Appendix J

STREAM AND WETLAND DELINEATION

Mantle Rock Solar LLC

Livingston County, Kentucky

COPPERHEAD
ENVIRONMENTAL CONSULTING

Wetland and Stream Delineation Report for the Proposed Mantle Rock Solar Project in Livingston County, Kentucky

3 April 2024

COPPERHEAD ENVIRONMENTAL CONSULTING, INC.
P.O. BOX 73 ■ 471 MAIN STREET ■ PAINT LICK, KENTUCKY 40461
(859) 925-9012 OFFICE (859) 925-9816 FAX

www.copperheadconsulting.com

TABLE OF CONTENTS

LIST OF TABLES

APPENDICES

ACRONYMS AND ABBREVIATIONS

FEMA	Federal Emergency Management Agency
GPS	global positioning system
NHD	National Hydrography Dataset
NLCD	National Land Cover Database
NRCS	Natural Resource Conservation Service
NWI	National Wetlands Inventory
OHWM	ordinary high-water mark
PEM	palustrine emergent wetland
PFO	palustrine forested wetland
PUB	palustrine unconsolidated bottom wetland
RBP	Rapid Bioassessment Protocol
UDF	upland drainage feature
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WOTUS	Waters of the United States

1 INTRODUCTION

Enerfin Renewables LLC (Enerfin) contracted Copperhead Environmental Consulting, Inc. (Copperhead) to conduct a wetland and stream delineation for the proposed Mantle Rock Solar Project (Project) in Livingston County, Kentucky, to identify and delineate aquatic features that may be considered jurisdictional waters of the United States (WOTUS) or non-jurisdictional waters. The project consists of an approximately 537-acre study area located near Hampton, Kentucky (Figure 1 – Overview Map in Appendix A). The field delineation was conducted on April 10th -13th by Jake Murphy, Meg Herod, and Isaac Bentley.

Features were originally delineated using the EPA 2023 pre-Sackett Vs. U.S. EPA definition of "Waters of the United States". On September 8, 2023, revised guidance from the USACE and the EPA was published to the Federal Register conforming to rulings from the case of Sackett vs EPA regarding determinations of the jurisdictional status for wetlands and waterbodies. The conforming rules removed the significant nexus standard introduced previously under the Rapanos rules, and eliminated the portion of the January 2023 definitions that considered all interstate waters jurisdictional. Ultimately, jurisdictional statuses for wetlands and waters were based on the relative permanence of a feature, and the presence of a direct surface connection between wetlands, relatively permanent waters, and downstream waters of the U.S. As such, Jurisdictional statuses for wetlands and waterbodies within the study area were revised to include only those waters with relatively permanent stagnant or flowing water and wetlands with a continuous overland connection to downstream navigable waters as federally jurisdictional. Ephemeral streams, upland drainage features and non-jurisdictional (isolated) wetlands are included in maps and tables for reference purposes only.

2 METHODS

2.1 Preliminary Desktop Analysis

Prior to the field survey, a preliminary desktop analysis of available information was conducted using the following sources:

- ESRI GeoServer Web Map Service, National Land Cover Database (NLCD)_2016 Land Cover L48;
- Federal Emergency Management Agency (FEMA) National Flood Hazard Map (FEMA 2015)
- National Wetlands Inventory (NWI) Maps (USFWS 2021);
- The National Hydrography Dataset (NHD; U.S. Geological Survey [USGS] 2006);
- U.S. Department of Agriculture (USDA) *Soil Survey of Livingston County, Kentucky* (2007);
- USDA Natural Resource Conservation Service (NRCS) Livingston County hydric soils lists (USDA NRCS 2021a); and
- Web Soil Survey (USDA NRCS 2021b).

The locations of surface waters, wetlands, and floodplains identified during the preliminary desktop analysis were mapped (Figure 3 – Existing Hydrology Map in Appendix A) and used as

a baseline reference that was compared, verified, and/or modified based on actual conditions observed during the field investigations using the methodologies outlined in Sections 2.2 and 2.3.

2.2 Methods for Delineating Wetlands

Copperhead conducted field investigations to identify the presence or absence of wetlands within the study area. When present, the location, extent, and boundaries of wetlands were delineated in accordance with the 1987 *U.S. Army Corps of Engineers Wetlands Delineation Manual* (USACE 1987) and *Regional Supplement to the Corps of Engineers' Wetland Delineation Manual: Eastern Mountains and Piedmont Region (Version 2.0)* (USACE 2012). Wetland delineations were based on the presence of wetland hydrology, hydrophytic (wetland) vegetation, and hydric soils. Wetlands were described utilizing Cowardin classes (Cowardin, et al. 1979) to ensure consistency with methodologies employed by the US Fish and Wildlife Service (USFWS) and other federal agencies when documenting the type of wetland feature present.

To verify the presence and extent of wetlands and waters on site, observations were made to identify primary and secondary wetland hydrology indicators visible above the soil surface. In areas possessing indicators of wetland hydrology, vegetative cover within each wetland was identified and the wetland indicator status of each plant species was determined according to the 2018 National Wetland Plant List (Lichvar et al. 2018). Finally, soil profiles within each respective community were sampled to a depth of approximately 18 inches to determine if hydric soil indicators were present. Soil colors were documented using a Munsell Soil Color Chart (Munsell Color 2010). Areas with the presence of all three wetland indicators (i.e., wetland hydrology, hydrophytic vegetation, and hydric soils) were delineated as wetlands. Areas with one or more parameters considered "significantly disturbed" or "naturally problematic" based on the 1987 manual and EMP regional supplement were evaluated on a case-by-case basis.

At locations where wetland indicators were observed (i.e., wetland hydrology, hydrophytic vegetation, and hydric soils), a USACE Wetland Determination Data Form was completed to represent the environmental conditions and vegetation communities present on site. Each data form included supporting rationales for determining the presence or absence of each wetland parameter. The classification of wetlands deemed potentially jurisdictional was computed using the Kentucky Division of Water Wetland Rapid Assessment Method (KYWRAM) version 3. The KYWRAM rating denotes the quality of the wetland and can be used to evaluate mitigation efforts.

The wetland boundaries within the study area were delineated using a Trimble global positioning system (GPS) handheld unit. GPS data were collected using ArcGIS Online Field Maps software. The GPS points of wetland boundaries and test pit locations (including coordinates and attribute information) were subsequently imported into ESRI ArcGIS software for creating maps of delineated wetlands and calculating wetland acreages.

2.3 Methods for Assessing Streams

Hydrologic features other than wetlands (e.g. stream channels) were delineated in the field by identifying the ordinary high-water mark (OHWM). OHWM is defined as the line on the shore

established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas (33 CFR 328.3(c)(7)).

Streams were evaluated to assess the flow regime (i.e. ephemeral, intermittent, or perennial). All natural linear features with an intermittent, or perennial flow regime with a defined bed and bank, OHWM, and observed or mapped hydrologic connection to navigable waters downstream are considered WOTUS. Man-made features (e.g. grassy swales or agricultural drainage ditches) with or without a bed and bank, but no discernable OHWM, were considered to be non-jurisdictional. Delineated streams and man-made features were evaluated and recorded with a Trimble R-1 and DA2 GPS handheld unit.

Stream habitat was evaluated following methods described in the U.S. Environmental Protection Agency's (USEPA) *Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers* (Barbour et al. 1999). The Rapid Bioassessment Protocol (RBP) Habitat Assessment Field Data Sheets were completed to determine habitat quality of each stream.

3 RESULTS

3.1 Desktop Analysis Results

The following information on soils and hydrology was gathered to inform and prepare the field team completing the delineation.

3.1.1 Site Soils

A review of the NRCS's Web Soil Survey and the Soil Survey of Livingston County, Kentucky, (USDA 2007) identified 8 soil map units within the study area (Figure 6 – USDA Soil Types Map in Appendix A). Of the 8 soil units within the study area none are considered hydric soil units by the NRCS. A complete report created using the USDA NRCS Web Soil Survey (WSS) is appended following Figure 6.

3.1.2 Site Hydrology

The study area is within the Lower Bayou Creek Watershed (Hydrologic Unit Code 051402030903) subwatershed. The NWI features in this area were photo-interpreted using 1:58,000 scale color infrared imagery from 1983 (USFWS 1983). The study area includes 1 NWI wetland, 8 NHD waterbodies, and 4 NHD streams (Figure 3 – Existing Hydrology Map in Appendix A). According to the CoCoRaHS precipitation gauge Station Number KY-LY-3, the last precipitation event that occurred near the study area was recorded on April 06, 2023 with a total of 0.30 inches.

3.2 Field Survey Results

The following sections provide the field survey results for the wetland and stream delineation. Photographic documentation of the site and delineated aquatic features is provided in Appendix B. USACE Wetland Determination Data Forms are provided in Appendix C. Resumes of Copperhead personnel who completed the delineation are included in Appendix D.

3.3 Wetland Delineation

The field survey resulted in the identification of 34 wetlands within the study area (Figure 4 – Wetland Delineation Overview Map in Appendix A). Classifications and acreages of each delineated wetland are described in Table 1

Table 1. Summary of delineated wetland resources within the Mantle Rock Solar Project study area, Livingston County, Kentucky.

Feature Name	Preliminary Jurisdictional Status[1]	Feature Size (acres)	Cowardin Classification Code[2]	Wetland Description
WAA	Jurisdictional	0.30	PEM	Open Pasture Wetland
WAB	Jurisdictional	0.44	PEM	Floodplain Bench Wetland
WAC	Non-Jurisdictional	0.20	PEM	Open Pasture Wetland
WAD	Jurisdictional	0.26	PEM	Open Pasture Wetland
WAE	Jurisdictional	0.06	PEM	Open Pasture Wetland
WAF	Jurisdictional	0.13	PEM	Open Pasture Wetland
WAF	Jurisdictional	1.97	PUB	Pond
WAG	Jurisdictional	0.32	PEM	Open Pasture Wetland
WAH	Jurisdictional	0.20	PFO	Forested Hillslope Wetland
WAI	Jurisdictional	0.34	PEM	Open Pasture Wetland
WAJ	Jurisdictional	0.16	PEM	Open Pasture Wetland
WAK	Jurisdictional	0.03	PEM	Open Pasture Wetland
WAL	Non-Jurisdictional	0.43	PUB	Pond
WBA	Jurisdictional	0.17	PEM	Open Pasture Wetland
WBB	Jurisdictional	0.18	PEM	Open Pasture Wetland
WBC	Jurisdictional	1.65	PUB	Pond
WBD	Jurisdictional	0.04	PEM	Open Pasture Wetland
WBE	Non-Jurisdictional	0.50	PUB	Pond
WBF	Non-Jurisdictional	0.33	PUB	Pond
WBG	Jurisdictional	0.24	PEM	Open Pasture Wetland
WBH	Jurisdictional	0.08	PEM	Floodplain Bench Wetland
WBI	Jurisdictional	0.19	PEM	Open Pasture Wetland
WBJ	Non-Jurisdictional	0.07	PEM	Open Pasture Wetland
WBK	Jurisdictional	1.38	PUB	Pond
WBL	Jurisdictional	0.90	PEM	Open Pasture Wetland
WBM	Jurisdictional	0.06	PFO	Forested Floodplain Wetland
WBN	Jurisdictional	0.07	PEM	Open Pasture Wetland
WCA	Jurisdictional	0.01	PEM	Open Pasture Wetland
WCB	Non-Jurisdictional	0.21	PEM	Open Pasture Wetland
WCC	Non-Jurisdictional	0.18	PEM	Open Pasture Wetland
WCD	Jurisdictional	0.59	PEM	Open Pasture Wetland
WCE	Jurisdictional	0.99	PEM	Open Pasture Wetland
WCF	Jurisdictional	0.05	PEM	Open Pasture Wetland
WCG	Non-Jurisdictional	0.39	PUB	Pond

Feature Name	Preliminary Jurisdictional Status[1]	Feature Size (acres)	Cowardin Classification Code[2]	Wetland Description
Total Non-Jurisdictional Wetlands		**2.31**		
Total Jurisdictional Wetlands		**10.81**		

[1]Jurisdictional statuses and boundaries when presented are preliminary and are subject to final verification by the USACE.

[2]Classifications are based on Copperhead's professional judgment of actual field conditions.

Open Pasture Wetland – The majority of wetlands found within the study area were palustrine emergent (PEM) wetlands located within open pastures. These wetlands receive hydrology from overland sheet flow and UDFs and drain toward UDFs or streams. These wetlands possess loamy, soils, and the most common hydric soil indicator observed within open pasture wetlands was Indicator F3 (Depleted Matrix). Vegetation in these wetlands was significantly disturbed at the time of study with dominant vegetation being tall fescue (*Schedonorus arundinaceus*). Common hop sedge (*Carex lupulina*) and soft rush (*Juncus effusus*) were sub-dominants within the plant community.

Floodplain Bench Wetland – Floodplain bench wetlands were PEM wetlands found in depressions where drainage features and streams possess floodplain connectivity that saturates the floodplain soils with sufficient frequency and duration to generate hydric conditions. Upstream and downstream channelization confines these wetlands to areas with an active floodplain. These wetlands were found at the bottom of pasture slopes and had loamy soils, and the most common hydric soil indicator observed within open pasture wetlands was Indicator F3 (Depleted Matrix). Vegetation in these wetlands was disturbed at the time of survey, and was dominated by tall fescue, and featured a larger percentage of sedges (*Carex* sp.) and rushes (*Juncus* sp.) than open pasture wetlands.

Forested Hillslope Wetland – The single forested hillslope wetland within the survey area receives hydrology from overland sheet flow and drains into an open pasture wetland. This wetland is mostly dense silt loam soils that allow for the pooling and ponding of water at topographically low areas within the wetland. Dominant vegetation consists of American sycamore (*Platanus occidentalis*), boxelder maple (*Acer negundo*), green ash (*Fraxinus pennsylvanica*), and Chinese privet (*Ligustrum sinense*).

Forested Floodplain Wetland – The single forested floodplain wetland within the study area is a palustrine forested (PFO) wetland that receives hydrology from overflow of stream SCJ – Peck Branch and drains back into the same stream. Vegetation is dominated by sedges (*Carex* sp.) and sparse tree growth within the wetland compared to the surrounding wooded area. Soils within this wetland were loamy, and signs of infrequent flooding were present throughout the wetland.

Pond – Ponds within the survey area were mostly man-made farm ponds fed by UDFs draining overland sheet flow from surrounding pastures. The ponds on site drained into UDFs or streams and had eroded banks due to their location within open pastures and lack of vegetation along the banks. In-line ponds, or impoundments of existing jurisdictional WOTUS are generally considered jurisdictional features. Ponds excavated entirely within uplands are generally non-jurisdictional.

3.3.1 Stream Assessments

The field survey resulted in the identification and delineation of 26 streams based on field observation at the time of the survey (Figure 4 – Wetland Delineation Overview Map in Appendix A). Flow regime and length of each of the streams are summarized in Table 2 and described in detail below.

Table 2. Summary of delineated streams within the Mantle Rock Solar Project study area, Livingston County, Kentucky.

Feature Name	Preliminary Jurisdictional Determination[1]	Feature Size (linear feet)	Flow Regime	OHWM Width (feet)
SAA	Non-Jurisdictional	155.6	EPH	3.5
SAB	Non-Jurisdictional	170.1	EPH	3
SAC	Non-Jurisdictional	171.3	EPH	1
SAD	Non-Jurisdictional	479.7	EPH	5
SAE	Non-Jurisdictional	200.4	EPH	3
SBA	Non-Jurisdictional	259.9	EPH	3
SBB	Non-Jurisdictional	540.8	EPH	2
SBC	Non-Jurisdictional	702.4	EPH	2
SBD	Non-Jurisdictional	294.3	EPH	3
SBE	Non-Jurisdictional	506.5	EPH	3
SBF	Non-Jurisdictional	303.5	EPH	3
SBF	Jurisdictional	634.2	INT	6
SCA	Non-Jurisdictional	732.4	EPH	3.5
SCB	Non-Jurisdictional	1072.2	EPH	2
SCC	Non-Jurisdictional	2280.2	EPH	2.5
SCD	Non-Jurisdictional	262.9	EPH	2.5
SCD	Jurisdictional	1830.4	INT	5
SCE	Non-Jurisdictional	155.5	EPH	2.5
SCE	Jurisdictional	140.3	INT	4.5
SCF	Non-Jurisdictional	335.0	EPH	4
SCG	Jurisdictional	4404.6	INT	7
SCG	Non-Jurisdictional	840.4	EPH	3
SCH	Non-Jurisdictional	666.4	EPH	3
SCI	Non-Jurisdictional	1060.9	EPH	1.5

Feature Name	Preliminary Jurisdictional Determination[1]	Feature Size (linear feet)	Flow Regime	OHWM Width (feet)
SCJ - Peck Branch	Jurisdictional	1682.3	PER	8
SCK	Non-Jurisdictional	661.0	EPH	3
UDFAA	Non-Jurisdictional	65.1	UDF	N/A
UDFAB	Non-Jurisdictional	82.0	UDF	N/A
UDFAC	Non-Jurisdictional	122.5	UDF	N/A
UDFAD	Non-Jurisdictional	41.4	UDF	N/A
UDFAE	Non-Jurisdictional	158.2	UDF	N/A
UDFAF	Non-Jurisdictional	189.8	UDF	N/A
UDFAH	Non-Jurisdictional	90.1	UDF	N/A
UDFAI	Non-Jurisdictional	133.6	UDF	N/A
UDFAJ	Non-Jurisdictional	212.4	UDF	N/A
UDFAK	Non-Jurisdictional	536.3	UDF	N/A
UDFAL	Non-Jurisdictional	284.8	UDF	N/A
UDFAM	Non-Jurisdictional	457.8	UDF	N/A
UDFAN	Non-Jurisdictional	675.0	UDF	N/A
UDFAO	Non-Jurisdictional	474.5	UDF	N/A
UDFAP	Non-Jurisdictional	480.3	UDF	N/A
UDFAQ	Non-Jurisdictional	110.3	UDF	N/A
UDFAR	Non-Jurisdictional	149.0	UDF	N/A
UDFAS	Non-Jurisdictional	79.5	UDF	N/A
UDFAT	Non-Jurisdictional	160.8	UDF	N/A
UDFBA	Non-Jurisdictional	74.4	UDF	N/A
UDFBB	Non-Jurisdictional	278.0	UDF	N/A
UDFBC	Non-Jurisdictional	362.9	UDF	N/A
UDFBD	Non-Jurisdictional	59.0	UDF	N/A
UDFBE	Non-Jurisdictional	591.9	UDF	N/A
UDFBF	Non-Jurisdictional	685.4	UDF	N/A
UDFBG	Non-Jurisdictional	135.8	UDF	N/A
UDFBH	Non-Jurisdictional	738.9	UDF	N/A
UDFBI	Non-Jurisdictional	243.8	UDF	N/A
UDFBJ	Non-Jurisdictional	100.1	UDF	N/A
UDFBK	Non-Jurisdictional	181.1	UDF	N/A
UDFBL	Non-Jurisdictional	65.0	UDF	N/A
UDFBM	Non-Jurisdictional	346.3	UDF	N/A
UDFBN	Non-Jurisdictional	393.5	UDF	N/A
UDFBO	Non-Jurisdictional	252.1	UDF	N/A
UDFBP	Non-Jurisdictional	526.8	UDF	N/A
UDFBQ	Non-Jurisdictional	25.9	UDF	N/A
UDFBR	Non-Jurisdictional	45.5	UDF	N/A
UDFBS	Non-Jurisdictional	159.8	UDF	N/A
UDFCA	Non-Jurisdictional	141.4	UDF	N/A

Feature Name	Preliminary Jurisdictional Determination[1]	Feature Size (linear feet)	Flow Regime	OHWM Width (feet)
UDFCB	Non-Jurisdictional	98.8	UDF	N/A
UDFCC	Non-Jurisdictional	282.4	UDF	N/A
UDFCD	Non-Jurisdictional	536.3	UDF	N/A
UDFCE	Non-Jurisdictional	392.0	UDF	N/A
UDFCF	Non-Jurisdictional	214.7	UDF	N/A
UDFCG	Non-Jurisdictional	358.5	UDF	N/A
UDFCH	Non-Jurisdictional	769.8	UDF	N/A
UDFCI	Non-Jurisdictional	304.9	UDF	N/A
UDFCJ	Non-Jurisdictional	109.2	UDF	N/A
Total Jurisdictional Streams		**8691.8**		
Total Non-Jurisdictional Channel		**24,829.0**		

[1]Jurisdictional statuses and boundaries when presented are preliminary and are subject to final verification by the USACE.

Ephemeral Streams – Ephemeral (EPH) streams in the study area are mostly found in pasture, having little to no vegetation along the banks. These streams are mostly small incisions with little to no vegetation within the channel, eroded banks and low sinuosity. Substrate within ephemeral streams on site is primarily silt or bedrock, with very little flow or standing water in any of the ephemeral streams.

Intermittent Streams – Intermittent (INT) streams in the study area have wide, eroded banks with moderate sinuosity. Bank vegetation consists of grasses and sparse trees, and substrate is mostly pebble and silt, with some larger boulders. Flowing water within these streams is low with elongated pools and few riffle areas. Evidence of groundwater influence was common within intermittent streams and manifested either as soil-based evidence of a persistent high-water table, or as aquatic fauna including crayfish found at or near the soil surface.

Perennial Streams – Perennial (PER) streams in the study area have large riparian buffers allowing for stable banks and a meandering stream bed. Substrates within perennial streams on site consist of pebbles and cobbles with some large boulders. Flow within these systems is low/moderate in velocity with mostly pools and few rifles making up these streams. Small aquatic macroinvertebrates and other fauna were found throughout perennial streams.

Upland Drainage Features – Upland drainage features (UDF's) in the study area are small concave drainages that drain pasture hillslopes into ephemeral streams or wetlands. These drains lack a defined bed and bank with most of them having vegetation growing within the drain and no substrate sorting or flow.

3.3.2 Existing Culverts

A total of 1 culvert was identified in the study area. This feature is summarized in Table 3.

Table 3. Summary of culverts within the Mantle Rock Solar Project study area, Livingston County, Kentucky.

Feature Name	Material	Size (inches)	Latitude	Longitude
CUL001	Iron	12	37.31038	-88.39308

4 CONCLUSIONS

It is Copperhead's professional judgment that the study area contains 34 wetlands that meet the technical criteria for wetlands (i.e. hydric soils, hydrophytic [wetland] vegetation, and wetland hydrology). Additionally, 1 perennial stream, 4 intermittent streams, 21 ephemeral streams, and 48 upland drainage features were identified.

5 LITERATURE CITED

Association of State Wetland Managers. 2014. Report on State Definitions, Jurisdiction and Mitigation Requirements in State Programs for Ephemeral, Intermittent and Perennial Streams in the United States. By Brenda Zollitsch, PhD and Jeanne Christie. April 2014.

Barbour, M.T., J. Gerristen, 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. U.S. Environmental Protection Agency; Office of Water; Washington, D.C.

Federal Emergency Management Agency (FEMA). 2015. National Flood Hazard Map, Livingston County, Kentucky.

Lichvar, R.W., D.L. Banks, W.N. Kirchner, and N.C. Melvin. 2018. The National Wetland Plant List: 2018 wetland ratings. Phytoneuron 2016-30: 1-17.

Munsell Color. 2010. Munsell soil color charts: with genuine Munsell color chips. Grand Rapids, Michigan.

US Army Corps of Engineers (USACE). 1987. Wetlands Delineation Manual. Wetlands Research Program Technical Report Y-87-1.

USACE. 2012. Regional Supplement to the Corps of Engineers' Wetland Delineation Manual: Eastern Mountains and Piedmont Region (Version 2.0).

US Department of Agriculture (USDA). 2007. Soil Survey of Livingston County, Kentucky. In cooperation with Kentucky Agricultural Experiment Station.

USDA Natural Resource Conservation Service (USDA NRCS). 2021a. Soil Data Access Hydric Soils List. Available at: https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcseprd1316620.html. Accessed April 2024.

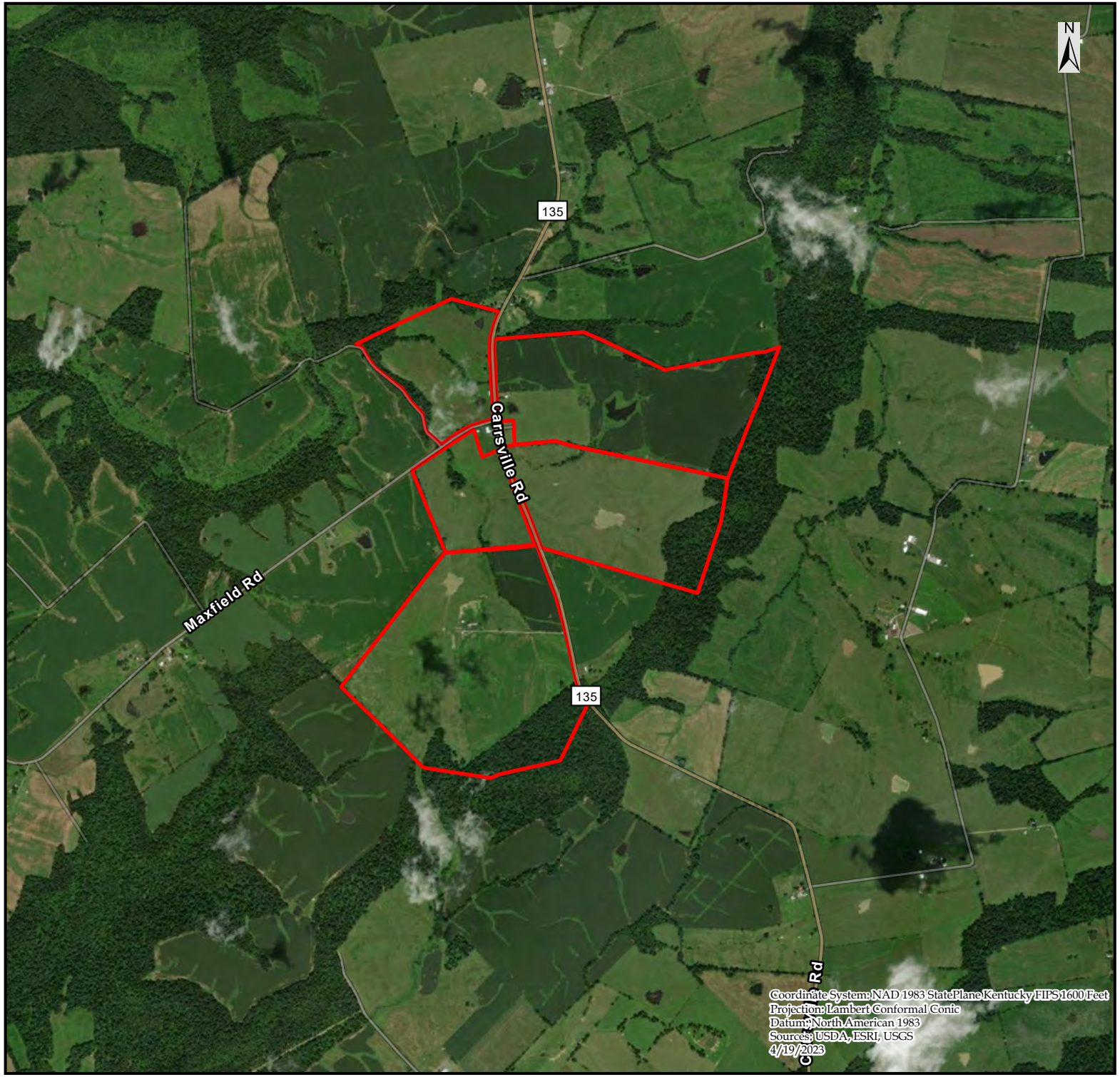
USDA NRCS. 2021b. Web Soil Survey. Available at: https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx. Accessed April 2024.

US Fish and Wildlife Service (USFWS). 2021. National Wetlands Inventory. Available at: https://www.fws.gov/wetlands/data/mapper.html. Accessed April 2024.

US Geological Survey (USGS). 2006. National Hydrography Dataset. https://viewer.nationalmap.gov/basic/?basemap=b1&category=nhd&title=NHD%20View. Accessed April 2024.

USGS. 2016. National Land Cover Database. NLCD_2016_Land_Cover_L48.

Appendix A – Figures and Web Soil Survey Results



COPPERHEAD
ENVIRONMENTAL CONSULTING

Prepared for:

Enerfin Renewables, LLC

FIGURE 1:
Overview Map for the
Mantle Rock Solar Project

Livingston County, Kentucky

Legend

Survey Area

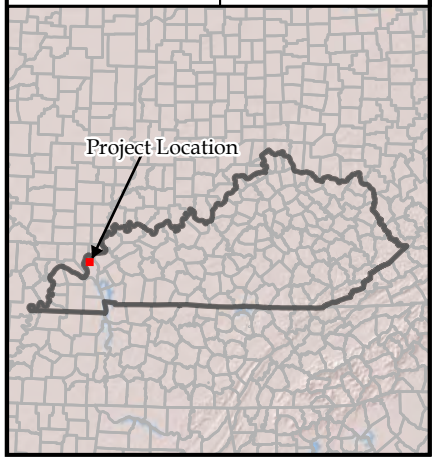
0 1,000 2,000
US Feet

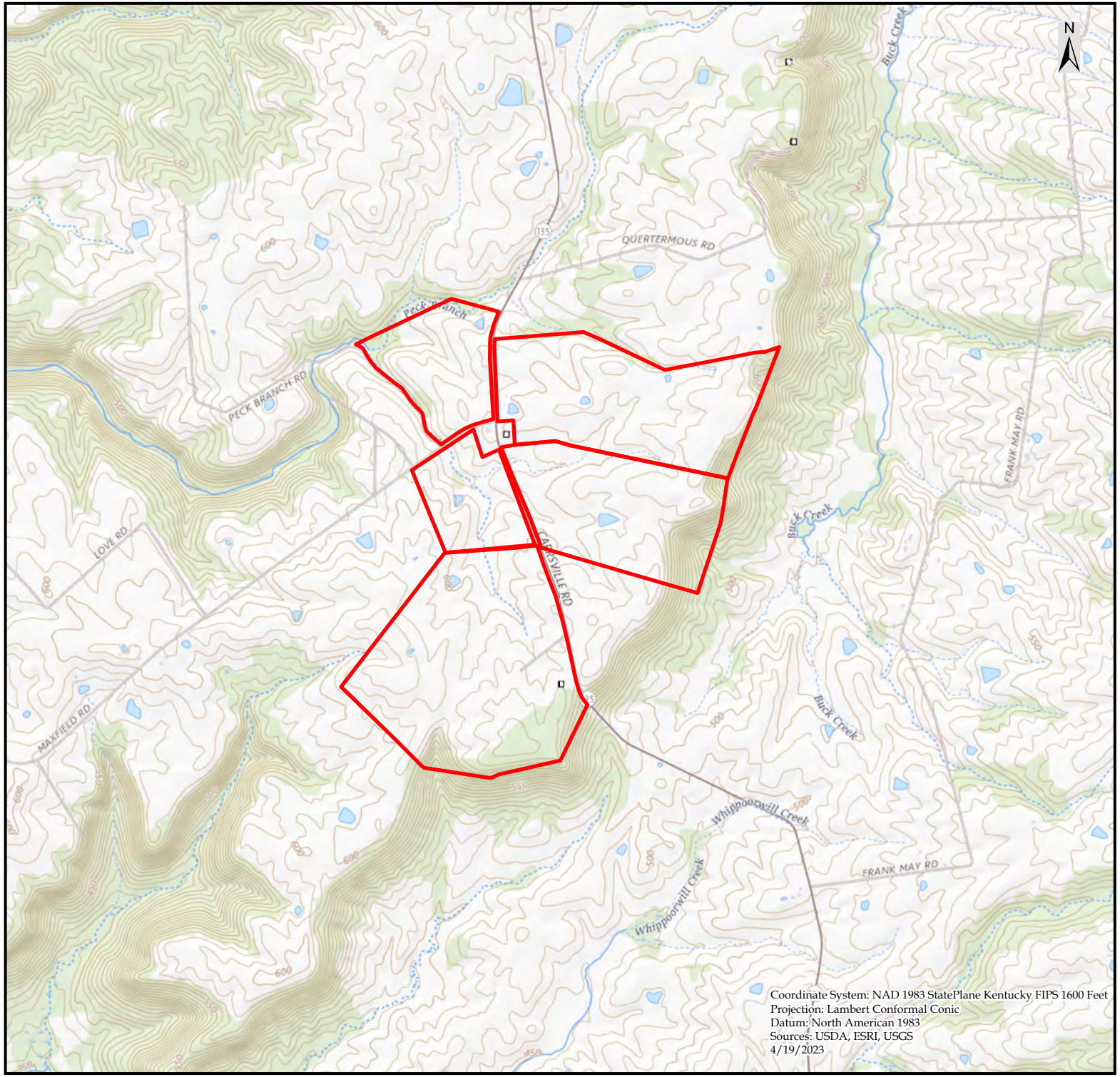
Scale: 1 in = 2,000 ft

Prepared by :

Copperhead Environmental Consulting, Inc.
471 Main Street
P.O. Box 73
Paint Lick, Kentucky 40461

Drawn by:	TC	Date:	4/19/2023
Checked by:	JM	Revision:	01





COPPERHEAD
ENVIRONMENTAL CONSULTING

Prepared for:

Enerfin Renewables, LLC

FIGURE 2:
USGS Topographic Map for the
Mantle Rock Solar Project

Livingston County, Kentucky

Legend

Survey Area

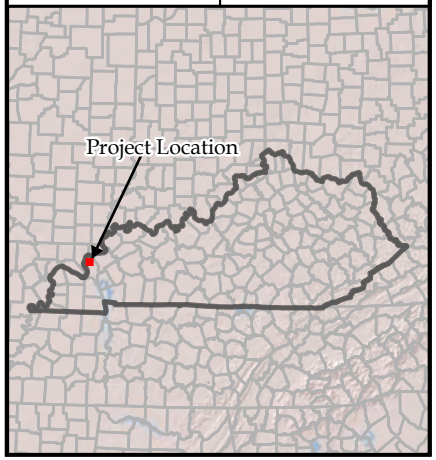
0 1,000 2,000
US Feet

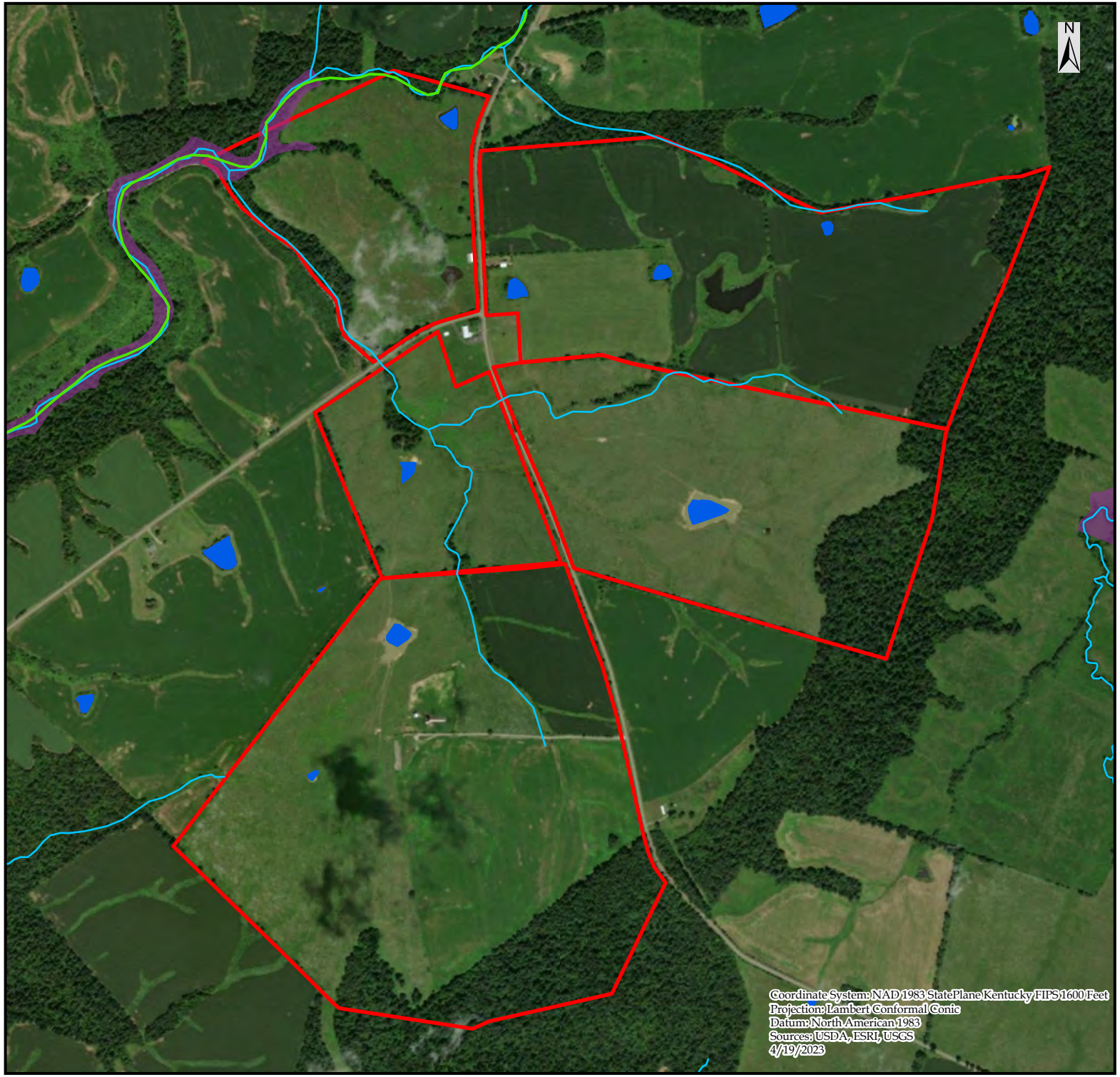
Scale: 1 in = 2,000 ft

Prepared by :

Copperhead Environmental Consulting, Inc.
471 Main Street
P.O. Box 73
Paint Lick, Kentucky 40461

Drawn by:	TC	Date:	4/19/2023
Checked by:	JM	Revision:	01





COPPERHEAD
ENVIRONMENTAL CONSULTING

Prepared for:

Enerfin Renewables, LLC

FIGURE 3:
Existing Hydrology Map for the
Mantle Rock Solar Project

Livingston County, Kentucky

Legend

- NHD Waterway
- NHD Waterbody
- NWI Wetland
- FEMA 1% Annual Chance Flood Hazard
- Survey Area

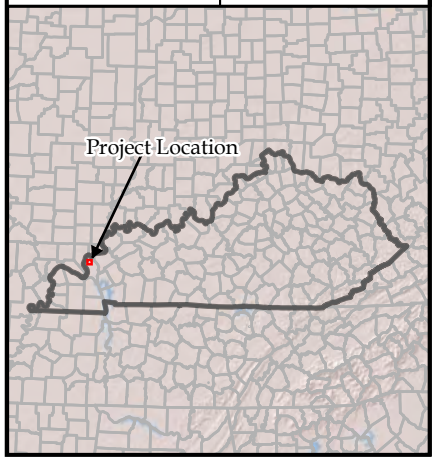
0 500 1,000
US Feet

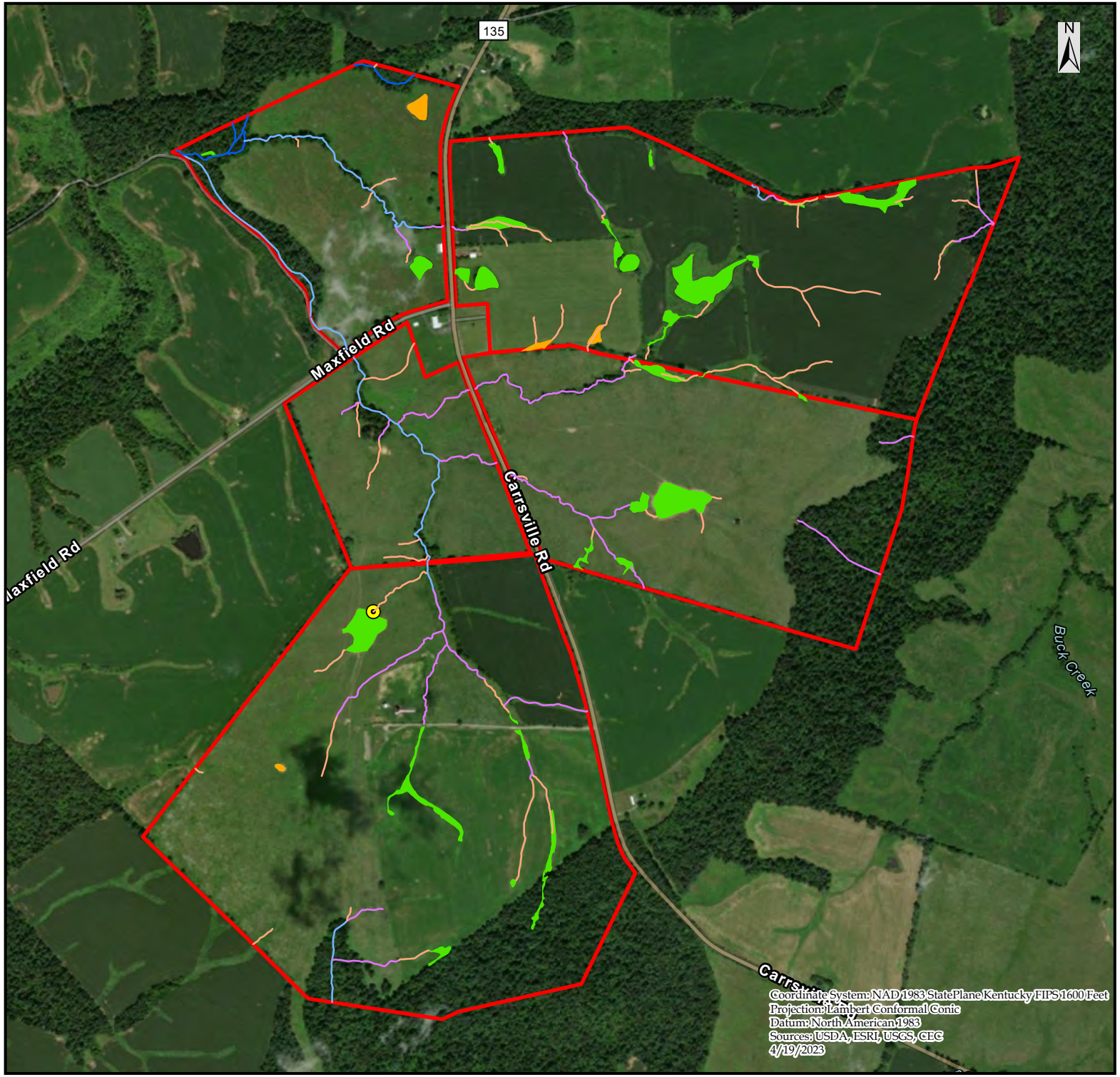
Scale: 1 in = 1,000 ft

Prepared by :

Copperhead Environmental Consulting, Inc.
471 Main Street
P.O. Box 73
Paint Lick, Kentucky 40461

Drawn by:	TC	Date:	4/19/2023
Checked by:	JM	Revision:	01





COPPERHEAD
ENVIRONMENTAL CONSULTING

Prepared for:

Enerfin Renewables, LLC

FIGURE 4.1:
Wetland Delineation Overview Map
for the Mantel Rock Solar Project

Livingston County, Kentucky

Legend

- Culvert
- Ephemeral Stream
- Intermittent Stream
- Perennial Stream
- Upland Drainage Feature
- Jurisdictional Wetland
- Non-Jurisdictional Wetland
- Survey Area

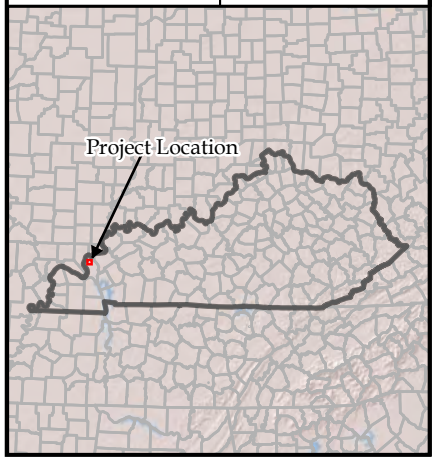
0 500 1,000
US Feet

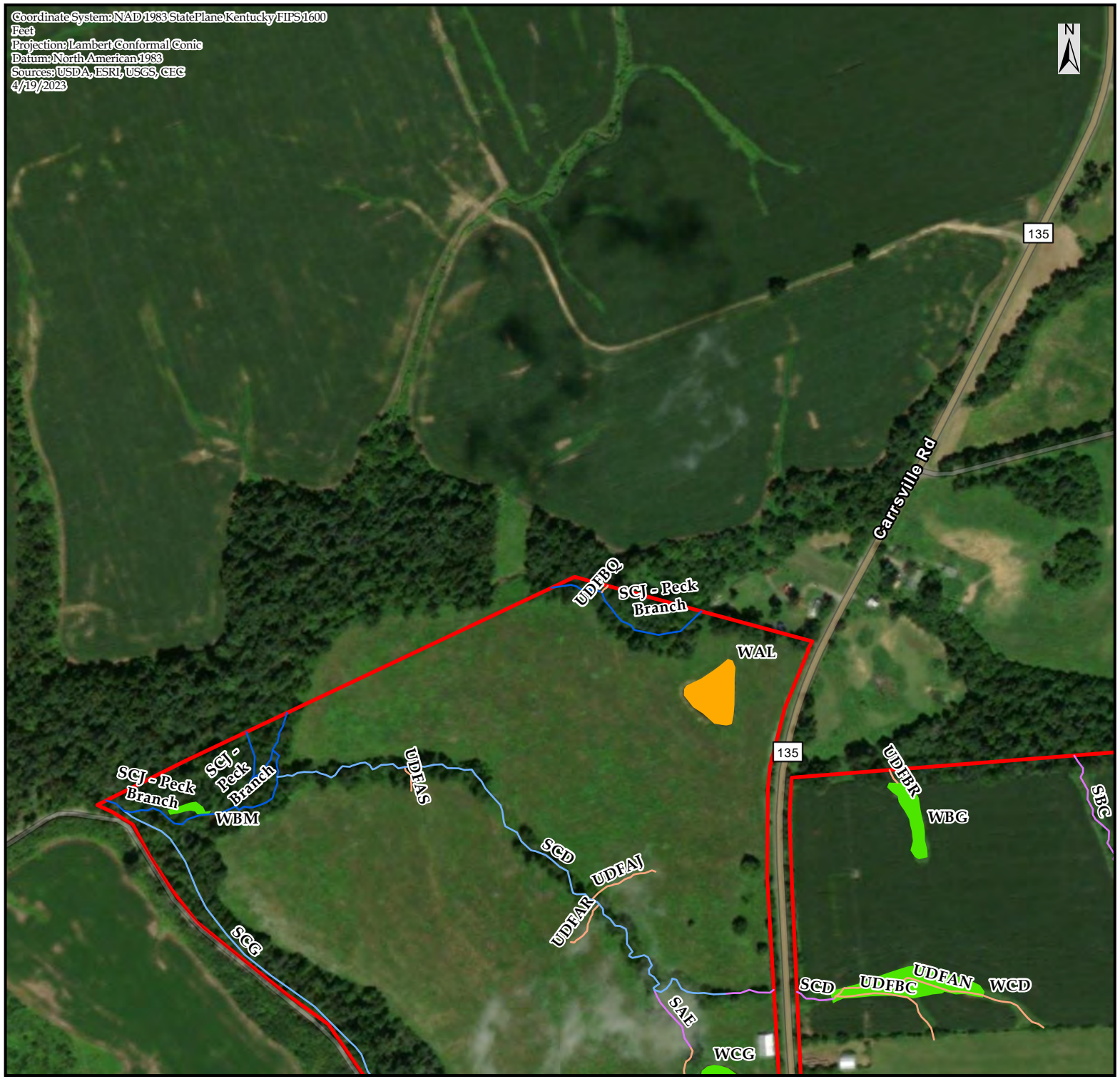
Scale: 1 in = 1,000 ft

Prepared by :

Copperhead Environmental Consulting, Inc.
471 Main Street
P.O. Box 73
Paint Lick, Kentucky 40461

Drawn by:	TC	Date:	4/19/2023
Checked by:	JM	Revision:	01





COPPERHEAD
ENVIRONMENTAL CONSULTING

Prepared for:

Enerfin Renewables, LLC

FIGURE 4.2:
Wetland Delineation Overview Map
for the Mantel Rock Solar Project

Livingston County, Kentucky

Legend

- Culvert
- Ephemeral Stream
- Intermittent Stream
- Perennial Stream
- Upland Drainage Feature
- Jurisdictional Wetland
- Non-Jurisdictional Wetland
- Survey Area

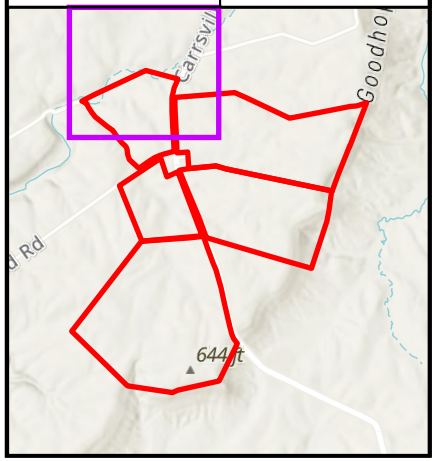
0 200 400
US Feet

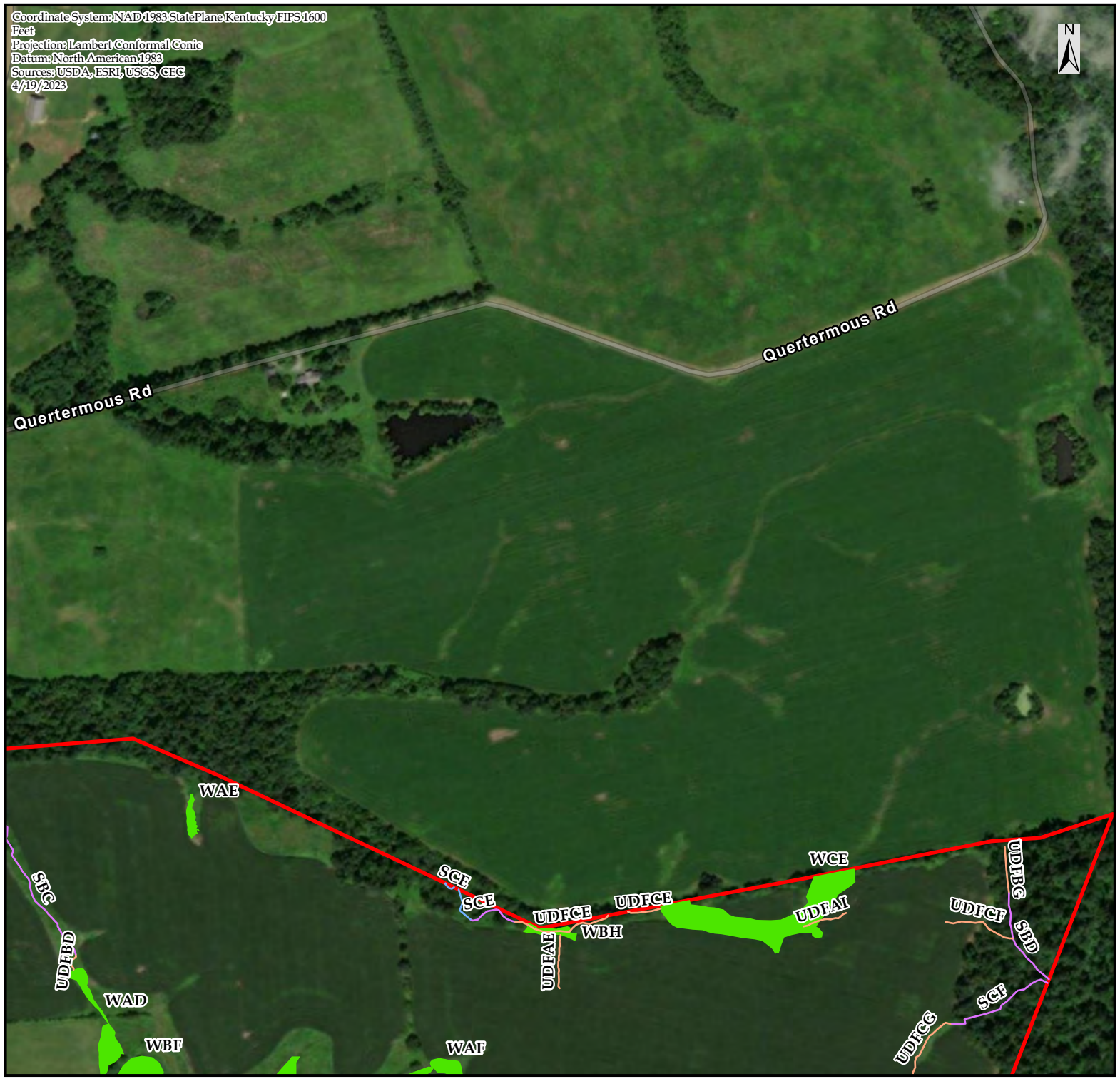
Scale: 1 in = 400 ft

Prepared by :

Copperhead Environmental Consulting, Inc.
471 Main Street
P.O. Box 73
Paint Lick, Kentucky 40461

Drawn by:	TC	Date:	4/19/2023
Checked by:	JM	Revision:	01





COPPERHEAD
ENVIRONMENTAL CONSULTING

Prepared for:

Enerfin Renewables, LLC

FIGURE 4.3:
Wetland Delineation Overview Map
for the Mantel Rock Solar Project

Livingston County, Kentucky

Legend

- Culvert
- Ephemeral Stream
- Intermittent Stream
- Perennial Stream
- Upland Drainage Feature
- Jurisdictional Wetland
- Non-Jurisdictional Wetland
- Survey Area

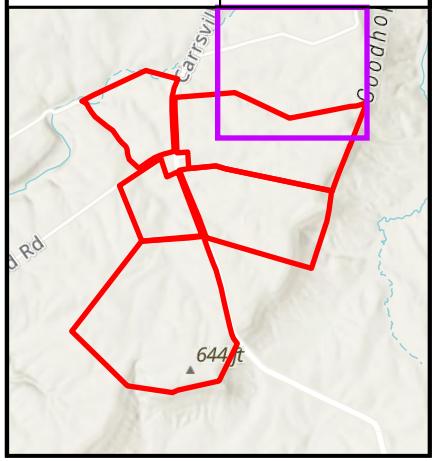
0 200 400
US Feet

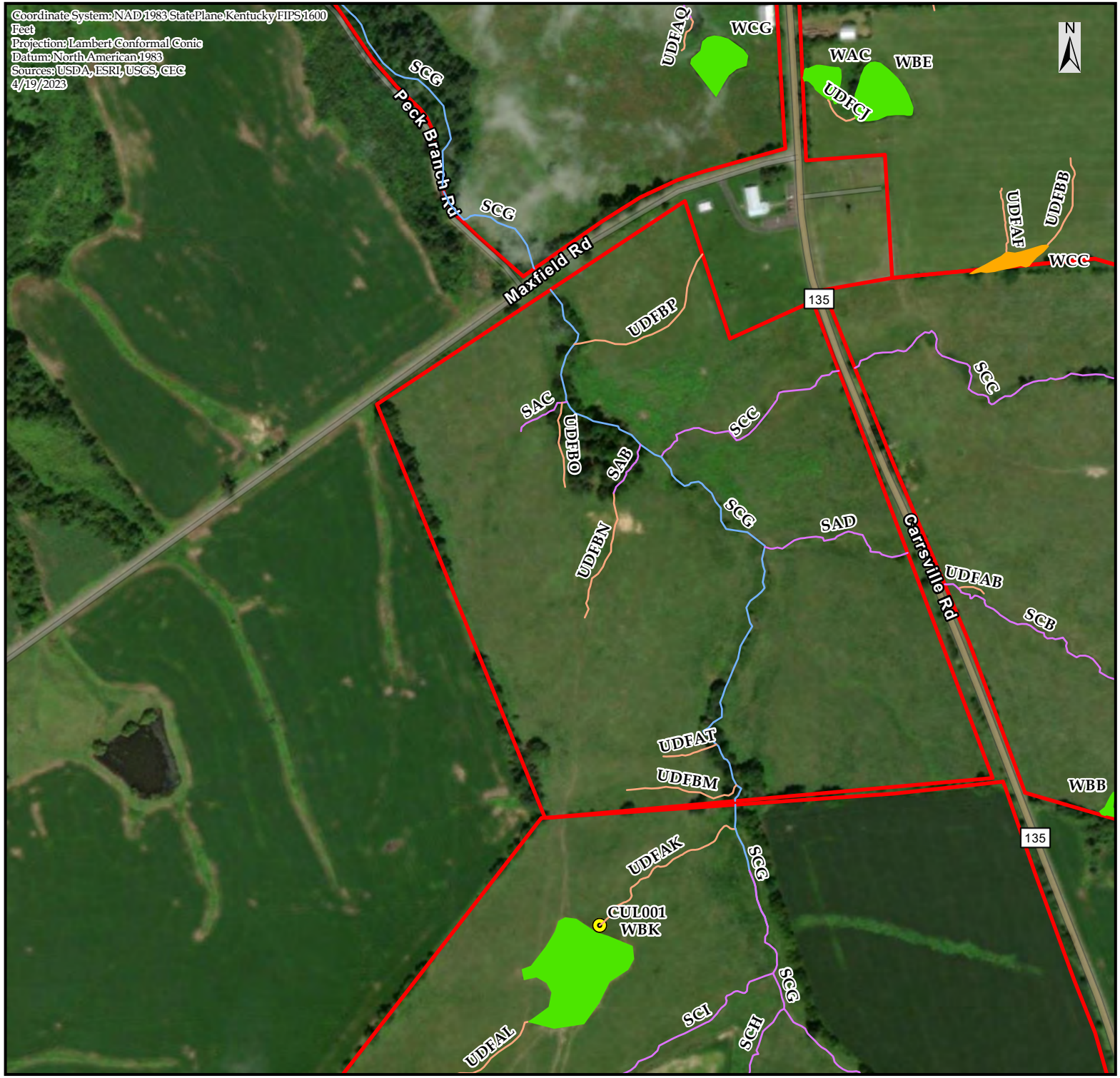
Scale: 1 in = 400 ft

Prepared by :

Copperhead Environmental Consulting, Inc.
471 Main Street
P.O. Box 73
Paint Lick, Kentucky 40461

Drawn by:	TC	Date:	4/19/2023
Checked by:	JM	Revision:	01





COPPERHEAD
ENVIRONMENTAL CONSULTING

Prepared for:

Enerfin Renewables, LLC

FIGURE 4.4:
Wetland Delineation Overview Map
for the Mantel Rock Solar Project

Livingston County, Kentucky

Legend

- Culvert
- Ephemeral Stream
- Intermittent Stream
- Perennial Stream
- Upland Drainage Feature
- Jurisdictional Wetland
- Non-Jurisdictional Wetland
- Survey Area

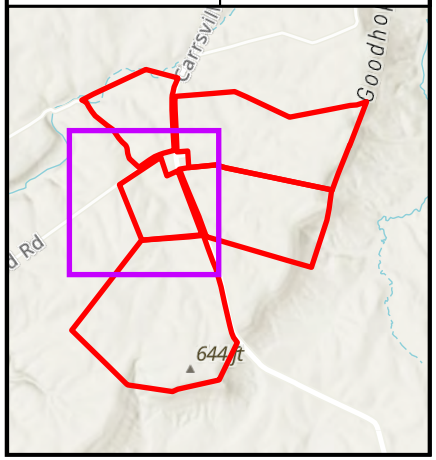
0 200 400
US Feet

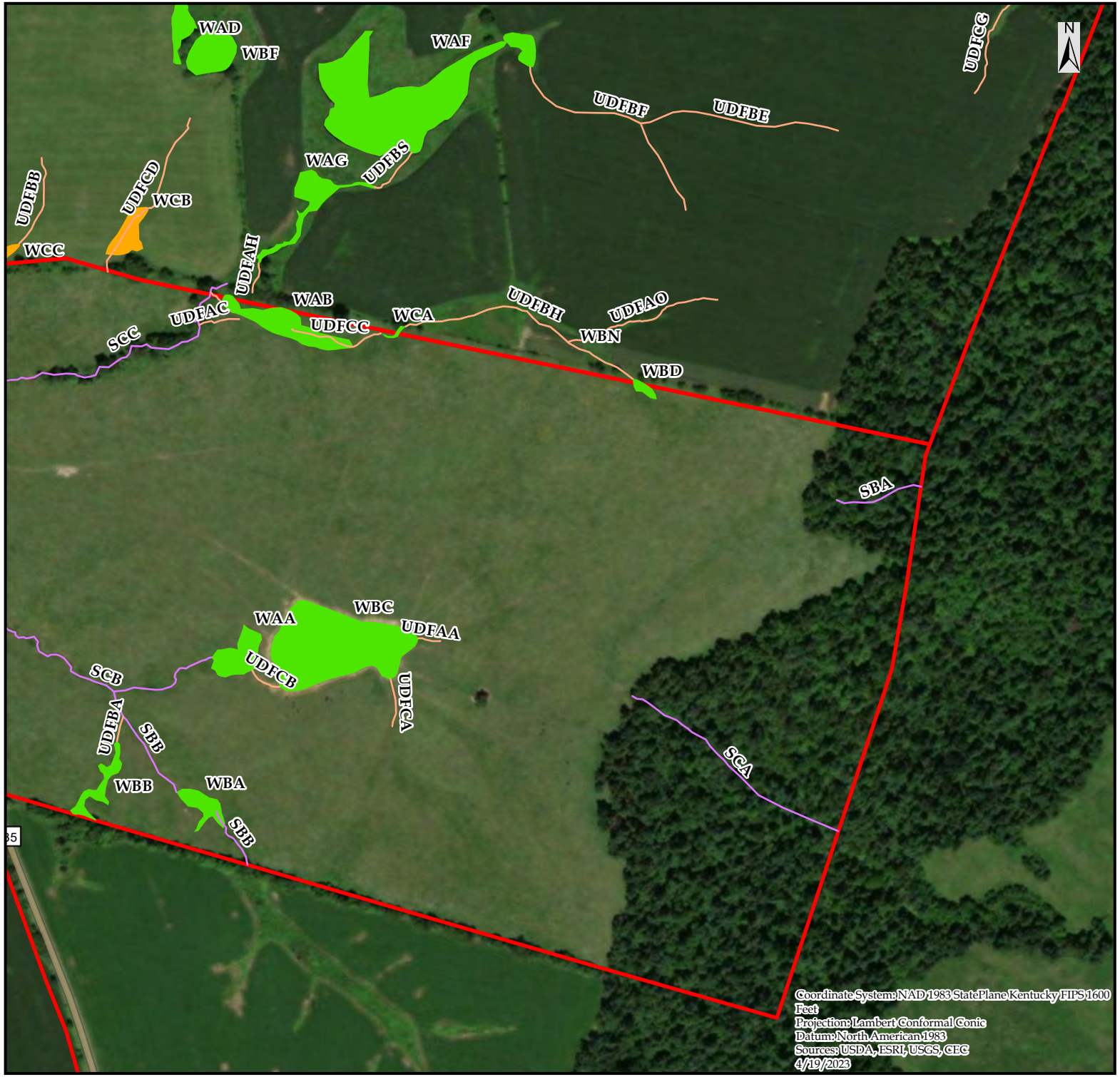
Scale: 1 in = 400 ft

Prepared by :

Copperhead Environmental Consulting, Inc.
471 Main Street
P.O. Box 73
Paint Lick, Kentucky 40461

Drawn by:	TC	Date:	4/19/2023
Checked by:	JM	Revision:	01





COPPERHEAD
ENVIRONMENTAL CONSULTING

Prepared for:

Enerfin Renewables, LLC

FIGURE 4.5:
Wetland Delineation Overview Map
for the Mantel Rock Solar Project

Livingston County, Kentucky

Legend

- Culvert
- Ephemeral Stream
- Intermittent Stream
- Perennial Stream
- Upland Drainage Feature
- Jurisdictional Wetland
- Non-Jurisdictional Wetland
- Survey Area

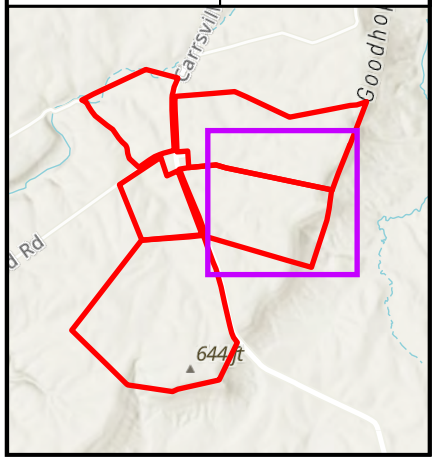
0 200 400
US Feet

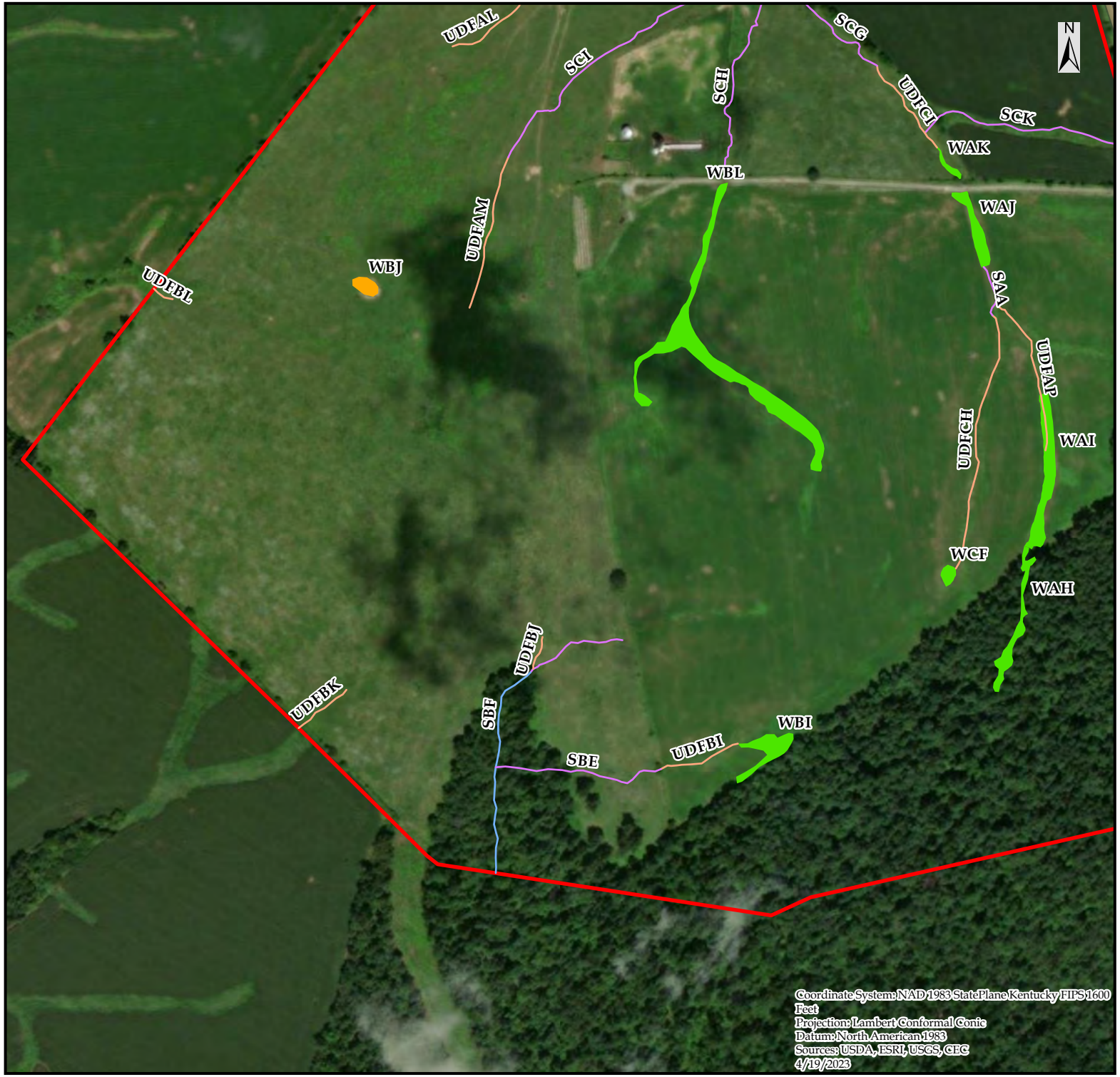
Scale: 1 in = 400 ft

Prepared by :

Copperhead Environmental Consulting, Inc.
471 Main Street
P.O. Box 73
Paint Lick, Kentucky 40461

Drawn by:	TC	Date:	4/19/2023
Checked by:	JM	Revision:	01





COPPERHEAD
ENVIRONMENTAL CONSULTING

Prepared for:

Enerfin Renewables, LLC

FIGURE 4.6:
Wetland Delineation Overview Map
for the Mantel Rock Solar Project

Livingston County, Kentucky

Legend

- Culvert
- Ephemeral Stream
- Intermittent Stream
- Perennial Stream
- Upland Drainage Feature
- Jurisdictional Wetland
- Non-Jurisdictional Wetland
- Survey Area

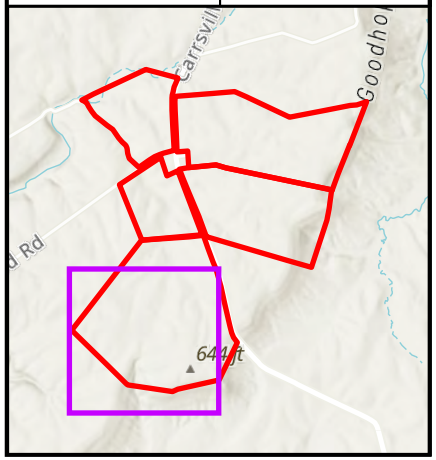
0 200 400
US Feet

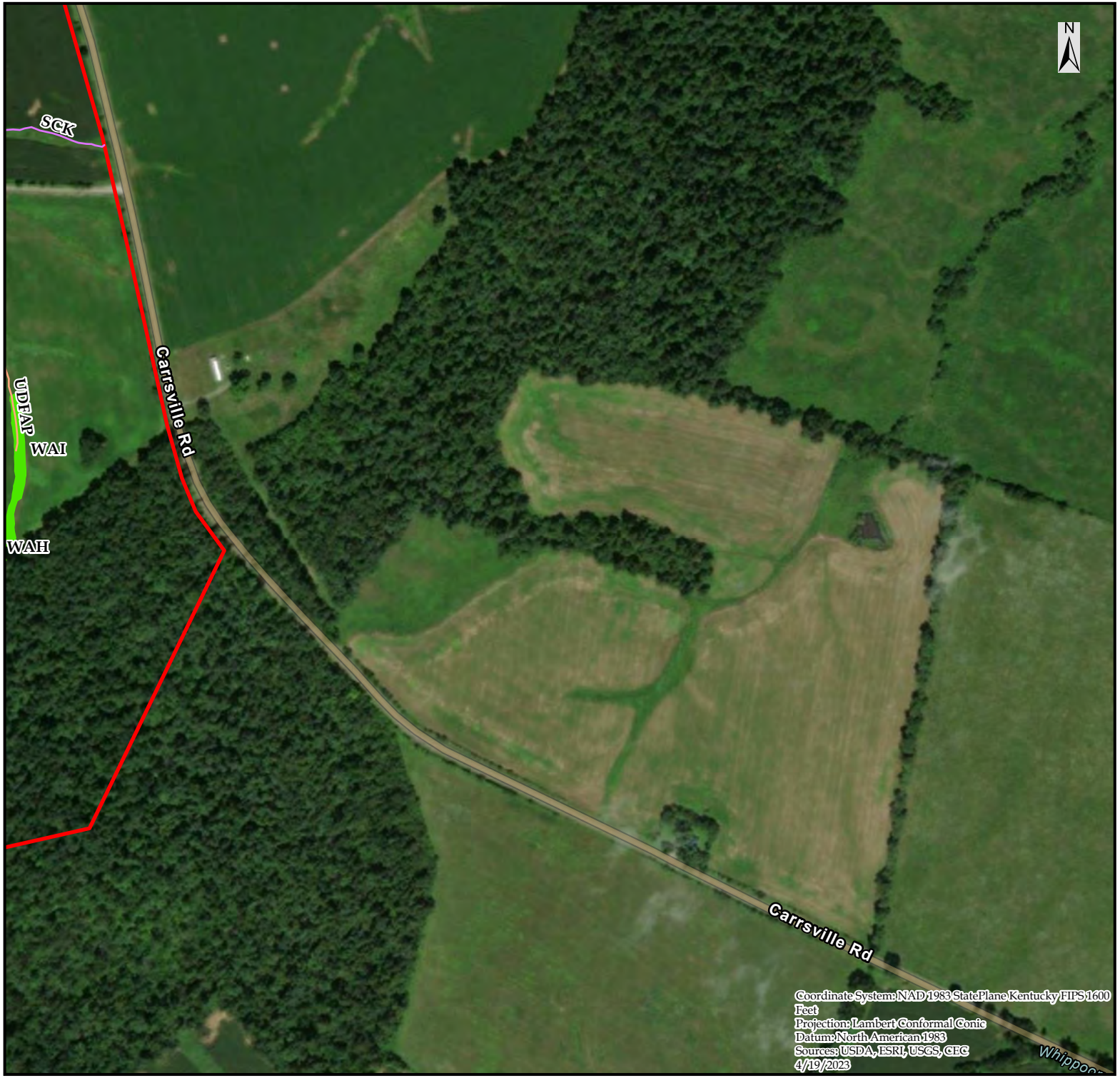
Scale: 1 in = 400 ft

Prepared by :

Copperhead Environmental Consulting, Inc.
471 Main Street
P.O. Box 73
Paint Lick, Kentucky 40461

Drawn by:	TC	Date:	4/19/2023
Checked by:	JM	Revision:	01





COPPERHEAD
ENVIRONMENTAL CONSULTING

Prepared for:

Enerfin Renewables, LLC

FIGURE 4.7:
Wetland Delineation Overview Map
for the Mantel Rock Solar Project

Livingston County, Kentucky

Legend

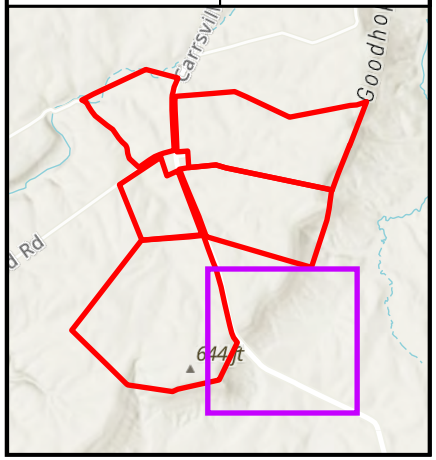
- Culvert
- Ephemeral Stream
- Intermittent Stream
- Perennial Stream
- Upland Drainage Feature
- Jurisdictional Wetland
- Non-Jurisdictional Wetland
- Survey Area

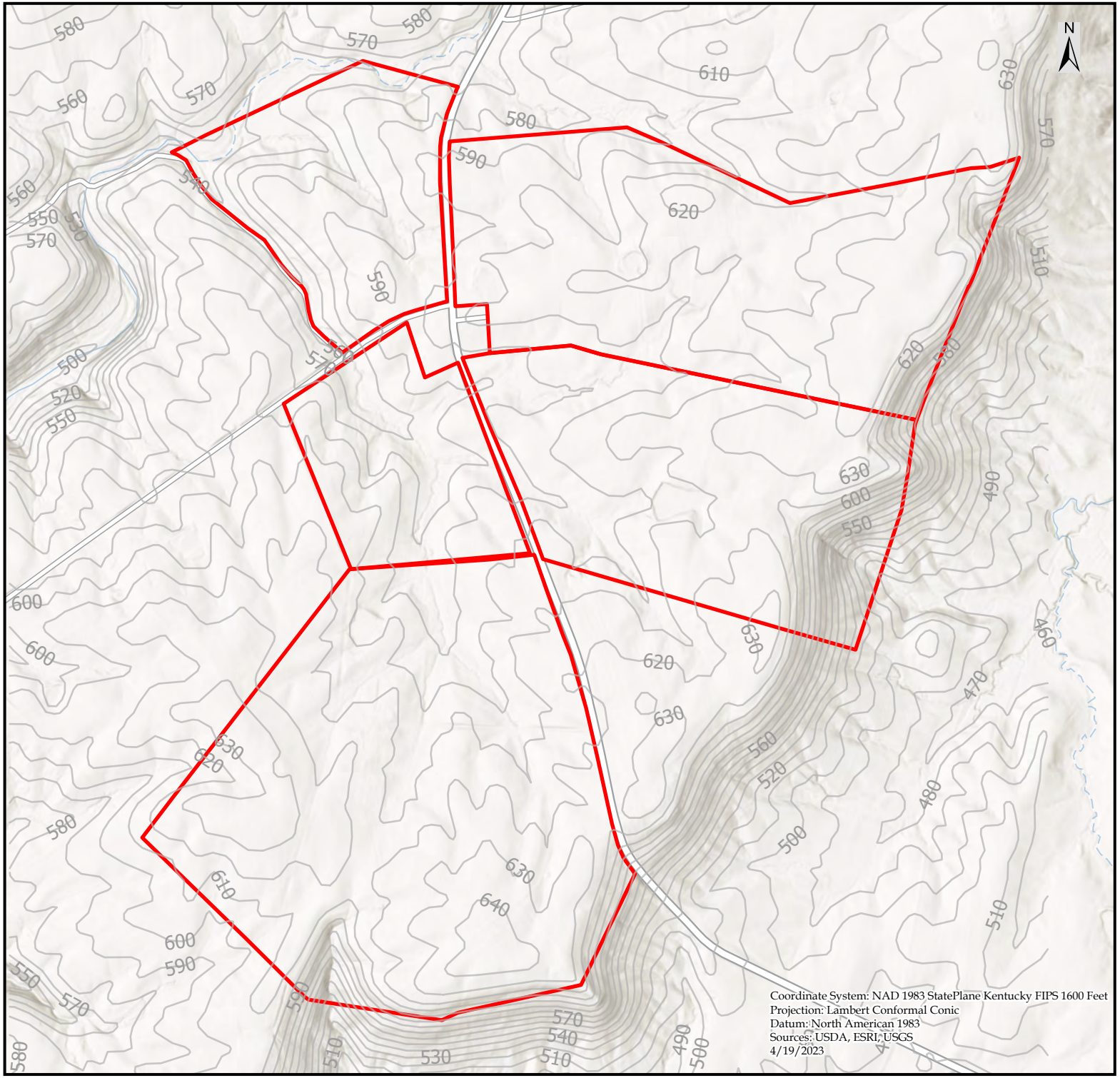
0 200 400
US Feet

Scale: 1 in = 400 ft

Prepared by :
Copperhead Environmental Consulting, Inc.
471 Main Street
P.O. Box 73
Paint Lick, Kentucky 40461

Drawn by:	TC	Date:	4/19/2023
Checked by:	JM	Revision:	01





COPPERHEAD
ENVIRONMENTAL CONSULTING

Prepared for:

Enerfin Renewables, LLC

FIGURE 5:
Topographic Contour Map for the
Mantle Rock Solar Project

Livingston County, Kentucky

Legend

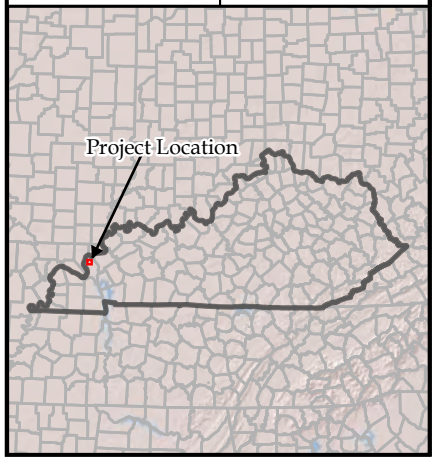
Survey Area
Elevation contour

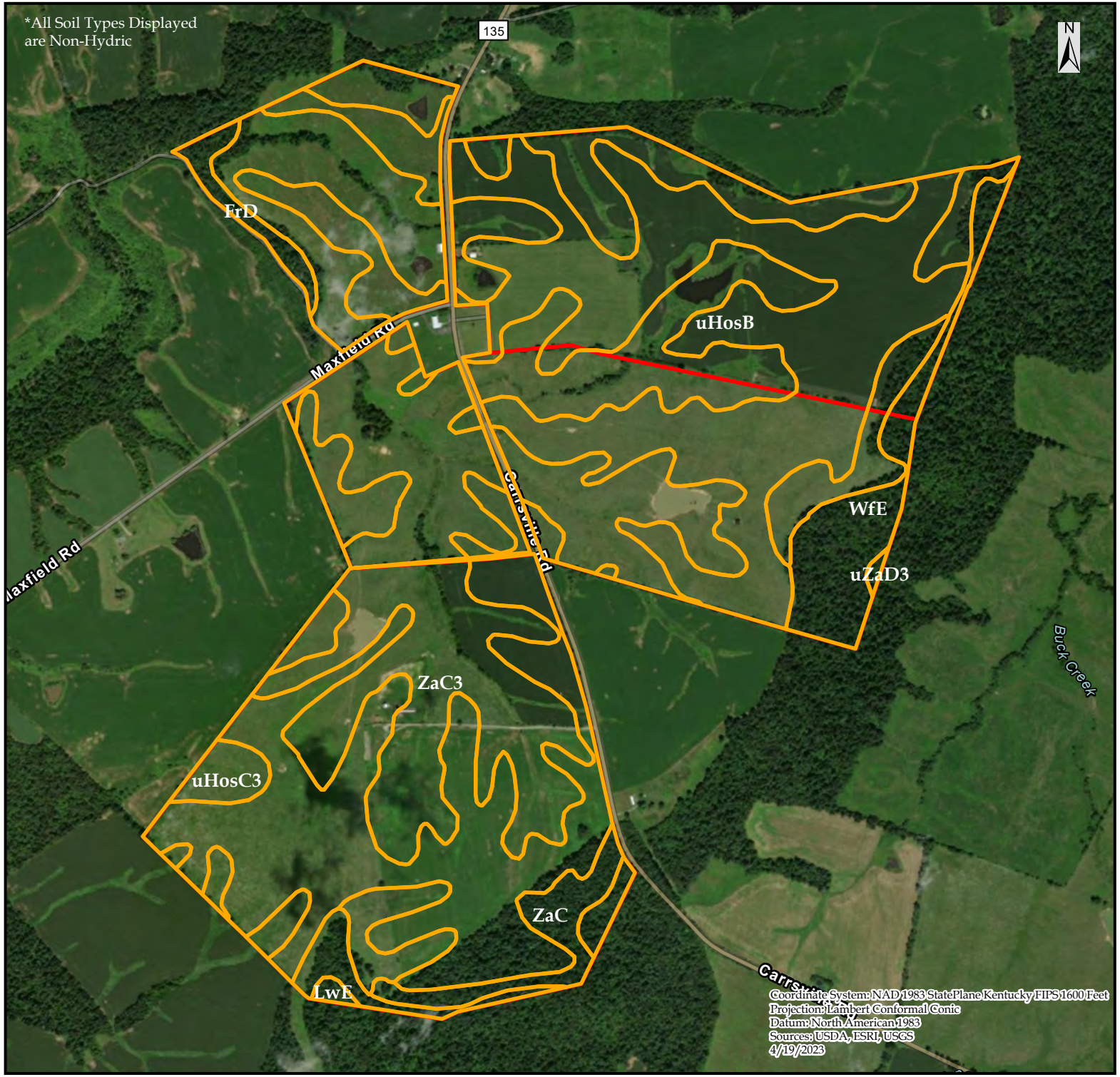
0 500 1,000
US Feet

Scale: 1 in = 1,000 ft

Prepared by :
Copperhead Environmental Consulting, Inc.
471 Main Street
P.O. Box 73
Paint Lick, Kentucky 40461

Drawn by:	TC	Date:	4/19/2023
Checked by:	JM	Revision:	01





COPPERHEAD
ENVIRONMENTAL CONSULTING

Prepared for:

Enerfin Renewables, LLC

FIGURE 6:
USDA SSURGO Soil Type Map
for the Mantle Rock Solar Project

Livingston County, Kentucky

Legend

- USDA SSURGO Soil Type
- Survey Area

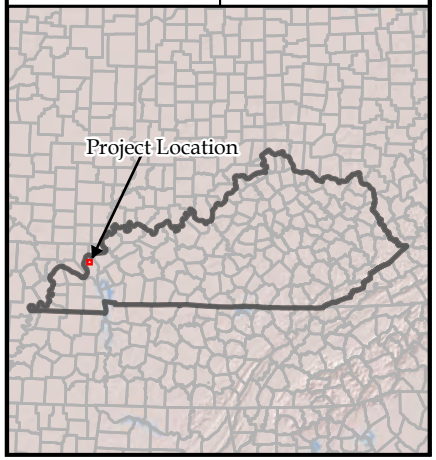
0 500 1,000
US Feet

Scale: 1 in = 1,000 ft

Prepared by :

Copperhead Environmental Consulting, Inc.
471 Main Street
P.O. Box 73
Paint Lick, Kentucky 40461

Drawn by:	TC	Date:	4/19/2023
Checked by:	JM	Revision:	01



United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Livingston County, Kentucky

Mantle Rock Solar Wetland and Stream Delineation

April 19, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

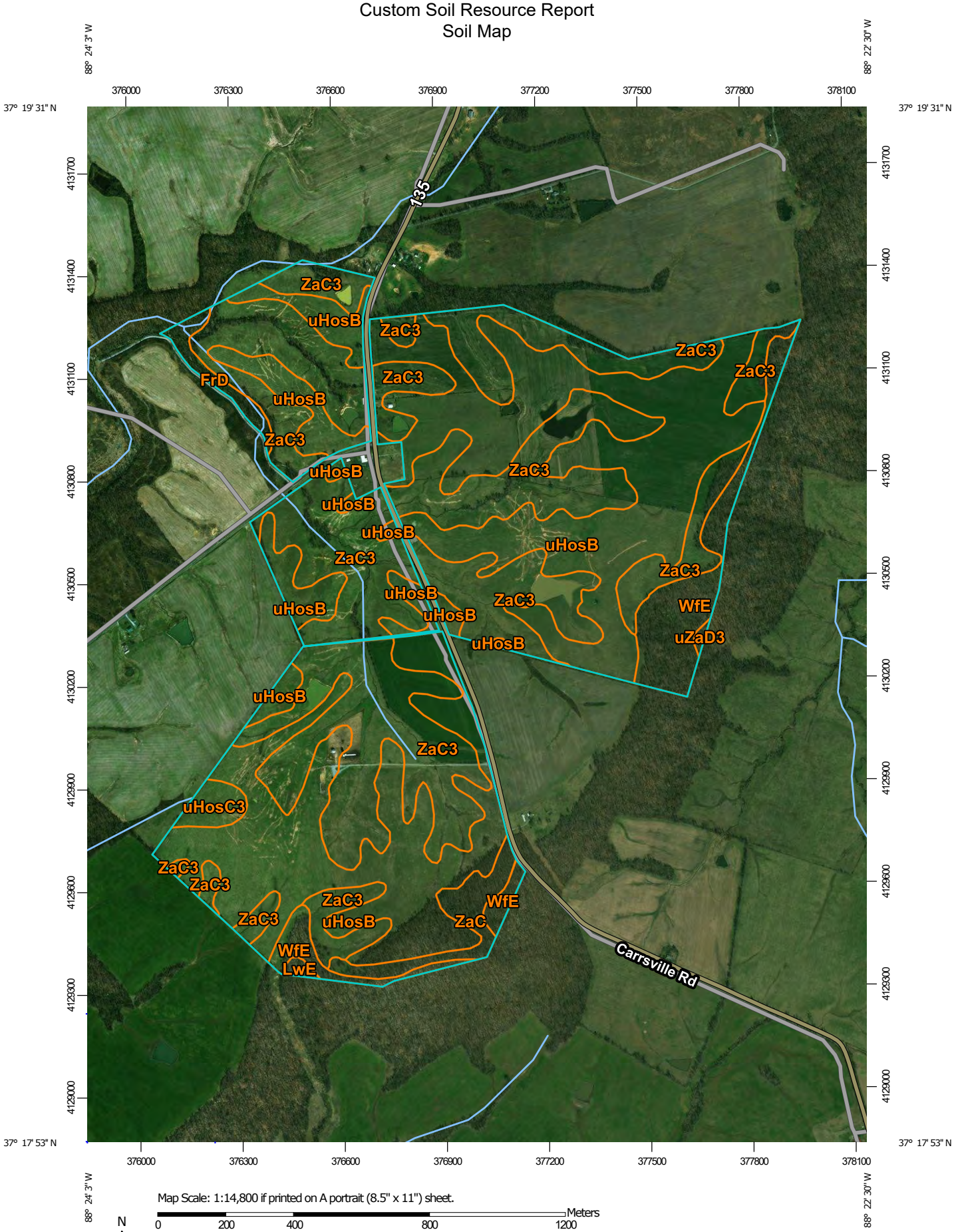
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:14,800 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 200 400 800 1200

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Livingston County, Kentucky
Survey Area Data: Version 21, Sep 2, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Feb 11, 2012—Oct 31, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
FrD	Frondorf silt loam, 12 to 20 percent slopes	5.3	1.0%
LwE	Lowell-Faywood complex, 20 to 40 percent slopes, very stony	1.0	0.2%
uHosB	Hosmer silt loam, 2 to 6 percent slopes	241.1	44.9%
uHosC3	Hosmer silt loam, 6 to 12 percent slopes, severely eroded	5.1	0.9%
uZaD3	Zanesville silt loam, 12 to 20 percent slopes, severely eroded	0.5	0.1%
WfE	Wellston-Frondorf silt loams, very rocky, 20 to 50 percent slopes	30.5	5.7%
ZaC	Zanesville silt loam, 6 to 12 percent slopes	10.9	2.0%
ZaC3	Zanesville silt loam, 6 to 12 percent slopes, severely eroded	243.0	45.2%
Totals for Area of Interest		**537.2**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different

management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Livingston County, Kentucky

FrD—Frondorf silt loam, 12 to 20 percent slopes

Map Unit Setting

National map unit symbol: lflv
Elevation: 320 to 750 feet
Mean annual precipitation: 44 to 61 inches
Mean annual air temperature: 49 to 70 degrees F
Frost-free period: 198 to 232 days
Farmland classification: Not prime farmland

Map Unit Composition

Frondorf and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Frondorf

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Thin fine-loamy noncalcareous loess over loamy residuum weathered from sandstone and siltstone and/or shale

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 37 inches: very channery silty clay loam
R - 37 to 47 inches: unweathered bedrock

Properties and qualities

Slope: 12 to 20 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: F120AY004KY - Loess Veneered Sandstone-Shale Uplands
Hydric soil rating: No

Minor Components

Wellston

Percent of map unit: 5 percent

Hydric soil rating: No

Zanesville

Percent of map unit: 4 percent
Hydric soil rating: No

Faywood

Percent of map unit: 3 percent
Hydric soil rating: No

Lowell

Percent of map unit: 3 percent
Hydric soil rating: No

LwE—Lowell-Faywood complex, 20 to 40 percent slopes, very stony

Map Unit Setting

National map unit symbol: lfmg
Elevation: 310 to 680 feet
Mean annual precipitation: 44 to 61 inches
Mean annual air temperature: 49 to 70 degrees F
Frost-free period: 198 to 232 days
Farmland classification: Not prime farmland

Map Unit Composition

Lowell, very stony, and similar soils: 60 percent
Faywood, very stony, and similar soils: 25 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lowell, Very Stony

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Clayey residuum weathered from limestone and shale

Typical profile

H1 - 0 to 4 inches: silt loam
H2 - 4 to 23 inches: silty clay
H3 - 23 to 44 inches: clay
R - 44 to 54 inches: unweathered bedrock

Properties and qualities

Slope: 20 to 40 percent
Depth to restrictive feature: 40 to 60 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 3 percent
Available water supply, 0 to 60 inches: Moderate (about 7.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: F120AY005KY - Moderately Deep Sandstone-Shale Uplands
Hydric soil rating: No

Description of Faywood, Very Stony

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Clayey residuum weathered from limestone and shale

Typical profile

H1 - 0 to 5 inches: silty clay loam
H2 - 5 to 36 inches: flaggy clay
R - 36 to 46 inches: unweathered bedrock

Properties and qualities

Slope: 20 to 40 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: F120AY005KY - Moderately Deep Sandstone-Shale Uplands
Hydric soil rating: No

Minor Components

Frondorf

Percent of map unit: 5 percent
Hydric soil rating: No

Wellston

Percent of map unit: 4 percent
Hydric soil rating: No

Nolin
Percent of map unit: 2 percent
Hydric soil rating: No

Lindside
Percent of map unit: 2 percent
Hydric soil rating: No

Rock outcrop
Percent of map unit: 2 percent
Hydric soil rating: No

uHosB—Hosmer silt loam, 2 to 6 percent slopes

Map Unit Setting
National map unit symbol: 2pz0p
Elevation: 330 to 840 feet
Mean annual precipitation: 30 to 58 inches
Mean annual air temperature: 42 to 69 degrees F
Frost-free period: 154 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition
Hosmer and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hosmer

Setting
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Thick fine-silty noncalcareous loess

Typical profile
Ap - 0 to 9 inches: silt loam
Bt - 9 to 25 inches: silt loam
Btx - 25 to 80 inches: silt loam

Properties and qualities
Slope: 2 to 6 percent
Depth to restrictive feature: 20 to 39 inches to fragipan
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 20 to 30 inches

Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C/D
Ecological site: F120AY002KY - Fragipan Uplands
Hydric soil rating: No

Minor Components

Alford

Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Zanesville

Percent of map unit: 4 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Robbs

Percent of map unit: 4 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Sadler

Percent of map unit: 2 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

uHosC3—Hosmer silt loam, 6 to 12 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: 2pz0s
Elevation: 330 to 840 feet
Mean annual precipitation: 30 to 58 inches
Mean annual air temperature: 42 to 69 degrees F
Frost-free period: 154 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Hosmer, severely eroded, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hosmer, Severely Eroded

Setting

Landform: Loess hills
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Thick fine-silty noncalcareous loess

Typical profile

Ap - 0 to 4 inches: silt loam
Bt - 4 to 20 inches: silt loam
Btx - 20 to 69 inches: silt loam
2BC - 69 to 80 inches: silt loam

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: 16 to 35 inches to fragipan
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.20 in/hr)
Depth to water table: About 20 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: F120AY002KY - Fragipan Uplands
Other vegetative classification: Severely Eroded Soils (PHG-10)
Hydric soil rating: No

Minor Components

Alford, severely eroded

Percent of map unit: 8 percent
Landform: Loess hills
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Other vegetative classification: Severely Eroded Soils (PHG-10)
Hydric soil rating: No

Zanesville, severely eroded

Percent of map unit: 7 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Other vegetative classification: Severely Eroded Soils (PHG-10)
Hydric soil rating: No

uZaD3—Zanesville silt loam, 12 to 20 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: 2wh5p
Elevation: 310 to 770 feet
Mean annual precipitation: 30 to 61 inches
Mean annual air temperature: 47 to 70 degrees F
Frost-free period: 172 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Zanesville, severely eroded, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Zanesville, Severely Eroded

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Thin fine-silty noncalcareous loess over loamy residuum weathered from sandstone and siltstone

Typical profile

Ap - 0 to 3 inches: silt loam

Bt - 3 to 25 inches: silt loam
Btx - 25 to 45 inches: silt loam
2BC - 45 to 65 inches: clay loam
R - 65 to 75 inches: bedrock

Properties and qualities

Slope: 12 to 20 percent
Depth to restrictive feature: 21 to 30 inches to fragipan; 40 to 72 inches to lithic bedrock
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.01 in/hr)
Depth to water table: About 19 to 27 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C/D
Ecological site: F120AY002KY - Fragipan Uplands
Hydric soil rating: No

Minor Components

Hosmer, severely eroded

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Other vegetative classification: Moderately Well Drained Soils With a Fragipan (PHG-11)
Hydric soil rating: No

Wellston, severely eroded

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Frondorf, severely eroded

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

WfE—Wellston-Frondorf silt loams, very rocky, 20 to 50 percent slopes

Map Unit Setting

National map unit symbol: lfn7
Elevation: 300 to 720 feet
Mean annual precipitation: 44 to 61 inches
Mean annual air temperature: 49 to 70 degrees F
Frost-free period: 198 to 232 days
Farmland classification: Not prime farmland

Map Unit Composition

Wellston and similar soils: 40 percent
Frondorf and similar soils: 30 percent
Minor components: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wellston

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Thin fine-silty noncalcareous loess over residuum weathered from sandstone and siltstone

Typical profile

H1 - 0 to 6 inches: silt loam
H2 - 6 to 35 inches: silty clay loam
H3 - 35 to 45 inches: silt loam
R - 45 to 55 inches: unweathered bedrock

Properties and qualities

Slope: 20 to 50 percent
Depth to restrictive feature: 40 to 72 inches to lithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: F120AY004KY - Loess Veneered Sandstone-Shale Uplands

Hydric soil rating: No

Description of Frondorf

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Thin fine-loamy noncalcareous loess over loamy residuum weathered from sandstone and siltstone and/or shale

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 37 inches: very channery silty clay loam
R - 37 to 47 inches: unweathered bedrock

Properties and qualities

Slope: 20 to 50 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: F120AY004KY - Loess Veneered Sandstone-Shale Uplands
Hydric soil rating: No

Minor Components

Lowell

Percent of map unit: 10 percent
Hydric soil rating: No

Faywood

Percent of map unit: 10 percent
Hydric soil rating: No

Zanesville

Percent of map unit: 5 percent
Hydric soil rating: No

Rock outcrop

Percent of map unit: 5 percent
Hydric soil rating: No

ZaC—Zanesville silt loam, 6 to 12 percent slopes

Map Unit Setting

National map unit symbol: 2s2cr
Elevation: 330 to 910 feet
Mean annual precipitation: 30 to 61 inches
Mean annual air temperature: 44 to 70 degrees F
Frost-free period: 168 to 212 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Zanesville and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Zanesville

Setting

Landform: Ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Thin fine-silty noncalcareous loess over loamy residuum weathered from sandstone and siltstone

Typical profile

Ap - 0 to 8 inches: silt loam
Bt - 8 to 30 inches: silt loam
Btx - 30 to 50 inches: silt loam
2C - 50 to 70 inches: clay loam
R - 70 to 80 inches: bedrock

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: 24 to 32 inches to fragipan; 40 to 79 inches to lithic bedrock
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.13 in/hr)
Depth to water table: About 21 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: C
Ecological site: F120AY002KY - Fragipan Uplands
Hydric soil rating: No

Minor Components

Hosmer
Percent of map unit: 5 percent
Landform: Loess hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Other vegetative classification: Moderately Well Drained Soils With a Fragipan (PHG-11)
Hydric soil rating: No

Wellston
Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Sadler
Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

ZaC3—Zanesville silt loam, 6 to 12 percent slopes, severely eroded

Map Unit Setting
National map unit symbol: 2s2ct
Elevation: 320 to 970 feet
Mean annual precipitation: 30 to 61 inches
Mean annual air temperature: 42 to 70 degrees F
Frost-free period: 154 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition
Zanesville, severely eroded, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Zanesville, Severely Eroded

Setting

Landform: Ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Thin fine-silty noncalcareous loess over loamy residuum weathered from sandstone and siltstone

Typical profile

Ap - 0 to 4 inches: silt loam
Bt - 4 to 23 inches: silt loam
Btx - 23 to 34 inches: silty clay loam
2C - 34 to 56 inches: clay loam
R - 56 to 66 inches: bedrock

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: 20 to 28 inches to fragipan; 38 to 75 inches to lithic bedrock
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.13 in/hr)
Depth to water table: About 17 to 26 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C/D
Ecological site: F120AY002KY - Fragipan Uplands
Hydric soil rating: No

Minor Components

Sadler, eroded

Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Wellston, severely eroded

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear

Hydric soil rating: No

Hosmer, severely eroded

Percent of map unit: 5 percent
Landform: Loess hills
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Other vegetative classification: Severely Eroded Soils (PHG-10)
Hydric soil rating: No

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

Appendix B – Representative Stream and Wetland Photographs

Photo Number:
1.

4/10/2023

Description:
View of PEM wetland WAA.

Photo Number:
2.

4/10/2023

Description:
View of PEM wetland WAB.

Photo Number:
3.

4/11/2023

Description:
View of PEM wetland WAC.

Photo Number:
4.

4/11/2023

Description:
View of PEM wetland WAD.

Photo Number:
5.

4/11/2023

Description:
View of PEM wetland WAE.

Photo Number:
6.

4/11/2023

Description:
View of PEM wetland WAF.

Photo Number:
7.

4/11/2023

Description:
View of PUB wetland WAF.

Photo Number:
8.

4/11/2023

Description:
View of wetland WAG.

Photo Number:
9.

4/12/2023

Description:
View of PFO wetland WAH.

Photo Number:
10.

4/12/2023

Description:
View of PEM wetland WAI.

Photo Number:
11.

4/12/2023

Description:
View of PEM wetland WAJ.

Photo Number:
12.

4/12/2023

Description:
View of PEM wetland WAK.

Photo Number:
13.

4/12/2023

Description:
View of PUB wetland WAL.

Photo Number:
14.

4/10/2023

Description:
View of PEM wetland WBA.

Photo Number:
15.

4/10/2023

Description:
View of PEM wetland WBB.

Photo Number:
16.

4/10/2023

Description:
View of PUB wetland WBC.

Photo Number:
17.

4/10/2023

Description:
View of PEM wetland WBD.

Photo Number:
18.

4/11/2023

Description:
View of PUB wetland WBE.

Photo Number:
19.

4/11/2023

Description:
View of PUB wetland WBF.

Photo Number:
20.

4/11/2023

Description:
View of PEM wetland WBH.

Photo Number:
21.

4/12/2023

Description:
View of PEM wetland WBI.

Photo Number:
22.

4/12/2023

Description:
View of PEM wetland WBJ.

Photo Number:
23.

4/12/2023

Description:
View of PUB wetland WBK.

Photo Number:
24.

4/12/2023

Description:
View of PEM wetland WBL.

Photo Number:
25.

4/12/2023

Description:
View of PFO wetland WBM.

Photo Number:
26.

4/10/2023

Description:
View of PEM wetland WCA.

Photo Number:
27.

4/11/2023

Description:
View of PEM wetland WCB.

Photo Number:
28.

4/11/2023

Description:
View of PEM wetland WCC.

Photo Number:
29.

4/11/2023

Description:
View of PEM wetland WCD.

Photo Number:
30.

4/11/2023

Description:
View of PEM wetland WCE.

Photo Number:
31.

4/12/2023

Description:
View of PEM wetland WCF.

Photo Number:
32.

4/12/2023

Description:
View of PUB wetland WCG.

Photo Number:
33.

4/12/2023

Description:
View of stream SAA facing upstream.

Photo Number:
34.

4/12/2023

Description:
View of stream SAA facing downstream.

Photo Number:
35.

4/12/2023

Description:
View of stream SAB facing upstream.

Photo Number:
36.

4/12/2023

Description:
View of stream SAB facing downstream.

Photo Number:
37.

4/12/2023

Description:
View of stream SAC facing upstream.

Photo Number:
38.

4/12/2023

Description:
View of stream SAC facing downstream.

Photo Number:
39.

4/12/2023

Description:
View of stream SAD facing upstream.

Photo Number:
40.

4/12/2023

Description:
View of stream SAD facing downstream.

Photo Number:
41.

4/12/2023

Description:
View of stream SAE facing upstream.

Photo Number:
42.

4/12/2023

Description:
View of stream SAE facing downstream.

Photo Number:
43.

4/10/2023

Description:
View of stream SBA facing upstream.

Photo Number:
44.

4/10/2023

Description:
View of stream SBA facing downstream.

Photo Number:
45.

4/10/2023

Description:
View of stream SBB facing upstream.

Photo Number:
46.

4/10/2023

Description:
View of stream SBB facing downstream.

Photo Number:
47.

4/11/2023

Description:
View of stream SBC facing upstream.

Photo Number:
48.

4/11/2023

Description:
View of stream SBC facing downstream.

Photo Number:
49.

4/11/2023

Description:
View of stream SBD facing upstream.

Photo Number:
50.

4/11/2023

Description:
View of stream SBD facing downstream.

Photo Number:
51.

4/12/2023

Description:
View of stream SBE facing upstream.

Photo Number:
52.

4/12/2023

Description:
View of stream SBE facing downstream.

Photo Number:
53.

4/12/2023

Description:
View of the ephemeral section of stream SBF facing upstream.

Photo Number:
54.

4/12/2023

Description:
View of the ephemeral section of stream SBF facing downstream.

Photo Number:
55.

4/12/2023

Description:
View of the intermittent section of stream SBF facing upstream.

Photo Number:
56.

4/12/2023

Description:
View of the intermittent section of stream SBF facing downstream.

Photo Number:
57.

4/12/2023

Description:
View of stream SCA facing upstream.

Photo Number:
58.

4/12/2023

Description:
View of stream SCA facing downstream.

Photo Number:
59.

4/10/2023

Description:
View of stream SCB facing upstream.

Photo Number:
60.

4/10/2023

Description:
View of stream SCB facing downstream.

Photo Number:
61.

4/10/2023

Description:
View of stream SCC facing upstream.

Photo Number:
62.

4/10/2023

Description:
View of stream SCC facing downstream.

Photo Number:
63.

4/11/2023

Description:
View of ephemeral section of stream SCD facing upstream.

Photo Number:
64.

4/11/2023

Description:
View of ephemeral section of stream SCD facing downstream.

Photo Number:
65.

4/12/2023

Description:
View of intermittent section of stream SCD facing upstream.

Photo Number:
66.

4/12/2023

Description:
View of intermittent section of stream SCD facing downstream.

Photo Number:
67.

4/11/2023

Description:
View of stream SCE facing upstream.

Photo Number:
68.

4/11/2023

Description:
View of stream SCE facing downstream.

Photo Number:
69.

4/12/2023

Description:
View of stream SCF facing upstream.

Photo Number:
70.

4/12/2023

Description:
View of stream SCF facing downstream.

Photo Number:
71.

4/12/2023

Description:
View of stream SCG facing upstream.

Photo Number:
72.

4/12/2023

Description:
View of stream SCG facing downstream.

Photo Number:
73.

4/12/2023

Description:
View of stream SCH facing upstream.

Photo Number:
74.

4/12/2023

Description:
View of stream SCH facing downstream.

Photo Number:
75.

4/12/2023

Description:
View of stream SCI facing upstream.

Photo Number:
76.

4/12/2023

Description:
View of stream SCI facing downstream.

Photo Number:
77.

4/12/2023

Description:
View of Peck Branch facing upstream.

Photo Number:
78.

4/12/2023

Description:
View of Peck Branch facing downstream.

Photo Number:
79.

4/12/2023

Description:
View of stream SCK facing upstream.

Photo Number:
80.

4/12/2023

Description:
View of stream SCK facing downstream.

Photo Number:
81.

4/10/2023

Description:
View of UDFAA.

Photo Number:
82.

4/10/2023

Description:
View of UDFAB.

Photo Number:
83.

4/10/2023

Description:
View of UDFAC.

Photo Number:
84.

4/10/2023

Description:
View of UDFAD.

Photo Number:
85.

4/11/2023

Description:
View of UDFAE.

Photo Number:
86.

4/11/2023

Description:
View of UDFAF.

Photo Number:
87.

4/11/2023

Description:
View of UDFAH.

Photo Number:
88.

4/11/2023

Description:
View of UDFAI.

Photo Number:
89.

4/12/2023

Description:
View of UDFAJ.

Photo Number:
90.

4/12/2023

Description:
View of UDFAK.

Photo Number:
91.

4/12/2023

Description:
View of UDFAL.

Photo Number:
92.

4/12/2023

Description:
View of UDFAN.

Photo Number:
93.

4/12/2023

Description:
View of UDFAO.

Photo Number:
94.

4/12/2023

Description:
View of UDFAP.

Photo Number:
95.

4/12/2023

Description:
View of UDFAQ.

Photo Number:
96.

4/12/2023

Description:
View of UDFAR.

Photo Number:
97.

4/12/2023

Description:
View of UDFAS.

Photo Number:
98.

4/12/2023

Description:
View of UDFAT.

Photo Number:
99.

4/10/2023

Description:
View of UDFBA.

Photo Number:
100.

4/10/2023

Description:
View of UDFBB.

Photo Number:
101.

4/11/2023

Description:
View of UDFBC.

Photo Number:
102.

4/11/2023

Description:
View of UDFBD.

Photo Number:
103.

4/11/2023

Description:
View of UDFBE.

Photo Number:
104.

4/11/2023

Description:
View of UDFBF.

Photo Number:
105.

4/11/2023

Description:
View of UDFBG.

Photo Number:
106.

4/11/2023

Description:
View of UDFBH.

Photo Number:
107.

4/12/2023

Description:
View of UDFBI.

Photo Number:
108.

4/12/2023

Description:
View of UDFBJ.

Photo Number:
109.

4/12/2023

Description:
View of UDFBK.

Photo Number:
110.

4/12/2023

Description:
View of UDFBL.

Photo Number:
111.

4/12/2023

Description:
View of UDFBM.

Photo Number:
112.

4/12/2023

Description:
View of UDFBN.

Photo Number:
113.

4/12/2023

Description:
View of UDFBO.

Photo Number:
114.

4/12/2023

Description:
View of UDFBP.

Photo Number:
115.

4/12/2023

Description:
View of UDFBQ.

Photo Number:
116.

4/11/2023

Description:
View of UDFBS.

Photo Number:
117.

4/10/2023

Description:
View of UDFCA.

Photo Number:
118.

4/10/2023

Description:
View of UDFCB.

Photo Number:
119.

4/10/2023

Description:
View of UDFCC.

Photo Number:
120.

4/11/2023

Description:
View of UDFCD.

Photo Number:
121.

4/11/2023

Description:
View of UDFCE.

Photo Number:
122.

4/11/2023

Description:
View of UDFCF.

Photo Number:
123.

4/11/2023

Description:
View of UDFCG.

Photo Number:
124.

4/12/2023

Description:
View of UDFCH.

Photo Number:
125.

4/12/2023

Description:
View of UDFCI.

Photo Number:
126.

4/12/2023

Description:
View of UDFCJ.

Photo Number:
127.

4/12/2023

Description:
View of culvert CUL001, which drains wetland WBK into UDFAK.

Photo Number:
128.

4/11/2023

Description:
Representative photo of upland pasture, which makes up a majority of the land use on site.

Photo Number:
129.

4/10/2023

Description:
Representative photo of upland wooded areas.

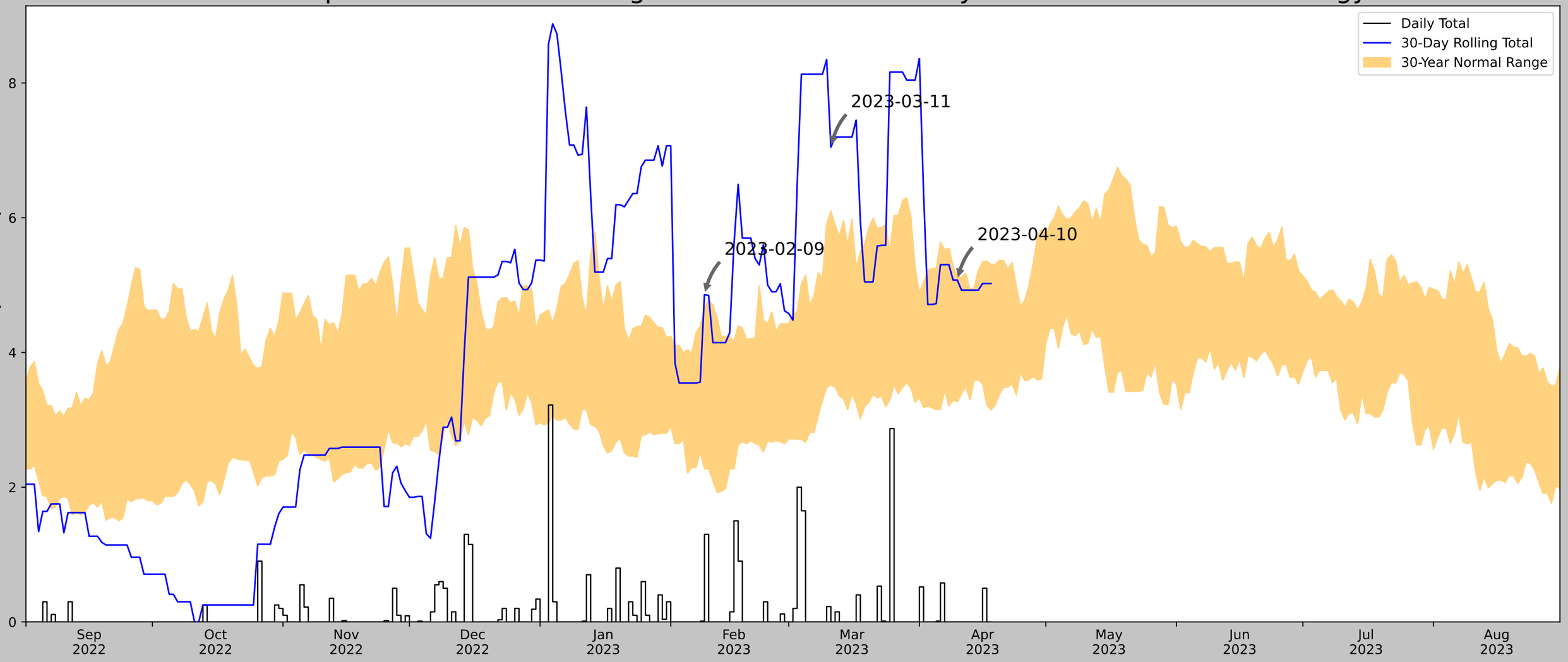
Photo Number:
130.

4/11/2023

Description:
View of a headwater Spring feeding into stream SCA.

Appendix C – Antecedent Precipitation Tool

Antecedent Precipitation vs Normal Range based on NOAA's Daily Global Historical Climatology Network



Coordinates	37.314237, -88.389812
Observation Date	2023-04-10
Elevation (ft)	590.401
Drought Index (PDSI)	Mild drought (2023-03)
WebWIMP H_2O Balance	Wet Season

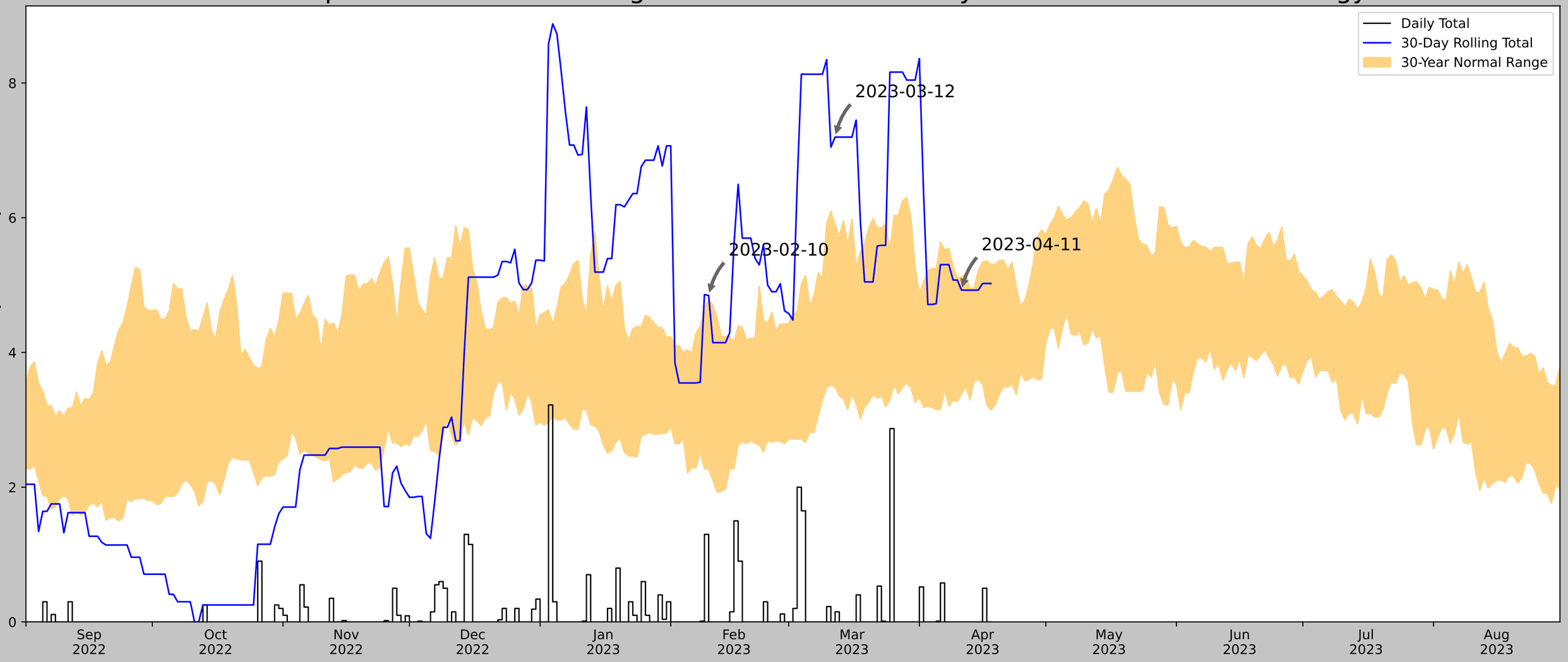
30 Days Ending	30th %ile (in)	70th %ile (in)	Observed (in)	Wetness Condition	Condition Value	Month Weight	Product
2023-04-10	3.26811	5.115748	5.074803	Normal	2	3	6
2023-03-11	3.518504	6.1	7.047244	Wet	3	2	6
2023-02-09	2.270473	4.659055	4.858268	Wet	3	1	3
Result							Wetter than Normal - 15

Weather Station Name	Coordinates	Elevation (ft)	Distance (mi)	Elevation Δ	Weighted Δ	Days Normal	Days Antecedent
SMITHLAND L&D	37.1644, -88.4311	356.955	10.599	233.446	7.244	10977	83
BROOKPORT 7.3 ENE	37.1617, -88.5026	416.995	3.941	60.04	2.01	79	7
REIDLAND 0.8 E	37.006, -88.5117	374.016	11.812	17.061	5.517	11	0
CALVERT CITY 2.7 SSW	37.0009, -88.3791	395.997	11.655	39.042	5.7	38	0
PADUCAH 0.9 NNE	37.0857, -88.6321	340.879	12.336	16.076	5.75	10	0
BROOKPORT DAM 52	37.1275, -88.6531	330.053	12.489	26.902	5.956	196	0
GILBERTSVILLE KY DAM	37.0147, -88.2678	359.908	13.711	2.953	6.21	20	0
METROPOLIS 2.1 ENE	37.1651, -88.6765	395.997	13.512	39.042	6.608	1	0
SALEM 0.4 S	37.2604, -88.2388	440.945	12.489	83.99	6.669	2	0
PADUCAH 4 WSW	37.055, -88.6511	418.963	14.286	62.008	7.315	10	0
FT MASSAC SP	37.1442, -88.7114	312.992	15.499	43.963	7.656	1	0
GOLCONDA 0.2 SSW	37.3599, -88.4888	465.879	13.875	108.924	7.755	1	0
BELKNAP 11.1 ESE	37.2551, -88.7567	371.063	18.981	14.108	8.809	1	0
W PADUCAH 2W	37.0683, -88.7725	413.058	19.947	56.103	10.095	6	0

Figure and tables made by the
Antecedent Precipitation Tool
Version 1.0

Written by Jason Deters
U.S. Army Corps of Engineers

Antecedent Precipitation vs Normal Range based on NOAA's Daily Global Historical Climatology Network



Coordinates	37.314237, -88.389812
Observation Date	2023-04-11
Elevation (ft)	590.401
Drought Index (PDSI)	Mild drought (2023-03)
WebWIMP H_2O Balance	Wet Season

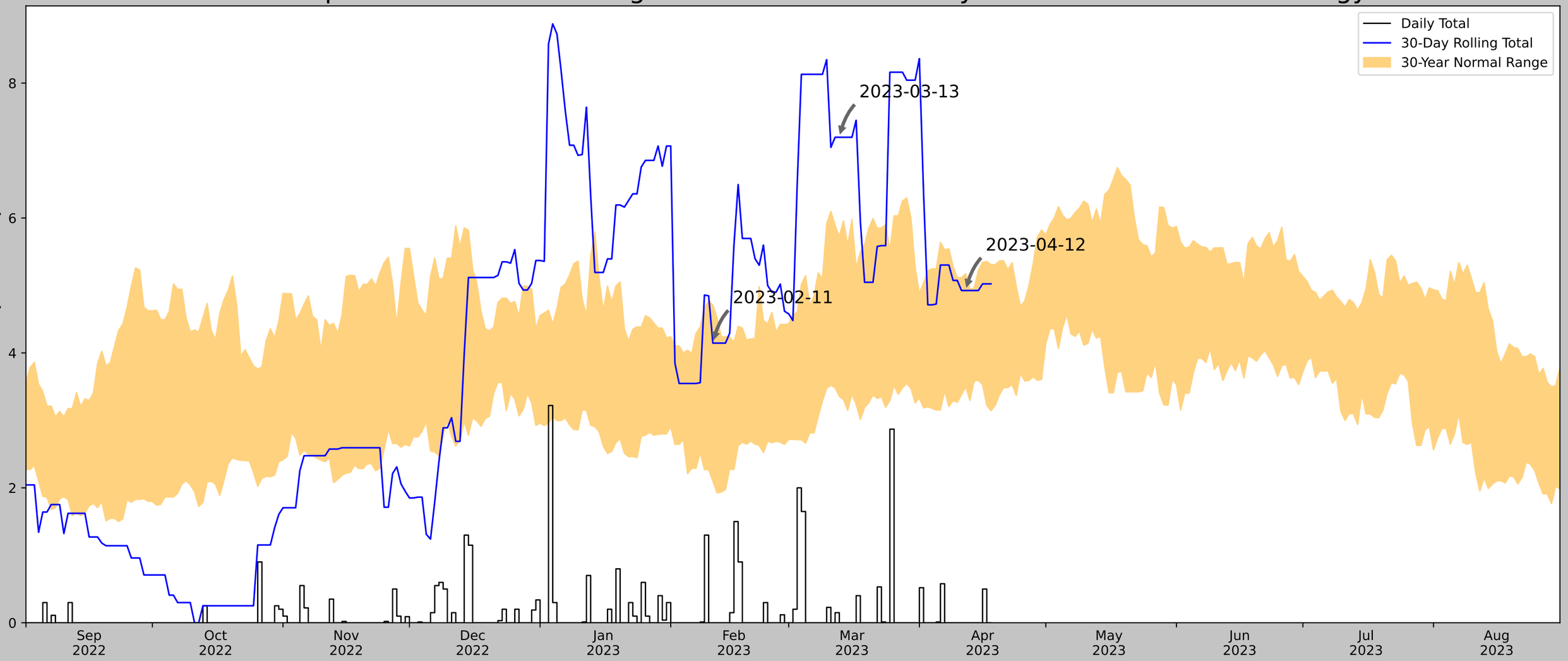
30 Days Ending	30th %ile (in)	70th %ile (in)	Observed (in)	Wetness Condition	Condition Value	Month Weight	Product
2023-04-11	3.382284	5.115748	4.925197	Normal	2	3	6
2023-03-12	3.484252	5.891339	7.196851	Wet	3	2	6
2023-02-10	2.270473	4.772047	4.846457	Wet	3	1	3
Result							Wetter than Normal - 15

Weather Station Name	Coordinates	Elevation (ft)	Distance (mi)	Elevation Δ	Weighted Δ	Days Normal	Days Antecedent
SMITHLAND L&D	37.1644, -88.4311	356.955	10.599	233.446	7.244	10977	83
BROOKPORT 7.3 ENE	37.1617, -88.5026	416.995	3.941	60.04	2.01	79	7
REIDLAND 0.8 E	37.006, -88.5117	374.016	11.812	17.061	5.517	11	0
CALVERT CITY 2.7 SSW	37.0009, -88.3791	395.997	11.655	39.042	5.7	38	0
PADUCAH 0.9 NNE	37.0857, -88.6321	340.879	12.336	16.076	5.75	10	0
BROOKPORT DAM 52	37.1275, -88.6531	330.053	12.489	26.902	5.956	196	0
GILBERTSVILLE KY DAM	37.0147, -88.2678	359.908	13.711	2.953	6.21	20	0
METROPOLIS 2.1 ENE	37.1651, -88.6765	395.997	13.512	39.042	6.608	1	0
SALEM 0.4 S	37.2604, -88.2388	440.945	12.489	83.99	6.669	2	0
PADUCAH 4 WSW	37.055, -88.6511	418.963	14.286	62.008	7.315	10	0
FT MASSAC SP	37.1442, -88.7114	312.992	15.499	43.963	7.656	1	0
GOLCONDA 0.2 SSW	37.3599, -88.4888	465.879	13.875	108.924	7.755	1	0
BELKNAP 11.1 ESE	37.2551, -88.7567	371.063	18.981	14.108	8.809	1	0
W PADUCAH 2W	37.0683, -88.7725	413.058	19.947	56.103	10.095	6	0

Figure and tables made by the
Antecedent Precipitation Tool
Version 1.0

Written by Jason Deters
U.S. Army Corps of Engineers

Antecedent Precipitation vs Normal Range based on NOAA's Daily Global Historical Climatology Network



Coordinates	37.314237, -88.389812
Observation Date	2023-04-12
Elevation (ft)	590.401
Drought Index (PDSI)	Mild drought (2023-03)
WebWIMP H_2O Balance	Wet Season

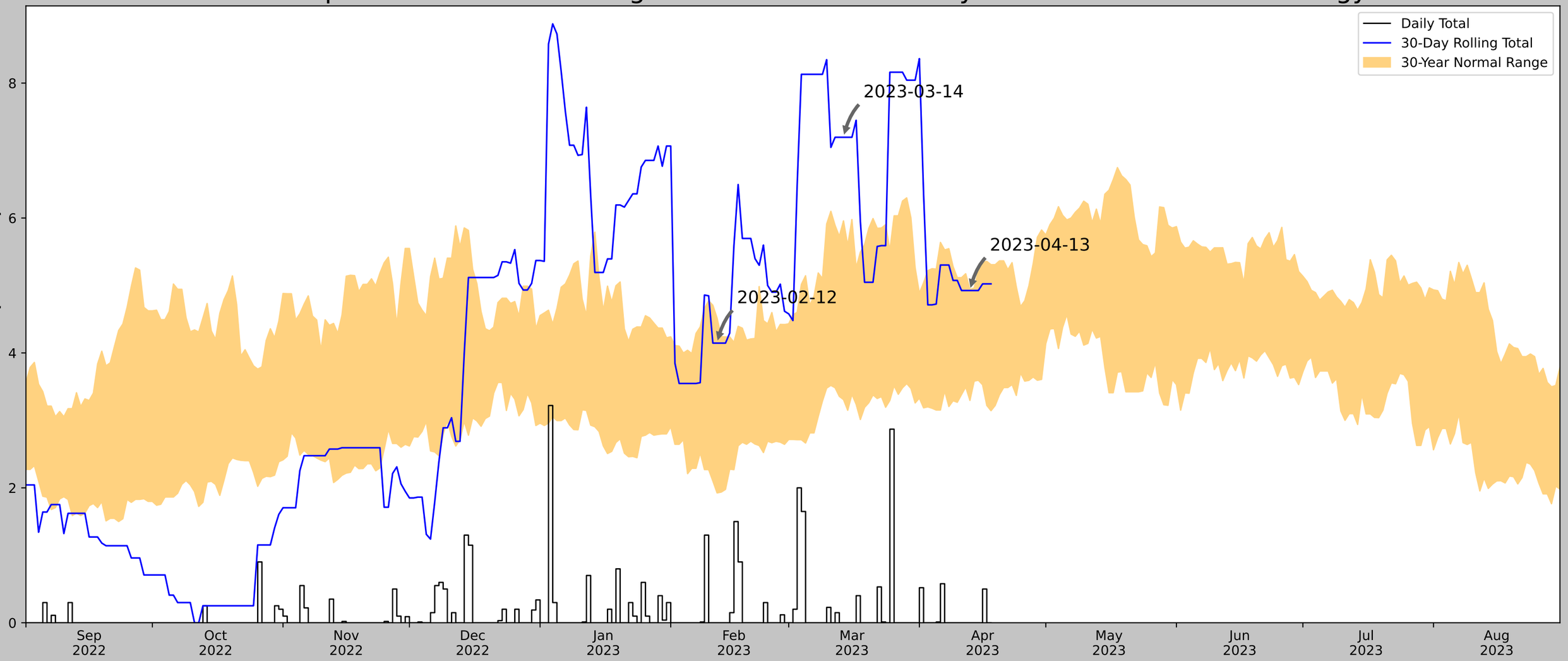
30 Days Ending	30th %ile (in)	70th %ile (in)	Observed (in)	Wetness Condition	Condition Value	Month Weight	Product
2023-04-12	3.494095	5.17441	4.925197	Normal	2	3	6
2023-03-13	3.356299	5.729134	7.196851	Wet	3	2	6
2023-02-11	2.100787	4.707874	4.145669	Normal	2	1	2
Result							Normal Conditions - 14

Weather Station Name	Coordinates	Elevation (ft)	Distance (mi)	Elevation Δ	Weighted Δ	Days Normal	Days Antecedent
SMITHLAND L&D	37.1644, -88.4311	356.955	10.599	233.446	7.244	10977	82
BROOKPORT 7.3 ENE	37.1617, -88.5026	416.995	3.941	60.04	2.01	79	8
REIDLAND 0.8 E	37.006, -88.5117	374.016	11.812	17.061	5.517	11	0
CALVERT CITY 2.7 SSW	37.0009, -88.3791	395.997	11.655	39.042	5.7	38	0
PADUCAH 0.9 NNE	37.0857, -88.6321	340.879	12.336	16.076	5.75	10	0
BROOKPORT DAM 52	37.1275, -88.6531	330.053	12.489	26.902	5.956	196	0
GILBERTSVILLE KY DAM	37.0147, -88.2678	359.908	13.711	2.953	6.21	20	0
METROPOLIS 2.1 ENE	37.1651, -88.6765	395.997	13.512	39.042	6.608	1	0
SALEM 0.4 S	37.2604, -88.2388	440.945	12.489	83.99	6.669	2	0
PADUCAH 4 WSW	37.055, -88.6511	418.963	14.286	62.008	7.315	10	0
FT MASSAC SP	37.1442, -88.7114	312.992	15.499	43.963	7.656	1	0
GOLCONDA 0.2 SSW	37.3599, -88.4888	465.879	13.875	108.924	7.755	1	0
BELKNAP 11.1 ESE	37.2551, -88.7567	371.063	18.981	14.108	8.809	1	0
W PADUCAH 2W	37.0683, -88.7725	413.058	19.947	56.103	10.095	6	0

Figure and tables made by the
Antecedent Precipitation Tool
Version 1.0

Written by Jason Deters
U.S. Army Corps of Engineers

Antecedent Precipitation vs Normal Range based on NOAA's Daily Global Historical Climatology Network



Coordinates	37.314237, -88.389812
Observation Date	2023-04-13
Elevation (ft)	590.401
Drought Index (PDSI)	Mild drought (2023-03)
WebWIMP H_2O Balance	Wet Season

30 Days Ending	30th %ile (in)	70th %ile (in)	Observed (in)	Wetness Condition	Condition Value	Month Weight	Product
2023-04-13	3.295669	4.939764	4.925197	Normal	2	3	6
2023-03-14	3.307874	5.957874	7.196851	Wet	3	2	6
2023-02-12	1.92441	4.516142	4.145669	Normal	2	1	2
Result							Normal Conditions - 14

Weather Station Name	Coordinates	Elevation (ft)	Distance (mi)	Elevation Δ	Weighted Δ	Days Normal	Days Antecedent
SMITHLAND L&D	37.1644, -88.4311	356.955	10.599	233.446	7.244	10977	82
BROOKPORT 7.3 ENE	37.1617, -88.5026	416.995	3.941	60.04	2.01	79	8
REIDLAND 0.8 E	37.006, -88.5117	374.016	11.812	17.061	5.517	11	0
CALVERT CITY 2.7 SSW	37.0009, -88.3791	395.997	11.655	39.042	5.7	38	0
PADUCAH 0.9 NNE	37.0857, -88.6321	340.879	12.336	16.076	5.75	10	0
BROOKPORT DAM 52	37.1275, -88.6531	330.053	12.489	26.902	5.956	196	0
GILBERTSVILLE KY DAM	37.0147, -88.2678	359.908	13.711	2.953	6.21	20	0
METROPOLIS 2.1 ENE	37.1651, -88.6765	395.997	13.512	39.042	6.608	1	0
SALEM 0.4 S	37.2604, -88.2388	440.945	12.489	83.99	6.669	2	0
PADUCAH 4 WSW	37.055, -88.6511	418.963	14.286	62.008	7.315	10	0
FT MASSAC SP	37.1442, -88.7114	312.992	15.499	43.963	7.656	1	0
GOLCONDA 0.2 SSW	37.3599, -88.4888	465.879	13.875	108.924	7.755	1	0
BELKNAP 11.1 ESE	37.2551, -88.7567	371.063	18.981	14.108	8.809	1	0
W PADUCAH 2W	37.0683, -88.7725	413.058	19.947	56.103	10.095	6	0

Figure and tables made by the
Antecedent Precipitation Tool
Version 1.0

Written by Jason Deters
U.S. Army Corps of Engineers

Appendix D – USACE Wetland Determination and Rapid Bioassessment Protocol Data Forms

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: 1359 - Mantle Rock Solar City/County: Livingston County Sampling Date: 2023-04-11

Applicant/Owner: Enerfin Renewables LLC State: Kentucky Sampling Point: DP-UP1

Investigator(s): I. Bentley, M.Herod, J. Murphy Section, Township, Range: sec T R

Landform (hillslope, terrace, etc.): Crest Local relief (concave, convex, none): Convex Slope (%): 0-2

Subregion (LRR or MLRA): LRR N, MLRA 120A Lat: 37.317082 Long: -88.387211 Datum: NAD83

Soil Map Unit Name: Hosmer silt loam, 2 to 6 percent slopes NWI classification: N/A

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:

0/3 parameters met. Area is not a wetland.

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:

Indicators of wetland hydrology absent; parameter not met.

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: DP-UP1

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *No rooted trees*			
2.			
3.			
4.			
5.			
6.			
7.			
	0 = Total Cover		
50% of total cover: 0.0	20% of total cover: 0.0		
Sapling/Shrub Stratum (Plot size: 15)			
1. *No rooted shrubs*			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	0 = Total Cover		
50% of total cover: 0.0	20% of total cover: 0.0		
Herb Stratum (Plot size: 5)			
1. *Schedonorus arundinaceous*	65	Y	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	65.0 = Total Cover		
50% of total cover: 32.5	20% of total cover: 13.0		
Woody Vine Stratum (Plot size: 30)			
1. *No rooted vines*			
2.			
3.			
4.			
5.			
	0 = Total Cover		
50% of total cover: 0.0	20% of total cover: 0.0		

Dominance Test worksheet:

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

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.00 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0.00	x 1 =	0.00
FACW species	0.00	x 2 =	0.00
FAC species	0.00	x 3 =	0.00
FACU species	65.00	x 4 =	260.00
UPL species	0.00	x 5 =	0.00
Column Totals:	65.00 (A)		260.00 (B)

Prevalence Index = B/A = 4.0

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 or equal to 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.)

Vegetation significantly disturbed by mowing.

SOIL Sampling Point: DP-UP1

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-1	10YR 4/3	100					L	
1-18	10YR 4/4	100					L	

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

Hydric Soil Indicators:

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

Indicators for Problematic Hydric Soils[3]:

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

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

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

Remarks:

No indicators of hydric soils present; parameter not met.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: 1359 - Mantle Rock Solar City/County: Livingston County Sampling Date: 2023-04-11

Applicant/Owner: Enerfin Renewables LLC State: Kentucky Sampling Point: DP-UP2

Investigator(s): I. Bentley, M.Herod, J. Murphy Section, Township, Range: sec T R

Landform (hillslope, terrace, etc.): Crest Local relief (concave, convex, none): Convex Slope (%): 0-2

Subregion (LRR or MLRA): LRR N, MLRA 120A Lat: 37.318448 Long: -88.389664 Datum: NAD83

Soil Map Unit Name: Zanesville silt loam, 6 to 12 percent slopes, severely eroded NWI classification: _____

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:
0/3 parameters met. Area is not a wetland.

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:
Indicators of wetland hydrology absent; parameter not met.

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: DP-UP2

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *No rooted trees*			
2.			
3.			
4.			
5.			
6.			
7.			
	0 = Total Cover		
50% of total cover: 0.0	20% of total cover: 0.0		
Sapling/Shrub Stratum (Plot size: 15)			
1. *No rooted shrubs*			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	0 = Total Cover		
50% of total cover: 0.0	20% of total cover: 0.0		
Herb Stratum (Plot size: 5)			
1. *Lamium purpureum*	30	Y	UPL
2. *Allium vineale*	5	N	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	35.0 = Total Cover		
50% of total cover: 17.5	20% of total cover: 7.0		
Woody Vine Stratum (Plot size: 30)			
1. *No rooted vines*			
2.			
3.			
4.			
5.			
	0 = Total Cover		
50% of total cover: 0.0	20% of total cover: 0.0		

Dominance Test worksheet:

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

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.00 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0.00	x 1 =	0.00
FACW species	0.00	x 2 =	0.00
FAC species	0.00	x 3 =	0.00
FACU species	5.00	x 4 =	20.00
UPL species	30.00	x 5 =	150.00
Column Totals:	35.00 (A)		170.00 (B)

Prevalence Index = B/A = 4.86

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 or equal to 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.)

Vegetation significantly disturbed by mowing. No indicators of hydrophytic vegetation present; parameter not met.

SOIL

Sampling Point: DP-UP2

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-18	10YR 5/4	95	10YR 5/8	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)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

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

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

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

Remarks:

No indicators of hydric soils present; parameter not met.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: 1359 - Mantle Rock Solar City/County: Livingston County Sampling Date: 2023-04-11

Applicant/Owner: Enerfin Renewables LLC State: Kentucky Sampling Point: DP-UP3

Investigator(s): I. Bentley, M.Herod, J. Murphy Section, Township, Range: sec T R

Landform (hillslope, terrace, etc.): Crest Local relief (concave, convex, none): Convex Slope (%): 3-7

Subregion (LRR or MLRA): LRR N, MLRA 120A Lat: 37.318694 Long: -88.380318 Datum: NAD83

Soil Map Unit Name: Zanesville silt loam, 6 to 12 percent slopes, severely eroded NWI classification: N/A

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:
0/3 parameters met. Area is not a wetland.

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:
Indicators of wetland hydrology absent; parameter not met.

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: DP-UP3

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *No rooted trees*			
2.			
3.			
4.			
5.			
6.			
7.			
	0 = Total Cover		
50% of total cover: 0.0	20% of total cover: 0.0		
Sapling/Shrub Stratum (Plot size: 15)			
1. *No rooted shrubs*			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	0 = Total Cover		
50% of total cover: 0.0	20% of total cover: 0.0		
Herb Stratum (Plot size: 5)			
1. *Lamium purpureum*	30	Y	UPL
2. *Allium vineale*	5	N	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	35.0 = Total Cover		
50% of total cover: 17.5	20% of total cover: 7.0		
Woody Vine Stratum (Plot size: 30)			
1. *No rooted vines*			
2.			
3.			
4.			
5.			
	0 = Total Cover		
50% of total cover: 0.0	20% of total cover: 0.0		

Dominance Test worksheet:

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

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.00 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0.00	x 1 =	0.00
FACW species	0.00	x 2 =	0.00
FAC species	0.00	x 3 =	0.00
FACU species	5.00	x 4 =	20.00
UPL species	30.00	x 5 =	150.00
Column Totals:	35.00 (A)		170.00 (B)

Prevalence Index = B/A = 4.86

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 or equal to 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.)

Vegetation significantly disturbed by mowing. No indicators of hydrophytic vegetation present; parameter not met.

SOIL

Sampling Point: DP-UP3

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

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-18	10YR 4/4	100					SIL	

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

Hydric Soil Indicators:

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

Indicators for Problematic Hydric Soils[3]:

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

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

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

Remarks:

No indicators of hydric soils present; parameter not met.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: 1359 - Mantle Rock Solar City/County: Livingston County Sampling Date: 2023-04-12

Applicant/Owner: Enerfin Renewables LLC State: Kentucky Sampling Point: DP-UP4

Investigator(s): I. Bentley, M.Herod, J. Murphy Section, Township, Range: sec T R

Landform (hillslope, terrace, etc.): Noseslope Local relief (concave, convex, none): Convex Slope (%): 3-7

Subregion (LRR or MLRA): LRR N, MLRA 120A Lat: 37.304296 Long: -88.388643 Datum: NAD83

Soil Map Unit Name: Zanesville silt loam, 6 to 12 percent slopes NWI classification: N/A

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:
0/3 parameters met. Area is not a wetland.

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:
Indicators of wetland hydrology absent; parameter not met.

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: DP-UP4

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Liriodendron tulipifera*	15	Y	FACU
2. *Acer negundo*	10	Y	FAC
3.			
4.			
5.			
6.			
7.			
	25.0 = Total Cover		
50% of total cover: 12.5	20% of total cover: 5.0		
Sapling/Shrub Stratum (Plot size: 15)			
1. *Ligustrum sinense*	10	Y	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	10.0 = Total Cover		
50% of total cover: 5.0	20% of total cover: 2.0		
Herb Stratum (Plot size: 5)			
1. *Toxicodendron radicans*	5	Y	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	5.0 = Total Cover		
50% of total cover: 2.5	20% of total cover: 1.0		
Woody Vine Stratum (Plot size: 30)			
1. *No rooted vines*			
2.			
3.			
4.			
5.			
	0 = Total Cover		
50% of total cover: 0.0	20% of total cover: 0.0		

Dominance Test worksheet:

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

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 50.00 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0.00	x 1 =	0.00
FACW species	0.00	x 2 =	0.00
FAC species	15.00	x 3 =	45.00
FACU species	25.00	x 4 =	100.00
UPL species	0.00	x 5 =	0.00
Column Totals:	40.00 (A)		145.00 (B)

Prevalence Index = B/A = 3.62

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 or equal to 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.)

No indicators of hydrophytic vegetation present; parameter not met.

SOIL

Sampling Point: DP-UP4

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 3/2	100					SIL	
2-18	10YR 5/4	100					SIL	

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

Hydric Soil Indicators:

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

Indicators for Problematic Hydric Soils[3]:

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

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

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

Remarks:

No indicators of hydric soils present; parameter not met.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: 1359 - Mantle Rock Solar City/County: Livingston County Sampling Date: 2023-04-10

Applicant/Owner: Ernfin Renewables LLC State: Kentucky Sampling Point: DP-WAA

Investigator(s): I. Bentley, M.Herod, J. Murphy Section, Township, Range: sec T R

Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): 0-2

Subregion (LRR or MLRA): LRR N, MLRA 120A Lat: 37.312678 Long: -88.386556 Datum: NAD83

Soil Map Unit Name: Zanesville silt loam, 6 to 12 percent slopes, severely eroded NWI classification: _____

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:
2/3 parameters met. Vegetation significantly disturbed by mowing. Area is a PEM wetland.

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

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

Field Observations:

Surface Water Present?	Yes ✓	No _____	Depth (inches): 2
Water Table Present?	Yes _____	No ✓	Depth (inches): _____
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:
Indicators of wetland hydrology present; parameter met.

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

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *No rooted trees*			
2.			
3.			
4.			
5.			
6.			
7.			
	0 = Total Cover		
50% of total cover: 0.0	20% of total cover: 0.0		
Sapling/Shrub Stratum (Plot size: 15)			
1. *No rooted shrubs*			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	0 = Total Cover		
50% of total cover: 0.0	20% of total cover: 0.0		
Herb Stratum (Plot size: 5)			
1. *Schedonorus arundinaceous*	45	Y	UPL
2. *Geranium spp.*	45	Y	UPL
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	90.0 = Total Cover		
50% of total cover: 45.0	20% of total cover: 18.0		
Woody Vine Stratum (Plot size: 30)			
1. *No rooted vines*			
2.			
3.			
4.			
5.			
	0 = Total Cover		
50% of total cover: 0.0	20% of total cover: 0.0		

Dominance Test worksheet:

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

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.00 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0.00	x 1 =	0.00
FACW species	0.00	x 2 =	0.00
FAC species	0.00	x 3 =	0.00
FACU species	0.00	x 4 =	0.00
UPL species	90.00	x 5 =	450.00
Column Totals:	90.00 (A)		450.00 (B)

Prevalence Index = B/A = 5.0

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 or equal to 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.)

Vegetation significantly disturbed by mowing. No indicators of hydrophytic vegetation present; parameter not met.

SOIL Sampling Point: DP-WAA

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 4/2	95	7.5YR 4/6	5	C	PL	L	
3-18	10YR 6/2	70	7.5YR 4/6	30	C	M/PL	L	

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

Hydric Soil Indicators:

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

Indicators for Problematic Hydric Soils[3]:

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

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

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

Remarks:

Two indicators (A11, F3) of hydric soils present; parameter met.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: 1359 - Mantle Rock Solar City/County: Livingston County Sampling Date: 2023-04-11

Applicant/Owner: Enerfin Renewables, LLC State: Kentucky Sampling Point: DP-WAE

Investigator(s): I. Bentley, J. Murphy, M. Herod Section, Township, Range: sec T R

Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): 3-7

Subregion (LRR or MLRA): LRR N, MLRA 120A Lat: 37.317684 Long: -88.387167 Datum: NAD83

Soil Map Unit Name: Zanesville silt loam, 6 to 12 percent slopes, severely eroded NWI classification: _____

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:
3/3 parameters met. Area is a PEM wetland.

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): 0.5
Saturation Present? (includes capillary fringe)	Yes ✓	No _____	Depth (inches): 0

Wetland Hydrology Present? Yes ✓ No _____

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

Remarks:
Indicators of wetland hydrology present; parameter met.

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

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *No rooted trees*			
2.			
3.			
4.			
5.			
6.			
7.			
	0 = Total Cover		
50% of total cover: 0.0	20% of total cover: 0.0		
Sapling/Shrub Stratum (Plot size: 15)			
1. *No rooted shrubs*			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	0 = Total Cover		
50% of total cover: 0.0	20% of total cover: 0.0		
Herb Stratum (Plot size: 5)			
1. *Carex lupulina*	10	Y	OBL
2. *Juncus effusus*	8	Y	FACW
3. *Setaria spp.*	5	Y	UPL
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	23.0 = Total Cover		
50% of total cover: 11.5	20% of total cover: 4.6		
Woody Vine Stratum (Plot size: 30)			
1. *No rooted vines*			
2.			
3.			
4.			
5.			
	0 = Total Cover		
50% of total cover: 0.0	20% of total cover: 0.0		

Dominance Test worksheet:

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

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

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

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	10.00	x 1 =	10.00
FACW species	8.00	x 2 =	16.00
FAC species	0.00	x 3 =	0.00
FACU species	0.00	x 4 =	0.00
UPL species	5.00	x 5 =	25.00
Column Totals:	23.00 (A)		51.00 (B)

Prevalence Index = B/A = 2.22

Hydrophytic Vegetation Indicators:

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

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

Definitions of Four Vegetation Strata:

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

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 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.)

Indicators of hydrophytic vegetation present; parameter met. Vegetation significantly disturbed by mowing. Indicator 1 (rapid test) not present. Indicator 2 (dominance test) present. Prevalence index calculated for reference purposes only.

SOIL Sampling Point: DP-WAE

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 5/2	95	7.5YR 5/6	5	C	PL	MUCK	
2-18	10YR 6/2	80	7.5YR 5/6	20	C	M/PL	L	

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

Hydric Soil Indicators:

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

Indicators for Problematic Hydric Soils[3]:

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

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

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

Remarks:

One indicator (A11) of hydric soils present; parameter met.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: 1359 - Mantle Rock Solar City/County: Livingston County Sampling Date: 2023-04-12

Applicant/Owner: Enerfin Renewables LLC State: Kentucky Sampling Point: DP-WAH

Investigator(s): I. Bentley, M.Herod, J. Murphy Section, Township, Range: sec T R

Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): 3-7

Subregion (LRR or MLRA): LRR N, MLRA 120A Lat: 37.304187 Long: -88.388725 Datum: NAD83

Soil Map Unit Name: Zanesville silt loam, 6 to 12 percent slopes NWI classification: N/A

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:
3/3 parameters met. Area is a PFO wetland.

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): 30
Water Table Present?	Yes _____	No ✓	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes ✓	No _____	Depth (inches): 0

Wetland Hydrology Present? Yes ✓ No _____

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

Remarks:
Indicators of wetland hydrology present; parameter met.

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

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Platanus occidentalis*	10	Y	FACW
2. *Acer negundo*	10	Y	FAC
3. *Diospyros virginiana*	5	N	FAC
4. *Fraxinus pennsylvanica*	5	N	FACW
5.			
6.			
7.			
	30.0	= Total Cover	
50% of total cover: 15.0	20% of total cover: 6.0		
Sapling/Shrub Stratum (Plot size: 15)			
1. *Fraxinus pennsylvanica*	15	Y	FACW
2. *Ligustrum sinense*	5	Y	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	20.0	= Total Cover	
50% of total cover: 10.0	20% of total cover: 4.0		
Herb Stratum (Plot size: 5)			
1. *Carex spp.*	5	Y	
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	5.0	= Total Cover	
50% of total cover: 2.5	20% of total cover: 1.0		
Woody Vine Stratum (Plot size: 30)			
1. *No rooted vines*			
2.			
3.			
4.			
5.			
	0	= Total Cover	
50% of total cover: 0.0	20% of total cover: 0.0		

Dominance Test worksheet:

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

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 60.00 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0.00	x 1 =	0.00
FACW species	30.00	x 2 =	60.00
FAC species	15.00	x 3 =	45.00
FACU species	5.00	x 4 =	20.00
UPL species	0.00	x 5 =	0.00
Column Totals:	50.00 (A)		125.00 (B)

Prevalence Index = B/A = 2.5

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 or equal to 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.)

Carex spp. unidentifiable due to lack of seed head. Indicators of hydrophytic vegetation present; parameter met. Indicator 1 (rapid test) not present. Indicator 2 (dominance test) present. Prevalence index calculated for reference purposes only.

SOIL

Sampling Point: DP-WAH

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-1	10YR 3/1	97	10YR 3/6	3	C	M	SIL	
1-18	10YR 6/2	70	7.5YR 4/6	30	C	M/PL	SIL	

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

Hydric Soil Indicators:

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

Indicators for Problematic Hydric Soils[3]:

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

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

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

Remarks:

Two indicators (A11, F3) of hydric soils present; parameter met.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: 1359 - Mantle Rock Solar City/County: Livingston County Sampling Date: 2023-04-11

Applicant/Owner: Enerfin Renewables LLC State: Kentucky Sampling Point: DP-WCD

Investigator(s): M.Herod, J. Murphy, I. Bentley Section, Township, Range: sec T R

Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): 0-2

Subregion (LRR or MLRA): LRR N, MLRA 120A Lat: 37.318269 Long: -88.389932 Datum: NAD83

Soil Map Unit Name: Zanesville silt loam, 6 to 12 percent slopes, severely eroded NWI classification:

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:
2/3 parameters met. Vegetation significantly disturbed by grazing and mowing. Area is a PEM wetland.

HYDROLOGY

Wetland Hydrology Indicators:

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

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

Secondary Indicators (minimum of two required)

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

Field Observations:

Surface Water Present? Yes ✓ No ____ Depth (inches): 2

Water Table Present? Yes ____ No ✓ Depth (inches): ____

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:
Indicators of wetland hydrology present; parameter met.

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

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *No rooted trees*			
2.			
3.			
4.			
5.			
6.			
7.			
	0 = Total Cover		
50% of total cover: 0.0	20% of total cover: 0.0		
Sapling/Shrub Stratum (Plot size: 15)			
1. *No rooted shrubs*			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	0 = Total Cover		
50% of total cover: 0.0	20% of total cover: 0.0		
Herb Stratum (Plot size: 5)			
1. *Carex spp.*	30	Y	UPL
2. *Schedonorus arundinaceous*	25	Y	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	55.0 = Total Cover		
50% of total cover: 27.5	20% of total cover: 11.0		
Woody Vine Stratum (Plot size: 30)			
1. *No rooted vines*			
2.			
3.			
4.			
5.			
	0 = Total Cover		
50% of total cover: 0.0	20% of total cover: 0.0		

Dominance Test worksheet:

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

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.00 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0.00	x 1 =	0.00
FACW species	0.00	x 2 =	0.00
FAC species	0.00	x 3 =	0.00
FACU species	25.00	x 4 =	100.00
UPL species	30.00	x 5 =	150.00
Column Totals:	55.00 (A)		250.00 (B)

Prevalence Index = B/A = 4.55

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 or equal to 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.)

Vegetation significantly disturbed by grazing and mowing. No indicators of hydrophytic vegetation present; parameter not met.

SOIL

Sampling Point: DP-WCD

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 4/2	100					SIL	
3-18	10YR 5/2	80	10YR 5/6	20	C	M/PL	SIL	

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

Hydric Soil Indicators:

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

Indicators for Problematic Hydric Soils[3]:

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

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

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

Remarks:

Two indicators (A11, F3) of hydric soils present; parameter met.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: 1359 - Mantle Rock Solar City/County: Livingston County Sampling Date: 2023-04-11

Applicant/Owner: Enerfin Renewables LLC State: Kentucky Sampling Point: DP-WCE

Investigator(s): I. Bentley, M.Herod, J. Murphy Section, Township, Range: sec T R

Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): 0-2

Subregion (LRR or MLRA): LRR N, MLRA 120A Lat: 37.318872 Long: -88.380461 Datum: NAD83

Soil Map Unit Name: Zanesville silt loam, 6 to 12 percent slopes, severely eroded NWI classification: N/A

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:
Vegetation significantly disturbed by mowing. 2/3 parameters met. Area is a PEM wetland.

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:
Indicators of wetland hydrology present; parameter met.

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

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *No rooted trees*			
2.			
3.			
4.			
5.			
6.			
7.			
	0 = Total Cover		
50% of total cover: 0.0	20% of total cover: 0.0		
Sapling/Shrub Stratum (Plot size: 15)			
1. *No rooted shrubs*			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	0 = Total Cover		
50% of total cover: 0.0	20% of total cover: 0.0		
Herb Stratum (Plot size: 5)			
1. *Schedonorus arundinaceous*	70	Y	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	70.0 = Total Cover		
50% of total cover: 35.0	20% of total cover: 14.0		
Woody Vine Stratum (Plot size: 30)			
1. *No rooted vines*			
2.			
3.			
4.			
5.			
	0 = Total Cover		
50% of total cover: 0.0	20% of total cover: 0.0		

Dominance Test worksheet:

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

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.00 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0.00	x 1 =	0.00
FACW species	0.00	x 2 =	0.00
FAC species	0.00	x 3 =	0.00
FACU species	70.00	x 4 =	280.00
UPL species	70.00	x 5 =	0.00
Column Totals:	0.00 (A)		280.00 (B)

Prevalence Index = B/A = 4.0

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 or equal to 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.)

No indicators of hydrophytic vegetation present; parameter met due to significant disturbance. Vegetation significantly disturbed by mowing.

SOIL

Sampling Point: DP-WCE

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 4/2	100					SIL	
2-18	10YR 5/2	70	10YR 5/6	30	C	M/PL	CL	

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

Hydric Soil Indicators:

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

Indicators for Problematic Hydric Soils[3]:

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

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

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

Remarks:

Two indicators (F3, A11) of hydric soils present; parameter met.

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME **SAA**		LOCATION **Livingston County KY**	
STATION #_____ RIVERMILE_____		STREAM CLASS **Ephemeral**	
LAT **37.3072103** LONG **-88.3889882**		RIVER BASIN **Ohio**	
STORET #		AGENCY **Copperhead Consulting**	
INVESTIGATORS		**M. Herod, I. Bentley, J. Murphy**	
FORM COMPLETED BY **M. Herod**	DATE TIME **Apr 19 2023 | 14:34**	REASON FOR SURVEY **Wetland Delineation**	

	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
Parameters to be evaluated in sampling reach	**1. Epifaunal Substrate/ Available Cover**	Greater than 50% 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).	30-50% 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).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% 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	X 4 3 2 1 0
	2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
	SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 X 6	5 4 3 2 1 0
	3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
	SCORE 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 X 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% 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 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	X 4 3 2 1 0
	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 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 X 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
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 17	20 19 18 **X** 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 10	20 19 18 17 16	15 14 13 12 11	**X** 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	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	**X** 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	**X** 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	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 3 (LB)	Left Bank 10 9	8 7 6	5 4 **X**	2 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 **X**	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 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	**X** 1 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	**X** 1 0

Total Score 68

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME **SAB**		LOCATION **Livingston County KY**	
STATION #_____ RIVERMILE_____		STREAM CLASS **Ephemeral**	
LAT **37.314056** LONG **-88.392896**		RIVER BASIN **Ohio**	
STORET #		AGENCY **Copperhead Consulting**	
INVESTIGATORS		**M. Herod, I. Bentley, J. Murphy**	
FORM COMPLETED BY **M. Herod**	DATE TIME **Apr 20 2023 | 09:11**	REASON FOR SURVEY **Wetland Delineation**	

	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
Parameters to be evaluated in sampling reach	**1. Epifaunal Substrate/ Available Cover**	Greater than 50% 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).	30-50% 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).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 **X** 6	5 4 3 2 1 0
	2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
	SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 **X** 7 6	5 4 3 2 1 0
	3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
	SCORE 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 **X** 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% 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 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 **X**	5 4 3 2 1 0
	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 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 **X** 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
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 17	20 19 18 **X** 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 **X** 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	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 **X**	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 **X** 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	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 4 (LB)	Left Bank 10 9	8 7 6	5 **X** 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 **X** 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 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	**X** 1 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	**X** 1 0

Total Score 74

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME **SAC**		LOCATION **Livingston County KY**	
STATION #_____ RIVERMILE_____		STREAM CLASS **Ephemeral**	
LAT **37.314502** LONG **-88.393697**		RIVER BASIN **Ohio**	
STORET #		AGENCY **Copperhead Consulting**	
INVESTIGATORS		**M. Herod, I. Bentley, J. Murphy**	
FORM COMPLETED BY **M. Herod**	DATE TIME **Apr 20 2023 | 09:31**	REASON FOR SURVEY **Wetland Delineation**	

Parameters to be evaluated in sampling reach	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
	1. Epifaunal Substrate/ Available Cover	Greater than 50% 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).	30-50% 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).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 X 6	5 4 3 2 1 0
	2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
	SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 X 7 6	5 4 3 2 1 0
	3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
	SCORE 1	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 X 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% 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 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 X	5 4 3 2 1 0
	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 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 X 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
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 17	20 19 18 **X** 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 **X** 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	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 **X** 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 **X** 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	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 4 (LB)	Left Bank 10 9	8 7 6	5 **X** 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 **X** 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 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	**X** 1 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	**X** 1 0

Total Score 74

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME **SAD**		LOCATION **Livingston County KY**	
STATION #_____ RIVERMILE_____		STREAM CLASS **Ephemeral**	
LAT **37.313536** LONG **-88.390828**		RIVER BASIN **Ohio**	
STORET #		AGENCY **Copperhead Consulting**	
INVESTIGATORS		**M. Herod, I. Bentley, J. Murphy**	
FORM COMPLETED BY **M. Herod**	DATE TIME **Apr 20 2023 | 09:31**	REASON FOR SURVEY **Wetland Delineation**	

Parameters to be evaluated in sampling reach	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
	1. Epifaunal Substrate/ Available Cover	Greater than 50% 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).	30-50% 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).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% 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 **X** 7 6	5 4 3 2 1 0
	2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
	SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 **X** 7 6	5 4 3 2 1 0
	3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
	SCORE 4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 **X** 3 2 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% 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 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 **X**	5 4 3 2 1 0
	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 4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 **X** 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
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 17	20 19 18 **X** 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 **X** 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	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 **X**	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 **X**	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	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 4 (LB)	Left Bank 10 9	8 7 6	5 **X** 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 **X** 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 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	**X** 1 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	**X** 1 0

Total Score 79

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME **SAE**		LOCATION **Livingston County KY**	
STATION #_____ RIVERMILE_____		STREAM CLASS **Ephemeral**	
LAT **37.317929** LONG **-88.392628**		RIVER BASIN **Ohio**	
STORET #		AGENCY **Copperhead Consulting**	
INVESTIGATORS		**M. Herod, I. Bentley, J. Murphy**	
FORM COMPLETED BY **M. Herod**	DATE TIME **Apr 20 2023 | 09:31**	REASON FOR SURVEY **Wetland Delineation**	

	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
Parameters to be evaluated in sampling reach	**1. Epifaunal Substrate/ Available Cover**	Greater than 50% 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).	30-50% 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).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE 3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 **X** 2 1 0
	2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
	SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 **X** 7 6	5 4 3 2 1 0
	3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
	SCORE 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 **X** 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% 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 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE 4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 **X** 3 2 1 0
	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 3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 **X** 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
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 17	20 19 18 **X** 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 **X** 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	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 **X**	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 **X**	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	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 3 (LB)	Left Bank 10 9	8 7 6	5 4 **X**	2 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 **X**	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 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	**X** 1 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	**X** 1 0

Total Score 66

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME **SBA**		LOCATION **Livingston County KY**	
STATION #_____ RIVERMILE_____		STREAM CLASS **Ephemeral**	
LAT **37.3140785** LONG **-88.380093**		RIVER BASIN	
STORET #		AGENCY **Copperhead Consulting**	
INVESTIGATORS		**M. Herod, I. Bentley, J. Murphy**	
FORM COMPLETED BY **M. Herod**	DATE TIME **Apr 19 2023 | 14:34**	REASON FOR SURVEY **Wetland Delineation**	

	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
Parameters to be evaluated in sampling reach	**1. Epifaunal Substrate/ Available Cover**	Greater than 50% 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).	30-50% 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).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE 11	20 19 18 17 16	15 14 13 12 **X**	10 9 8 7 6	5 4 3 2 1 0
	2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
	SCORE 10	20 19 18 17 16	15 14 13 12 11	**X** 9 8 7 6	5 4 3 2 1 0
	3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
	SCORE 3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 **X** 2 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% 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 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE 18	20 19 **X** 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	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 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 **X** 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
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 18	20 19 ~~18~~ 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
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)	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 4 (RB)	Right Bank 10 9	8 7 6	5 ~~4~~ 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	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 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

Total Score 109

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME **SBB**		LOCATION **Livingston County KY**	
STATION #_____ RIVERMILE_____		STREAM CLASS **Ephemeral**	
LAT **37.311999** LONG **-88.387441**		RIVER BASIN **Ohio**	
STORET #		AGENCY **Copperhead Consulting**	
INVESTIGATORS		**M. Herod, I. Bentley, J. Murphy**	
FORM COMPLETED BY **M. Herod**	DATE TIME **Apr 19 2023 | 14:34**	REASON FOR SURVEY **Wetland Delineation**	

	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
Parameters to be evaluated in sampling reach	**1. Epifaunal Substrate/ Available Cover**	Greater than 50% 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).	30-50% 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).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE 10	20 19 18 17 16	15 14 13 12 11	X 9 8 7 6	5 4 3 2 1 0
	2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
	SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 X 7 6	5 4 3 2 1 0
	3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
	SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 X 6	5 4 3 2 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% 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 80% 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	X 9 8 7 6	5 4 3 2 1 0
	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 7	20 19 18 17 16	15 14 13 12 11	10 9 8 X 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
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 18	20 19 **X** 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 **X** 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	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 **4** (LB)	Left Bank 10 9	8 7 6	5 **X** 3	2 1 0
SCORE **5** (RB)	Right Bank 10 9	8 7 6	**X** 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	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 **X**	5 4 3	2 1 0
SCORE **6** (RB)	Right Bank 10 9	8 7 **X**	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 **X**	2 1 0
SCORE **3** (RB)	Right Bank 10 9	8 7 6	5 4 **X**	2 1 0

Total Score 95

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME **SBC**		LOCATION **Livingston County KY**	
STATION #_____ RIVERMILE_____		STREAM CLASS **Ephemeral**	
LAT **37.319223** LONG **-88.388204**		RIVER BASIN **Ohio**	
STORET #		AGENCY **Copperhead Consulting**	
INVESTIGATORS		**M. Herod, I. Bentley, J. Murphy**	
FORM COMPLETED BY **M. Herod**	DATE TIME **Apr 19 2023 | 14:34**	REASON FOR SURVEY **Wetland Delineation**	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% 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).	30-50% 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).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 10	20 19 18 17 16	15 14 13 12 11	X 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 X 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 X 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% 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 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 X 6	5 4 3 2 1 0
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 14	20 19 18 17 16	15 X 13 12 11	10 X 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
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 17	20 19 18 **X** 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 10	20 19 18 17 16	15 14 13 12 11	**X** 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	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 4 (LB)	Left Bank 10 9	8 7 6	5 **X** 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	**X** 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	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 **X** 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 **X** 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 **X**	2 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 **X**	2 1 0

Total Score 99

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME **SBD**		LOCATION **Livingston County KY**	
STATION #_____ RIVERMILE_____		STREAM CLASS **Ephemeral**	
LAT **37.319223** LONG **-88.388204**		RIVER BASIN **Ohio**	
STORET #		AGENCY **Copperhead Consulting**	
INVESTIGATORS		**M. Herod, I. Bentley, J. Murphy**	
FORM COMPLETED BY **M. Herod**	DATE TIME **Apr 19 2023 | 14:34**	REASON FOR SURVEY **Wetland Delineation**	

Parameters to be evaluated in sampling reach	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
	1. Epifaunal Substrate/ Available Cover	Greater than 50% 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).	30-50% 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).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE 9	20 19 18 17 16	15 14 13 12 11	10 X 8 7 6	5 4 3 2 1 0
	2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
	SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 X 7 6	5 4 3 2 1 0
	3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
	SCORE 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 X 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% 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 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	X 4 3 2 1 0
	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 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 X 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
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 17	20 19 18 **X** 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 **X** 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	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 **X** 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 **X**	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	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 **X** 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 **X** 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 **X**	2 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 **X**	2 1 0

Total Score 84

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME **SBE**		LOCATION **Livingston County KY**	
STATION #_____ RIVERMILE_____		STREAM CLASS **Ephemeral**	
LAT **37.303369** LONG **-88.393058**		RIVER BASIN **Ohio**	
STORET #		AGENCY **Copperhead Consulting**	
INVESTIGATORS		**M. Herod, I. Bentley, J. Murphy**	
FORM COMPLETED BY **M. Herod**	DATE TIME **Apr 19 2023 | 14:34**	REASON FOR SURVEY **Wetland Delineation**	

Parameters to be evaluated in sampling reach	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
	1. Epifaunal Substrate/ Available Cover	Greater than 50% 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).	30-50% 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).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% 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 **X** 7 6	5 4 3 2 1 0
	2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
	SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 **X** 7 6	5 4 3 2 1 0
	3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
	SCORE 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 **X** 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% 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 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	**X** 4 3 2 1 0
	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 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 **X** 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
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 17	20 19 18 **X** 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 **X** 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	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	**X** 7 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 **X** 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	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 4 (LB)	Left Bank 10 9	8 7 6	5 **X** 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 **X** 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 **X**	2 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 **X**	2 1 0

Total Score 79

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME **SBF_Ephemeral**		LOCATION **Livingston County KY**	
STATION #_____ RIVERMILE_____		STREAM CLASS **Ephemeral**	
LAT **37.304265** LONG **-88.393301**		RIVER BASIN **Ohio**	
STORET #		AGENCY **Copperhead Consulting**	
INVESTIGATORS		**M. Herod, I. Bentley, J. Murphy**	
FORM COMPLETED BY **M. Herod**	DATE TIME **Apr 19 2023 | 14:34**	REASON FOR SURVEY **Wetland Delineation**	

	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
Parameters to be evaluated in sampling reach	**1. Epifaunal Substrate/ Available Cover**	Greater than 50% 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).	30-50% 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).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% 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 **X** 7 6	5 4 3 2 1 0
	2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
	SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	**X** 4 3 2 1 0
	3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
	SCORE 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 **X** 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% 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 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE 3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 **X** 2 1 0
	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 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 **X** 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
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 17	20 19 18 **X** 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 10	20 19 18 17 16	15 14 13 12 11	**X** 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	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	**X** 7 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 **X** 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	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 3 (LB)	Left Bank 10 9	8 7 6	5 4 **X**	2 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 **X**	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 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	**X** 1 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	**X** 1 0

Total Score 72

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME **SBF_Intermittent**	LOCATION **Livingston County KY**	
STATION #_____ RIVERMILE_____	STREAM CLASS **Ephemeral**	
LAT **37.303521** LONG **-88.393845**	RIVER BASIN **Ohio**	
STORET #	AGENCY **Copperhead Consulting**	
INVESTIGATORS	**M. Herod, I. Bentley, J. Murphy**	
FORM COMPLETED BY **M. Herod**	DATE TIME **Apr 19 2023 | 14:34**	REASON FOR SURVEY **Wetland Delineation**

Parameters to be evaluated in sampling reach	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
	1. Epifaunal Substrate/ Available Cover	Greater than 50% 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).	30-50% 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).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE 11	20 19 18 17 16	15 14 13 12 **X**	10 9 8 7 6	5 4 3 2 1 0
	2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
	SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 **X**	5 4 3 2 1 0
	3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
	SCORE 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 **X** 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% 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 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 **X** 7 6	5 4 3 2 1 0
	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 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 **X** 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
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 17	20 19 18 **X** 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 11	20 19 18 17 16	15 14 13 12 **X**	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	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	**X** 7 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 **X** 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	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 3 (LB)	Left Bank 10 9	8 7 6	5 4 **X**	2 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 **X**	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 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	**X** 1 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	**X** 1 0

Total Score 82

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME **SCA**		LOCATION **Livingston County KY**	
STATION #_____ RIVERMILE_____		STREAM CLASS **Ephemeral**	
LAT **37.311894** LONG **-88.381477**		RIVER BASIN **Ohio**	
STORET #		AGENCY **Copperhead Consulting**	
INVESTIGATORS		**M. Herod, I. Bentley, J. Murphy**	
FORM COMPLETED BY **M. Herod**	DATE TIME **Apr 19 2023 | 14:34**	REASON FOR SURVEY **Wetland Delineation**	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% 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).	30-50% 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).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 13	20 19 18 17 16	15 14 **X** 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 10	20 19 18 17 16	15 14 13 12 11	**X** 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 **X** 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% 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 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 18	20 19 **X** 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
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 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 **X** 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
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 18	20 19 ~~18~~ 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
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)	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 6 (RB)	Right Bank 10 9	8 7 ~~6~~	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	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 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

Total Score 115

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME **SCB**		LOCATION **Livingston County KY**	
STATION #_____ RIVERMILE_____		STREAM CLASS **Ephemeral**	
LAT **37.312653** LONG **-88.388315**		RIVER BASIN **Ohio**	
STORET #		AGENCY **Copperhead Consulting**	
INVESTIGATORS		**M. Herod, I. Bentley, J. Murphy**	
FORM COMPLETED BY **M. Herod**	DATE TIME **Apr 19 2023 | 14:34**	REASON FOR SURVEY **Wetland Delineation**	

	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
Parameters to be evaluated in sampling reach	**1. Epifaunal Substrate/ Available Cover**	Greater than 50% 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).	30-50% 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).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE 14	20 19 18 17 16	15 **X** 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
	SCORE 11	20 19 18 17 16	15 14 13 12 **X**	10 9 8 7 6	5 4 3 2 1 0
	3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
	SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 **X** 6	5 4 3 2 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% 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 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE 15	20 19 18 17 16	**X** 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	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 8	20 19 18 17 16	15 14 13 12 11	10 9 **X** 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
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 18	20 19 **X** 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 12	20 19 18 17 16	15 14 13 **X** 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	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	**X** 4 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 **X** 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	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	**X** 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	**X** 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 **X**	2 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 **X**	2 1 0

Total Score 116

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME **SCC**		LOCATION **Livingston County KY**	
STATION #_____ RIVERMILE_____		STREAM CLASS **Ephemeral**	
LAT **37.314857** LONG **-88.388752**		RIVER BASIN **Ohio**	
STORET #		AGENCY **Copperhead Consulting**	
INVESTIGATORS		**M. Herod, I. Bentley, J. Murphy**	
FORM COMPLETED BY **M. Herod**	DATE TIME **Apr 19 2023 | 14:34**	REASON FOR SURVEY **Wetland Delineation**	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% 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).	30-50% 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).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 16	20 19 18 17 **X16**	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 14	20 19 18 17 16	15 **X14** 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 16	20 19 18 17 **X16**	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 <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% 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 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 13	20 19 18 17 16	15 14 **X13** 12 11	10 9 8 7 6	5 4 3 2 1 0
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 13	20 19 18 17 16	15 14 **X13** 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
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 18	20 19 **X** 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 13	20 19 18 17 16	15 14 **X** 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	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 **X** 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 **X**	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	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	**X** 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	**X** 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 **X**	2 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 **X**	2 1 0

Total Score 138

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME **SCD**		LOCATION **Livingston County KY**	
STATION #_____ RIVERMILE_____		STREAM CLASS **Ephemeral**	
LAT **37.31809** LONG **-88.391214**		RIVER BASIN **Ohio**	
STORET #		AGENCY **Copperhead Consulting**	
INVESTIGATORS		**M. Herod, I. Bentley, J. Murphy**	
FORM COMPLETED BY **M. Herod**	DATE TIME **Apr 19 2023 | 14:34**	REASON FOR SURVEY **Wetland Delineation**	

	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
Parameters to be evaluated in sampling reach	**1. Epifaunal Substrate/ Available Cover**	Greater than 50% 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).	30-50% 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).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE 9	20 19 18 17 16	15 14 13 12 11	10 X 8 7 6	5 4 3 2 1 0
	2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
	SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 X 6	5 4 3 2 1 0
	3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
	SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 X 6	5 4 3 2 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% 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 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	X 4 3 2 1 0
	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 16	20 19 18 17 X	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
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 17	20 19 18 **X** 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 **X** 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	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 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	**X** 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 **X**	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	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 **X**	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 **X**	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 **X**	2 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 **X**	2 1 0

Total Score 91

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME **SCD_Intermittent**	LOCATION **Livingston County KY**	
STATION #_____ RIVERMILE_____	STREAM CLASS **Ephemeral**	
LAT **37.319247** LONG **-88.394136**	RIVER BASIN **Ohio**	
STORET #	AGENCY **Copperhead Consulting**	
INVESTIGATORS	**M. Herod, I. Bentley, J. Murphy**	
FORM COMPLETED BY **M. Herod**	DATE TIME **Apr 19 2023 | 14:34**	REASON FOR SURVEY **Wetland Delineation**

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% 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).	30-50% 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).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 15	20 19 18 17 16	X 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 14	20 19 18 17 16	15 X 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 16	20 19 18 17 X	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 <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% 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 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 15	20 19 18 17 16	X 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
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	X 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
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 18	20 19 **X** 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 13	20 19 18 17 16	15 14 **X** 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	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 4 (LB)	Left Bank 10 9	8 7 6	5 **X** 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	**X** 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	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	**X** 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	**X** 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 **X**	2 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 **X**	2 1 0

Total Score 137

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME **SCE_Ephemeral**		LOCATION **Livingston County KY**	
STATION #_____ RIVERMILE_____		STREAM CLASS **Ephemeral**	
LAT **37.318958** LONG **-88.38337**		RIVER BASIN **Ohio**	
STORET #		AGENCY **Copperhead Consulting**	
INVESTIGATORS		**M. Herod, I. Bentley, J. Murphy**	
FORM COMPLETED BY **M. Herod**	DATE TIME **Apr 19 2023 | 14:34**	REASON FOR SURVEY **Wetland Delineation**	

	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
Parameters to be evaluated in sampling reach	**1. Epifaunal Substrate/ Available Cover**	Greater than 50% 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).	30-50% 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).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE 11	20 19 18 17 16	15 14 13 12 **X**	10 9 8 7 6	5 4 3 2 1 0
	2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
	SCORE 0	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
	SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 **X** 6	5 4 3 2 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% 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 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE 11	20 19 18 17 16	15 14 13 12 **X**	10 9 8 7 6	5 4 3 2 1 0
	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 7	20 19 18 17 16	15 14 13 12 11	10 9 8 **X** 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
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 18	20 19 **X** 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 11	20 19 18 17 16	15 14 13 12 **X**	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	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 3 (LB)	Left Bank 10 9	8 7 6	5 4 **X**	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 **X** 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	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 **X** 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 **X** 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 **X** 3	2 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 **X**	2 1 0

Total Score 93

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME **SCE_Intermittent**		LOCATION **Livingston County KY**	
STATION #_____ RIVERMILE_____		STREAM CLASS **Intermittent**	
LAT **37.319027** LONG **-88.383713**		RIVER BASIN **Ohio**	
STORET #		AGENCY **Copperhead Consulting**	
INVESTIGATORS		**M. Herod, I. Bentley, J. Murphy**	
FORM COMPLETED BY **M. Herod**	DATE TIME **Apr 19 2023 | 14:34**	REASON FOR SURVEY **Wetland Delineation**	

	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
Parameters to be evaluated in sampling reach	**1. Epifaunal Substrate/ Available Cover**	Greater than 50% 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).	30-50% 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).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE 17	20 19 18 **X** 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
	SCORE 11	20 19 18 17 16	15 14 13 12 **X**	10 9 8 7 6	5 4 3 2 1 0
	3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
	SCORE 9	20 19 18 17 16	15 14 13 12 11	10 **X** 8 7 6	5 4 3 2 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% 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 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE 16	20 19 18 17 **X**	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	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	**X** 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
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 18	20 19 **X** 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 12	20 19 18 17 16	15 14 13 **X** 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	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	**X** 4 3	2 1 0
SCORE **5** (RB)	Right Bank 10 9	8 7 6	**X** 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	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	**X** 7 6	5 4 3	2 1 0
SCORE **8** (RB)	Right Bank 10 9	**X** 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 **X** 3	2 1 0
SCORE **3** (RB)	Right Bank 10 9	8 7 6	5 4 **X**	2 1 0

Total Score 131

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME **SCF**		LOCATION **Livingston County KY**	
STATION #_____ RIVERMILE_____		STREAM CLASS **Ephemeral**	
LAT **37.318315** LONG **-88.378227**		RIVER BASIN **Ohio**	
STORET #		AGENCY **Copperhead Consulting**	
INVESTIGATORS		**M. Herod, I. Bentley, J. Murphy**	
FORM COMPLETED BY **M. Herod**	DATE TIME **Apr 19 2023 | 14:34**	REASON FOR SURVEY **Wetland Delineation**	

	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
Parameters to be evaluated in sampling reach	**1. Epifaunal Substrate/ Available Cover**	Greater than 50% 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).	30-50% 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).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE 15	20 19 18 17 16	X 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
	SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 X 6	5 4 3 2 1 0
	3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
	SCORE 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 X 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% 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 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 X 7 6	5 4 3 2 1 0
	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 X 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
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 18	20 19 ~~18~~ 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
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)	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) Note: determine left or right side by facing downstream.	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 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

Total Score 101

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME	SCG_Ephemeral	LOCATION	Livingston County KY
STATION #_____	RIVERMILE_____	STREAM CLASS	Ephemeral
LAT 37.309411	LONG -88.390745	RIVER BASIN	Ohio
STORET #		AGENCY	Copperhead Consulting
INVESTIGATORS	M. Herod, I. Bentley, J. Murphy		
FORM COMPLETED BY: M. Herod	DATE / TIME: Apr 20 2023 | 09:31	REASON FOR SURVEY: Wetland Delineation	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% 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).	30-50% 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).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% 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	X 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 X 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 X 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% 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 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	X 4 3 2 1 0
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 3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 X 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
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 17	20 19 18 **X** 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 10	20 19 18 17 16	15 14 13 12 11	**X** 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	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 4 (LB)	Left Bank 10 9	8 7 6	5 **X** 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 **X** 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	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 3 (LB)	Left Bank 10 9	8 7 6	5 4 **X**	2 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 **X**	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 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	**X** 1 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	**X** 1 0

Total Score 67

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME **SCG_Intermittent**	LOCATION **Livingston County KY**	
STATION #_____ RIVERMILE_____	STREAM CLASS **Intermittent**	
LAT **37.310895** LONG **-88.391626**	RIVER BASIN **Ohio**	
STORET #	AGENCY **Copperhead Consulting**	
INVESTIGATORS	**M. Herod, I. Bentley, J. Murphy**	
FORM COMPLETED BY **M. Herod**	DATE TIME **Apr 20 2023 | 09:31**	REASON FOR SURVEY **Wetland Delineation**

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% 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).	30-50% 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).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 10	20 19 18 17 16	15 14 13 12 11	X 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 10	20 19 18 17 16	15 14 13 12 11	X 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 16	20 19 18 17 X	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 <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% 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 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 11	20 19 18 17 16	15 14 13 12 X	10 9 8 7 6	5 4 3 2 1 0
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 18	20 19 X 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
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 17	20 19 18 **X** 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 14	20 19 18 17 16	15 **X** 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	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 **X**	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 **X**	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	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 4 (LB)	Left Bank 10 9	8 7 6	5 **X** 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 **X** 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 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	**X** 1 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	**X** 1 0

Total Score 120

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME **SCH**		LOCATION **Livingston County KY**	
STATION #_____ RIVERMILE_____		STREAM CLASS **Ephemeral**	
LAT **37.308956** LONG **-88.391688**		RIVER BASIN **Ohio**	
STORET #		AGENCY **Copperhead Consulting**	
INVESTIGATORS		**M. Herod, I. Bentley, J. Murphy**	
FORM COMPLETED BY **M. Herod**	DATE TIME **Apr 19 2023 | 14:34**	REASON FOR SURVEY **Wetland Delineation**	

Parameters to be evaluated in sampling reach	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
	1. Epifaunal Substrate/ Available Cover	Greater than 50% 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).	30-50% 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).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE 10	20 19 18 17 16	15 14 13 12 11	X 9 8 7 6	5 4 3 2 1 0
	2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
	SCORE 9	20 19 18 17 16	15 14 13 12 11	10 X 8 7 6	5 4 3 2 1 0
	3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
	SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 X	5 4 3 2 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% 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 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 X	5 4 3 2 1 0
	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 2	20 19 18 17 16	15 14 13 12 11	10 X 8 7 6	5 4 3 X 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
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 17	20 19 18 **X** 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 **X** 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	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 4 (LB)	Left Bank 10 9	8 7 6	5 **X** 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	**X** 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	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 3 (LB)	Left Bank 10 9	8 7 6	5 4 **X**	2 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 **X**	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 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	**X** 1 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	**X** 1 0

Total Score 77

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME **SCI**		LOCATION **Livingston County KY**	
STATION #_____ RIVERMILE_____		STREAM CLASS **Ephemeral**	
LAT **37.309328** LONG **-88.392584**		RIVER BASIN **Ohio**	
STORET #		AGENCY **Copperhead Consulting**	
INVESTIGATORS		**M. Herod, I. Bentley, J. Murphy**	
FORM COMPLETED BY **M. Herod**	DATE TIME **Apr 19 2023 | 14:34**	REASON FOR SURVEY **Wetland Delineation**	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% 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).	30-50% 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).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% 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	X 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 10	20 19 18 17 16	15 14 13 12 11	X 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 16	20 19 18 17 X	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 <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% 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 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	X 4 3 2 1 0
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 8	20 19 18 17 16	15 14 13 12 11	10 9 X 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
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 17	20 19 18 **X** 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 **X** 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	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 3 (LB)	Left Bank 10 9	8 7 6	5 4 **X**	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 **X** 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	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 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	**X** 1 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	**X** 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 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	**X** 1 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	**X** 1 0

Total Score 83

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME **SCJ**		LOCATION **Livingston County KY**	
STATION #_____ RIVERMILE_____		STREAM CLASS **Perennial**	
LAT **37.320017** LONG **-88.396672**		RIVER BASIN **Ohio**	
STORET #		AGENCY **Copperhead Consulting**	
INVESTIGATORS		**M. Herod, I. Bentley, J. Murphy**	
FORM COMPLETED BY **M. Herod**	DATE TIME **Apr 19 2023 | 14:34**	REASON FOR SURVEY **Wetland Delineation**	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% 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).	30-50% 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).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 16	20 19 18 17 ~~16~~	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 15	20 19 18 17 16	~~15~~ 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 16	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 <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% 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 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 17	20 19 18 ~~17~~ 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
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 18	20 19 ~~18~~ 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
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 19	20 ~~19~~ 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 15	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)	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) Note: determine left or right side by facing downstream.	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 7 (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

Total Score 161

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME **SCK**		LOCATION **Livingston County KY**	
STATION #_____ RIVERMILE_____		STREAM CLASS **Ephemeral**	
LAT **37.310895** LONG **-88.391626**		RIVER BASIN **Ohio**	
STORET #		AGENCY **Copperhead Consulting**	
INVESTIGATORS		**M. Herod, I. Bentley, J. Murphy**	
FORM COMPLETED BY **M. Herod**	DATE TIME **Apr 20 2023 | 09:31**	REASON FOR SURVEY **Wetland Delineation**	

	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
Parameters to be evaluated in sampling reach	**1. Epifaunal Substrate/ Available Cover**	Greater than 50% 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).	30-50% 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).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% 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	X 4 3 2 1 0
	2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
	SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 X	5 4 3 2 1 0
	3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
	SCORE 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 X 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% 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 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 X	5 4 3 2 1 0
	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 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 X 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
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 17	20 19 18 **X** 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 **X** 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	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 4 (LB)	Left Bank 10 9	8 7 6	5 **X** 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 **X** 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	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 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	**X** 1 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	**X** 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 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	**X** 1 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	**X** 1 0

Total Score 62

Appendix E – Resumes

COPPERHEAD
ENVIRONMENTAL CONSULTING

ISAAC BENTLEY

AQUATIC/WETLAND SCIENTIST II

Regulatory Expertise

- CWA (Section 404 & 401)
- United States Army Corps of Engineering (USACE) Wetland Delineation Manual & Regional Supplements
- ESA (§7 & §10)
- Migratory Bird Treaty Act

Industry Clientele

- KY Department of Fish and Wildlife Resources
- TN Department of Environment and Conservation

Education

- **M.S. Biology**, 2020, Eastern Kentucky University, Richmond, Kentucky (did not defend)
- **B.S. Wildlife Management**, 2017, Eastern Kentucky University, Richmond, Kentucky

Taxa Expertise

- Inland Stream Fishes (Listed)
- Freshwater Invertebrates (Listed)
- Wetland and Aquatic plants
- Eastern U.S. Woody Plants and Vegetation
- Passerines and Raptors
- Reptiles/Amphibians
- Mammals

Survey Expertise

- Wetland and Stream Delineation
- Habitat Assessments, Aquatic and Terrestrial
- Presence/Absence
- Fish Shocking
- Aquatic Invertebrate
- Vegetation, Wetland and Upland
- Avian, Passerine and Raptor

Certifications/Trainings

- Wetland Delineation Certificate, Wetland Training Institute, 2021
- Swamp School Training, 2022
- Tennessee Department of Environment & Conservation Hydrologic Determination Training Course, 2022
- Certified Wildlife Biologist (TWS)
- Type II Wildland Firefighter
- Chronic Wasting Disease Workshop, Retropharyngeal Lymph Node Extraction

Qualifications and Background

Mr. Bentley has 8 years of experience studying, working, and volunteering alongside universities, agencies, and NGOs with federal and state listed flora and fauna species. He has conducted master's level research on the ability of movement in stream fishes as part of a restoration technique employed by Kentucky Department of Fish and Wildlife. He has worked extensively with wetland delineation, stream fishes, vegetation surveys, avian surveys/capture methods, and identification skills. Mr. Bentley has designed, developed, and implemented an inventory, research, management, and monitoring for his fish study. He has filled supervisory roles during his master's research, employing assistance and coordinating dates for employing field-method based research.

Affiliations

- The Wildlife Society
- National Wild Turkey Federation
- Rocky Mountain Elk Foundation
- Southeastern Fishes Council
- Ecological Society of America

Selected Project Experience

Wetland & Stream Delineation for Mammoth Cave Campground Denison Ferry Road, KY 2023
Conducted a wetland and stream delineation for a site of approximately 200 acres near Mammoth Cave, Kentucky.

Multiple Service Aquatic Surveys for Lochner Bridge Replacements, KY 2022
Conducted preliminary multiple-service surveys for 23 bridges to be replaced in areas that span the entirety of Kentucky. Once preliminary surveys were conducted, aquatic surveys for listed species (Big Sandy Crayfish, Cumberland Darter, and Kentucky Arrow Darter) were conducted.

Wetland & Stream Delineation for DNV Mastodon Solar Project, MI 2022
Conducted a wetland and stream delineation for a site of approximately 3,000 acres near Blissfield, Michigan.

Wetland & Stream Delineation for CCR Fiddler Solar Project, TN 2022
Conducted a wetland and stream delineation for a site of approximately 850 acres in DeKalb County, Tennessee.

Wetland & Stream Delineation for EDP Solar Project, KY 2022
Conducted a wetland and stream delineation for a site of approximately 2,500 acres in Breckinridge County, Kentucky.

Wetland & Stream Delineation for JDA Geil Lane Project, KY 2022
Conducted a wetland and stream delineation for a site of approximately 35 acres near Louisville, Kentucky.

Wetland & Stream Delineation for CCR Tupelo MS Solar Project, MS 2022
Conducted a wetland and stream delineation for a site of approximately 3,000 acres in Tupelo, Mississippi.

Wetland & Stream Delineation for TVA Transmission Lines (Barkley-Oakwood) Project, KY/TN 2022
Conducted a corridor wetland and stream delineation for a site of approximately 60 linear miles in Western Kentucky and Tennessee.

Wetland & Stream Delineation for Village at the Palisades, KY 2022
Conducted a wetland and stream delineation for a site of approximately 8 acres in Mercer County, Kentucky.

Wetland & Stream Delineation for WKRRA for Wickliffe Solar Project, KY 2022
Conducted a wetland and stream delineation for a site of approximately 15 acres in Ballard County, Kentucky.

Wetland & Stream Delineation for Horseshoe Bend Solar Project, KY 2022
Conducted a wetland and stream delineation for a site of approximately 560 acres in Green County, Kentucky.

Wetland & Stream Delineation for Engie, Mt. Olive Creek Solar Project KY 2022
Conducted a wetland and stream delineation for a site of approximately 512 acres in Russel and Adair Counties, Kentucky.

Wetland & Stream Delineation for TVA – Incompatible Vegetation Project in Transmission Right of Ways, TN/KY/AL/GA 2022

Conducted a corridor wetland and stream delineation for transmission lines approximately 200 linear miles long primarily in Tennessee, but also in Kentucky, Alabama, and Georgia.

Wetland & Stream Delineation for Hardin County Solar Project, KY 2021
Corrected a wetland and stream delineation alongside the USACE for a site of approximately 1100 acres in Hardin County, Kentucky.

Wetland & Stream Delineation for Pine Gate Renewables Belsena Solar Project, PA 2021
Conducted a wetland and stream delineation for a site of approximately 900 acres in Clearfield County, Pennsylvania.

Movement of Stream Fishes Over Potential Migratory Barriers, Kentucky Department of Fish and Wildlife Resources, Menifee Co., Kentucky – 2017-2020
Mr. Bentley designed, developed, managed, and conducted movement surveys of stream fishes in East Fork Indian Creek in the Red River Gorge of Kentucky. The study was formed to understand passage of all stream fish, including two species of Kentucky state concern (*Percina maculata* and *Etheostoma baileyi*), over potential anthropogenic migratory barriers. Logistics of the study included orchestrating, overseeing, and installing/removing field equipment, utilizing two types of marking techniques (PIT and VIE), and monitoring fish movement over the duration of two years. Management recommendations were provided to Federal and State organizations based on data analyses and results.

Presentations

Movement of stream fishes across potential migration barriers in East Fork Indian Creek, Menifee Co. Kentucky, 2019. The Kentucky Academy of Sciences and the Southeastern Fishes Council Annual Meeting

COPPERHEAD
ENVIRONMENTAL CONSULTING

MEG HEROD
WETLAND SCIENTIST

Regulatory Expertise
- Clean Water Act
- Executive Order 13751
- NEPA

Industry Clientele
- Texas Parks and Wildlife
- Tennessee Valley Authority
- National Park Service
- U.S. National Herbarium
- USACE

Environmental Services
- Ecosystem Restoration
- Wetland & Stream Delineation
- Invasive species management & control

Survey Expertise
- Vegetation Surveys
- Stream Surface Water Quality
- Invasive Species Monitoring
- Plant Relocation Assessment
- Macroinvertebrate Sampling

Education
Wetland Delineation, 2022, Swamp School LLC

Tennessee Hydrologic Determination Course,2022, TDEC

M.S. Aquatic Resources, 2022, Texas State University
Graduate Advisor: Dr. Jason Martina

B.S. Ecology for Environmental Science, 2018, University of North Texas

Experience
Copperhead Environmental Consulting, Inc., Wetland Scientist, January 2022-present

Texas State University, Graduate Research Assistant, Instructional Assistant, August 2019 – January 2022

USACE, Aquatic Ecosystem Research Student Leader, May 2018 – July 2019, Terrestrial Ecosystem Management Assistant, December 2017 – May 2018

Qualifications and Background

Mrs. Herod is a broadly experienced ecologist with four years of experience working for various state and federal agencies and universities. She has conducted master's level research on the ecological correlates of the spread and invasion success of *Arundo donax* in central Texas. She has contributed her skills to a wide range of environmental projects, including the global Nutrient Network experiment, invasive species management and monitoring with the USACE and USGS, habitat restoration with the USACE and Texas Water Development Board, and macroinvertebrate surveys with the University of North Texas. She has worked extensively in wetland, limnetic, and stream environments conducting surveys of these ecosystems' biotic and abiotic characteristics. Mrs. Herod has instructed over 250 students in laboratory coursework related to botany, general ecology, and wetland plant ecology and management. She has experience in field data collection techniques, greenhouse experiment design, GIS mapping, GPS data collection, remote sensing of vegetation and data analysis software.

Presentations

"Wetlands and Wetland Delineation". The Kentucky Wildlife Society Annual Conference, February 2022

"Endangered and Invasive Species". Boy Scouts of America – Kyle Chapter, June 2021

"Comparative Anatomy of the Submersed and Emergent Stems and Leaves of *Shinnersia rivularis* (Asteraceae: Eupatorieae)". Texas Academy of Science Annual Conference, Stephen F. Austin State University, February 2019

Project Experience

Wetland & Stream Delineation for Mantle Rock Solar Project, KY 2023
Conducted a wetland and stream delineation for an approximately 500-acre site in Livingston County, Kentucky

Wetland & Stream Delineation for Mastodon Solar Project, MI 2022
Conducted a wetland and stream delineation for an approximately 1,800-acre site in Lenawee County, Michigan

Wetland & Stream Delineation for KY-536 Expansion Project, KY 2022
Conducted a wetland and stream delineation for an approximately 150-acre site in Kenton County, Kentucky

Wetland & Stream Delineation for Fiddler Solar Project, TN 2022
Conducted a wetland and stream delineation for an approximately 800-acre site in DeKalb County, Tennessee

Wetland & Stream Delineation for Mount Vernon Trail (NPS), DC 2022
Conducted a wetland and stream delineation for an approximately 5-mile-long section of trail in Washington DC/Virginia.

Wetland & Stream Reconnaissance for Winner Solar Project, PA 2022
Conducted a wetland and stream delineation for an approximately 2000-acre site in Clearfield County, Pennsylvania

Wetland & Stream Delineation for Mammoth Cave Campground Rehabilitation (NPS) Project, KY 2022
Conducted a wetland and stream delineation for an approximately 100-acre site in Hart County, Kentucky

Wetland & Stream Delineation for Battelle Construction Project, KY 2022
Conducted a wetland and stream delineation for an approximately 100-acre site in Marshall County Kentucky

Wetland & Stream Delineation for EDP Solar Project, KY 2022
Conducted a wetland and stream delineation for an approximately 2,500-acre site in Breckinridge County Kentucky

Wetland & Stream Delineation for NPS Mammoth Cave Road Expansion, KY 2022

Conducted a wetland and stream delineation for an approximately 8-acre site in Mammoth Cave National Park Kentucky.

Wetland & Stream Delineation for CCR Tupelo MS Solar Project, MS 2022
Conducted a wetland and stream delineation for an approximately 3,000-acre site in Tupelo, Mississippi.

Wetland & Stream Delineation for TVA Powerlines (Barkley-Oakwood) Project, KY/TN 2022
Conducted a wetland and stream delineation for an approximately 60 linear mile site in the land between the lakes in Kentucky and Tennessee.

Wetland Delineation for CCR Strawhorn Solar Project, NC 2022
Conducted a wetland and stream delineation for an approximately 1200-acre site in Bladen County, North Carolina.

Wetland Delineation for Village at the Palisades, KY 2022
Conducted a wetland and stream delineation for an approximately 8-acre site in Mercer County, Kentucky.

Stream Assessment for Horse Soldier Distillery, KY 2022
Conducted a stream assessment for an approximately 236 -acre site in Somerset, Pulaski County, Kentucky.

Preliminary Wetland and Stream Assessment for Terry Shaw, P.E, KY 2022
Conducted a wetland and stream assessment for an approximately 215 -acre site in Henry County, Kentucky.

Wetland Delineation for Horseshoe Bend Solar Project, KY 2022
Conducted a wetland and stream delineation for an approximately 560-acre site in Green County, Kentucky.

The ecological correlates of the spread and invasion success of *Arundo donax* in central Texas – South Central Texas. 2019-2022. Designed, developed, and implemented a multistep experiment to inform management efforts of *Arundo donax* in central Texas. The two-phase experiment consisted of a greenhouse experiment in which the ecological factors contributing to the performance-related traits *Arundo* were assessed. The second phase of the experiment used remote sensing to identify the spatial dynamics of *Arundo* spread following a 100-year flood event.

Comparative Anatomy of the Submersed and Emergent Stems and Leaves of *Shinnersia rivularis* (Asteraceae: Eupatorieae). 2019-2020 Developed and executed a comparative analysis of the anatomical characteristics of *Shinnersia rivularis.* Collected and stored in fixative live samples of submersed and emergent plant material. Made and analyzed microscope slides of stems and leaves to assess and quantify the difference in anatomical characteristics between submersed and emergent individuals.

COPPERHEAD
ENVIRONMENTAL CONSULTING

JACOB MURPHY
WETLAND SCIENTIST

Regulatory Expertise
- Clean Water Act

Industry Clientele
- KY Department of Fish and Wildlife Resources

Environmental Services
- Stream Restoration
- Field Surveys
- Invasive Species Management

Survey Expertise
- Habitat Assessments
- Stream Water Quality Assessments
- Stream Fish Nesting Measurements
- Invasive Species Monitoring
- Electro Fishing
- Plant Community Surveys
- Presence/Absence

Certifications/Training
- Kentucky Department of Agriculture, Division of Environmental Services N2 Forestry Pesticide Applicators License

Education
M.S. Biology, 2022, Eastern Kentucky University, Richmond, Kentucky
Graduate Advisor: Dr. Sherry Harrel

B.S. Biology, 2020, University of Kentucky

Experience
Copperhead Environmental Consulting Inc., Wetland Scientist, June 2022-present

Eastern Kentucky University, Graduate Research Assistant and Instructional Assistant for the Cellular and Molecular Biology Lab, August 2020 – May 2022

Qualifications and Background
Mr. Murphy is an ecologist with two years of experience working for Eastern Kentucky university. He has conducted master's level research on spawning habitat and nest density of the soon-to-be threatened or endangered Buck Darter (*Etheostoma nebra)* in the Cumberland River drainage, Kentucky. He has experience running and supervising the cellular and molecular lab at Eastern Kentucky University, as well as teaching a freshman course in the subject. Mr. Murphy has volunteer experience with the maintenance and selective cutting of hybrid American Chestnut (*Castanea dentata)* trees, as well as invasive plant species removal in a secondary-growth forest. He has also managed an invasive plant species removal project for a controlled burn unit. Within his education, Mr. Murphy had experience conducting plant community surveys, presence/absence surveys, water quality assessments, and backpack and boat electro fishing.

Presentations

"Comparison of Spawning Habitat and Nest Density Between Buck Darter (*Etheostoma nebra)* and Striped Darter (*Etheostoma virgatum)* Populations in the Cumberland River Drainage, Kentucky". Graduate Research Seminar, Eastern Kentucky University, March 2022

Project Experience

Bat Habitat Survey for the EDP Solar Project, KY, November 2022.
Conducted a bat habitat survey looking for potential roost habitat for the Indiana Bat (*Myotis sodalis),* the Northern Long-eared Bat (*Myotis keenii),* and the Gray Bat (*Myotis grisescens)* on an approximately 690-acre site in Breckinridge County, Kentucky.

Crayfish Survey for the Kentucky Transportation Cabinet Bridge Program Project, Martin and Pike County, KY, November 2022
Collected and identified crayfish species within the impacted stream area, looking specifically for the threatened Big Sandy Crayfish (Cambarus callainus).

Crayfish Survey for the Kentucky Transportation Cabinet Bridge Program Project, Lawrence and Martin County, KY, November 2022
Collected and identified crayfish species within the impacted stream area, looking specifically for the threatened Big Sandy Crayfish (Cambarus callainus).

Wetland & Stream Delineation for Mastodon Solar Project, MI, November 2022
Conducted a wetland and stream delineation for an approximately 4,773-acre site in Lenawee County, Michigan.

Wetland & Stream Delineation for Fiddler Solar Project, TN, October - November 2022
Conducted a wetland and stream delineation for an approximately 870-acre site in DeKalb County, Tennessee.

Wetland and Stream Reconnaissance Survey for Winner Solar Project, PA, October 2022.
Conducted a wetland and stream reconnaissance survey to estimate feature sizes prior to project boundary decision on an approximately 4,362-acre site in Clinton County, Pennsylvania.

Crayfish Survey for the Kentucky Bridge Program Project, KY, September 2022
Collected and identified crayfish species within the impacted stream area, looking specifically for the threatened Big Sandy Crayfish (*Cambarus callainus*).

Fish Relocation for the Kentucky Bridge Program Project, KY, September 2022
Collected and identified fish within the impacted stream area and relocated the threatened Kentucky Arrow Darter (*Etheostoma spilotum*).

Wetland & Stream Delineation for EDP Solar Project, KY, July - August 2022
Conducted a wetland and stream delineation for an approximately 2,500-acre site in Breckinridge County, Kentucky.

Wetland Delineation for Geil Lane Project, KY, June 2022
Conducted a wetland delineation for an approximately 30-acre site in Jefferson County, Kentucky.

Comparison of Spawning Habitat and Nest Density Between Buck Darter (Etheostoma nebra) and Striped Darter (Etheostoma virgatum) Populations in the Cumberland River Drainage, Kentucky, March 2022.

Mr. Murphy collected nine nesting habitat measurements and nest density measurements for *Etheostoma nebra* and *Etheostoma virgatum* throughout the spawning season to compare between the declining Buck Darter population and the surviving Striped Darter populations. His findings were presented to employees of the Kentucky Department of Fish and Wildlife Resources and are to be used to help reintroduce populations of the species into streams with suitable habitat.