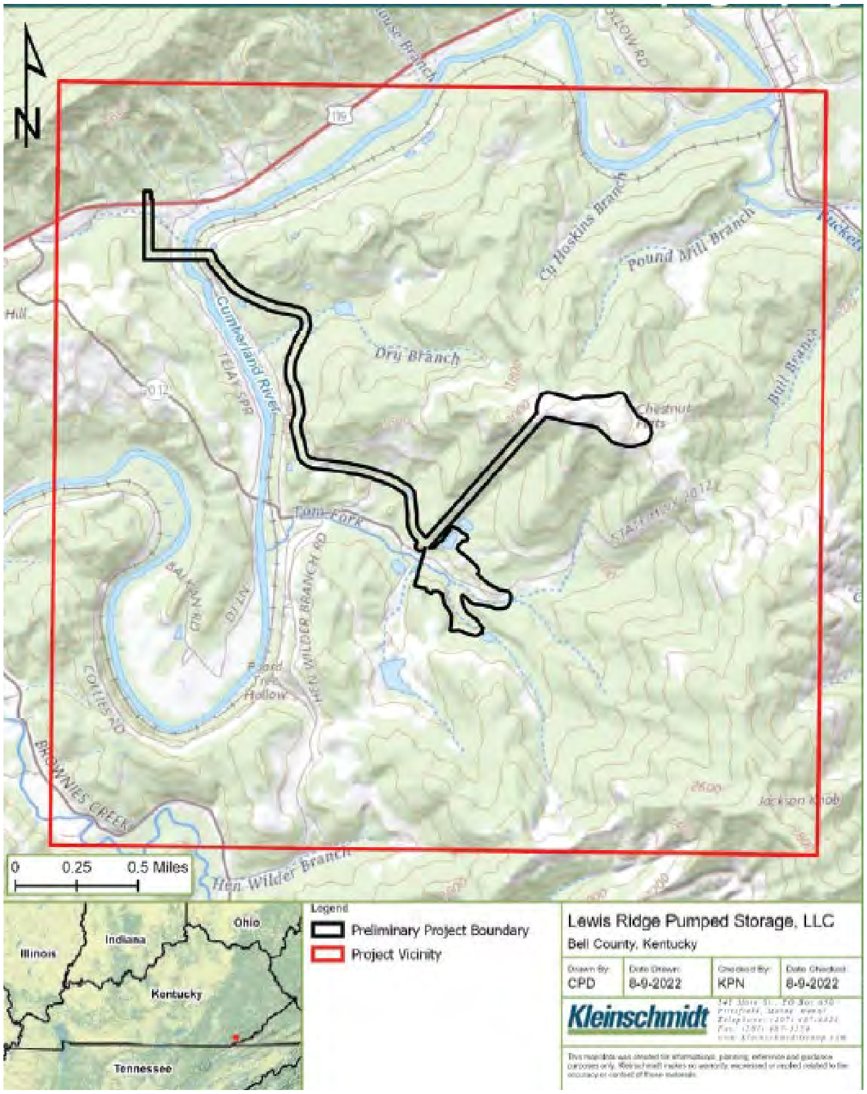
Nally & Hamilton Enterprises currently hold the active KPDES permit (KYGE41189) for the site as well as 16 SMRCRA permits. The site is AI #173517 in KyDEP's TEMPO database.

Because of the active mining sites, I contacted Jay Cunningham with KyDNR. KyDNR is preparing their own review of the proposed project. This review needs to be considered as part of the Cabinet's overall response.
Aerial photograph with mining site locations

In their presentation, FERC presented a topographical map on Slide 20. The map shows three intermittent streams flowing into the “Preliminary Boundary Project” that join and form Tom Fork. While the presentation states that the lower reservoir would be filled using a diversion structure to route water from Tom Fork, the “Preliminary Project Boundary” on the topographical map and the 3-D rendering of the project both show the lower reservoir dam being installed across Tom Fork. The reservoir would be formed by the portion of Tom Fork behind the dam and a portion of the three intermittend streams. This may not be problematic, but the Division of Water needs to do a technical assessment of this impact.

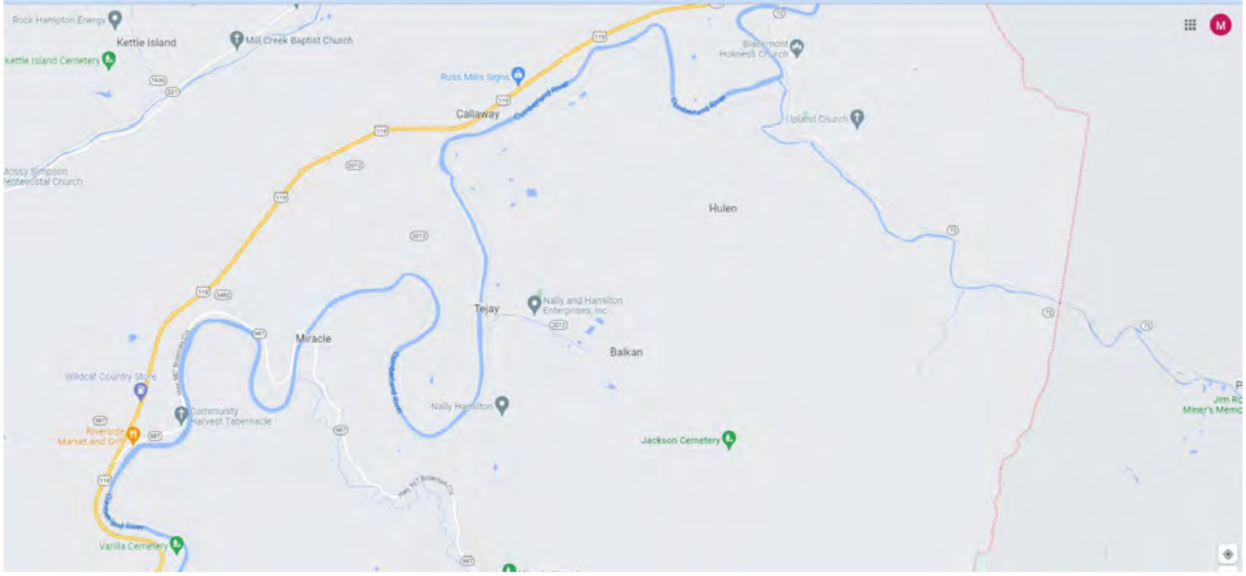
KyDEP has one active enforcement case with Nally & Hamilton at AI #101231 for KPDES effluent limit violations they reported on their Discharge Monitoring Reports (DMRs). This case is unrelated to the site of the proposed project.

Topgraphical map from the FERC presentation showing the intermittent streams forming Tom Fork.



Aerial photograph of the proposed project area.

GoogleMaps standard view map of the proposed site.



Terrain map of the proposed site.

Division of Water

Water Quality Branch
Comment: No comments.
Questions should be directed to Andrea Fredenburg, (502) 782-6950, Andrea.Fredenburg@ky.gov.

Field Operations Branch
Comment: 1) Developers would need to submit a Notice of Intent (NOI) for a KPDES General Stormwater Construction Activities and receive approval from DOW before implementing construction.
2) Construction plans would need to include development of a SWPPP (Stormwater Pollution Prevention Plan) applicable to the site and install/maintain proper Best Management Practices (BMPs) within the project area and throughout the duration of project to ensure protection of surface waters.
3) Ensure pre-dig planning of markup of all drinking water and wastewater collection system lines to ensure service lines are not damaged or services disrupted during the construction.
4) For work along or across the stream: Floodplain construction approval will need to be determined through DOW's Water Resources Branch.
5) For work along or across the stream: Developers to obtain a 404 Water Quality Certification approval through the USACE; 401 Water Quality Certification through Division of Water.
Questions should be directed to Constance Coy, (502) 782-6587, Constance.Coy@ky.gov.

Watershed Management Branch
Water Supply Section:
Comment: This proposed project will require a Water Withdrawal Permit. Due to the unique nature of the project, a meeting with the Water Supply Section would be necessary to determine the number and types of permits required. Applications for permits or authorizations should be

made four to six months prior to requested withdrawal initiation. Applications can be found at https://eec.ky.gov/Environmental-Protection/Water/Protection/Pages/WaterWithdrawal.aspx

This proposed project is within the Knox County Utility Commission designated Source Water Protection Areas, Zone 3 (Zone of Potential Impact/2.5 to 12.5 hour Time of Travel) Source Water Protection should include best management practices or BMP's that prevent, reduce, or eliminate storm water runoff, soil erosion, and movement of nutrients, bacteria, and contaminants into unprotected waterways that may pose threats to public drinking water supplies. It should also include contingency planning strategies if protective measures fail or accidents and/or disasters occur and emergency response planning for water supply contamination or service interruption. Examples can be referenced here: https://www.epa.gov/sourcewaterprotection/source-water-protection-practices or https://eec.ky.gov/Environmental-Protection/Water/Protection/Pages/SWP.aspx
Questions should be directed to Chip Zimmer at (502) 782-7141, Edward.Zimmer@ky.gov.

Groundwater Section:
Comment: The proposed work is endorsed by the Groundwater Section of the Watershed Management Branch. However, it is our recommendation that site be made aware of the requirements of 401 KAR 5:037 and the need to develop a Groundwater Protection Plan (GPP) for the protection of groundwater resources within that area.
Questions should be directed to Kurtis Spears at (502) 782-7119, Kurtis.Spears@ky.gov.

Water Resources Branch
Floodplain Management Section:
Comment: This project will require coordination and permitting from the Division of Water Dam Safety Section prior to initiation of construction. See https://eec.ky.gov/Environmental-Protection/Water/FloodDrought/Pages/DamSafety.aspx for permitting information and contacts

This project will also require a water quality certification from the Division of Water. See the following page for information on permitting procedures: https://eec.ky.gov/Environmental-Protection/Water/PermitCert/WQ401Cert/Pages/Apply-for-Certification.aspx

This project may also require stream construction permitting, but will be evaluated based on the application for WQC.
Questions should be directed to Shawn Hokanson at (502) 782-6977, Shawn.Hokanson@ky.gov.

Water Quality Certification Section:
Comment: If the activity requires a federal permit due to activities in or near Waters of the U.S., a Clean Water Act Section 401 Water Quality Certification from the DOW may be required for this project.
Questions should be directed to the Water Quality Certification Section, (502) 564-3410, 401WQC@ky.gov.

Surface Water Permits Branch
Permit Support Section:

Comment: If the construction area disturbed is equal to or greater than 1 acre, the applicant will need to apply for a Kentucky Pollutant Discharge Elimination System (KPDES) stormwater discharge permit. Questions should be directed to the Permit Support Section, (502) 564-3410, SWPBsupport@ky.gov.

Division of Waste Management

Based on the information provided by the applicant for this project:

UST Branch records indicate the following underground storage tank site issues identified within the project impact area:
Closed Site:
Former Englands Grocery

MASTER AI ID: 57066

LONGITUDE: -83.571775

LATITUDE: 36.782651

If any USTs are encountered during the project construction they should be reported to KDWM. Any UST issues or questions should be directed to the UST Branch.

Superfund Branch records indicate the following superfund sites identified within the project impact area:
Nally & Hamilton Enterprises Inc 807-0333

MASTER AI ID: 84403

SUBJECT ITEM DESIGNATION: DSL spill

CLOSURE OPTION DESC: Option A No Action Necessary

CLOSURE DATE: 12/11/2007

LAT LONG SOURCE: SI

LONGITUDE: -83.5544

LATITUDE: 36.7615

Any superfund issues or questions should be directed to the Superfund Branch.

Solid Waste Branch records indicate no active or historic landfill sites within the project impact area. Any solid waste issues or questions should be directed to the Solid Waste Branch.

Hazardous Waste Branch records indicate no hazardous waste issues identified within the project impact area. Any hazardous waste issues or questions should be directed to the Hazardous Waste Branch.

RLA Branch records indicate the following RLA tracked open dumps identified within the project impact area:

MASTER AI ID: 72117

MASTER AI NAME: KCCCP KY 2012 Dump

USER GROUP DESCRIPTION: RCLA Dump ID

ALTERNATE AI ID: 007-030

LONGITUDE: -83.57683333

LATITUDE: 36.77605556

Any issues or questions should be directed to the RLA Branch.

All solid waste generated by this project must be disposed of at a permitted facility.

If asbestos, lead paint and/or other contaminants are encountered during this project contact the Division of Waste Management for proper disposal and closure.

The information provided is based on those facilities or sites that KDWM currently has in its database. If you would like additional information on any of these facilities or sites, you may contact the file room custodian at (502) 782-6357. Please keep in mind additional locations of releases, potential contamination or waste facilities may be present but unknown to the agency. Therefore, it is recommended that appropriate precautions be taken during construction activities. Please report any evidence of illegal waste disposal facilities and releases of hazardous substances, pollutants, contaminants or petroleum to the 24-hour Environmental Response Team at 1-800-928-2380.

Division for Air Quality

401 KAR 63:010, Fugitive Emissions, states that no person shall cause, suffer, or allow any material to be handled, processed, transported, or stored without taking reasonable precaution to prevent particulate matter from becoming airborne. Additional requirements include the covering of open bodied trucks, operating outside the work area transporting materials likely to become airborne, and that no one shall allow earth or other material being transported by truck or earth-moving equipment to be deposited onto a paved street or roadway. Please note the Fugitive Emissions Fact Sheet located at https://eec.ky.gov/Environmental-Protection/Air/Documents/Fugitive%20Dust%20Fact%20Sheet.pdf

401 KAR 63:005 states that open burning shall be prohibited except as specifically provided. Open Burning is defined as the burning of any matter in such a manner that the products of combustion resulting from the burning are emitted directly into the outdoor atmosphere without passing through a stack or chimney. However, open burning may be utilized for the expressed purposes listed on the Open Burning Brochure located at https://eec.ky.gov/Environmental-Protection/Air/Pages/Open-Burning.aspx

The Division would like to offer the following suggestions on how this project can help us stay in compliance with the National Ambient Air Quality Standards (NAAQS). These air quality control strategies are beneficial to the health of citizens of Kentucky.

- Utilize alternatively fueled equipment.
- Utilize other emission controls that are applicable to your equipment.
- Reduce idling time on equipment.

The Division also suggests an investigation into compliance with applicable local government regulations.

Kentucky Nature Preserves

Your project might have the potential of impacting federally or state listed species and natural communities. Go to the Kentucky Biological Assessment Tool (kynaturepreserves.org) to obtain a Standard Occurrence Report for information regarding listed species known within your project area. The report will also provide information on public and private conservation lands, areas of biodiversity significance, and other natural resources in your project area for which the Office of Kentucky Nature Preserves maintains data.

Kentucky Department for Natural Resources

Comments are attached.

This review is based upon the information that was provided by the applicant. An endorsement of this project does not satisfy, or imply, the acceptance or issuance of any permits, certifications or approvals that may be required from this agency under Kentucky Revised Statutes or Kentucky Administrative Regulations. Such endorsement means this agency has found no major concerns from the review of the proposed project as presented other than those stated as conditions or comments. If you should have any questions, please contact me at (502) 782-0863 or e-mail Louanna.Aldridge@ky.gov.

Sincerely,

Louanna C. Aldridge

Louanna Aldridge
Environmental Scientist Consultant Sr.
Office of the Commissioner
Department for Environmental Protection
Energy and Environment Cabinet

Andy Beshear
GOVERNOR

ENERGY AND ENVIRONMENT CABINET
DEPARTMENT FOR NATURAL RESOURCES
300 Sower Boulevard
Frankfort, Kentucky 40601
Phone: (502) 564-6940

Rebecca Goodman
SECRETARY

Gordon R. Slone
COMMISSIONER

March 21, 2023

Michael Spencer
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426
United States

RE: Lewis Ridge Pumped Storage: Project No. 15249-001: Comments from the Kentucky Department for Natural Resources

Dear Mr. Spencer,

The Kentucky Department for Natural Resources (KYDNR) is responsible for implementing the Surface Mining Control and Reclamation Act of 1977 (SMCRA) through the Kentucky Revised Statues (KRS) 350.020. KYDNR is under the Kentucky Energy and Environment Cabinet (KYEEC). As such, KYDNR is providing the following comments to the Federal Regulatory Commission (FERC) review related to the Lewis Ridge Pumped Storage Proposal, located in Bell County, Kentucky.

Overview

The Lewis Ridge Pumped Storage project is located in Bell County, Kentucky near the communities of Blackmont, Tejay, and Balkan. The land is privately owned by Asher Land & Mineral. The proposed location of the project has been extensively mined by both surface and underground methods, with three (3) permits bonded and under the jurisdiction of KYDNR. Under Kentucky's SMCRA program, permits are mined and reclaimed pursuant to the approved permit application. The permit may file for Phase Releases, when applicable. Unless a permit has been approved for a Phase III[1] release, the permit or increment is still under the jurisdiction of KYDNR and must meet and obtain all requirements applicable under the approved permit application. These requirements include, but are not limited to: sediment control, elimination of highwall to approximate original contour (AOC), and implementation of the approved post mining land use (PMLU). Based upon the current Proposal, KYDNR has concerns related to the permits under its jurisdiction meeting regulatory obligations should the Proposal be implemented.

Underground Operations beneath the Upper and Lower Reservoirs.

- Lower Reservoir dimensions:
    - Minimum Water surface at 1,175'
    - Maximum Water Surface at: 1,225'
    - Dam Height at 1,230'

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[1] Under Kentucky's administrative regulations, 405 KAR 10:040 Section 2 (4) (c), as Phase III release is defined as, "*Reclamation phase III will be deemed to have been completed on the entire permit area or increment when the permittee has successfully completed all surface coal mining and reclamation operations in accordance with the approved reclamation plan, such that the land is capable of supporting the postmining land use approved pursuant to 405 KAR 16:210 or 405 KAR 18:220; and has achieved compliance with the requirements of KRS Chapter 350, 405 KAR Chapters 7 through 24, and the permit; and the applicable liability period under 405 KAR 10:020, Section 3(2) has expired*"

- Upper Reservoir Dimensions:
    - Minimum Water surface: 2,180’
    - Maximum Water Surface: 2,300’
    - Dam Height: 5,450’

The locations of the proposed Upper and Lower Reservoirs have been extensively mined in the following coal seams:

Upper Reservoir

- State File No. 10383-3:
    - Coal Seam(s) mined: Path fork Coal Seam at an approximate elevation of 1,664’.

- State File No. 111674:
    - Coal Seam(s) mined Harlan Coal Seam at an approximate local elevation of 1,997’to 2,000’.

- State File No. 111474:
    - Coal Seam(s) mined: (Hance Coal Seam at an approximate local elevation of 1,386’ to 1,445’.

- State File No. 00381-2:
    - Coal Seam(s) mined: Harlan Seam at an approximate elevation of 1,997’ to 2,000’.

Lower Reservoir

- State File No. 11541-127
    - Coal Seam(s) mined: Mason Coal Seam at a local elevation of 1,120’ and 1,165’.

- State File No. 08053
    - Coal Seam(s) mined: Mason Coal Seam at an approximate local elevation of 1,109’ to 1,168’.

Of concern is the approximate elevation in the Harlan Seam in the Upper Reservoir. The minimum water surface projected is at an elevation of 2,180’, whereas the upper elevations of the Harlan Coal Seam is approximately 2,000’, thus leaving approximately 180’ of depth-of-cover between the minimum water elevation and that of the underground mine works. Similarly, there is concern regarding the Mason Coal seam and the Lower Reservoir. The minimum water level for the Lower Reservoir as projected is at 1,175’, whereas the upper elevation of the Mason coal is approximately 1,168’, thus leaving approximately seven (7) feet depth-of-cover between the minimum water elevation and that of the underground mine works.

Based upon the provided dimensions of both reservoirs, KYDNR has extreme concerns related to the potential of breakthrough via the underground mine works. KYDNR requests that a breakthrough analysis be conducted by Rye Development.

Permits currently under KYDNR Jurisdiction

Nally and Hamilton Enterprises, Inc. DNR Permit No. 807-0353

DNR Permit No. 807-0353, is permitted and operated by Nally and Hamilton Resources, Inc. The permit is currently in A-1 status[2]. The permit is a surface contour, auger, and underground operation, permitted to mine the Mason Coal

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[2] A-1 status is defined as, the permit is actively conducting mining activities (no coal removal occurring); and/or the permit has not expired, coal reserves remain, and the future possibility of coal removal still exists; and/or all non-producing facilities will remain in A1 status until expiration of the permit (this includes preparation plants, haul roads, and impoundment facilities).

seam. The Mason Coal seam is at a local elevation between 1,120' and 1,165'[3]. The permit is bonded incrementally, with Increment one (1) through three (3) being posted.

Regulatory Concerns and Conflicts with the Lewis Ridge Pumped Station

The permittee has remaining coal reserves within the Mason Seam to be mined via the underground method. These underground reserves and mining will be within the proposed boundary of the upper reservoir and located along the pump line between the Upper and Lower Reservoirs.

In addition, the proposed location of the Lower Reservoir will overlap the sediment control of Ponds SS-3 through SS-6. Pursuant to 405 KAR 16:070 Section 1, "*All surface drainage from disturbed areas shall be passed through a sedimentation pond or a series of sedimentation ponds before leaving the permit area*". Prior to pond removal, the permittee must demonstrate that all areas above the facility have been backfilled, graded, and re-vegetated in accordance with the approved permit application; vegetation has successfully survived two (2) years after the last augmented seeding; vegetation meets the ground cover standards of 405 KAR 16:200; and the applicant has demonstrated that the ponds are not necessary for drainage from the disturbed drainage areas to meet applicable effluent requirements under their Kentucky Pollutant Discharge Elimination System (KPDES) permit. Based upon current field conditions, the deep-mine face-up associated with this permit has not been reclaimed, as there are still mineable reserves remaining, thus sediment control must be maintained.

The proposed location of the Lower Reservoir will also be located within the access road to the deep-mine face-up and may impact both access and coal haulage for the applicant—if underground mining activities do resume. In addition, the location of the Lower Reservoir will make the reclamation of the deep-mine face-up impracticable, depending on the timing of reclamation and construction of the project. Pursuant to 405 KAR 18:190 Section 2 (1), all disturbed areas, unless those approved for a remining[4] variance, must be returned to approximate original contour (AOC) and all highwall must be eliminated. Be advised, the applicant is not approved for a remining variance nor has documentation be presented for such a variance.

In addition, the applicant has a pending Amendment with the Department to add additional surface and auger/highwall mining acreage within the Mason Seam. This proposed mining will be located within the general vicinity of the proposed pump line from the Cumberland River. Upon commencement of these mining activities, the applicant must establish sediment control and reclaim all highwall to AOC.

The proposed location of the Lower Reservoir will be located within contour cuts related to the Mason Coal Seam. Failure to obtain a Phase III bond release on these areas and implementation of the pump storage project, will require a revision to the application to address approved backfill configurations.

Finally, the approved Post-Mining Land Use (PMLU) for the permit, is Fish and Wildlife Habitat. If the permit does not achieve Phase III bond release for those areas included within the current proposal, a Major Revision will have to be submitted to revise the approved PMLU.

Nally & Hamilton Enterprises, Inc. DNR Permit No. 807-0347

Overview of the Permit

DNR Permit No. 807-0347 is permitted and operated by Nally and Hamilton Enterprises, LLC. The permit is currently in A-1 status. The Permit is approved for Surface Contour and Refuse Disposal. The permit is bonded through a single area bond. The permit is approved to mine the Mason Seam and approved for coal waste disposal.

Regulatory Concerns and Conflicts with the Lewis Ridge Pumped Station

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[3] Mine Seam elevations were obtained from the issued Mine Reclamation Plan (MRP) Map approved under Minor Revision No. 4 application.

[4] 405 KAR 18:190 Section 5 identifies the requirements related to a remining variance.

While the permit is approved for surface mining of the Mason Seam, the primary function or purpose of the permit is course refuse disposal through a Course Refuse Impoundment or “Slurry Impoundment” known as the “Betsey Branch Impoundment”. These structures are highly engineered impoundments, approved through KYDNR and also the Mine Safety Health Administration (MSHA). The current proposal and location of the Lower Reservoir does encroach and overlap approved mining in the Mason Seam, along with approved borrow area[5]. The overlap with the Mason Seam mining may cause issues with the approved backfill configuration. However, the primary concern of KYDNR deals with the borrow area. This area is permitted to generate spoil to reclaim the impoundment. There is currently no time-table for reclamation of the impoundment as the Permittee, Nally and Hamilton, is utilizing the impoundment to dispose of their course refuse after processing of the mined coal. However, if the lower Reservoir does overlap the approved borrow area, there is concern as to where and how material will be generated in order to complete reclamation of the slurry impoundment.

In addition, the approved PMLU for the permit is Forestland. If the permit does not achieve Phase III bond release for those areas included within the current proposal, a Major Revision will have to be submitted to revise the approved PMLU.

Nally & Hamilton Enterprises, Inc. DNR Permit No. 807-0372

Overview of the Permit

DNR Permit No. 807-0372, is permitted and operated by Nally and Hamilton Resources, Inc. The permit is currently in P-1 status[6]. The permit is a surface contour, area, and auger, operations, permitted to mine the Pathfork Coal Seam. The Pathfork Coal seam is at a local elevation between 1,580’ and 1,740[7]. The permit is bonded incrementally, with Increment one (1), four (4), and six (6) through eleven (11) being posted.

Regulatory Concerns and Conflicts with the Lewis Ridge Pumped Station

Currently, the location of the Lower Reservoir will encompass an access road (Access Road No. 3), which is shared with 807-0353 and provides access to the permit. The road must be maintained until no longer necessary for mining and reclamation operations or monitoring of the permit.

In addition, the approved PMLU for the permit is Fish and Wildlife Habitat. If the permit does not achieve Phase III bond release for those areas included within the current proposal, a Major Revision will have to be submitted to revise the approved PMLU.

Conclusion

There are regulatory conflicts that must be addressed prior to commencement of the project. We look forward to continued discussions with Rye Development on their proposal and finding solutions within our statutory and regulatory authority.

Should you have any questions or additional comments, please do not hesitate to contact me at (502) 782-2903 or via email at gordonr.slone@ky.gov.

Sincerely,

Gordon Slone, Commissioner
Department for Natural Resources

---

[5] Borrow Area is area permitted to “cap” or reclaim the impoundment. These material is not coal removal area and the area is excavated to generate material to place on top of the impoundment to facilitate reclamation.

[6] P-1 status is defined as, Reclamation has been completed for all disturbed areas in accordance with 405 KAR 10:040 Section 2 (4)(a). The Permittee has submitted a request to the Cabinet for Phase I bond release and the request has been approved by the Cabinet. If the permit is incrementally bonded, EACH bonded increment that is disturbed must meet and be approved to Phase I standards prior to the ENTIRE permit being assigned P1 status.

[7] Mine Seam elevations were obtained from the issued Mine Reclamation Plan (MRP) Map approved under Minor Revision No. 4 application.

Cc: Sandy Slayton, Rye Development via email.

David Field, Deputy Commissioner, Department for Natural Resources
Jim Ward, Director, Division of Mine Reclamation and Enforcement
Justin Adams, Director, Division of Abandoned Mine Lands
Wes Jones, Director, Division of Mine Permits
Courtney Skaggs, Environmental Scientist Consultant Senior, Commissioner’s Office
Jay Cunningham, Environmental Scientist Consultant Senior, Commissioner’s

DATE: April 27, 2023

MEMO TO: OEP Issuances

FROM: Dustin Wilson, OEP/DHL/SB

SUBJECT: Project No. 15249-001

I received an email from the Cherokee Nation on March 20, 2023, with a reply to a letter sent on February 14, 2023, regarding early tribal consultation for the Lewis Ridge Pumped Storage Project. I request that the email and attachment be filed in the project record for P-15249-001

From: Elizabeth Toombs
To: Dustin Wilson
Subject: RE: PN-15249-001, Lewis Ridge Pumped Storage
Date: Monday, March 20, 2023 9:53:35 AM
Attachments: 032023 FERC COR 15249-001 Lewis Ridge Pumped Storage.pdf

---

Thank you for the map, Mr. Wilson. Attached is Cherokee Nation's response to the proposed undertaking. Please let me know if there are any questions or concerns.

Wado,

Elizabeth Toombs, Tribal Historic Preservation Officer
Cherokee Nation
Tribal Historic Preservation Office
PO Box 948
Tahlequah, OK 74465-0948
918.453.5389

From: Dustin Wilson <Dustin.Wilson@ferc.gov>
Sent: Monday, March 20, 2023 8:24 AM
To: Elizabeth Toombs <elizabeth-toombs@cherokee.org>
Subject: <EXTERNAL> RE: PN-15249-001, Lewis Ridge Pumped Storage

Good Morning Ms. Toombs,

Thank you for your letter. At this early stage, we have not received GIS data from the applicant, but I have attached a general map for you to view, as well as provided a link to the pre-application document for the project.

I will keep you informed as the licensing process proceeds.

Thank you!

Dustin

eLibrary | File List (ferc.gov)

From: Elizabeth Toombs <elizabeth-toombs@cherokee.org>
Sent: Thursday, March 16, 2023 5:47 PM
To: Dustin Wilson <Dustin.Wilson@ferc.gov>

Sept. 6, 1839

ᏣᎳᎩᎯ ᎠᏰᎵ
CHEROKEE NATION®
P.O. Box 948 • Tahlequah, OK 74465-0948
918-453-5000 • www.cherokee.org

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Principal Chief
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Bryan Warner
Deputy Principal Chief
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ᏔᎵᏁ ᎠᏝᏧᏁ ᎤᎬᏫᏳᎯ

March 20, 2023

Dustin Wilson
Federal Energy Regulatory Commission
888 First Street NE
Washington, D.C. 20426

Re:	PN-15249-001, Lewis Ridge Pumped Storage

Mr. Dustin Wilson:

The Cherokee Nation (Nation) is in receipt of your correspondence about **PN-15249-001**, and appreciates the opportunity to provide comment upon this project. Please allow this letter to serve as the Nation's continued interest in acting as a consulting party to this proposed project.

The Nation maintains databases and records of cultural, historic, and pre-historic resources in this area. Our Historic Preservation Office (Office) reviewed this project, cross referenced the project's legal description against our information, and found no instances where this project intersects or adjoins such resources. Thus, the Nation does not foresee this project imparting impacts to Cherokee cultural resources at this time.

However, the Nation requests that the Federal Energy Regulatory Commission (FERC) halt all project activities immediately and re-contact our Office for further consultation if items of cultural significance are discovered during the course of this project. Additionally, the Nation requests that FERC conduct appropriate inquiries with other pertinent Historic Preservation Offices regarding historic and prehistoric resources not included in the Nation's databases or records.

If you require additional information or have any questions, please contact me at your convenience. Thank you for your time and attention to this matter.

Wado,

Elizabeth Toombs

Elizabeth Toombs, Tribal Historic Preservation Officer
Cherokee Nation Tribal Historic Preservation Office
elizabeth-toombs@cherokee.org
918.453.5389

Telephone Memo

To: Public Files
From: Dustin Wilson
Date: May 11, 2023
Dockets: P-15249-001
Project: Lewis Ridge Pumped Storage Hydroelectric Project

Subject: **Consultation with Tribes for the Lewis Ridge Pumped Storage Hydroelectric Project No. 15249-001**

On February 14, 2023, Dustin Wilson, staff of the Division of Hydropower Licensing with the Federal Energy Regulatory Commission (Commission) issued a letter initiating Tribal consultation for the licensing process for the proposed Lewis Ridge Pumped Storage Hydroelectric Project No. 15249 (Lewis Ridge Project). Mr. Wilson followed up with the addressed Tribes via telephone on March 20, 2023, and April 19, 2023 to determine if any Tribes would be interested in participating in consultation for the Lewis Ridge Project. Ms. Elizabeth Toombs of the Cherokee Nation requested a map of the proposed project, to which Mr. Wilson sent. Ms. Toombs responded on March 20, 2023, to state that the Nation does not foresee the project imparting impacts to Cherokee cultural resources at this time. However, the Nation requests that the Federal Energy Regulatory Commission halt all project activities immediately and re-contact their office for further consultation if items of cultural significance are discovered during the course of the project. Mr. Wilson filed a copy of her email to the eLibrary system on April 27, 2023. No other responses were received.

From: Sandy Slayton

To: Johnnie.Turner@lrc.ky.gov; Adam.Bowling@lrc.ky.gov; darryl.lacounte@bia.gov; Kim.Amendola@noaa.gov; NashvilleRegulatory@usace.army.mil; Ehorn, Casey H CIV USARMY CELRN (USA); Scott, Aurora C CIV USARMY CELRN (USA); Oloriz, Joseph; andrew_raddant@ios.doi.gov; blackman.daniel@epa.gov; Michael_Oetker@fws.gov; Faustini, John; Andrews, Lee; mike_floyd@fws.org; karah_jaffe@fws.gov; Duncan, Jeffrey R; rdbrock@charter.net; thunt@mcn-nsn.gov; ashlstep@nc-cherokee.com; jbunch@ukb-nsn.gov; jbunch@ukb-nsn.gov; eoosahwee-voss@ukb-nsn.gov; chuck-hoskin@cherokee.org; chiefharper@peoriatribe.com; elizabeth-toombs@cherokee.org; syerka@nc-cherokee.com; ddotson@delawarenation-nsn.gov; dhill@muscogeenation.com; dlankford@miamination.com; louanna.aldridge@ky.gov; Lonis.Morgan@ky.gov; thomas.barbour@ky.gov; beth.trent@ky.gov; Slone, Gordon (EEC); matt.catron@ky.gov; Cunningham, Martin J (EEC); craig.potts@ky.gov; barry.butcher@ky.gov; Masters, B.R. R (TAH); Stump, Kenya K (EEC); info@kychamber.com; Debbie.Gambrel@ky.gov; econdev@ky.gov; swilson@middlesborokentucky.net; linda.bridwell@ky.gov; brock@bcje.com; ashley@kyrc.org; fitzkrc@aol.com; cacclement@gmail.com; josh@mtassociation.org; Michael Gambrel

Cc: Erik Steimle; Lesley Brotkowski; Sandra Wash; Elizabeth Krchnavek

Subject: Lewis Ridge Pumped Storage Project (P-15249) Draft Study Plan

Date: Thursday, June 13, 2024 2:48:41 PM

Attachments: image001.png
00 20240613 Lewis Ridge Study Plan FERC Filing.pdf

Good Afternoon,

Lewis Ridge Pumped Storage, LLC. (LRPS) is providing the Draft Study Plan (attached) for the Lewis Ridge Pumped Storage Project (P-15249) for a 30-day review and comment period. LRPS filed a Pre-Application Document (PAD) and Notice of Intent (NOI) to seek an original license for the proposed project on October 21, 2022. LRPS has prepared this Draft Study Plan to document and share with FERC, resource agencies, Tribes, and stakeholders its plans for conducting resource studies to inform project development and the licensing process. LRPS requests comments on the Draft Study Plan by Monday July 15, 2024.

If you have any questions regarding this email, please contact me at sandy@ryedevelopment.com.

Thank you,

Sandy

Sandy Slayton
Vice President, Environmental
(206) 919-3976
sandy@ryedevelopment.com
www.ryedevelopment.com

Electronically Filed

Rye
Development

100 S. Olive Street, West Palm Beach, FL 33401

June 13, 2024

VIA E-FILING

Debbie-Anne Reese, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, DC 20426

Subject: Lewis Ridge Pumped Storage, LLC
Lewis Ridge Pumped Storage Project, FERC Project No. 15249
Draft Study Plan

Dear Secretary Reese:

Lewis Ridge Pumped Storage, LLC (LRPS) is filing with the Federal Energy Regulatory Commission (FERC or Commission) its draft study plan for the Lewis Ridge Pumped Storage Project (FERC No. 15249) (Project). The Project received a preliminary permit from FERC on March 3, 2022. The Pre-Application Document (PAD) and Notice of Intent (NOI) to seek an original license for the Project were filed on October 21, 2022. LRPS hosted the Joint Meeting and site visit on January 25, 2023, under FERC's Traditional Licensing Process (TLP).

The unconstructed Project is located in the Upper Cumberland River Basin in Bell County, Kentucky near the borders of Tennessee and Virginia. The Project would be a closed loop pumped storage hydroelectric generating facility located at a site historically used for mining.

LRPS has prepared a draft study plan to document and share with FERC, resource agencies, Tribes, and stakeholders its plans for conducting resource studies to inform Project development and the licensing process. LRPS is proposing to conduct the following studies, as described in detail in the draft study plan:

- Wetland and Waterway Evaluation
- Blackside Dace Habitat Evaluation
- Bat Survey
- Cultural Resources Evaluation

LRPS requests comments from licensing participants on the draft study plan within 30 days of this filing, July 13, 2024. LRPS also requests concurrence with the proposed Area of Potential Effects (APE) for the Cultural Resources Evaluation from the Kentucky State Historic Preservation Office and interested tribes as defined in 36 CFR § 800.16(d).

Please direct any questions pertaining to the Project or process to Sandy Slayton by phone at (206) 919-3976 or email at sandy@ryedevelopment.com.

Sincerely,

Erik Steimle
Vice President
Lewis Ridge Pumped Storage, LLC

Attachments: Distribution List
Draft Study Plan

cc: Sandy Slayton, Lewis Ridge Pumped Storage, LLC
Lesley Brotkowski, Kleinschmidt Associates

Lewis Ridge Pumped Storage Project (P-15249)
Distribution List

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771 Corporate Drive, Suite 108
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STUDY PLAN

LEWIS RIDGE PUMPED STORAGE PROJECT
FERC NO. 15249

Prepared for:
Lewis Ridge Pumped Storage, LLC

Prepared by:
Kleinschmidt Associates

June 2024

Kleinschmidt

TABLE OF CONTENTS

LIST OF FIGURES

ACRONYMS

A

APE	Area of Potential Effects

C

CFR	Code of Federal Regulations
Commission	Federal Energy Regulatory Commission

F

FERC	Federal Energy Regulatory Commission

G

GPS	Global Positioning System

I

IPaC	Information for Planning, and Consultation

K

KDFWR	Kentucky Department of Fish and Wildlife Resources
KHC	Kentucky Heritage Council
KY USFWS	USFWS Kentucky Ecological Services Field Office

L

LRPS	Lewis Ridge Pumped Storage, LLC

M

µS/cm	microSiemens per centimeter

N

NOI	Notice of Intent
NRHP	National Register of Historic Places
NWI	National Wetland Inventory

O

OSA	Office of State Archaeology

P

PAD	Pre-application Document
Permittee	Lewis Ridge Pumped Storage, LLC
Project	Lewis Ridge Pumped Storage Project

S

SHPO	State Historic Preservation Office

T

TLP	Traditional Licensing Process

U

USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

1.0 INTRODUCTION

Lewis Ridge Pumped Storage, LLC (Permittee or LRPS) is filing with the Federal Energy Regulatory Commission (FERC or Commission) its draft study plan for the Lewis Ridge Pumped Storage Project (FERC No. 15249) (Project). The Project received a preliminary permit from FERC on March 3, 2022.[1] LRPS is using FERC's Traditional Licensing Process (TLP) as established in FERC regulations, Title 18 of the US Code of Federal Regulations (CFR), Part 16. The Permittee filed a Pre-Application Document (PAD) and Notice of Intent (NOI) to seek an original license for the Project on October 21, 2022.[2] As the Permittee is utilizing the TLP there is no requirement to prepare a formal study plan document, and therefore there is no subsequent study plan determination by FERC. Nonetheless, LRPS has prepared this study plan to document and share with FERC, resource agencies, Tribes, and stakeholders its plans for conducting resource studies to inform Project development and the licensing process. LRPS requests comments on the draft study plan within 30 days of this filing.

The Project is a proposed, unconstructed pumped storage hydroelectric generating facility located in Bell County, Kentucky on land that has been used for both underground and surface mining. The Project will involve the construction of new water storage, water conveyance, and electric generation facilities. The grid-connected project will use electricity to store potential energy by moving water between a lower and upper reservoir, connected by a penstock and powerhouse that contains two reversible pump hydroelectric turbines. During periods of peak electricity demand, this same water will be released, generating power and delivering it to the grid. The Project is a closed-loop system and will require a one-time fill of the reservoirs with minimal make-up water required.

Informal stakeholder outreach has been ongoing since Spring 2022. Joint agency and public meetings were held with stakeholders on January 25, 2023. No formal study requests were received as a result of those meetings; however, LRPS is planning to complete the following studies to collect information necessary for Project development and licensing: wetland and waterbody evaluation, blackside dace habitat evaluation, bat survey, and a cultural resources evaluation. Results of the studies will be used to inform and refine Project layout and design. The study area is depicted in Figure 1-1 and includes appropriate buffers around the proposed facilities to account for further refinement of the Project.

---

[1] Accession No. 20220303-3084

[2] Accession No. 20221021-5176

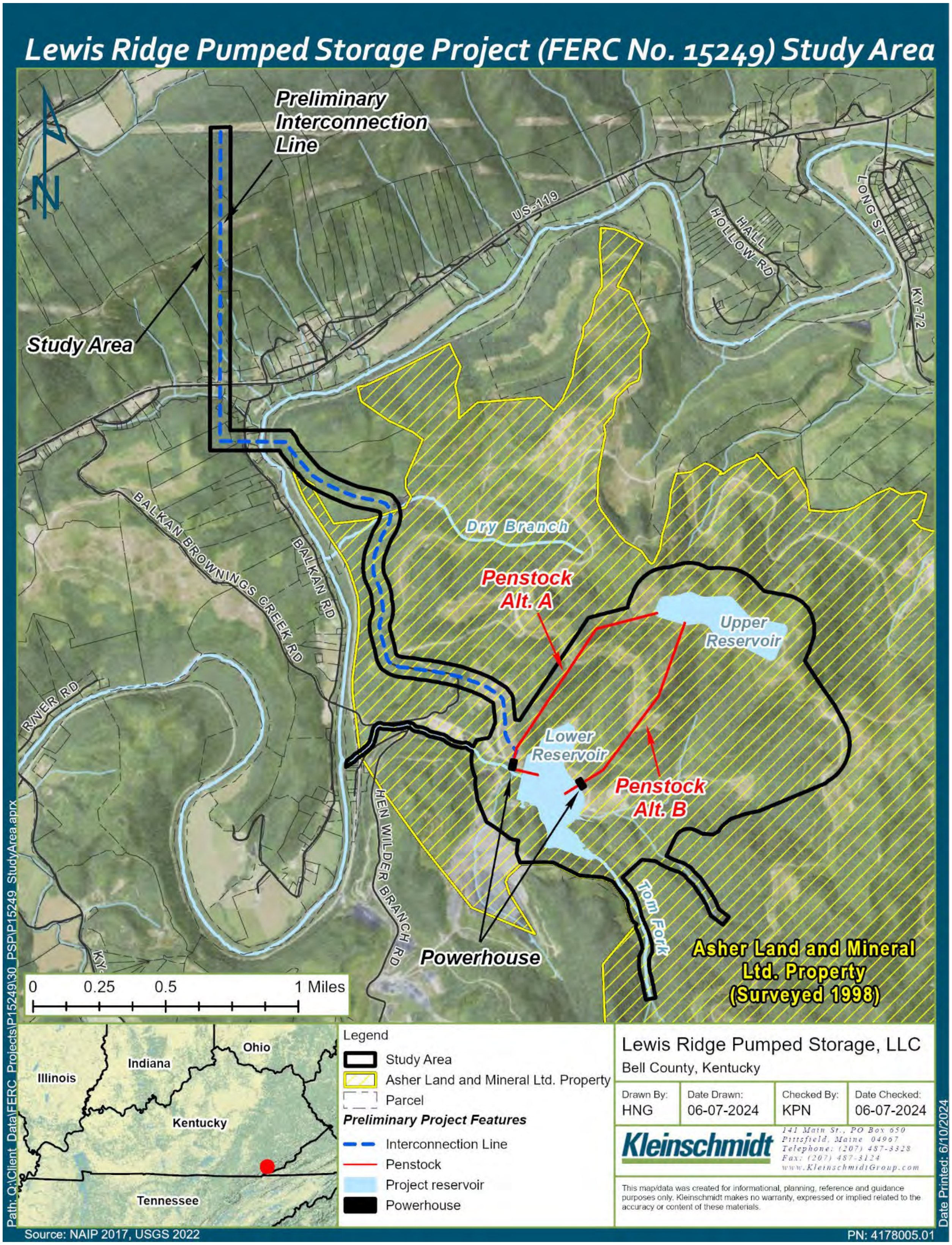

Figure 1-1. Study Area

2.0 INDIVIDUAL STUDY PLANS

2.1 Wetland and Waterway Evaluation

An initial wetland and waterway assessment for the Project was conducted in 2022. The Project has continued to advance in design and the study area has been refined since the 2022 assessment. LRPS proposes to conduct a wetland and waterway evaluation that will build upon the 2022 assessment to determine the presence of wetlands and waterways in the study area.

2.1.1 Background

In 2022, Ecosource, Inc. conducted a Jurisdictional Streams and Wetlands Determination assessment to determine the presence of jurisdictional waters in a preliminary Project study area. The assessment involved compiling background information (sources included the Bell County Soil Survey located on the U.S. Department of Agriculture (USDA) Web Soil Survey, the National Wetlands Inventory (NWI) Map, U.S. Geological Survey (USGS) topographic map, and Google Earth) and field reconnaissance. The assessment identified emergent type wetlands and streams inside and outside of the active/reclaimed mining areas.

2.1.2 Goals and Objectives

The goal of this study is to determine the presence of wetlands and waterways in the updated study area. The study includes the following objectives:

- Compile background information related to wetlands and waterways in the study area; and
- Perform a desktop and field reconnaissance to identify the location of wetlands and waterways in the study area.

2.1.3 Scope and Methods

Data sources will be reviewed to compile background information on the study area. Sources may include, but are not limited to soil surveys, NWI data and maps, topographic maps, Google Earth, and private data courses related to active and inactive mining permits.

Review of public and private data sources will be utilized to map approximate wetland and waterway locations on privately owned lands inside the study area. A field reconnaissance will be conducted to verify the locations of wetlands and waterways on lands owned by Asher Land and Mineral in the study area. Tasks include, but are not limited to:

- Conduct a wetland reconnaissance by inspecting mapped NWI wetland locations and areas that exhibit wetland indicators (hydrophytic vegetation, wetland hydrology, and hydric soils) in the field.
- Conduct a stream reconnaissance using presence of discernible bed and bank features observed in the field. Streams with these features will be documented for habitat value and beginning and ending jurisdictional limits.

2.1.4 Schedule

The wetland and waterway evaluation will be conducted in Summer 2024. Study results from the 2022 and 2024 assessments will be compiled in a study report that will be filed with the Draft License Application.

2.2 Blackside Dace Habitat Evaluation

LRPS proposes to conduct a water quality and habitat assessment in Tom Fork, a tributary to the Cumberland River, to assess the potential habitat suitability for blackside dace (*Chrosomus cumberlandensis*).

2.2.1 Background

Blackside dace is a federally listed (threatened) species endemic to the upper Cumberland River drainage in southeastern Kentucky and northern Tennessee. The US Fish and Wildlife Service (USFWS) Information, Planning, and Conservation (IPaC) tool lists blackside dace as potentially occurring within the proposed Project vicinity (LRPS 2022). Blackside dace generally inhabit small, moderate gradient streams (less than 15 feet wide) with cool water temperatures (rarely exceeding 70° Fahrenheit) and sufficient flows to remove silt from areas below riffles. The species is not known to occur in low gradient streams with notable silt deposition (Floyd 2016; USFWS 1988). Preferred physical habitat characteristics include structure (e.g., undercut banks, woody debris, and large rocks), and the presence of overhead and riparian vegetation cover (i.e., canopy cover at of 70 percent or greater) (USFWS 1988). Research has also documented higher blackside dace occupancy in streams with conductivity levels below 343 microSiemens per centimeter (µS/cm) (Hitt et al. 2016; Yates 2017).

2.2.2 Goals and Objectives

The goal of the blackside dace habitat evaluation is to assess habitat suitability and potential presence of blackside dace in Tom Fork. The study includes the following objectives:

- Document water quality and physical habitat parameters in Tom Fork; and
- Compare documented parameters with known blackside dace habitat requirements.

2.2.3 Scope and Methods

Water quality and physical habitat surveys will be conducted at up to ten locations throughout Tom Fork. Survey points will include the reach of Tom Fork between the Cumberland River and reaches upstream of the proposed lower reservoir within the study area. Coordinates for each point will be recorded with a handheld Global Positioning System (GPS).

Water quality will be recorded with a handheld meter at each survey point. Documented water quality parameters will include water temperature, dissolved oxygen, and conductivity.

Multiple stream width and depth measurements will be recorded in the immediate area of each survey point. Flow will be characterized visually with notation of water movement (e.g., riffles or runs) and pool habitat. The extent of canopy cover (percent cover) and the status of riparian vegetation will be recorded at each survey point, and upstream and downstream facing photos documenting the streambed and riparian habitat will be taken. Substrate types present at each survey point will be recorded, and the streambed composition (percentage of each substrate type present) will be estimated.

2.2.4 Schedule

The field survey will be conducted in Summer 2024. Study results will be compiled in a study report that includes habitat and water quality data in written and tabular format, reference photos of survey points, and a comparison of documented habitat and water quality conditions with known blackside dace habitat preferences. The study report will be filed with the Draft License Application.

2.3 Bat Survey

LRPS proposes to conduct a bat survey during the summer maternity season to determine if federally threatened or endangered bats are present within the study area.

2.3.1 Background

The Project was reviewed using the USFWS Information for Planning and Consultation (IPaC). Based upon the information obtained from the IPaC, it was determined that suitable summer habitat for the Indiana bat (*Myotis sodalis*), gray bat (*Myotis grisescens*), and northern long-eared bat (*Myotis septentrionalis*) may be present in the study area.

2.3.2 Goals and Objectives

The goal of the bat survey is to determine if federally threatened or endangered bats are present within the study area. The study includes the following objectives:

- Conduct a mist net survey to determine the presence/probable absence of federally threatened or endangered bat species during the summer maternity season; and
- Conduct radiotelemetry on up to two individuals for each threatened and/or endangered species that is captured per site, if encountered.

2.3.3 Scope and Methods

Prior to conducting the bat survey, LRPS will ensure appropriate permits are obtained.[3] Survey methods described herein are in accordance with the current USFWS survey guidelines (USFWS 2024). Survey results will be used to assess the amount of risk to threatened and/or endangered bat species within the study area. The capture of threatened and/or endangered bat species will be considered evidence that bats are currently occupying the potentially suitable forested habitat within the study area. The lack of captures of threatened and/or endangered bat species will be considered sufficient evidence that these species are not present within the study area during the summer maternity season.

<u>Mist Net Surveys</u>

Mist net surveys will be conducted in Summer 2024 within the study area. Mist nets will be placed in areas of potentially suitable habitat and positioned perpendicularly across flight corridors, encompassing the corridor from side-to-side and extending upwards into overhanging canopy, and will be checked approximately every 10 minutes. For each survey night, the date, survey start and end time, site description and coordinates, mist net specifics (net size, net location, and habitat type where each net is deployed) and hourly weather conditions will be recorded. In addition, captured bats will be identified to the species level and the following parameters will be recorded: age, sex, reproductive condition, body mass (grams), forearm length (millimeters), wing score, time of capture, capture location, and capture status (new or re-capture).

All species of bats captured will be documented with representative photographs. For each threatened and/or endangered bat that is captured, individual photographs portraying identifying characteristics will be documented for each bat. Upon capture of federally threatened and/or endangered species, both the USFWS Kentucky Ecological Services Field

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[3] Permit 3-200-59 (Recovery Permits) will be obtained from the USFWS, and a Scientific Wildlife Collecting Permit will be obtained from the Kentucky Department of Fish and Wildlife Resources (KDFWR).

Office (KY USFWS) and the Kentucky Department of Fish and Wildlife Resources (KDFWR) will be notified immediately.

Radio Telemetry

In the event a federally threatened and/or endangered species is captured, telemetry surveys will be conducted to determine if bats are utilizing areas in or around the Project as roosting sites, maternity colonies, or foraging areas.

2.3.4 Schedule

The bat survey will be conducted in Summer 2024. Study results will be compiled in a draft study report that will be filed with the Draft License Application.

2.4 Cultural Resources Evaluation

In preparing the PAD, LRPS conducted a preliminary records review for cultural historic and archaeological resources. The next step is to conduct a formal Section 106 cultural resources evaluation under the supervision of a qualified professional[4] to identify known cultural resources within the Project's Area of Potential Effects (APE).

2.4.1 Background

A Phase I survey was performed in 2007 in association with the permit submitted to the Division of Mines for a mining facility in the area of the preliminary Lower Reservoir location. The survey identified four previously unrecorded sites: two historic cemeteries, remains of a coal camp house, and remains of a historic coal mining operation (McGraw 2007). Although not eligible for the National Register of Historic Places (NRHP) individually, the Kentucky State Historic Preservation Office (SHPO) and the Division of Mines recommended Phase II investigations of the sites in the form of archival research to determine if they were eligible as a district. Due to extensive disturbance from coal mining operations and surface mining, the district was found ineligible for the NRHP.

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[4] All Section 106 investigations subject to review by the Kentucky SHPO must be carried out under the direct supervision of a qualified Principal Investigator who meets or exceeds the minimum professional requirements established in the Secretary of the Interior's Standards, as determined by the Kentucky SHPO.

In 2022, a preliminary historic resources site check of the Project Vicinity[5] was submitted to the Kentucky Heritage Council to identify previously recorded sites and any properties or sites already listed on or determined eligible for the NRHP. The site check identified ten historic houses along public roadways (one of which meets NRHP criteria) and the Balkan School (meets NRHP criteria) within the Project Vicinity (Kentucky Heritage Council 2022).

In 2022, a preliminary records review for archaeological sites was submitted to the University of Kentucky to determine whether there are previously recorded archaeological sites near the Project, and if present, their NRHP status. The review identified five sites and includes the two cemeteries identified in the 2007 Phase 1 survey noted above. Three of the sites do not meet NRHP eligibility criteria and the two cemeteries' NRHP status have not been assessed (University of Kentucky 2022). The previous mining facility did not impact the cemeteries by providing a 100-foot buffer zone.

2.4.2 Goals and Objectives

The goal of the cultural resources evaluation is to document the location of historic and archaeological resources that are listed or eligible for listing in the NRHP,[6] within the APE.[7] The study includes the following objectives:

- Perform a file search and archival research on historic and archaeological resources within the APE.
- Perform a field assessment to document the location of historic and archaeological resources within the APE.

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[5] For purposes of the PAD, environmental resources were described for the area within the Project Vicinity to allow for a broader geographic context of the immediate surrounding area to the Project. It was anticipated that the construction limits of disturbance and any potential changes to the Project Boundary were likely to be located within the defined Project Vicinity.

[6] Consistent with the Code of Federal Regulations (CFR), this study plan defines historic properties consistent with the Secretary of the Interior's Standards definition, defined as a district, site, building, structure, or object listed in or eligible for listing in the National Register of Historic Places. LRPS understands that the Kentucky SHPO defines a historic property as a tangible property (building, structure, archeological site, or object) which is fifty years of age or older.

[7] The APE is the geographic area within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if such properties exist (36 CFR Part 800.16[d]).

2.4.3 Scope and Methods

LRPS proposes the APE as the study area identified in Figure 1-1. LRPS, herein, is requesting concurrence on the proposed APE from the Kentucky SHPO and interested tribes as defined in 36 CFR § 800.16(d).

LRPS will conduct a historic and archaeological resources survey in accordance with current *Specifications for Conducting Fieldwork and Preparing Cultural Resource Assessment Reports* issued by the Kentucky SHPO within the APE.

The file and archival research will include a review of the historic site files at the Kentucky Heritage Council (KHC) and a review the archaeological site files at the Kentucky Office of State Archaeology (OSA). The results of the record search will be included in the cultural resources report.

The field assessment for historic resources will include the documentation of above-ground resources 50 years of age or older on lands owned by Asher Land and Mineral or that are publicly accessible within the APE. Resources will be mapped and photographed, with current condition and integrity noted. A KHC survey form will be completed for each property.

The field assessment for archaeological resources will include an intensive survey of the lands owned by Asher Land and Mineral that have not been previously mined. The survey will follow standard archaeological methods and Kentucky SHPO specifications. Pedestrian survey will occur at 20-meter intervals in areas of level terrain with good surface visibility and areas characterized by steep slopes. Shovel testing will be conducted at 20-meter intervals in areas of flat terrain with poor surface visibility. Shovel test pits will be excavated to subsoil and measure 35 centimeters in diameter; soil material excavated will be screened through 0.25-inch mesh. Site survey forms will be prepared for each archaeological site recorded and will be submitted to the Kentucky OSA.

2.4.4 Schedule

The cultural resources desktop evaluation will be conducted in Summer 2024. Study results will be compiled in a study report that will be filed with the Draft License Application.[8] The report will describe cultural resources located during the evaluation and recommendations for NRHP eligibility.

---

[8] Sensitive information will be filed with FERC as Privileged.

3.0 REFERENCES

EcoSource, Inc. (EcoSource). 2023. Jurisdictional Streams and Wetlands Determinations. For Rye Development, Lewis Ridge Pumped Storage, Bell County, Kentucky.

Floyd, M.A., 2016. Kentucky's Threatened and Endangered Fishes- Blackside Dace. American Currents. 41:16-18. Available at: blackside-dace-status.pdf (nanfa.org). Accessed April 2024.

Hitt, N.P., M. Floyd, M. Compton, and K. McDonald. 2016. Threshold responses of Blackside Dace (Chrosomus cumberlandensis) and Kentucky Arrow Darter (Etheostoma spilotum) to stream conductivity. Southeastern Naturalist. 15(1):41-60.

Kentucky Heritage Council (KY Heritage Council). 2022b. Preliminary Site Check. Site Identification Program. 410 High Street, Frankfort, KY 40601.

Kentucky Heritage Council / State Historic Preservation Office. 2017. Specifications for Conducting Fieldwork and Preparing Cultural Resource Assessment Reports. Edition 2.5. Available at: https://heritage.ky.gov/Documents/FieldworkCRspecs.pdf. Accessed June 2024.

McGraw, Betty J. 2007. Phase I Archaeological Survey of the Nally & Hamilton Enterprises, Inc. Balkan Coal Permit Area, Bell County, Kentucky.

United States Fish and Wildlife Service (USFWS). 2024. Range-wide Indiana Bat and Northern Long-eared Bat Survey Guidelines. Available at: https://www.fws.gov/media/range-wide-indiana-bat-and-northern-long-eared-bat-survey-guidelines. Accessed May 2024.

United States Fish and Wildlife Service (USFWS). 1988. Recovery Plan for Blackside Dace. Available at: https://ecos.fws.gov/docs/recovery_plan/880817.pdf. Accessed April 2024.

University of Kentucky. 2022. Kentucky Office of State Archaeology. Preliminary Records Review. 1020A Export Street, Lexington, KY 40506.

Yates, B.L. 2017. Water Quality's Influence on the Occupancy of Two Jeopardized Fishes: The Blackside Dace and the Cumberland Arrow Darter in Northeast Tennessee. Available at: https://scholarworks.moreheadstate.edu/msu_theses_dissertations/116/. Accessed April 2024.

From: Rubin, Marian R CIV USARMY CELRN (USA)
To: Sandy Slayton
Cc: Lesley Brotkowski
Subject: RE: LRN-2022-00976; Pre-Application Consultation; Federal Energy Regulatory Commission, Lewis Ridge Pumped Storage Project (FERC No. 15249); Balkan, Bell County, Kentucky (36.766049, -83.548405)
Date: Thursday, June 20, 2024 12:49:57 PM
Attachments: image002.png
image003.png

Thank you for the follow up, Sandy. I will coordinate our response with Michael Spencer with cc to you, Lesley, and Erik.

Aurora moved to another district so no need to keep her on the distribution list. Thanks again for the quick response!

Thank you,
Marian R. Rubin
Biologist, East Branch
Regulatory Division
U.S. Army Corps of Engineers
Nashville District
3701 Bell Road
Nashville, Tennessee 37214
Cell: (615) 651-0265
Marian.R.Rubin@usace.army.mil

Internet: http://www.lrn.usace.army.mil
Facebook: http://www.facebook.com/nashvillecorps

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From: Sandy Slayton <sandy@ryedevelopment.com>
Sent: Thursday, June 20, 2024 12:28 PM
To: Rubin, Marian R CIV USARMY CELRN (USA) <Marian.R.Rubin@usace.army.mil>
Cc: Lesley Brotkowski <Lesley.Brotkowski@kleinschmidtgroup.com>
Subject: [Non-DoD Source] RE: LRN-2022-00976; Pre-Application Consultation; Federal Energy Regulatory Commission, Lewis Ridge Pumped Storage Project (FERC No. 15249); Balkan, Bell County,

Kentucky (36.766049, -83.548405)

Marian,

Thank you for reaching out to us. I don't have an email address for Secretary Reese – we file information with the secretary via FERC's FERCOnline filing system. The project contact at FERC is: Michael Spencer, Phone: (202) 502-6093, email: Michael.spencer@ferc.gov.

Our prior communication with USACE assigned Aurora Scott as the project manager. Should she stay on the distribution list?

Thank you!

Sandy

Sandy Slayton
Vice President, Environmental
(206) 919-3976
sandy@ryedevelopment.com
www.ryedevelopment.com

From: Rubin, Marian R CIV USARMY CELRN (USA) <Marian.R.Rubin@usace.army.mil>
Sent: Thursday, June 20, 2024 6:17 AM
To: Sandy Slayton <sandy@ryedevelopment.com>
Subject: LRN-2022-00976; Pre-Application Consultation; Federal Energy Regulatory Commission, Lewis Ridge Pumped Storage Project (FERC No. 15249); Balkan, Bell County, Kentucky (36.766049, -83.548405)

Sandy,

The U.S. Army Corps of Engineers, Nashville District (Corps) received the pre-application consultation request from Lewis Ridge Pumped Storage, LLC on June 13, 2024. We have prepared our response addressing the Applicant's request for pre-application consultation with the Corps. Because the Federal Energy Regulatory Commission (FERC) is the federal lead agency, our response needs to be addressed/sent to Secretary Reese (with copy to you, Lesley Brotkowski, and Erik Steimle). As such, please provide the email address of Secretary Reese.

Please let me know if there are questions and thank you in advance.

Thank you,
Marian R. Rubin
Biologist, East Branch
Regulatory Division
U.S. Army Corps of Engineers
Nashville District
3701 Bell Road
Nashville, Tennessee 37214
Cell: (615) 651-0265
Marian.R.Rubin@usace.army.mil

Internet: http://www.lrn.usace.army.mil
Facebook: http://www.facebook.com/nashvillecorps

The Nashville District is committed to providing the highest level of support to the public. To help us ensure we continue to do so, please complete the Customer Satisfaction Survey located at our website at https://regulatory.ops.usace.army.mil/customer-service-survey/

From: Rubin, Marian R CIV USARMY CELRN (USA)
To: Michael.spencer@ferc.gov
Cc: Sandy Slayton; Erik Steimle; Lesley Brotkowski
Subject: LRN-2022-00976; Pre-Application Consultation; Federal Energy Regulatory Commission, Lewis Ridge Pumped Storage Project (FERC No. 15249); Balkan, Bell County, Kentucky (36.766049, -83.548405)
Date: Thursday, June 20, 2024 1:16:53 PM
Attachments: image001.png
LRN-2022-00976_20240620_PreApp-Letter.pdf

To Whom this May Concern:

I am writing to provide the U.S. Army Corps of Engineers, Nashville District's (Corps) response to Lewis Ridge Pumped Storage, LLC's (Applicant) pre-application consultation request dated June 13, 2024. The consultation requests agency comments by July 13, 2024.

Attached, please find our response addressing the Applicant's request for pre-application consultation with the Corps. This response is directed to the Federal Energy Regulatory Commission (FERC), serving as the federal lead agency.

Please feel free to contact me with any questions.

Thank you,
Marian R. Rubin
Biologist, East Branch
Regulatory Division
U.S. Army Corps of Engineers
Nashville District
3701 Bell Road
Nashville, Tennessee 37214
Cell: (615) 651-0265
Marian.R.Rubin@usace.army.mil

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Facebook: http://www.facebook.com/nashvillecorps

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
REGULATORY DIVISION
3701 BELL ROAD
NASHVILLE, TENNESSEE 37214

June 20, 2024

SUBJECT: LRN-2022-00976; Pre-Application Consultation; Federal Energy Regulatory Commission, Lewis Ridge Pumped Storage Project (FERC No. 15249); Balkan, Bell County, Kentucky (36.766049, -83.548405)

Debbie-Anne Reese, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, DC 20426

Dear Secretary Reese:

The U.S. Army Corps of Engineers, Nashville District (Corps) received a pre-application consultation request from Lewis Ridge Pumped Storage, LLC on June 13, 2024. The consultation requests agency comments by July 13, 2024. The proposed project is located in Balkan, Bell County, Kentucky (36.766049, -83.548405). This project has been assigned file number LRN-2022-00976. Please refer to this number in future correspondence.

Based on our review of the pre-application information provided, this activity will require evaluation under our standard individual permit review process. The application shall include all information listed below for complete evaluation of your proposal (33 CFR 325.1(d)):

INFORMATION NEEDED FOR A COMPLETE APPLICATION AND TO ISSUE A PUBLIC NOTICE:

1. A complete description of the proposed activity. All activities the applicant plans to undertake, which are reasonably related to the same project and for which a Department of the Army permit would be required, should be in the same permit application.
    a. The application should include a delineation of wetlands, other special aquatic sites, and other waters, such as lakes and ponds, and perennial, intermittent, and ephemeral streams, on the project site. Delineations must be prepared in accordance with the 1987 USACE Wetlands Delineation Manual and appropriate Regional Supplement. See the attachment titled "*Components of a Complete Waters of the U.S. Delineation Report*" for more information.

2. Drawings, sketches or plans sufficient for public notice (detailed engineering plans and specifications are not required).
    a. Sketches should contain sufficient detail to provide an illustrative description of the proposed activity (e.g., a conceptual plan), but do not need to be detailed engineering plans).

3. The location and dimensions of adjacent structures.

4. Project location.
5. Purpose and need for the proposed activity.

   a. As part of the evaluation of this permit application the Corps will ultimately determine the need and purpose of the proposed project for the purposes of evaluating alternatives. However, please provide a description of the need, purpose, and intended use of the project.

6. Scheduling of the proposed activity.

7. The names and mailing addresses of adjacent property owners.

8. A list of authorizations required by other federal, interstate, state, or local agencies for the work, including all approvals received or denials already made.

9. If dredging in a navigable water, provide a description of the type, composition and quantity of the material to be dredged, the method of dredging, and the site and plans for the disposal of the dredged material.

10. For the discharge of dredged or fill material into waters of the U.S., provide the source of the material, the purpose of the discharge, a description of the type, composition, and quantity of the material; the method of transportation and disposal of the material; and the location of the disposal site.

11. For the construction of an impoundment structure, demonstration that the structure complies with established state dam safety criteria, or that the structure has been designed by a qualified person and independently reviewed, is required.

12. For activities involving discharges of dredged or fill material into waters of the U.S., the application must include a statement describing how impacts to water of the U.S. are to be avoided and minimized. The application must also include a statement describing how impacts to waters of the U.S. are to be compensated for. See the “Mitigation” paragraph(s) below for more information.

13. Signature on application.

INFORMATION NEEDED FOR THE USACE TO MAKE A PERMIT DECISION (NOT REQUIRED TO ISSUE A PUBLIC NOTICE):

14. Section 401 Water Quality Certification: Your project may require a Water Quality Certification (WQC) from the certifying authority (state). See the certifying authority website for more information: https://eec.ky.gov/Environmental-Protection/Water/PermitCert/WQ401Cert/Pages/default.aspx .

15. **Section 408**: For an activity that requires permission from the USACE pursuant to 33 U.S.C. 408 because it will alter or temporarily or permanently occupy or use a USACE federally authorized civil works project, you must submit a written request for section 408 permission to the USACE office having jurisdiction over that USACE project. See our

website for more information: https://www.lrd.usace.army.mil/Submit-ArticleCS/Programs/Article/3648653/section-408-alter-an-army-corps-civil-works-project/.

16. **Public Interest Review**: The decision whether to issue a permit will be based on an evaluation of the probable impacts, including cumulative impacts, of the proposed activity and its intended use on the public interest. Please provide information regarding the project's anticipated impacts to each of the following Public Interest Factors, i.e. Cumulative and Secondary Impacts, Conservation, Economics, Aesthetics, General Environmental Concerns, Wetlands, Historic Properties, Fish and Wildlife Values, Flood Hazards, Floodplain Values, Land Use, Navigation, Shore Erosion and Accretion, Recreation, Water Supply and Conservation, Water Quality, Energy Needs, Safety, Food and Fiber Production, Mineral Needs, Consideration of Property Ownership, and the Needs and Welfare of the People. Please review and utilize the following federal regulations in formulating your response: 33 CFR 320.4 and 40 CFR 230.11(g) and (h).

17. **Clean Water Act Section 404(b)(1) Guidelines**: The proposed impacts must meet the 404(b)(1) guidelines of the Clean Water Act (Guidelines). The Guidelines are the substantive environmental standards by which all Section 404 permit applications are evaluated. The Guidelines, which are binding regulations, were published by the Environmental Protection Agency at 40 CFR Part 230 on December 24, 1980. The fundamental precept of the Guidelines is that discharges of dredged or fill material into waters of the United States, including wetlands, should not occur unless it can be demonstrated that such discharges, either individually or cumulatively, will not result in unacceptable adverse effects on the aquatic ecosystem. The Guidelines specifically require that "no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences." 40 CFR 230.10(a). Based on this provision, the applicant is required in every case (irrespective of whether the discharge site is a special aquatic site or whether the activity associated with the discharge is water dependent) to evaluate opportunities for use of non- aquatic areas and other aquatic sites that would result in less adverse impact on the aquatic ecosystem. A permit cannot be issued, therefore, in circumstances where a less environmentally damaging practicable alternative for the proposed discharge exists (except as provided for under Section 404(b)(2)).

18. **Mitigation:** Mitigation Hierarchy from §332.3(b)(2)-(6):

    All permit applicants are required to avoid and minimize impacts to waters of the U.S. "Mitigation" consists of actions to avoid, minimize, and compensate for impacts from the project. A compensatory wetland and/or stream mitigation plan is used to compensate for the unavoidable loss of waters of the U.S. and to ensure that those losses minimize adverse effects to the aquatic environment. There are three mechanisms for providing compensatory mitigation: mitigation banks, in-lieu fee mitigation, and permittee-responsible compensatory mitigation. Mitigation banks are generally the preferred option, followed by in-lieu fee mitigation, and permittee-responsible mitigation. This preference is based on the hierarchical framework for considering compensatory mitigation options provided in 33 CFR 332.3(b). Information about the availability of compensatory mitigation credits to offset adverse impacts authorized by Department of the Army permits can be found at: https://ribits.usace.army.mil/.

If a permittee responsible compensatory mitigation plan is prepared, please ensure it meets the requirements listed in the Federal Compensatory Mitigation for Losses of Aquatic Resources Final Rule (33 CFR Parts 325 and 332, April 10, 2008).

A mitigation plan is not required for a complete application for the publishing of a Public Notice. However, we highly recommend at least a conceptual mitigation plan be submitted to be included in the Public Notice. This will facilitate the public's review of your project and will likely not necessitate the publishing of a second Public Notice to describe the mitigation. A final mitigation plan will be required and reviewed as part of our permit evaluation.

19. **Lead Federal Agency**: For this project, the Federal Energy Regulatory Commission is the Federal lead agency responsible for compliance with Section 7 of the Endangered Species Act (ESA) and for compliance with Section 106 of the National Historic Preservation Act (NHPA). The following information must be submitted to the USACE:

    a. For ESA: Please provide a copy of the lead federal lead agency's written effects determination for threatened and endangered species, and their written rationale for the determination. For any determination other than "no effect," please provide a copy of the biological assessment/evaluation and correspondence confirming that the federal lead agency completed the required Section 7 consultation with the U.S. Fish and Wildlife Service.

    b. For NHPA: Please provide a copy of the lead federal agency's written effects determination, and correspondence confirming that the State Historic Preservation Officer has concurred with the lead federal agency's proposed actions for complying with the NHPA, as appropriate.

We ask that you include the requested information in your application for a Department of the Army permit. Should you have any questions concerning this consultation response, please contact the project manager Marian R. Rubin at (615) 651-0265 or via e-mail at marian.r.rubin@usace.army.mil.

Sincerely,

Marian R. Rubin

Marian R. Rubin
Biologist, East Branch
Regulatory Division

Electronic Copies Furnished:

Sandy Slayton, VP
Rye Development
sandy@ryedevelopment.com

Erik Steimle, VP
Lewis Ridge Pumped Storage, LLC
erik@ryedevelopment.com

Lesley Brotkowski, Senior Licensing Coordinator
Kleinschmidt Associates
Lesley.Brotkowski@kleinschmidtgroup.com

From: Michael Spencer
To: Sandy Slayton
Cc: Lesley Brotkowski; Erik Steimle
Subject: RE: Lewis Ridge Pumped Storage Project, P-15249 - Designation of Non-Federal Consultation Representative
Date: Tuesday, June 25, 2024 10:26:26 AM
Attachments: image001.png
20221221-3076_P-15249-001 TLP Notice.docx

Hi Sandy,

Please see the highlighted section of the attached notice, issued December 21, 2022. The response you are seeking was made it this notice.

Thank you,

Michael Spencer, Civil Engineer,
(202) 502-6093
Office of Energy Projects
Federal Energy Regulatory Commission
Washington, DC

From: Sandy Slayton <sandy@ryedevelopment.com>
Sent: Thursday, June 20, 2024 6:42 PM
To: Michael Spencer <Michael.Spencer@ferc.gov>
Cc: Lesley Brotkowski <Lesley.Brotkowski@kleinschmidtgroup.com>; Erik Steimle <erik@ryedevelopment.com>
Subject: Lewis Ridge Pumped Storage Project, P-15249 - Designation of Non-Federal Consultation Representative

Mr. Spencer,

I am reaching out to you regarding the application for the Lewis Ridge Pumped Storage Project, FERC No. P-15249. In our Notice of Intent and PAD filing October 21, 2022, we had requested to be designated as the Commission's non-federal representative for the purposes of consultation under Section 7 of the Endangered Species Act, and also authorization to initiate consultation under Section 106 of the National Historic Preservation Act and to implement regulations at 36 CFR Section 8000.2(c)(4). We have not received a response on this request and wanted to see if any information is needed in order to make this determination. We are planning to file a Draft License Application this fall.

Thank you.

Sandy

Sandy Slayton
Vice President, Environmental
(206) 919-3976
sandy@ryedevelopment.com
www.ryedevelopment.com

From: Hutchins, Patricia (Heritage Council)
To: Sandy Slayton
Cc: Potts, Craig A (Heritage Council); KHC Section106; Lesley Brotkowski; Sandra Wash
Subject: RE: Lewis Ridge Pumped Storage Project (P-15249) Draft Study Plan
Date: Friday, June 28, 2024 7:21:41 AM
Attachments: image002.png
image003.png

Thank you. The project originally made its way from Craig Potts, who was included below, to the Section 106 inbox, to me. In the future please submit only to the Section 106 inbox at khc.section106@ky.gov.

Sincerely,
Patti

Patricia E. Hutchins
Archaeology Review Coordinator
Kentucky Heritage Council
410 High Street
Frankfort, Kentucky 40601
Email: patricia.hutchins@ky.gov

Important Note about Section 106 Submissions:
In order for your Section 106 submission to be accepted, distributed, and reviewed all documents must be sent via email to our dedicated address: khc.section106@ky.gov.

For additional information on how and what to submit for Section 106 review, please visit our webpage:
https://heritage.ky.gov/compliance/Pages/overview.aspx

From: Sandy Slayton <sandy@ryedevelopment.com>
Sent: Thursday, June 27, 2024 5:09 PM
To: Hutchins, Patricia (Heritage Council) <patricia.hutchins@ky.gov>
Cc: Potts, Craig A (Heritage Council) <craig.potts@ky.gov>; KHC Section106 <KHC.Section106@ky.gov>; Lesley Brotkowski <Lesley.Brotkowski@kleinschmidtgroup.com>; Sandra Wash <Sandra.Wash@kleinschmidtgroup.com>
Subject: RE: Lewis Ridge Pumped Storage Project (P-15249) Draft Study Plan

Patricia,

Please also find the cover sheet attached.

Sandy

From: Sandy Slayton
Sent: Thursday, June 27, 2024 2:09 PM
To: Hutchins, Patricia (Heritage Council) <patricia.hutchins@ky.gov>
Cc: craig.potts@ky.gov; 'khc.section106@ky.gov' <khc.section106@ky.gov>; Lesley Brotkowski <Lesley.Brotkowski@kleinschmidtgroup.com>; Sandra Wash <Sandra.Wash@kleinschmidtgroup.com>
Subject: FW: Lewis Ridge Pumped Storage Project (P-15249) Draft Study Plan

Hi Patricia,

Lewis Ridge Pumped Storage, LLC (LRPS) distributed its draft study plan, below, on June 13, 2024. We erroneously omitted you from the original distribution and wanted to make sure you received the submittal. The Section 106 Review and Compliance cover sheet is also attached. LRPS proposes the Area of Potential Effects (APE) as the study area identified in Figure 1-1 of the draft Study Plan. LRPS is kindly requesting concurrence on the proposed APE from the Kentucky SHPO as defined in 36 CFR § 800.16(d) within 30 days of the original distribution, or by July 13, 2024.

Thank you!

Sandy

Sandy Slayton
Vice President, Environmental
(206) 919-3976
sandy@ryedevelopment.com
www.ryedevelopment.com

From: Sandy Slayton

Sent: Thursday, June 13, 2024 12:48 PM
To: Johnnie.Turner@lrc.ky.gov; Adam.Bowling@lrc.ky.gov; darryl.lacounte@bia.gov; Kim.Amendola@noaa.gov; NashvilleRegulatory@usace.army.mil; Ehorn, Casey H CIV USARMY CELRN (USA) <Casey.H.Ehorn@usace.army.mil>; Scott, Aurora C CIV USARMY CELRN (USA) <Aurora.C.Scott@usace.army.mil>; Oloriz, Joseph <joseph.oloriz@hq.doe.gov>; andrew_raddant@ios.doi.gov; blackman.daniel@epa.gov; Michael_Oetker@fws.gov; Faustini, John <john_faustini@fws.gov>; Andrews, Lee <lee_andrews@fws.gov>; mike_floyd@fws.org; karah_jaffe@fws.gov; Duncan, Jeffrey R <Jeff_Duncan@nps.gov>; rdbrock@charter.net; thunt@mcn-nsn.gov; ashlstep@nc-cherokee.com; jbunch@ukb-nsn.gov; jbunch@ukb-nsn.gov; eoosahwee-voss@ukb-nsn.gov; chuck-hoskin@cherokee.org; chiefharper@peoriatribe.com; elizabeth-toombs@cherokee.org; syerka@nc-cherokee.com; ddotson@delawarenation-nsn.gov; dhill@muscogeenation.com; dlankford@miamination.com; louanna.aldridge@ky.gov; Lonis.Morgan@ky.gov; thomas.barbour@ky.gov; beth.trent@ky.gov; Slone, Gordon (EEC) <gordonr.slone@ky.gov>; matt.catron@ky.gov; Cunningham, Martin J (EEC) <Jay.Cunningham@ky.gov>; craig.potts@ky.gov; barry.butcher@ky.gov; Masters, B.R. R (TAH) <BR.Masters@ky.gov>; Stump, Kenya K (EEC) <Kenya.Stump@ky.gov>; info@kychamber.com; Debbie.Gambrel@ky.gov; econdev@ky.gov; swilson@middlesborokentucky.net; linda.bridwell@ky.gov; brock@bcje.com; ashley@kyrc.org; fitzkrc@aol.com; cacclement@gmail.com; josh@mtassociation.org; Michael Gambrel <asherlandandmineral.mg@gmail.com>
Cc: Erik Steimle <erik@ryedevelopment.com>; Lesley Brotkowski <Lesley.Brotkowski@kleinschmidtgroup.com>; Sandra Wash <Sandra.Wash@kleinschmidtgroup.com>; Elizabeth Krchnavek <Elizabeth.Krchnavek@kleinschmidtgroup.com>
Subject: Lewis Ridge Pumped Storage Project (P-15249) Draft Study Plan

Good Afternoon,

Lewis Ridge Pumped Storage, LLC. (LRPS) is providing the Draft Study Plan (attached) for the Lewis Ridge Pumped Storage Project (P-15249) for a 30-day review and comment period. LRPS filed a Pre-Application Document (PAD) and Notice of Intent (NOI) to seek an original license for the proposed project on October 21, 2022. LRPS has prepared this Draft Study Plan to document and share with FERC, resource agencies, Tribes, and stakeholders its plans for conducting resource studies to inform project development and the licensing process. LRPS requests comments on the Draft Study Plan by Monday July 15, 2024.

If you have any questions regarding this email, please contact me at sandy@ryedevelopment.com.

Thank you,

Sandy

Sandy Slayton
Vice President, Environmental
(206) 919-3976
sandy@ryedevelopment.com
www.ryedevelopment.com

From: Fitz
To: Sandy Slayton
Cc: ashley@kyrc.org; Lesley Brotkowski
Subject: Re: Lewis Ridge Pumped Storage Project
Date: Monday, July 1, 2024 6:44:49 PM

That's great to hear. John Morgan, one of the principals with RESPEC, is a dear friend and colleague and I hold their mining engineering work in the highest regard. Will loop Perrin in from CBD!

Fitz

On Monday, July 1, 2024 at 06:25:49 PM EDT, Sandy Slayton <sandy@ryedevelopment.com> wrote:

> Hi Fitz! Thank you so much for your email and thoughts. I really appreciate your engagement.
>
> The answer to the first question is absolutely yes. Schnabel is our geotechnical contractor. We are also working locally with RESPEC, as they have significant history on the site. Nally and Hamilton, the current mine operator, has been extremely helpful in aiding us to piece together historical mining data and maps (we do also understand the limitations of the historic data). So far, we have conducted two rounds of geophysical investigations, with further geotechnical work happening this summer, and beyond. Schnabel is also closely partnered with our engineering firm, AECOM. We are piecing together the historic record with everything we can learn from the field to create as accurate a picture of what is underground as we can. We will groundtruth our understandings with geotechnical borings next year. All of this to say, we are taking the past mining very seriously and it is absolutely top of mind.
>
> Yes, of course, please feel free to share out plan with the Center for Biological Diversity. We welcome their input.
>
> Sandy
>
> ---
>
> **From:** Fitz <fitzkrc@aol.com>
> **Sent:** Sunday, June 30, 2024 3:17 PM
> **To:** Sandy Slayton <sandy@ryedevelopment.com>
> **Cc:** ashley@kyrc.org

Subject: Lewis Ridge Pumped Storage Project

Hi Sandy!

Thanks very much for including KRC in the list of stakeholders for review of the Draft Study Plan for the Lewis Ridge Pumped Storage Project (P-15249). We will have any comments on the draft plan in to you by the target date. I had two questions preliminary to that. The first is whether folks have overlain the proposed reservoirs with any underground mining that has occurred historically, to make certain that there are no underground works that could cause a catastrophic or other water loss from either reservoir or the pen stocks. The mine maps for much of the underground mining, particularly older maps, are notoriously inaccurate when it comes to identifying the boundaries of the mining, and to the extent that there has been underground mining in the proximity of either the upper or lower reservoir, it would be worthwhile to have a mining engineer with experience in eastern Kentucky do a careful review for you to assure that the integrity of the impoundments isn't compromised by the past mining and related subsidence.

The second is whether it would be ok to forward the Draft Plan to colleagues with the Center for Biological Diversity, which is dedicated to protection of T&E species. There may be another species or two to add to the dace survey to assure that all .of the I's are dotted for compliance with the Endangered Species Act, and my colleagues at the CBD would be able to review both the proposed plan with respect to the T&E species survey proposal, and to identify any other species of concern.

Thanks in advance, and I hope all is well!

Fitz

From: Lesley Brotkowski
To: Sandra Wash
Subject: Lewis Ridge Pumped Storage Project (P-15249) Draft Study Plan - NEPA 2024-0050 Final Review Complete
Date: Tuesday, July 9, 2024 9:00:37 AM
Attachments: image001.jpg
DEP Response 2024-50.pdf

From: Aldridge, Louanna C (EEC) <Louanna.Aldridge@ky.gov>
Sent: Tuesday, July 9, 2024 5:16 AM
To: Sandy Slayton <sandy@ryedevelopment.com>
Subject: FW: Lewis Ridge Pumped Storage Project (P-15249) Draft Study Plan - NEPA 2024-0050 Final Review Complete

> You don't often get email from louanna.aldridge@ky.gov. Learn why this is important

Hello,

Final review for Lewis Ridge Pumped Storage Project (P-15249) Draft Study Plan - NEPA 2024-0050 received on 6/14/2024 12:00:00 AM has been COMPLETED.
eForm Submitter email address : sandy@ryedevelopment.com.

Louanna Aldridge

ANDY BESHEAR
GOVERNOR

REBECCA W. GOODMAN
SECRETARY

ANTHONY R. HATTON
COMMISSIONER

ENERGY AND ENVIRONMENT CABINET
DEPARTMENT FOR ENVIRONMENTAL PROTECTION

300 SOWER BOULEVARD
FRANKFORT, KENTUCKY 40601
TELEPHONE: 502-564-2150 TELEFAX: 502-564-4245

July 9, 2024

Rye Development
100 S. Olive Street, ,
West Palm Beach, Florida 33401

Re: Lewis Ridge Pumped Storage Project (P-15249) Draft Study Plan – NEPA 2024-0050

Dear Sir or Madam,

The Energy and Environment Cabinet serves as the state clearinghouse for review of environmental documents generated pursuant to the National Environmental Policy Act (NEPA). Within the Cabinet, the Commissioner's Office in the Department for Environmental Protection coordinates the review for Kentucky state agencies. We received your letter requesting an environmental review for this project. We have reviewed the document and provided comments below.

Division of Water:

The Director's Office has no comments.

The Water Quality Branch has no comments.

Field Operations Branch has no comments.

Portions of the project in the regulated floodplain will require permitting from the Division of Water, Water Resources Branch. This project will require coordination and permitting from the Division of Water Dam Safety Section prior to initiation of construction. See https://eec.ky.gov/Environmental-Protection/Water/FloodDrought/Pages/DamSafety.aspx for permitting information and contacts.

Floodplain Maps

You can check https://watermaps.ky.gov/RiskPortal/ to determine if your site is located in the 1% chance floodplain (shown in Blue or Blue /Red on the map). The 1% chance floodplain was formerly called the 100-year floodplain. You can use the search bar in the top right corner of the page to find your location using either a Latitude & Longitude, street address, or community name. A User's Guide link is available in the upper left-hand side of the page. If you would like additional assistance determining if you are located in the floodplain, contact your community's local floodplain coordinator. Community contact information is provided at

https://eec.ky.gov/Environmental-Protection/Water/FloodDrought/Documents/FloodplainCoordinatorsList.pdf.

If your site is in the 1% annual chance floodplain a stream construction permit from the Division of Water and Floodplain permit from your local community is required prior to construction.

Floodplain Permits

The Floodplain General Permit FPGP covers projects that have little potential to impact regulatory base flood elevation. The FPGP does have conditions, requirements, and exclusions listed so be sure your project can meet all these prior to the start of development. The most common activities covered by the GP include:

- Underground utilities only with no ground surface elevation changes, where stream crossings, if any, are completed by directional boring; or
- Installation of utility poles; or
- Installation of fences that do not obstruct water flow; or
- Stream obstruction removals of items such as woody debris from near bridges and culverts.

A second Floodplain General Permit (FPGP UNSUB) covers additions or repairs to an existing structure where the cost of repairs/upgrade is less than 50% of the structure value per the local county Property Valuation Administrator or Certified Residential or General Real Property Appraiser.

Both GPs available for covered projects do not require prior public notice or application to the Division prior to construction. Exclusions to the GPs include work in or along an outstanding state resource water (OSRW) or other special use water, if an Individual 401 WQC required for the development, and development of structures or dams. The Floodplain GPs can be downloaded at https://eec.ky.gov/Environmental-Protection/Water/FloodDrought/Pages/UnderstandYourFloodHazards.aspx.

If your site is in the floodplain and the GPs do not apply, an Individual Permit is required from the Division of Water for any proposed development. On the application, you must provide accurate latitude/longitude and an aerial map (maps from the Riskmap link above or Google maps are acceptable) in lieu of a topo map. The map must show where structures or crossing will be placed, and if fill or cut/fill is being done, draw the full extents of the fill on the aerial map. For the project description, describe what you plan to do to complete the project, how much (if any) fill will be brought into the floodplain, or how much material will be moved from or redistributed within the floodplain. For structures, describe the structure, provide the size and type of foundation (slab on grade, elevated, crawl space). For culverts, describe how much material will be brought in and what type, how high above current surface elevation will the material be placed, especially in low lying areas where the roadway would impede flow. Include the number of culverts pipes used and description (length, diameter and material). For a bridge, describe how the bridge abutments will be installed, the thickness of the bridge deck and the height of the lowest point of the bridge over the ordinary high water mark (plant line on the shoreline) and height of the bottom of the bridge deck above the bottom of the creek channel. If you are replacing a bridge or culvert, describe how the new installation will compare to the old- if the new installation will have a larger opening or pipes, will have more or less fill for the installation, indicate that on the application description.

Other Permits

Anytime you need a state floodplain permit, and you live in a community that participates in the NFIP, a local permit is also required. Find the contact information your local floodplain manager at

https://eec.ky.gov/Environmental-Protection/Water/FloodDrought/Documents/FloodplainCoordinatorsList.pdf.

Your local floodplain manager can help you with the state permit, as well as help you with the local permit and to understand the floodplain requirements.

If you are working below the top of the bank, within a stream channel, or within wetlands, a 404 permit from the US Army Corps of Engineers and 401 Water Quality Certification may also be required. Our Water Quality Certification section will review the application to determine if 401/404 permitting is needed. For information on permitting procedures or for other information, visit https://eec.ky.gov/Environmental-Protection/Water/PermitCert/WQ401Cert/Pages/Apply-for-Certification.aspx.

The Engineering Section of the Water Infrastructure Branch of the Division of Water has no comments on the proposed projects.

The Water Supply Section has the following comments: The proposed project is within the are located within the Knox County Utilities Commission (KY0610110) Source Water Protection Area Zone 3 (Zone of Potential Impact/2.5 to 12.5 hour Time of Travel). These zones are defined by time of travel for a contaminant to the water supplier intake and are as follows:

Zone 1 (Critical Zone/Less than 1 hour Time of Travel)
Zone 2 (Zone of Responsibility/1 hour to 5 hour Time of Travel)
Zone 3 (Zone of Potential Impact/2.5 to 12.5 hour Time of Travel)

Source Water Protection should include best management practices or BMP’s that prevent, reduce, or eliminate storm water runoff, soil erosion, and movement of nutrients, bacteria, and contaminants into unprotected waterways that may pose threats to public drinking water supplies. It should also include contingency planning strategies if protective measures fail or accidents and/or disasters occur and emergency response planning for water supply contamination or service interruption. Examples can be referenced here: https://www.epa.gov/sourcewaterprotection/source-water-protection-practices or https://eec.ky.gov/Environmental-Protection/Water/Protection/Pages/SWP.aspx

The proposed work is endorsed by the Groundwater Section of the Watershed Management Branch. However, it is our recommendation that site be made aware of the requirements of 401 KAR 5:037 and the need to develop a Groundwater Protection Plan (GPP) for the protection of groundwater resources within that area.

Division of Enforcement:

Lewis Ridge Pumped Storage, LLC. (LRPS) is providing the Draft Study Plan (attached) for the Lewis Ridge Pumped Storage Project (P-15249) for a 30-day review and comment period. LRPS filed a Pre-Application Document (PAD) and Notice of Intent (NOI) to seek an original license for the proposed project on October 21, 2022. LRPS has prepared this Draft Study Plan to document and share with FERC, resource agencies, Tribes, and stakeholders its plans for conducting resource studies to inform project development and the licensing process. LRPS requests comments on the Draft Study Plan by Monday July 15, 2024. Lewis Ridge Pumped Storage, LLC (LRPS) is filing with the Federal Energy Regulatory Commission (FERC or Commission) its draft study plan for the

Lewis Ridge Pumped Storage Project (FERC No. 15249) (Project). The Project received a preliminary permit from FERC on March 3, 2022. The Pre-Application Document (PAD) and Notice of Intent (NOI) to seek an original license for the Project were filed on October 21, 2022. LRPS hosted the Joint Meeting and site visit on January 25, 2023, under FERC's Traditional Licensing Process (TLP). The unconstructed Project is located in the Upper Cumberland River Basin in Bell County, Kentucky near the borders of Tennessee and Virginia. The Project would be a closed loop pumped storage hydroelectric generating facility located at a site historically used for mining.
The Kentucky Division of Enforcement endorses this project.

Division for Air Quality:

401 KAR 63:010, Fugitive Emissions, states that no person shall cause, suffer, or allow any material to be handled, processed, transported, or stored without taking reasonable precaution to prevent particulate matter from becoming airborne. Additional requirements include the covering of open bodied trucks, operating outside the work area transporting materials likely to become airborne, and that no one shall allow earth or other material being transported by truck or earth-moving equipment to be deposited onto a paved street or roadway. Please note the Fugitive Emissions Fact Sheet located at https://eec.ky.gov/Environmental-Protection/Air/Documents/Fugitive%20Dust%20Fact%20Sheet.pdf

401 KAR 63:005 states that open burning shall be prohibited except as specifically provided. Open Burning is defined as the burning of any matter in such a manner that the products of combustion resulting from the burning are emitted directly into the outdoor atmosphere without passing through a stack or chimney. However, open burning may be utilized for the expressed purposes listed on the Open Burning Brochure located at
https://eec.ky.gov/Environmental-Protection/Air/Pages/Open-Burning.aspx

The Division would like to offer the following suggestions on how this project can help us stay in compliance with the National Ambient Air Quality Standards (NAAQS). These air quality control strategies are beneficial to the health of citizens of Kentucky.

¿ Utilize alternatively fueled equipment.
¿ Utilize other emission controls that are applicable to your equipment.
¿ Reduce idling time on equipment.

The Division also suggests an investigation into compliance with applicable local government regulations.

Division of Waste Management:

Based on the information provided by the applicant for this project:

Underground Storage Tank (UST) records indicate the following underground storage tank site issues identified within the project impact area:
Closed Site:
Former Englands Grocery
MASTER AI ID: 57066
LONGITUDE: -83.571775
LATITUDE: 36.782651

If any UST's are encountered during the project construction they should be reported to KDWM. Any UST issues or questions should be directed to the UST Branch.

Superfund Branch records indicate the following superfund sites identified within the project impact area:
Nally & Hamilton Enterprises Inc 807-0333
MASTER AI ID: 84403
SUBJECT ITEM DESIGNATION: DSL spill
CLOSURE OPTION DESC: Option A No Action Necessary
CLOSURE DATE: 12/11/2007
LAT LONG SOURCE: SI
LONGITUDE: -83.5544
LATITUDE: 36.7615
Any superfund issues or questions should be directed to the Superfund Branch.

Solid Waste Branch records indicate no active or historic landfill sites within the project impact area. Any solid waste issues or questions should be directed to the Solid Waste Branch.

Hazardous Waste Branch records indicate no hazardous waste issues identified within the project impact area. Any hazardous waste issues or questions should be directed to the Hazardous Waste Branch.

Recycle and Local Assistance (RLA) Branch records indicate the following RLA tracked open dumps identified within the project impact area:
MASTER AI ID: 72117
MASTER AI NAME: KCCCP KY 2012 Dump
USER GROUP DESCRIPTION: RCLA Dump ID
ALTERNATE AI ID: 007-030
LONGITUDE: -83.57683333
LATITUDE: 36.77605556
Any issues or questions should be directed to the RLA Branch.

All solid waste generated by this project must be disposed of at a permitted facility.

If asbestos, lead paint and/or other contaminants are encountered during this project contact the Division of Waste Management for proper disposal and closure.

The information provided is based on those facilities or sites that KDWM currently has in its database. If you would like additional information on any of these facilities or sites, you may contact the file room custodian at (502) 782-6357. Please keep in mind additional locations of releases, potential contamination or waste facilities may be present but unknown to the agency. Therefore, it is recommended that appropriate precautions be taken during construction activities. Please report any evidence of illegal waste disposal facilities and releases of hazardous substances, pollutants, contaminants or petroleum to the 24-hour Environmental Response Team at 1-800-928-2380.

Kentucky Nature Preserves

Your project might have the potential of impacting federally or state listed species and natural communities. Go to the Kentucky Biological Assessment Tool (kynaturepreserves.org) to obtain a Standard Occurrence Report for information regarding listed species known within your project area. The report will also provide information on public and private conservation lands, areas of biodiversity significance, and other natural resources in your project area for which the Office of Kentucky Nature Preserves maintains data.

This review is based upon the information that was provided by the applicant. An endorsement of this project does not satisfy, or imply, the acceptance or issuance of any permits, certifications or approvals that may be required from this agency under Kentucky Revised Statutes or Kentucky Administrative Regulations. Such endorsement means this agency has found no major concerns from the review of the proposed project as presented other than those stated as conditions or comments. If you should have any questions, please contact me at (502) 782-0863 or e-mail Louanna.Aldridge@ky.gov.

Sincerely,

Louanna C. Aldridge

Louanna Aldridge
Environmental Scientist Consultant
Office of the Commissioner
Department for Environmental Protection
Energy and Environment Cabinet

From: Lesley Brotkowski
To: Sandra Wash
Subject: Lewis Ridge Pumped Storage
Date: Tuesday, July 9, 2024 9:01:08 AM
Attachments: Outlook-feimucyn.png
241246 FERC Lewis Ridge Pumped Storage Bell.pdf (S).pdf

From: Fernandez, Gabrielle (Heritage Council) <gabrielle.fernandez@ky.gov>
Sent: Tuesday, July 9, 2024 5:06:27 AM
To: Sandy Slayton <sandy@ryedevelopment.com>
Cc: Hutchins, Patricia (Heritage Council) <patricia.hutchins@ky.gov>
Subject: Lewis Ridge Pumped Storage

Here's your signed letter back for the Lewis Ridge Pumped Storage project in Bell County, Kentucky.

Have a good day,

Gabrielle Fernandez

Historic Preservation Coordinator

Kentucky Heritage Council

Important Note about Section 106 Submissions:

In order for your Section 106 submission to be accepted, distributed, and reviewed all documents must be sent via email to our dedicated address: khc.section106@ky.gov.

For additional information on how and what to submit for Section 106 review, please visit our webpage:

https://heritage.ky.gov/compliance/Pages/overview.aspx

ANDY BESHEAR
GOVERNOR

JACQUELINE COLEMAN
LT. GOVERNOR

TOURISM, ARTS AND HERITAGE CABINET
KENTUCKY HERITAGE COUNCIL
THE STATE HISTORIC PRESERVATION OFFICE
410 HIGH STREET
FRANKFORT, KENTUCKY 40601
(502) 564-7005
www.heritage.ky.gov

LINDY CASEBIER
SECRETARY

CRAIG A. POTTS
EXECUTIVE DIRECTOR &
STATE HISTORIC PRESERVATION OFFICER

July 8, 2024

Sandy Slayton
Vice President, Environmental
Rye Development
830 NE Holladay Street
Portland, Oregon 97232
Via email: sandy@ryedevelopment.com

RE: FERC, Lewis Ridge Pumped Storage Project, Bell County, Kentucky

Dear Ms. Slayton:

Thank you for your submission of documents related to the above-referenced project. We understand Lewis Ridge Pumped Storage, LLC (LRPS) proposes construction of a closed loop pumped storage hydroelectric generating facility in Bell County, near Blackmont, Tejay, Balkan, and Callaway and near River Mile 659 of the Cumberland River.

LRPS proposes to conduct file and archival research and a field assessment for historic and archaeological resources.

Regarding archaeological resources: In addition to a review of the archaeological site files at the Kentucky Office of State Archaeology, please consult historic maps, soil maps, and any other relevant sources for a more complete background study of the area. LRPS proposes that the field assessment for archaeological resources include survey of the lands owned by Asher Land and Mineral that have not been previously mined. Survey should include the entire Study Area, including lands not owned by Asher Land and Mineral.

Regarding the above-ground report, the area of potential effect (APE) should include all parcels with a viewshed of the proposed undertaking. Survey of the APE should include all properties with structures 50 years of age or older, regardless of ownership. If access beyond the right of way is not available, that can be noted in the report along with a discussion on potential effects. The report and associated survey forms should meet our office's report and survey form standards and be completed by a Secretary of the Interior-qualified Historian or Architectural Historian.

LRPS proposes to compile a study report to be filed with the Draft License Application. Please note the archaeology report and cultural historic must be separate documents. These two reports, as well as any survey forms, should be submitted as separate PDFs to our office at khc.section106@ky.gov.

Since they have expressed an interest in consulting on projects involving cemeteries, we recommend you reach out to the Office of Army Cemeteries at michael.k.trimble.civ@army.mil.

We look forward to continued consultation regarding this proposed undertaking. Please feel free to contact Gabrielle Fernandez or Patti Hutchins of my staff with any questions or concerns at gabrielle.fernandez@ky.gov or patricia.hutchins@ky.gov.

Sincerely,

Craig A. Potts,
Executive Director and
State Historic Preservation Officer

CP: gf, peh,
KHC 241246; prev. 66139, 220208, 220598

From: Sandy Slayton
To: Hokanson, Shawn M (EEC); glen.alexander@ky.gov
Cc: Lesley Brotkowski
Subject: RE: Rye Development Lewis Ridge
Date: Monday, July 29, 2024 1:12:40 PM
Attachments: image001.png

Great, thank you! Will do.

Do any of the times below not work for you?

Sandy

From: Hokanson, Shawn M (EEC) <Shawn.Hokanson@ky.gov>
Sent: Monday, July 29, 2024 7:20 AM
To: Sandy Slayton <sandy@ryedevelopment.com>
Subject: Rye Development Lewis Ridge

Please include glen.alexander@ky.gov on an Lewis Ridge related correspondence.

Shawn Hokanson
Manager, Watershed Resources Branch
Division of Water
Kentucky Department of Environmental Protection
300 Sower Blvd
Frankfort KY 40601
502-782-6977

From: Sandy Slayton <sandy@ryedevelopment.com>
Sent: Monday, July 29, 2024 9:00 AM
To: Cunningham, Martin J (EEC) <Jay.Cunningham@ky.gov>; Aldridge, Louanna C (EEC) <Louanna.Aldridge@ky.gov>; Ehorn, Casey H CIV USARMY CELRN (USA) <Casey.H.Ehorn@usace.army.mil>; Hokanson, Shawn M (EEC) <Shawn.Hokanson@ky.gov>; cara.c.beverly@usace.army.mil; Zimmer, Edward (EEC) <Edward.Zimmer@ky.gov>
Cc: Michael Ricci <Michael.Ricci@respec.com>; Lesley Brotkowski <Lesley.Brotkowski@kleinschmidtgroup.com>; Ushakar Jha <ushakar@ryedevelopment.com>; Willis, Patrick <Patrick.Willis@aecom.com>
Subject: Lewis Ridge Pumped Storage Project water-related discussion

Good Morning,

We have been making good progress on the initial design of the Lewis Ridge project, and have a few ideas we would like to discuss regarding:

- initial fill and recharge water source (withdrawal permitting),
- routing and/or diversion of Tom Fork at the Lower Reservoir, and

- project design around these topics.

We are hoping for a one-hour virtual meeting. Would a window in any of these times work for you:

- Monday, August 12, any time
- Tuesday, August 13, before 2:30
- Wednesday, August 14, any time other than 10-11
- Thursday, August 15, after 3pm

Thank you! We look forward to discussing the project with you.

Sandy

Sandy Slayton
Vice President, Environmental
(206) 919-3976
sandy@ryedevelopment.com
www.ryedevelopment.com

From: Cunningham, Martin J (EEC)
To: Sandy Slayton; Aldridge, Louanna C (EEC); Ehorn, Casey H CIV USARMY CELRN (USA); Hokanson, Shawn M (EEC); cara.c.beverly@usace.army.mil; Zimmer, Edward (EEC)
Cc: Michael Ricci; Lesley Brotkowski; Ushakar Jha; Willis, Patrick
Subject: RE: Lewis Ridge Pumped Storage Project water-related discussion
Date: Monday, July 29, 2024 8:51:31 AM
Attachments: image001.png
image002.png

Good morning Sandy,

I am free all days and time proposed, except for t August 15th. That day a little hectic with external meetings until 3:00 pm. Please let me know if you need anything on DNR side.

Thanks,
Jay

Jay Cunningham
Environmental Scientist Consultant II
Commissioner's Office Department for Natural Resources
300 Sower Blvd.
Frankfort, KY 40601
1-502-782-6591
Jay.Cunningham@ky.gov

From: Sandy Slayton <sandy@ryedevelopment.com>
Sent: Monday, July 29, 2024 9:00 AM
To: Cunningham, Martin J (EEC) <Jay.Cunningham@ky.gov>; Aldridge, Louanna C (EEC) <Louanna.Aldridge@ky.gov>; Ehorn, Casey H CIV USARMY CELRN (USA) <Casey.H.Ehorn@usace.army.mil>; Hokanson, Shawn M (EEC) <Shawn.Hokanson@ky.gov>; cara.c.beverly@usace.army.mil; Zimmer, Edward (EEC) <Edward.Zimmer@ky.gov>
Cc: Michael Ricci <Michael.Ricci@respec.com>; Lesley Brotkowski <Lesley.Brotkowski@kleinschmidtgroup.com>; Ushakar Jha <ushakar@ryedevelopment.com>; Willis, Patrick <Patrick.Willis@aecom.com>
Subject: Lewis Ridge Pumped Storage Project water-related discussion

Good Morning,

We have been making good progress on the initial design of the Lewis Ridge project, and have a few ideas we would like to discuss regarding:

- initial fill and recharge water source (withdrawal permitting),
- routing and/or diversion of Tom Fork at the Lower Reservoir, and
- project design around these topics.

We are hoping for a one-hour virtual meeting. Would a window in any of these times work for you:

- Monday, August 12, any time
- Tuesday, August 13, before 2:30
- Wednesday, August 14, any time other than 10-11
- Thursday, August 15, after 3pm

Thank you! We look forward to discussing the project with you.

Sandy

Sandy Slayton
Vice President, Environmental
(206) 919-3976
sandy@ryedevelopment.com
www.ryedevelopment.com

From: Michael Ricci
To: Jones, Wes R (EEC); Cunningham, Martin J (EEC)
Cc: Sandy Slayton; Michael Rooney; Skaggs, Courtney (EEC)
Subject: Re: July 24, 2024 meeting
Date: Wednesday, July 31, 2024 5:20:35 PM
Attachments: image001.png
image002.png
image003.png
image004.png
image005.png
image006.png
C2_signature_respec_flag_72x137_3b9a3bfc-d4cb-4bd3-96ae-a9e3d20f6a88.png
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C2_signature_mobile_a0704062-4f31-4680-a8eb-6d99180b12af.png

Wes,

Thanks so much for the feedback. This really helps clarify our situation. We will continue to keep KYDNR updated on the project.

After we receive the funds from the DOE grant, we will make a formal submittal to the DMP documenting our case for an exemption from SMCRA jurisdiction.

Mike

Michael Ricci
michael.ricci@respec.com
859-361-4540

From: Jones, Wes R (EEC) <Wes.Jones@ky.gov>
Sent: Wednesday, July 31, 2024 1:40:36 PM
To: Michael Ricci <Michael.Ricci@respec.com>; Cunningham, Martin J (EEC) <Jay.Cunningham@ky.gov>
Cc: Sandy Slayton (sandy@ryedevelopment.com) <sandy@ryedevelopment.com>; michael@ryedevelopment.com; Skaggs, Courtney (EEC) <courtney.skaggs@ky.gov>
Subject: RE: July 24, 2024 meeting

Mike,

As far as using construction materials on site, that’s not an issue. As long as the sandstone isn’t being sold, there is no requirement for a non-coal permit. I spoke to Marty Brashear, the Branch Manager of the Non-coal Branch.

Information on the Betsie Branch Impoundment design is contained in 807-0347 MI-10.   The April 26, 2017 Slurry Bullets provide a staging summary that includes a 20’ wide emergency spillway at the final Stage B:

Stage B	Elevation
Crest	1455’
Principal Spillway	1440’
Emergency Spillway	1453’
Max. Water Surface (MSHA PMF)	1448.3’

The maximum routed water surface for the MSHA PMF is below the elevation of the emergency spillway and thus the emergency spillway is non-functioning. All discharge from the Betsie Branch Impoundment, other than seepage, is at the decant pipe exit. Maintaining sufficient volume in the pool to store the runoff from the 10-year, 24-hour storm will allow the impoundment to meet the settleable solids effluent limitation, and additional sediment control below the emergency spillway should not be necessary.

Wesley Jones
Director
Division of Mine Permits
Phone 502-782-6674
Cell 502-514-7242

From: Michael Ricci <Michael.Ricci@respec.com>
Sent: Friday, July 26, 2024 10:50 AM
To: Cunningham, Martin J (EEC) <Jay.Cunningham@ky.gov>; Jones, Wes R (EEC) <Wes.Jones@ky.gov>
Cc: Sandy Slayton (sandy@ryedevelopment.com) <sandy@ryedevelopment.com>; michael@ryedevelopment.com <IMCEAUNDEFINED-michael+40ryedevelopment+2Ecom@namprd02.prod.outlook.com>; Skaggs, Courtney (EEC) <courtney.skaggs@ky.gov>
Subject: July 24, 2024 meeting

Jay and Wes,

Thanks for taking the time to meet with us this week. It was a very productive meeting for us.

I wanted to summarize the main items that we discussed.

- SMCRA Permit exemption – It is possible that as the reservoirs are designed, small coal tonnages may be exposed. Rye expects to obtain funds from a DOE grant in October of this year. After Rye is in receipt of the funds, Rye will submit a formal written request for a SMCRA exemption based on the project's government funding.

- Construction materials – We are exploring using sandstones in the immediate area as a construction material. As with the permitting exemption with respect to coal, we want to make sure the permitting exemption applies to non-coal materials as well. Wes was going to verify this with the non-coal group.

- Nally's refuse impoundment – The Middlesboro office expressed concern to me that the emergency spillway designed for the final stage of the Betsy Br impoundment will outlet above Rye's lower reservoir. The regional office believes a permitted sediment pond is required below that outlet. My thoughts are that if the impoundment design maintains an open pool capacity => the 10-year/24-hour storm event volume, no additional sediment structures are required. Wes said he would review the impoundment design before he gave us an opinion on this. After we know the Department's thoughts on this, we will coordinate with Nally to make sure the permitting reflects those thoughts.

- PMLU – Rye has concerns that after Nally gets its active permit in Toms Branch into phase 1, future geotechnical work in the permit area could create issues with Nally's reclamation. We discussed changing the PMLU in that permit to Industrial/Commercial. We would want the permit to state that the PMLU was considered achieved by some level of activity such as road construction, geotechnical investigation, or other activities advancing the lower reservoir. Obviously, this will require coordination with Nally.

- Bat PEP – Jay mentioned that if Nally's current permit has a Bat PEP and we convert to Industrial/ Commerial PMLU, we may need to consider an offset. We will be sure to include that in our planning. We will work with Thomas Barbour to address those concerns.

- Other material sources or storage – We discussed AML or forfeited permits as either sources of construction material or potential sites for placement of mine spoil. Jay was going to connect with Jim Cable to see if he had sites nearby that he thought may have some benefit. We discussed mine spoil and coal refuse. I doubt we can haul spoil far and I am pretty sure it would need to be off-road but we like the idea of pairing with AML if possible. Please keep us updated. I am meet with Jim at his convenience if he has any ideas.

If you think I have misstated or omitted anything, please let me know. There are a lot of positives from our meeting that we will pursue. I intend to use this email as my punchlist for DNR issues.

We will continue to keep the DNR updated on the project's status. We greatly appreciate your thoughts and ideas regarding the project. Please continue to share freely.

Thanks again,

Mike

RESPEC

Michael Ricci
Principal Engineer
Michael.Ricci@respec.com
859-361-4540
146 East Third St.
Lexington, KY 40508

From: sean vanderhoff
To: Sandra Wash
Cc: ctdecelle@gmail.com; bobroth88@yahoo.com; pat.kambesis@wku.edu; Jules Roush; Howard K
Subject: Re: KSS Database Request - Sandra Wash, Proposed Lewis Ridge Pumped Storage Project
Date: Thursday, August 1, 2024 12:23:57 PM
Attachments: LewisRidge_StudyArea_20240619.zip

Hi Sarah,

A search of our database did **NOT** identify any cave locations with your provided study area in Bell County. Two caves were identified within three (3) miles of the study area.

There is a $50 fee for search origination, plus $10 per record, for a total of $50. You will be invoiced by our organization Treasurer – Julie Roush

This data is shared to aid in our organizational goals of conservation, research, and exploration of caves throughout the Commonwealth of Kentucky. Please remember that data reported by KSS is as has been reported to us, but not guaranteed to be complete or correct. There may be unknown caves, sinks or other unreported or unknown karst features. Additionally unreported or filled in cave entrances can open or subside at any time. Use caution when using this data.

Please mark supplied locations as Privileged and Confidential on all maps associated with this project.

Please note our updated guidelines on request turnaround timing:

> KSS is a volunteer organization. We do try to process standard requests as fast as possible, but cannot guarantee a turnaround time. We try to process non-voted requests in less than 1 month, and will attempt to vote on more complicated requests within 2 months.
>
> Requestors can contact us if a quick turnaround time is specifically needed.
>
> Timing is greatly reduced if an ArcGIS .shp file is provided

Sean Vanderhoff

Data Committee

Kentucky Speleological Survey

On Thursday, August 1, 2024 at 11:09:36 AM EDT, Kentucky Speleological Survey <wordpress@kss.caves.org> wrote:

From: Sandra Wash sandra.wash@kleinschmidtgroup.com
Sent: August 1, 2024, 3:09 pm

Qualifications: Licensing Coordinator/none specific to caves
Organization: Kleinschmidt Associates
Address: 5346 Stadium Trace Parkway, Suite 110, Hoover AL
Phone: 2055424494

Data Request:

Lewis Ridge Pumped Storage, LLC (LRPS) is pursuing an original Federal Energy Regulatory Commission (FERC) license for the proposed Lewis Ridge Pumped Storage Project. The Project is a proposed, unconstructed pumped storage hydroelectric generating facility located in Bell County, Kentucky on land that has been used for both underground and surface mining. The Project will involve the construction of new water storage, water conveyance, and electric generation facilities. On behalf of LRPS, we would like to determine if there are any caves in the Project study area. The proposed Project is located on private land.

Intended use:
While consulting with the U.S. Fish and Wildlife Service (USFWS) during the FERC licensing process, USFWS requested LRPS to determine if there were any caves that potentially could be impacted by the construction of the Project. We intend to include a high-level summary of this information in the License Application to be filed with FERC, however, we understand the privileged nature of the information and would not include any specific location information, etc. In addition, any site-specific info could be filed with certain agencies (such as USFWS and FERC) as privileged.

--

Lewis Ridge Pumped Storage Project, FERC P-15249

Meeting Summary

Date/Time: 8/12/2024 11:00AM EST

Meeting Type: Virtual meeting via Teams

Attendees:

Jay Cunningham, Kentucky Department for Natural Resources (Kentucky DNR)
Louanna Aldridge, Kentucky Department for Environmental Protection (Kentucky DEP)
Allan Shingleton, Kentucky DEP Division of Water
Shawn Hokanson, Kentucky DEP Division of Water
Glen Alexander, Kentucky DEP Division of Water – Dam Safety
Casey Ehorn, U.S. Army Corps of Engineers (USACE)
Cara Beverly, USACE
Sandy Slayton, Lewis Ridge Pumped Storage, LLC (LRPS)
Ushakar Jha, LRPS
Dylan Stankus, LRPS
Patrick Willis, AECOM
Mario Sebastiani, AECOM
Michael Ricci, RESPEC
Lesley Brotkowski, Kleinschmidt Associates
Elizabeth Krchnavek, Kleinschmidt Associates

Purpose:

Discuss water resources relating to the preliminary design of the Lewis Ridge Pumped Storage Project, FERC P-15249 (Lewis Ridge Project), specifically regarding:

- Initial fill and recharge water source (withdrawal permitting),
- Routing and/or diversion of Tom Fork at the Lower Reservoir, and
- Project design around these topics.

Summary:

- Sandy Slayton (LRPS) opened the call, described meeting purpose, and provided the meeting agenda.
- Introductions were provided from each attendee.
- Sandy provided an overview of a timeline of the Lewis Ridge Project, noting key milestones. She explained that studies are currently being conducted, and that the Draft License Application will be distributed to agencies and stakeholders, and filed with the Federal Energy Regulatory Commission (FERC) at the end of September 2024.
- Lesley Brotkowski (Kleinschmidt Associates) provided an overview of the four studies being conducted:
    - Wetland and Waterway Evaluation
    - Blackside Dace Habitat Evaluation
    - Bat Survey
    - Cultural Resource Evaluation

- Patrick Willis (AECOM) explained that the Lewis Ridge Project is in the early design phase. He presented an overview of the current design (PowerPoint provided), including:
  - Overview of site location.
  - General arrangement / project features site plan.
  - Lewis Ridge Project features, as currently designed: upper reservoir, lower reservoir, penstock, powerhouse.
- Patrick described required initial fill and annual makeup water needs.
  - The volume of water for initial fill is estimated to be 3,275 acre feet.
  - Annual makeup water due to evaporation and seepage losses is approximately 274 acre feet.
  - The source of initial fill is anticipated to be from natural inflows to the Lower Reservoir from Tom Fork; supplementary water may be required from the Cumberland River and/or groundwater wells.
  - The source of annual makeup water is anticipated to be from natural inflows from Tom Fork.
- Sandy Slayton provided an overview of the FERC licensing process and noted LRPS would like some feedback from the agencies regarding design options and permit requirements.
- Jay Cunningham (Kentucky DNR) stated that he doesn't have any comments.
- Casey Ehorn (USACE) explained that stream impacts will need to be permitted (404 Permit).
- Cara Beverly (USACE) added that if withdrawal is needed from the Cumberland River, a 408 permit review will need to be conducted.
- Allan Shingleton (Kentucky DEP)
  - Explained that a one time initial fill from the Cumberland River would require a single temporary authorization.
  - Allan asked for an estimation of timing for the refill.
    - Patrick answered that they will be looking at this further, but currently it appears it will be a continuous need for a small amount of recharge water, which will likely be sufficiently provided from the drainage at Tom Fork.
  - Allan asked if the recharge water will require fill from the Cumberland River.
    - Patrick said that use of the Cumberland River for recharge water is not anticipated.
  - Allan stated that if two sources are needed (wells and Cumberland), two separate permits will be required.
- Shawn Hokanson (Kentucky DEP) explained that LRPS will need work with Samantha Vogeler (samantha.vogeler@ky.gov) regarding the 401 Water Quality Certificate (WQC).
- Sandy Slayton asked the present agency staff if the placement of the lower reservoir within Tom Fork compared to diversion around the lower reservoir will greatly impact permitting needs. Lesley Brotkowski also asked about potential mitigation of Tom Fork, and if water quality will need to be improved or maintained to meet existing conditions.
  - Shawn Hokanson stated that placement of the lower reservoir and how it relates to Tom Fork will impact the permitting a little bit, such as the type of WQC needed (Individual WQC vs. General WQC). An Individual WQC may be required for more significant impacts if general permit conditions are not met. He added that he couldn't answer all of the questions now without additional information regarding the Lewis Ridge Project.

- Sandy Slayton asked the group if there are any further comments, questions, or water related topics or concerns that should be discussed. Patrick Willis also asked if there were any other reactions to the preliminary concepts presented.
    - Casey Ehorn stated that the burden is on the applicant that the project is the least damaging to achieve the project purposes. Casey suggested that as FERC conducts their environmental analysis, LRPS may want to contact FERC to see if they can consider USACE needs during their analysis.
    - Glen Alexander (Kentucky DEP) suggested that as design progresses a separate meeting is set up as a preliminary design conference to discuss requirements related to dam safety.
        - Lesley asked about permitting review time. Glen said it is typically a 60 day review period.
    - Patrick Willis stated that AECOM will continue engineering design in Fall of 2024and that there will be additional dam safety design conferences during the design process. Patrick asked Glen if the state would like to participate in these meetings in conjunction with FERC. Glen concurred but added that FERC dam safety requirements are typically equal or above the state requirements, so usually if the project meets FERC requirements, it will meet the state requirements (although exceptions can occur, so early consultation is recommended).
- Lesley Brotkowski asked about the application process and anticipated timeline for the 404 permit from USACE.
    - Casey Ehorn stated that the information on impoundment safety is a requirement for a complete application (33 CFR 325.1(d)(6) states: If the activity would involve the construction of an impoundment structure, the applicant may be required to demonstrate that the structure complies with established state dam safety criteria or that the structure has been designed by qualified persons and, in appropriate cases, independently reviewed (and modified as the review would indicate) by similarly qualified persons. No specific design criteria are to be prescribed nor is an independent detailed engineering review to be made by the district engineer.) Casey stated that the appropriate timing for the 404 permit is likely after FERC's process.
    - Lesley Brotkowski asked about options for stream mitigation, and whether on-site mitigation or banks are generally preferred. Casey stated that mitigation banks are typically preferred. Casey stated that credits can be found on Ribits website. Casey recommended that LRPS may want to initiate discussion with mitigation providers.
- Cara Beverly confirmed that if a 408 permit is required, she is the correct contact. If there are any questions on this process, LRPS can reach out to Cara.
- Sandy Slayton stated that LRPS will follow up with Samantha Vogeler regarding the 401 WQC.
- Sandy Slayton thanked the attendees for the participation and feedback.

AECOM

Design Update

Lewis Ridge Pumped Storage Project

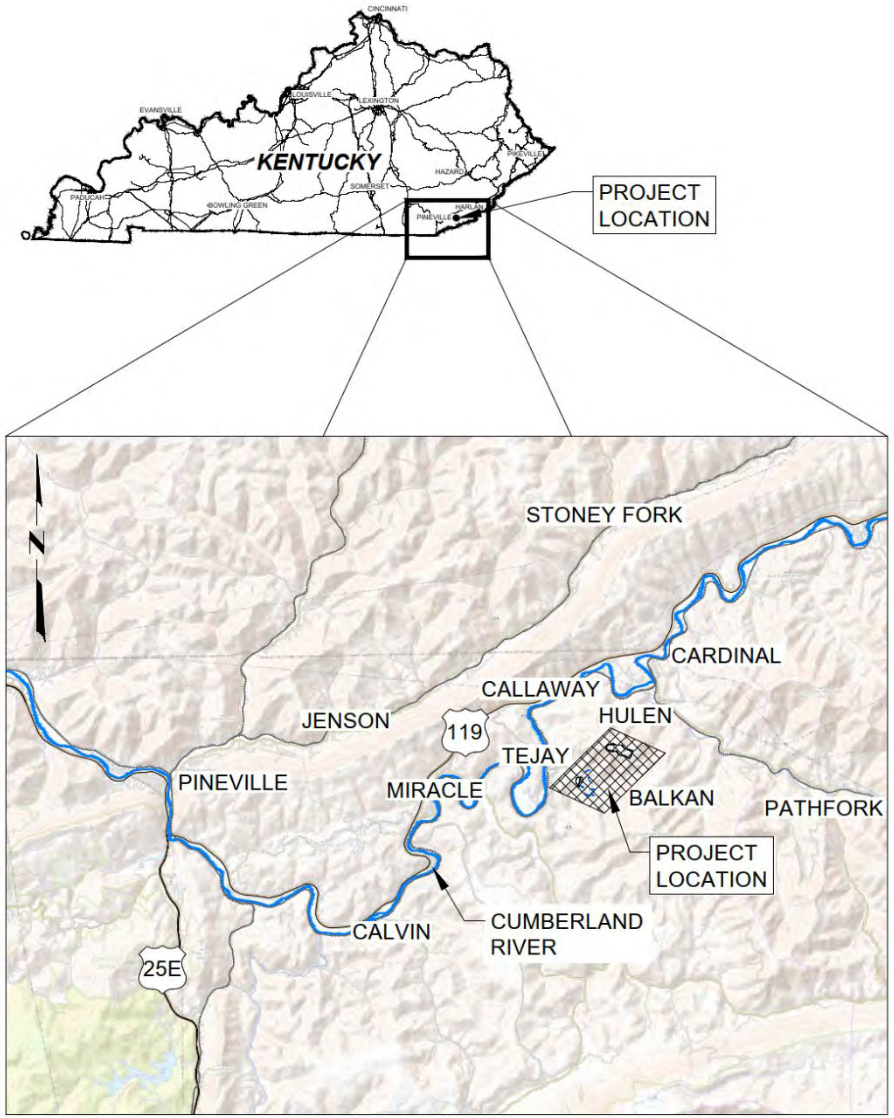
August 12, 2024

Delivering a better world

aecom.com

Drawings containing CEII were redacted

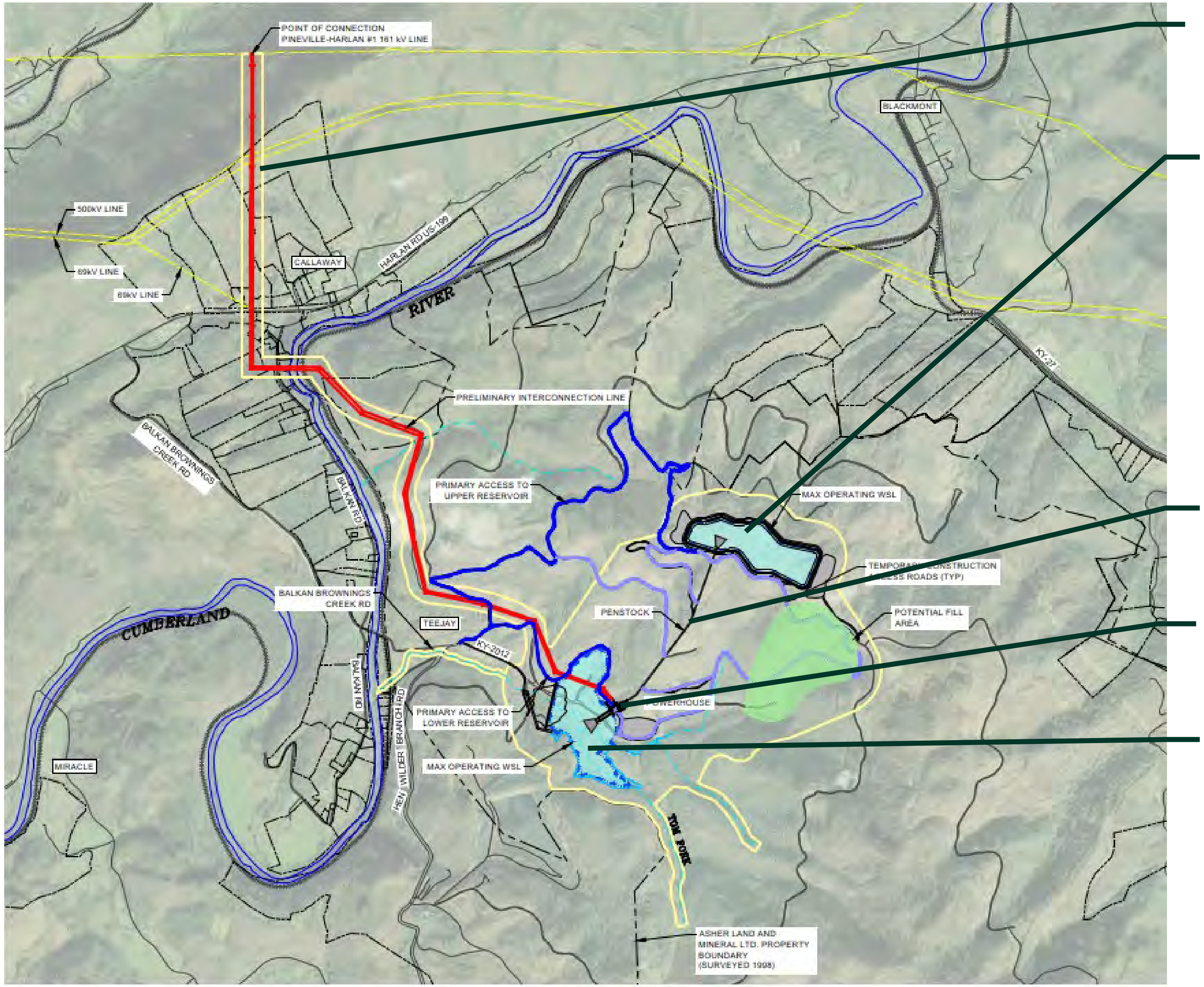
Project Location



- Project is located in Bell County, Kentucky
- Upper Cumberland River Basin within the Tom Fork Creek drainage basin
- Approximately 10 miles east of Pineville, Kentucky

Drawings containing CEII were redacted

Project General Arrangement



PROJECT GENERAL ARRANGEMENT

161 kV Overhead Transmission Line (3.2 miles)

Upper Reservoir

Surface Penstock

Powerhouse (287MW)

Lower Reservoir

Drawings containing CEII were redacted

Upper Reservoir

- 5,450-foot-long ring dike hardfill dam
- 135 feet high
- Surface area of 40 acres
- Active storage capacity of 2,600 acre-feet
- Integrated overflow spillway and low-level outlet works
- Floor of the reservoir will be lined with Hydraulic Asphalt Concrete

Drawings containing CEII were redacted

Lower Reservoir

- 830-foot-long cross valley embankment dam
- 120 feet high
- Surface area of 48 acres
- Active storage capacity of 2,600 acre-feet
- Concrete lined emergency spillway in left abutment
- Low-level outlet works
- Upstream face of the dam will be lined with Hydraulic Asphalt Concrete

Drawings containing CEII were redacted

Photos of Tom Fork Creek in Proposed Lower Reservoir Location

- Area of drainage basin above Lower Reservoir site is 1.8 square miles

Drawings containing CEII were redacted

Penstock Plan and Profile

- 4,757-foot-long steel surface penstock (pipeline)
- Penstock will be 16 feet in diameter

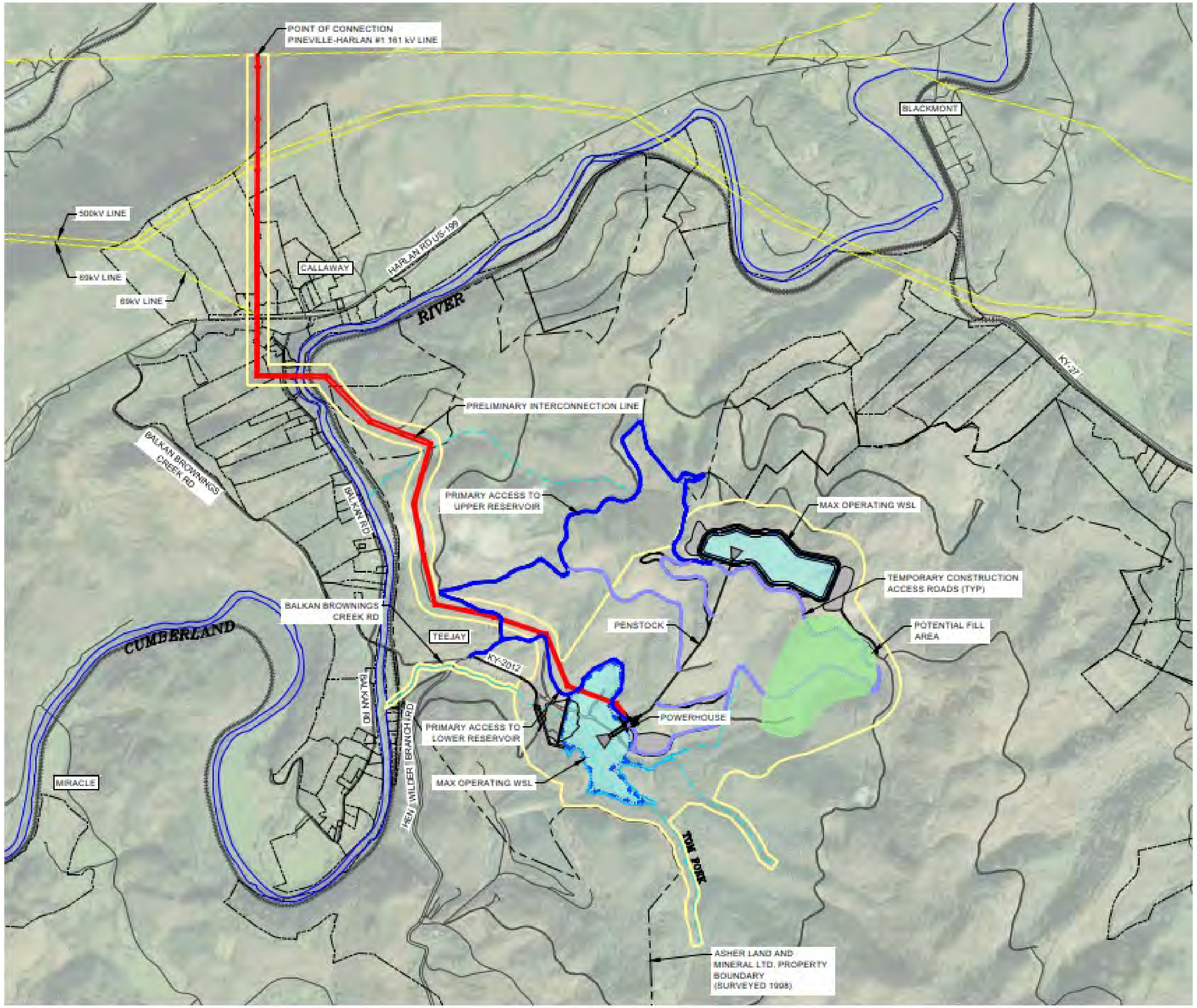
Powerhouse

Drawings containing CEII were redacted

- Shaft-type powerhouse
- 150-foot-diameter circular shaft 250 feet below ground surface
- Two 143.5 MW reversible Francis pump-turbines (total installed capacity of 287 MW)
- Short tunnel sections of penstocks on upstream side and tailrace tunnels on downstream side

Drawings containing CEII were redacted

Initial Fill and Annual Makeup Water



PROJECT GENERAL ARRANGEMENT

- Volume of water required for initial fill is 3,275 acre-feet
- Annual make-up water due to evaporation and seepage losses is 274 acre-feet
- Source of initial fill is anticipated to be from natural inflows to the Lower Reservoir from the Tom Fork Creek Drainage; supplementary water may be required from the Cumberland River and / or groundwater wells
- Source of annual make-up water is anticipated to be from natural inflows from the Tom Fork Creek Drainage

AECOM

Thank you.

Delivering a better world

aecom.com

From: Sandy Slayton

To: Adam.Bowling@lrc.ky.gov; darryl.lacounte@bia.gov; Kim.Amendola@noaa.gov; NashvilleRegulatory@usace.army.mil; Casey.H.Ehorn@usace.army.mil; Cara.c.beverly@usace.army.mil; Marian.r.rubin@usace.army.mil; joseph.oloriz@hq.doe.gov; andrew_raddant@ios.doi.gov; blackman.daniel@epa.gov; Michael_Oetker@fws.gov; john_faustini@fws.gov; lee_andrews@fws.gov; KentuckyES@fws.gov; karah_jaffe@fws.gov; Jeff_Duncan@nps.gov; Johnnie.Turner@lrc.ky.gov; rdbrock@charter.net; thunt@mcn-nsn.gov; ashlstep@nc-cherokee.com; jbunch@ukb-nsn.gov; chuck-hoskin@cherokee.org; chiefharper@peoriatribe.com; elizabeth-toombs@cherokee.org; syerka@nc-cherokee.com; ddotson@delawarenation-nsn.gov; dhill@muscogeenation.com; dlankford@miamination.com; louanna.aldridge@ky.gov; Lonis.Morgan@ky.gov; Shawn.hockanson@ky.gov; Allan.shingleton@ky.gov; Samantha.vogeler@ky.gov; Glen.alexander@ky.gov; thomas.barbour@ky.gov; beth.trent@ky.gov; gordonr.slone@ky.gov; matt.catron@ky.gov; Jay.Cunningham@ky.gov; khc.section106@ky.gov; barry.butcher@ky.gov; Kenya.Stump@ky.gov; info@kychamber.com; Debbie.Gambrel@ky.gov; econdev@ky.gov; swilson@middlesborokentucky.net; linda.bridwell@ky.gov; brock@bcje.com; ashley@kyrc.org; fitzkrc@aol.com; cacclement@gmail.com; josh@mtassociation.org; asherlandandmineral.mg@gmail.com; mike_floyd@fws.gov; mona.juett@ky.gov; rcain@ukb-nsn.gov

Cc: Ushakar Jha; Erik Steimle; Sandra Wash; Elizabeth Krchnavek; Lesley Brotkowski; Michael Ricci

Subject: Lewis Ridge Pumped Storage Project (P-15249) Revised Study Plan

Date: Friday, August 16, 2024 2:51:39 PM

Attachments: image001.png
Lewis Ridge Revised Study Plan - 2024-08-16 FERC filing.pdf

Good afternoon,

Lewis Ridge Pumped Storage, LLC. (LRPS) is providing the Revised Study Plan (attached) for the Lewis Ridge Pumped Storage Project (P-15249). LRPS distributed the draft study plan on June 13 for a 30-day review period. The Kentucky Energy and Environment Cabinet Department for Environmental Protection and the Kentucky State Historic Preservation Office provided comments on the draft study plan, which have been incorporated into the revised study plan.

If you have any questions regarding this email, please contact me at sandy@ryedevelopment.com.

Thank you,

Sandy

Sandy Slayton
Vice President, Environmental
(206) 919-3976
sandy@ryedevelopment.com
www.ryedevelopment.com

Electronically Filed

Rye
Development

100 S. Olive Street, West Palm Beach, FL 33401

August 16, 2024

VIA E-FILING

Debbie-Anne Reese, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, DC 20426

Subject: Lewis Ridge Pumped Storage, LLC
Lewis Ridge Pumped Storage Project, FERC Project No. 15249
Revised Study Plan

Dear Secretary Reese:

Lewis Ridge Pumped Storage, LLC (LRPS) is filing with the Federal Energy Regulatory Commission (FERC or Commission) its revised study plan for the Lewis Ridge Pumped Storage Project (FERC No. 15249) (Project). The Project received a preliminary permit from FERC on March 3, 2022. The Pre-Application Document (PAD) and Notice of Intent (NOI) to seek an original license for the Project were filed on October 21, 2022. LRPS hosted the Joint Meeting and site visit on January 25, 2023, under FERC's Traditional Licensing Process (TLP).

The unconstructed Project is located in the Upper Cumberland River Basin in Bell County, Kentucky near the borders of Tennessee and Virginia. The Project would be a pumped storage hydroelectric generating facility located at a site historically used for mining.

LRPS has prepared a study plan to document and share with FERC, resource agencies, Tribes, and stakeholders its plans for conducting resource studies to inform Project development and the licensing process. LRPS is proposing to conduct the following studies, as described in detail in the study plan:

- Wetland and Waterway Evaluation
- Blackside Dace Habitat Evaluation
- Bat Survey
- Cultural Resources Evaluation

LRPS distributed the draft study plan on June 13, 2024 for a 30-day review period. The Kentucky Energy and Environment Cabinet Department for Environmental Protection (DEP) and the Kentucky State Historic Preservation Office (SHPO) provided comments on the draft study plan, which have been incorporated into the revised study plan.

Please direct any questions pertaining to the Project or process to Sandy Slayton by phone at (206) 919-3976 or email at sandy@ryedevelopment.com.

Sincerely,

Erik Steimle
Vice President
Lewis Ridge Pumped Storage, LLC

Attachments: Distribution List
Revised Study Plan

cc: Sandy Slayton, Lewis Ridge Pumped Storage, LLC
Lesley Brotkowski, Kleinschmidt Associates

Lewis Ridge Pumped Storage Project (P-15249)
Distribution List

Elected Officials

Office of Senator Mitch McConnell
Lexington Office
771 Corporate Drive, Suite 108
Lexington, Kentucky 40503

Office of Senator Rand Paul
Main State Office
1029 State Street
Bowling Green, Kentucky 42101

Office of Representative Harold "Hal" Rogers
Somerset Office
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Somerset, Kentucky 42503

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Johnnie.Turner@lrc.ky.gov

Adam Bowling
Kentucky House of Representatives (87th District)
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REVISED STUDY PLAN

LEWIS RIDGE PUMPED STORAGE PROJECT
FERC NO. 15249

Prepared for:
Lewis Ridge Pumped Storage, LLC

Prepared by:
Kleinschmidt Associates

August 2024

Kleinschmidt

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ACRONYMS

A	
APE	Area of Potential Effects
C	
CFR	Code of Federal Regulations
Commission	Federal Energy Regulatory Commission
F	
FERC	Federal Energy Regulatory Commission
G	
GPS	Global Positioning System
I	
IPaC	Information for Planning, and Consultation
K	
KDFWR	Kentucky Department of Fish and Wildlife Resources
KHC	Kentucky Heritage Council
KY USFWS	USFWS Kentucky Ecological Services Field Office
L	
LRPS	Lewis Ridge Pumped Storage, LLC
M	
µS/cm	microSiemens per centimeter
N	
NOI	Notice of Intent
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
O	
OSA	Office of State Archaeology

P

PAD	Pre-application Document
Permittee	Lewis Ridge Pumped Storage, LLC
Project	Lewis Ridge Pumped Storage Project

S

SHPO	State Historic Preservation Office

T

TLP	Traditional Licensing Process

U

USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

1.0 INTRODUCTION

Lewis Ridge Pumped Storage, LLC (Permittee or LRPS) is filing with the Federal Energy Regulatory Commission (FERC or Commission) its revised study plan for the Lewis Ridge Pumped Storage Project (FERC No. 15249) (Project). The Project received a preliminary permit from FERC on March 3, 2022.[1] LRPS is using FERC's Traditional Licensing Process (TLP) as established in FERC regulations, Title 18 of the US Code of Federal Regulations (CFR), Part 4. The Permittee filed a Pre-Application Document (PAD) and Notice of Intent (NOI) to seek an original license for the Project on October 21, 2022.[2] As the Permittee is utilizing the TLP there is no requirement to prepare a formal study plan document, and therefore there is no subsequent study plan determination by FERC. Nonetheless, LRPS has prepared this study plan to document and share with FERC, resource agencies, Tribes, and stakeholders its plans for conducting resource studies to inform Project development and the licensing process. LRPS distributed the draft study plan on June 13, 2024 for a 30-day review period. The Kentucky Energy and Environment Cabinet Department for Environmental Protection (DEP) and the Kentucky State Historic Preservation Office (SHPO) provided comments on the draft study plan (Appendix A), which have been incorporated into the revised study plan.

The Project is a proposed, unconstructed pumped storage hydroelectric generating facility located in Bell County, Kentucky on land that has been used for both underground and surface mining. The Project will involve the construction of new water storage, water conveyance, and electric generation facilities. The grid-connected project will use electricity to store potential energy by moving water between a lower and upper reservoir, connected by a penstock and powerhouse that contains two reversible pump hydroelectric turbines. During periods of peak electricity demand, this same water will be released, generating power and delivering it to the grid. The Project will require a one-time fill of the reservoirs with minimal make-up water required.

Informal stakeholder outreach has been ongoing since Spring 2022. Joint agency and public meetings were held with stakeholders on January 25, 2023. No formal study requests were received as a result of those meetings; however, LRPS is planning to complete the following studies to collect information necessary for Project development and licensing: wetland and waterbody evaluation, blackside dace habitat evaluation, bat survey, and a cultural resources evaluation. Results of the studies will be used to inform and refine Project layout and design.

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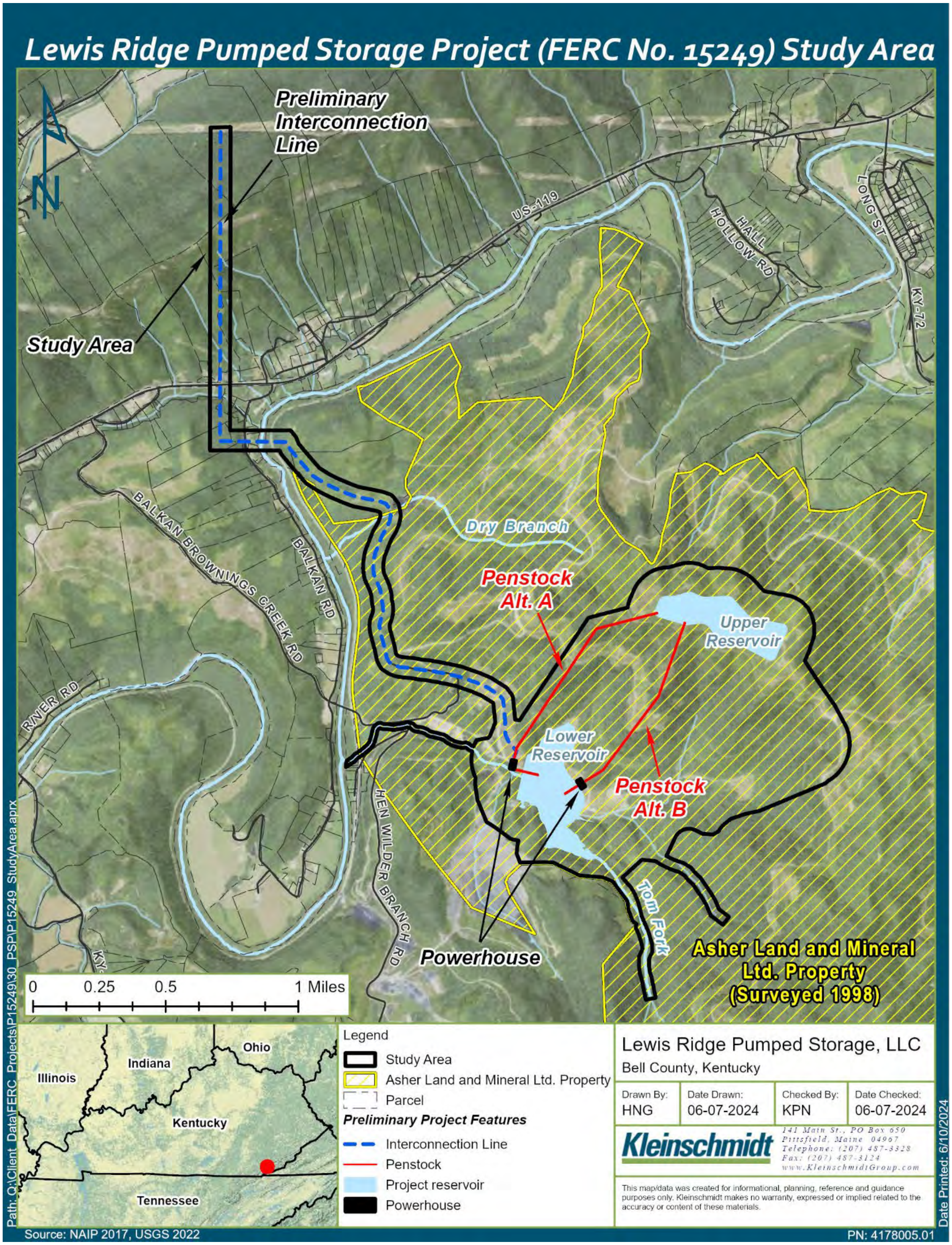
[1] Accession No. 20220303-3084

[2] Accession No. 20221021-5176

The study area is depicted in Figure 1-1 and includes appropriate buffers around the proposed facilities to account for further refinement of the Project.



This map/data was created for informational, planning, reference and guidance purposes only. Kleinschmidt makes no warranty, expressed or implied related to the accuracy or content of these materials.

Figure 1-1. Study Area

2.0 INDIVIDUAL STUDY PLANS

2.1 Wetland and Waterway Evaluation

An initial wetland and waterway assessment for the Project was conducted in 2022. The Project has continued to advance in design and the study area has been refined since the 2022 assessment. LRPS proposes to conduct a wetland and waterway evaluation that will build upon the 2022 assessment to determine the presence of wetlands and waterways in the study area.

2.1.1 Background

In 2022, Ecosource, Inc. conducted a Jurisdictional Streams and Wetlands Determination assessment to determine the presence of jurisdictional waters in a preliminary Project study area. The assessment involved compiling background information (sources included the Bell County Soil Survey located on the U.S. Department of Agriculture (USDA) Web Soil Survey, the National Wetlands Inventory (NWI) Map, U.S. Geological Survey (USGS) topographic map, and Google Earth) and field reconnaissance. The assessment identified emergent type wetlands and streams inside and outside of the active/reclaimed mining areas.

2.1.2 Goals and Objectives

The goal of this study is to determine the presence of wetlands and waterways in the updated study area. The study includes the following objectives:

- Compile background information related to wetlands and waterways in the study area; and
- Perform a desktop and field reconnaissance to identify the location of wetlands and waterways in the study area.

2.1.3 Scope and Methods

Data sources will be reviewed to compile background information on the study area. Sources may include, but are not limited to soil surveys, NWI data and maps, topographic maps, Google Earth, and private data courses related to active and inactive mining permits.

Review of public and private data sources will be utilized to map approximate wetland and waterway locations on privately owned lands inside the study area. A field reconnaissance will be conducted to verify the locations of wetlands and waterways on lands owned by Asher Land and Mineral in the study area. Tasks include, but are not limited to:

- Conduct a wetland reconnaissance by inspecting mapped NWI wetland locations and areas that exhibit wetland indicators (hydrophytic vegetation, wetland hydrology, and hydric soils) in the field.
- Conduct a stream reconnaissance using presence of discernible bed and bank features observed in the field. Streams with these features will be documented for habitat value and beginning and ending jurisdictional limits.

2.1.4 Schedule

The wetland and waterway evaluation will be conducted in Summer 2024. Study results from the 2022 and 2024 assessments will be compiled in a study report that will be filed with the Draft License Application.

2.2 Blackside Dace Habitat Evaluation

LRPS proposes to conduct a water quality and habitat assessment in Tom Fork, a tributary to the Cumberland River, to assess the potential habitat suitability for blackside dace (*Chrosomus cumberlandensis*).

2.2.1 Background

Blackside dace is a federally listed (threatened) species endemic to the upper Cumberland River drainage in southeastern Kentucky and northern Tennessee. The US Fish and Wildlife Service (USFWS) Information, Planning, and Conservation (IPaC) tool lists blackside dace as potentially occurring within the proposed Project vicinity (LRPS 2022). Blackside dace generally inhabit small, moderate gradient streams (less than 15 feet wide) with cool water temperatures (rarely exceeding 70° Fahrenheit) and sufficient flows to remove silt from areas below riffles. The species is not known to occur in low gradient streams with notable silt deposition (Floyd 2016; USFWS 1988). Preferred physical habitat characteristics include structure (e.g., undercut banks, woody debris, and large rocks), and the presence of overhead and riparian vegetation cover (i.e., canopy cover at of 70 percent or greater) (USFWS 1988). Research has also documented higher blackside dace occupancy in streams with conductivity levels below 343 microSiemens per centimeter (μS/cm) (Hitt et al. 2016; Yates 2017).

2.2.2 Goals and Objectives

The goal of the blackside dace habitat evaluation is to assess habitat suitability and potential presence of blackside dace in Tom Fork. The study includes the following objectives:

- Document water quality and physical habitat parameters in Tom Fork; and
- Compare documented parameters with known blackside dace habitat requirements.

2.2.3 Scope and Methods

Water quality and physical habitat surveys will be conducted at up to ten locations throughout Tom Fork. Survey points will include the reach of Tom Fork between the Cumberland River and reaches upstream of the proposed lower reservoir within the study area. Coordinates for each point will be recorded with a handheld Global Positioning System (GPS).

Water quality will be recorded with a handheld meter at each survey point. Documented water quality parameters will include water temperature, dissolved oxygen, and conductivity.

Multiple stream width and depth measurements will be recorded in the immediate area of each survey point. Flow will be characterized visually with notation of water movement (e.g., riffles or runs) and pool habitat. The extent of canopy cover (percent cover) and the status of riparian vegetation will be recorded at each survey point, and upstream and downstream facing photos documenting the streambed and riparian habitat will be taken. Substrate types present at each survey point will be recorded, and the streambed composition (percentage of each substrate type present) will be estimated.

2.2.4 Schedule

The field survey will be conducted in Summer 2024. Study results will be compiled in a study report that includes habitat and water quality data in written and tabular format, reference photos of survey points, and a comparison of documented habitat and water quality conditions with known blackside dace habitat preferences. The study report will be filed with the Draft License Application.

2.3 Bat Survey

LRPS proposes to conduct a bat survey during the summer maternity season to determine if federally threatened or endangered bats are present within the study area.

2.3.1 Background

The Project was reviewed using the USFWS Information for Planning and Consultation (IPaC). Based upon the information obtained from the IPaC, it was determined that suitable summer habitat for the Indiana bat (*Myotis sodalis*), gray bat (*Myotis grisescens*), and northern long-eared bat (*Myotis septentrionalis*) may be present in the study area.

2.3.2 Goals and Objectives

The goal of the bat survey is to determine if federally threatened or endangered bats are present within the study area. The study includes the following objectives:

- Conduct a mist net survey to determine the presence/probable absence of federally threatened or endangered bat species during the summer maternity season; and
- Conduct radiotelemetry on up to two individuals for each threatened and/or endangered species that is captured per site, if encountered.

2.3.3 Scope and Methods

Prior to conducting the bat survey, LRPS will ensure appropriate permits are obtained.[3] Survey methods described herein are in accordance with the current USFWS survey guidelines (USFWS 2024). Survey results will be used to assess the amount of risk to threatened and/or endangered bat species within the study area. The capture of threatened and/or endangered bat species will be considered evidence that bats are currently occupying the potentially suitable forested habitat within the study area. The lack of captures of threatened and/or endangered bat species will be considered sufficient evidence that these species are not present within the study area during the summer maternity season.

<u>Mist Net Surveys</u>

Mist net surveys will be conducted in Summer 2024 within the study area. Mist nets will be placed in areas of potentially suitable habitat and positioned perpendicularly across flight corridors, encompassing the corridor from side-to-side and extending upwards into overhanging canopy, and will be checked approximately every 10 minutes. For each survey night, the date, survey start and end time, site description and coordinates, mist net specifics (net size, net location, and habitat type where each net is deployed) and hourly weather conditions will be recorded. In addition, captured bats will be identified to the species level and the following parameters will be recorded: age, sex, reproductive condition, body mass (grams), forearm length (millimeters), wing score, time of capture, capture location, and capture status (new or re-capture).

All species of bats captured will be documented with representative photographs. For each threatened and/or endangered bat that is captured, individual photographs portraying identifying characteristics will be documented for each bat. Upon capture of federally threatened and/or endangered species, both the USFWS Kentucky Ecological Services Field

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[3] Permit 3-200-59 (Recovery Permits) will be obtained from the USFWS, and a Scientific Wildlife Collecting Permit will be obtained from the Kentucky Department of Fish and Wildlife Resources (KDFWR).

Office (KY USFWS) and the Kentucky Department of Fish and Wildlife Resources (KDFWR) will be notified immediately.

Radio Telemetry

In the event a federally threatened and/or endangered species is captured, telemetry surveys will be conducted to determine if bats are utilizing areas in or around the Project as roosting sites, maternity colonies, or foraging areas.

2.3.4 Schedule

The bat survey will be conducted in Summer 2024. Study results will be compiled in a study report that will be filed with the Draft License Application.

2.4 Cultural Resources Evaluation

In preparing the PAD, LRPS conducted a preliminary records review for cultural historic and archaeological resources. The next step is to conduct a formal Section 106 cultural resources evaluation under the supervision of a qualified professional[4] to identify known cultural resources within the Project's Area of Potential Effects (APE).

2.4.1 Background

A Phase I survey was performed in 2007 in association with the permit submitted to the Division of Mines for a mining facility in the area of the preliminary Lower Reservoir location. The survey identified four previously unrecorded sites: two historic cemeteries, remains of a coal camp house, and remains of a historic coal mining operation (McGraw 2007). Although not eligible for the National Register of Historic Places (NRHP) individually, the Kentucky State Historic Preservation Office (SHPO) and the Division of Mines recommended Phase II investigations of the sites in the form of archival research to determine if they were eligible as a district. Due to extensive disturbance from coal mining operations and surface mining, the district was found ineligible for the NRHP.

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[4] All Section 106 investigations subject to review by the Kentucky SHPO must be carried out under the direct supervision of a qualified Principal Investigator who meets or exceeds the minimum professional requirements established in the Secretary of the Interior's Standards, as determined by the Kentucky SHPO.

In 2022, a preliminary historic resources site check of the Project Vicinity[5] was submitted to the Kentucky Heritage Council to identify previously recorded sites and any properties or sites already listed on or determined eligible for the NRHP. The site check identified ten historic houses along public roadways (one of which meets NRHP criteria) and the Balkan School (meets NRHP criteria) within the Project Vicinity (Kentucky Heritage Council 2022).

In 2022, a preliminary records review for archaeological sites was submitted to the University of Kentucky to determine whether there are previously recorded archaeological sites near the Project, and if present, their NRHP status. The review identified five sites and includes the two cemeteries identified in the 2007 Phase 1 survey noted above. Three of the sites do not meet NRHP eligibility criteria and the two cemeteries' NRHP status have not been assessed (University of Kentucky 2022). The previous mining facility did not impact the cemeteries by providing a 100-foot buffer zone.

2.4.2 Goals and Objectives

The goal of the cultural resources evaluation is to document the location of historic and archaeological resources that are listed or eligible for listing in the NRHP,[6] within the APE.[7] The study includes the following objectives:

- Perform a file search and archival research on historic and archaeological resources.
- Perform a field assessment to document the location of historic and archaeological resources.

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[5] For purposes of the PAD, environmental resources were described for the area within the Project Vicinity to allow for a broader geographic context of the immediate surrounding area to the Project. It was anticipated that the construction limits of disturbance and any potential changes to the Project Boundary were likely to be located within the defined Project Vicinity.

[6] Consistent with the Code of Federal Regulations (CFR), this study plan defines historic properties consistent with the Secretary of the Interior's Standards definition, defined as a district, site, building, structure, or object listed in or eligible for listing in the National Register of Historic Places. LRPS understands that the Kentucky SHPO defines a historic property as a tangible property (building, structure, archeological site, or object) which is fifty years of age or older.

[7] The APE is the geographic area within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if such properties exist (36 CFR Part 800.16[d]).

2.4.3 Scope and Methods

LRPS proposes the APE as the study area identified in Figure 1-1. [8]

LRPS will conduct a historic and archaeological resources survey in accordance with current *Specifications for Conducting Fieldwork and Preparing Cultural Resource Assessment Reports* issued by the Kentucky SHPO within the APE.

The file and archival research will include a review of the historic site files at the Kentucky Heritage Council (KHC), review the archaeological site files at the Kentucky Office of State Archaeology (OSA), and review of historic maps, soil maps, and any other relevant sources that may provide additional context. The results of the record search will be included in the appropriate historic or archaeology report.

The field assessment for historic resources will include the documentation of above-ground resources 50 years of age or older on lands owned by Asher Land and Mineral or that are publicly accessible within the APE. Resources will be mapped and photographed, with current condition and integrity noted. A KHC survey form will be completed for each property. The historic report and associated survey forms will comply with Kentucky SHPO's report and survey form standards and be completed by a Secretary of the Interior-qualified Historian or Architectural Historian.

The field assessment for archaeological resources will include an intensive survey of the lands owned by Asher Land and Mineral that have not been previously mined. The survey will follow standard archaeological methods and Kentucky SHPO specifications. Pedestrian survey will occur at 20-meter intervals in areas of level terrain with good surface visibility and areas characterized by steep slopes. Shovel testing will be conducted at 20-meter intervals in areas of flat terrain with poor surface visibility. Shovel test pits will be excavated to subsoil and measure 35 centimeters in diameter; soil material excavated will be screened through 0.25-inch mesh. Site survey forms will be prepared for each archaeological site recorded and will be submitted to the Kentucky OSA.

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[8] In its draft study plan comments, Kentucky SHPO requested the APE include all parcels with a viewshed of the proposed undertaking in the above-ground report, and the archaeological survey to include the entire study area, or proposed APE. As depicted in Figure 1-1, the key Project features, with the exception of the preliminary interconnection line, are located at a site owned largely by Asher Land and Mineral. LRPS will conduct additional surveys as needed when the interconnection line location is finalized.

2.4.4 Schedule

The cultural resources desktop evaluation will be conducted in Summer 2024. Study results will be compiled in a study report that will be filed with the Draft License Application.[9] The report will describe cultural resources located during the evaluation and recommendations for NRHP eligibility.

---

[9] Sensitive information will be filed with FERC as Privileged.

3.0 REFERENCES

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APPENDIX A

COMMENT LETTERS ON DRAFT STUDY PLAN

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SECRETARY

ANTHONY R. HATTON
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July 9, 2024

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Re: Lewis Ridge Pumped Storage Project (P-15249) Draft Study Plan – NEPA 2024-0050

Dear Sir or Madam,

The Energy and Environment Cabinet serves as the state clearinghouse for review of environmental documents generated pursuant to the National Environmental Policy Act (NEPA). Within the Cabinet, the Commissioner’s Office in the Department for Environmental Protection coordinates the review for Kentucky state agencies. We received your letter requesting an environmental review for this project. We have reviewed the document and provided comments below.

Division of Water:

The Director's Office has no comments.

The Water Quality Branch has no comments.

Field Operations Branch has no comments.

Portions of the project in the regulated floodplain will require permitting from the Division of Water, Water Resources Branch. This project will require coordination and permitting from the Division of Water Dam Safety Section prior to initiation of construction. See https://eec.ky.gov/Environmental-Protection/Water/FloodDrought/Pages/DamSafety.aspx for permitting information and contacts.

Floodplain Maps

You can check https://watermaps.ky.gov/RiskPortal/ to determine if your site is located in the 1% chance floodplain (shown in Blue or Blue /Red on the map). The 1% chance floodplain was formerly called the 100-year floodplain. You can use the search bar in the top right corner of the page to find your location using either a Latitude & Longitude, street address, or community name. A User’s Guide link is available in the upper left-hand side of the page. If you would like additional assistance determining if you are located in the floodplain, contact your community’s local floodplain coordinator. Community contact information is provided at

https://eec.ky.gov/Environmental-Protection/Water/FloodDrought/Documents/FloodplainCoordinatorsList.pdf.

If your site is in the 1% annual chance floodplain a stream construction permit from the Division of Water and Floodplain permit from your local community is required prior to construction.

Floodplain Permits

The Floodplain General Permit FPGP covers projects that have little potential to impact regulatory base flood elevation. The FPGP does have conditions, requirements, and exclusions listed so be sure your project can meet all these prior to the start of development. The most common activities covered by the GP include:

- Underground utilities only with no ground surface elevation changes, where stream crossings, if any, are completed by directional boring; or
- Installation of utility poles; or
- Installation of fences that do not obstruct water flow; or
- Stream obstruction removals of items such as woody debris from near bridges and culverts.

A second Floodplain General Permit (FPGP UNSUB) covers additions or repairs to an existing structure where the cost of repairs/upgrade is less than 50% of the structure value per the local county Property Valuation Administrator or Certified Residential or General Real Property Appraiser.

Both GPs available for covered projects do not require prior public notice or application to the Division prior to construction. Exclusions to the GPs include work in or along an outstanding state resource water (OSRW) or other special use water, if an Individual 401 WQC required for the development, and development of structures or dams. The Floodplain GPs can be downloaded at https://eec.ky.gov/Environmental-Protection/Water/FloodDrought/Pages/UnderstandYourFloodHazards.aspx.

If your site is in the floodplain and the GPs do not apply, an Individual Permit is required from the Division of Water for any proposed development. On the application, you must provide accurate latitude/longitude and an aerial map (maps from the Riskmap link above or Google maps are acceptable) in lieu of a topo map. The map must show where structures or crossing will be placed, and if fill or cut/fill is being done, draw the full extents of the fill on the aerial map. For the project description, describe what you plan to do to complete the project, how much (if any) fill will be brought into the floodplain, or how much material will be moved from or redistributed within the floodplain. For structures, describe the structure, provide the size and type of foundation (slab on grade, elevated, crawl space). For culverts, describe how much material will be brought in and what type, how high above current surface elevation will the material be placed, especially in low lying areas where the roadway would impede flow. Include the number of culverts pipes used and description (length, diameter and material). For a bridge, describe how the bridge abutments will be installed, the thickness of the bridge deck and the height of the lowest point of the bridge over the ordinary high water mark (plant line on the shoreline) and height of the bottom of the bridge deck above the bottom of the creek channel. If you are replacing a bridge or culvert, describe how the new installation will compare to the old- if the new installation will have a larger opening or pipes, will have more or less fill for the installation, indicate that on the application description.

Other Permits

Anytime you need a state floodplain permit, and you live in a community that participates in the NFIP, a local permit is also required. Find the contact information your local floodplain manager at

https://eec.ky.gov/Environmental-Protection/Water/FloodDrought/Documents/FloodplainCoordinatorsList.pdf.

Your local floodplain manager can help you with the state permit, as well as help you with the local permit and to understand the floodplain requirements.

If you are working below the top of the bank, within a stream channel, or within wetlands, a 404 permit from the US Army Corps of Engineers and 401 Water Quality Certification may also be required. Our Water Quality Certification section will review the application to determine if 401/404 permitting is needed. For information on permitting procedures or for other information, visit https://eec.ky.gov/Environmental-Protection/Water/PermitCert/WQ401Cert/Pages/Apply-for-Certification.aspx.

The Engineering Section of the Water Infrastructure Branch of the Division of Water has no comments on the proposed projects.

The Water Supply Section has the following comments: The proposed project is within the are located within the Knox County Utilities Commission (KY0610110) Source Water Protection Area Zone 3 (Zone of Potential Impact/2.5 to 12.5 hour Time of Travel). These zones are defined by time of travel for a contaminant to the water supplier intake and are as follows:

Zone 1 (Critical Zone/Less than 1 hour Time of Travel)
Zone 2 (Zone of Responsibility/1 hour to 5 hour Time of Travel)
Zone 3 (Zone of Potential Impact/2.5 to 12.5 hour Time of Travel)

Source Water Protection should include best management practices or BMP’s that prevent, reduce, or eliminate storm water runoff, soil erosion, and movement of nutrients, bacteria, and contaminants into unprotected waterways that may pose threats to public drinking water supplies. It should also include contingency planning strategies if protective measures fail or accidents and/or disasters occur and emergency response planning for water supply contamination or service interruption. Examples can be referenced here: https://www.epa.gov/sourcewaterprotection/source-water-protection-practices or https://eec.ky.gov/Environmental-Protection/Water/Protection/Pages/SWP.aspx

The proposed work is endorsed by the Groundwater Section of the Watershed Management Branch. However, it is our recommendation that site be made aware of the requirements of 401 KAR 5:037 and the need to develop a Groundwater Protection Plan (GPP) for the protection of groundwater resources within that area.

Division of Enforcement:

Lewis Ridge Pumped Storage, LLC. (LRPS) is providing the Draft Study Plan (attached) for the Lewis Ridge Pumped Storage Project (P-15249) for a 30-day review and comment period. LRPS filed a Pre-Application Document (PAD) and Notice of Intent (NOI) to seek an original license for the proposed project on October 21, 2022. LRPS has prepared this Draft Study Plan to document and share with FERC, resource agencies, Tribes, and stakeholders its plans for conducting resource studies to inform project development and the licensing process. LRPS requests comments on the Draft Study Plan by Monday July 15, 2024. Lewis Ridge Pumped Storage, LLC (LRPS) is filing with the Federal Energy Regulatory Commission (FERC or Commission) its draft study plan for the

Lewis Ridge Pumped Storage Project (FERC No. 15249) (Project). The Project received a preliminary permit from FERC on March 3, 2022. The Pre-Application Document (PAD) and Notice of Intent (NOI) to seek an original license for the Project were filed on October 21, 2022. LRPS hosted the Joint Meeting and site visit on January 25, 2023, under FERC's Traditional Licensing Process (TLP). The unconstructed Project is located in the Upper Cumberland River Basin in Bell County, Kentucky near the borders of Tennessee and Virginia. The Project would be a closed loop pumped storage hydroelectric generating facility located at a site historically used for mining.
The Kentucky Division of Enforcement endorses this project.

Division for Air Quality:

401 KAR 63:010, Fugitive Emissions, states that no person shall cause, suffer, or allow any material to be handled, processed, transported, or stored without taking reasonable precaution to prevent particulate matter from becoming airborne. Additional requirements include the covering of open bodied trucks, operating outside the work area transporting materials likely to become airborne, and that no one shall allow earth or other material being transported by truck or earth-moving equipment to be deposited onto a paved street or roadway. Please note the Fugitive Emissions Fact Sheet located at https://eec.ky.gov/Environmental-Protection/Air/Documents/Fugitive%20Dust%20Fact%20Sheet.pdf

401 KAR 63:005 states that open burning shall be prohibited except as specifically provided. Open Burning is defined as the burning of any matter in such a manner that the products of combustion resulting from the burning are emitted directly into the outdoor atmosphere without passing through a stack or chimney. However, open burning may be utilized for the expressed purposes listed on the Open Burning Brochure located at
https://eec.ky.gov/Environmental-Protection/Air/Pages/Open-Burning.aspx

The Division would like to offer the following suggestions on how this project can help us stay in compliance with the National Ambient Air Quality Standards (NAAQS). These air quality control strategies are beneficial to the health of citizens of Kentucky.

¿ Utilize alternatively fueled equipment.
¿ Utilize other emission controls that are applicable to your equipment.
¿ Reduce idling time on equipment.

The Division also suggests an investigation into compliance with applicable local government regulations.

Division of Waste Management:

Based on the information provided by the applicant for this project:

Underground Storage Tank (UST) records indicate the following underground storage tank site issues identified within the project impact area:
Closed Site:
Former Englands Grocery
MASTER AI ID: 57066
LONGITUDE: -83.571775
LATITUDE: 36.782651

If any UST's are encountered during the project construction they should be reported to KDWM. Any UST issues or questions should be directed to the UST Branch.

Superfund Branch records indicate the following superfund sites identified within the project impact area:
Nally & Hamilton Enterprises Inc 807-0333
MASTER AI ID: 84403
SUBJECT ITEM DESIGNATION: DSL spill
CLOSURE OPTION DESC: Option A No Action Necessary
CLOSURE DATE: 12/11/2007
LAT LONG SOURCE: SI
LONGITUDE: -83.5544
LATITUDE: 36.7615
Any superfund issues or questions should be directed to the Superfund Branch.

Solid Waste Branch records indicate no active or historic landfill sites within the project impact area. Any solid waste issues or questions should be directed to the Solid Waste Branch.

Hazardous Waste Branch records indicate no hazardous waste issues identified within the project impact area. Any hazardous waste issues or questions should be directed to the Hazardous Waste Branch.

Recycle and Local Assistance (RLA) Branch records indicate the following RLA tracked open dumps identified within the project impact area:
MASTER AI ID: 72117
MASTER AI NAME: KCCCP KY 2012 Dump
USER GROUP DESCRIPTION: RCLA Dump ID
ALTERNATE AI ID: 007-030
LONGITUDE: -83.57683333
LATITUDE: 36.77605556
Any issues or questions should be directed to the RLA Branch.

All solid waste generated by this project must be disposed of at a permitted facility.

If asbestos, lead paint and/or other contaminants are encountered during this project contact the Division of Waste Management for proper disposal and closure.

The information provided is based on those facilities or sites that KDWM currently has in its database. If you would like additional information on any of these facilities or sites, you may contact the file room custodian at (502) 782-6357. Please keep in mind additional locations of releases, potential contamination or waste facilities may be present but unknown to the agency. Therefore, it is recommended that appropriate precautions be taken during construction activities. Please report any evidence of illegal waste disposal facilities and releases of hazardous substances, pollutants, contaminants or petroleum to the 24-hour Environmental Response Team at 1-800-928-2380.

Kentucky Nature Preserves

Your project might have the potential of impacting federally or state listed species and natural communities. Go to the Kentucky Biological Assessment Tool (kynaturepreserves.org) to obtain a Standard Occurrence Report for information regarding listed species known within your project area. The report will also provide information on public and private conservation lands, areas of biodiversity significance, and other natural resources in your project area for which the Office of Kentucky Nature Preserves maintains data.

This review is based upon the information that was provided by the applicant. An endorsement of this project does not satisfy, or imply, the acceptance or issuance of any permits, certifications or approvals that may be required from this agency under Kentucky Revised Statutes or Kentucky Administrative Regulations. Such endorsement means this agency has found no major concerns from the review of the proposed project as presented other than those stated as conditions or comments. If you should have any questions, please contact me at (502) 782-0863 or e-mail Louanna.Aldridge@ky.gov.

Sincerely,

Louanna C. Aldridge

Louanna Aldridge
Environmental Scientist Consultant
Office of the Commissioner
Department for Environmental Protection
Energy and Environment Cabinet

ANDY BESHEAR
GOVERNOR

JACQUELINE COLEMAN
LT. GOVERNOR

TOURISM, ARTS AND HERITAGE CABINET
KENTUCKY HERITAGE COUNCIL
THE STATE HISTORIC PRESERVATION OFFICE
410 HIGH STREET
FRANKFORT, KENTUCKY 40601
(502) 564-7005
www.heritage.ky.gov

LINDY CASEBIER
SECRETARY

CRAIG A. POTTS
EXECUTIVE DIRECTOR &
STATE HISTORIC PRESERVATION OFFICER

July 8, 2024

Sandy Slayton
Vice President, Environmental
Rye Development
830 NE Holladay Street
Portland, Oregon 97232
Via email: sandy@ryedevelopment.com

RE: FERC, Lewis Ridge Pumped Storage Project, Bell County, Kentucky

Dear Ms. Slayton:

Thank you for your submission of documents related to the above-referenced project. We understand Lewis Ridge Pumped Storage, LLC (LRPS) proposes construction of a closed loop pumped storage hydroelectric generating facility in Bell County, near Blackmont, Tejay, Balkan, and Callaway and near River Mile 659 of the Cumberland River.

LRPS proposes to conduct file and archival research and a field assessment for historic and archaeological resources.

Regarding archaeological resources: In addition to a review of the archaeological site files at the Kentucky Office of State Archaeology, please consult historic maps, soil maps, and any other relevant sources for a more complete background study of the area. LRPS proposes that the field assessment for archaeological resources include survey of the lands owned by Asher Land and Mineral that have not been previously mined. Survey should include the entire Study Area, including lands not owned by Asher Land and Mineral.

Regarding the above-ground report, the area of potential effect (APE) should include all parcels with a viewshed of the proposed undertaking. Survey of the APE should include all properties with structures 50 years of age or older, regardless of ownership. If access beyond the right of way is not available, that can be noted in the report along with a discussion on potential effects. The report and associated survey forms should meet our office's report and survey form standards and be completed by a Secretary of the Interior-qualified Historian or Architectural Historian.

LRPS proposes to compile a study report to be filed with the Draft License Application. Please note the archaeology report and cultural historic must be separate documents. These two reports, as well as any survey forms, should be submitted as separate PDFs to our office at khc.section106@ky.gov.

Since they have expressed an interest in consulting on projects involving cemeteries, we recommend you reach out to the Office of Army Cemeteries at michael.k.trimble.civ@army.mil.

We look forward to continued consultation regarding this proposed undertaking. Please feel free to contact Gabrielle Fernandez or Patti Hutchins of my staff with any questions or concerns at gabrielle.fernandez@ky.gov or patricia.hutchins@ky.gov.

Sincerely,

Craig A. Potts,
Executive Director and
State Historic Preservation Officer

CP: gf, peh,
KHC 241246; prev. 66139, 220208, 220598

APPENDIX B

JURISDICTIONAL STREAMS AND WETLANDS DETERMINATIONS

RYE DEVELOPMENT
Lewis Ridge Pumped Storage
Bell County, Kentucky

Jurisdictional Streams and Wetlands Determinations

September 2024

EcoSource, Inc. 120 Marketplace Circle, Ste C-163, Georgetown, Kentucky 40324 Telephone (502) 868-5200

RYE DEVELOPMENT
Lewis Ridge Pumped Storage
Bell County, Kentucky

Jurisdictional Streams and Wetlands Determinations

September 2024

Prepared for

Rye Development
100 S. Olive Street
West Palm Beach, FL 33401

I. PURPOSE

EcoSource, Inc. performed a review of jurisdictional waters for the proposed Rye Development Project in Bell County, Kentucky. A level of review was provided that would determine if jurisdictional waters were present within the proposed project area. The ground reconnaissance for the proposed project was performed on the following dates:

- October 12, 2022
- November 14, 2022
- August 22, 2024
- September 3, 2024
- September 12, 2024

All information concerning the delineation of streams and wetlands that is presented in this report is subject to verification and approval by the US Army Corps of Engineers prior to any site disturbance.

II. PROJECT AREA DESCRIPTION

The proposed project is located on the Balkan, Kentucky 7.5’ USGS topographic quadrangle at the following coordinates: 36.760895°, -83.551033°. From the intersection of US 25E and US 119 south of Pineville, Kentucky, travel north on US 119 for a distance of 11.4 miles. Turn right or south onto Balkan Road, travel for a distance of 1.4 miles. Turn right or east onto KY 2012, travel for a distance of 0.5 mile to the project area.

III. BACKGROUND INFORMATION

Several data sources were used to provide background information for this review including the Bell County Soil Survey as represented by the US Department of Agriculture (USDA) Web Soil Survey[1], the National Wetlands Inventory (NWI) Map[2], Balkan, Kentucky 7.5’ US Geological Survey (USGS) topographic quadrangle, and Google Earth. These information sources were used only for preliminary review and were followed by field investigations. Reference the Jurisdictional Determination (JD) map provided with this report.

The following information was gleaned from these sources:

- USDA web soil survey – the follow soil series were mapped within the proposed project area.
    - Alticrest-Totz-Helechawa complex, rocky, 20-55%
    - Craigsville-Philo Complex, occasionally flooded (possible hydric components)
    - Fairpoint and Bethesda Soils, 2-70%, stony
    - Gilpin-Shelocta silt loams, 12-20%
    - Gilpin-Rayne-Sequoia Complex, 25-55%, very stony
    - Helechawa-Varilla-Jefferson Complex, 35-75%, very rocky

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[1] Mapping can be found at http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx
[2] Mapping can be found at http://wetlandsfws.er.usgs.gov/NWI/

    - Highsplint-Cloverlick-Guyandotte Complex, very rocky 35-75%
    - Kimper-Renox-Sharondale Complex, very rocky 35-75%
    - Pope fine sandy loam, occasionally flooded (possible hydric components)
    - Shelbiana loam, occasionally flooded (possible hydric components)
    - Shelocta-Highsplint-Gilpin Complex, 20-70%, very stony
    - Shelocta-Kimper-Cloverlick Complex, 20-80%, very stony
    - Udorthents-Urban Land Complex, 15-35%
    - Varilla very stony loam, 5-20%, extremely bouldery
    - Water

- NWI mapping – streams and a three wetland features (ponds) were mapped within the project area.
    - R2UBH – riverine, lower perennial, unconsolidated bottom, permanently flooded
    - R4SBC – riverine, intermittent, streambed, seasonally flooded
    - R5UBH – riverine, unknown perennial, unconsolidated bottom, permanently flooded
    - PUBHh – palustrine, unconsolidated bottom, permanently flooded, diked/impounded
    - PUBHx – palustrine, unconsolidated bottom, permanently flooded, excavated

- USGS Topographic mapping – was used to reference any mapped locations of waterways and ponds within the proposed project area.
- Google Earth – was used to locate open water features.

After the field investigations, additional private data sources related to active and inactive mining permits were referenced. These permits provided past and approved jurisdictional mapping and approved mitigation for these permitting actions. The Kentucky mining permit Numbers 807-0372 and 807-0353 were reviewed for pertinent information. This permit information was provided by RESPEC.

IV. FIELD RECONNAISSANCE

A. Wetlands/Open Water

After reviewing the public data sources, reconnaissance of the proposed project area was conducted. This reconnaissance included ground truthing of the NWI mapping and looking closely at any non-mapped wetland sites based upon the potential for hydric soils or hydric inclusions. Wetland reviews were performed based on the criteria set forth in the 1987 manual[3], with priority set to the 2012 manual addendum for the region[4]. Table 1 provides a summary of the wetlands located within the assessment area. Included in the appendix are photos and delineation forms for these wetlands. Reference the JD map for locations. All open water features that are currently present are associated with active sediment ponds. These ponds are not included as jurisdictional features.

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[3] Army Corps of Engineers Wetlands Delineation Manual, Technical Report Y-87-1. 1987. Environmental Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.
[4] Army Corps of Engineers. April 2012. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region (ver. 2.0)..

Table 1. Section 404 Regulated Wetlands and Open Water

Wetland	Area (ac)	NWI Classification*	1979 Cowardin Classification*
1	0.02	Not classified	Palustrine emergent (PEM)
2	0.13	Not classified	PEM
3	0.07	Not classified	PEM
4	0.52	Not classified	Palustrine forested (PFO)
5	0.63	Not classified	PEM
6	0.10	Not classified	PEM
Total	1.47	▨	▨

* "Classification of Wetlands and Deepwater Habitats of the United States," US Fish and Wildlife Service, FWS/OBS-79/31, December 1979.

B. Streams

Stream reconnaissance was performed in order to determine the presence of jurisdictional streams within the proposed project area. The methodology used was the presence of discernible bed and bank features. Streams with these features within the proposed project area were documented for habitat value, specific conductivity, and beginning and ending jurisdictional limits. These results are provided in Table 2. Reaches 11, 12, and 13 were not included in the reconnaissance, but projected values for these stream reaches are included.

A map and photos illustrating the streams within the assessment area are included in the appendix. Rapid Bioassessment Protocol (RBP) habitat sheets and Ecological Integrity Index (EII) calculation sheets for the streams to be directly impacted are also included in the appendix. Table 2 provides a summary of the streams located, delineated, and mapped that have the possibility of being directly impacted. These streams are regulated under Section 404 of the Clean Water Act. As required, the streams have been assigned a designation of Relatively Permanent Water (RPW) or NonRPW. This assignment was based upon the dominant flow regime within the overall reach length.

The Cumberland River can be impacted in two different manners. First, on the northern end of the project area, a utility corridor would span the river. No direct impact to the river would occur at this location. Second, on the southern end of the project area, a water withdrawal corridor would directly access the river.

Table 2. Section 404 Regulated Streams

Stream Reach	Stream Order**	Flow Regime	Reach Length (lft)	Reach Designation	RBP Score	Ecological Integrity Index (EII)
1 Upper	3rd	Perennial	1,106	RPW	99	0.10
1 Lower	3rd	Perennial	3,573	RPW	128	0.24
3	2nd	Ephemeral	480	NonRPW	128	0.24
3A	1st	Ephemeral	673	NonRPW	128	0.24
3B	1st	Ephemeral	763	NonRPW	128	0.24
4 Upper	1st	Perennial	955	RPW	111	0.16
4 Lower	2nd	Perennial	1,059	RPW	117	0.19
4A	1st	Perennial	163	RPW	92	0.10
5	1st	Intermittent	1,546	RPW	111	0.27
5A	2nd	Intermittent	811	RPW	111	0.30
5A-1	1st	Ephemeral	573	NonRPW	113	0.31
5A-2	1st	Ephemeral	852	NonRPW	113	0.31
6	1st	Ephemeral	1,290	RPW	113	0.17
6	1st	Intermittent	487	RPW	113	0.17
6	1st	Perennial	350	RPW	123	0.22
7	2nd	Intermittent	447	RPW	102	0.31
7A	1st	Intermittent	443	RPW	102	0.31
7B	1st	Intermittent	532	RPW	102	0.31
7A-1	1st	Ephemeral	935	NonRPW	93	0.30
7B-1	1st	Ephemeral	693	NonRPW	93	0.30
8	2nd	Perennial	105	RPW	148	0.37
9	1st	Intermittent	207	RPW	96	0.10
10	1st	Ephemeral	20	NonRPW	91	0.10
11	1st	Ephemeral	325	NonRPW	No site visit ***	
12	1st	Intermittent	202	RPW	No site visit ***	
13	1st	Intermittent	1,102	RPW	No site visit ***	
Cumberland River	---	Perennial	155	Traditionally Navigable Water (TNW)	Impacts will be limited to a utility span and/or water withdrawal	
		Total	19,847			
		Perennial	7,466			
		Intermittent	5,777			
		Ephemeral	6,604			
		RPW Total	14,378			
		NonRPW Total	5,314			
		TNW Total	155			

* As defined by Dave Rosgen (Applied River Morphology. Wildland Hydrology, 1996) using a Level 1 characterization.
** Generated from the actual aerial mapping and site reconnaissance, and not from the 1:24,000 scale USGS mapping.
*** All table values are projected since a site visit has not been performed.

In addition to the streams listed in Table 2, several jurisdictional stream reaches had been previously permitted within the limits of active mining permits. These streams are listed in Table 3. As represented in the approved US Army Corps of Engineers (ACE) permit, the mitigation for these permitted streams is for on-site restoration. The overlay of the proposed project area onto these stream reaches will require the replacement of that projected mitigation value. These overlain streams are labeled on the JD map as Old Reaches.

Table 3. Proposed Impacts on Active Mine Permit 807-0353 (LRN-2007-01642)

Original Mine Permit On-Site Mitigation Information					Proposed Project Replacement Mitigation	
Old Stream Reach	**Stream Length (LF)**	**Baseline EII**	**Mature EII**	**Total Restored Ecological Integrity Unit (EIU)**	**Stream Impact Length (LF)**	**Required Replaced EIU's***
Reach 1 Mine Area	1,100	0.1	0.42	462.00	205	86.1
Reach 1 Pond 1	300	0.1	0.42	126.00	0	0.0
Reach 2 Mine Area	1,030	0.1	0.42	432.60	207	86.94
Reach 2 Pond 2	300	0.1	0.42	126.00	0	0.0
Reach 3 Mine Area	1,630	0.1	0.42	684.60	1,630	684.6
Reach 3 Pond 6	160	0.1	0.42	67.20	160	67.2
Reach 4 Mine Area	2,400	0.24	0.42	1,008.00	1,506	632.52
Reach 4A Mine Area	222	0.24	0.42	93.24	222	93.24
Reach 4 Pond 4	300	0.24	0.42	126.00	300	126.0
Reach 5 Mine Area	2,550	0.1	0.42	1,071.00	1,180	495.6
Reach 5 Pond 5	350	0.1	0.42	147.00	350	147.0
Reach 6 Mine Area	600	0.1	0.42	252.00	0	0.0
Totals	10,942			4,595.64	5,760	2,419.2

******Required Replaced EIU's = Stream Impact Length * Mature EII*

Wetland	Delineated Area (AC)	Proposed Replacement Area (AC)
Reach 5 Wetland	0.05	0.15

Based on the 2023 annual monitoring report for the approved ACE permit, the status of the reconstructed reaches follows:

- Old Reach 1 and 2, upper portions reconstructed with the lower portions not yet reconstructed
- Old Reach 3, disturbed, not yet reconstructed
- Old Reach 3 Pond 6, disturbed, not yet reconstructed
- Old Reach 4, never disturbed
- Old Reach 5, upper and lower portions are reconstructed, the balance was never disturbed
- Old Reach 5 Pond 5, disturbed, not yet reconstructed
- Old Reach 5 Wetland, disturbed, not yet reconstructed
- Old Reach 6, never disturbed

V. SUMMARY

The following Section 404 regulated features were documented or located within the proposed project area:

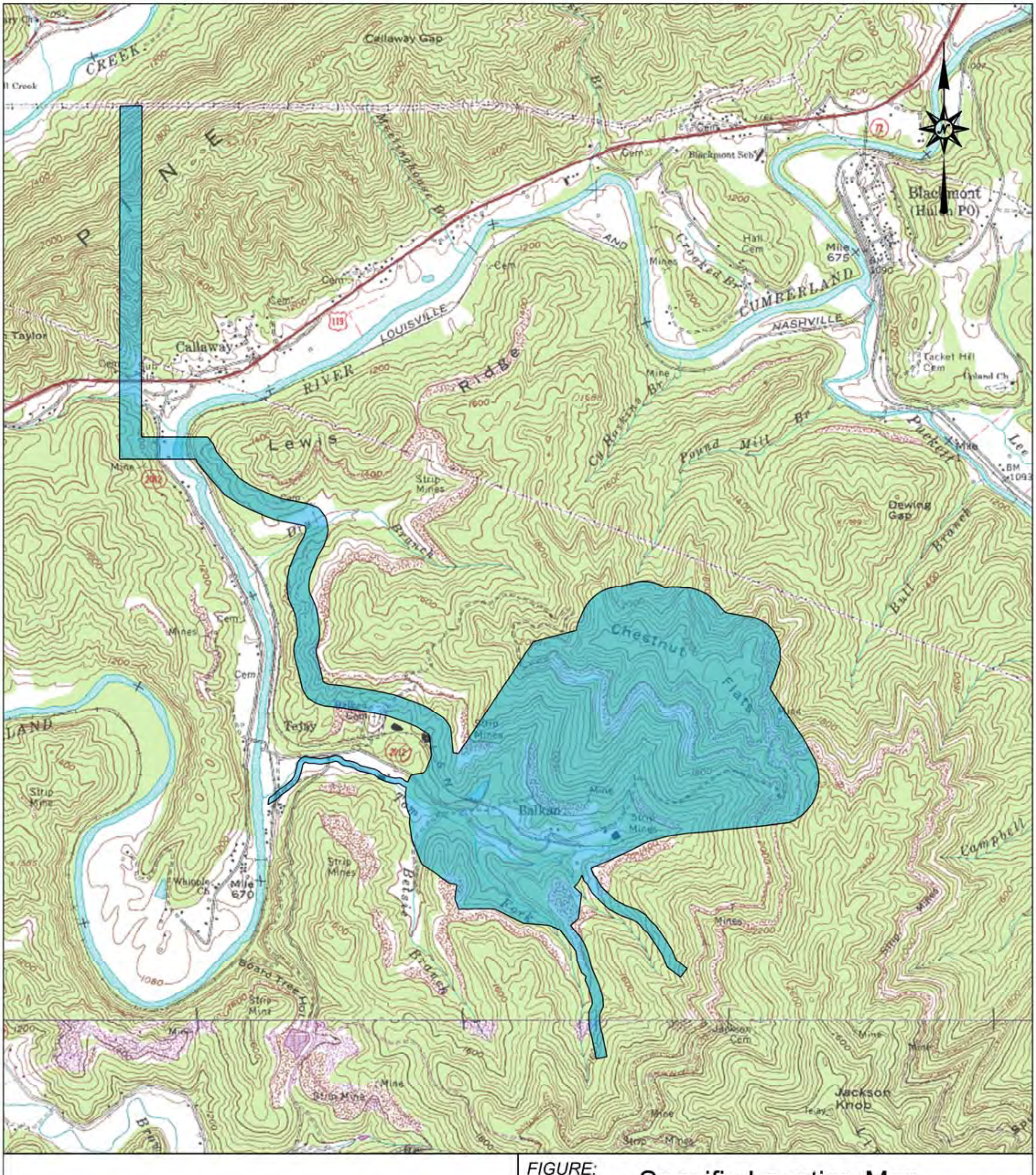
- Wetlands
    - 1.47 acres
- Streams
    - Ephemeral – 6,604 linear feet
    - Intermittent – 5,777 linear feet
    - Perennial – 7,455 linear feet
    - RPW – 14,378 linear feet
    - NonRPW – 5,314 linear feet
    - TNW – 155 linear feet

VI. REFERENCES

Current Soil Survey: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx
NWI Mapping: https://www.fws.gov/wetlands/data/Mapper.html
USGS Topographic Mapping: https://ngmdb.usgs.gov/topoview/
Aerial Imagery:
- Google Earth Pro
- Bing
https://www.arcgis.com/home/webmap/viewer.html?webmap=8651e4d585654f6b955564efe44d04e5#!
Plant Lists: USDA Plant Database (https://plantsorig.sc.egov.usda.gov/posters.html)
Wetland Manuals:
- Army Corps of Engineers Wetlands Delineation Manual, Technical Report Y-87-1. 1987. Environmental Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.
- Army Corps of Engineers. April 2012. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region (ver. 2.0).
Jurisdiction: https://www.federalregister.gov/documents/2021/12/07/2021-25601/revised-definition-ofwaters-of-the-united-states

ATTACHMENT A – MAPS

- **Specific Location Map**
- **Jurisdictional Determination Map**
- **NWI and Soils Map**



EcoSource, Inc.

426 North Broadway, Georgetown, Kentucky 40324
(502) 868-5200

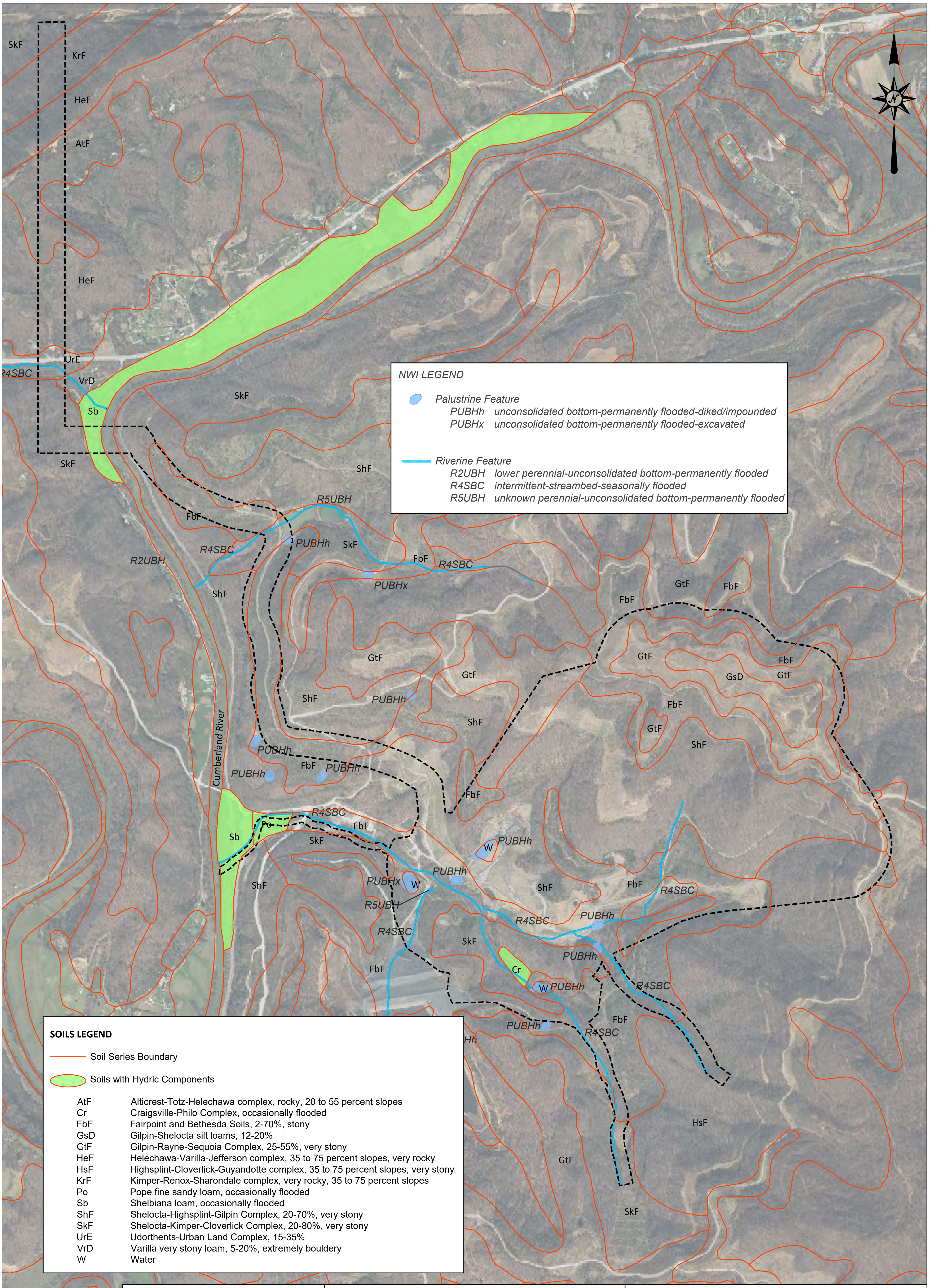
FIGURE:

Specific Location Map

(Excerpted from the Balkan, KY 7.5' USGS Topo. Quad.)

PROJECT NAME: Lewis Ridge Pumped Storage	APPLICANT: Rye Development

ACE ID NO:	DNR WQC No:	SCALE: 1" = 2500'



NWI LEGEND

●	Palustrine Feature	
	PUBHh	unconsolidated bottom-permanently flooded-diked/impounded
	PUBHx	unconsolidated bottom-permanently flooded-excavated
—	Riverine Feature	
	R2UBH	lower perennial-unconsolidated bottom-permanently flooded
	R4SBC	intermittent-streambed-seasonally flooded
	R5UBH	unknown perennial-unconsolidated bottom-permanently flooded

SOILS LEGEND

— Soil Series Boundary

🟩 Soils with Hydric Components

AtF	Alticrest-Totz-Helechawa complex, rocky, 20 to 55 percent slopes
Cr	Craigsville-Philo Complex, occasionally flooded
FbF	Fairpoint and Bethesda Soils, 2-70%, stony
GsD	Gilpin-Shelocta silt loams, 12-20%
GtF	Gilpin-Rayne-Sequoia Complex, 25-55%, very stony
HeF	Helechawa-Varilla-Jefferson complex, 35 to 75 percent slopes, very rocky
HsF	Highsplint-Cloverlick-Guyandotte complex, 35 to 75 percent slopes, very stony
KrF	Kimper-Renox-Sharondale complex, very rocky, 35 to 75 percent slopes
Po	Pope fine sandy loam, occasionally flooded
Sb	Shelbiana loam, occasionally flooded
ShF	Shelocta-Highsplint-Gilpin Complex, 20-70%, very stony
SkF	Shelocta-Kimper-Cloverlick Complex, 20-80%, very stony
UrE	Udorthents-Urban Land Complex, 15-35%
VrD	Varilla very stony loam, 5-20%, extremely bouldery
W	Water

▭ PROJECT AREA

EcoSource, Inc.

120 Marketplace Circle, Ste C-163
Georgetown, Kentucky 40324
(502) 868-5200

FIGURE:
Soils and NWI Map

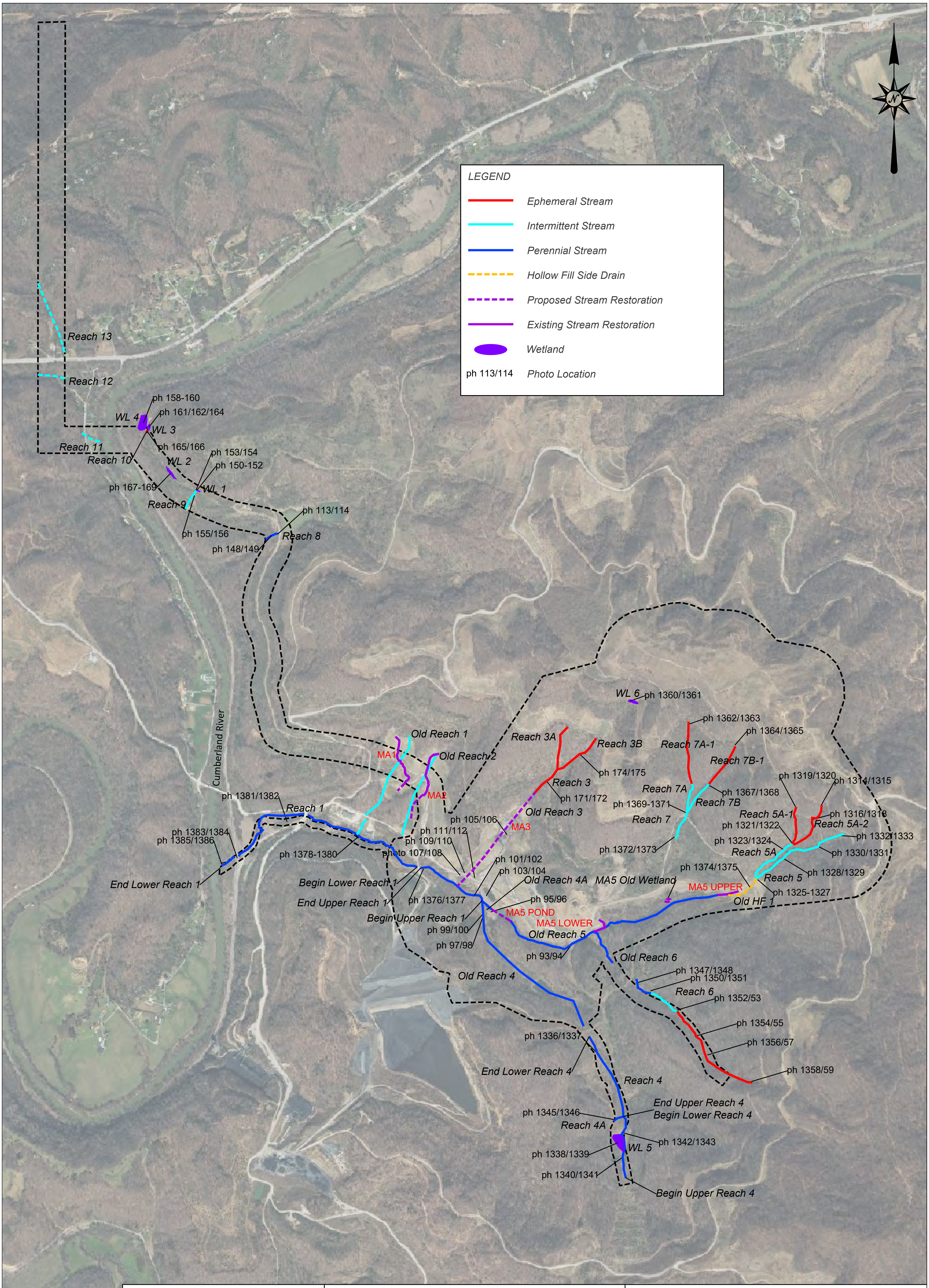
PROJECT NAME:
Lewis Ridge
Pumped Storage

APPLICANT:
Rye Development

ACE ID NO.:

DNR WQC NO.:

SCALE:
1"=1200'



⬚ PROJECT AREA

EcoSource, Inc.

120 Marketplace Circle, Ste C-163
Georgetown, Kentucky 40324
(502) 868-5200

FIGURE:
Jurisdictional Determination Map

PROJECT NAME: Lewis Ridge Pumped Storage		APPLICANT: Rye Development
ACE ID NO.:	DNR WQC NO.:	SCALE: 1"=1200'

ATTACHMENT B – FIELD DATA

- **Wetland Delineation Form**
- **Stream RBP Sheets**
- **EII Calculation Sheets**
- **Photos**

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Bell County Water Battery City/County: Bell Sampling Date: November 14, 2022

Applicant/Owner: Rye Development State: KY Sampling Point: 1 (in)

Investigator(s): D. Collinsworth Section, Township, Range: N/A

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

Subregion (LRR or MLRA): LRR N Lat: 36.7766 Long: -83.5633 Datum: NAD 83

Soil Map Unit Name: Fairpoint and Bethesda Soils, 2-70%, stony NWI classification: not classified

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

Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No ☐

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

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

Hydrophytic Vegetation Present? Yes ☒ No ☐
Hydric Soil Present? Yes ☒ No ☐
Wetland Hydrology Present? Yes ☒ No ☐

Is the Sampled Area within a Wetland? **Yes** ☒ **No** ☐

Remarks: Community type:

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

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

Field Observations:

Surface Water Present? Yes ☒ No ☐ Depth (inches): 3
Water Table Present? Yes ☐ No ☒ Depth (inches):
Saturation Present? (includes capillary fringe) Yes ☒ No ☐ Depth (inches): 3

Wetland Hydrology Present? **Yes** ☒ **No** ☐

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

Remarks:

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

Sampling Point: 1 (in)

Tree Stratum (Plot size: 30 ft radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Betula nigra*	20	YES	FACW
2. *Platanus occidentalis*	30	YES	FACW
3.			
4.			
5.			
6.			
7.			
8. *50%=25 20%=10*			
	50	= Total Cover	

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

Herb Stratum (Plot size: 5 ft radius)			
1. *Microstegium vimineum*	10	YES	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12. *50%=49.5 & 20%=19.8*			
	99	= Total Cover	

Woody Vine Stratum (Plot size: 15' R)			
1.			
2.			
3.			
4.			
5.			
6.			
		= Total Cover	

Dominance Test worksheet:

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

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

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

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

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

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

Definitions of Four Vegetation Strata:

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

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

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

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

Hydrophytic Vegetation Present? **Yes** ☒ **No** ☐

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

SOIL

Sampling Point: 1 (in)

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	Gley1 2.5N	90	10YR8/1	5	D	M		

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

Hydric Soil Indicators:

☐ Histosol (A1)
☐ Histic Epipedon (A2)
☐ Black Histic (A3)
☐ Hydrogen Sulfide (A4)
☐ Stratified Layers (A5)
☐ 2 cm Muck (A10) **(LRR N)**
☐ Depleted Below Dark Surface (A11)
☐ Thick Dark Surface (A12)
☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
☐ Sandy Gleyed Matrix (S4)
☐ Sandy Redox (S5)
☐ Stripped Matrix (S6)

☐ Dark Surface (S7)
☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
☐ Loamy Gleyed Matrix (F2)
☒ Depleted Matrix (F3)
☐ Redox Dark Surface (F6)
☐ Depleted Dark Surface (F7)
☐ Redox Depressions (F8)
☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
☐ Umbric Surface (F13) **(MLRA 136, 122)**
☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

☐ 2 cm Muck (A10) **(MLRA 147)**
☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
☐ Red Parent Material (TF2)
☐ Very Shallow Dark Surface (TF12)
☐ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: ____

Depth (inches): ____

Hydric Soil Present? **Yes** ☒ **No** ☐

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Bell County Water Battery City/County: Bell Sampling Date: November 14, 2022

Applicant/Owner: Rye Development State: KY Sampling Point: 1 (out)

Investigator(s): D. Collinsworth Section, Township, Range: N/A

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

Subregion (LRR or MLRA): LRR N Lat: 36.7766 Long: -83.5633 Datum: NAD 83

Soil Map Unit Name: Fairpoint and Bethesda Soils, 2-70%, stony NWI classification: not classified

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

Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No ☐

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

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

Hydrophytic Vegetation Present? Yes ☐ No ☒

Hydric Soil Present? Yes ☐ No ☒

Wetland Hydrology Present? Yes ☐ No ☒

Is the Sampled Area within a Wetland? **Yes** ☐ **No** ☒

Remarks: Community type:

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

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

Field Observations:

Surface Water Present? Yes ☐ No ☒ Depth (inches): ____

Water Table Present? Yes ☐ No ☒ Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ☐ No ☒ Depth (inches): ____

Wetland Hydrology Present? **Yes** ☐ **No** ☒

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

Remarks:

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

Sampling Point: 1 (out)

Tree Stratum (Plot size: 30 ft radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Betula nigra*	15	YES	FACW
2. *Fagus grandifolia*	40	YES	FACU
3.			
4.			
5.			
6.			
7.			
8. *50%=257.5 20%=11*			
	55	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15 ft radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Carpinus caroliniana*	20	YES	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	20	= Total Cover	

Herb Stratum (Plot size: 5 ft radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Polystichum acrostichoides*	10	YES	FACU
2. *Lonicera japonica*	10	YES	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12. *50%=10 & 20%=4*			
	20	= Total Cover	

Woody Vine Stratum (Plot size: 15' R)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
		= Total Cover	

Dominance Test worksheet:

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

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 40 (A/B)

Prevalence Index worksheet:

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

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

☐ 1 - Rapid Test for Hydrophytic Vegetation

☐ 2 - Dominance Test is >50%

☐ 3 - Prevalence Index is ≤3.0[1]

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

☐ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Four Vegetation Strata:

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

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

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

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

Hydrophytic Vegetation Present? **Yes** ☐ **No** ☒

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

SOIL

Sampling Point: 1 (out)

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

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
0-12	10YR4/3	80	10YR4/2	10	D	M		

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

Hydric Soil Indicators:

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

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ☐ **No** ☒

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Bell County Water Battery City/County: Bell Sampling Date: November 14, 2022
Applicant/Owner: Rye Development State: KY Sampling Point: 2 (in)
Investigator(s): D. Collinsworth Section, Township, Range: N/A
Landform (hillslope, terrace, etc.): old road Local relief (concave, convex, none): concave Slope (%): <1
Subregion (LRR or MLRA): LRR N Lat: 36.7773 Long: -83.5647 Datum: NAD 83
Soil Map Unit Name: Fairpoint and Bethesda Soils, 2-70%, stony NWI classification: not classified
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No ☐
Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

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

Hydrophytic Vegetation Present? Yes ☒ No ☐
Hydric Soil Present? Yes ☒ No ☐
Wetland Hydrology Present? Yes ☒ No ☐

Is the Sampled Area within a Wetland? **Yes** ☒ **No** ☐

Remarks: Community type:

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

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

Field Observations:

Surface Water Present? Yes ☐ No ☒ Depth (inches):
Water Table Present? Yes ☐ No ☒ Depth (inches):
Saturation Present? (includes capillary fringe) Yes ☒ No ☐ Depth (inches): 3

Wetland Hydrology Present? **Yes** ☒ **No** ☐

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

Remarks:

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

Sampling Point: 2 (in)

Tree Stratum (Plot size: 30 ft radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. Salix nigra	20	YES	OBL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	20 = Total Cover		

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

Herb Stratum (Plot size: 5 ft radius)			
1. Microstegium vimineum	30	YES	FAC
2. Lonicera japonica	5	NO	FACU
3. Scirpus cyperinus	10	YES	FACW
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12. 50%=22.5 & 20%=9			
	45 = Total Cover		

Woody Vine Stratum (Plot size: 15' R)			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

Dominance Test worksheet:

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

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

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

Prevalence Index worksheet:

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

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

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

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

Definitions of Four Vegetation Strata:

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

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

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

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

Hydrophytic Vegetation Present? Yes ☒ No ☐

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

SOIL

Sampling Point: 2 (in)

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

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
0-12	10YR4/1	80	10YR3/2	5	D	M		
			10YR5/6	10	C	M		

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

Hydric Soil Indicators:

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

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ☒ **No** ☐

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Bell County Water Battery City/County: Bell Sampling Date: November 14, 2022

Applicant/Owner: Rye Development State: KY Sampling Point: 3 (in)

Investigator(s): D. Collinsworth Section, Township, Range: N/A

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

Subregion (LRR or MLRA): LRR N Lat: 36.779528 Long: -83.565988 Datum: NAD 83

Soil Map Unit Name: Shelocta-Highsplint-Gilpin Complex, 20-70%, very stony NWI classification: not classified

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

Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No ☐

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

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

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

Remarks: Community type:

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

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

Field Observations:

Surface Water Present?	Yes ☐	No ☒	Depth (inches):
Water Table Present?	Yes ☐	No ☒	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ☒	No ☐	Depth (inches): 3

Wetland Hydrology Present? Yes ☒ **No** ☐

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

Remarks:

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

Sampling Point: 3 (in)

Tree Stratum (Plot size: 30 ft radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. Betula nigra	10	YES	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8. 50%=25 20%=10			
	10 = Total Cover		

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

Herb Stratum (Plot size: 5 ft radius)			
1. Typha angustifolia	70	YES	OBL
2. Microstegium vimineum	20	NO	FAC
3. Lonicera sp.	5	NO	
4. Schoenoplectus tabernaemontani	5	NO	OBL
5. Scirpus cyperinus	10	NO	FACW
6.			
7.			
8.			
9.			
10.			
11.			
12. 50%=55 & 20%=22			
	110 = Total Cover		

Woody Vine Stratum (Plot size: 15' R)			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

Dominance Test worksheet:

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

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

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

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

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

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

Definitions of Four Vegetation Strata:

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

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

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

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

Hydrophytic Vegetation Present? Yes ☒ No ☐

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

SOIL

Sampling Point: 3 (in)

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

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12	2.5Y 3/1	80	10YR 4/2	5	D	M		
			10YR 5/4	5	D	M		

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.

[2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

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

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ☒ **No** ☐

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Bell County Water Battery City/County: Bell Sampling Date: November 14, 2022

Applicant/Owner: Rye Development State: KY Sampling Point: 4 (in)

Investigator(s): D. Collinsworth Section, Township, Range: N/A

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

Subregion (LRR or MLRA): LRR N Lat: 36.77914 Long: -83.56629 Datum: NAD 83

Soil Map Unit Name: Shelocta-Highsplint-Gilpin Complex, 20-70%, very stony NWI classification: not classified

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

Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No ☐

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

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

Hydrophytic Vegetation Present? Yes ☒ No ☐

Hydric Soil Present? Yes ☒ No ☐

Wetland Hydrology Present? Yes ☒ No ☐

Is the Sampled Area within a Wetland? **Yes** ☒ **No** ☐

Remarks: Community type:

old pond

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

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

Field Observations:

Surface Water Present? Yes ☐ No ☒ Depth (inches): ____

Water Table Present? Yes ☐ No ☒ Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ☒ No ☐ Depth (inches): 4

Wetland Hydrology Present? **Yes** ☒ **No** ☐

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

Remarks:

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

Sampling Point: 4 (in)

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30 ft radius)			
1. Betula nigra	90	YES	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8. 50%=25 20%=10			
	10 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15 ft radius)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		
Herb Stratum (Plot size: 5 ft radius)			
1. Euonymus fortunei	5	YES	NI
2. Microstegium vimineum	10	YES	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12. 50%=7.5 & 20%=3			
	15 = Total Cover		
Woody Vine Stratum (Plot size: 15' R)			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

Dominance Test worksheet:

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

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 67 (A/B)

Prevalence Index worksheet:

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

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

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

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

Definitions of Four Vegetation Strata:

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

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

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

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

Hydrophytic Vegetation Present? **Yes** ☒ **No** ☐

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

SOIL

Sampling Point: 4 (in)

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

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
0-16	10YR 5/1	70	10YR 6/8	5	C	M		
			10YR 5/2	10	D	M		
			10YR 7/6	5	C	M		

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

Hydric Soil Indicators:

☐ Histosol (A1)
☐ Histic Epipedon (A2)
☐ Black Histic (A3)
☐ Hydrogen Sulfide (A4)
☐ Stratified Layers (A5)
☐ 2 cm Muck (A10) **(LRR N)**
☐ Depleted Below Dark Surface (A11)
☐ Thick Dark Surface (A12)
☐ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
☐ Sandy Gleyed Matrix (S4)
☐ Sandy Redox (S5)
☐ Stripped Matrix (S6)

☐ Dark Surface (S7)
☐ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
☐ Thin Dark Surface (S9) **(MLRA 147, 148)**
☐ Loamy Gleyed Matrix (F2)
☒ Depleted Matrix (F3)
☐ Redox Dark Surface (F6)
☐ Depleted Dark Surface (F7)
☐ Redox Depressions (F8)
☐ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
☐ Umbric Surface (F13) **(MLRA 136, 122)**
☐ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

☐ 2 cm Muck (A10) **(MLRA 147)**
☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
☐ Red Parent Material (TF2)
☐ Very Shallow Dark Surface (TF12)
☐ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ☒ **No** ☐

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Bell County Water Battery City/County: Bell Sampling Date: September 3, 2024
Applicant/Owner: Rye Development State: KY Sampling Point: 5 (in)
Investigator(s): D. Collinsworth Section, Township, Range: N/A
Landform (hillslope, terrace, etc.): old pond Local relief (concave, convex, none): concave Slope (%): <1
Subregion (LRR or MLRA): LRR N Lat: 36.74945 Long: -83.54276 Datum: NAD 83
Soil Map Unit Name: Shelocta-Kimper-Cloverlick Complex, 20-80%, very stony NWI classification: not classified
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No ☐
Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

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

Hydrophytic Vegetation Present? Yes ☒ No ☐
Hydric Soil Present? Yes ☒ No ☐
Wetland Hydrology Present? Yes ☒ No ☐

Is the Sampled Area within a Wetland? **Yes** ☒ **No** ☐

Remarks: Community type:

old pond

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

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

Field Observations:

Surface Water Present? Yes ☒ No ☐ Depth (inches): 1
Water Table Present? Yes ☐ No ☒ Depth (inches):
Saturation Present? (includes capillary fringe) Yes ☒ No ☐ Depth (inches): 2

Wetland Hydrology Present? **Yes** ☒ **No** ☐

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

Remarks:

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

Sampling Point: 5 (in)

Tree Stratum (Plot size: 30 ft radius)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8. 50%=25 20%=10			
	10	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15 ft radius)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
		= Total Cover	

Herb Stratum (Plot size: 5 ft radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Typha angustifolia*	10	NO	OBL
2. *Scirpus cyperinus*	50	NO	FACW
3. *Eutrochium fistulosum*	10	NO	FACW
4. *Liquidambar styraciflua*	10	NO	FAC
5. *Scirpus atrovirens*	5	NO	OBL
6. *Lespedeza cuneata*	5	NO	FACU
7.			
8.			
9.			
10.			
11.			
12. 50%=42.5 & 20%=17			
	85	= Total Cover	

Woody Vine Stratum (Plot size: 15' R)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
		= Total Cover	

Dominance Test worksheet:

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

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	2	x 1 = 2
FACW species	2	x 2 = 4
FAC species	1	x 3 = 3
FACU species	1	x 4 = 4
UPL species		x 5 =
Column Totals:	6 (A)	11 (B)

Prevalence Index = B/A = 1.83

Hydrophytic Vegetation Indicators:

☐ 1 - Rapid Test for Hydrophytic Vegetation

☐ 2 - Dominance Test is >50%

☒ 3 - Prevalence Index is ≤3.0[1]

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

☐ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Four Vegetation Strata:

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

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

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

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

Hydrophytic Vegetation Present? **Yes** ☒ **No** ☐

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

SOIL

Sampling Point: 5 (in)

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

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 5/2	80	10YR 6/6	5	C	M		
			10YR 5/4	5	D	M		

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

Hydric Soil Indicators:

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

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ☒ **No** ☐

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Bell County Water Battery City/County: Bell Sampling Date: September 3, 2024
Applicant/Owner: Rye Development State: KY Sampling Point: 6 (in)
Investigator(s): D. Collinsworth Section, Township, Range: N/A
Landform (hillslope, terrace, etc.): BENCH Local relief (concave, convex, none): concave Slope (%): <1
Subregion (LRR or MLRA): LRR N Lat: 36.76737 Long: -83.51460 Datum: NAD 83
Soil Map Unit Name: Shelocta-Highsplint-Gilpin Complex, 20-70%, very stony NWI classification: not classified
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No ☐
Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

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

Hydrophytic Vegetation Present? Yes ☒ No ☐
Hydric Soil Present? Yes ☒ No ☐
Wetland Hydrology Present? Yes ☒ No ☐

Is the Sampled Area within a Wetland? **Yes** ☒ **No** ☐

Remarks: Community type:

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

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

Field Observations:

Surface Water Present? Yes ☒ No ☐ Depth (inches): 3
Water Table Present? Yes ☐ No ☒ Depth (inches):
Saturation Present? (includes capillary fringe) Yes ☐ No ☒ Depth (inches):

Wetland Hydrology Present? **Yes** ☒ **No** ☐

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

Remarks:

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

Sampling Point: 6 (in)

Tree Stratum (Plot size: 30 ft radius)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8. 50%=25 20%=10			
	10 = Total Cover		

Sapling/Shrub Stratum (Plot size: 15 ft radius)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		

Herb Stratum (Plot size: 5 ft radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Typha angustifolia*	50	YES	OBL
2. *Scirpus cyperinus*	30	YES	FACW
3. *Eutrochium fistulosum*	10	NO	FACW
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12. 50%=45 & 20%=18			
	90 = Total Cover		

Woody Vine Stratum (Plot size: 15' R)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

Dominance Test worksheet:

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

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

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

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

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

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

Definitions of Four Vegetation Strata:

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

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

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

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

Hydrophytic Vegetation Present? **Yes** ☒ **No** ☐

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

SOIL

Sampling Point: 6 (in)

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

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12	2.5Y 5/1	80	2.5Y 5/6	5	C	M		
			10YR 6/6	5	C	M		

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

Hydric Soil Indicators:

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

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) **(MLRA 147)**
- ☐ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: ____

Depth (inches): ____

Hydric Soil Present? Yes ☒ **No** ☐

Remarks:

High Gradient Stream Data Sheet

STREAM NAME: Tom Fork (of Cumberland River)	LOCATION: Reach 1 LOWER
STATION #: MILE:	BASIN/WATERSHED: Upper Cumberland (05130101)
LAT.: LONG.:	COUNTY: Bell USGS 7.5 TOPO: Balkan, KY
DATE: September 12, 2024 TIME: ☐AM ☐PM	INVESTIGATORS: DLC

TYPE SAMPLE: θ P-CHEM θ Macroinvertebrate θ FISH θ BACT.

WEATHER:

Now	Past 24 hours	Has there been a heavy rain in the last 7 days?
θ	θ Heavy rain	θ Yes [✓ θ No]
θ	θ Steady rain	Air Temperature _27 °C. Inches rainfall in past 24 hours __0_ in.
θ	θ Intermittent showers	___10_ % Cloud Cover
[✓ θ]	[✓ θ Clear/sunny]	

P-Chem: Temp (°C)_________ D.O. (mg/l)__________ % Saturation__________ pH (S.U.)__________ Cond.__1181____ θ Grab

INSTREAM WATERSHED FEATURES:

Stream Width ________ ft
Range of Depth ________ ft
Average Velocity ________ ft/s
Discharge ________ cfs
Est. Reach Length ________

LOCAL WATERSHED FEATUREES:

Predominant Surrounding Land Use:

[✓ θ Surface Mining]
θ Deep Mining
θ Oil Wells
θ Land Disposal
θ Construction
θ Commercial
θ Industrial
θ Row Crops
θ Forest
θ Pasture/Grazing
θ Silviculture
θ Urban Runoff/Storm Sewers

Hydraulic Structures:

θ Dams θ Bridge Abutments
θ Island θ Waterfalls
θ Other _________________________

Stream Flow:

θ Dry θ Pooled θ Low [✓ θ Normal]
θ High θ Very Rapid or Torrential

Stream Type:

[✓ θ Perennial] θ Intermittent
θ Ephemeral θ Seep

Riparian Vegetation: Dom. Tree/Shrub Taxa
Dominate Type:
θ Trees θ Shrubs
θ Grasses θ Herbaceous
Number of strata ____

Canopy Cover:
θ Fully Exposed (0-25%)
θ Partially Exposed (25-50%)
θ Partially Shaded (50-75%)
[✓ θ Fully Shaded (75-100%)]

Channel Alterations:
θ Dredging
[✓ θ Channelization]
(θFull θPartial)

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE __13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE __10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE __12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE __13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

High Gradient Stream Data Sheet (page 2)

5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE 12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 8 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 8 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 4 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

128 **Total Score**

Notes/Comments:

High Gradient Stream Data Sheet

STREAM NAME: Tom Fork (of Cumberland River)	LOCATION: Reach 1 UPPER
STATION #: MILE:	BASIN/WATERSHED: Upper Cumberland (05130101)
LAT.: LONG.:	COUNTY: Bell USGS 7.5 TOPO: Balkan, KY
DATE: October 12, 2022 TIME: ☐AM ☐PM	INVESTIGATORS: DLC

TYPE SAMPLE: θ P-CHEM θ Macroinvertebrate θ FISH θ BACT.

WEATHER:

Now	Past 24 hours
θ	θ Heavy rain
θ	θ Steady rain
θ	θ Intermittent showers
[✓ θ]	[✓ θ Clear/sunny]

Has there been a heavy rain in the last 7 days?

θ Yes [✓ θ No]

Air Temperature _10 ^{o}C. Inches rainfall in past 24 hours __0_ in.

___50_ % Cloud Cover

P-Chem: Temp (^{o}C)_________ D.O. (mg/l)__________ % Saturation__________ pH (S.U.)__________ Cond.__1100____ θ Grab

INSTREAM WATERSHED FEATURES:

Stream Width ________ ft
Range of Depth ________ ft
Average Velocity ________ ft/s
Discharge ________ cfs
Est. Reach Length ________

LOCAL WATERSHED FEATUREES:

Predominant Surrounding Land Use:

[✓ θ Surface Mining]
θ Deep Mining
θ Oil Wells
θ Land Disposal
θ Construction
θ Commercial
θ Industrial
θ Row Crops
θ Forest
θ Pasture/Grazing
θ Silviculture
θ Urban Runoff/Storm Sewers

Hydraulic Structures:

θ Dams θ Bridge Abutments
θ Island θ Waterfalls
θ Other _________________________

Stream Flow:

θ Dry θ Pooled θ Low [✓ θ Normal]
θ High θ Very Rapid or Torrential

Stream Type:

[✓ θ Perennial] θ Intermittent
θ Ephemeral θ Seep

Riparian Vegetation: Dom. Tree/Shrub Taxa
Dominate Type:
θ Trees θ Shrubs
θ Grasses θ Herbaceous
Number of strata ____

Canopy Cover:

[✓ θ Fully Exposed (0-25%)]
θ Partially Exposed (25-50%)
θ Partially Shaded (50-75%)
θ Fully Shaded (75-100%)

Channel Alterations:

θ Dredging
[✓ θ Channelization]
(θFull θPartial)

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE __10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE __10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE __8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE __11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

High Gradient Stream Data Sheet (page 2)

5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE __10__	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE __11__	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE __10__	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE __5__ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE __5__ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE __6__ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE __5__ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE __6__ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE __2__ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

99 **Total Score**

Notes/Comments:

High Gradient Stream Data Sheet

STREAM NAME: Tom Fork (of Cumberland River)

LOCATION: Reach 3 and 3A and 3B

STATION #: MILE:

BASIN/WATERSHED: Upper Cumberland (05130101)

LAT.: LONG.:

COUNTY: Bell USGS 7.5 TOPO: Balkan, KY

DATE: November 14, 2022 TIME: ☐AM ☐PM

INVESTIGATORS: DLC

TYPE SAMPLE: θ P-CHEM θ Macroinvertebrate θ FISH θ BACT.

WEATHER:

Now	Past 24 hours
θ	θ Heavy rain
θ	θ Steady rain
θ	θ Intermittent showers
[✓ θ]	[✓ θ Clear/sunny]

Has there been a heavy rain in the last 7 days?
θ Yes [✓ θ No]
Air Temperature _13 ºC. Inches rainfall in past 24 hours __0_ in.
___20_ % Cloud Cover

P-Chem: Temp (ºC)_________ D.O. (mg/l)__________ % Saturation__________ pH (S.U.)__________ Cond.________ θ Grab

INSTREAM WATERSHED FEATURES:
Stream Width ________ ft
Range of Depth ________ ft
Average Velocity ________ ft/s
Discharge ________ cfs
Est. Reach Length ________

LOCAL WATERSHED FEATUREES:
Predominant Surrounding Land Use:
[✓ θ Surface Mining]
θ Deep Mining
θ Oil Wells
θ Land Disposal
θ Construction
θ Commercial
θ Industrial
θ Row Crops
θ Forest
θ Pasture/Grazing
θ Silviculture
θ Urban Runoff/Storm Sewers

Hydraulic Structures:
θ Dams θ Bridge Abutments
θ Island θ Waterfalls
θ Other _________________________

Stream Flow:
θ Dry θ Pooled θ Low [✓ θ Normal]
θ High θ Very Rapid or Torrential

Stream Type:
θ Perennial θ Intermittent
[✓ θ Ephemeral] θ Seep

Riparian Vegetation: Dom. Tree/Shrub Taxa
Dominate Type:
θ Trees θ Shrubs
θ Grasses θ Herbaceous
Number of strata ____

Canopy Cover:
θ Fully Exposed (0-25%)
θ Partially Exposed (25-50%)
θ Partially Shaded (50-75%)
[✓ θ Fully Shaded (75-100%)]

Channel Alterations:
θ Dredging
θ Channelization
(θFull θPartial)

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE __10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE __15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE __10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE __14	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

High Gradient Stream Data Sheet (page 2)

5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 1	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 8 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 9 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 9 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

128 **Total Score**

Notes/Comments:

High Gradient Stream Data Sheet

STREAM NAME: Tom Fork (of Cumberland River)
LOCATION: Reach 4 LOWER
STATION #: MILE:
BASIN/WATERSHED: Upper Cumberland (05130101)
LAT.: LONG.:
COUNTY: Bell USGS 7.5 TOPO: Balkan, KY
DATE: September 3, 2024 TIME: ☐AM ☐PM
INVESTIGATORS: DLC
TYPE SAMPLE: θ P-CHEM θ Macroinvertebrate θ FISH θ BACT.

WEATHER: Now Past 24 hours
θ θ Heavy rain
θ θ Steady rain
θ θ Intermittent showers
[✓ θ] [✓ θ Clear/sunny]

Has there been a heavy rain in the last 7 days?
θ Yes [✓ θ No]
Air Temperature _27 °C. Inches rainfall in past 24 hours __0_ in.
__10_ % Cloud Cover

P-Chem: Temp (°C)_________ D.O. (mg/l)__________ % Saturation__________ pH (S.U.)__________ Cond._1005___ θ Grab

INSTREAM WATERSHED FEATURES:
Stream Width ________ ft
Range of Depth ________ ft
Average Velocity ________ ft/s
Discharge ________ cfs
Est. Reach Length ________

LOCAL WATERSHED FEATUREES:
Predominant Surrounding Land Use:
[✓ θ Surface Mining]
θ Deep Mining
θ Oil Wells
θ Land Disposal
θ Construction
θ Commercial
θ Industrial
θ Row Crops
θ Forest
θ Pasture/Grazing
θ Silviculture
θ Urban Runoff/Storm Sewers

Hydraulic Structures:
θ Dams θ Bridge Abutments
θ Island θ Waterfalls
θ Other _________________________

Stream Flow:
θ Dry θ Pooled θ Low [✓ θ Normal]
θ High θ Very Rapid or Torrential

Stream Type:
[✓ θ Perennial] θ Intermittent
θ Ephemeral θ Seep

Riparian Vegetation: Dom. Tree/Shrub Taxa
Dominate Type:
θ Trees θ Shrubs
θ Grasses θ Herbaceous
Number of strata ____

Canopy Cover:
θ Fully Exposed (0-25%)
θ Partially Exposed (25-50%)
[✓ θ Partially Shaded (50-75%)]
θ Fully Shaded (75-100%)

Channel Alterations:
θ Dredging
θ Channelization
(θFull θPartial)

Habitat	Condition Category			
Parameter	**Optimal**	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE __8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE __10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE __10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE __10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

High Gradient Stream Data Sheet (page 2)

5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE 13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 7 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 6 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 6 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

117 **Total Score**

Notes/Comments:

High Gradient Stream Data Sheet

STREAM NAME: Tom Fork (of Cumberland River)

LOCATION: Reach 4 UPPER

STATION #: MILE:

BASIN/WATERSHED: Upper Cumberland (05130101)

LAT.: LONG.:

COUNTY: Bell USGS 7.5 TOPO: Balkan, KY

DATE: September 3, 2024 TIME: ☐AM ☐PM

INVESTIGATORS: DLC

TYPE SAMPLE: θ P-CHEM θ Macroinvertebrate θ FISH θ BACT.

WEATHER:	Now	Past 24 hours	Has there been a heavy rain in the last 7 days?
	θ	θ Heavy rain	θ Yes [✓ θ No]
	θ	θ Steady rain	Air Temperature _27 °C. Inches rainfall in past 24 hours __0_ in.
	θ	θ Intermittent showers	__10_ % Cloud Cover
	[✓ θ]	[✓ θ Clear/sunny]	

P-Chem: Temp (°C)_________ D.O. (mg/l)__________ % Saturation__________ pH (S.U.)__________ Cond._1005___ θ Grab

INSTREAM WATERSHED FEATURES:

Stream Width	________	ft
Range of Depth	________	ft
Average Velocity	________	ft/s
Discharge	________	cfs
Est. Reach Length	________	

LOCAL WATERSHED FEATUREES:

Predominant Surrounding Land Use:

[✓ θ Surface Mining]	θ Construction	θ Forest
θ Deep Mining	θ Commercial	θ Pasture/Grazing
θ Oil Wells	θ Industrial	θ Silviculture
θ Land Disposal	θ Row Crops	θ Urban Runoff/Storm Sewers

Hydraulic Structures:

θ Dams θ Bridge Abutments
θ Island θ Waterfalls
θ Other _________________________

Stream Flow:

θ Dry θ Pooled θ Low [✓ θ Normal]
θ High θ Very Rapid or Torrential

Stream Type:

[✓ θ Perennial] θ Intermittent
θ Ephemeral θ Seep

Riparian Vegetation: Dom. Tree/Shrub Taxa
Dominate Type:
θ Trees θ Shrubs
θ Grasses θ Herbaceous
Number of strata ____

Canopy Cover:
θ Fully Exposed (0-25%)
θ Partially Exposed (25-50%)
[✓ θ Partially Shaded (50-75%)]
θ Fully Shaded (75-100%)

Channel Alterations:
θ Dredging
θ Channelization
(θFull θPartial)

Habitat Parameter	**Condition Category**			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE __8__	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE __10__	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE __10__	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE __10__	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

High Gradient Stream Data Sheet (page 2)

5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE 13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 6 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 6 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

111 **Total Score**

Notes/Comments:

High Gradient Stream Data Sheet

STREAM NAME: Tom Fork (of Cumberland River)
LOCATION: Reach 4A
STATION #:
MILE:
BASIN/WATERSHED: Upper Cumberland (05130101)
LAT.:
LONG.:
COUNTY: Bell
USGS 7.5 TOPO: Balkan, KY
DATE: September 3, 2024
TIME: ☐AM ☐PM
INVESTIGATORS: DLC
TYPE SAMPLE: θ P-CHEM θ Macroinvertebrate θ FISH θ BACT.

WEATHER:	Now	Past 24 hours	Has there been a heavy rain in the last 7 days?
	θ	θ Heavy rain	θ Yes [✓ θ No]
	θ	θ Steady rain	Air Temperature _27 °C. Inches rainfall in past 24 hours __0_ in.
	θ	θ Intermittent showers	__10_ % Cloud Cover
	[✓ θ]	[✓ θ Clear/sunny]	

P-Chem: Temp (°C)_________ D.O. (mg/l)__________ % Saturation__________ pH (S.U.)__________ Cond._824___ θ Grab

INSTREAM WATERSHED FEATURES:
Stream Width ________ ft
Range of Depth ________ ft
Average Velocity ________ ft/s
Discharge ________ cfs
Est. Reach Length ________

LOCAL WATERSHED FEATUREES:
Predominant Surrounding Land Use:
[✓ θ Surface Mining]
θ Deep Mining
θ Oil Wells
θ Land Disposal
θ Construction
θ Commercial
θ Industrial
θ Row Crops
θ Forest
θ Pasture/Grazing
θ Silviculture
θ Urban Runoff/Storm Sewers

Hydraulic Structures:
θ Dams θ Bridge Abutments
θ Island θ Waterfalls
θ Other _________________________

Stream Flow:
θ Dry θ Pooled θ Low [✓ θ Normal]
θ High θ Very Rapid or Torrential

Stream Type:
[✓ θ Perennial] θ Intermittent
θ Ephemeral θ Seep

Riparian Vegetation: Dom. Tree/Shrub Taxa
Dominate Type:
θ Trees θ Shrubs
θ Grasses θ Herbaceous
Number of strata ____

Canopy Cover:
θ Fully Exposed (0-25%)
[✓ θ Partially Exposed (25-50%)]
θ Partially Shaded (50-75%)
θ Fully Shaded (75-100%)

Channel Alterations:
θ Dredging
θ Channelization
(θFull θPartial)

Habitat	Condition Category			
Parameter	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE 12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

High Gradient Stream Data Sheet (page 2)

5. **Channel Flow Status**	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. **Channel Alteration**	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. **Frequency of Riffles (or bends)**	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 6 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 3 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

92 **Total Score**

Notes/Comments:

High Gradient Stream Data Sheet

STREAM NAME: Tom Fork (of Cumberland River)

LOCATION: Reach 5

STATION #: MILE:

BASIN/WATERSHED: Upper Cumberland (05130101)

LAT.: LONG.:

COUNTY: Bell USGS 7.5 TOPO: Balkan, KY

DATE: August 22, 2024 TIME: ☐AM ☐PM

INVESTIGATORS: DLC

TYPE SAMPLE: θ P-CHEM θ Macroinvertebrate θ FISH θ BACT.

WEATHER:

	Now	Past 24 hours	Has there been a heavy rain in the last 7 days?
	θ	θ Heavy rain	θ Yes [✓ θ No]
	θ	θ Steady rain	Air Temperature _27 °C. Inches rainfall in past 24 hours __0_ in.
	θ	θ Intermittent showers	__10_ % Cloud Cover
	[✓ θ]	[✓ θ Clear/sunny]	

P-Chem: Temp (°C)_________ D.O. (mg/l)__________ % Saturation__________ pH (S.U.)__________ Cond._402___ θ Grab

INSTREAM WATERSHED FEATURES:

Stream Width ________ ft

Range of Depth ________ ft

Average Velocity ________ ft/s

Discharge ________ cfs

Est. Reach Length ________

LOCAL WATERSHED FEATUREES:

Predominant Surrounding Land Use:

[✓ θ Surface Mining]

θ Deep Mining

θ Oil Wells

θ Land Disposal

θ Construction

θ Commercial

θ Industrial

θ Row Crops

θ Forest

θ Pasture/Grazing

θ Silviculture

θ Urban Runoff/Storm Sewers

Hydraulic Structures:

θ Dams θ Bridge Abutments

θ Island θ Waterfalls

θ Other _________________________

Stream Flow:

θ Dry θ Pooled θ Low [✓ θ Normal]

θ High θ Very Rapid or Torrential

Stream Type:

θ Perennial [✓ θ Intermittent]

θ Ephemeral θ Seep

Riparian Vegetation: Dom. Tree/Shrub Taxa

Dominate Type:

θ Trees θ Shrubs

θ Grasses θ Herbaceous

Number of strata ____

Canopy Cover:

θ Fully Exposed (0-25%)

θ Partially Exposed (25-50%)

θ Partially Shaded (50-75%)

[✓ θ Fully Shaded (75-100%)]

Channel Alterations:

θ Dredging

θ Channelization

(θFull θPartial)

Habitat	Condition Category			
Parameter	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE __13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE __10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE __7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE __10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

High Gradient Stream Data Sheet (page 2)

5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 7 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 8 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

111 **Total Score**

Notes/Comments:

High Gradient Stream Data Sheet

STREAM NAME: Tom Fork (of Cumberland River)

LOCATION: Reach 5A

STATION #: MILE:

BASIN/WATERSHED: Upper Cumberland (05130101)

LAT.: LONG.:

COUNTY: Bell USGS 7.5 TOPO: Balkan, KY

DATE: August 22, 2024 TIME: ☐AM ☐PM

INVESTIGATORS: DLC

TYPE SAMPLE: θ P-CHEM θ Macroinvertebrate θ FISH θ BACT.

WEATHER:

Now	Past 24 hours	Has there been a heavy rain in the last 7 days?
θ	θ Heavy rain	θ Yes [✓ θ No]
θ	θ Steady rain	Air Temperature _27 °C. Inches rainfall in past 24 hours __0_ in.
θ	θ Intermittent showers	__10_ % Cloud Cover
[✓ θ]	[✓ θ Clear/sunny]	

P-Chem: Temp (°C)_________ D.O. (mg/l)__________ % Saturation__________ pH (S.U.)__________ Cond._375___ θ Grab

INSTREAM WATERSHED FEATURES:

Stream Width ________ ft

Range of Depth ________ ft

Average Velocity ________ ft/s

Discharge ________ cfs

Est. Reach Length ________

LOCAL WATERSHED FEATUREES:

Predominant Surrounding Land Use:

[✓ θ Surface Mining]	θ Construction	θ Forest
θ Deep Mining	θ Commercial	θ Pasture/Grazing
θ Oil Wells	θ Industrial	θ Silviculture
θ Land Disposal	θ Row Crops	θ Urban Runoff/Storm Sewers

Hydraulic Structures:

θ Dams θ Bridge Abutments

θ Island θ Waterfalls

θ Other _________________________

Stream Flow:

θ Dry θ Pooled θ Low [✓ θ Normal]

θ High θ Very Rapid or Torrential

Stream Type:

θ Perennial [✓ θ Intermittent]

θ Ephemeral θ Seep

Riparian Vegetation: Dom. Tree/Shrub Taxa

Dominate Type:

θ Trees θ Shrubs

θ Grasses θ Herbaceous

Number of strata ____

Canopy Cover:

θ Fully Exposed (0-25%)

θ Partially Exposed (25-50%)

θ Partially Shaded (50-75%)

[✓ θ Fully Shaded (75-100%)]

Channel Alterations:

θ Dredging

θ Channelization

(θFull θPartial)

Habitat	Condition Category			
Parameter	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

High Gradient Stream Data Sheet (page 2)

5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 7 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 8 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

111 **Total Score**

Notes/Comments:

High Gradient Stream Data Sheet

STREAM NAME: Tom Fork (of Cumberland River)
LOCATION: Reach 5A-1 AND 5A-2

STATION #: MILE:
BASIN/WATERSHED: Upper Cumberland (05130101)

LAT.: LONG.:
COUNTY: Bell USGS 7.5 TOPO: Balkan, KY

DATE: August 22, 2024 TIME: ☐AM ☐PM
INVESTIGATORS: DLC

TYPE SAMPLE: θ P-CHEM θ Macroinvertebrate θ FISH θ BACT.

WEATHER:

	Now	Past 24 hours	Has there been a heavy rain in the last 7 days?
	θ	θ Heavy rain	θ Yes [✓ θ No]
	θ	θ Steady rain	Air Temperature _27 °C. Inches rainfall in past 24 hours __0_ in.
	θ	θ Intermittent showers	__10_ % Cloud Cover
	[✓ θ]	[✓ θ Clear/sunny]	

P-Chem: Temp (°C)_________ D.O. (mg/l)__________ % Saturation__________ pH (S.U.)__________ Cond._375___ θ Grab

INSTREAM WATERSHED FEATURES:

Stream Width ________ ft
Range of Depth ________ ft
Average Velocity ________ ft/s
Discharge ________ cfs
Est. Reach Length ________

LOCAL WATERSHED FEATUREES:

Predominant Surrounding Land Use:

[✓ θ Surface Mining]
θ Deep Mining
θ Oil Wells
θ Land Disposal
θ Construction
θ Commercial
θ Industrial
θ Row Crops
θ Forest
θ Pasture/Grazing
θ Silviculture
θ Urban Runoff/Storm Sewers

Hydraulic Structures:
θ Dams θ Bridge Abutments
θ Island θ Waterfalls
θ Other _________________________

Stream Flow:
θ Dry θ Pooled θ Low [✓ θ Normal]
θ High θ Very Rapid or Torrential

Stream Type:
θ Perennial θ Intermittent
[✓ θ Ephemeral] θ Seep

Riparian Vegetation: Dom. Tree/Shrub Taxa
Dominate Type:
θ Trees θ Shrubs
θ Grasses θ Herbaceous
Number of strata ____

Canopy Cover:
θ Fully Exposed (0-25%)
θ Partially Exposed (25-50%)
θ Partially Shaded (50-75%)
[✓ θ Fully Shaded (75-100%)]

Channel Alterations:
θ Dredging
θ Channelization
(θFull θPartial)

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE __11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE __10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE __7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE __10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

High Gradient Stream Data Sheet (page 2)

5. **Channel Flow Status**	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. **Channel Alteration**	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. **Frequency of Riffles (or bends)**	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 7 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 7 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 8 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

113 **Total Score**

Notes/Comments:

High Gradient Stream Data Sheet

STREAM NAME: Tom Fork (of Cumberland River)	LOCATION: Reach 6 EPHEMERAL/INTERMITTENT
STATION #: MILE:	BASIN/WATERSHED: Upper Cumberland (05130101)
LAT.: LONG.:	COUNTY: Bell USGS 7.5 TOPO: Balkan, KY
DATE: September 3, 2024 TIME: ☐AM ☐PM	INVESTIGATORS: DLC

TYPE SAMPLE: θ P-CHEM θ Macroinvertebrate θ FISH θ BACT.

WEATHER:	Now	Past 24 hours	Has there been a heavy rain in the last 7 days?
	θ	θ Heavy rain	θ Yes [✓ θ No]
	θ	θ Steady rain	Air Temperature _27 °C. Inches rainfall in past 24 hours __0_ in.
	θ	θ Intermittent showers	__10_ % Cloud Cover
	[✓ θ]	[✓ θ Clear/sunny]	

P-Chem: Temp (°C)_________ D.O. (mg/l)__________ % Saturation__________ pH (S.U.)__________ Cond._657___ θ Grab

INSTREAM WATERSHED FEATURES:

Stream Width ________ ft
Range of Depth ________ ft
Average Velocity ________ ft/s
Discharge ________ cfs
Est. Reach Length ________

LOCAL WATERSHED FEATUREES:

Predominant Surrounding Land Use:

[✓ θ Surface Mining]	θ Construction	θ Forest
θ Deep Mining	θ Commercial	θ Pasture/Grazing
θ Oil Wells	θ Industrial	θ Silviculture
θ Land Disposal	θ Row Crops	θ Urban Runoff/Storm Sewers

Hydraulic Structures:
θ Dams θ Bridge Abutments
θ Island θ Waterfalls
θ Other _________________________

Stream Flow:
θ Dry θ Pooled θ Low [✓ θ Normal]
θ High θ Very Rapid or Torrential

Stream Type:
θ Perennial [✓ θ Intermittent]
[✓ θ Ephemeral] θ Seep

Riparian Vegetation: Dom. Tree/Shrub Taxa
Dominate Type:
θ Trees θ Shrubs
θ Grasses θ Herbaceous
Number of strata ____

Canopy Cover:
θ Fully Exposed (0-25%)
θ Partially Exposed (25-50%)
θ Partially Shaded (50-75%)
[✓ θ Fully Shaded (75-100%)]

Channel Alterations:
θ Dredging
θ Channelization
(θFull θPartial)

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

High Gradient Stream Data Sheet (page 2)

5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 7 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 6 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 8 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

113 **Total Score**

Notes/Comments:

High Gradient Stream Data Sheet

STREAM NAME: Tom Fork (of Cumberland River)
LOCATION: Reach 6 PERENNIAL
STATION #: MILE:
BASIN/WATERSHED: Upper Cumberland (05130101)
LAT.: LONG.:
COUNTY: Bell USGS 7.5 TOPO: Balkan, KY
DATE: September 3, 2024 TIME: ☐AM ☐PM
INVESTIGATORS: DLC
TYPE SAMPLE: θ P-CHEM θ Macroinvertebrate θ FISH θ BACT.

WEATHER:

Now	Past 24 hours
θ	θ Heavy rain
θ	θ Steady rain
θ	θ Intermittent showers
[✓ θ]	[✓ θ Clear/sunny]

Has there been a heavy rain in the last 7 days? θ Yes [✓ θ No]
Air Temperature _27 °C. Inches rainfall in past 24 hours __0_ in.
__10_ % Cloud Cover

P-Chem: Temp (°C)_________ D.O. (mg/l)__________ % Saturation__________ pH (S.U.)__________ Cond._657___ θ Grab

INSTREAM WATERSHED FEATURES:
Stream Width ________ ft
Range of Depth ________ ft
Average Velocity ________ ft/s
Discharge ________ cfs
Est. Reach Length ________

LOCAL WATERSHED FEATUREES:
Predominant Surrounding Land Use:
[✓ θ Surface Mining]
θ Deep Mining
θ Oil Wells
θ Land Disposal
θ Construction
θ Commercial
θ Industrial
θ Row Crops
θ Forest
θ Pasture/Grazing
θ Silviculture
θ Urban Runoff/Storm Sewers

Hydraulic Structures:
θ Dams θ Bridge Abutments
θ Island θ Waterfalls
θ Other _________________________

Stream Flow:
θ Dry θ Pooled θ Low [✓ θ Normal]
θ High θ Very Rapid or Torrential

Stream Type:
[✓ θ Perennial] θ Intermittent
θ Ephemeral θ Seep

Riparian Vegetation: Dom. Tree/Shrub Taxa
Dominate Type:
θ Trees θ Shrubs
θ Grasses θ Herbaceous
Number of strata ____

Canopy Cover:
θ Fully Exposed (0-25%)
θ Partially Exposed (25-50%)
θ Partially Shaded (50-75%)
[✓ θ Fully Shaded (75-100%)]

Channel Alterations:
θ Dredging
θ Channelization
(θFull θPartial)

Habitat	Condition Category			
Parameter	**Optimal**	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE __13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE __10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE __10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE __10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

High Gradient Stream Data Sheet (page 2)

5. **Channel Flow Status**	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. **Channel Alteration**	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. **Frequency of Riffles (or bends)**	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 7 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 6 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 8 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

123 **Total Score**

Notes/Comments:

High Gradient Stream Data Sheet

STREAM NAME: Tom Fork (of Cumberland River)

LOCATION: Reach 7, 7A, AND 7B

STATION #: MILE:

BASIN/WATERSHED: Upper Cumberland (05130101)

LAT.: LONG.:

COUNTY: Bell USGS 7.5 TOPO: Balkan, KY

DATE: September 3, 2024 TIME: ☐AM ☐PM

INVESTIGATORS: DLC

TYPE SAMPLE: θ P-CHEM θ Macroinvertebrate θ FISH θ BACT.

WEATHER:

Now	Past 24 hours	Has there been a heavy rain in the last 7 days?
θ	θ Heavy rain	θ Yes [✓ θ No]
θ	θ Steady rain	Air Temperature _27 °C. Inches rainfall in past 24 hours __0_ in.
θ	θ Intermittent showers	__10_ % Cloud Cover
[✓ θ]	[✓ θ Clear/sunny]	

P-Chem: Temp (°C)_________ D.O. (mg/l)__________ % Saturation__________ pH (S.U.)__________ Cond._322___ θ Grab

INSTREAM WATERSHED FEATURES:

Stream Width ________ ft
Range of Depth ________ ft
Average Velocity ________ ft/s
Discharge ________ cfs
Est. Reach Length ________

LOCAL WATERSHED FEATUREES:

Predominant Surrounding Land Use:

[✓ θ Surface Mining]
θ Deep Mining
θ Oil Wells
θ Land Disposal
θ Construction
θ Commercial
θ Industrial
θ Row Crops
θ Forest
θ Pasture/Grazing
θ Silviculture
θ Urban Runoff/Storm Sewers

Hydraulic Structures:

θ Dams θ Bridge Abutments
θ Island θ Waterfalls
θ Other _________________________

Stream Flow:

θ Dry θ Pooled θ Low [✓ θ Normal]
θ High θ Very Rapid or Torrential

Stream Type:

θ Perennial [✓ θ Intermittent]
θ Ephemeral θ Seep

Riparian Vegetation: Dom. Tree/Shrub Taxa
Dominate Type:
θ Trees θ Shrubs
θ Grasses θ Herbaceous
Number of strata ____

Canopy Cover:
θ Fully Exposed (0-25%)
θ Partially Exposed (25-50%)
θ Partially Shaded (50-75%)
[✓ θ Fully Shaded (75-100%)]

Channel Alterations:
θ Dredging
θ Channelization
(θFull θPartial)

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE __10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE __10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE __7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE __10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

High Gradient Stream Data Sheet (page 2)

5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 8 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

102 **Total Score**

Notes/Comments:

High Gradient Stream Data Sheet

STREAM NAME: Tom Fork (of Cumberland River)

LOCATION: Reach 7A-1 AND 7B-1

STATION #: MILE:

BASIN/WATERSHED: Upper Cumberland (05130101)

LAT.: LONG.:

COUNTY: Bell USGS 7.5 TOPO: Balkan, KY

DATE: September 3, 2024 TIME: ☐AM ☐PM

INVESTIGATORS: DLC

TYPE SAMPLE: θ P-CHEM θ Macroinvertebrate θ FISH θ BACT.

WEATHER:

Now	Past 24 hours
θ	θ Heavy rain
θ	θ Steady rain
θ	θ Intermittent showers
[✓ θ]	[✓ θ Clear/sunny]

Has there been a heavy rain in the last 7 days?
θ Yes [✓ θ No]
Air Temperature _27 °C. Inches rainfall in past 24 hours __0_ in.
__10_ % Cloud Cover

P-Chem: Temp (°C)_________ D.O. (mg/l)__________ % Saturation__________ pH (S.U.)__________ Cond._322___ θ Grab

INSTREAM WATERSHED FEATURES:
Stream Width ________ ft
Range of Depth ________ ft
Average Velocity ________ ft/s
Discharge ________ cfs
Est. Reach Length ________

LOCAL WATERSHED FEATUREES:
Predominant Surrounding Land Use:

[✓ θ Surface Mining]
θ Deep Mining
θ Oil Wells
θ Land Disposal

θ Construction
θ Commercial
θ Industrial
θ Row Crops

θ Forest
θ Pasture/Grazing
θ Silviculture
θ Urban Runoff/Storm Sewers

Hydraulic Structures:
θ Dams θ Bridge Abutments
θ Island θ Waterfalls
θ Other _________________________

Stream Flow:
θ Dry θ Pooled θ Low [✓ θ Normal]
θ High θ Very Rapid or Torrential

Stream Type:
θ Perennial θ Intermittent
[✓ θ Ephemeral] θ Seep

Riparian Vegetation: Dom. Tree/Shrub Taxa
Dominate Type:
θ Trees θ Shrubs
θ Grasses θ Herbaceous
Number of strata ____

Canopy Cover:
θ Fully Exposed (0-25%)
θ Partially Exposed (25-50%)
θ Partially Shaded (50-75%)
[✓ θ Fully Shaded (75-100%)]

Channel Alterations:
θ Dredging
θ Channelization
(θFull θPartial)

Habitat	Condition Category			
Parameter	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE __8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE __10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE __5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE __10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

High Gradient Stream Data Sheet (page 2)

5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 6 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 6 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 8 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

93 **Total Score**

Notes/Comments:

High Gradient Stream Data Sheet

STREAM NAME: Tom Fork (of Cumberland River)
LOCATION: Reach 8
STATION #:
MILE:
BASIN/WATERSHED: Upper Cumberland (05130101)
LAT.:
LONG.:
COUNTY: Bell
USGS 7.5 TOPO: Balkan, KY
DATE: November 14, 2022
TIME: ☐AM ☐PM
INVESTIGATORS: DLC

TYPE SAMPLE: θ P-CHEM θ Macroinvertebrate θ FISH θ BACT.

WEATHER:

Now	Past 24 hours
θ	θ Heavy rain
θ	θ Steady rain
θ	θ Intermittent showers
[✓ θ]	[✓ θ Clear/sunny]

Has there been a heavy rain in the last 7 days? θ Yes [✓ θ No]
Air Temperature _13 °C. Inches rainfall in past 24 hours __0_ in.
___20_ % Cloud Cover

P-Chem: Temp (°C)_________ D.O. (mg/l)__________ % Saturation__________ pH (S.U.)__________ Cond._1150___ θ Grab

INSTREAM WATERSHED FEATURES:
Stream Width ________ ft
Range of Depth ________ ft
Average Velocity ________ ft/s
Discharge ________ cfs
Est. Reach Length ________

LOCAL WATERSHED FEATUREES:
Predominant Surrounding Land Use:
[✓ θ Surface Mining]
θ Deep Mining
θ Oil Wells
θ Land Disposal
θ Construction
θ Commercial
θ Industrial
θ Row Crops
θ Forest
θ Pasture/Grazing
θ Silviculture
θ Urban Runoff/Storm Sewers

Hydraulic Structures:
θ Dams θ Bridge Abutments
θ Island θ Waterfalls
θ Other _________________________

Stream Flow:
θ Dry θ Pooled θ Low [✓ θ Normal]
θ High θ Very Rapid or Torrential

Stream Type:
[✓ θ Perennial] θ Intermittent
θ Ephemeral θ Seep

Riparian Vegetation: Dom. Tree/Shrub Taxa
Dominate Type:
θ Trees θ Shrubs
θ Grasses θ Herbaceous
Number of strata ____

Canopy Cover:
θ Fully Exposed (0-25%)
θ Partially Exposed (25-50%)
θ Partially Shaded (50-75%)
[✓ θ Fully Shaded (75-100%)]

Channel Alterations:
θ Dredging
θ Channelization
(θFull θPartial)

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE __13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE __15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE __13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE __15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

High Gradient Stream Data Sheet (page 2)

5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE 13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 8 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 8 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 8 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

148 **Total Score**

Notes/Comments:

High Gradient Stream Data Sheet

STREAM NAME: Tom Fork (of Cumberland River)	LOCATION: Reach 9
STATION #: MILE:	BASIN/WATERSHED: Upper Cumberland (05130101)
LAT.: LONG.:	COUNTY: Bell USGS 7.5 TOPO: Balkan, KY
DATE: November 14, 2022 TIME: ☐AM ☐PM	INVESTIGATORS: DLC

TYPE SAMPLE: θ P-CHEM θ Macroinvertebrate θ FISH θ BACT.

WEATHER:	Now	Past 24 hours	Has there been a heavy rain in the last 7 days?
	θ	θ Heavy rain	θ Yes [✓ θ No]
	θ	θ Steady rain	Air Temperature _13 °C. Inches rainfall in past 24 hours __0_ in.
	θ	θ Intermittent showers	___20_ % Cloud Cover
	[✓ θ]	[✓ θ Clear/sunny]	

P-Chem: Temp (°C)_________ D.O. (mg/l)__________ % Saturation__________ pH (S.U.)__________ Cond._1150___ θ Grab

INSTREAM WATERSHED FEATURES:
Stream Width ________ ft
Range of Depth ________ ft
Average Velocity ________ ft/s
Discharge ________ cfs
Est. Reach Length ________

LOCAL WATERSHED FEATUREES:
Predominant Surrounding Land Use:
[✓ θ Surface Mining]
θ Deep Mining
θ Oil Wells
θ Land Disposal
θ Construction
θ Commercial
θ Industrial
θ Row Crops
θ Forest
θ Pasture/Grazing
θ Silviculture
θ Urban Runoff/Storm Sewers

Hydraulic Structures:
θ Dams θ Bridge Abutments
θ Island θ Waterfalls
θ Other _________________________

Stream Flow:
θ Dry θ Pooled θ Low [✓ θ Normal]
θ High θ Very Rapid or Torrential

Stream Type:
θ Perennial θ Intermittent
[✓ θ Ephemeral] θ Seep

Riparian Vegetation: Dom. Tree/Shrub Taxa
Dominate Type:
θ Trees θ Shrubs
θ Grasses θ Herbaceous
Number of strata ____

Canopy Cover:
θ Fully Exposed (0-25%)
θ Partially Exposed (25-50%)
θ Partially Shaded (50-75%)
[✓ θ Fully Shaded (75-100%)]

Channel Alterations:
θ Dredging
θ Channelization
(θFull θPartial)

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE __6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE __10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE __6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE __10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

High Gradient Stream Data Sheet (page 2)

5. **Channel Flow Status**	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. **Channel Alteration**	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. **Frequency of Riffles (or bends)**	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 7 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 7 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 7 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

96 **Total Score**

Notes/Comments:

High Gradient Stream Data Sheet

STREAM NAME: Tom Fork (of Cumberland River)
LOCATION: Reach 10
STATION #:
MILE:
BASIN/WATERSHED: Upper Cumberland (05130101)
LAT.:
LONG.:
COUNTY: Bell
USGS 7.5 TOPO: Balkan, KY
DATE: November 14, 2022
TIME: ☐AM ☐PM
INVESTIGATORS: DLC
TYPE SAMPLE: θ P-CHEM θ Macroinvertebrate θ FISH θ BACT.

WEATHER:

Now	Past 24 hours
θ	θ Heavy rain
θ	θ Steady rain
θ	θ Intermittent showers
[✓ θ]	[✓ θ Clear/sunny]

Has there been a heavy rain in the last 7 days?
θ Yes [✓ θ No]
Air Temperature _13 °C. Inches rainfall in past 24 hours __0_ in.
___20_ % Cloud Cover

P-Chem: Temp (°C)_________ D.O. (mg/l)__________ % Saturation__________ pH (S.U.)__________ Cond._1300___ θ Grab

INSTREAM WATERSHED FEATURES:
Stream Width ________ ft
Range of Depth ________ ft
Average Velocity ________ ft/s
Discharge ________ cfs
Est. Reach Length ________

LOCAL WATERSHED FEATUREES:
Predominant Surrounding Land Use:
[✓ θ Surface Mining]
θ Deep Mining
θ Oil Wells
θ Land Disposal
θ Construction
θ Commercial
θ Industrial
θ Row Crops
θ Forest
θ Pasture/Grazing
θ Silviculture
θ Urban Runoff/Storm Sewers

Hydraulic Structures:
θ Dams θ Bridge Abutments
θ Island θ Waterfalls
θ Other _________________________

Stream Flow:
θ Dry θ Pooled θ Low [✓ θ Normal]
θ High θ Very Rapid or Torrential

Stream Type:
θ Perennial θ Intermittent
[✓ θ Ephemeral] θ Seep

Riparian Vegetation: Dom. Tree/Shrub Taxa
Dominate Type:
θ Trees θ Shrubs
θ Grasses θ Herbaceous
Number of strata ____

Canopy Cover:
θ Fully Exposed (0-25%)
θ Partially Exposed (25-50%)
θ Partially Shaded (50-75%)
[✓ θ Fully Shaded (75-100%)]

Channel Alterations:
θ Dredging
θ Channelization
(θFull θPartial)

Habitat	Condition Category			
Parameter	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

High Gradient Stream Data Sheet (page 2)

5. **Channel Flow Status**	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 1	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. **Channel Alteration**	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. **Frequency of Riffles (or bends)**	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 7 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 7 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 7 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

91 **Total Score**

Notes/Comments:

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (Version 2002.6)

(Family Level Taxonomy - All Habitats)

Project ID: Rye Development - Bell County Water Battery

Stream/Reach: REACH 1 LOWER

Assessment Objectives: Baseline

EII	Model
NA	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.24	Ecological Integrity Index (Habitat Integrity + Conductivity)

>>>>>>> Enter quantitative or categorical measure from Field Data Sheet in shaded cells

Variables	Measure	Units	Subindex
RBP Habitat Parameters			
1. Epifaunal Substrate	13	no units	
2. Embeddedness	10	no units	
3. Velocity/Depth Regime	12	no units	
4. Sediment Deposition	13	no units	
5. Channel Flow Status	15	no units	
6. Channel Alteration	13	no units	
7. Freq. Of Riffles (bends)	12	no units	
8. Bank stability (both combined)	16	no units	
9. Veg. Protection (both combined)	16	no units	
10. Riparian Width (both combined)	8	no units	
Total Habitat Score	128	no units	
Habitat Integrity Index			0.38
Macroinvertebrate Data - Family Level (All Habitats)			
11. Family Taxa Richness	0	# of taxa sampled	
12. Family EPT Richness	0	# of EPT species sampled	
13. % Ephemeroptera	0	% Mayflies (0-100)	
14. % Chironomidae & Oligochaeta	0	% Midges & Worms (0-100)	
15. mFBI	0	no units	
Macroinvertebrate Bioassessment	NA	no units	NA
Conductivity	1181	microMHOs	0.10

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (Version 2002.6)

(Family Level Taxonomy - All Habitats)

Project ID: Rye Development - Bell County Water Battery

Stream/Reach: REACH 1 UPPER

Assessment Objectives: Baseline

EII	Model
NA	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.10	Ecological Integrity Index (Habitat Integrity + Conductivity)

>>>>>>> Enter quantitative or categorical measure from Field Data Sheet in shaded cells

Variables	Measure	Units	
RBP Habitat Parameters			
1. Epifaunal Substrate	10	no units	
2. Embeddedness	10	no units	
3. Velocity/Depth Regime	8	no units	
4. Sediment Deposition	11	no units	
5. Channel Flow Status	10	no units	
6. Channel Alteration	11	no units	
7. Freq. Of Riffles (bends)	10	no units	
8. Bank stability (both combined)	10	no units	
9. Veg. Protection (both combined)	11	no units	
10. Riparian Width (both combined)	8	no units	
Total Habitat Score	99	no units	**Subindex**
Habitat Integrity Index			0.10
Macroinvertebrate Data - Family Level (All Habitats)			
11. Family Taxa Richness	0	# of taxa sampled	
12. Family EPT Richness	0	# of EPT species sampled	
13. % Ephemeroptera	0	% Mayflies (0-100)	
14. % Chironomidae & Oligochaeta	0	% Midges & Worms (0-100)	
15. mFBI	0	no units	
Macroinvertebrate Bioassessment	NA	no units	NA
Conductivity	1100	microMHOs	0.10

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (Version 2002.6)

(Family Level Taxonomy - All Habitats)

Project ID: Rye Development - Bell County Water Battery

Stream/Reach: Reach 3&3A&3B

Assessment Objectives: Baseline

EII	Model
NA	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.24	Ecological Integrity Index (Habitat Integrity + Conductivity)

>>>>>>> Enter quantitative or categorical measure from Field Data Sheet in shaded cells

Variables	Measure	Units	Subindex
RBP Habitat Parameters			
1. Epifaunal Substrate	10	no units	
2. Embeddedness	15	no units	
3. Velocity/Depth Regime	10	no units	
4. Sediment Deposition	14	no units	
5. Channel Flow Status	1	no units	
6. Channel Alteration	16	no units	
7. Freq. Of Riffles (bends)	10	no units	
8. Bank stability (both combined)	16	no units	
9. Veg. Protection (both combined)	18	no units	
10. Riparian Width (both combined)	18	no units	
Total Habitat Score	128	no units	
Habitat Integrity Index			0.38
Macroinvertebrate Data - Family Level (All Habitats)			
11. Family Taxa Richness	0	# of taxa sampled	
12. Family EPT Richness	0	# of EPT species sampled	
13. % Ephemeroptera	0	% Mayflies (0-100)	
14. % Chironomidae & Oligochaeta	0	% Midges & Worms (0-100)	
15. mFBI	0	no units	
Macroinvertebrate Bioassessment	NA	no units	NA
Conductivity	500	microMHOs	0.10

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (Version 2002.6)

(Family Level Taxonomy - All Habitats)

Project ID:	**Rye Development - Bell County Water Battery**
Stream/Reach:	**REACH 4 LOWER**
Assessment Objectives:	**Baseline**

EII	Model
NA	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.19	Ecological Integrity Index (Habitat Integrity + Conductivity)

>>>>>>> Enter quantitative or categorical measure from Field Data Sheet in shaded cells

Variables	Measure	Units	Subindex
RBP Habitat Parameters			
1. Epifaunal Substrate	8	no units	
2. Embeddedness	10	no units	
3. Velocity/Depth Regime	10	no units	
4. Sediment Deposition	10	no units	
5. Channel Flow Status	15	no units	
6. Channel Alteration	13	no units	
7. Freq. Of Riffles (bends)	13	no units	
8. Bank stability (both combined)	14	no units	
9. Veg. Protection (both combined)	12	no units	
10. Riparian Width (both combined)	12	no units	
Total Habitat Score	117	no units	
Habitat Integrity Index			0.27
Macroinvertebrate Data - Family Level (All Habitats)			
11. Family Taxa Richness	0	# of taxa sampled	
12. Family EPT Richness	0	# of EPT species sampled	
13. % Ephemeroptera	0	% Mayflies (0-100)	
14. % Chironomidae & Oligochaeta	0	% Midges & Worms (0-100)	
15. mFBI	0	no units	
Macroinvertebrate Bioassessment	NA	no units	NA
Conductivity	1005	microMHOs	0.10

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (Version 2002.6)

****(Family Level Taxonomy - All Habitats)****

Project ID: Rye Development - Bell County Water Battery

Stream/Reach: REACH 4 UPPER

Assessment Objectives: Baseline

EII	Model
NA	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.16	Ecological Integrity Index (Habitat Integrity + Conductivity)

\>>>>>>> Enter quantitative or categorical measure from Field Data Sheet in shaded cells

Variables	Measure	Units	Subindex
RBP Habitat Parameters			
1. Epifaunal Substrate	8	no units	
2. Embeddedness	10	no units	
3. Velocity/Depth Regime	10	no units	
4. Sediment Deposition	10	no units	
5. Channel Flow Status	15	no units	
6. Channel Alteration	11	no units	
7. Freq. Of Riffles (bends)	13	no units	
8. Bank stability (both combined)	12	no units	
9. Veg. Protection (both combined)	12	no units	
10. Riparian Width (both combined)	10	no units	
Total Habitat Score	**111**	no units	
Habitat Integrity Index			**0.21**
Macroinvertebrate Data - Family Level (All Habitats)			
11. Family Taxa Richness	0	# of taxa sampled	
12. Family EPT Richness	0	# of EPT species sampled	
13. % Ephemeroptera	0	% Mayflies (0-100)	
14. % Chironomidae & Oligochaeta	0	% Midges & Worms (0-100)	
15. mFBI	0	no units	
Macroinvertebrate Bioassessment	**NA**	no units	**NA**
Conductivity	**1005**	microMHOs	**0.10**

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (Version 2002.6)

****(Family Level Taxonomy - All Habitats)****

Project ID: **Rye Development - Bell County Water Battery**

Stream/Reach: **REACH 4A**

Assessment Objectives: **Baseline**

EII	Model
NA	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.10	Ecological Integrity Index (Habitat Integrity + Conductivity)

>>>>>>> Enter quantitative or categorical measure from Field Data Sheet in shaded cells

Variables	Measure	Units	Subindex
RBP Habitat Parameters			
1. Epifaunal Substrate	5	no units	
2. Embeddedness	12	no units	
3. Velocity/Depth Regime	5	no units	
4. Sediment Deposition	12	no units	
5. Channel Flow Status	10	no units	
6. Channel Alteration	13	no units	
7. Freq. Of Riffles (bends)	7	no units	
8. Bank stability (both combined)	10	no units	
9. Veg. Protection (both combined)	12	no units	
10. Riparian Width (both combined)	6	no units	
Total Habitat Score	**92**	no units	**Subindex**
Habitat Integrity Index			**0.10**
Macroinvertebrate Data - Family Level (All Habitats)			
11. Family Taxa Richness	0	# of taxa sampled	
12. Family EPT Richness	0	# of EPT species sampled	
13. % Ephemeroptera	0	% Mayflies (0-100)	
14. % Chironomidae & Oligochaeta	0	% Midges & Worms (0-100)	
15. mFBI	0	no units	
Macroinvertebrate Bioassessment	**NA**	no units	**NA**
Conductivity	**824**	microMHOs	**0.10**

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (Version 2002.6)

(Family Level Taxonomy - All Habitats)

Project ID:	**Rye Development - Bell County Water Battery**
Stream/Reach:	**REACH 5**
Assessment Objectives:	**Baseline**

EII	Model
NA	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.27	Ecological Integrity Index (Habitat Integrity + Conductivity)

>>>>>>> Enter quantitative or categorical measure from Field Data Sheet in shaded cells

Variables	Measure	Units	Subindex
RBP Habitat Parameters			
1. Epifaunal Substrate	13	no units	
2. Embeddedness	10	no units	
3. Velocity/Depth Regime	7	no units	
4. Sediment Deposition	10	no units	
5. Channel Flow Status	6	no units	
6. Channel Alteration	15	no units	
7. Freq. Of Riffles (bends)	10	no units	
8. Bank stability (both combined)	10	no units	
9. Veg. Protection (both combined)	14	no units	
10. Riparian Width (both combined)	16	no units	
Total Habitat Score	111	no units	
Habitat Integrity Index			0.21
Macroinvertebrate Data - Family Level (All Habitats)			
11. Family Taxa Richness	0	# of taxa sampled	
12. Family EPT Richness	0	# of EPT species sampled	
13. % Ephemeroptera	0	% Mayflies (0-100)	
14. % Chironomidae & Oligochaeta	0	% Midges & Worms (0-100)	
15. mFBI	0	no units	
Macroinvertebrate Bioassessment	NA	no units	NA
Conductivity	402	microMHOs	0.32

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (Version 2002.6)

****(Family Level Taxonomy - All Habitats)****

Project ID: Rye Development - Bell County Water Battery

Stream/Reach: REACH 5A

Assessment Objectives: Baseline

EII	Model
NA	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.30	Ecological Integrity Index (Habitat Integrity + Conductivity)

>>>>>>> Enter quantitative or categorical measure from Field Data Sheet in shaded cells

Variables	Measure	Units	
RBP Habitat Parameters			
1. Epifaunal Substrate	13	no units	
2. Embeddedness	10	no units	
3. Velocity/Depth Regime	7	no units	
4. Sediment Deposition	10	no units	
5. Channel Flow Status	6	no units	
6. Channel Alteration	15	no units	
7. Freq. Of Riffles (bends)	10	no units	
8. Bank stability (both combined)	10	no units	
9. Veg. Protection (both combined)	14	no units	
10. Riparian Width (both combined)	16	no units	
Total Habitat Score	**111**	no units	**Subindex**
Habitat Integrity Index			**0.21**
Macroinvertebrate Data - Family Level (All Habitats)			
11. Family Taxa Richness	0	# of taxa sampled	
12. Family EPT Richness	0	# of EPT species sampled	
13. % Ephemeroptera	0	% Mayflies (0-100)	
14. % Chironomidae & Oligochaeta	0	% Midges & Worms (0-100)	
15. mFBI	0	no units	
Macroinvertebrate Bioassessment	**NA**	no units	**NA**
Conductivity	**375**	microMHOs	**0.39**

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (Version 2002.6)

(Family Level Taxonomy - All Habitats)

Project ID:	**Rye Development - Bell County Water Battery**
Stream/Reach:	**REACH 5A -1 AND 5A-2**
Assessment Objectives:	**Baseline**

EII	Model
NA	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.31	Ecological Integrity Index (Habitat Integrity + Conductivity)

	Variables	Measure	Units	Subindex
>>>>>>>	Enter quantitative or categorical measure from Field Data Sheet in shaded cells			
	RBP Habitat Parameters			
	1. Epifaunal Substrate	11	no units	
	2. Embeddedness	10	no units	
	3. Velocity/Depth Regime	7	no units	
	4. Sediment Deposition	10	no units	
	5. Channel Flow Status	6	no units	
	6. Channel Alteration	15	no units	
	7. Freq. Of Riffles (bends)	10	no units	
	8. Bank stability (both combined)	14	no units	
	9. Veg. Protection (both combined)	14	no units	
	10. Riparian Width (both combined)	16	no units	
	Total Habitat Score	113	no units	
	Habitat Integrity Index			0.23
	Macroinvertebrate Data - Family Level (All Habitats)			
	11. Family Taxa Richness	0	# of taxa sampled	
	12. Family EPT Richness	0	# of EPT species sampled	
	13. % Ephemeroptera	0	% Mayflies (0-100)	
	14. % Chironomidae & Oligochaeta	0	% Midges & Worms (0-100)	
	15. mFBI	0	no units	
	Macroinvertebrate Bioassessment	NA	no units	NA
	Conductivity	375	microMHOs	0.39

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (Version 2002.6)

(Family Level Taxonomy - All Habitats)

Project ID: Rye Development - Bell County Water Battery

Stream/Reach: REACH 6 EPHEMERAL AND INTERMITTENT

Assessment Objectives: Baseline

EII	Model
NA	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.17	Ecological Integrity Index (Habitat Integrity + Conductivity)

>>>>>>> Enter quantitative or categorical measure from Field Data Sheet in shaded cells

Variables	Measure	Units	
RBP Habitat Parameters			
1. Epifaunal Substrate	13	no units	
2. Embeddedness	10	no units	
3. Velocity/Depth Regime	10	no units	
4. Sediment Deposition	10	no units	
5. Channel Flow Status	5	no units	
6. Channel Alteration	13	no units	
7. Freq. Of Riffles (bends)	10	no units	
8. Bank stability (both combined)	14	no units	
9. Veg. Protection (both combined)	12	no units	
10. Riparian Width (both combined)	16	no units	
Total Habitat Score	**113**	no units	**Subindex**
Habitat Integrity Index			**0.23**
Macroinvertebrate Data - Family Level (All Habitats)			
11. Family Taxa Richness	0	# of taxa sampled	
12. Family EPT Richness	0	# of EPT species sampled	
13. % Ephemeroptera	0	% Mayflies (0-100)	
14. % Chironomidae & Oligochaeta	0	% Midges & Worms (0-100)	
15. mFBI	0	no units	
Macroinvertebrate Bioassessment	**NA**	no units	**NA**
Conductivity	**657**	microMHOs	**0.10**

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (Version 2002.6)

(Family Level Taxonomy - All Habitats)

Project ID: Rye Development - Bell County Water Battery

Stream/Reach: REACH 6 PERENNIAL

Assessment Objectives: Baseline

EII	Model
NA	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.22	Ecological Integrity Index (Habitat Integrity + Conductivity)

>>>>>>> Enter quantitative or categorical measure from Field Data Sheet in shaded cells

Variables	Measure	Units	Subindex
RBP Habitat Parameters			
1. Epifaunal Substrate	13	no units	
2. Embeddedness	10	no units	
3. Velocity/Depth Regime	10	no units	
4. Sediment Deposition	10	no units	
5. Channel Flow Status	15	no units	
6. Channel Alteration	13	no units	
7. Freq. Of Riffles (bends)	10	no units	
8. Bank stability (both combined)	14	no units	
9. Veg. Protection (both combined)	12	no units	
10. Riparian Width (both combined)	16	no units	
Total Habitat Score	123	no units	
Habitat Integrity Index			0.33
Macroinvertebrate Data - Family Level (All Habitats)			
11. Family Taxa Richness	0	# of taxa sampled	
12. Family EPT Richness	0	# of EPT species sampled	
13. % Ephemeroptera	0	% Mayflies (0-100)	
14. % Chironomidae & Oligochaeta	0	% Midges & Worms (0-100)	
15. mFBI	0	no units	
Macroinvertebrate Bioassessment	NA	no units	NA
Conductivity	657	microMHOs	0.10

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (Version 2002.6)

(Family Level Taxonomy - All Habitats)

Project ID:	**Rye Development - Bell County Water Battery**
Stream/Reach:	**REACH 7A-1 AND 7B-1**
Assessment Objectives:	**Baseline**

EII	Model
NA	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.30	Ecological Integrity Index (Habitat Integrity + Conductivity)

>>>>>>> Enter quantitative or categorical measure from Field Data Sheet in shaded cells

Variables	Measure	Units	Subindex
RBP Habitat Parameters			
1. Epifaunal Substrate	8	no units	
2. Embeddedness	10	no units	
3. Velocity/Depth Regime	5	no units	
4. Sediment Deposition	10	no units	
5. Channel Flow Status	5	no units	
6. Channel Alteration	15	no units	
7. Freq. Of Riffles (bends)	8	no units	
8. Bank stability (both combined)	12	no units	
9. Veg. Protection (both combined)	12	no units	
10. Riparian Width (both combined)	8	no units	
Total Habitat Score	**93**	no units	
Habitat Integrity Index			**0.10**
Macroinvertebrate Data - Family Level (All Habitats)			
11. Family Taxa Richness	0	# of taxa sampled	
12. Family EPT Richness	0	# of EPT species sampled	
13. % Ephemeroptera	0	% Mayflies (0-100)	
14. % Chironomidae & Oligochaeta	0	% Midges & Worms (0-100)	
15. mFBI	0	no units	
Macroinvertebrate Bioassessment	**NA**	no units	**NA**
Conductivity	**322**	microMHOs	**0.51**

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (Version 2002.6)

(Family Level Taxonomy - All Habitats)

Project ID: Rye Development - Bell County Water Battery

Stream/Reach: Reach 8

Assessment Objectives: Baseline

EII	Model
NA	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.37	Ecological Integrity Index (Habitat Integrity + Conductivity)

>>>>>>> Enter quantitative or categorical measure from Field Data Sheet in shaded cells

Variables	Measure	Units	Subindex
RBP Habitat Parameters			
1. Epifaunal Substrate	13	no units	
2. Embeddedness	15	no units	
3. Velocity/Depth Regime	13	no units	
4. Sediment Deposition	15	no units	
5. Channel Flow Status	15	no units	
6. Channel Alteration	16	no units	
7. Freq. Of Riffles (bends)	13	no units	
8. Bank stability (both combined)	16	no units	
9. Veg. Protection (both combined)	16	no units	
10. Riparian Width (both combined)	16	no units	
Total Habitat Score	148	no units	
Habitat Integrity Index			0.63
Macroinvertebrate Data - Family Level (All Habitats)			
11. Family Taxa Richness	0	# of taxa sampled	
12. Family EPT Richness	0	# of EPT species sampled	
13. % Ephemeroptera	0	% Mayflies (0-100)	
14. % Chironomidae & Oligochaeta	0	% Midges & Worms (0-100)	
15. mFBI	0	no units	
Macroinvertebrate Bioassessment	NA	no units	NA
Conductivity	1150	microMHOs	0.10

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (Version 2002.6)

****(Family Level Taxonomy - All Habitats)****

Project ID:	**Rye Development - Bell County Water Battery**
Stream/Reach:	**Reach 9**
Assessment Objectives:	**Baseline**

EII	Model
NA	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.10	Ecological Integrity Index (Habitat Integrity + Conductivity)

>>>>>>> Enter quantitative or categorical measure from Field Data Sheet in shaded cells

Variables	Measure	Units	Subindex
RBP Habitat Parameters			
1. Epifaunal Substrate	6	no units	
2. Embeddedness	10	no units	
3. Velocity/Depth Regime	6	no units	
4. Sediment Deposition	10	no units	
5. Channel Flow Status	5	no units	
6. Channel Alteration	11	no units	
7. Freq. Of Riffles (bends)	6	no units	
8. Bank stability (both combined)	14	no units	
9. Veg. Protection (both combined)	14	no units	
10. Riparian Width (both combined)	14	no units	
Total Habitat Score	**96**	no units	**Subindex**
Habitat Integrity Index			**0.10**
Macroinvertebrate Data - Family Level (All Habitats)			
11. Family Taxa Richness	0	# of taxa sampled	
12. Family EPT Richness	0	# of EPT species sampled	
13. % Ephemeroptera	0	% Mayflies (0-100)	
14. % Chironomidae & Oligochaeta	0	% Midges & Worms (0-100)	
15. mFBI	0	no units	
Macroinvertebrate Bioassessment	**NA**	no units	**NA**
Conductivity	**1150**	microMHOs	**0.10**

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (Version 2002.6)

(Family Level Taxonomy - All Habitats)

Project ID:	**Rye Development - Bell County Water Battery**
Stream/Reach:	**Reach 10**
Assessment Objectives:	**Baseline**

EII	Model
NA	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.10	Ecological Integrity Index (Habitat Integrity + Conductivity)

>>>>>>> Enter quantitative or categorical measure from Field Data Sheet in shaded cells

Variables	Measure	Units	Subindex
RBP Habitat Parameters			
1. Epifaunal Substrate	6	no units	
2. Embeddedness	10	no units	
3. Velocity/Depth Regime	6	no units	
4. Sediment Deposition	10	no units	
5. Channel Flow Status	1	no units	
6. Channel Alteration	10	no units	
7. Freq. Of Riffles (bends)	6	no units	
8. Bank stability (both combined)	14	no units	
9. Veg. Protection (both combined)	14	no units	
10. Riparian Width (both combined)	14	no units	
Total Habitat Score	91	no units	
Habitat Integrity Index			0.10
Macroinvertebrate Data - Family Level (All Habitats)			
11. Family Taxa Richness	0	# of taxa sampled	
12. Family EPT Richness	0	# of EPT species sampled	
13. % Ephemeroptera	0	% Mayflies (0-100)	
14. % Chironomidae & Oligochaeta	0	% Midges & Worms (0-100)	
15. mFBI	0	no units	
Macroinvertebrate Bioassessment	NA	no units	NA
Conductivity	1300	microMHOs	0.10

Photo 93 – Old Reach 5 – facing upstream (at upstream limits of project)

Photo 94 – Old Reach 5 – facing downstream (at upstream limits of project)

Photo 95 – Old Reach 5 – pond inlet

Photo 96 – Old Reach 5 – pond overview

Photo 97 – Old Reach 4 – facing upstream

Photo 98 – Old Reach 4 – facing downstream

Photo 99 – Old Reach 4 – at stream confluence – facing upstream

Photo 100 – Old Reach 4 – facing downstream

Photo 101 – Reach 1 – facing upstream

Photo 102 - Reach 1 – facing downstream

Photo 103 – Old Reach 5 – pond overview

Photo 104 – Old Reach 5 – pond overview

Photo 105 – Old Reach 3 – inside faceup area

Photo 106 – Old Reach 3 – inside faceup area

Photo 107 – Old Reach 3 – pond overview

Photo 108 – Old Reach 3 – pond overview

Photo 109 – Old Reach 3 – small pond overview

Photo 110 – Old Reach 3 – small pond overview

Photo 111 – Old Reach 3 – pond overview

Photo 112 – Old Reach 3 – pond overview

Photo 113 – Reach 8 – overview of pond

Photo 114 – Reach 8 – overview of pond

Photo 148 – Reach 8 – downstream of pond – facing upstream

Photo 149 – Reach 8 – downstream of pond – facing downstream

Photo 150 – Wetland 1 – soil profile

Photo 151 – Wetland 1 – overview

Photo 152 – Wetland 1 – overview

Photo 153 – Wetland 1 – upland soil profile

Photo 154 – Wetland 1 – upland vegetation

Photo 155 – Reach 9 – exiting Wetland 1 – facing downstream

Photo 156 – Reach 9 – facing downstream

Photo 158 – Wetland 4 – soil profile

Photo 159 – Wetland 4 – overview

Photo 160 – Wetland 4 – overview


Photo 161 – Wetland 3 – soil profile


Photo 162 – Wetland 3 – overview

Photo 164 – Wetland 3 – overview

Photo 165 – Reach 10 – facing upstream

Photo 166 – Reach 10 – facing downstream

Photo 167 – Wetland 2 – soil profile

Photo 168 – Wetland 2 – overview

Photo 169 – Wetland 2 – overview

Photo 171 – Reach 3 – facing upstream

Photo 172 – Reach 3 – facing downstream

Photo 174 – Reach 3B – facing upstream

Photo 175 – Reach 3B – facing downstream

Photo 1314 – Reach 5A-2 – facing upstream

Photo 1315 – Reach 5A-2 – facing downstream

Photo 1316 – Reach 5A-2 – facing upstream

Photo 1318 – Reach 5A-2 – facing downstream

Photo 1319 – Reach 5A-1 – facing upstream

Photo 1320 – Reach 5A-1 – facing downstream

Photo 1321 – Reach 5A-1 and 5A-2 – facing upstream

Photo 1322 – Reach 5A – facing downstream


Photo 1323 – Reach 5A – facing upstream


Photo 1324 – Reach 5A – facing downstream

Photo 1325 – Reach 5A – facing upstream

Photo 1326 – Reach 5 – facing upstream

Photo 1327 – Old Hollow Fill 1 side drain – facing downstream

Photo 1328 – Reach 5 – facing upstream

Photo 1329 – Reach 5 – facing downstream

Photo 1330 – Reach 5 – facing upstream

Photo 1331 – Reach 5 – facing downstream

Photo 1332 – Reach 5 – facing upstream (near upstream terminus)

Photo 1333 – Reach 5 – facing downstream (near upstream terminus)

Photo 1336 – Reach 4 – facing upstream

Photo 1337 – Reach 4 – facing downstream

Photo 1338 – Wetland 5

Photo 1339 – Wetland 5

Photo 1340 – Reach 4 – facing upstream

Photo 1341 – Reach 4 – facing downstream

Photo 1342 – Reach 4 – facing upstream

Photo 1343 – Reach 4 – facing downstream

Photo 1345 – Reach 4A – facing upstream

Photo 1346 – Reach 4A – facing downstream

Photo 1347 – Reach 6 – facing upstream

Photo 1348 – Reach 6 – facing downstream

Photo 1350 – Reach 6 – facing upstream

Photo 1351 – Reach 6 – facing downstream

Photo 1352 – Reach 6 – facing upstream into ephemeral break point

Photo 1353 – Reach 6 – facing downstream into intermittent break point

Photo 1354 – Reach 6 – facing upstream

Photo 1355 – Reach 6 – facing downstream

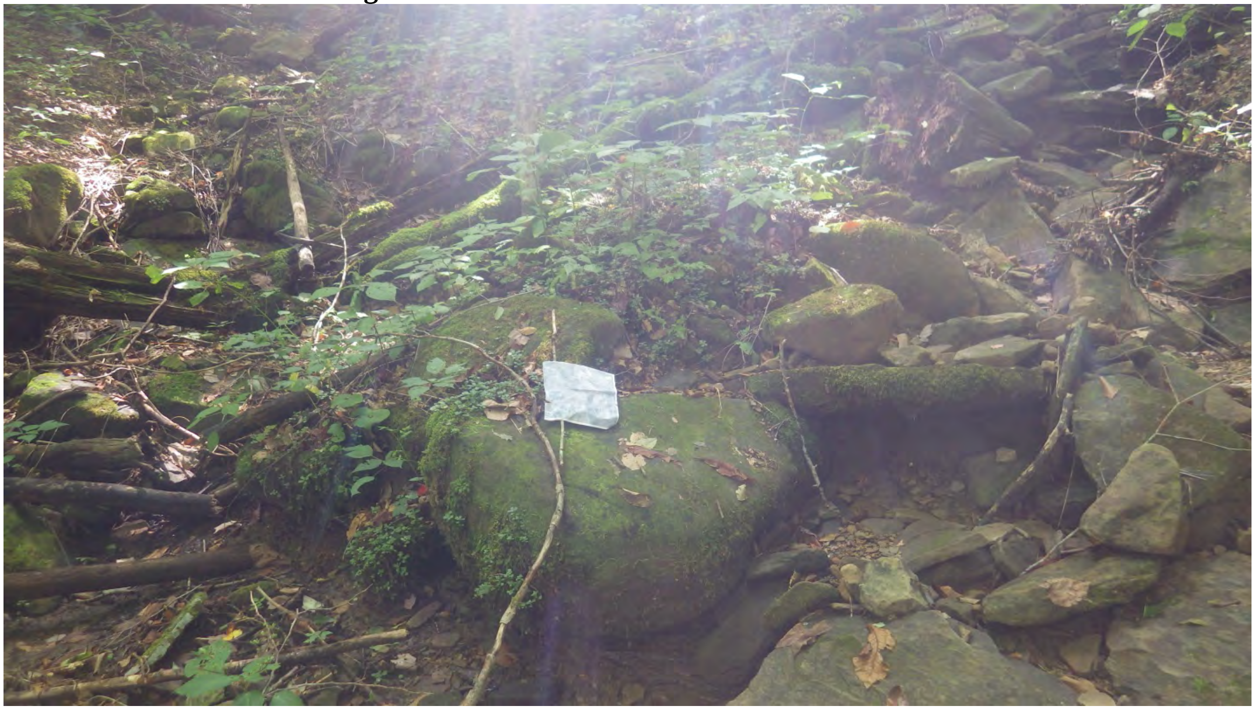


Photo 1356 – Reach 6 – facing upstream

Photo 1357 – Reach 6 – facing downstream

Photo 1358 – Reach 6 – facing upstream near terminus

Photo 1359 – Reach 6 – facing downstream near terminus

Photo 1360 – Wetland 6

Photo 1361 – Wetland 6

Photo 1362 – Reach 7A-1 – facing upstream

Photo 1363 – Reach 7A-1 – facing downstream

.

Photo 1364 – Reach 7B-1 – facing upstream

Photo 1365 – Reach 7B-1 – facing downstream

Photo 1367 – Reach 7B-1 – facing upstream

Photo 1368 – Reach 7B-1 – facing downstream

Photo 1369 – Reach 7A – facing upstream

Photo 1370 – Reach 7B – facing upstream

Photo 1371 – Reach 7 – facing downstream

Photo 1372 – Reach 7 – facing upstream

Photo 1373 – Reach 7 – facing downstream

Photo 1374 – Old Hollow Fill side drain facing upstream

Photo 1375 – Old Hollow Fill side drain – facing downstream

Photo 1376 – Reach 1 – facing upstream

Photo 1377 – Reach 1 – facing downstream

Photo 1378 – Unnamed reach outside of project area adjacent to office

Photo 1379 – Reach 1 – facing upstream

Photo 1380 – Reach 1 – facing downstream

Photo 1381 – Reach 1 – facing upstream

Photo 1382 – Reach 1 – facing downstream

Photo 1383 – Reach 1 – facing upstream (at railroad crossing)

Photo 1384 – Reach 1 – facing downstream (at railroad crossing)

Photo 1385 – Reach 1 – facing upstream at confluence with the Cumberland River

Photo 1386 – Reach 1 – facing downstream at confluence with the Cumberland River

APPENDIX C

BLACKSIDE DACE HABITAT ASSESSMENT

BLACKSIDE DACE HABITAT ASSESSMENT

Project ID:	Lewis Ridge Pumped Storage Project FERC No. 15249 Bell County, Kentucky Project No. KY24-035
Prepared for:	Michael Ricci, PE, Principal Engineer RESPEC
Prepared by:	Bert Remley Senior Aquatic Ecologist
Prepared on:	August 26, 2024

BACKGROUND

Third Rock Consultants, LLC (Third Rock) was retained by RESPEC to provide threatened and endangered species services associated with the potential development of a site on Tom Fork in Bell County, Kentucky (**Vicinity Map**, **Appendix A**). Specifically, Third Rock was asked to assess Tom Fork and its tributaries for suitability of federally listed threatened blackside dace (*Chrosomus cumberlandemsis*) habitat associated with the proposed Lewis Ridge Pumped Storage Project. The Project is a proposed, unconstructed pumped storage hydroelectric generating facility located in Bell County, Kentucky on previously mined land. This Technical Memorandum (TM) documents the methodology and findings of the blackside dace (BSD) habitat assessment.

STUDY AREA

For purposes of this TM, "study area" is defined as Tom Fork and tributaries as illustrated on **Exhibit 1** (**Appendix B**).

The study area is within the Puckett Creek - Cumberland River (HUC12: 051301010204) watershed at center coordinates 36.761031, -83.552943. Land use is primarily active/inactive surface mining, floodplain forest, and upland forested areas. Forested areas adjacent to Tom Fork are generally narrow and composed of mature trees with dense groundcover. The topography is relatively steep, with settlement ponds interspersed within the Tom Fork watershed.

METHODOLOGY

Third Rock permitted personnel evaluated Tom Fork within the proposed project area for potential BSD habitat on July 25, 2024. Third Rock personnel followed procedures outlined in the draft Lewis Ridge Pump Storage Project Study Plan developed by Kleinschmidt Associates (May 2024). Potential BSD habitat was assessed in 10 stations within the Tom Fork watershed, the locations of which were delineated with an EOS Arrow 100+ GPS unit. Field data sheets were completed, and representative photo documentation of upstream and downstream habitat were taken at each station within the study area.

Water quality and physical habitat were evaluated at each station. Sampling locations were located near the confluence with the Cumberland River and at evenly spaced sampling locations along Toms Fork until the stream was no longer considered capable of supporting BSD (i.e. intermittent flow, steep gradient).

Water quality measurements were taken with a Hydrolab multi-parameter water quality probe. The probe was calibrated prior to field use. Dissolved oxygen concentration, dissolved oxygen percent saturation, pH, and specific conductance were recorded from each sampling location on a Kentucky Division of Water (KDOW) High Gradient Habitat Assessment Datasheet.

Physical habitat assessments were conducted at each site concurrent with water quality sampling. The US EPA's Rapid Bioassessment Protocol (RBP) (Barbour *et al.* 1999, KDOW 2022) were used for assessing stream habitat based on ten physical habitat parameters that characterize the stream "micro-scale" habitat, "macro-scale" features, and the riparian and bank structure features. Habitat scores were then compared to habitat criteria for the Mountain Bioregion to determine a narrative rating. For the Mountain Bioregion, habitat scores less than 117 are labeled "poor", scores between 117 to 159 are labeled "fair", and scores greater than 159 are labeled "good" (KDOW 2022).

Water quality data and habitat assessments were compared to BSD requirements (USFWS 2015). BSD are usually excluded from streams with specific conductance levels over 343 microsiemens per centimeter (µS/cm). BSD inhabit perennial headwater streams that have a wetted width of 6 to 17 feet, relatively high riffle-pool ratio, gradient between 1 and 6 percent, and moderate current velocities. They are not found in the steeper, high gradient upper headwater reaches, or in low gradient downstream reaches with a much higher proportion of deeper pools containing large predators. Other habitat factors that correlate well with the presence of BSD are low turbidity and low silt loads and relatively cool summer water temperatures. The latter is tied to good riparian cover and shading that helps keep water temperatures down. Adult BSD are found in pools with undercut banks, root wads, or overhanging vegetation. Pool depth can vary from less than a foot to more than three (3) feet deep.

FINDINGS

Habitat assessment and water quality sampling station locations are illustrated on aerial mapping (**Exhibit 2, Appendix B**) and documented by representative photographs (**Photo Log**, **Appendix C**). Field habitat assessment data sheets are included in **Appendix D**.

BSD habitat assessments and water quality sampling were conducted at nine (9) stations on the mainstem of Tom Fork, and on one (1) unnamed tributary (Station S7). All other tributaries were too small to support BSD. Water quality sampling results are presented in **Table 1** below.

The water temperature generally decreased from downstream to upstream in the watershed, except for the unnamed tributary (Station S7) which had the warmest temperature recorded (23.9 °Celsius). The riparian zone right descending bank was dominated by kudzu (*Pueraria* sp.) and provided little to no shade for the stream. Dissolved oxygen levels were above both chronic (>5.0 mg/L) and acute (>4.0 mg/L) warmwater aquatic habitat (WAH) standards for all stations. Additionally, pH was with WAH criteria (6 to 9 standard units) for all stations. Specific conductance generally decreased from downstream to upstream. The unnamed tributary (S7) had the lowest specific conductance (581 µS/cm) of all stations. It is possible that the unnamed tributary was diluting specific conductance in the mainstem of Tom Fork for the first couple stations (S5 and S6) immediately downstream of its confluence with the mainstem.

Table 1. Water Quality Sampling Results

Parameter	Station									
	S1	S2	S3	S4	S5	S6	S7*	S8	S9	S10
Temperature (Celsius)	21.3	21.2	20.0	20.5	20.3	20.4	23.9	18.5	18.1	17.7
Dissolved Oxygen (mg/L)	8.6	8.3	11.3	8.3	8.4	8.4	7.3	8.6	9.0	8.8
% Dissolved Oxygen Saturation	96.7	94.9	98.8	93.6	95.7	95.2	88.4	93.9	97.4	95.7
pH (Standard Units)	7.8	8.2	7.6	7.7	7.9	7.9	7.6	8.0	7.9	8.0
Specific Conductance (µS/cm)	888	894	746	754	684	688	581	772	774	775

* Station S7 was located on an Unnamed tributary to Tom Fork, all other stations were located on the mainstem of Tom Fork.

Habitat rated "fair" at all stations assessed on Tom Fork and on the unnamed tributary. The riparian zone of the descending bank along Tom Fork was generally narrower than the left descending bank due to either previous mining activity or the presence of a mining road. The amount of epifaunal substrate/available cover decreased slightly from downstream to upstream stations. Root wads and undercut banks became sparse then entirely absent from the downstream to upstream stations. Additionally, the stream gradient became steeper in the upstream stations compared to the downstream stations, especially compared to Stations S1 and S2. Habitat assessment results are summarized in **Table 2** (Page 4).

Table 2. Habitat Assessment Results

Habitat Parameter	Station									
	S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**
Epifaunal Substrate/Available Cover	14	12	13	12	11	11	11	10	12	10
Embeddedness	14	15	14	14	12	11	12	11	12	11
Velocity Depth/Regime	12	12	10	11	8	10	7	9	10	8
Sediment Deposition	15	13	12	11	10	13	13	9	13	10
Channel Flow Status	12	12	8	10	9	12	12	12	12	9
Channel Alteration	14	13	15	15	14	11	11	14	17	15
Frequency of Riffles	17	17	17	17	17	17	17	17	17	17
Bank Stability - Left Bank	8	6	8	9	9	9	6	5	6	8
Bank Stability - Right Bank	8	8	8	9	9	6	6	6	6	8
Vegetative Protection - Left Bank	8	7	7	7	9	8	7	6	7	9
Vegetative Protection - Right Bank	8	4	8	7	6	6	6	6	7	9
Riparian Vegetative Zone Width - Left Bank	4	9	2	9	9	9	9	9	9	9
Riparian Vegetative Zone Width - Right Bank	3	1	6	9	7	1	1	8	9	7
Habitat Score	**137**	**129**	**128**	**140**	**130**	**124**	**118**	**122**	**137**	**130**
Habitat Rating*	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair

*Habitat Ratings for streams of the Mountain Bioregion: < 117 (Poor), 117-159 (Fair), and >159 (Good).

Riffle and run substrates were generally dominated by coarse substrate (cobble/boulder), and pools were generally dominated by finer substrates (gravel/sand). Pool habitat was scarce throughout the watershed but became mostly absent in the upstream stations as the gradient increased contributing to the stream being dominated by riffle/run habitat.

Fish were observed in the downstream stations, most likely creek chub (*Semotilus atromaculatus*) a pioneer fish species. Pioneer fishes are species that are usually the first fish species to colonize or re-colonize damaged or altered habitat. No fish were observed upstream of Station S5.

CONCLUSIONS

Blackside Dace Habitat

The specific conductance levels in the Tom Fork watershed make the stream and its tributaries uninhabitable for BSD. Specific conductance levels were mostly double or triple the specific conductance level (343 μS/cm) that usually exclude BSD from a stream. BSD habitat such as pool habitat, undercut banks, and root wads were mostly absent from Station S5 and upstream from there. Additionally, the stream gradient becomes too steep for BSD habitat beginning at Station S5. According to the United States Fish and Wildlife Service (USFWS 2015) there are not any known BSD populations in Tom Fork, or other Cumberland River tributaries within proximity to Tom Fork. Informal coordination with the USFWS Frankfort Field Office may be required prior to the initiation of construction activity.

REFERENCES

Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. *Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish.* Second Edition. EPA 841-B-99-002. USEPA, Office of Water, Washington, D.C.

Kentucky Division of Water (KDOW). 2022. Methods for Assessing Habitat in Wadeable Waters. Kentucky Department for Environmental Protection, Division of Water, Frankfort, Kentucky.

United States Fish and Wildlife Service. 2015. Blackside Dace (*Chrosomus cumberlandensis*) 5 Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service Southeast Region Kentucky Ecological Services Field Office. Frankfort, KY.

APPENDIX A

VICINITY MAP

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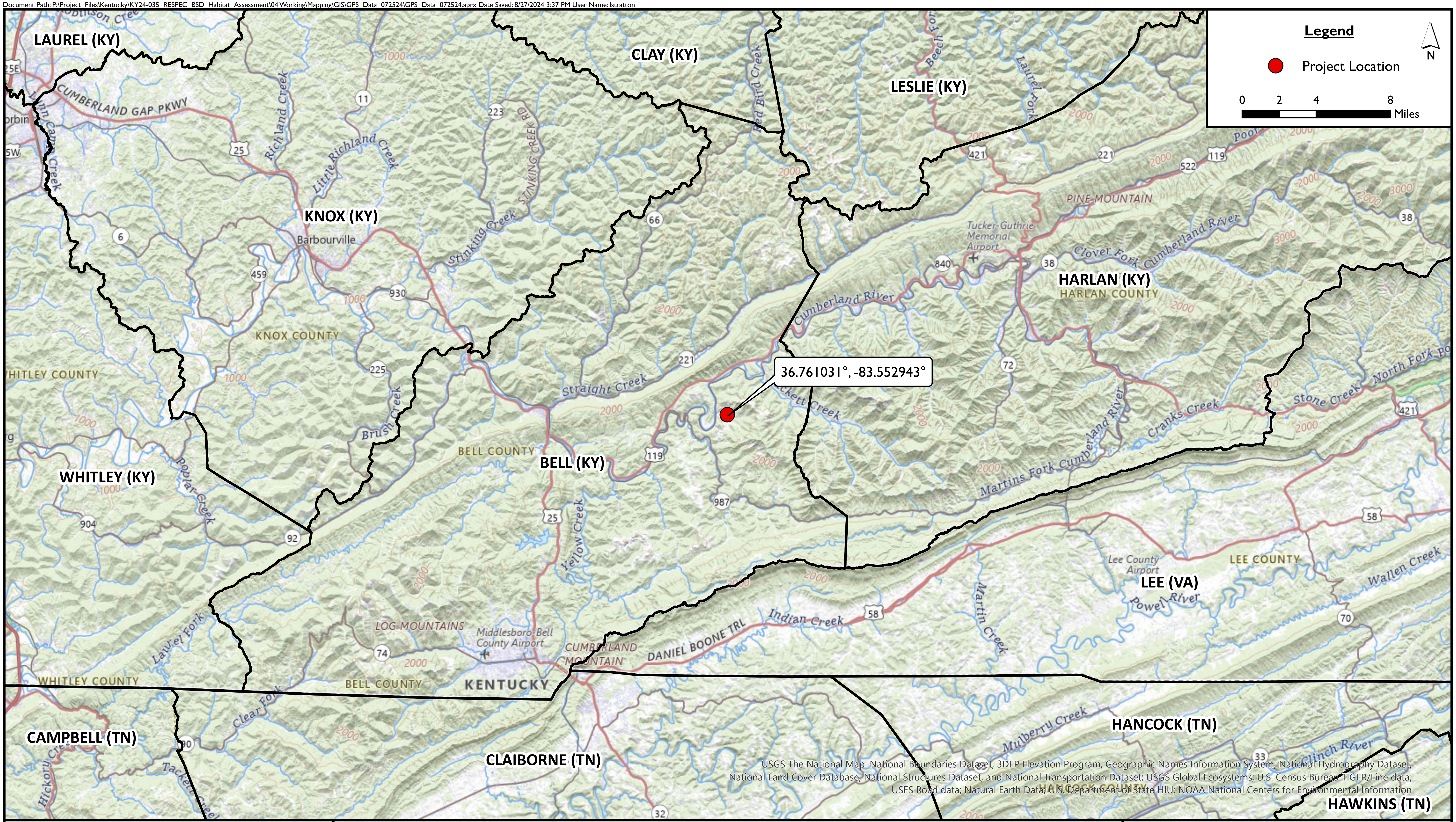


THIRD ROCK CONSULTANTS

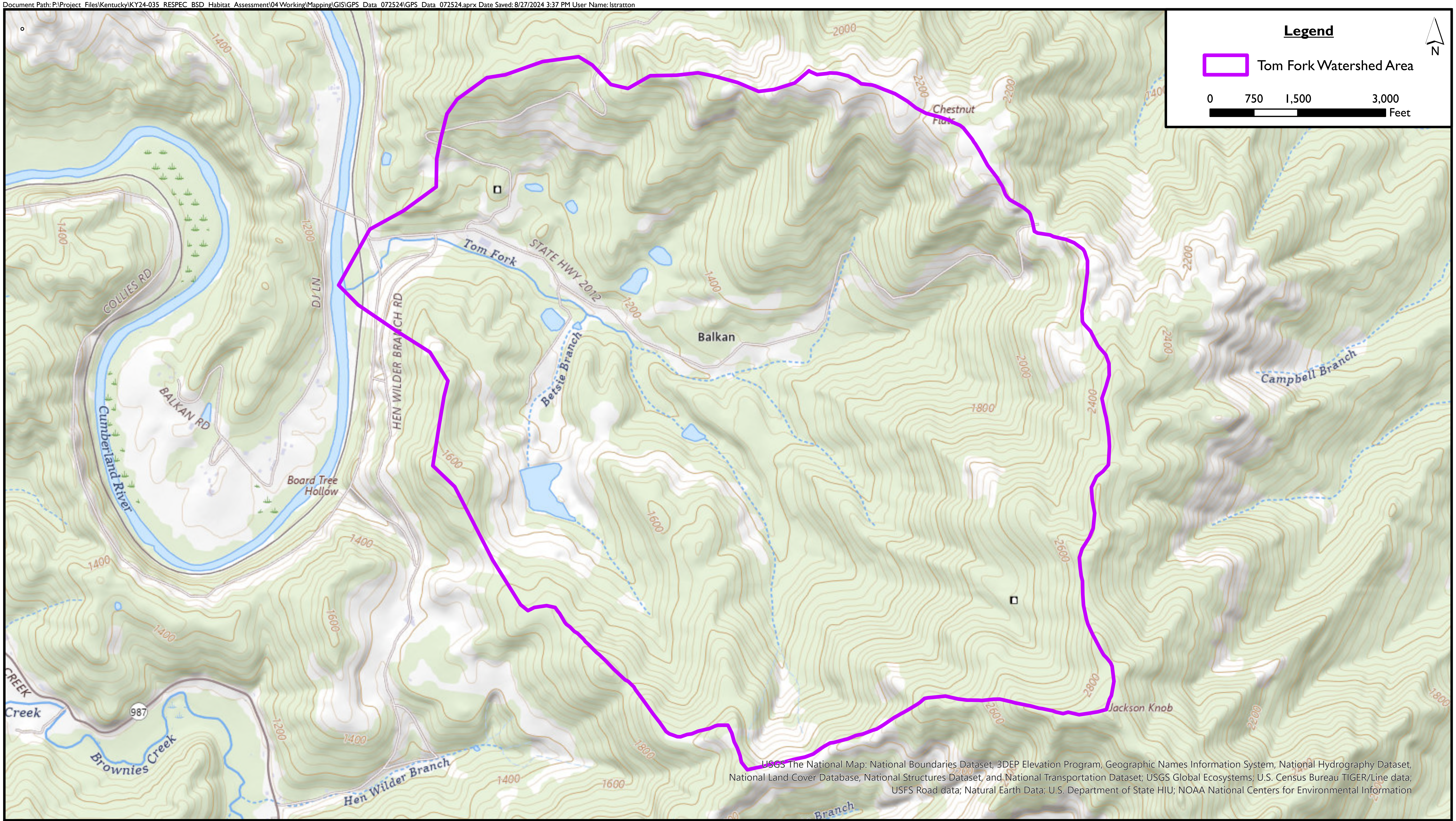
Project Vicinity
Blackside Dace Habitat Assessment
Lewis Ridge Pumped Storage Project
Bell County, Kentucky

Prepared for:
RESPEC
146 E Third St.
Lexington, Kentucky 40508

APPENDIX B

EXHIBITS 1 AND 2

Document Path: P:\Project_Files\Kentucky\KY24-035_RESPEC_BSD_Habitat_Assessment\04 Working\Mapping\GIS\GPS_Data_072524\GPS_Data_072524.aprx Date Saved: 8/27/2024 3:37 PM User Name: lstratton



USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Global Ecosystems; U.S. Census Bureau TIGER/Line data; USFS Road data; Natural Earth Data; U.S. Department of State HIU; NOAA National Centers for Environmental Information

THIRD ROCK
CONSULTANTS

Exhibit 1 - Tom Fork Watershed
Blackside Dace Habitat Assessment
Lewis Ridge Pumped Storage Project
Bell County, Kentucky

Prepared for:
RESPEC
146 E Third St.
Lexington, Kentucky 40508

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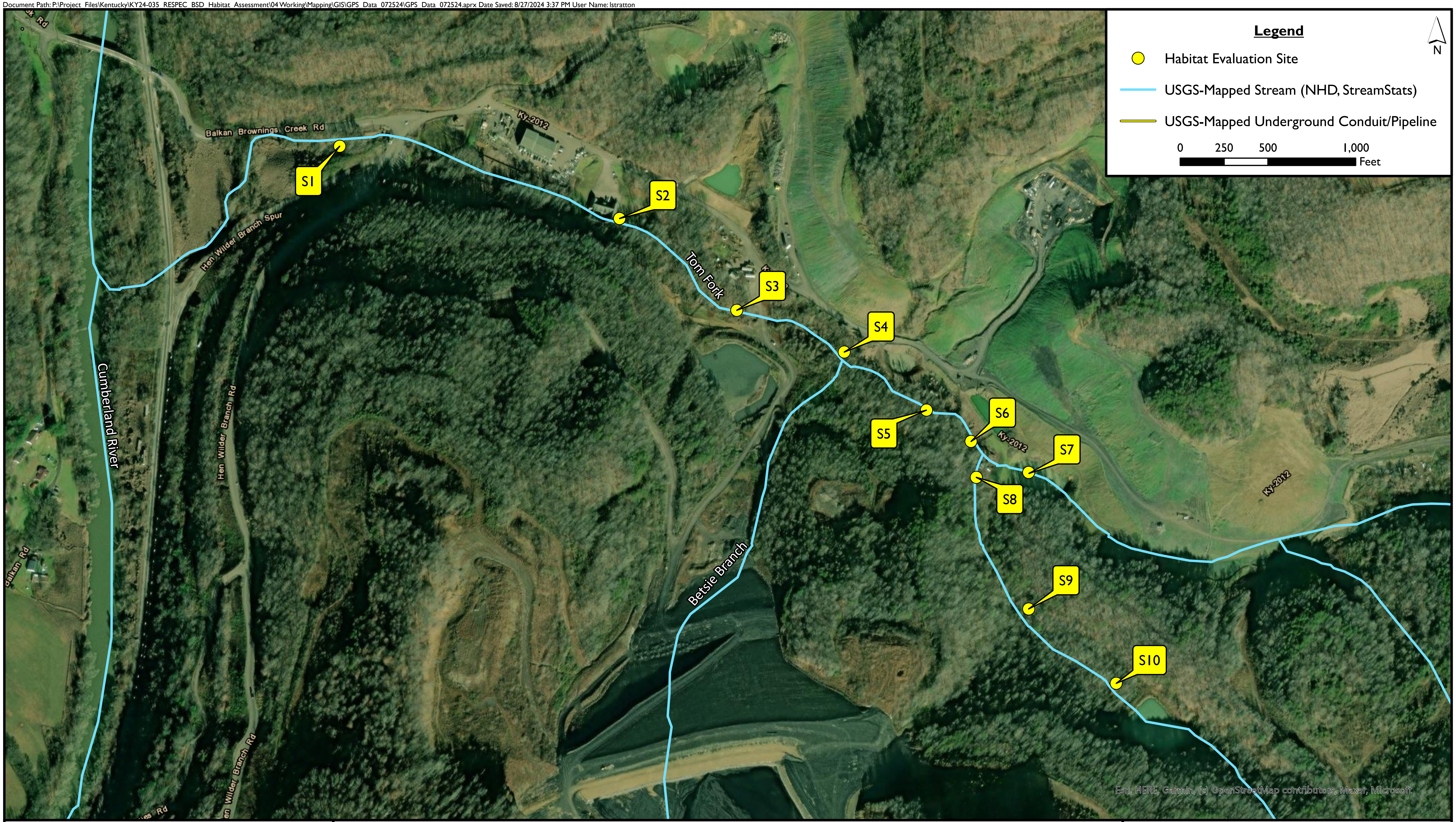

THIRD ROCK
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Exhibit 2 - Habitat Assessment Sites
Blackside Dace Habitat Assessment
Lewis Ridge Pumped Storage Project
Bell County, Kentucky

Prepared for:
RESPEC
146 E Third St.
Lexington, Kentucky 40508

APPENDIX C

PHOTO LOG

Station S1, Upstream View.jpg

Station S1, Downstream View.jpg

Station S2, Upstream View.jpeg

Station S2, Downstream View.jpeg

Station S3, Downstream View.jpeg

Station S3, Upstream View.jpeg

Station S4, Upstream View IMG_2037.jpeg

Station S4, Downstream View IMG_2038.jpeg

Station S5, Upstream View IMG_2039.jpeg

Station S5, Downstream View IMG_2040.jpeg

Station S6, Downstream View IMG_2041.jpeg

Station S6, Upstream View IMG_2042.jpeg

Station S7, Upstream View IMG_2043.jpeg

Station S7, Downstream View IMG_2044.jpeg

Station S8, Downstream View IMG_2045.jpeg

Station S8, Upstream View IMG_2046.jpeg

Station S9, Upstream View IMG_2047.jpeg

Station S9, Downstream View IMG_2049.jpeg

Station S10, Upstream View IMG_2052.jpeg

Station S10, Downstream View IMG_2053.jpeg

APPENDIX D

FIELD DATA SHEETS

High Gradient Habitat Assessment Datasheet

Page 1

Station Visit Information

Locale Name:	Tom Fork	**Project:**	KY 24-035	**Trip:**	BSD Habitat	**County:**	Bell
Station ID:	S1	**Loc. Desc.:**	downstream of Hen Wilder Br. Road			**Visit Date:**	7-25-24
Field Lead:	B. Remley	**Primary Bioregion:**	Mountain	**Secondary Bioregion:**	—	**Visit Start Time:**	1040a
Team:	BR/CW	**Stream Perm.**	Eph | Int | [✓ Per]	**Stream Type (HW or WA):**	HW	**Visit Finish Time:**	1115

STATION POINT VERIFICATION

	1) K-WADE Target Point	2) Field GPS Location	Nav. to Target Point Within GPS Error?	Target On Correct Stream?	Field GPS Error (M)	3) GPS Final	K-WADE Station Update	
Lat:		36.763091				K-WADE	Staff:	
Long:		-83.559144	[✓ Y] | N	[✓ Y] | N		Field	Date:	

WEATHER

Scouring Rain In Last 14 Days? YN	Y | [✓ N]
Now: Circle 1	HR | SR | IS CS | [✓ CO] | SSH
Past 24hr:	HR | SR | [✓ IS] CS | CO | SSH

Stream Shading

Leafed Out? Y/N	[✓ Y] | N
General Shading Circle 1	[✓ Full] | Partial | None

STREAM FLOW Circle 1

Dry | Pooled | Low

[✓ Seasonal Normal]

Above Normal | Flood

INSTREAM FEATURES

Avgerage Wetted Width (m):	3
Maximum Depth (m):	0.5
Reach Length (m):	100

RIFFLE/RUN/POOL SEQ.

# of riffles in reach	5
# of runs in reach	5
# of pools in reach	5

LOCAL WATERSHED FEATURES (Major Land Use): (Check all that are present)

Surface Mining	✓	Construction		Pasture/Grazing	
Deep Mining		Commercial		Silviculture	
Oil Wells		Industrial		Urban Runoff	
Land Disposal		Row Crops		Storm Sewers	
Residential		Forest	✓	Permitted Outfalls	

CHANNEL ALTERATIONS- Full, Partial or Not/None

Dredging:	F | P | [✓ N]	Channelization:	F | P | [✓ N]

RIPARIAN VEGETATION

Dom. Veg. Type:	Herbs | Grasses Shrubs | [✓ Trees]	# of Strata:	3
Dom. Taxa:	Box Elder / SYC		

HYDRAULIC STRUCTURES (Check all that are present)

Dams:		Bridge Abutments:		Fords:		Islands:		Waterfalls:		Berms:	

FIELD METER DATA

Temp (°C):	21.3	DO (mg/l):	8.6	DO %Sat:	96.7	pH (SU):	7.8	Sp. Cond (µS/cm):	888	Discharge CFS | Uncert.	moderate	

FIELD ACTIVITIES

Activity Completed?		Collectors	Collection Information (Check all that apply and/or enter/circle necessary information)
Algae:			QualMHC: | Visual Form: | R4MULTI: | Other:
Fish:			Equip.: BPEF | Seine | Barge | EF Seconds: | Seine Minutes:
Habitat:		BR/CW	Habitat data other than RBP? NO
Invertebrate:			$1m^2$ riffle + MH: | MACS 20-Jab: | Other:
Multihabs Sampled Y/N or # Jabs		Undercuts/Roots: | Sticks/Wood: | Leaf Packs: | *Justicia*: | Aufwuchs: | Edge: Bedrock/Slab: | Depositional: | Rock Pick: | Em. Veg.: | Wood Pick: | Other:	
Chemistry:			H_2SO_4 Lot #: | HNO_3 Lot #:
Multi-Probe:		BR/CW	Inst. ID: Quanta | Cal. Date: 7/25/24
Discharge:			Inst. ID: | Beam Check:
Other:			Other Desc:

SUBSTRATE CHARACTERIZATION

Substrate Category	% Riffle: 45	% Run: 35	% Pool: 20	Reach Total
Silt/Clay (<0.06 mm)				
Sand (0.06 – 2 mm)	20	40	55	34
Gravel (2-64 mm)	30	20	30	26.5
Cobble (64 – 256 mm)	45	40	15	37.25
Boulders (>256 mm)	5			2.25
Bedrock/Hardpan Clay				

Site Not Sampled (Reason)- Please Add Comments

Land Owner Denial
Too Deep/Impounded
Site Not Found
Unsafe
Dry
Other (See Comments)

Reach Location Description:	Just downstream of Nally Hamilton Mine entr	Weather Choices:	HR = Heavy Rain | SR = Steady Rain IS = Intermittent Showers | CS = Clear Sunny CO = Cloudy Overcast | SSH = Snow Sleet
Initial Data Review By:	ML	Initial Data Review Date:	7/26/24
Date Entered:	7/26/24		

Habitat	**Condition Category**			
Parameter	**Optimal**	**Suboptimal**	**Marginal**	**Poor**
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
1.Epifaunal Substrate/ Available Cover **Score** 14	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
2.Embeddedness **Score** 14	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
3.Velocity/ Depth Regime **Score** 12	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
4. Sediment Deposition **Score** 15	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
5.Channel Flow Status **Score** 12	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
6.Channel Alteration **Score** 14	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
7.Frequency of Riffles (or bends) **Score** 17	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
Left/Right Bank	10 9	8 7 6	5 4 3	2 1 0
8.Bank Stability LB 8 RB 8	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
9. Vegetative Protection LB 8 RB 8	More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the stream bank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the stream bank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
10. Riparian Vegetative Zone Width LB 4 RB 3	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.

137 Kudzu present in non forested areas

Some pools present with cover for BSD.

High Gradient Habitat Assessment Datasheet

Page 1

Station Visit Information

Locale Name:	Tom Fork	Project:	KY24-035	Trip:	BSO Habitat	County:	Bell
Station ID:	S2	Loc. Desc.:	behind Nally + Hamilton office			Visit Date:	7-2
Field Lead:	B. Pemley	Primary Bioregion:	Mountain	Secondary Bioregion:	—	Visit Start Time:	1120
Team:	BR/CO	Stream Perm.	Eph | Int | [✓ Per]	Stream Type (HW or WA):	HW	Visit Finish Time:	1150

STATION POINT VERIFICATION

	1) K-WADE Target Point	2) Field GPS Location	Nav. to Target Point Within GPS Error?	Target On Correct Stream?	Field GPS Error (M)	3) GPS Final	K-WADE Station Update	
Lat:		36.762187				K-WADE | Field	Staff:	
Long:		-83.554777	[✓ Y] | N	[✓ Y] | N			Date:	

WEATHER

Scouring Rain In Last 14 Days? YN	Y | [✓ N]
Now: Circle 1	HR | SR | IS CS | [✓ CO] | SSH
Past 24hr:	HR | SR | [✓ IS] CS | CO | SSH

Stream Shading

Leafed Out? Y/N	[✓ Y] | N
General Shading Circle 1	[✓ Full] | Partial | None

STREAM FLOW Circle 1

Dry | Pooled | Low
Seasonal Normal
Above Normal | Flood

INSTREAM FEATURES

Avgerage Wetted Width (m):	3
Maximum Depth (m):	0.5
Reach Length (m):	100

RIFFLE/RUN/POOL SEQ.

# of riffles in reach	5
# of runs in reach	4
# of pools in reach	3

LOCAL WATERSHED FEATURES (Major Land Use): (Check all that are present)

Surface Mining	✓	Construction		Pasture/Grazing	
Deep Mining		Commercial		Silviculture	
Oil Wells		Industrial		Urban Runoff	
Land Disposal	-	Row Crops		Storm Sewers	
Residential		Forest	✓	Permitted Outfalls	

CHANNEL ALTERATIONS- Full, Partial or Not/None

Dredging:	F | P | [✓ N]	Channelization:	F | P | [✓ N]

RIPARIAN VEGETATION

Dom. Veg. Type:	Herbs | Grasses Shrubs | [✓ Trees]	# of Strata:	3
Dom. Taxa:	sugar maple		

HYDRAULIC STRUCTURES (Check all that are present)

Dams:		Bridge Abutments:		Fords:		Islands:		Waterfalls:		Berms:	

FIELD METER DATA

Temp (°C):	21.2	DO (mg/l):	8.3	DO %Sat:	94.9	pH (SU):	8.2	Sp. Cond (µS/cm):	894	Discharge CFS | Uncert.	moderate

FIELD ACTIVITIES

Activity Completed?		Collectors	Collection Information (Check all that apply and/or enter/circle necessary information)							
Algae:			QualMHC:		Visual Form:		R4MULTI:		Other:	
Fish:			Equip.:	BPEF | Seine | Barge	EF Seconds:				Seine Minutes:	
Habitat:		BR/CW	Habitat data other than RBP?		NO					
Invertebrate:			1m² riffle + MH:		MACS 20-Jab:		Other:			
Multihabs Sampled Y/N or # Jabs		Undercuts/Roots: Bedrock/Slab:	Sticks/Wood: Depositional:	Leaf Packs: Rock Pick:	Justicia : Em. Veg.:	Aufwuchs: Wood Pick:	Edge: Other:			
Chemistry:			H_2SO_4 Lot #:			HNO_3 Lot #:				
Multi-Probe:		BR/CW	Inst. ID:	Quanta		Cal. Date:	7/25/24			
Discharge:			Inst. ID:			Beam Check:				
Other:			Other Desc:							

SUBSTRATE CHARACTERIZATION

Substrate Category	% Riffle: 50	% Run: 40	% Pool: 10	Reach Total
Silt/Clay (<0.06 mm)				
Sand (0.06 – 2 mm)	5	10	20	8.5
Gravel (2-64 mm)	10	30	50	22
Cobble (64 – 256 mm)	55	40	25	46
Boulders (>256 mm)	20	15	5	16.5
Bedrock/Hardpan Clay	10	5		7

Site Not Sampled (Reason)- Please Add Comments

Land Owner Denial
Too Deep/Impounded
Site Not Found
Unsafe
Dry
Other (See Comments)

Reach Location Description:	behind N+H office

Weather Choices:
HR = Heavy Rain | SR = Steady Rain
IS = Intermittent Showers | CS = Clear Sunny
CO = Cloudy Overcast | SSH = Snow Sleet

Initial Data Review By:	MM	Initial Data Review Date:	7/26/24	Date Entered:	7/26/24

Habitat	Condition Category			
Parameter	Optimal	Suboptimal	Marginal	Poor
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
1.Epifaunal Substrate/ Available Cover Score 12	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
2.Embeddedness Score 15	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
3.Velocity/ Depth Regime Score 12	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
4. Sediment Deposition Score 13	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
5.Channel Flow Status Score 12	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
6.Channel Alteration 7 20 years Score 13	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
7.Frequency of Riffles (or bends) Score 17	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
Left/Right Bank	10 9	8 7 6	5 4 3	2 1 0
8.Bank Stability LB 6 RB 8	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
9. Vegetative Protection LB 7 RB 4	More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the stream bank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the stream bank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
10. Riparian Vegetative Zone Width LB 9 RB 1	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.

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undercut banks + root wads sparse,
some Large boulders provide BSD cover

High Gradient Habitat Assessment Datasheet

Page 1

Station Visit Information

Locale Name:	Tom Fork	Project:	K123-055	Trip:	BSD Habitat	County:	Bell
Station ID:	53	Loc. Desc.:	below mine Road crossing			Visit Date:	7-25-24
Field Lead:	B. Remley	Primary Bioregion:	Mountain	Secondary Bioregion:	—	Visit Start Time:	1200
Team:	BR/CW	Stream Perm.	Eph | Int | [✓ Per]	Stream Type (HW or WA):	HW	Visit Finish Time:	1230

STATION POINT VERIFICATION

	1) K-WADE Target Point	2) Field GPS Location	Nav. to Target Point Within GPS Error?	Target On Correct Stream?	Field GPS Error (M)	3) GPS Final	K-WADE Station Update	
Lat:		36.761028				K-WADE Field	Staff:	
Long:		-83.552938	[✓ Y] | N	[✓ Y] | N			Date:	

WEATHER

Scouring Rain In Last 14 Days? YN	Y | [✓ N]
Now: Circle 1	HR | SR | IS CS | [✓ CO] | SSH
Past 24hr:	HR | SR | [✓ IS] CS | CO | SSH

Stream Shading

Leafed Out? Y/N	[✓ Y] | N
General Shading Circle 1	[✓ Full] | Partial | None 100%

STREAM FLOW Circle 1

Dry | Pooled | Low
[✓ Seasonal Normal]
Above Normal | Flood

INSTREAM FEATURES

Avgerage Wetted Width (m):	3
Maximum Depth (m):	0.2
Reach Length (m):	100

RIFFLE/RUN/POOL SEQ.

# of riffles in reach	6
# of runs in reach	6
# of pools in reach	0

LOCAL WATERSHED FEATURES (Major Land Use): (Check all that are present)

Surface Mining	✓	Construction		Pasture/Grazing	
Deep Mining		Commercial		Silviculture	
Oil Wells		Industrial		Urban Runoff	
Land Disposal		Row Crops		Storm Sewers	
Residential		Forest	✓	Permitted Outfalls	

CHANNEL ALTERATIONS- Full, Partial or Not/None

Dredging: F | P | [✓ N]   Channelization: F | P | [✓ N]

RIPARIAN VEGETATION

Dom. Veg. Type:	Herbs | Grasses Shrubs | Trees	# of Strata: 3
Dom. Taxa:	Sugar maple	

HYDRAULIC STRUCTURES (Check all that are present)

Dams:		Bridge Abutments:		Fords:		Islands:		Waterfalls:		Berms:	

FIELD METER DATA

Temp (°C):	20.0	DO (mg/l):	11.3	DO %Sat:	98.8	pH (SU):	7.6	Sp. Cond (µS/cm):	746	Discharge CFS | Uncert.	Fast

FIELD ACTIVITIES

Activity Completed?		Collectors	Collection Information (Check all that apply and/or enter/circle necessary information)					
Algae:			QualMHC:		Visual Form:		R4MULTI:	Other:
Fish:			Equip.:	BPEF | Seine | Barge	EF Seconds:		Seine Minutes:	
Habitat:		BR/CW	Habitat data other than RBP?	NA				
Invertebrate:			1m² riffle + MH:		MACS 20-Jab:		Other:	
Multihabs Sampled Y/N or # Jabs		Undercuts/Roots: Bedrock/Slab:	Sticks/Wood: Depositional:	Leaf Packs: Rock Pick:	Justicia: Em. Veg.:	Aufwuchs: Wood Pick:	Edge: Other:	
Chemistry:			H_2SO_4 Lot #:		HNO$_3$ Lot #:			
Multi-Probe:			Inst. ID:	Quanta	Cal. Date:	7-25-24		
Discharge:			Inst. ID:		Beam Check:			
Other:			Other Desc:					

SUBSTRATE CHARACTERIZATION

Substrate Category	% Riffle: 60	% Run: 40	% Pool: 0	Reach Total
Silt/Clay (<0.06 mm)				
Sand (0.06 – 2 mm)	10	10		10
Gravel (2-64 mm)	20	20		20
Cobble (64 – 256 mm)	40	40		40
Boulders (>256 mm)	30	30		30
Bedrock/Hardpan Clay				

Site Not Sampled (Reason)- Please Add Comments

- Land Owner Denial
- Too Deep/Impounded
- Site Not Found
- Unsafe
- Dry
- Other (See Comments)

Reach Location Description:	downstream mine Road Culvert

Weather Choices:
HR = Heavy Rain | SR = Steady Rain
IS = Intermittent Showers | CS = Clear Sunny
CO = Cloudy Overcast | SSH = Snow Sleet

Initial Data Review By:	M	Initial Data Review Date:	7/26/24	Date Entered:	7/26/24

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
1.Epifaunal Substrate/ Available Cover No undercut banks Score 13	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
2.Embeddedness Score 14	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
3.Velocity/ Depth Regime Score 10	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
4. Sediment Deposition Score 12	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
5.Channel Flow Status Score 8	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
6.Channel Alteration Score 15	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
7.Frequency of Riffles (or bends) Score 17	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
Left/Right Bank	10 9	8 7 6	5 4 3	2 1 0
8.Bank Stability LB 8 RB 8	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
9. Vegetative Protection 7* LB RB 8	More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the stream bank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the stream bank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
10. Riparian Vegetative Zone Width LB 2 RB 6	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
128	* Non-native Kudzu present			

No deep

High Gradient Habitat Assessment Datasheet

Station Visit Information

Locale Name:	Tom Fork	Project:	KY 24-035	Trip:	BSD Habitat	County:	Bell
Station ID:	54	Loc. Desc.:	Upstream of Mine Road crossing			Visit Date:	7-25-24
Field Lead:	B. Renley	Primary Bioregion:	Mountain	Secondary Bioregion:		Visit Start Time:	1300
Team:	BR/CW	Stream Perm.	Eph | Int | [✓ Per]	Stream Type (HW or WA):	HW	Visit Finish Time:	1330

STATION POINT VERIFICATION

	1) K-WADE Target Point	2) Field GPS Location	Nav. to Target Point Within GPS Error?	Target On Correct Stream?	Field GPS Error (M)	3) GPS Final	K-WADE Station Update	
Lat:		36.760482				K-WADE Field	Staff:	
Long:		-83.551270	[✓ Y] | N	[✓ Y] | N			Date:	

WEATHER

Scouring Rain In Last 14 Days? YN: Y | [✓ N]

Now: Circle 1: HR | SR | IS | [✓ CS] | CO | SSH

Past 24hr: HR | SR | [✓ IS] | CS | CO | SSH

Stream Shading

Leafed Out? Y/N: [✓ Y] | N

General Shading Circle 1: [✓ Full] | Partial | None
100%

STREAM FLOW Circle 1

Dry | Pooled | Low | [✓ Seasonal Normal] | Above Normal | Flood

INSTREAM FEATURES

Avgerage Wetted Width (m):	2.5
Maximum Depth (m):	0.5
Reach Length (m):	120

RIFFLE/RUN/POOL SEQ.

# of riffles in reach	6
# of runs in reach	6
# of pools in reach	1

LOCAL WATERSHED FEATURES (Major Land Use): (Check all that are present)

Surface Mining	✓	Construction		Pasture/Grazing	
Deep Mining		Commercial		Silviculture	
Oil Wells		Industrial		Urban Runoff	
Land Disposal		Row Crops		Storm Sewers	
Residential		Forest	✓	Permitted Outfalls	

CHANNEL ALTERATIONS- Full, Partial or Not/None

Dredging: F | P | [✓ N]

Channelization: F | P | [✓ N]

RIPARIAN VEGETATION

Dom. Veg. Type: Herbs | Grasses | Shrubs | [✓ Trees]

# of Strata: 3

Dom. Taxa: Sugar maple

HYDRAULIC STRUCTURES (Check all that are present)

Dams:		Bridge Abutments:		Fords:		Islands:		Waterfalls:		Berms:	

FIELD METER DATA

Temp (°C):	20.5	DO (mg/l):	8.3	DO %Sat:	93.6	pH (SU):	7.7	Sp. Cond (µS/cm):	754	Discharge CFS | Uncert.	Fast	

FIELD ACTIVITIES

Activity Completed?		Collectors	Collection Information (Check all that apply and/or enter/circle necessary information)					
Algae:			QualMHC:		Visual Form:		R4MULTI:	Other:
Fish:			Equip.:	BPEF | Seine | Barge	EF Seconds:		Seine Minutes:	
Habitat:		BR/CW	Habitat data other than RBP?	No				
Invertebrate:			1m² riffle + MH:		MACS 20-Jab:		Other:	
Multihabs Sampled Y/N or # Jabs		Undercuts/Roots: Bedrock/Slab:	Sticks/Wood: Depositional:	Leaf Packs: Rock Pick:	Justicia : Em. Veg.:	Aufwuchs: Wood Pick:	Edge: Other:	
Chemistry:			H_2SO_4 Lot #:		HNO_3 Lot #:			
Multi-Probe:		BR/CW	Inst. ID:	Quanta	Cal. Date:	7-25-24		
Discharge:			Inst. ID:		Beam Check:			
Other:			Other Desc.:					

SUBSTRATE CHARACTERIZATION

Substrate Category	% Riffle: 50	% Run: 40	% Pool: 10	Reach Total
Silt/Clay (<0.06 mm)				
Sand (0.06 – 2 mm)	10	10	20	12
Gravel (2-64 mm)	30	30	40	31
Cobble (64 – 256 mm)	35	35	20	33.5
Boulders (>256 mm)	25	25	10	23.5
Bedrock/Hardpan Clay				

Site Not Sampled (Reason)- Please Add Comments

Land Owner Denial
Too Deep/Impounded
Site Not Found
Unsafe
Dry
Other (See Comments)

Reach Location Description: downstream of supposed Betsie Br conf

Weather Choices:
HR = Heavy Rain | SR = Steady Rain
IS = Intermittent Showers | CS = Clear Sunny
CO = Cloudy Overcast | SSH = Snow Sleet

Initial Data Review By:	BR	Initial Data Review Date:	7/26/24	Date Entered:	7/26/24

High Gradient Habitat Assessment Datasheet

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
1. Epifaunal Substrate/ Available Cover Score 12	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
2. Embeddedness Score 14	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
3. Velocity/ Depth Regime Score 11	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
4. Sediment Deposition Score 11	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
5. Channel Flow Status Score 10	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
6. Channel Alteration Score 15	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
7. Frequency of Riffles (or bends) Score 17	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
Left/Right Bank	10 9	8 7 6	5 4 3	2 1 0
8. Bank Stability LB 9 RB 9	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
9. Vegetative Protection non natives present LB 7 RB 7	More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the stream bank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the stream bank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
10. Riparian Vegetative Zone Width LB 9 RB 9	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.

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Pool habitat is scarce, mostly riffle run. a Few Fish observed (creek chubs). Fast current, steeper gradient than S1-S3, no undercut banks.

NO sign of Betsie Branch confluence even though mapping indicates should be present. Likely moved during surface mining activities.

High Gradient Habitat Assessment Datasheet

Page 1

Station Visit Information

Locale Name:	Tom Fork	Project:	K124-035	Trip:	BSO Habitat	County:	Bell
Station ID:	55	Loc. Desc.:	upstream 54			Visit Date:	7-25-24
Field Lead:	B. Penley	Primary Bioregion:	mountain	Secondary Bioregion:	—	Visit Start Time:	1334
Team:	BR/CW	Stream Perm.	Eph | Int | [✓ Per]	Stream Type (HW or WA):	HW	Visit Finish Time:	1345

STATION POINT VERIFICATION

	1) K-WADE Target Point	2) Field GPS Location	Nav. to Target Point Within GPS Error?	Target On Correct Stream?	Field GPS Error (M)	3) GPS Final	K-WADE Station Update	
Lat:		36.7597894				Field	Staff:	
Long:		-83.5499864	[✓ Y] | N	[✓ Y] | N		K-WADE	Date:	

WEATHER

Scouring Rain In Last 14 Days? YN: Y | [✓ N]

Now: Circle 1: HR | SR | IS | CS | [✓ CO] | SSH

Past 24hr: HR | SR | [✓ IS] | CS | CO | SSH

Stream Shading

Leafed Out? Y/N: [✓ Y] | N

General Shading Circle 1: [✓ Full] | Partial | None 100

STREAM FLOW Circle 1

Dry | Pooled | Low | [✓ Seasonal Normal] | Above Normal | Flood

INSTREAM FEATURES

Avgerage Wetted Width (m):	2.5
Maximum Depth (m):	0.25
Reach Length (m):	100

RIFFLE/RUN/POOL SEQ.

# of riffles in reach	10
# of runs in reach	10
# of pools in reach	0

LOCAL WATERSHED FEATURES (Major Land Use): (Check all that are present)

Surface Mining	✓	Construction		Pasture/Grazing	
Deep Mining		Commercial		Silviculture	
Oil Wells		Industrial		Urban Runoff	
Land Disposal		Row Crops		Storm Sewers	
Residential		Forest	✓	Permitted Outfalls	

CHANNEL ALTERATIONS- Full, Partial or Not/None

Dredging: F | P | [✓ N]

Channelization: F | P | [✓ N]

RIPARIAN VEGETATION

Dom. Veg. Type: Herbs | Grasses | Shrubs | [✓ Trees]

# of Strata: 3

Dom. Taxa: Elm

HYDRAULIC STRUCTURES (Check all that are present)

Dams: | Bridge Abutments: | Fords: | Islands: | Waterfalls: | Berms:

FIELD METER DATA

Temp (°C):	20.3	DO (mg/l):	8.4	DO %Sat:	95.7	pH (SU):	7.9	Sp. Cond (µS/cm):	684	Discharge CFS | Uncert.	Fast	

FIELD ACTIVITIES

Activity Completed?		Collectors	Collection Information (Check all that apply and/or enter/circle necessary information)							
Algae:			QualMHC:		Visual Form:		R4MULTI:		Other:	
Fish:			Equip.:	BPEF | Seine | Barge	EF Seconds:				Seine Minutes:	
Habitat:		BR/CW	Habitat data other than RBP?	NO						
Invertebrate:			1m² riffle + MH:		MACS 20-Jab:		Other:			
Multihabs Sampled Y/N or # Jabs		Undercuts/Roots: Bedrock/Slab:	Sticks/Wood: Depositional:	Leaf Packs: Rock Pick:	Justicia: Em. Veg.:	Aufwuchs: Wood Pick:	Edge: Other:			
Chemistry:			H_2SO_4 Lot #:		HNO_3 Lot #:					
Multi-Probe:		BR/CW	Inst. ID:	Quanta	Cal. Date:	7-25-24				
Discharge:			Inst. ID:		Beam Check:					
Other:			Other Desc:							

SUBSTRATE CHARACTERIZATION

Substrate Category	% Riffle: 50	% Run: 50	% Pool:	Reach Total
Silt/Clay (<0.06 mm)				
Sand (0.06 – 2 mm)		20		10
Gravel (2-64 mm)	20	40		30
Cobble (64 – 256 mm)	40	20		30
Boulders (>256 mm)	40	20		30
Bedrock/Hardpan Clay				

Site Not Sampled (Reason)- Please Add Comments
- Land Owner Denial
- Too Deep/Impounded
- Site Not Found
- Unsafe
- Dry
- Other (See Comments)

Reach Location Description: upstream 54

Weather Choices:
HR = Heavy Rain | SR = Steady Rain
IS = Intermittent Showers | CS = Clear Sunny
CO = Cloudy Overcast | SSH = Snow Sleet

Initial Data Review By: mh

Initial Data Review Date: 7/26/24

Date Entered: 7/26/24

Habitat Parameter	**Condition Category**			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
1.Epifaunal Substrate/ Available Cover **Score** 11	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
2.Embeddedness **Score** 12	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
3.Velocity/ Depth Regime **Score** 8	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
4. Sediment Deposition **Score** 10	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
5.Channel Flow Status **Score** 9	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
6.Channel Alteration > 20 years **Score** 14	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
7.Frequency of Riffles (or bends) **Score** 17	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
Left/Right Bank	10 9	8 7 6	5 4 3	2 1 0
8.Bank Stability LB 9 RB 9	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
9. Vegetative Protection 9 LB RB 6 Non-natives	More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the stream bank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the stream bank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
10. Riparian Vegetative Zone Width LB 9 RB 7	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.

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Gradient increasing. Fish observed
water does not reach banks, therefore no rootwads
or undercut banks for cover

High Gradient Habitat Assessment Datasheet

Page 1

Station Visit Information

Locale Name:	Tom Fork	**Project:**	KY24-035	**Trip:**	BSD Habitat	**County:**	Bell
Station ID:	56	**Loc. Desc.:**	Just downstream conf/with UNT			**Visit Date:**	7-25-24
Field Lead:	B. Remley	**Primary Bioregion:**	Mountain	**Secondary Bioregion:**	—	**Visit Start Time:**	1350
Team:	BR/CW	**Stream Perm.**	Eph | Int | [✓ Per]	**Stream Type (HW or WA):**	HW	**Visit Finish Time:**	1400

STATION POINT VERIFICATION

	1) K-WADE Target Point	2) Field GPS Location	Nav. to Target Point Within GPS Error?	Target On Correct Stream?	Field GPS Error (M)	3) GPS Final	K-WADE Station Update	
Lat:		36.759398				K-WADE | Field	**Staff:**	
Long:		-83.549291	[✓ Y] | N	[✓ Y] | N			**Date:**	

WEATHER

Scouring Rain In Last 14 Days? YN	Y | [✓ N]
Now: Circle 1	HR | SR | IS CS | [✓ CO] | SSH
Past 24hr:	HR | SR | [✓ IS] CS | CO | SSH

Stream Shading

Leafed Out? Y/N	[✓ Y] | N
General Shading Circle 1	Full | [✓ Partial] | None 50%

STREAM FLOW Circle 1

Dry | Pooled | Low
[✓ Seasonal Normal]
Above Normal | Flood

INSTREAM FEATURES

Avgerage Wetted Width (m):	2
Maximum Depth (m):	0.1
Reach Length (m):	100

RIFFLE/RUN/POOL SEQ.

# of riffles in reach	4
# of runs in reach	4
# of pools in reach	0

LOCAL WATERSHED FEATURES (Major Land Use): (Check all that are present)

Surface Mining	✓	**Construction**		**Pasture/Grazing**	
Deep Mining		**Commercial**		**Silviculture**	
Oil Wells		**Industrial**		**Urban Runoff**	
Land Disposal		**Row Crops**		**Storm Sewers**	
Residential		**Forest**	✓	**Permitted Outfalls**	

CHANNEL ALTERATIONS- Full, Partial or Not/None

Dredging:	F | P | [✓ N]	**Channelization:**	F | P | [✓ N]

RIPARIAN VEGETATION

Dom. Veg. Type:	[✓ Herbs] | Grasses Shrubs | Trees	**# of Strata:**	3
Dom. Taxa:	Kudzu		

HYDRAULIC STRUCTURES (Check all that are present)

Dams:		**Bridge Abutments:**		**Fords:**		**Islands:**		**Waterfalls:**		**Berms:**	

FIELD METER DATA

Temp (°C):	20.4	**DO (mg/l):**	8.4	**DO %Sat:**	95.2	**pH (SU):**	7.9	**Sp. Cond (µS/cm):**	688	**Discharge CFS | Uncert.**	Fast	

FIELD ACTIVITIES

Activity Completed?		Collectors	Collection Information (Check all that apply and/or enter/circle necessary information)							
Algae:			**QualMHC:**		**Visual Form:**		**R4MULTI:**		**Other:**	
Fish:			**Equip.:**	BPEF | Seine | Barge	**EF Seconds:**				**Seine Minutes:**	
Habitat:		BR/CW	**Habitat data other than RBP?**	NC						
Invertebrate:			**1m² riffle + MH:**		**MACS 20-Jab:**		**Other:**			
Multihabs Sampled Y/N or # Jabs		Undercuts/Roots: Bedrock/Slab:	Sticks/Wood: Depositional:	Leaf Packs: Rock Pick:	Justicia : Em. Veg.:	Aufwuchs: Wood Pick:	Edge: Other:			
Chemistry:			**H_2SO_4 Lot #:**		**HNO_3 Lot #:**					
Multi-Probe:		BR/CW	**Inst. ID:**	Quanta	**Cal. Date:**	7-25-24				
Discharge:			**Inst. ID:**		**Beam Check:**					
Other:			**Other Desc:**							

SUBSTRATE CHARACTERIZATION

Substrate Category	% Riffle: 50	% Run: 50	% Pool: 0	Reach Total
Silt/Clay (<0.06 mm)				
Sand (0.06 – 2 mm)	10	20		15
Gravel (2-64 mm)	30	40		35
Cobble (64 – 256 mm)	40	30		35
Boulders (>256 mm)	20	10		15
Bedrock/Hardpan Clay				

Site Not Sampled (Reason)- Please Add Comments

Land Owner Denial
Too Deep/Impounded
Site Not Found
Unsafe
Dry
Other (See Comments)

Reach Location Description:	Just below conf w/UNT	**Weather Choices:**	HR = Heavy Rain | SR = Steady Rain IS = Intermittent Showers | CS = Clear Sunny CO = Cloudy Overcast | SSH = Snow Sleet
Initial Data Review By:		**Initial Data Review Date:**	7-26-24
Date Entered:	7-26-24		

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
1.Epifaunal Substrate/ Available Cover Score 11	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
2.Embeddedness Score 11	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
3.Velocity/ Depth Regime Score 10	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
4. Sediment Deposition Score 13	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
5.Channel Flow Status Score 12	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
6.Channel Alteration >20 years Score 11	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
7.Frequency of Riffles (or bends) Score 17	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
Left/Right Bank	10 9	8 7 6	5 4 3	2 1 0
8.Bank Stability LB 9 RB 6	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
9. Vegetative Protection LB 8 RB 6 Kudzu	More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the stream bank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the stream bank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
10. Riparian Vegetative Zone Width LB 9 RB 1	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.

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Right bank 100% Kudzu. no pool habitat. no Fish observed. NO undercut banks or root wad habitat.

High Gradient Habitat Assessment Datasheet

Page 1

Station Visit Information

Locale Name:	Unt Tom Fork	Project:	KY 24-035	Trip:	BSD Habitat	County:	Bell
Station ID:	57	Loc. Desc.:	Unt Tom Fork			Visit Date:	7-25-24
Field Lead:	B. Remley	Primary Bioregion:	Mountain	Secondary Bioregion:	—	Visit Start Time:	1405
Team:	BR/CW	Stream Perm.	Eph | Int | [✓ Per]	Stream Type (HW or WA):	HW	Visit Finish Time:	1418

STATION POINT VERIFICATION

	1) K-WADE Target Point	2) Field GPS Location	Nav. to Target Point Within GPS Error?	Target On Correct Stream?	Field GPS Error (M)	3] GPS Final	K-WADE Station Update	
Lat:		36.759332				K-WADE | Field	Staff:	
Long:		-83.549215	[✓ Y] | N	[✓ Y] | N			Date:	

WEATHER

Scouring Rain In Last 14 Days? YN	Y | [✓ N]
Now: Circle 1	HR | SR | IS CS | [✓ CO] | SSH
Past 24hr:	HR | SR | [✓ IS] CS | CO | SSH

Stream Shading

Leafed Out? Y/N	[✓ Y] | N
General Shading Circle 1	Full | [✓ Partial] | None 50%

STREAM FLOW Circle 1

Dry | Pooled | Low
[✓ Seasonal Normal]
Above Normal | Flood

INSTREAM FEATURES

Avgerage Wetted Width (m):	1
Maximum Depth (m):	0.1
Reach Length (m):	100

RIFFLE/RUN/POOL SEQ.

# of riffles in reach	4
# of runs in reach	4
# of pools in reach	0

LOCAL WATERSHED FEATURES (Major Land Use): (Check all that are present)

Surface Mining	✓	Construction		Pasture/Grazing	
Deep Mining		Commercial		Silviculture	
Oil Wells		Industrial		Urban Runoff	
Land Disposal		Row Crops		Storm Sewers	
Residential		Forest	✓	Permitted Outfalls	

CHANNEL ALTERATIONS- Full, Partial or Not/None

Dredging:	F | P | [✓ N]	Channelization:	F | P | [✓ N]

RIPARIAN VEGETATION

Dom. Veg. Type:	[✓ Herbs] | Grasses Shrubs | Trees	# of Strata:	3
Dom. Taxa:			Anadza

HYDRAULIC STRUCTURES (Check all that are present)

Dams:		Bridge Abutments:		Fords:		Islands:		Waterfalls:		Berms:	

FIELD METER DATA

Temp (°C):	23.9	DO (mg/l):	7.3	DO %Sat:	88.4	pH (SU):	7.6	Sp. Cond (µS/cm):	581	Discharge CFS | Uncert.	Fast	

FIELD ACTIVITIES

Activity Completed?		Collectors	Collection Information (Check all that apply and/or enter/circle necessary information)							
Algae:			QualMHC:		Visual Form:		R4MULTI:		Other:	
Fish:			Equip.:	BPEF | Seine | Barge	EF Seconds:				Seine Minutes:	
Habitat:		BR/CW	Habitat data other than RBP?		No					
Invertebrate:			1m² riffle + MH:		MACS 20-Jab:		Other:			
Multihabs Sampled Y/N or # Jabs		Undercuts/Roots: Bedrock/Slab:	Sticks/Wood: Depositional:		Leaf Packs: Rock Pick:		Justicia: Em. Veg.:	Aufwuchs: Wood Pick:	Edge: Other:	
Chemistry:			H_2SO_4 Lot #:				HNO_3 Lot #:			
Multi-Probe:		BR/CW	Inst. ID:	Quanta			Cal. Date:	7-25-24		
Discharge:			Inst. ID:				Beam Check:			
Other:			Other Desc:							

SUBSTRATE CHARACTERIZATION

Substrate Category	% Riffle: 60	% Run: 40	% Pool: 0	Reach Total
Silt/Clay (<0.06 mm)				
Sand (0.06 – 2 mm)	10	30		18
Gravel (2-64 mm)	20	30		24
Cobble (64 – 256 mm)	50	40		46
Boulders (>256 mm)	20			12
Bedrock/Hardpan Clay				

Site Not Sampled (Reason)- Please Add Comments

- Land Owner Denial
- Too Deep/Impounded
- Site Not Found
- Unsafe
- Dry
- Other (See Comments)

Reach Location Description:	Upstream From conf w/Tom Fork	Weather Choices:	HR = Heavy Rain | SR = Steady Rain IS = Intermittent Showers | CS = Clear Sunny CO = Cloudy Overcast | SSH = Snow Sleet
Initial Data Review By:	MA	Initial Data Review Date:	7-26-24
Date Entered:	7-26-24		

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
1. Epifaunal Substrate/ Available Cover Score 11	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
2. Embeddedness Score 12	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
3. Velocity/ Depth Regime Score 7	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
4. Sediment Deposition Score 13	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
5. Channel Flow Status Score 12	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
6. Channel Alteration >20 yrs Score 11	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
7. Frequency of Riffles (or bends) Score 17	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
Left/Right Bank	10 9	8 7 6	5 4 3	2 1 0
8. Bank Stability LB 6 RB 6	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
9. Vegetative Protection LB 7 RB 6	More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the stream bank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the stream bank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
10. Riparian Vegetative Zone Width LB 9 RB 1	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.

Kudzu dominated RDB stream is too small for BSD, possibly intermittent during dry periods. No cover or pools present for BSD. not BSD habitat.

High Gradient Habitat Assessment Datasheet

Page 1

Station Visit Information

Locale Name: Tom Fork
Project: KY24-035
Trip: BSD HabitaT
County: Bell

Station ID: S8
Loc. Desc.: Tom Fork upstream of Conf/wnt
Visit Date: 7/25/24

Field Lead: B. Renley
Primary Bioregion: Mountain
Secondary Bioregion: —
Visit Start Time: 1420

Team: BR/CW
Stream Perm.: Eph | Int | [✓ Per]
Stream Type (HW or WA): HW
Visit Finish Time: 1437

STATION POINT VERIFICATION

	1) K-WADE Target Point	2) Field GPS Location	Nav. to Target Point Within GPS Error?	Target On Correct Stream?	Field GPS Error (M)	3) GPS Final
Lat:		36.758949				K-WADE / Field
Long:		-83.549208	[✓ Y] | N	[✓ Y] | N		

K-WADE Station Update
Staff:
Date:

WEATHER

Scouring Rain In Last 14 Days? YN: Y | [✓ N]

Now: Circle 1: HR | SR | IS | CS | [✓ CO] | SSH

Past 24hr: HR | SR | [✓ IS] | CS | CO | SSH

Stream Shading

Leafed Out? Y/N: [✓ Y] | N

General Shading Circle 1: [✓ Full] | Partial | None

100%

STREAM FLOW Circle 1

Dry | Pooled | Low | [✓ Seasonal Normal] | Above Normal | Flood

INSTREAM FEATURES

Avgerage Wetted Width (m): 2
Maximum Depth (m): 0.15
Reach Length (m): 100

RIFFLE/RUN/POOL SEQ.

\# of riffles in reach: 7
\# of runs in reach: 6
\# of pools in reach: 0

LOCAL WATERSHED FEATURES (Major Land Use): (Check all that are present)

Surface Mining	✓	Construction		Pasture/Grazing	
Deep Mining		Commercial		Silviculture	
Oil Wells		Industrial		Urban Runoff	
Land Disposal		Row Crops		Storm Sewers	
Residential		Forest	✓	Permitted Outfalls	

CHANNEL ALTERATIONS- Full, Partial or Not/None

Dredging: F | P | [✓ N]
Channelization: F | P | [✓ N]

RIPARIAN VEGETATION

Dom. Veg. Type: Herbs | Grasses | Shrubs | [✓ Trees]
\# of Strata:
Dom. Taxa:

HYDRAULIC STRUCTURES (Check all that are present)

Dams:
Bridge Abutments:
Fords:
Islands:
Waterfalls:
Berms:

FIELD METER DATA

Temp (°C):	DO (mg/l):	DO %Sat:	pH (SU):	Sp. Cond (µS/cm):	Discharge CFS | Uncert.
18.5	9.6	93.9	8.0	772	Fast

FIELD ACTIVITIES

Activity Completed?		Collectors	Collection Information (Check all that apply and/or enter/circle necessary information)
Algae:			QualMHC: Visual Form: R4MULTI: Other:
Fish:			Equip.: BPEF | Seine | Barge EF Seconds: Seine Minutes:
Habitat:		BR/CW	Habitat data other than RBP? No
Invertebrate:			1m² riffle + MH: MACS 20-Jab: Other:
Multihabs Sampled Y/N or # Jabs		Undercuts/Roots: | Sticks/Wood: | Leaf Packs: | Justicia: | Aufwuchs: | Edge: Bedrock/Slab: | Depositional: | Rock Pick: | Em. Veg.: | Wood Pick: | Other:	
Chemistry:			H_2SO_4 Lot #: HNO$_3$ Lot #:
Multi-Probe:		BR/CW	Inst. ID: Quanta Cal. Date: 7-25-24
Discharge:			Inst. ID: Beam Check:
Other:			Other Desc:

SUBSTRATE CHARACTERIZATION

Substrate Category	% Riffle: 50	% Run: 50	% Pool: 0	Reach Total
Silt/Clay (<0.06 mm)				
Sand (0.06 – 2 mm)	10	20		15
Gravel (2-64 mm)	30	50		40
Cobble (64 – 256 mm)	40	20		30
Boulders (>256 mm)	20	10		15
Bedrock/Hardpan Clay				

Site Not Sampled (Reason)- Please Add Comments
- Land Owner Denial
- Too Deep/Impounded
- Site Not Found
- Unsafe
- Dry
- Other (See Comments)

Reach Location Description: upstream of Conf w/wnt

Weather Choices:
HR = Heavy Rain | SR = Steady Rain
IS = Intermittent Showers | CS = Clear Sunny
CO = Cloudy Overcast | SSH = Snow Sleet

Initial Data Review By: mr
Initial Data Review Date: 7-26-24
Date Entered: 7-26-24

Habitat **Parameter**	**Condition Category**			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
1.Epifaunal Substrate/ Available Cover **Score** 10	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
2.Embeddedness **Score** 11	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
3.Velocity/ Depth Regime **Score** 9	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
4. Sediment Deposition **Score** 9	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
5.Channel Flow Status **Score** 12	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
6.Channel Alteration **Score** 14	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
7.Frequency of Riffles (or bends) **Score** 17	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
Left/Right Bank	10 9	8 7 6	5 4 3	2 1 0
8.Bank Stability LB 5 RB 6	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
9. Vegetative Protection LB 6 RB 6	More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the stream bank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the stream bank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
10. Riparian Vegetative Zone Width LB 9 RB 6	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.

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Larger than UNT but still small. no pools, no Fish observed. no undercut banks

High Gradient Habitat Assessment Datasheet

Page 1

Station Visit Information

Locale Name:	Tom Fork	Project:	KY24-035	Trip:	BSD Habitat	County:	Bell
Station ID:	59	Loc. Desc.:	upstream S8			Visit Date:	7/25/24
Field Lead:	B. Ramley	Primary Bioregion:	Mountain	Secondary Bioregion:	—	Visit Start Time:	1440
Team:	BR/CW	Stream Perm.	Eph | [✓ Int | Per]	Stream Type (HW or WA):	HW	Visit Finish Time:	1455

STATION POINT VERIFICATION

	1) K-WADE Target Point	2) Field GPS Location	Nav. to Target Point Within GPS Error?	Target On Correct Stream?	Field GPS Error (M)	3) GPS Final	K-WADE Station Update	
Lat:		36.757301				Field K-WADE	Staff:	
Long:		83.548391	[✓ Y] | N	[✓ Y] | N			Date:	

WEATHER

Scouring Rain In Last 14 Days? YN	Y | [✓ N]		
Now: Circle 1	HR | SR | IS	CS | [✓ CO] | SSH	
Past 24hr:	HR | SR | [✓ IS]	CS | CO | SSH	

Stream Shading

Leafed Out? Y/N	[✓ Y] | N
General Shading Circle 1	[✓ Full] | Partial | None 100%

STREAM FLOW Circle 1

Dry | Pooled | Low

Seasonal Normal

Above Normal | Flood

INSTREAM FEATURES

Avgerage Wetted Width (m):	1.5
Maximum Depth (m):	0.15
Reach Length (m):	100

RIFFLE/RUN/POOL SEQ.

# of riffles in reach	7
# of runs in reach	6
# of pools in reach	2

LOCAL WATERSHED FEATURES (Major Land Use): (Check all that are present)

Surface Mining	✓	Construction		Pasture/Grazing	
Deep Mining		Commercial		Silviculture	
Oil Wells		Industrial		Urban Runoff	
Land Disposal		Row Crops		Storm Sewers	
Residential		Forest	✓	Permitted Outfalls	

CHANNEL ALTERATIONS- Full, Partial or Not/None

Dredging:	F | P | [✓ N]	Channelization:	F | P | [✓ N]

RIPARIAN VEGETATION

Dom. Veg. Type:	Herbs | Grasses Shrubs | [✓ Trees]	# of Strata:	3
Dom. Taxa:	Elm / Beech		

HYDRAULIC STRUCTURES (Check all that are present)

Dams:		Bridge Abutments:		Fords:		Islands:		Waterfalls:		Berms:	

FIELD METER DATA

Temp (°C):	18.1	DO (mg/l):	9.0	DO %Sat:	97.4	pH (SU):	7.9	Sp. Cond (µS/cm):	774	Discharge CFS | Uncert.	Fast	

FIELD ACTIVITIES

Activity Completed?		Collectors	Collection Information (Check all that apply and/or enter/circle necessary information)							
Algae:			QualMHC:		Visual Form:		R4MULTI:		Other:	
Fish:			Equip.:	BPEF | Seine | Barge	EF Seconds:				Seine Minutes:	
Habitat:		BR/CW	Habitat data other than RBP?		NO					
Invertebrate:			1m² riffle + MH:		MACS 20-Jab:		Other:			
Multihabs Sampled Y/N or # Jabs		Undercuts/Roots: Bedrock/Slab:	Sticks/Wood: Depositional:	Leaf Packs: Rock Pick:	Justicia : Em. Veg.:	Aufwuchs: Wood Pick:	Edge: Other:			
Chemistry:			H_2SO_4 Lot #:			HNO$_3$ Lot #:				
Multi-Probe:		BR/CW	Inst. ID:	Quanta		Cal. Date:	7-25-24			
Discharge:			Inst. ID:			Beam Check:				
Other:			Other Desc:							

SUBSTRATE CHARACTERIZATION

Substrate Category	% Riffle: 60	% Run: 20	% Pool: 20	Reach Total
Silt/Clay (<0.06 mm)				
Sand (0.06 – 2 mm)	10	10	30	14
Gravel (2-64 mm)	20	30	40	26
Cobble (64 – 256 mm)	40	50	20	38
Boulders (>256 mm)	30	10	10	22
Bedrock/Hardpan Clay				

Site Not Sampled (Reason)- Please Add Comments

Land Owner Denial
Too Deep/Impounded
Site Not Found
Unsafe
Dry
Other (See Comments)

Reach Location Description:	upstream S8

Weather Choices:
HR = Heavy Rain | SR = Steady Rain
IS = Intermittent Showers | CS = Clear Sunny
CO = Cloudy Overcast | SSH = Snow Sleet

Initial Data Review By:	BR	Initial Data Review Date:	7-26-24	Date Entered:	7-26-24

High Gradient Habitat Assessment Datasheet

Habitat Parameter	**Condition Category**			
	Optimal	Suboptimal	Marginal	Poor
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
1.Epifaunal Substrate/ Available Cover Score 12	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
2.Embeddedness Score 12	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
3.Velocity/ Depth Regime Score 10	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
4. Sediment Deposition Score 13	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
5.Channel Flow Status Score 12	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
6.Channel Alteration Score 17	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
7.Frequency of Riffles (or bends) Score 17	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
Left/Right Bank	10 9	8 7 6	5 4 3	2 1 0
8.Bank Stability LB 6 RB 6	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
9. Vegetative Protection LB 7 RB 7	More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the stream bank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the stream bank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
10. Riparian Vegetative Zone Width LB 9 RB 9	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.

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steep gradient. No Fish observed.

High Gradient Habitat Assessment Datasheet

Station Visit Information

Locale Name:	Tom Fork	Project:	KY24-035	Trip:	BSD Habitat	County:	Bell
Station ID:	S10	Loc. Desc.:	Below old Settlement Pond			Visit Date:	7-25-24
Field Lead:	B. Renley	Primary Bioregion:	Mountain	Secondary Bioregion:	—	Visit Start Time:	1500
Team:	BR/CW	Stream Perm.	Eph | [✓ Int] | Per	Stream Type (HW or WA):	HW	Visit Finish Time:	1530

STATION POINT VERIFICATION

	1) K-WADE Target Point	2) Field GPS Location	Nav. to Target Point Within GPS Error?	Target On Correct Stream?	Field GPS Error (M)	3) GPS Final	K-WADE Station Update	
Lat:		36.756371				K-WADE Field	Staff:	
Long:		-83.547025	[✓ Y] | N	[✓ Y] | N			Date:	

WEATHER

Scouring Rain In Last 14 Days? YN: Y | [✓ N]

Now: Circle 1: HR | SR | IS | CS | [✓ CO] | SSH

Past 24hr: HR | SR | [✓ IS] | CS | CO | SSH

Stream Shading

Leafed Out? Y/N: [✓ Y] | N

General Shading Circle 1: [✓ Full] | Partial | None 100

STREAM FLOW Circle 1

Dry | Pooled | Low | [✓ Seasonal Normal] | Above Normal | Flood

INSTREAM FEATURES

Avgerage Wetted Width (m): 1

Maximum Depth (m): 0.15

Reach Length (m): 100

RIFFLE/RUN/POOL SEQ.

of riffles in reach: 8

# of runs in reach: 8

# of pools in reach: 0

LOCAL WATERSHED FEATURES (Major Land Use): (Check all that are present)

Surface Mining	✓	Construction		Pasture/Grazing	
Deep Mining		Commercial		Silviculture	
Oil Wells		Industrial		Urban Runoff	
Land Disposal		Row Crops		Storm Sewers	
Residential		Forest	✓	Permitted Outfalls	

CHANNEL ALTERATIONS- Full, Partial or Not/None

Dredging: F | P | [✓ N]

Channelization: F | P | [✓ N]

RIPARIAN VEGETATION

Dom. Veg. Type: Herbs | Grasses | Shrubs | [✓ Trees]

# of Strata: 3

Dom. Taxa: Beech / sugar maple

HYDRAULIC STRUCTURES (Check all that are present)

Dams:		Bridge Abutments:		Fords:		Islands:		Waterfalls:		Berms:	

FIELD METER DATA

Temp (°C):	17.7	DO (mg/l):	8.6	DO %Sat:	95.7	pH (SU):	8.0	Sp. Cond (µS/cm):	775	Discharge CFS | Uncert.	Fast

FIELD ACTIVITIES

Activity Completed?		Collectors	Collection Information (Check all that apply and/or enter/circle necessary information)					
Algae:			QualMHC:		Visual Form:		R4MULTI:	Other:
Fish:			Equip.:	BPEF | Seine | Barge	EF Seconds:		Seine Minutes:	
Habitat:		BR/CW	Habitat data other than RBP?	NO				
Invertebrate:			1m² riffle + MH:		MACS 20-Jab:		Other:	
Multihabs Sampled Y/N or # Jabs		Undercuts/Roots: | Sticks/Wood: | Leaf Packs: | *Justicia*: | Aufwuchs: | Edge: Bedrock/Slab: | Depositional: | Rock Pick: | Em. Veg.: | Wood Pick: | Other:						
Chemistry:			H_2SO_4 Lot #:				HNO_3 Lot #:	
Multi-Probe:		BR/CW	Inst. ID:	Quanta			Cal. Date:	7-25-24
Discharge:			Inst. ID:				Beam Check:	
Other:			Other Desc:					

SUBSTRATE CHARACTERIZATION

Substrate Category	% Riffle: 60	% Run: 40	% Pool: 0	Reach Total
Silt/Clay (<0.06 mm)				
Sand (0.06 – 2 mm)		10		4
Gravel (2-64 mm)	20	50		32
Cobble (64 – 256 mm)	55	30		45
Boulders (>256 mm)	25	10		19
Bedrock/Hardpan Clay				

Site Not Sampled (Reason)- Please Add Comments

- Land Owner Denial
- Too Deep/Impounded
- Site Not Found
- Unsafe
- Dry
- Other (See Comments)

Reach Location Description: Below old Settlement Pond

Weather Choices:

HR = Heavy Rain	SR = Steady Rain
IS = Intermittent Showers	CS = Clear Sunny
CO = Cloudy Overcast	SSH = Snow Sleet

Initial Data Review By: M

Initial Data Review Date: 7-26-24

Date Entered: 7-26-24

Habitat Parameter	**Condition Category**			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
1.Epifaunal Substrate/ Available Cover Score 10	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
2.Embeddedness Score 11	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
3.Velocity/ Depth Regime Score 8	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Sow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
4. Sediment Deposition Score 10	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
5.Channel Flow Status Score 9	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
6.Channel Alteration 15 Score	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
7.Frequency of Riffles (or bends) Score 17	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
Left/Right Bank	10 9	8 7 6	5 4 3	2 1 0
8.Bank Stability LB 8 RB 8	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
9. Vegetative Protection LB 9 RB 9	More than 90% of the stream bank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the stream bank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the stream bank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
10. Riparian Vegetative Zone Width LB 9 RB 7	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.

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Steep gradient, No pools, NO Fish, no BSD habitat. old mine pond upstream. Rock Dam approximately 15' tall, Old pond upstream has been converted back to a very small intermittent stream, not BSD habitat.

APPENDIX D

RARE SPECIES REPORTS
(PRIVILEGED)

APPENDIX E

LISTED BAT PRESENCE/PROBABLE ABSENCE SURVEY
(PRIVILEGED)

APPENDIX F

ARCHAEOLOGICAL SURVEY
(PRIVILEGED)

APPENDIX G

CULTURAL HISTORIC SURVEY
(PRIVILEGED)

APPENDIX H

SOIL AND GEOLOGICAL RESOURCE INFORMATION

APPENDIX H

Appendix H-1:	Geologic Map of Balkan Quadrangle Bell and Harlan Counties Kentucky 1973
Appendix H-2:	Geologic Map of Cumberland Gap Coal Field
Appendix H-3:	Geologic Map of Kentucky 1988
Appendix H-4:	Geologic Map of Middlesboro and Part of the Bristol Quadrangles
Appendix H-5:	USDA NRCS Physical Soil Properties of Bell and Harlan County Kentucky
Appendix H-6:	MTR Mining Darby
Appendix H-7:	MTR Mining Kellioka
Appendix H-8:	Harlan Seam
Appendix H-9:	Pathfork Seam
Appendix H-10:	Hance Seam
Appendix H-11:	Mason Seam

Appendix H-1:

Geologic Map of Balkan Quadrangle Bell and Harlan Counties Kentucky 1973

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
V. E. McKELVEY, DIRECTOR

PREPARED IN COOPERATION WITH
THE COMMONWEALTH OF KENTUCKY, UNIVERSITY OF KENTUCKY
KENTUCKY GEOLOGICAL SURVEY
WALLACE W. HAGAN, DIRECTOR AND STATE GEOLOGIST

GEOLOGIC QUADRANGLE MAP
BALKAN QUADRANGLE, KENTUCKY
GQ-1127

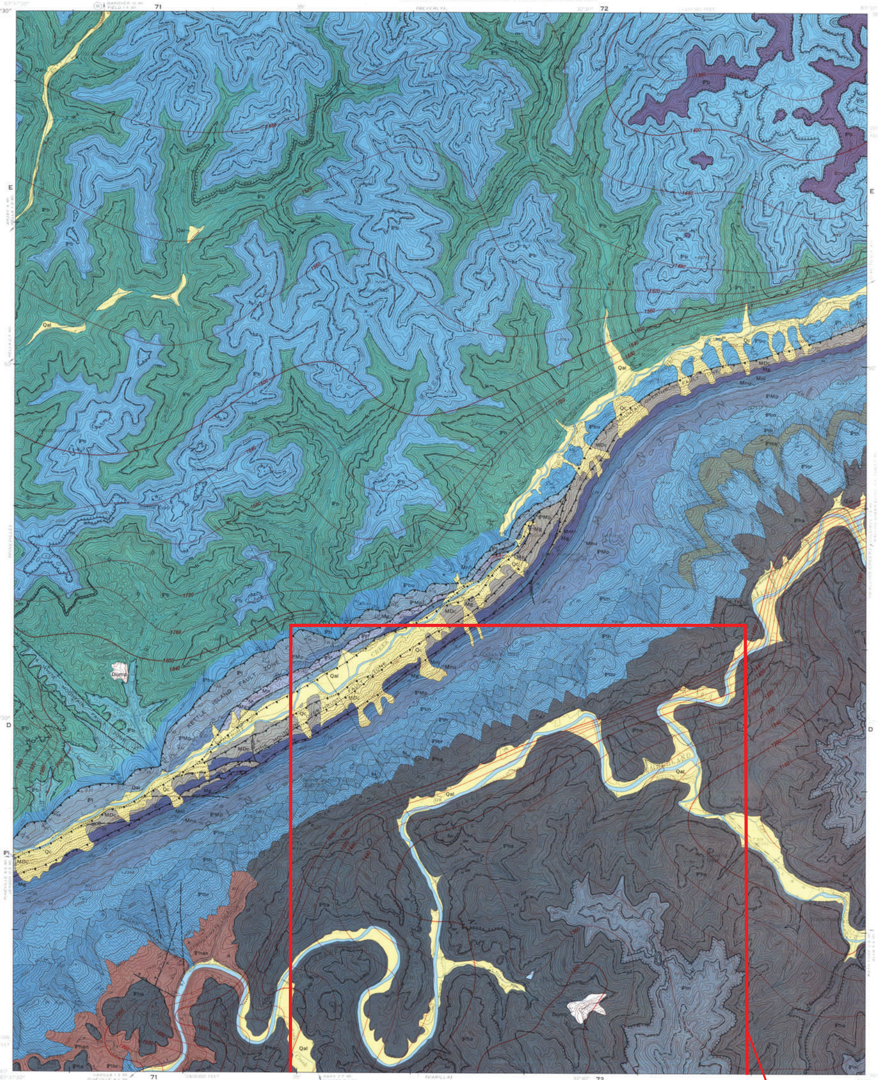
AREA NORTH OF PINE MOUNTAIN AND BENEATH OVERTHRUST FAULT

SYSTEM	SERIES	FORMATION AND BED	LITHOLOGY	THICKNESS OF COAL BED IN FEET	THICKNESS, IN FEET	DESCRIPTION
QUATERNARY		Alluvium and colluvium			0-30	Sand, silt, clay, and gravel. Alluvium consists of gravel overlain by poorly stratified sand, silt, and clay. Colluvium consists mainly of sandstone blocks and boulders in sandy to clayey matrix; widespread in steep gullies and as talus, fan, or landslide deposits; forms veneer along north slope and foot of Pine Mountain.
PENNSYLVANIAN	Lower and Middle Pennsylvanian	Breathitt Formation Hindman coal bed Hazard No. 8 coal bed Hazard No. 7(?) coal bed Hazard coal zone		?-3 ?-3½ 0-2 2-4 0-4 ?-3 0-1½ 1-3	240+ 140-180 180-240 660+	Sandstone, shale, siltstone, and coal: Sandstone, light- to dark-gray, very fine to fine-grained, generally silty, medium- to thin-bedded; locally medium to coarse grained, thick bedded, crossbedded, and moderately quartzose; sandstone beds are not continuous across the area. Shale and siltstone, olive-gray to gray; shale is locally sandy or silty. A fossiliferous marine zone consisting of about 10 feet of calcareous gray shale and nodular "blue" limestone locally overlies the Hindman coal bed. The Hazard No. 8 coal bed splits in the northeastern part of this quadrangle and forms a zone that commonly consists of two coal beds separated by 5 to 10 feet of shale or siltstone; the zone generally occurs between cliff-forming, medium- to coarse-grained, quartzose sandstone beds.
		Magoffin Beds of Morse (1931) Fire Clay rider coal bed Fire Clay coal bed		0-2½ 0-3½ 0-½ 1-3½ 1½-5½	200-270 190-240 390-460	Sandstone, siltstone, shale, and coal: Sandstone, medium- to light-gray, very fine to medium-grained, silty; interbedded with or gradational to siltstone; poorly exposed. Magoffin Beds of Morse (1931), is a fossiliferous, dark-gray, calcareous marine shale several feet thick. A sparsely fossiliferous silty gray marine shale commonly overlies the Fire Clay rider coal bed. The Fire Clay rider coal bed is thickest west of Stoney Fork in northwestern part of map area. The Fire Clay coal bed generally contains a distinctive flint-clay parting as much as 7 inches thick near its base; the flint clay is brownish gray with pearly luster and conchoidal fracture, and usually contains fossil plant trash.
		Kendrick Shale of Jillson (1919) Rim (Moss) coal zone Straight Creek coal bed		1-2½ 0-3 0?-1½ 0?-3½ 0-2 0-3 0-2½ 0-2 2-4 0-2 ?-1½	600-720 60-100 50-70	Shale, siltstone, sandstone, and coal: Shale and siltstone, gray to olive-gray; a thin black shale bed with sparse marine fossils commonly occurs in lowest third of unit. The Kendrick Shale of Jillson (1919) is poorly exposed north of Pine Mountain; sparse fossil fragments were recognized in silty shale only near northwest corner. Sandstone, medium-gray, fine- to medium-grained, locally very silty; common in eastern and western parts of area north of Pine Mountain. The upper coal bed in the Rim coal zone is the principal one in the zone; it is also known as the Moss coal bed (Lyons, 1963, p. 140). The Straight Creek coal bed in Bell County has been correlated with the Jellico coal bed (Lyons, 1963, p. 138); however, the Straight Creek bed may be an older one which lies as much as 200 feet below the Jellico equivalent. The Rim and Straight Creek coal beds apparently persist in the subsurface of most of the area north of the Kettle Island fault zone. The higher coal beds are rarely exposed and may be discontinuous.
				0-3?	550-620	Shale, siltstone, sandstone, and coal: Shale and siltstone, light- to dark-gray, interbedded; some dark-gray shale beds contain rare linguloid brachiopods. Sandstone, medium- to dark-gray, fine-grained, in thin interbeds in siltstone and shale. Coal beds and carbonaceous shale zones occur near top and middle of unit. Most of this unit, which dips steeply, is poorly exposed in structurally deformed belt north of Pine Mountain and in the Kettle Island fault zone; thickness data are mostly from drillers' logs of core holes.
	Lower Pennsylvanian	Lee Formation		? ?	700-800	Sandstone, shale, and coal: Sandstone, white to light-gray, fine- to coarse-grained, mostly quartzose and well-indurated; medium to thick bedded, crossbedded, generally pebbly, cliff forming. A thin lenticular chert-pebble conglomerate and a sheared, lenticular coal bed associated with silty carbonaceous shale between pebbly sandstone beds with coal fragments are exposed near mouth of Kettle Island Branch.
MISSISSIPPIAN AND PENNSYLVANIAN	?	Pennington Formation			500-600 1200-1350 Thickness based on subsurface data only	Sandstone, shale, and limestone: Sandstone, light- to medium-gray, very fine to medium-grained, argillaceous, moderately quartzose, locally pebbly; poorly exposed in fault slices. Shale, medium- to greenish-gray, rarely crops out. Limestone and shale sequence reported in drillers' logs.
MISSISSIPPIAN		Newman Limestone			360-440	Limestone and shale: Limestone, blue-gray to gray, fine- to medium-crystalline; basal part contains chert nodules; middle part granular and oolitic, locally fossiliferous; sandy and argillaceous near top. Upper part, seen only in fault slices, is medium- to dark-gray, lustrous, partly calcareous shale with thin greenish-gray shale or siltstone interbeds and lenses.
		Grainger Formation			240-330	Shale and siltstone, interbedded, dusky-red to greenish-gray, platy to blocky; thin-bedded, very fine grained greenish-gray sandstone at top of unit in a few places.
DEVONIAN AND MISSISSIPPIAN	? Upper Devonian	Chattanooga Shale			280+	Shale, dark-gray to black, carbonaceous, fissile to platy, locally sheared and slaty; locally silty, pyritic, with reddish-brown plant spores; commonly weathers to fragments with red-, yellow-, or green-hued surfaces.

AREA ALONG AND SOUTH OF PINE MOUNTAIN

SYSTEM	SERIES	GROUP, FORMATION, MEMBER, AND BED	LITHOLOGY	THICKNESS OF COAL BED IN FEET	THICKNESS, IN FEET	DESCRIPTION
QUATERNARY		Alluvium and colluvium			0-25	Sand, silt, clay and gravel. Alluvium occurs chiefly in poorly stratified floodplain and terrace deposits along Cumberland River, Tom Fork, and Puckett and Brownies Creeks. Colluvium and landslide deposits, not mapped, consist mainly of large angular sandstone blocks and boulders in unsorted sand, silt and clay matrix; common on most hillsides and abundant as veneer on southern foothills of Pine Mountain.
PENNSYLVANIAN	Lower and Middle Pennsylvanian	Breathitt Group Mingo Formation Puckett Sandstone Member Kendrick Shale of Jillson (1919) Creech coal zone Darby(?) coal bed Kellioka coal bed Harlan coal bed		1-3 0-2 1-3 0-2 0-2½ 0-1½ 2½-4½	240+ 220-300 220-260 780+	Shale, siltstone, sandstone, and coal: Shale and siltstone, olive- to dark-gray; shale commonly silty. Kendrick Shale of Jillson (1919) and unnamed fossiliferous siltstone below Creech coal zone contain sparse marine fossils in roadcuts in mining area southeast of Cardinal. Sandstone, light-gray, generally silty, mostly very fine to fine-grained, commonly micaceous; usually discontinuous or interbedded with shale; poorly exposed except for thick, crossbedded Puckett Sandstone Member 120 feet above Creech coal zone near Cardinal. Upper coal bed of Creech coal zone is probably the same as Amburgy(?) coal bed of Varilla quadrangle (Englund, Landis, and Smith, 1963). The name "Kellioka" has been applied to different coal beds in adjacent quadrangles; Kellioka coal bed of Varilla quadrangle is apparently continuous with the Darby(?) coal bed of this quadrangle. Kellioka coal bed of this quadrangle occurs from 40 to 80 feet below the Darby(?) coal bed. In some areas Darby(?) and Kellioka are each split into two coal beds which are separated by as much as 50 feet of shale and siltstone. Harlan coal bed persistent, occurs at base of formation.
		Hance Formation Path Fork coal zone Hance coal zone Mason rider coal bed Mason coal bed Split Seam coal bed Clear Fork coal bed Naese coal bed †Naese Sandstone Member		½-2 0-2 0-1½ 0-3 1½-3½ 0-2 1-3½ 0-2 0-3½ 0-2 0-1 0?-2 0-3½ ?	180-240 330-420 160-240 200-280 120-180 120-160 60-180 1110-1500	Shale, siltstone, sandstone, and coal: Shale and siltstone, medium- to dark-gray, locally dark-gray to black with ironstone nodules common in lowest third of unit; generally interbedded with thin silty sandstone beds. Sandstone, medium- to light-gray, very fine to fine-grained, silty, locally micaceous, crossbedded or ripple-bedded. Sandstone ledges below Mason and above Path Fork coal beds are generally prominent and continuous across most of map area. Both the coal bed at base of Hance coal zone and the Naese coal bed contain nonbanded coal and canneloid shale in some areas. The Mason rider coal bed is discontinuous; the Split Seam and Clear Fork coal beds occur in the southwestern part of the quadrangle. The Naese Sandstone Member is medium gray, fine grained, quartzose, crossbedded, with micaceous laminae; contains black shale lenses as much as 10 feet thick; locally contains a breccia bed. Member thins markedly east of Yellow Cliff Branch and is mapped separately only where thicker than about 30 feet. It has been considered the upper member of the Lee Formation in the Varilla quadrangle (Englund, Landis, and Smith, 1963), and the probable lower sandstone member of the Hance Formation in the Ewing quadrangle (Englund, Smith, Harris, and Stephens, 1963, p. B16). The stratigraphic problem at the upper boundary of the Lee Formation is discussed in greater detail by Englund (1964, p. B37-B38). As the Naese Sandstone Member of this quadrangle appears to intertongue with shale and siltstone of the lower Hance Formation, it is here considered a lenticular basal sandstone of the Hance Formation (see correlation diagram). Poor exposures in roadcuts and outcrops near Yellow Cliff Branch and Middle Fork of Watts Creek suggest that the Naese is thickest where it is locally unconformable on the Bee Rock Sandstone Member of the Lee Formation; the sandstone beds of the Naese are essentially indistinguishable from those of the underlying Lee Formation in this quadrangle.
	Lower Pennsylvanian	Lee Formation Bee Rock Sandstone Member			160-325	Sandstone and shale: Sandstone, light- to medium-gray, very fine to coarse-grained, commonly quartzose, locally silty and micaceous, generally crossbedded; forms prominent cliffs along Pine Mountain. Quartz pebbles as much as 1 inch in mean diameter occur sporadically near top of unit over easternmost third of outcrop. Shale is locally interbedded with the sandstone.
		Hensley Member Tunnel coal bed Pebbly sandstone beds		?	250-350	Sandstone, siltstone, shale and coal: Sandstone, light- to medium-gray, very fine to medium-grained, generally silty although moderately quartzose near base; in part crossbedded. A sequence of cliff-forming, pebbly, quartzose, fine- to medium-grained sandstone beds as much as 80 feet thick occurs in upper part of unit; mapped separately in eastern part of map area. Siltstone and shale near top of unit are medium to olive gray, form topographic swale; contain Tunnel coal bed which is inferred to be continuous along Pine Mountain, although it is exposed only locally.
		Middlesboro(?) Member			400-575 950-1250	Sandstone and shale: Sandstone in upper half of unit, white to medium-gray, fine- to medium-grained, mostly quartzose and pebbly, locally a conglomerate, massive, crossbedded; minor gray silty shale interbeds. Sandstone in lower half of unit, light- to olive-gray, silty, very fine to medium-grained, ripplebedded, generally thin-bedded; contains medium- to greenish-gray shale and silty shale interbeds. Basal sandstone, medium-gray, fine-grained, thick-bedded, crossbedded; moderately quartzose, contains scattered pebbles and local conglomeratic zones; cliff forming. Lower half of unit grades westward into very fine to fine-grained moderately quartzose to silty sandstone. Sandstone beds in unit form three or four hogbacks on Pine Mountain.
MISSISSIPPIAN AND PENNSYLVANIAN	?	Pennington Formation			700-1100	Sandstone and shale: Sandstone, light- to light-olive-gray, fine- to medium-grained, silty, in part moderately quartzose; thin to locally thick bedded, in part ripplebedded or wavy bedded. Thick, moderately quartzose sandstone beds occur near top and base of unit. Shale interbeds, medium- to greenish-gray, silty, poorly exposed. Driller's log of the No. 2 Asher hole on Tom Fork shows 80 feet of fossiliferous shale and limestone lying between sandstone beds near middle of unit; this sequence not seen in outcrop.
MISSISSIPPIAN		Newman Limestone Upper member			80-140	Shale and limestone: Shale, dark-gray, with thin argillaceous dark-gray limestone interbeds near top of unit; underlies topographic bench along north slope of Pine Mountain and is almost completely covered by colluvium.
		Newman Limestone Lower member			270-450 350-550	Limestone, light-greenish-gray to dark-bluish-gray, fine- to coarse-grained, in part with sparry calcite cement, partly oolitic, locally sandy or argillaceous; finely crystalline; chert nodules in basal part, chert bands and nodules as much as 100 feet above base of unit. Marine fossils common in middle and upper parts.
		Grainger Formation			275-360	Shale, siltstone, and sandstone: Shale, dusky-red to grayish-olive-green; thin interbeds of similarly colored siltstone and of very fine grained sandstone in upper part.
DEVONIAN AND MISSISSIPPIAN	? Upper Devonian	Chattanooga Shale			300+	Shale, grayish-black, in part carbonaceous; brittle, fissile. Contains small asphaltic lenses in extremely deformed outcrop southeast of mouth of Kettle Island Branch. Unit poorly exposed; forms gently sloping, colluvium-covered slopes at base of Pine Mountain.

*Mapped unnamed coal beds
†Mapped as uppermost member of Lee Formation in Varilla quadrangle (Englund, Landis, and Smith, 1963)



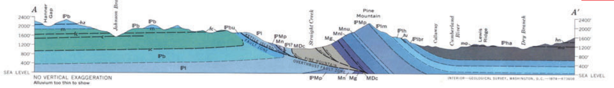
Base from U.S. Geological Survey, 1954. Revised 1973
The Carter Coordinate System letters and numbers used to designate five-minute divisions of latitude and longitude are shown along the margins; tick marks indicate one-minute divisions
10,000-foot grid based on Kentucky coordinate system south zone

SCALE 1:24000

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

QUADRANGLE LOCATION

Geology mapped in 1967-71



NO VERTICAL EXAGGERATION
Alluvium too thin to show

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D.C.—1974—

EXPLANATION

AREA NORTH OF PINE MOUNTAIN

QUATERNARY
- Qal Alluvium
- Qc Colluvium

PENNSYLVANIAN — Lower and Middle Pennsylvanian
- Pb Breathitt Formation
  - *c, unnamed coal bed
  - hi, Hindman coal bed
  - h_8, Hazard No. 8 coal bed
  - *h_7, Hazard No. 7(?) coal bed
  - hz, Hazard coal zone
  - m, base of Magoffin Beds of Morse (1931)
  - *fcr, Fire Clay rider coal bed
  - fc, Fire Clay coal bed
  - ri, coal bed in Rim coal zone
  - sc, Straight Creek coal bed
- Pbu Breathitt Formation, intensely deformed, undivided
  - *c, unnamed coal bed

Lower Pennsylvanian
- Pl Lee Formation
  - *c, unnamed coal bed

MISSISSIPPIAN AND PENNSYLVANIAN
- PMp Pennington Formation

MISSISSIPPIAN
- Mn Newman Limestone
- Mg Grainger Formation

DEVONIAN AND MISSISSIPPIAN — Upper Devonian
- MDc Chattanooga Shale

AREA ALONG AND SOUTH OF PINE MOUNTAIN

UNITS IN PROJECT VICINITY

QUATERNARY
- Qal Alluvium

PENNSYLVANIAN — Lower and Middle Pennsylvanian — Breathitt Group
- Pm Mingo Formation
  - cr, coal bed in Creech coal zone
  - *c, unnamed coal bed
  - d, Darby(?) coal bed
  - kl, Kellioka coal bed
  - hl, Harlan coal bed
- Pha Hance Formation
  - *pf, coal bed in Path Fork coal zone
  - *c, unnamed coal bed
  - *hn, coal bed in Hance coal zone
  - *mr, Mason rider coal bed
  - ma, Mason coal bed
  - *sp, Split Seam coal bed
  - *cf, Clear Fork coal bed
  - *n, Naese coal bed
  - Phan, Naese Sandstone Member

Lower Pennsylvanian
- Lee Formation
  - Plbr, Bee Rock Sandstone Member
  - Plh, Hensley Member
  - *tu, Tunnel coal bed
  - Plhs, pebbly sandstone beds
  - Plm, Middlesboro(?) Member

MISSISSIPPIAN AND PENNSYLVANIAN
- PMp Pennington Formation

MISSISSIPPIAN
- Newman Limestone
  - Mnu, upper member
  - Mnl, lower member
- Mg Grainger Formation

DEVONIAN AND MISSISSIPPIAN — Upper Devonian
- MDc Chattanooga Shale

*Shown locally by adit or outcrop symbol only

Structure contours and contacts do not precisely match Varilla quadrangle because of additional data

Contact, approximately located
Dashed where inferred or indefinite; dotted where concealed

Coal bed or coal zone
Dashed where approximately located; short dashed where inferred; dotted where concealed

Thrust fault, approximately located
Dotted where concealed. Sawteeth on upper plate

Fault, approximately located
Short dashed where inferred; dotted where concealed. Bar and ball on downthrown side

Tear fault, approximately located
Dotted where concealed. Arrows indicate relative displacement

Overturned anticline
Showing direction of dip of limbs

25 Strike and dip of beds

25 Approximate strike and dip of beds

78 Strike and dip of overturned beds

Strike of vertical beds

1400 Structure contours
Drawn on base of Fire Clay coal bed north of Pine Mountain; on base of Hance coal zone south of Pine Mountain. Projected where contoured horizon is missing. Contour interval 40 feet

DRILL HOLES FROM WHICH STRUCTURAL DATA WERE OBTAINED

DDH Diamond-drill hole

Gas well

Show of gas

Adit

cf Caved adit
Letter symbol indicates coal bed

h_7 Coal prospect or outcrop
Letter symbol indicates coal bed

Abandoned quarry (limestone)

Contour strip or auger mine

Strip mine
Area completely stripped

Dump

Probable landslide scar
Sawteeth on mobile side

m Outcrop of fossil-bearing strata
m, Magoffin Beds of Morse (1931)
k, Kendrick Shale of Jillson (1919)
f, unnamed fossil bed

ECONOMIC GEOLOGY

Coal, gas, oil, and limestone are the principal mineral resources known in the quadrangle. Gas and oil accumulations are present mostly in pre-Pennsylvanian strata north of Pine Mountain. Thick Mississippian limestone beds on the northern slope of Pine Mountain are a potential source of large amounts of crushed limestone.

Coal beds north of Pine Mountain: A general study of coal resources in the region was made by Lyons (1963). All production from this area has been common banded high-volatile A or B rank bituminous coal from the Breathitt Formation.

The Straight Creek coal bed has been mined extensively in the Kettle Island area; it may contain large subsurface coal reserves elsewhere in the quadrangle. The coal bed averages 3 feet in thickness and locally has a very thin shale parting. At mines near Kettle Island the coal is reportedly scoured and overlain by channel-fill sandstone (E. Dean, oral communication, 1968). Lyons (1963, p. 140) has included Straight Creek coal reserves with those of the Jellico coal bed.

Little is known regarding the Rim (or Moss) coal zone and the unnamed coal beds between the Rim and Fire Clay coal beds in this quadrangle. The principal coal bed of the Rim coal zone is mined extensively to the west of the map area; mineable reserves may be present in the subsurface north of Kettle Island. A persistent coal bed, locally called the Vanderpool coal bed, occurs about 100 feet below the Fire Clay coal bed; it has been extensively mined by local residents for house coal.

The Fire Clay coal bed, known locally as the Hazard No. 4, Crockett, or Dean seam, has been mined extensively in the western part of the area where it averages 2½ feet thick. It varies in thickness, is split by shale partings, and has not been mined elsewhere in the quadrangle.

The Fire Clay rider coal bed, locally called the McGuire seam, commonly is thicker than the Fire Clay coal bed in the eastern part of the area and is the principal mined coal bed in the northwestern part of the quadrangle.

The principal coal bed above the Magoffin Beds of Morse (1931) is locally called the Hazard No. 7, although the latter coal occurs about 80 feet above the Hazard coal zone. Both of these coal beds are thickest east of Stoney Fork and in the stripped area north of Kettle Island.

The Hazard No. 8 coal bed is thickest and has been extensively stripped and augered east of Stoney Fork. The coal is split into a zone in this area, and the main coal bed averages 25 inches thick in a 6-foot zone of carbonaceous shale and thin coal beds. An unmapped coal bed about 50 feet below the Hazard No. 8 is locally as much as 4 feet thick in the northeastern part of the quadrangle.

The Hindman coal bed, known locally as the Hazard No. 9, has been extensively augered in the northeastern part of the map area. Locally an overlying calcareous siltstone is in contact with this coal; operators report that where limy rocks directly overlie this coal bed its quality is low.

Coal beds along and south of Pine Mountain: Several collapsed openings in the Tunnel coal bed of the Lee Formation were found north and west of Callaway. The extent and thickness of this bed in the Balkan quadrangle are not known. The coal was 3½ to 5 feet thick where mined a few miles to the east in the Wallins Creek quadrangle (Froelich, 1972).

A general description of the coal resources of the Breathitt Group in this region is given by Smith (1963). All commercial production from this area has been common banded bituminous coal of A or B rank from the Breathitt Group.

Several coals beds were stripped, augered, and mined underground south and southwest of Cardinal in the late 1960's. However, the only active operation at the time of mapping was a small truck mine in the Mason coal bed on Tom Fork. The Mason thickens from an average of 2 feet just south of Pine Mountain to about 3 feet near the southern boundary of the quadrangle.

The Split Seam, Clear Fork, Naese, and possibly coal beds in the Path Fork coal zone are locally thicker than 2 feet; however, they commonly are irregular in thickness, or are impure, or occur in steeply dipping strata.

Two coal beds more than 30 inches thick in the Hance coal zone probably contain the largest reserves in the area. The Hance has been mined underground only locally; because of unreliable roof conditions, it is more safely and readily recovered by stripping or augering.

The Harlan coal bed has been intensively mined and augered in the southeastern part of the quadrangle, and reserves are essentially depleted. The Kellioka and Darby(?) coal beds rarely exceed 2 feet in thickness; only the Kellioka has been locally mined and augered. Coal beds of the Creech coal zone are irregular in thickness and quality, and commonly are less than 2 feet thick.

Of the 21 test holes drilled for oil and gas north of Pine Mountain, about half produce gas. The main producing formations are the Newman Limestone ("Big Lime"), Chattanooga Shale, and Hancock Dolomite ("Lockport" or "Corniferous") of Silurian age, with minor production from sandstone ("Maxton") of the Pennington Formation and sandstone ("Salt") of the Lee Formation. The only exploratory hole drilled south of Pine Mountain was abandoned, but it had gas shows in the lower member of the Newman Limestone and in the Chattanooga Shale.

An abandoned quarry is in the Newman Limestone north of Straight Creek; the limestone is in a fault slice of the Kettle Island fault zone. This limestone deposit is accessible but limited in extent and quality varies from good to poor along the strike. Large limestone reserves are present in the lower member of the Newman Limestone on the north slope of Pine Mountain; however, access is steep and difficult as the bed lies 400 to 800 feet above the railroad spur line along Straight Creek.

One of three reported cave openings in the lower part of the Newman Limestone is on the north side of Pine Mountain east of Laurel Ford. This cave and the nearby park-like Salting Ground are potential recreational sites; however, access in 1970 was difficult.

Availability of ground water in the quadrangle and in surrounding areas is discussed by Price and others (1962) and by Kilburn and others (1962). They indicate that most of the drilled wells in Lee and Breathitt strata yield water at rates adequate for modern domestic supplies. The water comes mainly from joints and bedding plane openings in sandstone, shale, and coal and is soft to moderately hard, with noticeable amounts of iron. The lower member of the Newman Limestone at places produces good flows from Pine Mountain, and some springs yield prolifically from solution cavities and joints.

The most favorable sites for construction are on the flood plain and terraces along Straight Creek, which are the only well-drained level surfaces north of Pine Mountain; similar alluviated areas south of Pine Mountain are present along Cumberland River, Tom Fork, and Puckett and Brownies Creeks; all are prone to periodic flooding.

Rock falls, creep, and landslides have caused engineering design and maintenance problems in new highway and railroad cuts north and south of Pine Mountain. Failure has occurred in unconsolidated colluvial deposits and in dipping bedrock; landslide scars are locally prominent on the south slope of Pine Mountain east of Green Howard Branch. Bedding-plane landslides have repeatedly occurred in jointed rocks of the south-dipping Hance Formation north of Cumberland River (Froelich, 1970).

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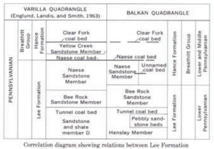


Correlation diagram showing relations between Lee Formation and Breathitt Group in Varilla and Balkan quadrangles

GEOLOGIC MAP OF THE BALKAN QUADRANGLE, BELL AND HARLAN COUNTIES, KENTUCKY

By

Albert J. Froelich and James F. Tazelaar

1973

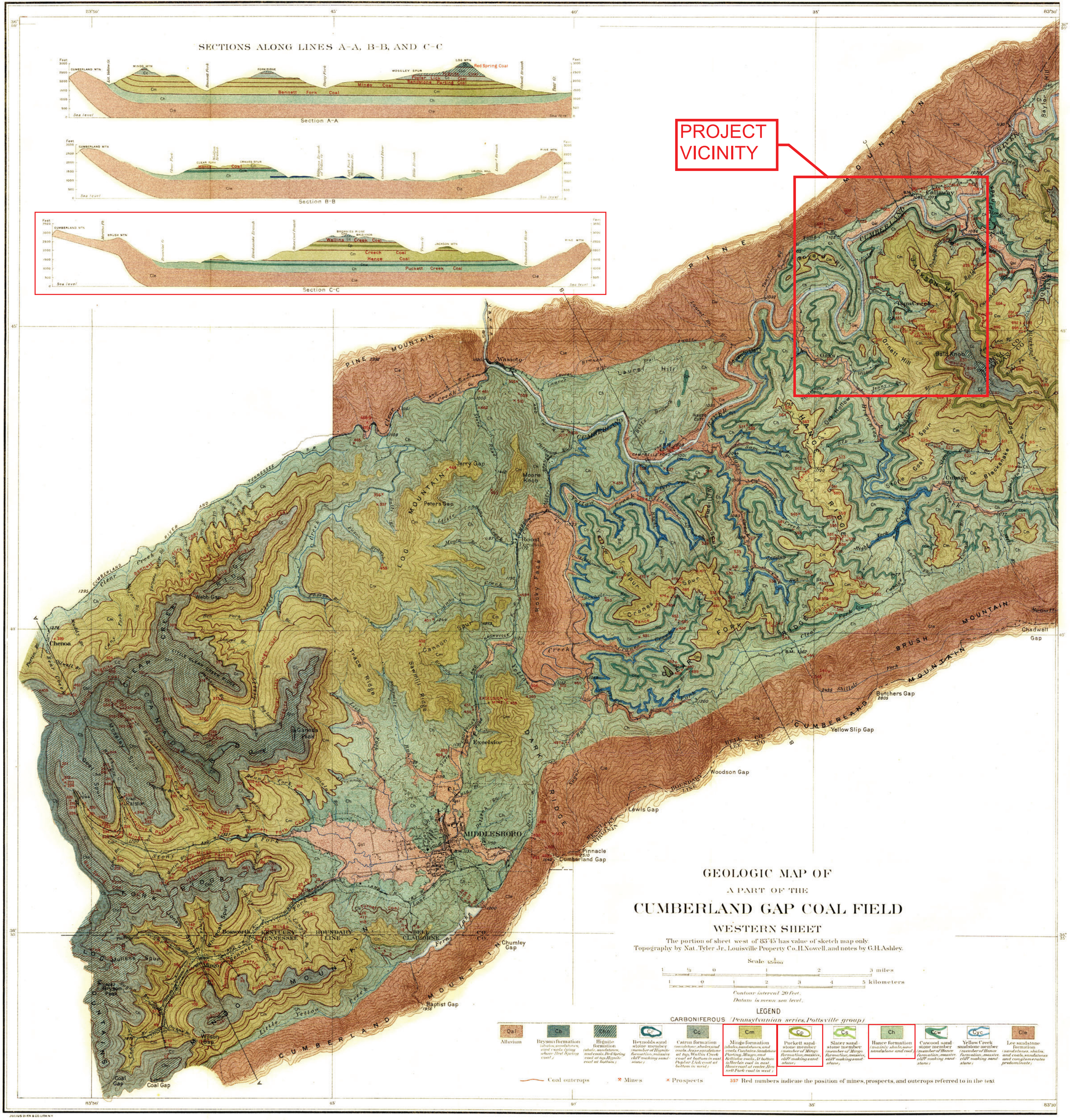
Price $1.00

Appendix H-2:

Geologic Map of Cumberland Gap Coal Field

U.S. GEOLOGICAL SURVEY

PROFESSIONAL PAPER NO. 49 PL. XLA



GEOLOGIC MAP OF

A PART OF THE

CUMBERLAND GAP COAL FIELD

WESTERN SHEET

The portion of sheet west of 83°45' has value of sketch map only.
Topography by Nat. Tyler Jr., Louisville Property Co., H. Nowell, and notes by G. H. Ashley.

Scale $\frac{1}{45000}$

1 ½ 0 1 2 3 miles

1 0 1 2 3 4 5 kilometers

Contour interval 20 feet.
Datum is mean sea level.

LEGEND

CARBONIFEROUS *(Pennsylvanian series, Pottsville group)*

Symbol	Description
Qal	Alluvium
Cb	Bryson formation *(shales, sandstones, and coals lying above Red Spring coal)*
Chg	Hignite formation *(shale, sandstones, and coals. Red Spring coal at top, Hignite coal at bottom)*
Cr	Reynolds sandstone member *(member of Hignite formation; massive cliff-making sandstone)*
Cc	Catron formation *(sandstone, shales and coals. Jesse sandstone at top, Wallins Creek coal at bottom in east, Poplar Lick coal at bottom in west)*
Cm	Mingo formation *(shales, sandstones, and coals. Contains Sandstone Parting, Mingo, and Kellioka coals. At bottom is Harlan coal in east, Hance coal at center, Bennett Fork coal in west)*
Cp	Puckett sandstone member *(member of Mingo formation; massive, cliff-making sandstone)*
Cs	Slater sandstone member *(member of Mingo formation; massive, cliff-making sandstone)*
Ch	Hance formation *(mainly shale, some sandstone and coal)*
Ccw	Cawood sandstone member *(member of Hance formation; massive cliff-making sandstone)*
Cyc	Yellow Creek sandstone member *(member of Hance formation; massive cliff-making sandstone)*
Cle	Lee sandstone formation *(sandstones, shales, and coals, sandstones and conglomerates predominate)*

Coal outcrops × Mines × Prospects 357 Red numbers indicate the position of mines, prospects, and outcrops referred to in the text

JULIUS BIEN & CO. LITH. N.Y.

Appendix H-3:

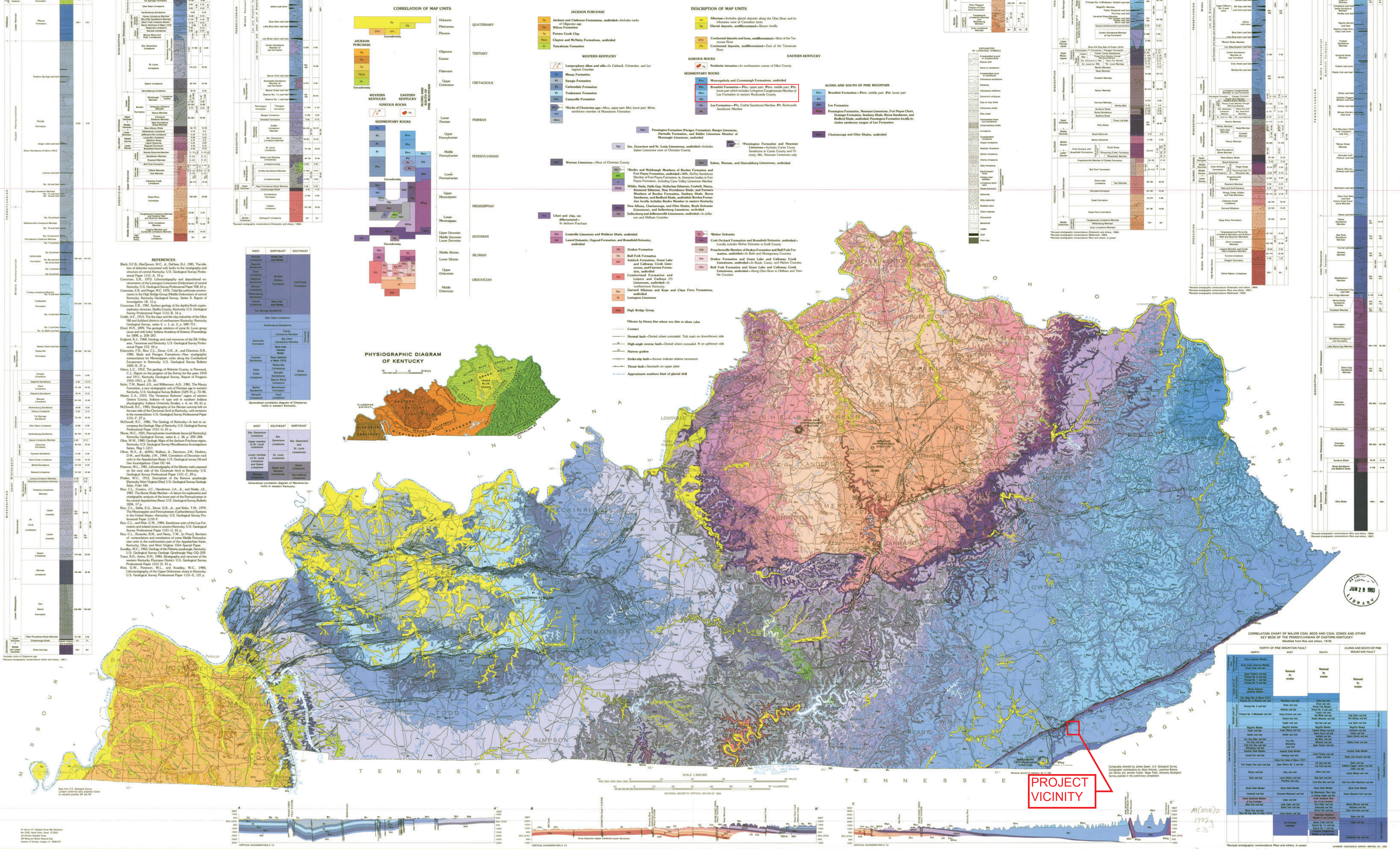
Geologic Map of Kentucky 1988

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

GEOLOGIC MAP OF KENTUCKY

Sesquicentennial Edition of the Kentucky Geological Survey

By the
U.S. GEOLOGICAL SURVEY
Dallas L. Peck, Director
In cooperation with the
KENTUCKY GEOLOGICAL SURVEY
Donald C. Haney, State Geologist and Director
1988
Compiled by Martin C. Noger, Kentucky Geological Survey,
from the
Geologic Map of Kentucky (Scale 1:250,000), 1981
by
Robert C. McDowell, George J. Grabowski, Jr., and Samuel L. Moore, U.S. Geological Survey



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Cartography directed by James Queen, U.S. Geological Survey. Cartographic contributions by Alicia Antunes, Lawrence Brence, Jan Dennis and Jennifer Fowler. Roger Potts, Kentucky Geological Survey, assisted in the preliminary compilation.

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INTERIOR—GEOLOGICAL SURVEY, RESTON, VA—1992

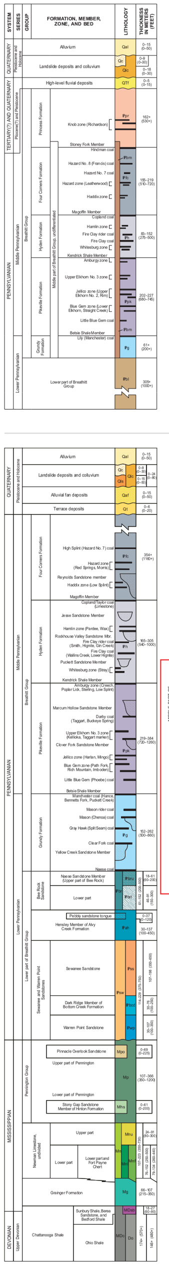
Reference copy only! No circulation!

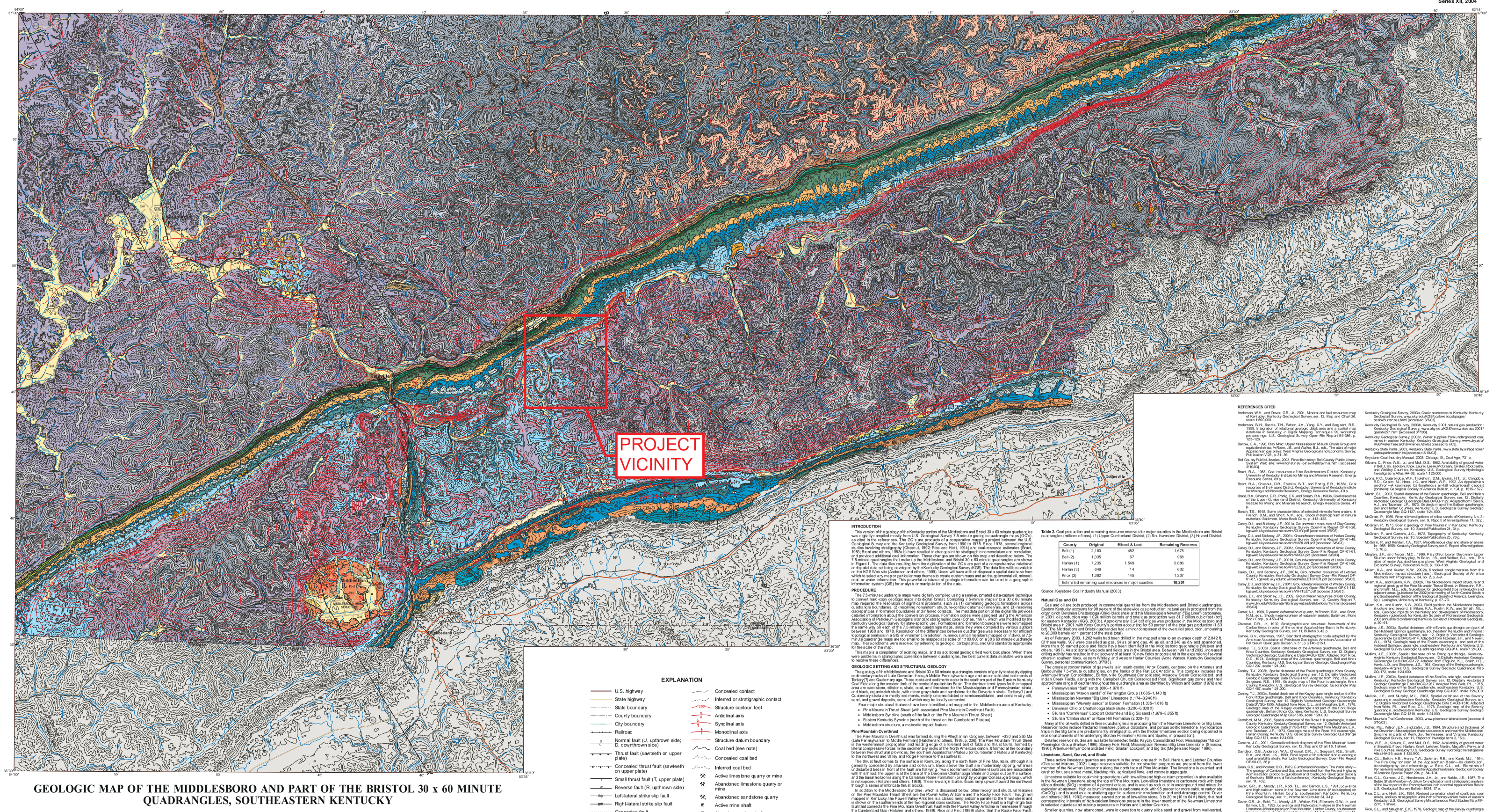
Appendix H-4:

Geologic Map of Middlesboro and Part of the Bristol Quadrangles

KENTUCKY GEOLOGICAL SURVEY
James C. Cobb, State Geologist and Director
UNIVERSITY OF KENTUCKY, LEXINGTON

GEOLOGIC MAP 7
Series XII, 2004





GEOLOGIC MAP OF THE MIDDLESBORO AND PART OF THE BRISTOL 30 x 60 MINUTE QUADRANGLES, SOUTHEASTERN KENTUCKY

Thomas N. Sparks

Cartography by Terry D. Hounshell

SCALE 1:100 000

universal transverse Mercator projection, zone 17: 1927 North American datum

TOPOGRAPHIC CONTOUR INTERVAL 50 METERS

EXPLANATION

U.S. highway	Concealed contact
State highway	Inferred or stratigraphic contact
State boundary	Structure contour, feet
County boundary	Anticlinal axis
City boundary	Synclinal axis
Railroad	Monoclinal axis
Normal fault (U, upthrown side; D, downthrown side)	Structure datum boundary
Thrust fault (sawteeth on upper plate)	Coal bed (see note)
Concealed thrust fault (sawteeth on upper plate)	Concealed coal bed
Small thrust fault (T, upper plate)	Inferred coal bed
Reverse fault (R, upthrown side)	⚒ Active limestone quarry or mine
Left-lateral strike slip fault	⚒ Abandoned limestone quarry or mine
Right-lateral strike slip fault	⚒ Abandoned sandstone quarry
Concealed fault	Active mine shaft
	Abandoned mine shaft

NOTE: Not all coals digitized under the STATEMAP Program are included on this map. Coals included on map are Clear Fork, Gray Hawk, Manchester (Hance), Blue Gem (Path Fork), Jellico (Harlan), Upper Elkhorn No. 3 (Darby), Amburgy (Creech), Fire Clay, Fire Clay rider, Taylor (Limestone), Hazard, Hazard No. 7, Hazard No. 8 (Francis), and Hindman coals.

MDc CHATTANOOGA SHALE—Shale, dark-gray to black, weathers rust red to greenish-yellow, fissile to platy, brittle, carbonaceous, locally pyritic and silty, rare conodonts and linguloid brachiopods present, reddish-brown plant spores locally abundant. Poorly exposed, forms gentle colluvium-covered slopes along sole of Pine Mountain Overthrust Fault, locally thickened and deformed by drag folding; base not found.

MDsb SUNBURY SHALE, BEREA SANDSTONE, AND BEDFORD SHALE, UNDIVIDED—Shale and sandstone, 15 m (50 ft) thick interbedded sequence of very fine-grained, light-gray, quartzose sandstone, siltstone, and shale overlain by 3 m (10 ft) of black shale. Presence inferred by drillhole occurrence in quadrangle to northeast and by outcrop exposure in Louellen 7.5-minute quadrangle. Mapped in northeast corner of quadrangle; correlates to upper part of Chattanooga Shale immediately to the southwest.

Do OHIO SHALE—Shale, black shale as described above for Chattanooga Shale. Correlates to middle and lower exposed outcrops of Chattanooga Shale to the southwest. Poorly exposed, unit thickened by imbricate faults and drag folds above Pine Mountain Overthrust Fault; base not found.

ACKNOWLEDGMENTS: This map was digitally generated from 1:24,000-scale geologic maps under the STATEMAP Program authorized by the National Geologic Mapping Act of 1992, Grant No. 02HQPA0003, and was funded in part by the U.S. Geological Survey National Cooperative Geologic Mapping Program.

The author would like to thank the following persons for their assistance in planning, digitizing, and reviewing this map: Warren H. Anderson, Carl Petersen, Thomas J. Conley, Tammie L. Johnson, Jack E. "Chip" Mullins, Steven L. Martin, Matthew M. Crawford, Mark F. Thompson, Michael L. Murphy, Jason R. Lambert, Kristin S. Toth, Stephen F. Greb, Margaret Luther Smath, and Garland R. Dever Jr.

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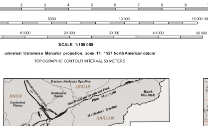
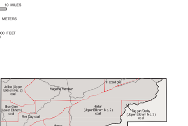
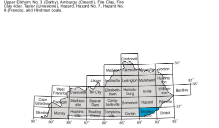
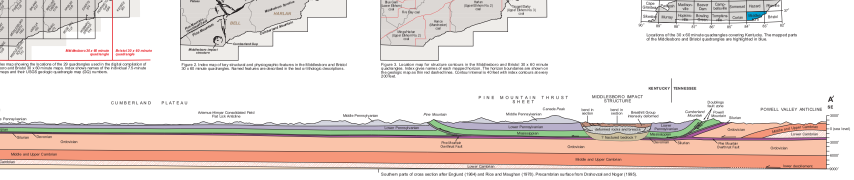
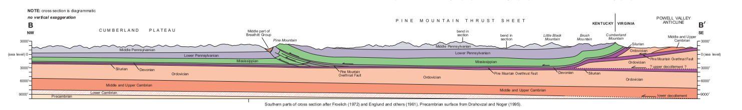
Figure 1. Index map











INTRODUCTION

This version of the geology of the Kentucky portion of the Middlesboro and Bristol 30 x 60 minute quadrangles was digitally compiled mostly from U.S. Geological Survey 7.5-minute geologic quadrangle maps (GQ's), as cited in the references. The GQ's are products of a cooperative mapping project between the U.S. Geological Survey and the Kentucky Geological Survey from 1960 to 1978. Since 1978, several regional studies involving stratigraphy (Chesnut, 1992; Rice and Hiett, 1994) and coal-resource estimates (Brant, 1983; Brant and others, 1983a,b) have resulted in changes in the stratigraphic nomenclature and correlation, and provided additional coal information. These changes are shown on this map and described below. The 7.5-minute quadrangles that make up the Middlesboro and Bristol 30 x 60 minute quadrangles are shown in Figure 1. The data files resulting from the digitization of the GQ's are part of a comprehensive relational and spatial data set being developed by the Kentucky Geological Survey (KGS). The data files will be available on the KGS Web site (Anderson and others, 1999). Users will have at their disposal a spatial database from which to select any map or particular map themes to create custom maps and add supplemental oil, mineral, coal, or water information. This powerful database of geologic information can be used in a geographic information system (GIS) for analysis or manipulation of the data.

PROCEDURE

The 7.5-minute quadrangle maps were digitally compiled using a semi-automated data-capture technique to convert hard-copy geologic maps into digital format. Compiling 7.5-minute maps into a 30 x 60 minute map required the resolution of significant problems, such as (1) correlating geologic formations across quadrangle boundaries, (2) resolving nonuniform structure-contour datums or intervals, and (3) resolving discrepancies in formation boundaries and inferred contacts. The metadata portion of the digital file provides detailed information about the conversion process. Formation codes were assigned using the American Association of Petroleum Geologists' standard stratigraphic code (Cohee, 1967), which was modified by the Kentucky Geological Survey for state-specific use. Formations and formation boundaries were not mapped the same way on each of the 7.5-minute quadrangle maps, since they were compiled by various authors between 1960 and 1978. Resolution of the differences between quadrangles was necessary for efficient topological analysis in a GIS environment. In addition, numerous small members mapped on individual 7.5-minute quadrangle maps are too small to be mapped at a scale of 1:100,000 on a 30 x 60 minute quadrangle map. These problems were resolved by adhering to geologic, cartographic, and GIS standards appropriate for the scale of the map.

This map is a compilation of existing maps, and no additional geologic field work took place. When there were problems in stratigraphic correlation between quadrangles, the best current data available were used to resolve these differences.

GEOLOGIC SETTING AND STRUCTURAL GEOLOGY

The geology of the Middlesboro and Bristol 30 x 60 minute quadrangles consists of gently to steeply dipping sedimentary rocks of Late Devonian through Middle Pennsylvanian age and unconsolidated sediments of Tertiary(?) and Quaternary age. These rocks and sediments occur in the southern part of the Eastern Kentucky Coal Field along the western limb of the central Appalachian Basin. The dominant rock types for the mapped area are sandstone, siltstone, shale, coal, and limestone for the Mississippian and Pennsylvanian strata, and black, organic-rich shale, with minor gray shale and sandstone for the Devonian strata. Tertiary(?) and Quaternary strata are mostly sediments, mainly unconsolidated or semiconsolidated, and contain clay, silt, sand, and gravel deposits, some of which may be locally cemented.

Four major structural features have been identified and mapped in the Middlesboro area of Kentucky:

- Pine Mountain Thrust Sheet (with associated Pine Mountain Overthrust Fault)
- Middlesboro Syncline (south of the fault on the Pine Mountain Thrust Sheet)
- Eastern Kentucky Syncline (north of the thrust on the Cumberland Plateau)
- Middlesboro structure, a meteorite impact feature.

Pine Mountain Overthrust

The Pine Mountain Overthrust was formed during the Alleghanian Orogeny, between ~330 and 265 Ma (Late Pennsylvanian to Middle Permian) (Hatcher and others, 1989, p. 236). The Pine Mountain Thrust Sheet is the westernmost propagation and leading edge of a foreland belt of folds and thrust faults, formed by lateral compressive forces in the sedimentary rocks of the North American craton. It formed at the boundary between two structural provinces, the southern Appalachian Plateau (or Cumberland Plateau of Kentucky) to the northwest and Valley and Ridge Province to the southeast.

The thrust fault comes to the surface in Kentucky along the north flank of Pine Mountain, although it is generally concealed by alluvium and colluvium. Beds above the fault are moderately dipping, whereas undisturbed beds in front of the fault are flat-lying. Two décollement detachment surfaces are associated with this thrust; the upper is at the base of the Devonian Chattanooga Shale and crops out on the surface, and the basal horizon is along the Cambrian Rome Formation (or slightly younger Conasauga Group), which is not exposed (Hatcher and others, 1989). These low-angle fault surfaces ramp upward toward the northwest through a series of imbricate thrust blocks.

In addition to the Middlesboro Syncline, which is discussed below, other recognized structural features on the Pine Mountain Thrust Sheet are the Powell Valley Anticline and the Rocky Face Fault. Though not mapped in Kentucky, the Powell Valley Anticline is a classic ramp anticline parallel to the thrust sheet and is shown on the southern ends of the two regional cross sections. The Rocky Face Fault is a high-angle tear fault that connects the Pine Mountain Overthrust Fault with the Powell Valley Anticline in Tennessee through the Cumberland Gap (Hatcher and others, 1989). Rice and Ping (1989) stated that the Rocky Face Fault, a left-lateral strike-slip fault, is an upper splay of the Pine Mountain Thrust Fault. This thrusting resulted in local tectonic thickening of the Chattanooga Shale in a domal structure due west of the Rocky Face Fault.

Middlesboro Syncline

The Middlesboro Syncline is a large, longitudinal basin, 219 km (136 mi) long, 5,178 km² (2,000 mi²) in area, whose axis is parallel to the Pine Mountain Thrust Sheet (Potter and others, 1984). The syncline is located on the leading edge of the thrust sheet, and was formed along with the Powell Valley Anticline during movement of the detached rock layers up tectonic ramps from deeper to higher décollement surfaces (Harris and Milici, 1977). The Middlesboro Syncline has a broad, flat synclinal axis that is characteristic of central Appalachian folding (Hatcher and others, 1989). Beds that crop out on the northwest limb of the syncline along Pine Mountain have an average dip of 30º to the southeast. On the southeast side of the syncline along Cumberland Mountain, the beds generally dip 40º to the northwest (Dean and Moshier, 1989). The regional dip along the axis in the subsurface is relatively flat (1 to 2º), where the Chattanooga Shale reaches a depth of –914 m (–3,000 ft) (Potter and others, 1984).

Eastern Kentucky Syncline

The Eastern Kentucky Syncline is equivalent to the Coalburg Syncline of West Virginia, and extends across the Eastern Kentucky Coal Field in a northeast–southwest trend (Huddle and others, 1963; Chesnut, 1992). On the Middlesboro quadrangle, only the southernmost edge of the Eastern Kentucky Syncline is observed north of Pine Mountain, where over 152 m (500 ft) of structural relief is mapped on the Cumberland Plateau (see structure contours). Pennsylvanian beds gently dip northwest into the syncline, as shown on cross section B-B', whereas the Mississippian and deeper strata dip to the southeast away from the Cincinnati Arch. Chesnut (1992) attributed part of this dip reversal to a shift of the depositional basin prior to and following Early Pennsylvanian erosion, which was followed by uplift of the basin.

Middlesboro Impact Structure

The Middlesboro impact structure, also known as the Middlesboro Basin by some geologists, is a circular topographic depression about 5.3 km (3.3 mi) in diameter, in which the entire city of Middlesboro is located. The structure is superimposed on the Pine Mountain Thrust Sheet near the junction of Kentucky, Tennessee, and Virginia. Rice and Ping (1989) concluded that the Middlesboro Basin postdates the Alleghanian Orogeny (Late Pennsylvanian to Middle Permian) because the structure's overall morphology was not deformed by movement of the thrust sheet.

Englund and Roen (1963) were the first to propose a meteorite impact origin, based on the presence of a circular basin, deformed rock, an arcuate trend of normal faults, overturned beds, shattered quartz grains, and a central core of uplifted material. The basin is not a crater, but rather the brecciated and faulted material beneath the old crater; the crater itself has long since eroded away. Dietz (1966) discovered shatter cones in the central uplift area, and Bunch (1968) and Carter (1968) identified shocked quartz, further confirming an impact origin. Ehmann (2000, p. 30) determined that based on the presence of shatter cones, intense brecciation, and shocked quartz grains, a meteorite-impact origin for the Middlesboro structure was "probable." Greb and Chesnut (1998) documented the presence of brecciated, deformed gray shales, tilted coal beds, and normal faulting in coal mines in the Middlesboro structure. They concluded these features were consistent with a history of compression followed by relaxation, as would happen during an impact.

Milam and Kuehn (2002a) presented petrographic microanalyses of shocked conglomerates from the Middlesboro impact structure to describe their deformation fabrics. These included planar fractures, planar deformation features, shattering and fracturing of the conglomeratic sandstones, possible melt textures of the matrix, and sheared (microfaulted) quartzite pebbles. Milam and Kuehn (2002b, 2003) also presented an updated guide to the Middlesboro impact structure describing its central uplift, transient crater rim, modification stage, and modified crater rim.

ECONOMIC GEOLOGY

Coal, natural gas, and oil are the principal economic mineral resources in the Middlesboro and Bristol quadrangles. Limestone, sand, gravel, and shale are also available as mineral resources for general construction purposes and for use in the coal industry. The locations of industrial mineral resources, including limestone and sand operations in Bell, Harlan, and Letcher Counties, were mapped and described by Anderson and Dever (2001) and Glass and Malone (2002).

Coal production and reserves

The Middlesboro and Bristol quadrangles comprise a major part (more than 90 percent) of the Upper Cumberland Coal Reserve District, significant parts of the Hazard District, and parts of the Southwestern District, as described by Brant (1983) and Brant and others (1983a,b). The quadrangles encompass the majority of Bell, Harlan, and Knox Counties, with lesser parts of Clay, Laurel, Leslie, Letcher, Perry, and Whitley Counties (see Figure 2). Of the counties that make up these quadrangles, Harlan is ranked second in the state for cumulative coal production (Pike County is first). Total coal production from the three major counties is summarized in Table 1.

Table 1. Cumulative coal production (millions of tons) by county and mining method (1829–2000).

County	Undifferentiated	Underground	Surface	Total
Bell	34.055	154.845	103.900	292.800
Harlan	27.178	786.925	57.120	871.223
Knox	15.410	33.265	24.510	73.185
Total	76.643	975.035	185.530	1,237.208

Source: Kentucky Geological Survey coal production database, kgsweb.uky.edu/DataSearching/Coal/Production [accessed 3/7/03].

The Middlesboro and Bristol quadrangles are bisected by the Pine Mountain Thrust Fault. On the part of the quadrangle north of Pine Mountain (the Cumberland Plateau) at least 17 coal beds have been mined or prospected. The 10 most important beds in the Hazard and Southwestern Districts are, in ascending stratigraphic order: Lily, Blue Gem, Jellico, Upper Elkhorn No. 3, Amburgy, Fire Clay (Hazard No. 4), Fire Clay rider, Hazard No. 7, and Francis (Hazard No. 8). Twenty-one coals are mapped in the Middlesboro Syncline south of the Pine Mountain Thrust Fault. The principal coal beds in the Upper Cumberland District (located on the Pine Mountain Thrust Sheet) are, in ascending stratigraphic order: Hance (Manchester), Path Fork (Lower Elkhorn), Harlan (Upper Elkhorn No. 1 and No. 2), Darby (Upper Elkhorn No. 3), and Creech (Amburgy). The quality of most coals from this area is generally good to high. The Upper Cumberland District coals are of high volatile A or B bituminous rank, with a range of mean heating values of 13,100 to 13,789 Btu/lb; north of Pine Mountain, the coals range from 12,537 to 13,837 Btu/lb (Keystone Coal Industry Manual, 2003).

Coal-availability studies for selected 7.5-minute quadrangles in or adjacent to the mapped area have been completed (Sergeant and others, 1989; Davidson and others, 1990; Greb and others, 1999a,b). Coal-resource and -thickness maps from the availability studies have been published for the Lower Elkhorn coal (Thacker and others, 1998, 2000a), the Fire Clay coal (Thacker and others, 2000b,c), the Upper Elkhorn No. 3 coal (Esterle and others, 2000a–c), and the Amburgy coal (Shultz and others, 2003). Remaining coal reserves for the three largest counties in the Middlesboro and Bristol quadrangles have been tabulated (see Table 2). Coal-availability studies from selected quadrangles in eastern Kentucky indicate that approximately 50 percent of the remaining coal resources are available for mining by current methods, so the actual recoverable reserves may be less (KGS, 2003a).

Table 2. Coal production and remaining resource reserves for major counties in the Middlesboro and Bristol quadrangles (millions of tons). (1) Upper Cumberland District, (2) Southwestern District, (3) Hazard District.

County	Original	Mined & Lost	Remaining Reserves
Bell (1)	2,160	482	1,678
Bell (2)	1,035	67	968
Harlan (1)	7,235	1,549	5,686
Harlan (3)	646	14	632
Knox (2)	1,382	145	1,237
Estimated remaining coal resources in major counties			**10,201**

Source: Keystone Coal Industry Manual (2003)

Natural Gas and Oil

Gas and oil are both produced in commercial quantities from the Middlesboro and Bristol quadrangles. Eastern Kentucky accounts for 98 percent of the statewide gas production; natural gas is produced from the organic-rich Devonian Chattanooga (Ohio) black shale and the Mississippian Newman ("Big Lime") carbonates. In 2001, oil production was 1.024 million barrels and total gas production was 81.7 billion cubic feet (bcf) for eastern Kentucky (KGS, 2003b). Approximately 3.24 bcf of gas was produced in the Middlesboro and Bristol area in 2001, with Knox County's portion accounting for 50 percent of the total gas production (1.63 bcf). The Middlesboro and Bristol quadrangles had a minor component of the overall oil production, amounting to 28,000 barrels (or 1 percent of the state total).

As of February 2003, 1,262 wells had been drilled in the mapped area to an average depth of 2,842 ft. Of these wells, 907 were classified as gas, 54 as oil and gas, 46 as oil, and 248 as dry and abandoned. More than 55 named pools and fields have been identified in the Middlesboro quadrangle (Watson and others, 1997). An additional five pools and fields are in the Bristol area. Between 1997 and 2002, increased drilling activity has resulted in the discovery of at least 10 new fields or pools and in the expansion of several others in southern Knox, eastern Whitley, and western Harlan Counties (Anna Watson, Kentucky Geological Survey, personal communication, 3/7/03).

The greatest concentration of gas wells is in south-central Knox County, centered on the Artemus and Barbourville 7.5-minute quadrangles, on the flanks of the Flat Lick Anticline. This complex includes the Artemus-Himyar Consolidated, Barbourville Southwest Consolidated, Meadow Creek Consolidated, and Indian Creek Fields, along with the Campbell Church Consolidated Pool. Significant gas zones and their approximate range of depths throughout the quadrangle area as identified by Wilson and Sutton (1976) are:

- Pennsylvanian "Salt" sands (600–1,970 ft)
- Mississippian "Maxon sands" of Pennington Group (1,085–1,140 ft)
- Mississippian Newman "Big Lime" Limestone (1,174–3,940 ft)
- Mississippian "Waverly sands" or Borden Formation (1,335–1,616 ft)
- Devonian Ohio or Chattanooga black shale (3,200–6,000 ft)
- Silurian "Corniferous" Lockport Dolomite and Big Six sand (1,979–3,855 ft)
- Silurian "Clinton shale" or Rose Hill Formation (2,000+ ft)

Many of the oil wells drilled in these quadrangles are producing from the Newman Limestone or Big Lime. Reservoir rocks include fractured limestone, porous dolostone, and porous oolitic limestone. Hydrocarbon traps in the Big Lime are predominantly stratigraphic, with the thicker limestone section being deposited in erosional channels of the underlying Borden Formation (Harris and Sparks, in preparation).

Detailed reservoir studies are available for selected fields: KayJay Consolidated Pool, Mississippian "Maxon" Pennington Group (Barlow, 1996); Stoney Fork Field, Mississippian Newman Big Lime Limestone (Smosna, 1996); Artemus-Himyar Consolidated Field; Silurian Lockport; and Big Six (Meglen and Noger, 1996).

Limestone, Sand, Gravel, and Shale

Three active limestone quarries are present in the area: one each in Bell, Harlan, and Letcher Counties (Glass and Malone, 2002). Large reserves suitable for construction purposes are present from the lower member of the Newman Limestone along the north face of Pine Mountain. The limestone is quarried and crushed for use as road metal, blacktop mix, agricultural lime, and concrete aggregate.

Limestone suitable for coal-mining operations (with low-silica and high-calcium properties) is also available in the Newman Limestone along the top of Pine Mountain. Low-silica limestone is carbonate rock with total silicon dioxide (SiO_2) content of 4 percent or less, and is used as rock dust in underground coal mines for explosion abatement. High-calcium limestone is carbonate rock with 95 percent or more calcium carbonate ($CaCO_3$), and is used as a neutralizing agent in surface-mine reclamation and acid-drainage control. Dever and others (1991, 1992) measured several zones of low-silica stone, 3 to 20 m (10 to 64 ft) thick, that had corresponding intervals of high-calcium limestone present in the lower member of the Newman Limestone in selected quarries and outcrop exposures in Harlan and Letcher Counties.

Smaller quarries, now abandoned, were in operation to quarry silica sand and gravel from well-sorted, friable quartzose sandstone beds of the lower Breathitt Group, and from the pebbly quartzarenites of the Sewanee–Warren Point Sandstones and the Bee Rock Sandstone of the Breathitt Group ("Lee" sandstones of McGrain, 1956). Sand and gravel are also available from alluvial deposits. Clay shale below the Blue Gem coal zone of the Breathitt Group has been found to be satisfactory for use in lightweight aggregate and in the manufacture of common brick and structural tile (McGrain and Kendall, 1957).

ENGINEERING GEOLOGY

The highly dissected topography in the Middlesboro and Bristol area, in conjunction with the steeply dipping bedrock exposed along Pine Mountain, has contributed to a history of landslides and also present a future potential for engineering and maintenance problems. The interbedded sequence of sandstone, shale, and coal in the Grundy Formation, on the south-dipping flank of Pine Mountain, is prone to failure by landslide and creep. Numerous slumps and landslides also surround the central uplift in the Middlesboro impact structure. The presence of prominent landslide scars and slumped bedrock indicate that future landslides may occur where these relatively unstable beds are undercut by rivers and their tributaries or by construction work for roads and mines. Because the geologic factors apparently contributing to instability are known, potentially slide-prone areas can be outlined and construction can be planned to avoid disturbing natural conditions of equilibrium (Froelich, 1970). Logging, clearcutting, and removal of vegetation for construction can destabilize slopes. Coal-mining activities can also precipitate landslides, removing vegetation, steepening slopes, and cutting the toes of old slides. Landslides of colluvium from hillsides pose engineering hazards and have damaged roads and railroads.

The escarpment of Pine Mountain (the north-facing flank) has created several naturally occurring, precipitous overhangs of large sandstone boulders, which are an imminent hazard to the communities below. One prominent example is the hanging or Chained Rock at Pineville. This boulder is a thrust sheet remnant, which has minimal basal support and is "held in place" by a thick chain 100 ft long and weighing 1.5 tons. This chain obviously would not prevent a rock fall if the basal support of this boulder were removed. The chain was placed there by local citizens in 1933 more for a publicity stunt than as a safety precaution (Bell County Public Libraries, 2003). The threat is real, however; and caution must be exercised wherever construction may remove material from along the north slope of Pine Mountain.

HYDROGEOLOGY

The Middlesboro and Bristol quadrangles cover parts of the Cumberland River and Kentucky River Basin watersheds. The availability and quality of groundwater in this area are discussed in Price and others (1962) and Kilburn and others (1962). Carey and Stickney (2001a–f, 2002) have written a series of Web-based groundwater resource reports for Bell, Clay, Harlan, Knox, Leslie, Letcher, and Whitley Counties.

Water Quality and Production

Soft to moderately hard water at rates adequate for domestic supply is available from most sandstone beds of the Breathitt Group at shallow to moderate depth across much of the quadrangle area. Groundwater comes from joints and bedding planes in sandstone, shale, and coal. Naturally occurring contaminants that may be present in objectionable amounts in the groundwater are sulfate, salt (sodium chloride), iron, and manganese. In some locations, abandoned oil and gas wells have contaminated shallow, freshwater aquifers with salt water brought up from deeper formations. High iron and manganese levels, found in many wells, can produce objectionable taste and stain laundry and porcelain fixtures. Coal mining increases the amount of fresh surface area of the rocks exposed to oxidation, which can increase the sulfate and metals concentrations (Carey and Stickney, 2001a–f, 2002).

Some wells drilled into permeable units of the lower Breathitt and Pennington Groups, and the Newman Formation south of Pine Mountain, may produce artesian flow. Wells from the lower member of the Newman Limestone on Pine Mountain yield as much as 400 gallons per minute (gpm) near Pineville (Froelich and Tazelaar, 1974). The most prolific wells and springs produce water from solution cavities in the limestone. Most springs throughout the area, however, generally produce at 5 to 10 gal/min (Carey and Stickney, 2001b,c, 2002).

Most of the wells drilled in valley bottoms are adequate for a modern domestic supply; however, fewer wells drilled on hillsides and ridgetops supply adequate yields. Wells drilled into bedrock deeper than 61 m (200 ft) below the valley bottoms may produce enough water for small municipal or industrial supplies. Municipal water-supply resources have also been generated from abandoned underground coal mines. Detailed analyses at sites in Letcher, Perry, Clay, and Harlan Counties (KGS, 2003c) indicate recharge rates ranging from 120,000 to 700,000 gallons per day, and storage volumes ranging from 260 to 480 million gallons. Even though water from abandoned underground mines tends to have higher concentrations of sulfate and dissolved metals (iron, magnesium, and manganese), municipal water systems successfully use this source of water after conventional treatment methods.

Karst

Pine Mountain is one of the four major karst regions in Kentucky (Currens, 2001). Caves and other karst features (sinkholes, vertical shafts, and springs) develop in and along a long, narrow strip of exposed, tilted Newman Limestone. The exposure of the Newman Limestone is the result of the faulting and folding of the Mississippian carbonates during movement of the Pine Mountain Thrust, and the subsequent erosion of overlying strata. The limestone is bounded by sandstones and shales, and karst development is further limited by the area of limestone exposed and by structure restricting groundwater circulation. Many springs are located at major gaps or in small hollows on the northwest slope of the mountain. Sinkholes are small and scattered because of rapid infill by downslope movement of debris and by widely distributed joints and bedding planes.

TOURISM AND SITES OF SPECIAL INTEREST

Pine Mountain and Cumberland Mountain, with their many spectacular sandstone cliffs and hogbacks, are among the most scenic places in southeastern Kentucky. This rugged beauty has been deemed worthy of preservation and development for outdoor recreational purposes.

Two areas of special scenic interest in Bell County are Pine Mountain State Park, on Pine Mountain overlooking Pineville (McGrain, 1975), and Cumberland Gap National Historic Park, south of Middlesboro, which covers part of Cumberland Mountain (Dean and Moshier, 1989; Englund and Harris, 1961). Cumberland Gap, a remnant of an ancient stream channel, is at an elevation of 502 m (1,648 ft). The gap was the gateway through the Cumberland Mountain barrier for early settlers more than 200 years ago, and today is an important route for north–south motor vehicle traffic (McGrain and Currens, 1978; Dean and Moshier, 1989).

The Dr. Thomas Walker State Historic Site at Barbourville, located in adjacent Knox County, commemorates the site where the surveyor and physician led the first expedition through Cumberland Gap in 1750, preceding the pioneer Daniel Boone by 17 years. Kingdom Come State Park, in Cumberland, Ky. (Harlan County), named after the popular Civil War novel *The Little Shepherd of Kingdom Come* by Kentucky author John Fox Jr., preserves 1,283 acres of unspoiled wilderness and some of the most extraordinary rock formations in the state. The park offers a spectacular view of Black Mountain to the south, which at an elevation of 1,263 m (4,145 ft) is the highest point in Kentucky (McGrain and Currens, 1978; Kentucky State Parks, 2003).

In March 2002, the Kentucky legislature passed a bill calling for the creation of the Pine Mountain Trail State Linear Park. The proposed trail will be more than 193 km (120 mi) long and extend from the Breaks Interstate Park on the Kentucky-Virginia border near Elkhorn City, Ky. (Pike County), to the Cumberland Gap National Park at Middlesboro, eventually connecting to the Cumberland Trail into Tennessee. As of spring 2003, 45 km (28 mi) of the trail has been completed (Pine Mountain Trail Conference, 2003). When completed, the Pine Mountain Trail will traverse terrain replete with pioneer homesteads, waterfalls, cliffs, rock shelters, caves, upland bogs, and many other scenic features.

Appendix H-5:

USDA NRCS Physical Soil Properties of Bell and Harlan County, Kentucky

Physical Soil Properties

Bell and Harlan Counties, Kentucky

[Entries under "Erosion Factors--T" apply to the entire profile. Entries under "Wind Erodibility Group" and "Wind Erodibility Index" apply only to the surface layer. Absence of an entry indicates that data were not estimated. This report shows only the major soils in each map unit]

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensi-bility	Organic matter	Erosion factors			Wind erodi-bility group	Wind erodi-bility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
AgB:														
Allegheny	0-8	20-52	28-65	10-27	1.43-1.48	4.00-14.00	0.17-0.21	0.4-1.4	1.0-4.0	.32	.32	5	5	56
	8-33	20-60	20-65	12-35	1.44-1.63	4.00-14.00	0.15-0.19	0.5-2.5	0.0-0.5	.37	.37			
	33-42	30-70	15-60	5-35	1.61-1.65	4.00-14.00	0.11-0.15	0.2-2.5	0.0-0.5	.32	.32			
	42-72	30-70	15-50	5-35	1.44-1.62	4.00-14.00	0.11-0.15	0.1-2.5	0.0-0.5	.37	.37			
	72-82	35-75	10-50	5-35	1.49-1.68	4.00-14.00	0.10-0.15	0.1-2.5	0.0-0.5	.32	.32			
AtF:														
Alticrest	0-2	---	---	8-18	1.40-1.55	14.00-42.00	0.12-0.18	0.0-2.9	1.0-3.0	.17	.17	2	3	86
	2-33	---	---	8-18	1.40-1.55	14.00-42.00	0.10-0.16	0.0-2.9	0.0-0.5	.24	.37			
	33-43	---	---	---	---	---	---	---	---	---	---			
Helechawa	0-5	---	---	4-15	1.10-1.40	14.00-42.00	0.10-0.18	0.0-2.9	2.0-10	.15	.15	5	3	86
	5-49	---	---	7-18	1.35-1.70	14.00-42.00	0.08-0.14	0.0-2.9	0.8-1.5	.24	.24			
	49-63	---	---	5-15	1.50-1.70	14.00-42.00	0.08-0.13	0.0-2.9	0.3-0.8	.28	.28			
	63-73	---	---	---	---	---	---	---	---	---	---			
Totz	0-7	---	---	3-12	1.15-1.35	42.00-141.00	0.07-0.12	0.0-2.9	1.0-5.0	.32	.32	1	3	86
	7-18	---	---	3-12	1.50-1.70	42.00-141.00	0.05-0.11	0.0-2.9	0.0-0.8	.37	.37			
	18-28	---	---	---	---	---	---	---	---	---	---			
CgF:														
Cloverlick	0-2	---	---	---	0.05-0.10	42.00-141.00	0.15-0.45	---	61-78	---	---	5	7	38
	2-8	23-52	28-50	7-27	1.05-1.52	14.11-42.34	0.11-0.15	0.2-1.7	0.5-3.0	.10	.20			
	8-24	18-45	28-65	7-27	1.25-1.52	4.23-42.34	0.12-0.16	0.1-1.7	0.3-0.7	.24	.37			
	24-43	20-52	28-65	7-27	1.25-1.52	14.11-42.34	0.07-0.11	0.1-2.1	0.0-1.0	.15	.43			
	43-80	28-60	28-60	5-35	1.00-1.50	4.23-42.34	0.05-0.09	0.0-2.1	0.3-0.7	.10	.37			

Physical Soil Properties

Bell and Harlan Counties, Kentucky

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
CgF:														
Guyandotte	0-2	---	---	---	0.20-0.35	42.00-141.00	0.15-0.39	---	30-90	---	---	5	6	48
	2-5	---	---	---	0.26-0.35	42.00-141.00	0.15-0.38	---	30-90	---	---			
	5-15	52-75	8-35	5-20	1.08-1.53	4.00-42.00	0.07-0.11	0.1-0.7	2.0-10	.02	.05			
	15-67	30-70	15-55	3-20	1.35-1.60	4.00-42.00	0.03-0.07	0.0-1.0	0.2-1.5	.05	.24			
Highsplint	0-1	---	---	---	0.05-0.10	42.00-141.00	0.15-0.43	---	61-78	---	---	5	8	0
	1-4	15-35	50-65	10-27	1.22-1.46	4.23-42.34	0.08-0.12	0.2-1.3	0.5-5.0	.10	.32			
	4-11	15-35	40-65	18-34	1.39-1.48	4.23-42.34	0.07-0.11	0.4-2.0	0.3-0.7	.10	.37			
	11-28	15-35	40-65	18-34	1.39-1.53	4.23-42.34	0.07-0.11	0.4-2.0	0.3-0.7	.10	.37			
	28-48	15-40	35-60	18-34	1.39-1.44	4.23-42.34	0.07-0.11	0.4-2.0	0.3-0.7	.10	.37			
	48-85	15-50	28-50	7-40	1.40-1.58	1.41-14.11	0.07-0.11	0.1-2.7	0.2-0.7	.10	.43			
Cr:														
Craigsville, occasionally flooded	0-9	---	---	5-15	1.20-1.40	14.11-141.14	0.07-0.15	0.0-2.9	1.0-5.0	.10	.17	3	5	56
	9-20	---	---	5-15	1.30-1.60	14.11-141.14	0.06-0.15	0.0-2.9	0.5-1.0	.15	.28			
	20-60	---	---	5-10	1.35-1.55	42.34-141.14	0.04-0.09	0.0-2.9	0.5-1.0	.05	.24			
Philo, occasionally flooded	0-9	---	---	10-18	1.20-1.40	14.11-42.34	0.10-0.14	0.0-2.9	2.0-4.0	.17	.17	5	3	86
	9-60	---	---	5-18	1.20-1.40	4.23-14.11	0.10-0.20	0.0-2.9	0.0-0.5	.55	.55			
Du:														
Dumps, mine (tailings & tipples)	---	---	---	---	---	---	---	---	---	---	---	---	---	---
FbC:														
Fairpoint, unstable fill	0-3	---	---	18-27	1.40-1.55	4.23-14.11	0.09-0.18	0.0-2.9	0.0-0.5	.20	.43	5	7	38
	3-60	---	---	18-35	1.60-1.80	1.41-4.23	0.03-0.10	3.0-5.9	0.0-0.5	.05	.49			
Bethesda, unstable fill	0-7	---	---	18-27	1.40-1.55	4.23-14.11	0.10-0.16	0.0-2.9	0.0-0.5	.15	.37	5	8	0
	7-60	---	---	18-35	1.60-1.90	1.41-4.23	0.04-0.13	0.0-2.9	0.0-0.5	.10	.37			

Physical Soil Properties

Bell and Harlan Counties, Kentucky

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
FbF:														
Fairpoint, unstable fill	0-11	24-52	28-50	7-27	1.35-1.50	4.23-14.11	0.14-0.20	0.3-2.3	0.5-2.0	.20	.37	3	7	38
	11-32	10-52	28-60	7-40	1.60-1.80	1.40-4.00	0.03-0.10	0.2-2.9	0.0-0.3	.10	.43			
	32-41	20-52	28-60	7-27	1.60-1.80	1.40-4.00	0.00-0.10	0.0-1.7	0.0-0.3	.10	.43			
	41-51	20-52	28-60	7-27	1.60-1.80	1.40-4.00	0.01-0.10	0.0-1.0	0.0-0.3	.05	.43			
	51-58	20-52	28-60	7-27	1.60-1.80	1.40-4.00	0.01-0.10	0.0-1.0	0.0-0.3	.10	.49			
	58-72	20-52	28-60	7-27	1.60-1.80	1.40-4.00	0.01-0.10	0.0-1.0	0.0-0.3	.05	.43			
Bethesda, unstable fill	0-12	18-52	28-60	7-40	1.35-1.50	4.23-14.11	0.14-0.20	0.3-4.0	0.5-5.0	.20	.37	5	7	38
	12-36	10-52	28-60	7-40	1.60-1.80	1.40-4.00	0.03-0.10	0.1-3.2	0.0-5.0	.15	.37			
	36-58	10-52	28-60	7-35	1.60-1.80	1.40-4.00	0.03-0.10	0.1-2.5	0.0-5.0	.15	.37			
	58-72	20-52	28-60	7-35	1.60-1.80	1.40-4.00	0.01-0.10	0.0-2.5	0.0-5.0	.10	.28			
GsD:														
Gilpin	0-6	---	---	15-27	1.20-1.40	4.23-14.11	0.18-0.22	0.0-2.9	1.0-3.0	.32	.32	3	6	48
	6-28	---	---	20-35	1.20-1.45	4.23-14.11	0.08-0.16	0.0-2.9	0.0-0.5	.24	.43			
	28-38	---	---	---	---	---	---	---	---	---	---			
Shelocta	0-12	---	---	10-27	1.15-1.30	4.00-14.00	0.16-0.22	0.0-2.9	0.5-5.0	.32	.32	3	5	56
	12-48	---	---	18-45	1.30-1.55	4.00-14.00	0.10-0.20	0.0-2.9	0.0-0.5	.43	.43			
	48-58	---	---	---	---	---	---	---	---	---	---			
GtF:														
Gilpin, very stony	0-1	---	---	---	0.05-0.10	42.00-141.00	0.00-0.30	---	52-86	---	---	2	5	56
	1-5	10-43	30-70	7-27	1.01-1.45	4.00-14.00	0.12-0.18	0.2-1.7	2.0-4.0	.24	.37			
	5-11	10-52	28-70	18-27	1.20-1.61	4.00-14.00	0.08-0.12	0.7-1.8	1.0-2.0	.28	.49			
	11-20	10-45	28-65	18-35	1.20-1.80	4.00-14.00	0.08-0.12	0.7-3.1	0.3-1.0	.32	.55			
	20-28	10-45	28-65	15-35	1.20-1.80	4.00-14.00	0.08-0.12	0.6-3.8	0.0-0.5	.24	.49			
	28-38	---	---	---	---	0.01-0.10	---	---	---	---	---			

Physical Soil Properties

Bell and Harlan Counties, Kentucky

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensi-bility	Organic matter	Erosion factors			Wind erodi-bility group	Wind erodi-bility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
GtF:														
Rayne, very stony	0-1	---	---	---	0.05-0.10	42.00-141.00	0.00-0.30	---	52-86	---	---	4	5	56
	1-2	10-45	45-70	10-27	0.50-1.00	4.00-14.00	0.16-0.22	0.4-1.7	1.0-4.0	.37	.37			
	2-7	10-45	28-65	10-27	1.30-1.60	4.00-14.00	0.10-0.20	0.4-1.9	0.5-3.0	.43	.43			
	7-17	10-45	28-62	15-35	1.30-1.50	4.00-14.00	0.08-0.16	0.5-2.0	0.3-0.8	.49	.49			
	17-24	10-45	28-65	18-35	1.40-1.80	4.00-14.00	0.08-0.16	0.3-1.9	0.3-0.8	.49	.49			
	24-31	10-45	28-65	18-35	1.40-1.80	4.00-14.00	0.08-0.16	0.3-2.1	0.0-0.8	.24	.43			
	31-44	10-32	41-70	18-27	1.35-1.46	4.00-14.00	0.08-0.16	0.4-1.0	0.0-0.3	.17	.49			
	44-54	---	---	---	---	0.00-0.01	---	---	---	---	---			
Sequoia, very stony	0-1	---	---	---	0.05-0.10	42.00-141.00	0.00-0.30	---	52-86	---	---	3	5	56
	1-5	6-39	34-72	15-27	1.00-1.42	4.23-14.11	0.17-0.20	0.0-2.9	0.5-2.0	.49	.49			
	5-12	6-39	16-55	27-45	1.31-1.50	1.41-4.23	0.08-0.16	0.0-5.9	0.0-0.5	.43	.43			
	12-20	6-39	6-45	35-55	1.31-1.45	1.41-4.23	0.08-0.16	0.0-5.9	0.0-0.5	.28	.28			
	20-34	6-39	6-45	35-55	1.31-1.45	1.41-4.23	0.08-0.16	0.0-5.9	0.0-0.5	.28	.28			
	34-44	---	---	---	---	0.00-1.41	---	---	---	---	---			
HeF:														
Helechawa	0-1	---	---	---	0.22-0.27	42.00-141.00	0.15-0.45	---	61-78	---	---	5	2	134
	1-3	40-90	2-50	4-15	0.70-1.43	14.00-42.00	0.10-0.14	0.1-0.9	4.0-20	.05	.05			
	3-12	40-90	2-50	4-15	1.40-1.53	14.00-42.00	0.13-0.17	0.1-0.7	1.3-4.0	.15	.15			
	12-45	40-85	2-50	4-17	1.43-1.67	14.00-42.00	0.11-0.15	0.1-0.9	0.1-1.3	.28	.28			
	45-80	40-90	2-50	4-27	1.45-1.64	14.00-42.00	0.10-0.14	0.1-1.4	0.1-1.0	.17	.17			
Varilla	0-2	---	---	---	0.22-0.27	42.00-141.00	0.15-0.45	---	61-78	---	---	3	5	56
	2-5	30-70	20-67	2-27	1.29-1.48	14.00-42.00	0.10-0.14	0.0-1.2	0.7-6.0	.10	.20			
	5-12	30-70	28-67	2-27	1.48-1.60	14.00-42.00	0.09-0.13	0.0-1.1	0.5-2.0	.17	.32			
	12-22	30-70	28-64	2-27	1.48-1.63	14.00-42.00	0.06-0.10	0.0-0.9	0.1-1.0	.15	.37			
	22-36	30-70	21-64	2-27	1.43-1.60	14.00-42.00	0.05-0.09	0.0-0.9	0.1-1.0	.10	.37			
	36-47	40-76	21-50	3-18	1.43-1.60	14.00-42.00	0.03-0.07	0.0-0.6	0.1-0.5	.05	.28			
	47-66	43-90	5-50	2-18	1.43-1.60	14.00-141.00	0.01-0.03	0.0-0.6	0.1-0.5	.02	.17			

Physical Soil Properties

Bell and Harlan Counties, Kentucky

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensi-bility	Organic matter	Erosion factors			Wind erodi-bility group	Wind erodi-bility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
HeF:														
Jefferson	0-1	---	---	---	0.22-0.27	42.00-141.00	0.15-0.45	---	61-78	---	---	5	6	48
	1-10	24-70	10-65	10-20	1.34-1.47	14.11-42.34	0.14-0.18	0.3-0.9	0.8-5.0	.20	.32			
	10-24	21-70	10-53	10-27	1.48-1.55	14.11-42.34	0.13-0.17	0.3-1.3	0.4-0.8	.43	.43			
	24-41	21-70	10-53	10-27	1.54-1.64	14.11-42.34	0.13-0.17	0.3-1.3	0.2-0.4	.43	.43			
	41-81	28-75	20-50	5-30	1.50-1.58	14.11-42.34	0.08-0.12	0.1-1.2	0.1-0.2	.15	.37			
HsF:														
Highsplint	0-4	---	---	15-27	1.10-1.30	4.23-42.34	0.07-0.15	0.0-2.9	0.5-5.0	.10	.32	5	8	0
	4-48	---	---	18-34	1.30-1.55	4.23-42.34	0.07-0.13	0.0-2.9	0.3-0.7	.10	.43			
	48-60	---	---	18-34	1.55-1.70	1.41-14.11	0.05-0.11	0.0-2.9	0.2-0.7	.15	.43			
Cloverlick	0-11	---	---	18-27	1.00-1.20	4.00-14.00	0.20-0.24	0.0-2.9	5.0-15	.10	.20	5	8	0
	11-45	---	---	15-30	1.30-1.50	4.00-14.00	0.12-0.20	0.0-2.9	0.3-0.8	.10	.37			
	45-60	---	---	15-30	1.30-1.60	4.00-14.00	0.05-0.12	0.0-2.9	0.0-0.5	.10	.37			
Guyandotte	0-13	---	---	5-27	1.00-1.30	4.00-14.00	0.10-0.16	0.0-2.9	2.0-10	.10	.37	5	8	0
	13-60	---	---	5-27	1.30-1.60	4.00-14.00	0.05-0.15	0.0-2.9	0.3-0.8	.10	.43			
Ph:														
Philo, occasionally flooded	0-9	---	---	10-18	1.20-1.40	14.11-42.34	0.10-0.14	0.0-2.9	2.0-4.0	.17	.17	3	3	86
	9-37	---	---	10-18	1.20-1.40	4.23-14.11	0.10-0.20	0.0-2.9	0.0-0.5	.28	.28			
	37-60	---	---	5-18	1.20-1.40	14.00-42.00	0.06-0.10	0.0-2.9	0.0-0.5	.05	.32			
Po:														
Pope, occasionally flooded	0-4	---	---	5-15	1.20-1.40	14.00-42.00	0.10-0.16	0.0-2.9	1.0-4.0	.20	.20	4	3	86
	4-23	---	---	5-18	1.30-1.60	4.00-42.00	0.10-0.18	0.0-2.9	0.3-0.8	.32	.32			
	23-59	---	---	5-20	1.30-1.60	4.00-42.00	0.10-0.18	0.0-2.9	0.0-0.5	.20	.20			
	59-62	---	---	5-20	1.30-1.60	4.00-42.00	0.10-0.18	0.0-2.9	0.0-0.5	.02	.10			

Physical Soil Properties

Bell and Harlan Counties, Kentucky

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensi-bility	Organic matter	Erosion factors			Wind erodi-bility group	Wind erodi-bility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	micro m/sec	In/In	Pct	Pct					
Sb:														
Shelbiana, occasionally flooded	0-15	---	---	10-27	1.20-1.40	4.23-14.11	0.12-0.22	0.0-2.9	2.0-6.0	.32	.32	5	5	56
	15-70	---	---	18-34	1.20-1.50	4.23-14.11	0.12-0.22	0.0-2.9	0.3-0.8	.43	.43			
SgE:														
Shelocta	0-6	---	---	10-27	1.15-1.30	4.23-14.11	0.16-0.22	0.0-2.9	0.5-5.0	.32	.32	3	5	56
	6-33	---	---	20-34	1.30-1.55	4.23-14.11	0.10-0.20	0.0-2.9	0.5-2.0	.43	.43			
	33-58	---	---	15-45	1.30-1.55	4.23-42.34	0.08-0.16	0.0-2.9	0.0-0.5	.24	.43			
	58-68	---	---	---	---	---	---	---	---	---	---			
Gilpin	0-6	---	---	15-27	1.20-1.40	4.23-14.11	0.18-0.22	0.0-2.9	1.0-3.0	.32	.32	3	6	48
	6-26	---	---	18-35	1.20-1.45	4.23-14.11	0.08-0.16	0.0-2.9	0.0-0.5	.43	.43			
	26-36	---	---	---	---	---	---	---	---	---	---			
ShF:														
Shelocta, very stony	0-1	---	---	---	0.15-0.30	42.00-141.00	0.27-0.38	---	52-86	---	---	4	5	56
	1-3	10-35	50-70	10-27	1.26-1.39	4.00-14.00	0.12-0.22	0.6-2.9	1.0-10	.32	.32			
	3-7	10-45	28-65	10-27	1.31-1.42	4.00-14.00	0.11-0.17	0.5-2.8	0.5-3.0	.37	.37			
	7-23	20-45	28-62	18-35	1.34-1.50	4.00-14.00	0.11-0.19	0.7-2.6	0.3-1.0	.32	.43			
	23-34	10-45	28-65	18-35	1.42-1.53	4.00-14.00	0.07-0.19	0.4-2.7	0.3-0.8	.28	.49			
	34-45	10-45	28-65	18-35	1.42-1.53	4.00-14.00	0.08-0.20	0.4-2.9	0.1-0.5	.17	.43			
	45-59	10-32	50-70	18-27	1.35-1.46	4.00-14.00	0.00-0.18	0.5-1.7	0.0-0.3	.64	.64			
	59-69	---	---	---	---	0.00-0.01	---	---	---	---	---			
Highsplint, very stony	0-1	---	---	---	0.05-0.10	42.00-141.00	0.14-0.26	---	61-78	---	---	5	8	0
	1-4	13-32	50-64	7-27	1.22-1.46	4.23-42.34	0.07-0.14	0.2-1.3	0.5-5.0	.10	.32			
	4-11	13-40	35-64	18-34	1.39-1.48	4.23-42.34	0.07-0.14	0.4-2.0	0.3-0.7	.10	.37			
	11-28	13-35	42-62	18-34	1.39-1.53	4.23-42.34	0.07-0.13	0.4-2.0	0.3-0.7	.10	.37			
	28-48	18-40	40-62	18-34	1.39-1.44	4.23-42.34	0.07-0.15	0.4-2.0	0.3-0.7	.10	.37			
	48-85	18-40	40-62	18-34	1.40-1.58	1.41-14.11	0.07-0.15	0.4-2.0	0.2-0.7	.10	.43			

Physical Soil Properties

Bell and Harlan Counties, Kentucky

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
ShF:														
Gilpin, very stony	0-1	---	---	---	0.05-0.10	42.00-141.00	0.25-0.34	---	52-86	---	---	2	6	48
	1-5	10-40	50-70	7-27	1.01-1.45	4.00-14.00	0.11-0.17	0.1-1.5	2.0-4.0	.24	.37			
	5-11	10-50	30-70	18-27	1.20-1.61	4.00-14.00	0.10-0.20	0.7-1.8	1.0-2.0	.28	.49			
	11-20	10-45	24-70	18-35	1.20-1.80	4.00-14.00	0.10-0.23	0.7-3.1	0.3-1.0	.32	.55			
	20-28	10-45	28-70	15-40	1.20-1.80	4.00-14.00	0.00-0.23	0.6-4.8	0.0-0.5	.24	.49			
	28-38	---	---	---	---	0.01-0.10	---	---	---	---	---			
SkF:														
Shelocta, very stony	0-1	---	---	---	0.05-0.10	42.00-141.00	0.00-0.30	---	52-86	---	---	4	5	56
	1-3	10-45	45-70	10-27	0.50-1.00	4.00-14.00	0.16-0.22	0.3-2.6	2.0-12	.32	.32			
	3-7	10-45	28-65	10-27	1.30-1.60	4.00-14.00	0.10-0.20	0.4-1.9	1.5-5.0	.32	.32			
	7-23	20-45	28-62	18-35	1.30-1.50	4.00-14.00	0.08-0.16	0.5-2.0	1.0-2.0	.28	.43			
	23-34	10-45	28-65	18-35	1.40-1.80	4.00-14.00	0.08-0.16	0.3-1.9	0.3-0.8	.28	.49			
	34-45	10-45	28-65	18-35	1.40-1.80	4.00-14.00	0.08-0.16	0.3-2.1	0.0-0.8	.17	.43			
	45-59	8-32	50-70	18-27	1.35-1.46	4.00-14.00	0.08-0.16	0.4-1.0	0.0-0.3	.64	.64			
	59-69	---	---	---	---	0.00-0.01	---	---	---	---	---			
Kimper, very stony	0-2	---	---	---	0.05-0.10	42.00-141.00	0.00-0.03	---	61-78	---	---	5	7	38
	2-8	23-52	28-50	8-27	1.00-1.50	14.11-42.34	0.09-0.15	0.2-1.9	0.5-3.0	.10	.24			
	8-13	20-65	20-70	8-27	1.00-1.50	14.11-42.34	0.09-0.15	0.2-1.3	0.5-1.8	.17	.37			
	13-27	20-65	20-65	8-27	1.25-1.60	14.11-42.34	0.07-0.15	0.2-1.5	0.0-1.0	.24	.43			
	27-41	20-65	20-65	8-27	1.25-1.50	14.11-42.34	0.07-0.15	0.3-1.9	0.0-1.0	.20	.37			
	41-52	20-65	20-65	8-35	1.25-1.50	14.11-42.34	0.07-0.15	0.2-2.7	0.0-1.0	.15	.37			
	52-64	20-65	20-70	8-35	1.25-1.60	14.11-42.34	0.07-0.15	0.2-2.7	0.0-1.0	.15	.37			
	64-75	20-65	20-70	8-35	1.25-1.50	14.11-42.34	0.07-0.15	0.2-2.7	0.0-1.0	.15	.49			
	75-85	---	---	---	---	0.42-1.40	---	---	---	---	---			

Physical Soil Properties

Bell and Harlan Counties, Kentucky

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensi-bility	Organic matter	Erosion factors			Wind erodi-bility group	Wind erodi-bility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
SkF:														
Cloverlick, very stony	0-2	---	---	---	0.05-0.10	42.00-141.00	0.00-0.03	---	61-78	---	---	5	7	38
	2-8	23-52	28-50	8-27	1.00-1.50	14.11-42.34	0.09-0.15	0.2-1.7	0.5-3.0	.10	.20			
	8-24	18-45	28-65	8-27	1.00-1.50	4.23-42.34	0.07-0.13	0.2-3.0	0.3-0.7	.24	.37			
	24-43	20-52	28-65	8-27	1.00-1.50	14.11-42.34	0.07-0.15	0.0-1.6	0.0-1.0	.15	.43			
	43-80	40-60	8-52	8-35	1.00-1.50	4.23-42.34	0.03-0.13	0.0-2.1	0.3-0.7	.10	.37			
SmF:														
Shelocta	0-8	---	---	10-25	1.15-1.30	4.00-14.00	0.16-0.22	0.0-2.9	0.5-5.0	.32	.32	3	5	56
	8-31	---	---	18-34	1.30-1.55	4.00-14.00	0.10-0.20	0.0-2.9	0.3-0.8	.28	.43			
	31-55	---	---	15-34	1.30-1.55	4.00-14.00	0.08-0.16	0.0-2.9	0.0-0.5	.24	.43			
	55-65	---	---	---	---	---	---	---	---	---	---			
Kimper	0-7	---	---	12-27	1.00-1.40	4.23-42.34	0.13-0.20	0.0-2.9	2.0-15	.15	.28	5	6	48
	7-48	---	---	18-30	1.20-1.70	4.23-14.11	0.13-0.20	0.0-2.9	0.5-2.0	.24	.43			
	48-62	---	---	12-20	1.20-1.70	4.23-42.34	0.10-0.16	0.0-2.9	0.0-0.5	.37	.64			
	62-72	---	---	---	---	---	---	---	---	---	---			
Cutshin	0-17	---	---	12-27	1.20-1.40	4.23-14.11	0.08-0.16	0.0-2.9	3.0-7.0	.28	.28	3	5	56
	17-60	---	---	12-27	1.20-1.40	4.23-14.11	0.08-0.16	0.0-2.9	0.5-2.0	.15	.37			
Ud:														
Udorthents, unstable fill	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Urban land	---	---	---	---	---	---	---	---	---	---	---	---	---	---
UrE:														
Udorthents, unstable fill	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Urban land	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Physical Soil Properties

Bell and Harlan Counties, Kentucky

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
VrD:														
Varilla	0-5	---	---	3-20	1.00-1.40	14.11-42.34	0.10-0.13	0.0-2.9	1.0-6.0	.05	.15	5	7	38
	5-31	---	---	3-20	1.45-1.65	14.11-42.34	0.05-0.10	0.0-2.9	0.5-1.5	.10	.32			
	31-60	---	---	3-20	1.45-1.65	14.11-141.14	0.01-0.05	0.0-2.9	0.0-0.5	.05	.24			
W:														
Water	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Appendix H-6:

MTR Mining Darby

🟪	*ESTIMATED LIMITS OF MOUNTAINTOP REMOVAL IN DARBY SEAM FROM 7-13-07 TO 7-2-08, APPROXIMATE ELEVATION 2180'*
▨	*LIKELY AREAS OF MOUNTAINTOP REMOVAL MINING IN DARBY SEAM (DARBY PITS NOT SHOWN, BUT LIKELY MINED BASED ON ADJACENT KELLIOKA MTR)*
⬡	*ESTIMATED LIMITS OF MOUNTAINTOP REMOVAL IN DARBY SEAM FROM STAMPED DRAWING DATED 12-31-2015*

NOTES:

1. *DRAWING ADAPTED FROM "CHESTNUT FLATS SECOND QUARTER PIT MAP" DATED JUNE 27, 2008 PREPARED BY NALLY AND HAMILTON ENTERPRISES PROVIDED BY RESPEC.*

GRAPHIC SCALE
200' 0 200' 400'

THESE DRAWINGS ARE PART OF A SET OF DESIGN DOCUMENTS WHICH ALSO CONTAINS A WRITTEN TEXT. THAT TEXT EXPLAINS SOME OF THE DETAILS SHOWN HEREIN AND THEREFORE THESE DRAWINGS SHOULD ONLY BE USED IN CONJUNCTION WITH THE TEXT.

DATE	REVISIONS	BY

MTR MINING DARBY

RYE LEWIS RIDGE
KENTUCKY

SCALE: *AS SHOWN* | DR *RAR* | CHK *MSH* | REV *MSH*

PREPARED FOR:
RYE DEVELOPMENT

PREPARED BY:
Schnabel ENGINEERING
3502 OVERLOOK CIRCLE • KNOXVILLE, TENNESSEE 37909 • (865) 584-0344

PROJ: *220210100* | DATE: *9-4-24* | SHEET *1* OF *1*

Appendix H-7:

MTR Mining Kellioka

🟨 ESTIMATED LIMITS OF MOUNTAINTOP REMOVAL IN KELLIOKA SEAM FROM 7-2-07 TO 2-28-09, APPROXIMATE ELEVATION 2140'

▨ ESTIMATED LIMITS OF MOUNTAINTOP REMOVAL IN KELLIOKA SEAM FROM STAMPED DRAWING DATED 12-31-2015

NOTES:

1. DRAWING ADAPTED FROM "CHESTNUT FLATS SECOND QUARTER PIT MAP" DATED JUNE 27, 2008 PREPARED BY NALLY AND HAMILTON ENTERPRISES PROVIDED BY RESPEC.

THESE DRAWINGS ARE PART OF A SET OF DESIGN DOCUMENTS WHICH ALSO CONTAINS A WRITTEN TEXT. THAT TEXT EXPLAINS SOME OF THE DETAILS SHOWN HEREIN AND THEREFORE THESE DRAWINGS SHOULD ONLY BE USED IN CONJUNCTION WITH THE TEXT.

DATE	REVISIONS	BY

MTR MINING KELLIOKA

RYE LEWIS RIDGE
KENTUCKY

SCALE: AS SHOWN | DR RAR | CHK MSH | REV MSH

PREPARED FOR:

RYE DEVELOPMENT

PREPARED BY:

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PROJ: 220210100 | DATE: 9-4-24 | SHEET 1 OF 1

Appendix H-8:

Harlan Seam

TEAL BARS SHOWN HAVE LENGTHS OF AS MUCH AS ABOUT 500-600' AND ARE ABOUT 24-33' APART, BUT NOTES ON DRAWINGS SAY WORKS ARE 42" AUGER HOLES 1.7' APART LENGTH OF ABOUT 125', SEAM THICKNESS = 53" BOTTOM OF COAL ELEVATION APPROXIMATELY 1925. SEE NOTE 4.

NOTES

1. BASE MAP CONTOURS BASED ON KENTUCKY LIDAR MAPPING OBTAINED FROM KYFROMABOVE.KY.GOV DATED 2023.
2. MINE INFORMATION BASED ON MINE MAPS OBTAINED FROM KENTUCKY MINE MAPPING INFORMATION SYSTEM MARCH 2024.
3. BASED ON NOTES ON DRAWING PROVIDED, THE ENTRY ENCOUNTERED A MINE VOID, BUT DRAWINGS PROVIDED DO NOT SHOW DEEP MINING IN THE AREA.
4. IN SEVERAL AREAS OF HIGHWALL MINING INCLUDING THE CRITICAL AREA THAT EXTENDS BELOW THE NORTH SIDE OF THE RESERVOIR, THE TYPE OF MINING (AUGER OR HIGHWALL) IS UNCLEAR.
5. AROUND MUCH OF THE PERIMETER, MAPPING PROVIDED SHOWS THE CONTOUR CUT EXTENDING INTO THE HILLSIDE PAST THE HIGHWALL ENTRIES, WHICH WOULD NOT HAVE OCCURRED IN THE FIELD.
6. MAPPING PROVIDED SHOWS THE DEEP MINE WORKS EXTENDING TO NEAR, OR EVEN PAST THE OUTCROP, WHICH WOULD NOT HAVE OCCURRED IN THE FIELD.

LEGEND

🟥	ESTIMATED LIMITS OF CONTOUR MINING, FROM JANUARY 2013 TO APRIL 2014
🟨	ESTIMATED ZONES WHERE PILLARS WERE PULLED
═	HIGHWALL MINING ENTRIES
—	ESTIMATED HARLAN SEAM OUTCROP
—	LIMITS OF MINE WORKS
- - -	PROJECTED LIMITS OF MINE WORKS
- - -	PROJECTED PILLARS

GRAPHIC SCALE
300' 0 300' 600'

THESE DRAWINGS ARE PART OF A SET OF DESIGN DOCUMENTS WHICH ALSO CONTAINS A WRITTEN TEXT. THAT TEXT EXPLAINS SOME OF THE DETAILS SHOWN HEREIN AND THEREFORE THESE DRAWINGS SHOULD ONLY BE USED IN CONJUNCTION WITH THE TEXT.

DATE	REVISIONS	BY

HARLAN SEAM

RYE LEWIS RIDGE
KENTUCKY

SCALE: AS SHOWN	DR RAR	CHK MSH	REV MSH

PREPARED FOR:
RYE DEVELOPMENT

PREPARED BY:
Schnabel ENGINEERING
3502 OVERLOOK CIRCLE • KNOXVILLE, TENNESSEE 37909 • (865) 584-0344

PROJ: 220210100	DATE: 9-4-24	SHEET 1 OF 1

Appendix H-9:

Pathfork Seam

THESE DRAWINGS ARE PART OF A SET OF DESIGN DOCUMENTS WHICH ALSO CONTAINS A WRITTEN TEXT. THAT TEXT EXPLAINS SOME OF THE DETAILS SHOWN HEREIN AND THEREFORE THESE DRAWINGS SHOULD ONLY BE USED IN CONJUNCTION WITH THE TEXT.

NOTES

1. BASE MAP CONTOURS BASED ON KENTUCKY LIDAR MAPPING OBTAINED FROM KYFROMABOVE.KY.GOV DATED 2023..
2. MINE INFORMATION BASED ON MINE MAPS OBTAINED FROM KENTUCKY MINE MAPPING INFORMATION SYSTEM MARCH 2024.

LEGEND

≡	HIGHWALL MINING ENTRIES
▨	ESTIMATED LIMITS OF CONTOUR MINING
▨	HIGHWALL MINING IDENTIFIED BY KY

DATE	REVISIONS	BY

PATHFORK SEAM

RYE LEWIS RIDGE
KENTUCKY

SCALE: AS SHOWN
DR RAR
CHK MSH
REV MSH

PREPARED FOR:
RYE DEVELOPMENT

PREPARED BY:
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PROJ: 220210100
DATE: 9-4-24
SHEET 1 OF 1

Appendix H-10:

Hance Seam

NOTES

1. BASE MAP CONTOURS BASED ON KENTUCKY LIDAR MAPPING OBTAINED FROM KYFROMABOVE.KY.GOV DATED 2023..

2. MINE INFORMATION BASED ON MINE MAPS OBTAINED FROM KENTUCKY MINE MAPPING INFORMATION SYSTEM MARCH 2024.

LEGEND

▨	ESTIMATED LIMITS OF CONTOUR MINING
▨	ESTIMATED LIMITS OF CONTOUR MINING FROM RESPEC
≡	HIGHWALL MINING ENTRIES, FROM AUGUST 2014 TO SEPTEMBER 2014'
—	LIMITS OF MINE WORKS
—	PULLED PILLARS
—	PILLARS

GRAPHIC SCALE
300' 0 300' 600'

THESE DRAWINGS ARE PART OF A SET OF DESIGN DOCUMENTS WHICH ALSO CONTAINS A WRITTEN TEXT. THAT TEXT EXPLAINS SOME OF THE DETAILS SHOWN HEREIN AND THEREFORE THESE DRAWINGS SHOULD ONLY BE USED IN CONJUNCTION WITH THE TEXT.

DATE	REVISIONS	BY

HANCE SEAM

RYE LEWIS RIDGE
KENTUCKY

SCALE: AS SHOWN
DR RAR
CHK MSH
REV MSH

PREPARED FOR:
RYE DEVELOPMENT

PREPARED BY:
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3502 OVERLOOK CIRCLE • KNOXVILLE, TENNESSEE 37909 • (865) 584-0344

PROJ: 220210100
DATE: 9-4-24
SHEET 1 OF 1

Appendix H-11:

Mason Seam

NOTES

1. BASE MAP CONTOURS BASED ON KENTUCKY LIDAR MAPPING OBTAINED FROM KYFROMABOVE.KY.GOV DATED 2023..
2. MINE INFORMATION BASED ON MINE MAPS OBTAINED FROM KENTUCKY MINE MAPPING INFORMATION SYSTEM MARCH 2024.
3. SURFACE MINING BASED ON "807-0353 TOMS FORK MASON SEAM" DRAWING PROVIDED BY RESPEC MARCH 2024. WORKINGS HAVE NOT BEEN VERIFIED AND MAY NOT BE ACCURATE. PARTICULARLY ON THE SOUTH SIDE OF THE LOWER RESERVOIR WHERE SURFACE MINE LIMITS SHOWN ARE NOT CONSISTENT WITH ON-SITE OBSERVATIONS OF LARGE TREES.

LEGEND

▦	ESTIMATED LIMITS OF AUGER MINING
▨	ESTIMATED LIMITS OF SPOIL STORAGE
▦	ESTIMATED LIMITS OF CONTOUR MINING FROM RESPEC
▦	ESTIMATED LIMITS OF CONTOUR MINING FROM NALLY

GRAPHIC SCALE
300' 0 300' 600'

THESE DRAWINGS ARE PART OF A SET OF DESIGN DOCUMENTS WHICH ALSO CONTAINS A WRITTEN TEXT. THAT TEXT EXPLAINS SOME OF THE DETAILS SHOWN HEREIN AND THEREFORE THESE DRAWINGS SHOULD ONLY BE USED IN CONJUNCTION WITH THE TEXT.

DATE	REVISIONS	BY

MASON SEAM

RYE LEWIS RIDGE
KENTUCKY

SCALE: AS SHOWN | DR RAR | CHK MSH | REV MSH

PREPARED FOR:
RYE DEVELOPMENT

PREPARED BY:
Schnabel ENGINEERING
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PROJ: 220210100 | DATE: 9-4-24 | SHEET 1 OF 1

Contains Critical Energy Infrastructure Information
- CUI//CEII –

LEWIS RIDGE PUMPED STORAGE PROJECT
FERC NO. 15249

DRAFT EXHIBIT F
GENERAL DESIGN DRAWINGS

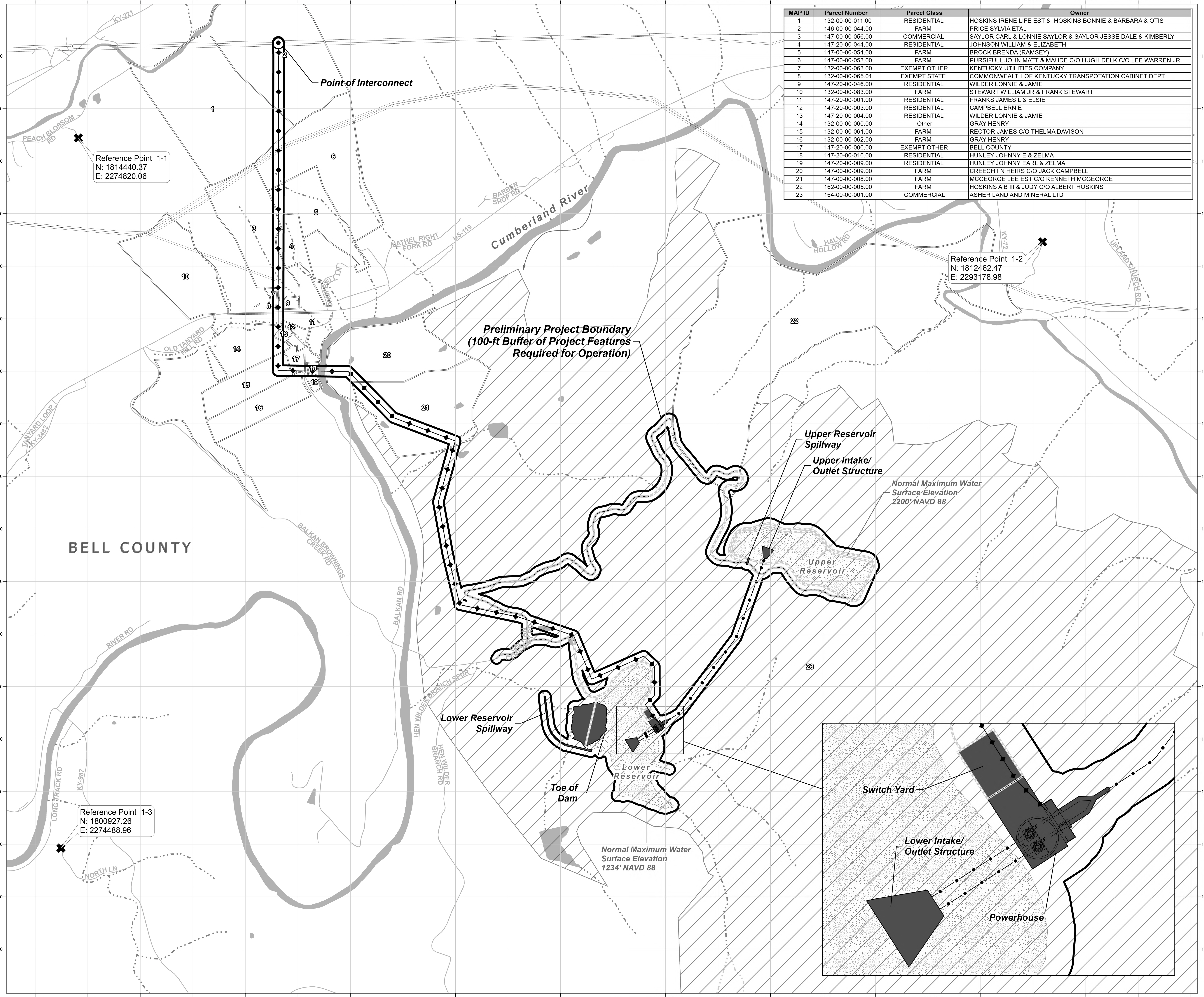
(This Exhibit is Filed under Separate Cover as CEII)

LEWIS RIDGE PUMPED STORAGE PROJECT

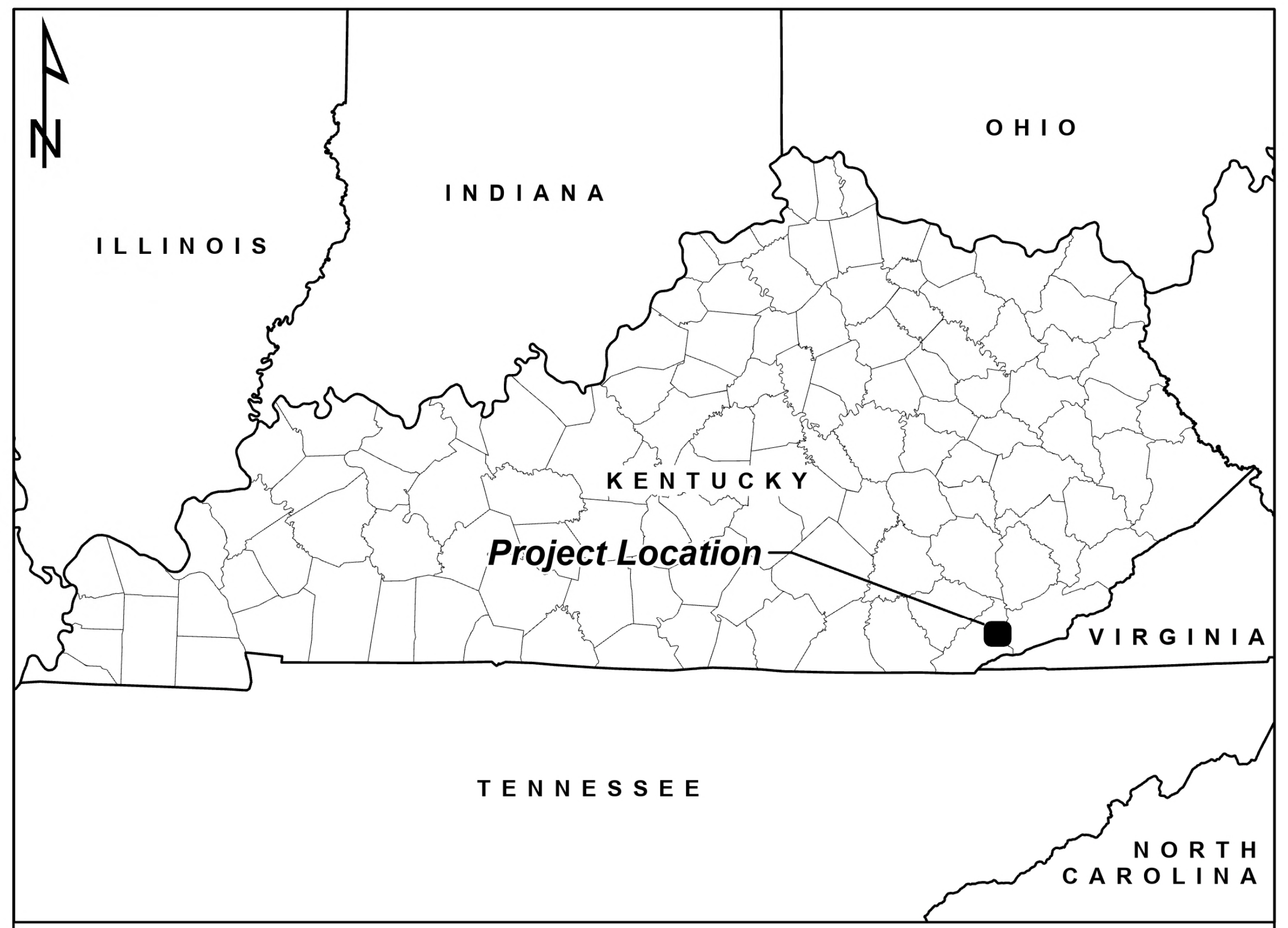
FERC NO. 15249

DRAFT EXHIBIT G

PROJECT BOUNDARY MAP



MAP ID	Parcel Number	Parcel Class	Owner
1	132-00-00-011.00	RESIDENTIAL	HOSKINS IRENE LIFE EST & HOSKINS BONNIE & BARBARA & OTIS
2	146-00-00-044.00	FARM	PRICE SYLVIA ETAL
3	147-00-00-056.00	COMMERCIAL	SAYLOR CARL & LONNIE SAYLOR & SAYLOR JESSE DALE & KIMBERLY
4	147-20-00-044.00	RESIDENTIAL	JOHNSON WILLIAM & ELIZABETH
5	147-00-00-054.00	FARM	BROCK BRENDA (RAMSEY)
6	147-00-00-053.00	FARM	PURSIFULL JOHN MATT & MAUDE C/O HUGH DELK C/O LEE WARREN JR
7	132-00-00-063.00	EXEMPT OTHER	KENTUCKY UTILITIES COMPANY
8	132-00-00-065.01	EXEMPT STATE	COMMONWEALTH OF KENTUCKY TRANSPOTATION CABINET DEPT
9	147-20-00-046.00	RESIDENTIAL	WILDER LONNIE & JAMIE
10	132-00-00-083.00	FARM	STEWART WILLIAM JR & FRANK STEWART
11	147-20-00-001.00	RESIDENTIAL	FRANKS JAMES L & ELSIE
12	147-20-00-003.00	RESIDENTIAL	CAMPBELL ERNIE
13	147-20-00-004.00	RESIDENTIAL	WILDER LONNIE & JAMIE
14	132-00-00-060.00	Other	GRAY HENRY
15	132-00-00-061.00	FARM	RECTOR JAMES C/O THELMA DAVISON
16	132-00-00-062.00	FARM	GRAY HENRY
17	147-20-00-006.00	EXEMPT OTHER	BELL COUNTY
18	147-20-00-010.00	RESIDENTIAL	HUNLEY JOHNNY E & ZELMA
19	147-20-00-009.00	RESIDENTIAL	HUNLEY JOHNNY EARL & ZELMA
20	147-00-00-009.00	FARM	CREECH I N HEIRS C/O JACK CAMPBELL
21	147-00-00-008.00	FARM	MCGEORGE LEE EST C/O KENNETH MCGEORGE
22	162-00-00-005.00	FARM	HOSKINS A B III & JUDY C/O ALBERT HOSKINS
23	164-00-00-001.00	COMMERCIAL	ASHER LAND AND MINERAL LTD



TN
MN
6.45°W
9/27/2024

- Preliminary Project Boundary
- Point of Interconnect
- Reference Point
- Regional Transmission Line
- River/Waterbody
- Stream/River
- Other Hydrography
- Road
- Asher Land and Mineral LTD Parcel
- Parcels Intersecting the Preliminary Project Boundary
- Penstock
- Transmission Interconnection Line
- Permanent Access Road (Existing)
- Permanent Access Road (New)
- Project Reservoir
- Project Features

Map notes:

1. The Lewis Ridge Project is located in the State of Kentucky in Bell County.
2. Reference Point coordinates are shown in NAD 1983 StatePlane Kentucky South FIPS 1602 Ft US.
3. Elevations shown are referenced to North American Vertical Datum of 1988.
4. Licensee has acquired or plans to acquire rights to occupy and use all lands necessary or appropriate for the construction, maintenance, and operation of the Project. All property records are kept on file with the licensee.
5. There are no federal lands within the Project boundary.
6. The Project boundary description, as required by 18 CFR 4.41, is represented here by a grid of Northings and Eastings around, and graticules within, the map frame. Any position in Northings and Eastings along the Project boundary can be determined using these references.
7. The Project boundary was generated using a 100-ft buffer of Lewis Ridge Project features required for project operation.
8. Asher Land and Mineral LTD parcel boundary was derived from a survey completed in 1998 (estimate). No land has been sold or modified since the time of the survey. All other parcel boundaries were sourced from regrid (2022). Ownership for these parcels were sourced from qPublic (2024).

LEWIS RIDGE PUMPED STORAGE, LLC

LEWIS RIDGE PUMP STORAGE PROJECT
FERC NO. 15249

PROJECT BOUNDARY MAP

EXHIBIT G

SCALE: 1" = 900'

SHEET NO. 1 OF 1

0 500 1,000 2,000 3,000 4,000 Feet

DATE: SEPTEMBER 2024

FERC DWG. NO. 15249-