

**Wetlands and Riparian Habitat Study for the  
Pensacola Hydroelectric Project (Project; FERC  
[Federal Energy Regulatory Commission] No. 1494);  
Craig, Delaware, Mayes and Ottawa Counties,  
Oklahoma**

Prepared for:



**Grand River Dam Authority**

Prepared by:



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## **1.0 INTRODUCTION AND BACKGROUND**

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Grand River Dam Authority (GRDA, Licensee) holds a license issued by the Federal Energy Regulatory Commission (FERC, Commission) to operate and maintain the Pensacola Hydroelectric Project (Project). The Project is owned, operated, and maintained by the Licensee. The current license, which designates the Project as FERC No. 1494, expires on May 31, 2025 (FERC, 2018a).

As part of the relicensing of the Project, GRDA filed a Pre-Application Document (PAD) with FERC on February 1, 2017 (GRDA 2017). The GRDA filed its Proposed Study Plan (PSP) for the relicensing on April 27, 2018 (GRDA 2018a). Also, on April 27, 2018, FERC released its Scoping Document 2 for the relicensing of the Project (FERC 2018b). In its PSP, GRDA did not include a specific study to investigate potential Project effects on wetlands and riparian habitat. Based on comments received from federal and state resource agencies and other stakeholders, GRDA's Revised Study Plan (RSP), filed on September 24, 2018, proposed a Wetland and Riparian Habitat Study (Study) to provide further details regarding how potential impacts to these habitats related to changing water levels due to Project operations will be assessed during the relicensing process.

This Study proposed to collect information to support an assessment of the Project effects, if any, on wetlands and riparian habitat as part of FERC's National Environmental Policy Act (NEPA) analysis for the relicensing of the Project.

According to the approved study plan, GRDA has completed the following:

- Used the National Wetlands Inventory (NWI) and GRDA's Shoreline Management Plan (SMP) maps to identify, display, and describe the current composition of wetland communities within and adjacent to the study area.
- Used the NWI and GRDA's SMP maps to develop a Geographic Information System (GIS) database on the extent, classification, and plant community structure of wetland and riparian habitats within and adjacent to the study area.
- Utilized the GIS database to estimate the total acres of wetlands and riparian habitats that currently exist within the study area.

According to the approved study plan, GRDA will complete the following:

- Use results of GRDA's Hydrologic and Hydraulic Modeling Study (H&H Study) to determine potential Project effects based on the seasonal variability of hydrologic conditions related to Project operations.
- Use the results of the H&H Study to determine potential changes to habitat in currently designated WMAs in the Project area.

This study report contains the information required by the FERC-approved Wetlands and Riparian Habitat Study for the first season of studies for the relicensing of the Project.

## 2.0 STUDY YEAR ONE ACTIVITIES

### 2.1 DATABASE CONTENTS

Continued operation of the Project will influence water levels of Grand Lake. These water level fluctuations have the potential to affect aquatic vegetation, wetlands, and riparian habitat, which can be important habitats for fish and wildlife. As such, Horizon was contracted to conduct a wetlands and riparian habitat study to quantify and refine the potential impacts associated with the operation of the Project. Horizon used the National Wetlands Inventory (NWI) and GRDA's Shoreline Management Plan (SMP) maps to identify, display, and describe the current composition of wetland communities within and adjacent to the study area in a GIS database. The Study Area is in Craig, Mayes, Delaware, and Ottawa counties, Oklahoma. The Study extends upstream from Pensacola Dam along the Neosho River to within approximately 3 miles of the Kansas State line, upstream along the Spring River to within 6.5 miles of the Kansas State line, and upstream along the Elk River to the upstream extent dictated by the H&H model, and along Tar Creek to just upstream of the U.S. Geological Survey (USGS) gage at the 22<sup>nd</sup> Avenue Bridge. The study also encompasses the bays/coves within Grand Lake associated with tributaries flowing into the lake.

The database displays 54,980.72 acres of wetland habitat types according to the hierarchy created by Cowardin et al. (1979) in Table 1 and 4,236.06 acres of riparian habitat types in Table 2. These data are also displayed graphically in Figure 1, and in closer detail in Figures 2 – 6.

**Table 1. Wetland Composition within Study Area**

Wetland Habitat Type	Acres Within Study Area
<b>Lakes</b>	
Lacustrine, Limnetic, Unconsolidated Bottom, Permanently Flooded (L1UBH)	46.37
Lacustrine, Limnetic, Unconsolidated Bottom, Permanently Flooded, Diked/Impounded (L1UBHh)	38,835.34
Lacustrine, Littoral, Unconsolidated Bottom, Semi Permanently Flooded, Diked/Impounded (L2UBFh)	3.88

Lacustrine, Littoral, Unconsolidated Shore, Seasonally Flooded, Diked/Impounded (L2USCh)	2,891.01
<b>Total Lakes Acres</b>	<b>41,776.6</b>
<b>Freshwater Emergent Wetlands</b>	
Palustrine, Emergent, Persistent, Scrub-Shrub, Broad-Leaved Deciduous, Seasonally Flooded, Diked/Impounded (PEM1/SS1Ch)	22.12
Palustrine, Emergent, Persistent, Temporary Flooded (PEM1A)	154.65
Palustrine, Emergent, Persistent, Temporary Flooded, Diked/Impounded (PEM1Ah)	32.70
Palustrine, Emergent, Persistent, Temporary Flooded, Excavated (PEM1Ax)	2.40
Palustrine, Emergent, Persistent, Seasonally Flooded (PEM1C)	246.45
Palustrine, Emergent, Persistent, Seasonally Flooded, Ditched (PEM1Cd)	15.77
Palustrine, Emergent, Persistent, Seasonally Flooded, Diked/Impounded (PEM1Ch)	87.13
Palustrine, Emergent, Persistent, Seasonally Flooded, Excavated (PEM1Cx)	23.60
Palustrine, Emergent, Persistent, Semi-permanently Flooded (PEM1F)	35.85
Palustrine, Emergent, Persistent, Semi-permanently Flooded, Diked/Impounded (PEM1Fh)	0.49
Palustrine, Emergent, Persistent, Semi-permanently Flooded, Excavated (PEM1Fx)	5.78
<b>Total Freshwater Emergent Wetlands Acres</b>	<b>626.94</b>
<b>Freshwater Forested/Shrub Wetland</b>	
Palustrine, Forested, Broad-Leaved Deciduous, Emergent, Persistent, Temporary Flooded (PFO1/EM1A)	334.92
Palustrine, Forested, Broad-Leaved Deciduous, Emergent, Persistent, Seasonally Flooded, Diked/Impounded (PFO1/EM1Ch)	20.17
Palustrine, Forested, Broad-Leaved Deciduous, Scrub-Shrub, Broad-Leaved Deciduous, Temporary Flooded (PFO1/SS1A)	102.70
Palustrine, Forested, Broad-Leaved Deciduous, Scrub-Shrub, Broad-Leaved Deciduous, Temporary Flooded, Diked/Impounded (PFO1/SS1Ah)	74.66
Palustrine, Forested, Broad-Leaved Deciduous, Scrub-Shrub, Broad-Leaved	10.43

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Deciduous, Seasonally Flooded (PFO1/SS1C)	
Palustrine, Forested, Broad-Leaved Deciduous, Scrub-Shrub, Broad-Leaved Deciduous, Seasonally Flooded, Diked/Impounded (PFO1/SS1Ch)	201.50
Palustrine, Forested, Broad-Leaved Deciduous, Unconsolidated Bottom, Semi-permanently Flooded, Diked/Impounded (PFO1/UBFh)	58.70
Palustrine, Forested, Broad-Leaved Deciduous, Temporary Flooded (PFO1A)	4997.67
Palustrine, Forested, Broad-Leaved Deciduous, Temporary Flooded, Diked/Impounded (PFO1Ah)	407.60
Palustrine, Forested, Broad-Leaved Deciduous, Temporary Flooded, Excavated (PFO1Ax)	20.46
Palustrine, Forested, Broad-Leaved Deciduous, Seasonally Flooded (PFO1C)	820.54
Palustrine, Forested, Broad-Leaved Deciduous, Seasonally Flooded, Diked/Impounded (PFO1Ch)	1134.39
Palustrine, Forested, Broad-Leaved Deciduous, Seasonally Flooded, Excavated (PFO1Cx)	1.34
Palustrine, Forested, Broad-Leaved Deciduous, Semi-permanently Flooded (PFO1F)	66.76
Palustrine, Forested, Broad-Leaved Deciduous, Semi-permanently Flooded, Diked/Impounded (PFO1Fh)	69.84
Palustrine, Forested, Dead, Broad-Leaved Deciduous, Semi-permanently Flooded, Diked/Impounded (PFO5/1Fh)	4.71
Palustrine, Forested, Dead, Unconsolidated Bottom, Permanently Flooded, Diked/Impounded (PFO5/UBHh)	1.61
Palustrine, Forested, Deciduous, Semi-permanently Flooded (PFO6F)	0.60
Palustrine, Scrub-Shrub, Broad-Leaved Deciduous, Emergent, Persistent, Temporary Flooded (PSS1/EM1A)	1.12
Palustrine, Scrub-Shrub, Broad-Leaved Deciduous, Emergent, Persistent, Temporary Flooded, Ditched (PSS1/EM1Ad)	14.44



Palustrine, Scrub-Shrub, Broad-Leaved Deciduous, Emergent, Persistent, Seasonally Flooded (PSS1/EM1C)	54.57
Palustrine, Scrub-Shrub, Broad-Leaved Deciduous, Emergent, Persistent, Seasonally Flooded, Diked/Impounded (PSS1/EM1Ch)	74.98
Palustrine, Scrub-Shrub, Broad-Leaved Deciduous, Unconsolidated Bottom, Semi-permanently Flooded, Diked/Impounded (PSS1/UBFh)	0.77
Palustrine, Scrub-Shrub, Broad-Leaved Deciduous, Unconsolidated Bottom, Seasonally Flooded, Diked/Impounded (PSS1/USCh)	1.83
Palustrine, Scrub-Shrub, Broad-Leaved Deciduous, Temporary Flooded (PSS1A)	152.93
Palustrine, Scrub-Shrub, Broad-Leaved Deciduous, Temporary Flooded, Ditched (PSS1Ad)	4.57
Palustrine, Scrub-Shrub, Broad-Leaved Deciduous, Temporary Flooded, Diked/Impounded (PSS1Ah)	12.55
Palustrine, Scrub-Shrub, Broad-Leaved Deciduous, Seasonally Flooded (PSS1C)	84.05
Palustrine, Scrub-Shrub, Broad-Leaved Deciduous, Seasonally Flooded, Diked/Impounded (PSS1Ch)	182.70
Palustrine, Scrub-Shrub, Broad-Leaved Deciduous, Seasonally Flooded, Excavated (PSS1Cx)	9.59
Palustrine, Scrub-Shrub, Broad-Leaved Deciduous, Semi-permanently Flooded (PSS1F)	67.03
Palustrine, Scrub-Shrub, Broad-Leaved Deciduous, Semi-permanently Flooded, Diked/Impounded (PSS1Fh)	90.91
<b>Total Freshwater Forested/Shrub Wetland Acres</b>	<b>9080.64</b>
<b>Freshwater Ponds</b>	
Palustrine, Unconsolidated Bottom, Semi-permanently Flooded (PUBF)	0.86
Palustrine, Unconsolidated Bottom, Semi-permanently Flooded, Diked/Impounded (PUBFh)	2.87
Palustrine, Unconsolidated Bottom, Semi-permanently Flooded, Excavated (PUBFx)	14.81
Palustrine, Unconsolidated Bottom, Permanently Flooded (PUBH)	177.06

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Palustrine, Unconsolidated Bottom, Permanently Flooded, Diked/Impounded (PUBHh)	571.71
Palustrine, Unconsolidated Bottom, Permanently Flooded, Excavated (PUBHx)	246.10
Palustrine, Unconsolidated Bottom, Artificially Flooded, Excavated (PUBKx)	6.57
Palustrine, Unconsolidated Shore, Temporary Flooded (PUSAh)	0.59
Palustrine, Unconsolidated Shore, Seasonally Flooded (PUSC)	2.54
Palustrine, Unconsolidated Shore, Seasonally Flooded (PUSCh)	3.38
Palustrine, Unconsolidated Shore, Seasonally Flooded (PUSCx)	1.94
Palustrine, Aquatic Bed, Floating Vascular, Permanently Flooded, Diked/Impounded (PAB4Hh)	0.50
<b>Total Freshwater Ponds Acres</b>	<b>1,028.93</b>
<b>Riverine Systems</b>	
Riverine, Lower Perennial, Unconsolidated Bottom, Permanently Flooded (R2UBH)	1707.36
Riverine, Lower Perennial, Unconsolidated Shore, Temporary Flooded (R2USA)	12.39
Riverine, Lower Perennial, Unconsolidated Shore, Seasonally Flooded (R2USC)	90.24
Riverine, Intermittent, Streambed, Temporary Flooded (R4SBA)	1.14
Riverine, Intermittent, Streambed, Seasonally Flooded (R4SBC)	616.44
Riverine, Intermittent, Streambed, Seasonally Flooded, Excavated (R4SBCx)	0.82
Riverine, Unknown Perennial, Unconsolidated Bottom, Semi-permanently Flooded (R5UBF)	35.74
Riverine, Unknown Perennial, Unconsolidated Bottom, Permanently Flooded (R5UBH)	3.48
<b>Total Riverine Acres</b>	<b>2,467.61</b>
<b>Total Wetland Acres Within Study Area</b>	<b>54,980.72</b>

**Table 2. Riparian Composition within Study Area**

<b>Riparian Habitat Type</b>	<b>Acres Within Study Area</b>
Riparian, Lotic, Forested, Deciduous (Rp1FO6)	4056.27
Riparian, Lotic, Forested, Mixed Deciduous/Evergreen (Rp1FO8)	9.67
Riparian, Lentic, Forested, Deciduous (Rp2FO6)	28.79
Riparian, Lentic, Scrub/Shrub, Deciduous (Rp1SS6)	63.12
<b>Total Riparian Habitat Acres</b>	<b>4,236.06</b>

Wetlands and Riparian Habitat Study for the Pensacola Hydroelectric Project (Project; FERC [Federal Energy Regulatory Commission] No. 1494); Craig, Delaware, Mayes and Ottawa Counties, Oklahoma

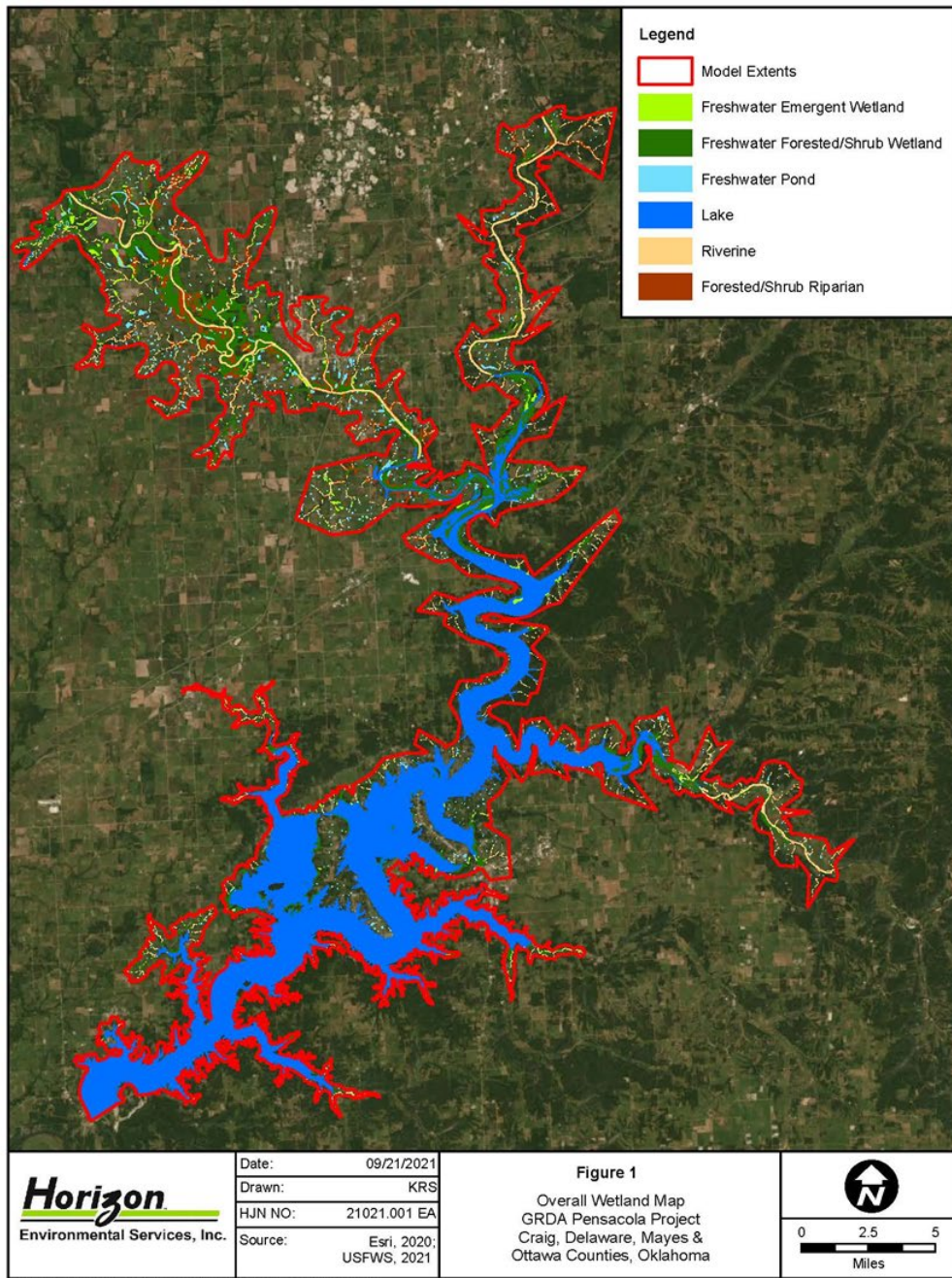


Figure 1. Wetland and Riparian Habitat within the Study Area

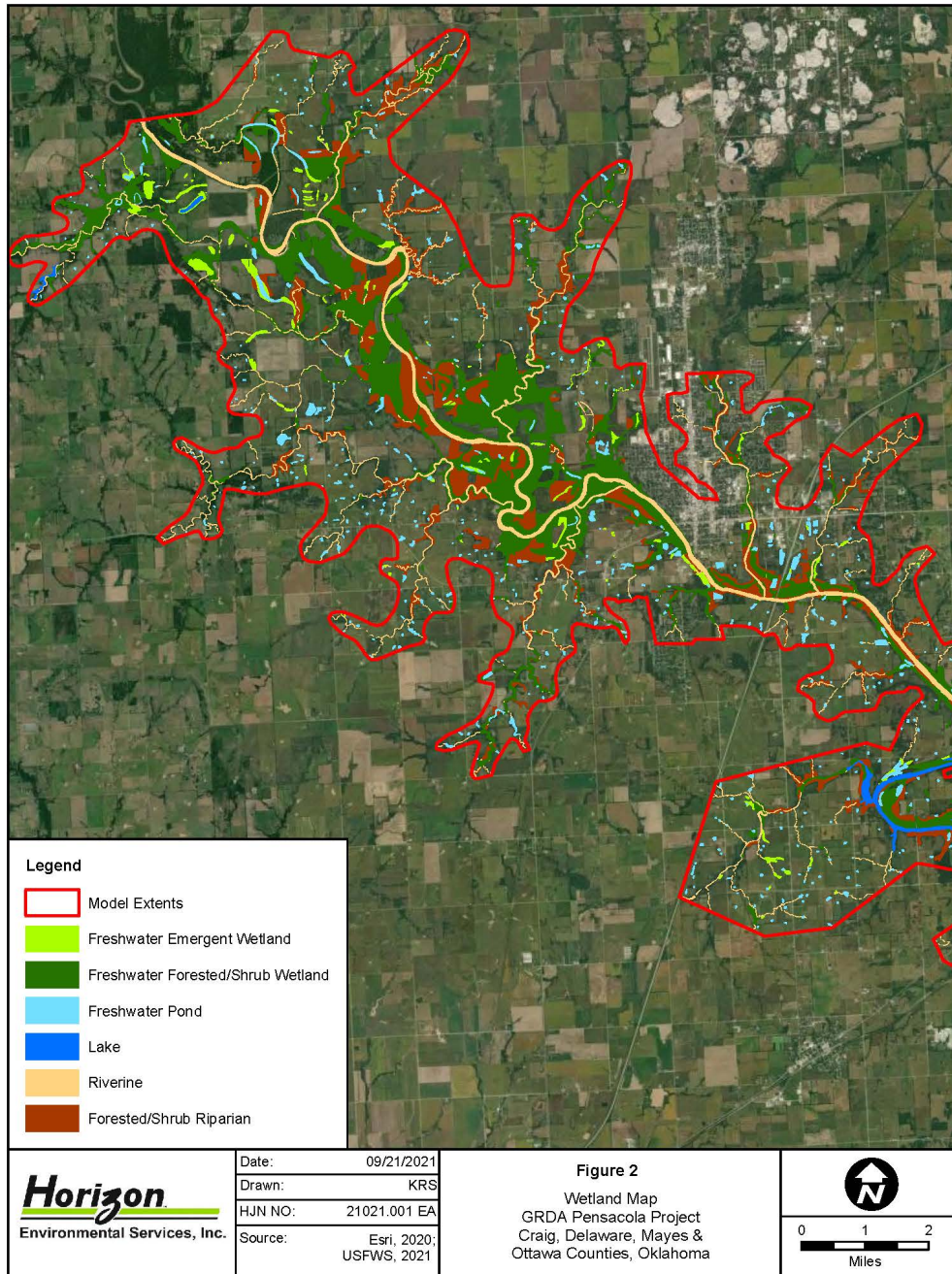


Figure 2. Wetland and Riparian Habitat within the Study Area, Northwest Section

Wetlands and Riparian Habitat Study for the Pensacola Hydroelectric Project (Project; FERC [Federal Energy Regulatory Commission] No. 1494); Craig, Delaware, Mayes and Ottawa Counties, Oklahoma

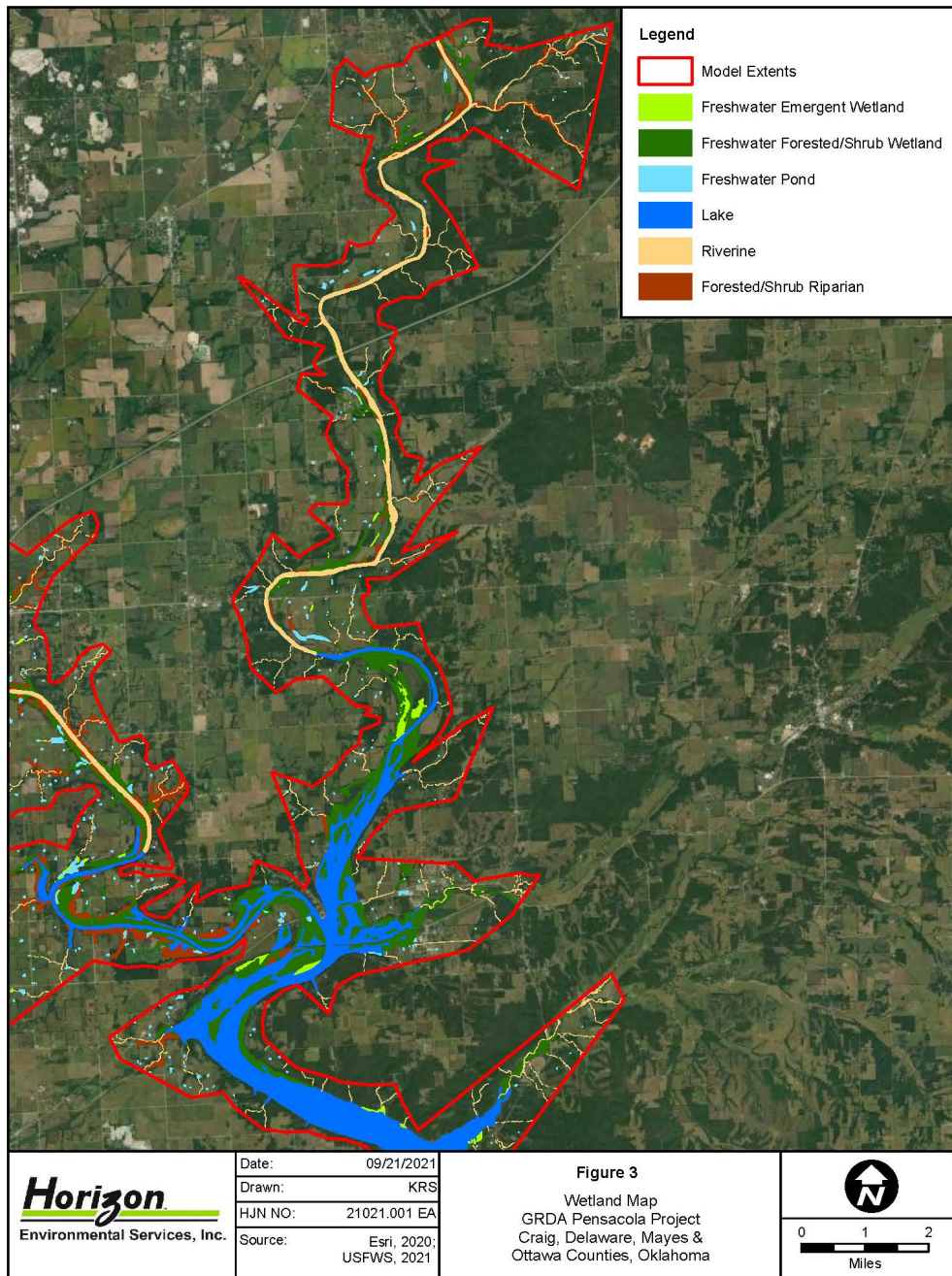
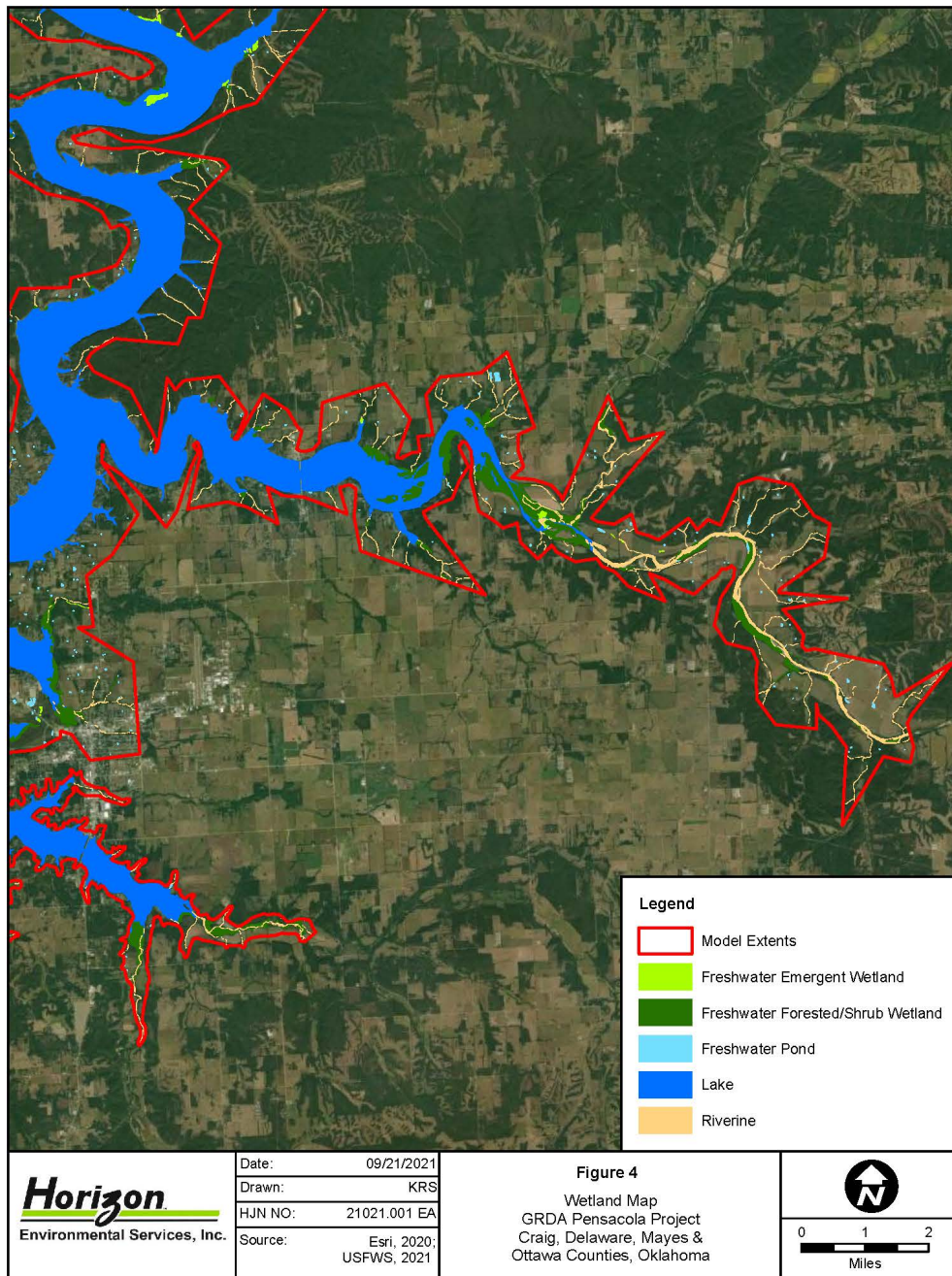


Figure 3. Wetland and Riparian Habitat within the Study Area, Northeast Section



**Figure 4. Wetland and Riparian Habitat within the Study Area, Eastern Section**

Wetlands and Riparian Habitat Study for the Pensacola Hydroelectric Project (Project; FERC [Federal Energy Regulatory Commission] No. 1494); Craig, Delaware, Mayes and Ottawa Counties, Oklahoma

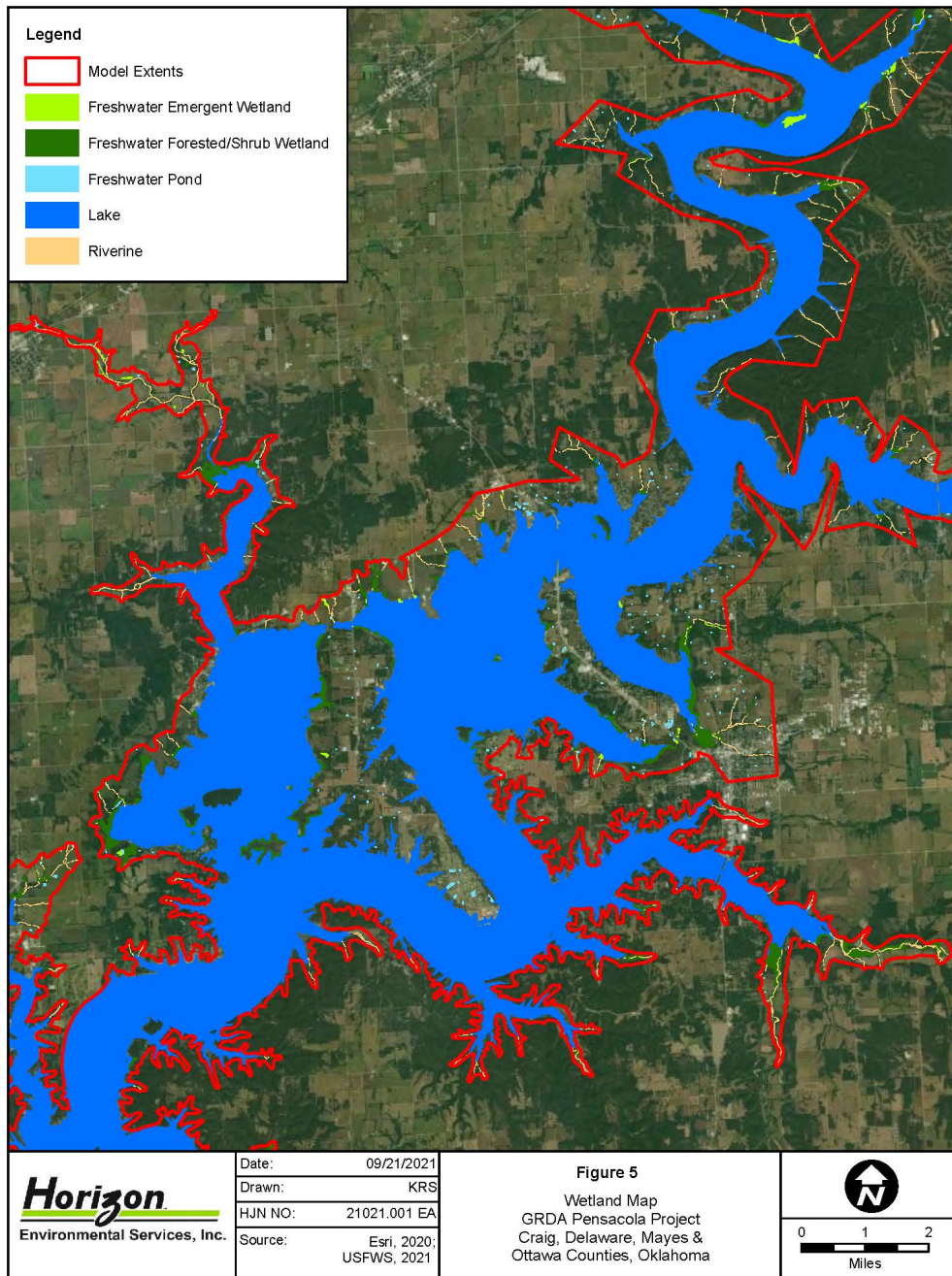


Figure 5. Wetland and Riparian Habitat within the Study Area, Central Section



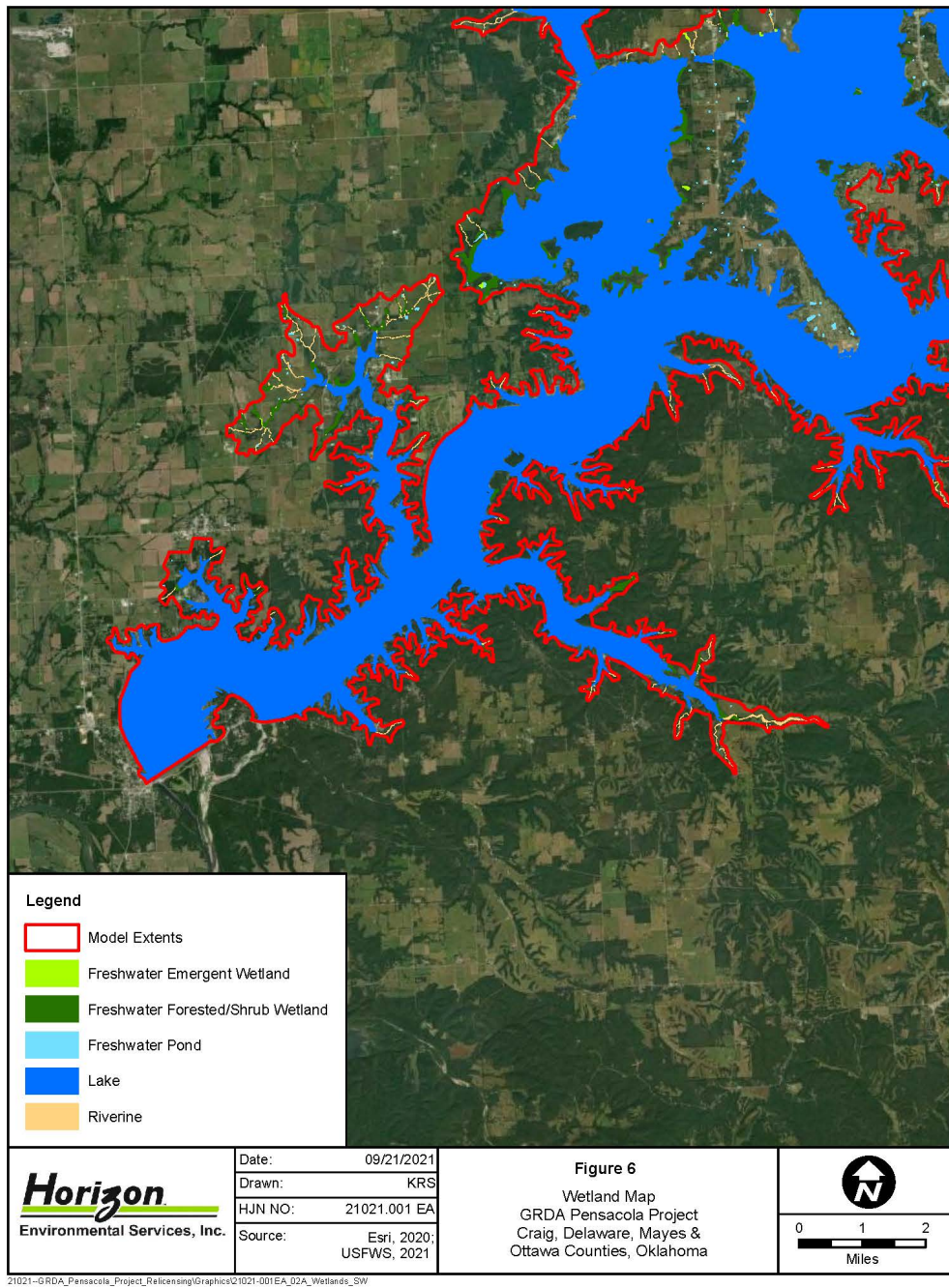


Figure 6. Wetland and Riparian Habitat within the Study Area, Southwestern Section

## **2.2 DISCUSSION**

In 2010, the Oklahoma Conservation Commission (OCC) and Oklahoma State University (OSU) conducted a mapping effort in the Deep Fork River watershed to assess the loss and gain of wetland resources in the region. The project included digital conversion of National NWI maps created using aerial photography to determine wetland locations and areas in the early 1980s, comparison with current aerial photography and field verification at six sample plots. The results showed an overall 28% increase in wetland resources from the early NWI map period through 2008 (approximately 35 years). The findings are tempered, however, with the caveat that digitization and attribution of palustrine forested wetlands is more difficult than other wetland types via aerial photography and that the increased number of man-made ponds inflated the total wetland area (OCC, 2010). Further, a “Comparison of USACE Three-Factor Wetland Delineations to National Wetland Inventory Maps. Wetlands” (Gage, Edward & Lichvar, 2020) found that a comparison of 3-factor wetland delineations to NWI maps for 1,751 assessment areas in different regions found 74% of NWI polygons were mapped in common with 3-factor polygons. NWI identified greater area in 33% of assessment areas and greater total area across all sites. Approximately 27% of assessment areas had 3-factor but no NWI polygons, while 6.7% of assessment areas had features mapped only by NWI.

## **3.0 STUDY YEAR TWO ACTIVITIES**

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### **3.1 DATABASE ANALYSIS**

Based upon the first year results of the H&H Study, the second study period will determine Project effects including habitat changes in currently designated Wildlife Management Areas (WMAs).

Inundation depth maps generated by the Comprehensive Hydraulic Model (CHM) will be overlaid onto the preliminary base maps that were developed using existing wetlands information and information related to the WMAs. The maps will delineate the area inundated under current operations predicted to be inundated. The maps will show the current Project Boundary and will include an inundation line to represent the maximum water surface elevation under current project operations and anticipated future operations. GRDA will assess potential impacts to wetlands and WMAs by identifying the extent, duration, and seasonality (timing) of inundation occurring in the Project area. The effects analysis will focus on potential change in wetland habitats and WMAs due to operation of the Project.

If it is determined, based on the results of the H&H Study, that anticipated operations impact wetlands in the Study area, GRDA will perform a field verification of the cover-type maps prepared during the desktop mapping portion of this study. GRDA will verify the accuracy of the preliminary wetland cover-type maps and update these maps accordingly. Ground-truthing (map change recommendations) will only be required for any major deviations from the preliminary wetland cover-type maps. Any identified inconsistencies with the preliminary maps will be marked in the field and revised within the database accordingly. Wetland classifications will distinguish the degree of inundation (e.g., seasonally flooded, permanently flooded) based upon information obtained from this study. The results of the field verification will allow GRDA to provide a more accurate estimate of the acreage of wetlands that may be potentially impacted by anticipated operation of the Project.

## **4.0 REFERENCES CITED**

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- (Gage, Edward & Lichvar, 2020) Gage, Edward & Cooper, David & Lichvar, Robert. *Comparison of USACE Three-Factor Wetland Delineations to National Wetland Inventory Maps*. Wetlands. 40. 1-9. 10.1007/s13157-019-01234-y.