Ecological Risk Assessment and Expert Report of Helen Connelly, Ph.D. and John H. Rodgers, Jr., Ph.D.

Jeanerette Lumber & Shingle Co., LLC v.
ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

9 April 2021

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Bayou Pigeon Oil & Gas Field
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Acronyms and Abbreviations

Name	Description
AOIs	Areas of Investigation
Apache	Apache Corporation
BERA	Baseline Ecological Risk Assessment
bgs	Below ground surface
Chevron	Chevron U.S.A. Inc.
CIMS	Coastal Information System
COPEC	Constituents of Potential Ecological Concerns
CPRA	Coastal Protection and Restoration Authority
CRMS	Coastwide Reference Monitoring System
CSM	Conceptual Site Model
DBH	Diameter at Breast Height
DO	Dissolved Oxygen
E&P	Exploration and Production
EC	Electrical conductivity
EEC	Estimated Environmental Concentration
Element	Element Materials Technology Lafayette
ERA	Ecological Risk Assessment
ERM	Environmental Resources Management
ESVs	Ecological Screening Values
HQ	Hazard Quotient
JLS	Jeanerette Lumber & Shingle Co., LLC
LDEQ	Louisiana Department of Environmental Quality
LDWF	Louisiana Department of Wildlife and Fisheries
LOAEL	Lowest Observed Adverse Effect Level
NOAA	National Oceanic Atmospheric Administration
NOAEL	No Observed Adverse Effect Level
NWI	National Wetlands Inventory
OPW	Oilfield Produced Water
Pace	Pace Analytical Gulf Coast
PAH	Polycyclic aromatic hydrocarbons
RECAP	Risk Evaluation/Corrective Action Program
SETAC	Society of Environmental Toxicology and Chemistry
SLERA	Screening Level Ecological Risk Assessment
SQuiRT	Screening Quick Reference Tables
SSLs	Soil Screening Levels

TECs	Threshold Effect Concentrations
TPH	Total Petroleum Hydrocarbons
TRVs	Toxicity Reference Values
USDA	United States Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
Waypoint	Waypoint Analytical Louisiana, Inc.
WMA	Wildlife Management Area

EXECUTIVE SUMMARY

An ecological risk assessment (ERA) was performed for the Jeanerette Lumber & Shingle Co., LLC Property (JLS, Property, or site), located in the Bayou Pigeon Oil and Gas Field. This ERA has been prepared in accordance with U.S. Environmental Protection Agency (USEPA) and Louisiana Department of Environmental Quality (LDEQ) guidance (e.g. USEPA, 1997; LDEQ, 2003). The ERA evaluates whether oilfield exploration and production (E&P) operations near Chevron U.S.A., Inc. (Chevron) Well SN 70817 and Apache Corporation (Apache) Well SN 187214 have damaged the ecology (flora and fauna) on the Property. The ERA demonstrates that there are no unacceptable risks to ecological receptors on the Property from Chevron operations or from Apache operations and that additional remedial action based on ecological risk is not warranted. This conclusion is supported by the following information and evidence:

- Site inspections and evaluations performed in 2020 and 2021 by Angle/Purdom (2021), Connelly/Rodgers (2020 and 2021), Levert (2021), Holloway/Ritchie (2021), ICON (2020), and Omega EnviroSolutions (2020);
- Data from investigations in 2020 and 2021 of soil and sediment samples (chemical concentrations), vegetation, and wildlife (Angle/Purdom, 2021; Connelly/Rodgers, 2021; Holloway/Ritchie, 2021; ICON, 2020; Rogers, 2020);
- A Screening-Level Ecological Risk Assessment (SLERA); and
- A site-specific Baseline Ecological Risk Assessment (BERA).

The Property is vegetated with freshwater forested cypress-tupelo swamp wetlands and emergent wetlands. Chevron and Apache have each used a portion of the Property in Area 2 for oil and gas production. The vegetation on the Property in the vicinity of former Chevron and Apache operations do not exhibit symptoms of exposure or adverse effects due to oil and gas E&P.

Wildlife and vegetation habitat on the Property is functioning as would be expected for freshwater forested cypress-tupelo swamp wetland and emergent wetland habitats in the area. The forested areas are habitat for Louisiana wildlife such as raccoons, alligators, crawfish, frogs, snakes, foxes, bobcats, coyote, and numerous species of birds. There is no evidence of adverse effects on wildlife from E&P activities. The Property supports a functioning freshwater forested cypress-tupelo swamp wetlands food web, and the Property is providing appropriate and expected ecological functions and services for human and animal populations. The freshwater forested cypress-tupelo swamp wetlands are providing ecosystem services such as water storage, wildlife habitat, and storm protection.

Based on the results of the SLERA, arsenic, barium, and zinc were retained as Constituents of Potential Ecological Concern (COPECs) for a more in-depth assessment in a site-specific BERA. The BERA has been completed using site-specific data and receptor factors for the ecological populations observed and expected on site. The BERA quantitatively confirms that former E&P activities by Chevron and Apache on this Property do not pose an unacceptable risk to wildlife.

1. INTRODUCTION

Environmental Resources Management (ERM) has prepared this expert report pertaining to the Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al. matter, in which ERM was retained by Chevron U.S.A. Inc. (Chevron) and Apache Corporation (Apache).

The Jeanerette Lumber & Shingle Co., LLC Property (JLS, Property, or site) is located in the Bayou Pigeon Oil and Gas Field. The Property consists of multiple tracts within the Bayou Pigeon Oil and Gas Field in Iberia Parish, Louisiana (Figure 1). The Property encompasses approximately 3,825 acres in Sections 1, 2, 9, 10, 11, 12, 13, 14, 15, 22, 23, 26 and 27 of Township 12 South, Range 10 East. Much of the area on and adjacent to the Property is identified by the U.S. Fish and Wildlife Service (USFWS) as freshwater forested/shrub wetland, with freshwater ponds, canals, and small areas of freshwater emergent wetlands (Figure 2). The Property can support game animals such as squirrels, raccoons, and ducks, and portions of the Property have been used for oil and gas development.

This ERA has been performed to evaluate the claim that oilfield E&P operations by Chevron and by Apache have damaged the ecology (flora and fauna) on the Property and whether remediation is required to protect the ecology. The former operations areas for Chevron and Apache are located in the southern portion of the Property; these areas and surrounding vicinity area referred to as Area 2 in the ERA. An ERA evaluates the ecological effects of chemical, physical or biological actions on an ecosystem by quantifying adverse effects on individuals, populations, communities, or ecosystems. This ERA has been performed in accordance with USEPA and LDEQ guidance (e.g. USEPA, 1997; LDEQ, 2003).

ERA, per USEPA guidance, begins with a screening level assessment and progresses to a more site-specific ecological risk assessment to estimate if unacceptable risk to ecological receptors is present due to exposure to site COPECs in soils.

The conclusions in this ERA are supported by the following information and data:

1. Site inspections and evaluations performed in 2020 and 2021 by Angle/Purdom (2020), Connelly/Rodgers (2020 and 2021), Levert (2021), Holloway/Ritchie (2020 and 2021), ICON (2020), and Omega EnviroSolutions (2020);
2. Data from 2020 and 2021 investigations of soils, wildlife, and vegetation (ERM, HET, ICON, Holloway Environmental, Omega EnviroSolutions);
3. The results of a SLERA of the Property in Area 2, which compares soil and sediment COPEC concentrations with ecological screening values (ESVs); and
4. The results of a site-specific BERA for the Property for COPECs that exceeded screening values in the SLERA.

The purpose of this ERA, which includes a SLERA and a more site-specific BERA, is to determine if 1) additional investigation and studies are needed, 2) remediation is needed, or 3) no further action is required.

1.1 Statement of Qualifications

Dr. Helen Connelly

Dr. Helen Connelly is a toxicologist and ecological and human health risk assessor. Dr. Connelly has a Bachelor of Science degree in geology from Louisiana State University and a Ph.D. from Louisiana State University School of Veterinary Medicine, Department of Physiology, Pharmacology and Toxicology. Dr. Connelly is an adjunct professor at Louisiana State University in the Department of Environmental Science. Dr. Connelly has taught graduate and undergraduate classes in environmental science, environmental sampling, conservation biology, ecology, biology, and ERA at Louisiana State University and Baton Rouge Community College. She has been a mentor for many students receiving their graduate degrees in natural sciences over the years. For almost 20 years, she has been involved with research and investigation of the effects of oil and gas production and exploration on aquatic and terrestrial life in Louisiana wetlands, lakes, bayous, estuaries, and other water bodies.

Dr. Connelly is a member of the Society of Environmental Toxicology and Chemistry (SETAC) and the Baton Rouge Geological Society. Dr. Connelly began working for the LDEQ in 1991 in the Inactive and Abandoned Sites division, and it was at LDEQ that she became interested in ERA. After obtaining her Ph.D. in 1997, she worked as an environmental consultant first for Michael Pisani and Associates, and then ERM, while also teaching concurrently. Dr. Connelly's research investigations have been a part of her consulting work and have been focused on ERA of the effects of organic and inorganic compounds, including metals and hydrocarbons associated with oil and gas production and exploration, on vegetation and wildlife. A copy of Dr. Connelly's Curriculum Vitae is appended to this report (Appendix A).

Dr. John Rodgers

Dr. John Rodgers is currently an Emeritus Professor in the Department of Forestry and Environmental Conservation and former Director of the Ecotoxicology Program at Clemson University. Immediately prior to coming to Clemson University in January 1998, he was Professor of Biology and Adjunct Professor in the School of Pharmacy at the University of Mississippi, located in Oxford, Mississippi. He conducted research, taught, and directed programs at the University of Mississippi for nine years. He was Director of the Biological Field Station at the University of Mississippi and Director of the Center for Water and Wetland Resources.

Dr. Rodgers received a Bachelor of Science degree in Botany/Biology from Clemson University in South Carolina in 1972. He earned a Master of Science degree in Plant Ecology/Aquatic Biology from Clemson University in 1974. In 1977, he obtained a Ph.D. degree in Aquatic Ecology/Ecotoxicology from Virginia Polytechnic Institute and State University in Blacksburg, Virginia, and he held a post-doctoral research position at Virginia Polytechnic Institute and State University in 1977.

Dr. Rodgers has conducted research and taught graduate and undergraduate classes in biology, ecology, ecotoxicology, risk assessment, sediment toxicology, wetlands and aquatic toxicology at Clemson University, the University of Mississippi, the University of North Texas, and East Tennessee State University. For more than 40 years, he has been involved with research on a variety of water bodies including rivers, streams, reservoirs, lakes, marsh areas (wetlands) and associated lands in various parts of the United States, both east and west of the Mississippi River. Essentially, his research has been focused on the health and well-being of the ecosystems within water bodies and the surrounding areas. Among other places, he has studied the impact of both man and nature on plant and animal life in Texas, South Carolina, Mississippi, Alabama, and Louisiana wetlands, rivers, streams, and reservoirs. For example, he has investigated the effects of point sources (e.g. effluents, spills, production and refining activities) as well as non-point sources (e.g. cropland runoff) on wetlands, streams and rivers in Mississippi and Louisiana. He has conducted research on materials released to aquatic systems from a variety of processes and facilities. For more than four decades, he has studied the responses of wetlands and other aquatic systems to discharges. He has also designed and constructed wetlands for mitigation of contaminants, wildlife habitat and rehabilitation. These studies have resulted in more than 100 peer reviewed scientific publications and books. He incorporates this information in his undergraduate and graduate classes as well as short courses that are presented for postgraduates.

Dr. Rodgers has extensive experience with organics and inorganics as well as mixtures such as crude oil, brine and produced waters. He has also been involved with development of national water quality criteria and sediment guidelines as a consultant to the USEPA. He was an author of the USEPA protocol on Ecological Risk Assessment for field studies. Dr. Rodgers continues to be involved in reviews of ecological risk assessments for the USEPA under contract. He taught courses for the U.S. Army Corps of Engineers, Waterways Experiment Station in Vicksburg, Mississippi, on wetland construction and remediation. He has also taught short courses at international meetings of the Society of Environmental Toxicology and Chemistry on Constructed Wetlands for remediation and rehabilitation. Dr. Rodgers currently serves on the Science Advisory Panel for the Aquatic Ecosystem Restoration Foundation.

Dr. John Rodgers has served on the Board of Directors of the Society of Environmental Toxicology and Chemistry (SETAC), as the elected President of that scientific organization and as a Board representative from North America to the SETAC World Council. He was also President of the Aquatic Plant Management Society. He has also served in a variety of advisory capacities for government agencies. For example, he was on the review panel for the U.S. Environmental Protection Agency's (USEPA) Ecorisk Program as well as the Environmental Biology Panel that makes technical and scientific recommendations regarding prioritizing environmental research. He recently served as an invited scientist to a joint SETAC/USEPA workshop on Ecological Risk Assessment focused on Problem Formulation. He was also retained by the USEPA to provide scientific advice and oversight in problem formulation and ecological risk assessment. He has also served on the Expert Advisory Panel for the Canadian Network of Toxicology Centres funded by Environment Canada and Health Canada and chaired that Panel for three years. He advised the USEPA regarding water quality criteria and water quality based toxics control. He served on the Society of Environmental Toxicology and Chemistry/USEPA Expert Advisory Panel on Whole Effluent Toxicity Testing and recently served as a member of the Science Advisory Panel (and was elected to chair that panel) for the California Environmental Protection Agency and USEPA on water borne materials. He recently won an award for research on risk mitigation in wetlands from the U.S. Department of Energy and a Water Resources award for a constructed wetland in Oconee County, SC. He also was recently retained to evaluate risk assessments for the state of California. A copy of Dr. Rodgers' Curriculum Vitae is appended to this report (Appendix A).

1.2 Purpose of Report and Sources of Information

This report documents our opinions regarding the ecological conditions of the Jeanerette Lumber & Shingle Co., LLC Property in the vicinity of Area 2 and provides: 1) a review of site background information and data; 2) an ERA; 3) recommendations for a scientifically reliable course of action for the Property; and 4) a response to plaintiffs' expert reports.

Fundamental principles of toxicology have been used to evaluate the Property and prepare this report. Basic principles of toxicology that govern the evaluation process include: 1) there must be an exposure to elicit a sufficient dose, response, and subsequent risk; and 2) an implemented remedy should not cause harm to a functioning ecosystem.

Information reviewed to prepare this report, other than the data in this report and the literature cited, include expert reports by:

- Mr. Dave Angle and Mr. Mike Purdom;
- Dr. Luther Holloway and Mr. Patrick Ritchie; and
- Ms. Angela Levert.

Additional information may be reviewed and added to this report, if additional information becomes available.

2. LISTING OF OPINIONS

1. The data clearly show that the Jeanerette Lumber & Shingle Co., LLC Property provides habitat for wildlife species and vegetation. The Property is mostly freshwater forested cypress-tupelo swamp wetlands and emergent wetlands. During the site investigations, we observed numerous plants, animals, and signs of wildlife, which indicate a fully-functioning forested swamp ecosystem. There is clear evidence of a healthy ecosystem, and there is no evidence of adverse effects on wildlife or vegetation populations from past E&P activities by Chevron or by Apache. The Jeanerette Lumber & Shingle Co., LLC Property is providing habitat and services that would be disrupted or destroyed by unnecessary and intrusive actions, including the remediation proposed by ICON (ICON 2020).
2. The reported concentrations, locations, and forms of constituents (COPECs) in the surface soils and canal sediments of the Jeanerette Lumber & Shingle Co., LLC Property in the vicinity of Area 2 that are of potential ecological concern are not at concentrations or in forms that currently or potentially provide exposures presenting unacceptable risks to ecological receptors or their habitats. The area on the Property that is designated as contingent for remediation by ERM, Inc. was included in this assessment to consider the risk posed by proposed remedies.
3. Plaintiffs' experts' conclusions regarding potential ecological risks to wildlife and to cypress trees are not substantiated and were not observed during site investigations.
4. Intrusive remedial actions or disturbances such as the plan proposed by the Plaintiffs' experts would cause unjustified harm to this ecosystem. The remediation proposals of the Plaintiffs' experts would not serve to remediate any adverse ecological impacts and would remove acres of flourishing cypress-tupelo swamp.

3. SITE INSPECTIONS AND OBSERVATIONS

Dr. Helen Connelly and Dr. John Rodgers performed site investigations and collected wildlife and vegetation data on November 19, 2020 (Connelly) and March 15, 2021 (Connelly/Rodgers). These data, along with wildlife and vegetation data collected by Mr. Jody Shugart, Mr. Patrick Ritchie, and Dr. Luther Holloway, were used to prepare the ERA. Wildlife and vegetation data from the following site investigations were included in the ERA: Dr. Helen Connelly (ERM, November 19, 2020 and March 15, 2021), Dr. John Rodgers (Clemson, March 15, 2021), Mr. Jody Shugart (ERM, May 19, 2020; May 26, 2020; August 29-31, 2020; January 26, 2021; March 4, 2021; March 15, 2021), Mr. Patrick Ritchie (ERM, November 19, 2020; December 9-11, 2020), and Dr. Luther Holloway (December 8-10, 2020).

The focus of the ERA is Area 2, which includes the canals and swamp in the vicinity of the former Chevron and Apache operations. The footprint of Chevron and Apache former operations in Area 2 is less than 2 acres in size and is much less than 0.1% of the 3,825-acre Jeanerette Lumber & Shingle Co., LLC Property. A discussion of the data collected during site investigations is included in the following Sections 3.1 through 3.8.

Locations investigated during vegetation/wildlife surveys and cypress tree measurement studies are shown on Figures 3, 3-A, 3-B, and 3-C. Vegetation photos of sampling and observation locations are shown on Figures 4, 4-A, and 4-B. Cypress tree measurements are shown on Figure 5. The Property supports vegetated freshwater forested cypress-tupelo swamp wetlands and emergent wetlands that are providing ecological services to native wildlife species and humans. Photographs taken of habitat, vegetation, and wildlife are included in Appendix B and field notes are in Appendix C. LDEQ's Risk Evaluation/Corrective Action Program (RECAP) Form 18 is included in Appendix D.

3.1 Vegetation Observations

Fifty total vegetative taxa were observed on the Property and recorded by ERM personnel. Key obligate wetland species observed include lizard's tail (*Saururus cernuus*), buttonbush (*Cephalanthus occidentalis*), lanceleaf frogfruit (*Phyla lanceolate*), halberdleaf rosemallow (*Hibiscus laevis*), Eastern swampprivet (*Forestiera acuminata*), butterweed (*Packera glabella*), Cuban bulrush (*Oxycaryum cubense*), horsetail paspalum (*Paspalum fluitans*), and wand lythrum (*Lythrum lineare*). The dominant tree species on site are bald cypress (*Taxodium distichum*) and water tupelo, (*Nyssa aquatica*). Cypress and tupelo are characteristic of Louisiana cypress-tupelo swamps, along with the observed black willow (*Salix nigra*), Chinese tallow (*Triadica sebifera*), red maple (*Acer rubrum*), planertree (*Planera aquatica*) and water locust (*Gleditsia aquatica*). In addition to the terrestrial wetland species, floating aquatic species such as common duckweed (*Lemna minor*), common water hyacinth (*Eichhornia crassipes*), floating marshpennywort (*Hydrocotyle ranunculoides*), smooth beggartick (*Bidens laevis*), mosquitofern (*Azolla sp.*), American spongeplant (*Limnobium spongia*), and water spangles (*Salvinia minima*) are also present on site. A complete list of observed vegetation is provided in Table 1.

The Property is characterized as cypress-tupelo swamp, per the United States Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI). The dominant NWI classification on the Property is PFO1/2F, which denotes palustrine (P), forested (FO), broad- (1) and needle-leaved (2) deciduous, semi-permanently flooded (F) wetlands (Cowardin et al., 1979; USFWS, Appendix E-1). PFO1/2F wetlands in the region are cypress-tupelo natural communities (USFWS) containing bald cypress and tupelo gum, among other key tree species such as blackgum (*Nyssa sylvatica*), willow (*Salix* sp.), green ash (*Fraxinus pennsylvanica)*, and water hickory (*Carya aquatica*) (Appendix E-2). Of these five trees that are representative of cypress-tupelo swamps, three are present at the Property, including the dominant bald cypress and tupelo gum (Inset Table 3-1). In addition to the semi-permanently flooded PFO1/2F wetlands, the Property also includes smaller seasonally flooded (C) areas of forested wetlands (PFO1Cs), as well as palustrine emergent wetland (PEM1Cs) adjacent to the canals. The (s) modifier is included in the NWI characterization to indicate that spoil material forms the primary substrate type in these areas adjacent to the canal.

The natural community at the Property is also characterized as cypress-tupelo swamp by the Louisiana Department of Wildlife and Fisheries (LDWF). LDWF characterizes cypress-tupelo communities as forested, alluvial swamps growing on intermittently exposed soils along rivers and stream beds, as well as backswamp depressions and swales (LDWF, 2010). According to the LDWF, cypress-tupelo swamps commonly contain an overstory of bald cypress and tupelo gum, and a mid- and understory composed of maple (*Acer* sp.), buttonbush (*Cephalanthus* sp.), ash (*Fraxinus* sp.), locust (*Gleditsia* sp.), sweetspire (*Itea* sp.), planertree (*Planer* sp.) and willow (*Salix* sp.) (LDWF, 2010). Of these nine key genera representative of Louisiana's cypress-tupelo swamps, seven were observed at the Property, including the two overstory dominants bald cypress and tupelo gum and five of the expected understory tree species (Inset Table 3-1).

The vegetation documented during field investigations is a line of evidence that the Property is a functioning cypress-tupelo swamp that supports the expected dominant cypress and tupelo trees, as well as the expected swamp midstory and understory trees.

Table 3-1: Representative cypress-tupelo plant community associates observed at the Property as defined by the National Wetlands Inventory (NWI) and the Louisiana Department of Wildlife and Fisheries (LDWF).

Common Name	Genus	NWI[a]	LDWF[b]	Property
Topstory				
Tupelo	*Nyssa*	√	√	√
Cypress	*Taxodium*	√	√	√
Mid- and Understory				
Maple	*Acer*		√	√
Hybrid hickory	*Carya*	√		
Buttonbush	*Cephalanthus*		√	√
Ash	*Fraxinus*	√	√	
Locust	*Gleditsia*		√	√
Sweetspire	*Itea*		√	
Planertree	*Planera*		√	√
Willow	*Salix*	√	√	√
	Total	**5**	**9**	**7**

[a] List of genera associated with palustrine forested (PFO1/2F) cypress-tupelo swamps in the Baton Rouge and Lake Charles region provided by the National Wetlands Inventory (NWI) (Appendix E-2). The Property is located in the Baton Rouge region, as defined by U.S. Fish and Wildlife.

[b] List of cypress-tupelo plant community associate genera established by the Louisiana Department of Fish and Wildlife (LDWF 2010).

A comparison to vegetation cataloged at Louisiana's Coastal Protection and Restoration Authority (CPRA) Coastwide Reference Monitoring System (CRMS) stations in the vicinity of the Property documents that the vegetation on the Property is as expected for the region. CPRA monitors 390 CRMS stations throughout coastal Louisiana using standardized data collection techniques and fixed sampling schedules (CPRA, 2021). There are 20 CRMS stations within a 25-mile radius of the Property that were considered as potential references for the Property. Seventeen of these stations lie outside of the Atchafalaya Basin, west of Route 90, and 9 are characterized as emergent marsh, which is not the habitat at the property (Appendix E-3). The remaining three CRMS stations within 25 miles of the Property (CRMS0324, CRMS5536, and CRMS0403) are located within the Atchafalaya Basin and host natural communities dominated by cypress-tupelo swamp. These three stations provide an appropriate point of comparison for evaluating the natural communities present at the Property. The list of vegetative taxa present in the three CRMS stations is included in Appendix E-4.

The wetland classifications of plant species observed at the Property and recorded at the three CRMS stations is shown in Inset Figure 3-1. The majority of plant species at the Property and at the CRMS stations are hydrophytic species, which are plants that grow partly or totally submerged in water or in waterlogged soil. A vegetation comparison shows that the percentage of observed hydrophytic species is very similar at the Property (74%) and at the CRMS stations (75%). There are also similar percentages (48% Property; 47% CRMS) of obligate species (plants that are always found in wetlands). Additionally, as shown in Inset Figure 3-1, vegetative species that are found “equally commonly in wetland and upland” settings (facultative) were observed on the Property at a greater percentage than species that are “typically found in wetlands” (facultative wetland), due to the availability of habitat on the Property for species such as honey locust (*Gleditsia triacanthos*) and southern dewberry (*Rubus trivialis*) that can thrive in higher soil elevations adjacent to the canals. In areas of the Property that are not adjacent to canals, vegetation is dominated by wetland-obligate species with fidelity to the swamp such as bald cypress, water tupelo, buttonbush, black willow, and lizard’s tail. These favorable comparisons of the Property to comparable CRMS stations, including similar percentages of vegetation with fidelity to wetland habitats, show that the vegetation at the Property is similar to wetland habitats in the region.

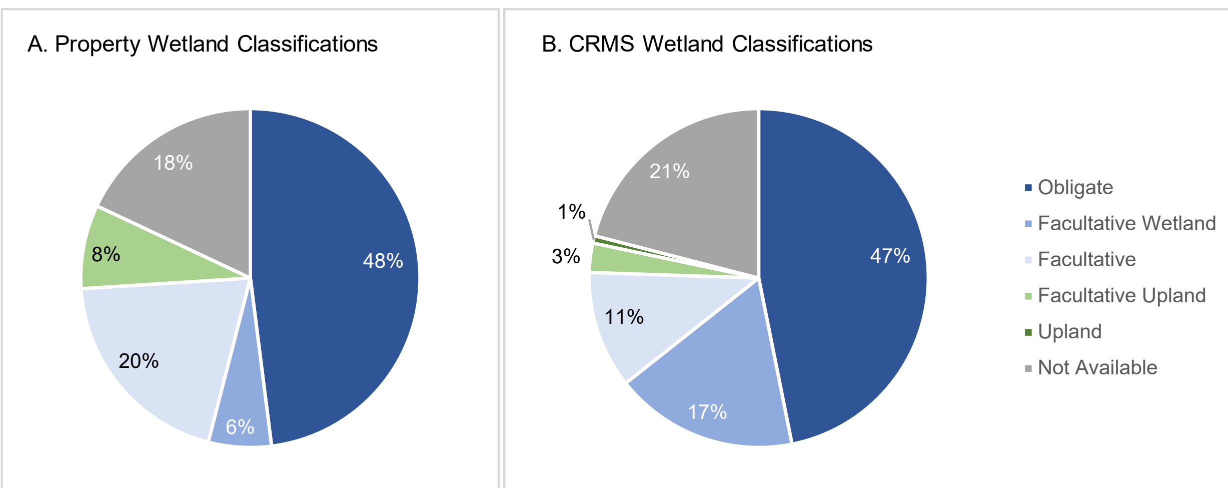

Figure 3-1. Comparison of wetland classification between the Property (A) and three nearby CRMS stations characterized as cypress-tupelo swamp (B). Property taxa include all those identified during ERM site visits. Coastwide Reference Monitoring System (CRMS) station forested and herbaceous vegetation taxa lists were downloaded from the Coastal Protection and Restoration Authority's (CPRA) Coastal Information System (CIMS) for stations CRMS0324, CRMS0403, and CRMS5336. Hydrophytic wetland species (Obligate, Facultative Wetland, and Facultative) are shown in shades of blue, and non-hydrophytic upland species (Facultative Upland, Upland) are shown in shades of green (USDA, 2012). Taxa identified to the genus level have a status that is considered “not available” (grey) as species within genera may vary in wetland classification.

Community structure, as measured by vegetative growth forms on site, is comparable between the Property and CRMS stations, as both support a similar proportion of woody tree/shrub/subshrub vegetation (50% and 49%, respectively) (Inset Figure 3-2). Specifically, trees comprise 24% of species observed at the Property, and 25% of species recorded across the CRMS stations. Tree species observed at the Property that have fidelity to wetland settings and indicate quality wetlands include bald cypress, tupelo gum, buttonbush, red water locust, planertree, and maple. Emergent wetland species observed that have fidelity to wetland habitats include lizard's tail and rosemallow, and aquatic vegetation includes floating marshpennywort, water spangles, American spongeplant, mosquitofern, and common duckweed.

The presence of comparable community structure on the Property and similar CRMS locations is a line of evidence that the ecosystem is functioning as expected, and that the cypress-tupelo swamp present at the Property is representative of the region and supports vegetation that has fidelity to vigorous coastal wetlands. Based on favorable comparisons to expected vegetation in cypress-tupelo swamps, as documented by USFWS (Appendix E-2), CRMS (2021), and LDWF (2010), the Property cypress-tupelo swamp ecosystem is functioning as expected for the region.

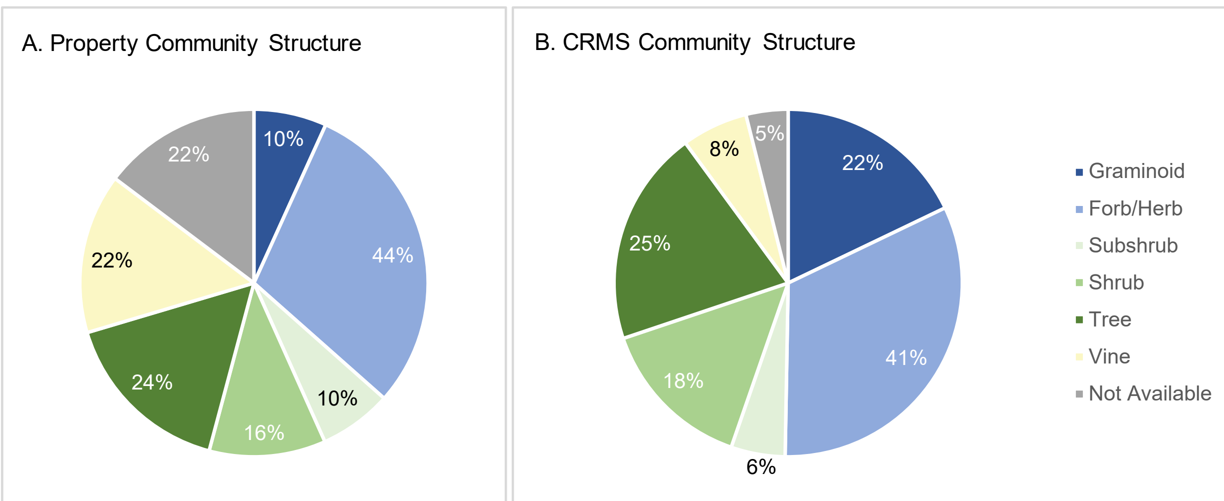

Figure 3-2. Comparison of community structure between the Property (A) and three nearby CRMS stations characterized as cypress-tupelo swamp (B). Property taxa include all those identified during ERM site visits. Coastwide Reference Monitoring System (CRMS) station forested and herbaceous vegetation taxa lists were downloaded from the Coastal Protection and Restoration Authority's (CPRA) Coastal Information System (CIMS) for stations CRMS0324, CRMS0403, and CRMS5336. Mid- and top-story woody vegetation (Tree, Shrub, Subshrub) is shown in shades of blue, and understory herbaceous species (Forb/herb) and grasses (Graminoid) are shown in shades of green. Vines can be either herbaceous or woody and are shown in yellow. Note that some species have multiple growth forms, so community structure percentages add up to greater than 100. Taxa identified to the genus level may have a status that is considered "not available" (grey) as species within genera can vary in wetland classification and growth form.

3.2 Cypress Trees

An investigation was conducted to address plaintiffs' claims that cypress tree growth is affected by salts in soils/sediments on the Property. To investigate this claim, on March 4 and 15, 2021, ERM measured the diameter at breast height (DBH) of 40 trees inside the ICON proposed remediation area, 3 trees outside the ICON proposed remediation area, and 18 trees at an on-site reference location. The on-site cypress tree reference area (about a mile to the northwest of the site) was selected based on being of similar elevations and habitat as the site, but outside of the area of influence of former E&P activities. Large, medium, and small trees were measured at each location, recorded and photographed (Appendix B-2). Representative saplings were also recorded and photographed (Appendix B-2). The presence of saplings was documented to confirm the recruitment of new trees, but a count of all saplings in each area was not performed during this field effort. Four saplings were recorded within the ICON proposed remediation area, five saplings were recorded outside of the ICON proposed remediation area, and two saplings were recorded within the on-site reference area. Additionally, diameter of 2 trees outside the ICON proposed remediation area was recorded on December 19, 2020 by Holloway and Ritchie (2021). A summary of the cypress tree survey results is presented in Inset Table 3-2 below (see Table 4 for individual tree measurements). The conclusion based on this data is that the Property cypress trees are of typical size for swamp stands in the region, as based on DBH comparison to measured cypress trees outside the proposed ICON remediation area and at the on-site reference area (Table 4), and comparison to historical studies of Louisiana cypress swamps (Conner et al., 1981; Conner and Day, 1992; Krinard and Johnson, 1987) (Inset Table 3-2). The cypress trees are of expected diameter, which is a line of evidence that cypress tree growth is not affected by salts in Property soils/sediments. The locations and measurements of the cypress trees inside and outside of the proposed remediation area and at the reference location are shown on Figure 5.

Table 3-2: Comparison of diameter at breast height (DBH) of cypress trees surveyed inside and outside of the ICON proposed remediation area and at an on-site reference location. Two cypress trees measured by Holloway and Ritchie (2021) are included in the Outside Proposed Remediation Area summary below. Saplings were not measured for DBH and are not included in the range and mean calculations. See Figure 5 for the locations of all surveyed trees and saplings.

Community Characteristic		Inside ICON Proposed Remediation Area	Outside ICON Proposed Remediation Area	On-Site Reference Location	Literature Reference
DBH (inches)	Range	2.1 – 66.2	7.6 – 23.2	5.1 – 26.1	1.03 – 18.72[a]
	Mean	14.2	15.5	16.3	13.35[b] – 14.2[c]
Saplings	Count	4	5	2	NA

a) DBH range for cypress trees in naturally flooded swamps provided by Conner et al. (1981).

b) Average diameter of natural cypress trees in a Louisiana swamp provided by Conner and Day (1992).

c) Average diameter of large planted cypress trees provided by Krinard and Johnson (1987).

In addition to measuring DBH, ERM investigated nine factors to identify if salts are affecting cypress tree growth (LASAF, 2015). The results of this investigation are that eight of nine salt-related factors were not observed, and one factor was observed, but was not deemed to be weighted in importance. The conclusion is that there is no evidence of salt inhibition of cypress tree growth at the Property. The one factor that was observed, but dismissed, was observation of cypress snags (broken off cypress trees). Cypress snags were observed on the Property, but they were also observed in areas unrelated to the Property, and are a known feature of cypress swamps. Snags can comprise as much as 10% of a cypress stand in locations with no access to elevated salt (USDA, 1998). Therefore, because snags are not uniquely related to salinity and are a known feature of Louisiana cypress stands, and because the measured cypress trees on site are of expected size for the region, the conclusion of the investigation is that there is no evidence salt inhibition of cypress growth.

Results of the investigation for salinity indicators are shown in Inset Table 3-3 below. Some of the important findings are no evidence of brackish vegetation on the Property, and the presence of freshwater vegetation throughout the Property and in the area proposed by ICON for salt remediation. The cypress trees in the area planned for remediation are not stunted and there are juvenile cypress trees present. The presence of healthy cypress trees of appropriate size is a line of evidence that the Property is currently and should continue to support a cypress tree population that is unaffected by salt on the Property.

Table 3-3: High salinity indicator investigation results

High Salinity Indicator	At Property	Comments
Absence of freshwater vegetation	No	Obligate freshwater wetland species are present, healthy, and abundant on site. Examples include: bald cypress (*Taxodium distichum*), Spanish moss (*Tillandsia usneoide*), water tupelo (*Nyssa aquatica*), mosquitofern (*Azolla sp.*), common duckweed (*Lemna minor*) and American spongeplant (*Limnobium spongia*), among others. These species, particularly the floating aquatics, do not tolerate saline environments (Haller et al., 1974, Upadhyay and Panda, 2005).
Presence of saltmarsh and brackish water vegetation	No	Salt-tolerant species are not present on site. Examples of saltmarsh associates prominent in southern Louisiana include black needlerush (*Juncus roemerianus)*, smooth cordgrass (*Spartina alterniflora*), wiregrass (*Spartina patens*), and salt wort (*Batis maritima*) (LNHP, 2009). None of these species were observed on site during ERM's multiple site investigations. For a complete list of plant species observed on site, see Table 1.
Stunted trees with small crowns and low overall basal area	No	Trees on site are growing as expected for the region. The sizes (DBH) of the 44 trees and saplings measured within the proposed remediation area are as expected based on comparisons to areas outside the remediation area, to a nearby reference area, and to historic literature. See Section 3.2 and Holloway and Ritchie (2021) for more details.
Presence of cypress or tupelo snags	Yes	Cypress snags were identified during site investigations. The presence of snags as a part of cypress-tupelo swamps is documented as far back as 1937. Snags are reported to occur with frequencies of a few per acre up to 10% of the cypress population. One possibility for their presence is the lack of typical understory for new growth, therefore dead trees remain elevated above the waterline to serve as a platform for biological activity (USDA, 1998).
Lack of cypress seedling distribution or recruitment of juveniles	No	Eleven total saplings were recorded on site during the March 4 and 15, 2021 site investigations when observed. There was not an effort to identify all saplings in any area, but saplings were documented opportunistically. Saplings were noted inside and outside of the ICON proposed remediation area, as well as in the reference location (Inset Table 3-2). All saplings observed showed evidence of new growth (i.e., bright green needles). Photos of the observed saplings are included in Appendix B-2.
Chlorotic foliage discoloration	No	ERM personnel conducted site investigations on November 19, 2020, December 9-11, 2020, May 26, 2020, August 29-31, March 5, 2021, and March 15, 2021. No chlorotic foliage discoloration was observed on site during any of ERM's multiple site visits.
Presence of marine species	No	Examples of marine species in Louisiana include blue crabs (*Callinectes sapidus*), brown shrimp (*Farfantepenaeus aztecus*), Eastern oysters (*Crassostrea virginica*), and barnacles (LDWF, 2021). No evidence of marine species was observed on site. A list of non-avian fauna observed on site, supporting a freshwater setting, is included in Table 3.
White crusts on soil surface when dry	No	ERM personnel conducted site investigations on November 19, 2020, December 9-11, 2020, May 26, 2020, August 29-31, March 5, 2021, and March 15, 2021 and did not observe white crusts on dry soil surfaces. It should be noted that site soil is not dry, but is wet or submerged, so dry white crusts are not expected to form.

3.3 Submerged Wetland Designation

The wetlands and adjacent areas on the Property are characterized as submerged wetlands. Evidence of submerged wetland status was observed throughout the Property as outlined below:

1. Property elevations were surveyed by T. Baker Smith in February and March of 2021. The Property is of low elevation and is inundated with water, except for limited portions of the spoil banks.
2. Site soils are hydric as documented by USDA (1978; 2021b) and as evidenced by soil boring logs and photographs of soil borings on site (ERM, 2021).
3. The wetlands at the site are described by USFWS (2021) as being predominantly permanently or semi-permanently flooded.
4. The wetland aquatic free-floating, submerged, and emergent aquatic vegetation found on site is associated with submerged wetlands. Examples of obligate aquatic wetland vegetation observed include duckweed, floating marshpennywort, water hyacinth, smooth beggarstick, and water spangles.

A quantitative evaluation was conducted that compares water-level data in the region to site survey elevation data. The results of the evaluation are that site sampling locations are inundated for most of year. The Property submerged wetland evaluation is included in Appendix F.

3.4 Avian Observations

Forty-one species of birds were observed at the Property by ERM personnel during site investigations. Species recorded that have specific fidelity to cypress-tupelo swamps in Louisiana (USFWS, 2006) include barred owl (*Strix varia*), great blue heron (*Ardea herodias*), great egret (*Ardea alba*), little blue heron (*Egretta caerulea*), prothonotary warbler (*Protonotaria citrea*), red-shouldered hawk (*Buteo lineatus*), snowy egret (*Egretta thula*), and wood duck (*Aix sponsa*). Predatory birds observed include the bald eagle (*Haliaeetus leucocephalus*), Mississippi kite (*Ictinia mississippiensis*), red-shouldered and red-tailed hawks (*Buteo jamaicensis*), osprey (*Pandion haliaetus*), and swallow-tailed kite (*Elanoides forficatus*). The presence of these top predators on the Property indicate that the food chain is sufficient to support top trophic levels and is a line of evidence of a functioning wetland. Other birds that are commonly associated with wetlands that were observed at the Property include the anhinga (*Anhinga anhinga*), black-crowned night-heron (*Nycticorax nycticorax*), red-winged blackbird (*Agelaius phoeniceus*), downy woodpecker (*Dryobates pubescens*), red-bellied woodpecker (*Melanerpes carolinus*), pileated woodpecker (*Dryocopus pileatus*), belted kingfisher (*Megaceryle alcyon*), and many passerines.

The Property also supports seven birds identified by the USFWS (2006) as Species of Concern due to their declining populations: bald eagle, black-crowned night-heron, Mississippi kite, northern parula (*Setophaga americana*), prothonotary warbler, swallow-tailed kite, and white-eyed vireo (*Vireo griseus*). The presence of these birds of Special Concern is a line of evidence that the Property is providing nourishing habitat that is protecting biodiversity in the region. The bird population on the Property is documented as supporting avian species with specific fidelity to swamp wetlands, top predators, birds expected in wetlands, and birds of Special Concern. These birds representative of wetland status are important lines of evidence that the Property habitat is functioning and providing habitat and services as expected.

A bird's diet characterizes its trophic level, or position in the food web. Herbivorous birds, which consume plants and plant material (i.e., nuts, seeds, nectar) are considered primary consumers. Examples of primary consumers at the Property include Northern cardinal (*Cardinalis cardinalis*) and wood duck. Secondary consumers are those that consume primary consumers, including insects and aquatic invertebrates, and can be either omnivorous or carnivorous. Secondary consumers on the Property include the insectivorous American robin (*Turdus migratorius*), blue-gray gnatcatcher (*Polioptila caerulea*), and red-eyed vireo (*Vireo olivaceus*), and the omnivorous American and fish crows (*Corvus brachyrhynchos, Corvus ossifragus*). The top or tertiary trophic level contains higher level predators, including omnivores, carnivores, and piscivores, that prey on both primary and secondary consumers. Examples of higher trophic level consumers observed onsite include many of the wetland birds outlined above (egrets, herons, anhinga), as well as apex birds of prey. A species is defined as an apex predator if it does not have any natural predators in its ecosystem. On site, apex bird species include the piscivorous bald eagle and the turkey vulture (*Cathartes aura*). The presence of all avian trophic levels at the Property is a line of evidence of the health of the Property wetlands. The diets and trophic levels of the birds observed on site are provided in Table 2 and Appendix E-5.

The avian community at the Property was compared to avian communities in two protected areas in the region: Elm Hall Wildlife Management Area (WMA) and Attakapas Island WMA. These protected areas contain swamp habitat for birds, and provide a reference for expected birds in the region. The rationale for selecting the areas to serve as references is discussed in the following paragraphs. The avian species comparison between the protected areas and the Property is shown in Appendix E-6 and summarized in Inset Table 3-4 below.

Elm Hall Wildlife Management Area (WMA) is an appropriate reference for the site, as it contains cypress-tupelo swamp. Elm Hall is approximately 12 miles southeast of the Property in Assumption Parish, Louisiana. The western end of the WMA, bordering Lake Verret, is cypress-tupelo swamp, and the eastern portion is bottomland hardwood forest (LDWF, 2021a). The LDWF does not have a comprehensive bird species list for this WMA; however, an eBird hotspot for Lake Verret, directly adjacent the WMA, lists 80 species of birds recorded by observers from 2013 to 2021 (eBird, 2021a). Of the 80 bird species listed, 12 (15%) are considered regular swamp inhabitants according to the USFWS (2006) (Appendix E-6).

Attakapas Island WMA, located approximately 9 miles southwest of the Property, is another reference for the Property, with flat swampland subjected to periodic flooding from the Atchafalaya River. Like the Property, the swamps at Attakapas Island WMA are dominated by cypress and tupelo, with other common herbaceous plants including lizard tail and smartweed (LDWF, 2021b). While no comprehensive avian species list is available for this WMA, the eBird hotspot at the Atchafalaya Basin West Containment Levee adjacent to the management area lists 95 species of birds observed in the area, including 12 (12.8%) species with fidelity to swamps (eBird, 2021; USFWS, 2006; Appendix E-6).

The comparison of the Property to the protected areas is summarized in Inset Table 3-4 below and in Appendix E-5. The trophic structure of the avian population at the Property is similar to the trophic structure in the two protected areas (WMAs). At the Property and in the WMAs, the documented bird species with fidelity to forest (all forest, including swamp forest) is dominated (61%) by secondary consumers (especially insectivores). When considering only the swamp species at each site (rather than all forest birds), the proportion (75%) of piscivores is greater in the Property bird species and in the two WMAs. This strong shift towards fish-eating birds in the swamp is likely a function of the flooded-nature of cypress-tupelo swamps, which are inundated with standing water more than other forested bottom land hardwood habitats.

The presence of the expected percentage of tertiary consumers (75%) at the Property (Inset Table 3-4) is a line of evidence supporting a functioning swamp food chain. These tertiary consumers that are top predators are evidence that there is sufficient diet to support the very top of the food chain. For example, carnivorous birds observed at the Property, include the barred owl (*Strix varia*) and the red-shouldered hawk (*Buteo lineatus*). Fish-eating birds observed at the Property indicate that there is a sufficient fish diet for birds documented on site such as the bald eagle (*Haliaeetus leucocephalus*), osprey (*Pandion* *haliaetus*), Anhinga (*Anhinga anhinga*), Belted Kingfisher (*Megaceryle alcyon*), Black-crowned Night-heron (*Nycticorax nycticorax*), Great Blue Heron (*Ardea herodias*), Great Egret (*Ardea alba*), Little Blue Heron (*Egretta caerulea*), and the Snowy Egret (*Egretta thula).*

The avian trophic structure at the Property, as measured by the percentage of primary, secondary, and tertiary species, is similar to the trophic structure in the protected WMA reference locations. This is true for birds with specific fidelity to swamps, as well as for all forest-dwelling bird species. This similarity between the avian trophic structure (primary/secondary/tertiary) at the Property and in protected areas in the region is a line of evidence supporting the characterization of the Property as a functioning wetland habitat.

Table 3-4: Trophic level breakdown of bird communities at the Property and nearby protected areas, Elm Hall and Attakapas Island Wildlife Management Areas. The proportions of each consumer level (tertiary, secondary, and primary) are provided for each location for all species and for the specific swamp species identified by the U.S. Fish and Wildlife Service Southeast Louisiana Refuges (USFWS, 2006).

Population	All Birds			Swamp Species		
Location	Property	Elm Hall	Attakapas	Property	Elm Hall	Attakapas
Tertiary	29%	30%	27%	75%	75%	75%
Secondary	61%	61%	61%	13%	25%	17%
Primary	7%	9%	12%	13%	0%	8%

Our avian field observations provide several lines of evidence that the Property is providing expected swamp wetland services. We have documented that the avian population at the Property is composed of the expected percentages of predators and insectivores as compared to protected areas in the region, and that the Property is a home to the specific avian species that are expected in cypress-tupelo swamps. The presence of expected avian diversity is a line of evidence that the Property swamp is functioning and providing the ecological service of habitat and protection of biodiversity. The fish population on the Property is sufficient to support numerous fish-eating birds, which indicates appropriate water quality in Property canals. The presence of seven avian Species of Concern (USFWS, 2006) on the Property is a line of evidence that the Property is functioning to protect birds of low species count. All lines of evidence associated with the avian population on the Property support the conclusion of a functioning cypress-tupelo swamp.

3.5 Non-Avian Fauna Observations

A total of 40 non-avian taxa were observed by ERM personnel at the Property during all site investigations, including primary consumers (grasshoppers, bees, beetles, ants, mosquitos, moths, and paper wasps), secondary consumers (frogs, fish, anoles, lizards, dragonflies, spiders, and crayfish), tertiary consumers (Northern raccoon [*Procyon lotor*], red fox [*Vulpes vulpes*], and snakes) and apex predators, (American alligator [*Alligator mississippiensis*], coyote, and bobcat) (Table 3). The Property is also especially rich in pollinators, such as the American lady (*Vanessa virginiensis*), Phaon crescent (*Phyciodes phaon*), Eastern carpenter bee (*Xylocopa virginica*), Southern carpenter bee (*Xylocopa* *micans*), and Western honeybee (*Apis mellifera*). Swamp plants such as black willow, buttonbush, red maple, and tupelo, provide pollen at critical times of the year when female bees are provisioning their nests (Mogren, 2021). These pollinators are important in their role as a diet for the insectivorous birds that are numerous on the Property. Many higher trophic level taxa have diets consisting partially or wholly on flying insects, such as Mississippi and swallow-tailed kites, and therefore rely on these insect populations for sustenance. As each trophic level, from the primary producers to the apex predators, is represented at the Property, the swamp food web is identified to be intact in this ecosystem.

The protected areas (WMAs) in the vicinity of the Property do not have complete species lists available for non-avian fauna, however, Elm Hall Wildlife Management Area and Attakapas Island Wildlife Management Area both identify common species associated with recreation, such as furbearers (white-tailed deer, rabbit, and squirrel), crawfish, and fish (bass, bluefin, bowfin, bream, catfish, freshwater drum, gar, mullet, and white crappie) (LDWF, 2021a; LDWF, 2021b). Recreational fisherman and fish have been observed on the Property. Land mammals observed or identified by scat at the Property include Eastern grey squirrel (*Sciurus carolinensis*), northern raccoon, red fox (*Vulpes vulpes*), bobcat (*Lynx rufus*), and coyote (*Canis latrans*).

Photo documentation of cypress trees, wetland vegetation, and wildlife observed on site is provided in Appendix B.

3.6 Ecosystem Services

Due to historic activity (e.g. legacy oil and gas E&P, etc.) on the Property and claims by the plaintiffs' experts (e.g. Rogers 2020), the Property has been evaluated for evidence of services and functions. The Property is providing services that are expected for forested cypress-tupelo swamp wetland (Barbier, 2013). The expected and observed ecological services provided by the Property in the forested area include dissipation of storms (trees provide buffering), soil stabilization (roots hold soil in place), erosion and flood control (soils absorb water), water purification (surface water is cleaned via interactions with plants), biological productivity and diversity (habitat produces diverse vegetative biomass), carbon sequestration (carbon stored in abundant vegetation), provision of habitat (presence of diverse vegetative species), and recreation (abundant wildlife populations and flowering vegetation).

The observations on the Property of the expected ecosystem functions and services is a line of evidence supporting the conclusion of no adverse impacts to ecological species or their habitats.

3.7 Habitat in Areas Proposed for Remediation by ICON

An important line of evidence supporting the health of the ecosystem on the Property is that the areas that are planned for excavation by ICON were observed to support cypress trees and expected wetland vegetation. See Figure 6 for vegetation observation locations in relation to the planned ICON remediation. Photos of functioning vegetative habitats in the areas planned by ICON for remediation are shown on Figures 4, 4-A, and 4-B.

One location of ICON's planned sediment removal remediation is in the vicinity of sediment location JLS-2 in the vicinity of former Chevron operations. A vegetation survey was performed in the JLS-2 area due to location JLS-2 being the location of maximum detected sediment concentrations of arsenic (24.81 mg/kg-dry, 2-4'), barium (2,353 mg/kg-dry, 2-4'), and zinc (159.1 mg/kg-dry, 0-2'). JLS-2 is also the location of maximum sediment TPH (637 mg/kg-dry, 2-4',sum of TPH aliphatic and aromatic fractions) and total PAH (0.599 mg/kg-dry, sum of PAH). This PAH concentration is well below conservative sediment ecotoxicity screening levels of 1.6 mg/kg-dry (TEC screening value, Buchman, 2008). ERM proposes no remediation at this location for any ecological reason, but a contingent remediation may be performed to address RECAP and 29-B standards if requested by LDNR or LDEQ.

Because JLS-2 is a sediment location, the vegetation survey was performed onshore adjacent to the JLS-2 location. Documented in the vegetation survey were four tree species: bald cypress (*Taxodium distichum*), water tupelo (*Nyssa aquatica*), red maple (*Acer rubrum*) and black willow (*Salix nigra*). All four of these tree species are representative of cypress-tupelo swamps (LDWF, 2010). Understory vegetation includes balloon vine (*Cardiospermum halicacabum*), roundleaf greenbrier (*Smilax rotundifolia*), and rosemallow (*Hibiscus lasiocarpos*), and aquatic vegetation included smooth beggarstick (*Bidens laevis*), common water hyacinth (*Eichhornia crassipes*), common duckweed (*lemna minor*), and water spangles (*Salvinia minima*) (see Appendices B and E). Wildlife observed in this area (in the JLS-2 Area and JLS-11 Area) includes Northern Parula, crawfish, ribbon snake, bees, beetles, grasshoppers, red-bellied woodpecker, lizards, and anoles. The location is supporting vegetation and wildlife and there is not evidence of adverse health effects to the biota from E&P operations. ICON's planned remediation would remove functioning habitat. See Figure 4-A, which shows a photo of the wetland habitat at the JLS-2 vegetation survey location, and see Figure 6, which shows measurements of cypress trees in the ICON planned remediation area, including cypress trees in the JLS-2 Area.

A vegetation survey was performed at sediment location JLS-23 due to the location being included in ICON's planned sediment removal action near the Chevron area of former operation. Metals concentrations at this location are less than at JLS-2, and hydrocarbons are below any ecological levels of concern (See Table 5). Location JLS-23 is on the edge of the canal and the shoreline. Trees growing at the JLS-23 Area include bald cypress trees, cypress saplings, and red maple, all of which are representative of cypress-tupelo swamps in Louisiana (LDWF, 2010). Evidence of wildlife at this location is abundant, including red fox and bobcat scat, owl pellets, and sightings of red-tailed hawk and osprey. Sediment removal in this area would disrupt a habitat that is functioning to protect species and diversity. See Figure 4-A, which shows a photo of the wetland habitat at the JLS-23 Area vegetation survey location, and see Figure 6, which shows the ICON planned remediation area in relationship to measured cypress trees, including cypress trees in the JLS-23 Area.

A vegetation survey was performed in in the JLS-1 area (in the vicinity of former Apache operations), due to it being an area proposed by ICON for sediment remediation. Metals concentrations at this location are less than at the JLS-2 location and TPH concentrations are below any levels of ecological concern (See Table 5). JLS-1 is in the canal so the vegetation survey was performed at the eastern shoreline adjacent to the location. Trees at location JLS-1 Area include juvenile and mature bald cypress trees and black willow trees, which are representative of Louisiana cypress-tupelo swamps (LDWF, 2010). The floating vegetation is dense along the shoreline at JLS-1 Area and is not vegetation that would tolerate elevated salinity. Floating vegetation at this location includes floating marshpennywort, alligatorweed, American frogbit (*limnobium*), smooth beggartick (*bidens laevis*), *salvinia minor*, mosquito fern (*azolla* sp.), anglestem primrose-willow (*ludwigea leptocarpa*), and duckweed (*lemna minor*). ICON's planned sediment removal at this location would destroy mature cypress trees and remove sediments supporting good water quality, as evidenced by the dense and flourishing floating aquatic vegetation. See Figure 4-A, which shows a photo of the wetland habitat at the JLS-1 Area vegetation survey location, and see Figure 6, which shows the ICON planned remediation area in relationship to measured cypress trees in the swamp vicinity of the JLS-1 Area.

A vegetation survey was performed at JLS-3 (west of former Chevron operations area), where ICON is also proposing sediment remediation. JLS-3 metals concentrations in this location are within the range of background concentrations and hydrocarbons are non-detect. Vegetation at the JLS-3 Area is representative of Louisiana cypress-tupelo swamps (LWLF, 2010) and includes bald cypress (mature and juvenile), water tupelo, red maple, honey locust, and lizard's tail (an aquatic species with fidelity to wetlands). See Figure 4-B, which shows a photo of the JLS-3 Area vegetation survey location and aerial photo evidence of a dense cypress-tupelo swamp at the JLS-3 Area location.

A cypress tree survey was performed in the forested swamp adjacent to the canals, where ICON is proposing soil remediation (to meet a cypress tree EC value). Cypress tupelo swamp planned for remediation/removal by ICON includes 40 acres of functioning mature treed swamp. Bald cypress trees are present throughout the soil areas that ICON identified as needing to be restored/removed. ICON's stated rationale for forest removal is to meet an EC value for "bald cypress tree growth". ERM measured 40 bald cypress trees in the area ICON has planned for removal. ICON is proposing to remove cypress trees to grow cypress trees. The diameter of the cypress trees on the Property that we measured range from 2 inches to 66 inches. Seedlings, saplings, and recruitment were observed, along with healthy, mature cypress trees. The cypress tree field study was not an attempt to measure every tree, but an effort to document the presence of mature and reproducing trees in the forested swamp that ICON plans to remove. The field observations indicate that the cypress tree community is thriving, growing, and reproducing. Adverse impacts due to salinity were not observed (see Section 3.2). Removing 40 acres of dense, thriving cypress-tupelo forest for the express purpose of protecting cypress trees is counterproductive and destructive.

ICON also plans remediation of the canal sediment bottoms, in order to protect cypress trees from salt effects. These canal locations include Chevron area locations JLS-2 and JLS-23 and Apache area location JLS-1, and because they are canal bottoms, cypress trees would not grow in these locations. Surface water data for the canals do not show salt impact, as maximum chloride concentration is 27.2 mg/L (see Table 6), which is less than the LDEQ Numerical Criteria for Chloride of 65 mg/L for Drainage Basin Subsegment #010501. Specific conductance in surface water samples ranges from 259 umhos/cm to 271 umhos/cm. ICON's planned remediation of canal sediments for protection of cypress trees from salt is unfounded, based on the fact that water depth in the canals makes it unsuitable for growing trees.

Photographs of wetland habitat are shown on Figures 4, 4-A and 4-B in locations of ICON's planned remediation. Photos of site vegetation from all areas inspected, including photos of cypress trees measured, are shown in Appendix B and an inventory of vegetation and wildlife observed and photographed is shown in Appendix B and Tables 1, 2, and 3.

ICON's planned removal of 40 acres of functioning cypress-tupelo swamp habitat is in direct conflict with society's preference for habitat protection and conservation of earth's resources. The ICON plan is unfounded by any measure: ecological, biological, or toxicological. We have documented that removal of functioning swamp habitat would destroy habitat for Species of Concern, for fish-eating birds, for upper trophic level mammals, and for all levels of the swamp food web. We have provided solid evidence of wetland health in the form of vegetation diversity data that is similar to the diversity of nearby protected areas, cypress tree measurements that are consistent with natural Louisiana cypress populations, and observations of the expected balance of predatory and insectivorous birds in a swamp setting. Adverse health effects have not been observed, and constituent concentrations in soils and sediments are insufficient to result in health effects to native ecological populations (see Section 5.6.1). There is no ecological justification for intrusive excavation and destruction of soils, sediments, surface waters, fish, cypress-tupelo swamp, and wildlife.

3.8 Ecological Observation Summary

The measured lines of evidence presented in this ERA are weighted towards the conclusion that the cypress-tupelo swamp ecosystem on the Property is functioning, including the areas proposed for remediation by ICON. Vegetation at the Property is the expected vegetation for the region (CRMS, 2021; LDWF, 2010; USFWS, Appendix E-2). Avian species were observed that have fidelity to cypress-tupelo swamps. Birds of prey and apex predators that depend on a sufficient diet of mammals and fish were observed, indicating that the top of the food chain is supported by the lower levels of the food chain. The avian community trophic structure is as expected for swamps in the region, with the expected percentages of insectivores, omnivores, and herbivores. Cypress trees in the area that is proposed for remediation by ICON are of expected diameter for the region. No indicators of salt effects (conditions that would be unfavorable for cypress) were observed in the area planned by ICON for remediation. Based on all of these findings, and based on all lines of field evidence, the Property is functioning as a cypress-tupelo swamp wetland and emergent wetlands and there is no evidence that remediation is required. Remediation would disrupt and unbalance a functioning system.

Based on analysis of field observations and data, ecological populations on the Property do not show evidence of adverse impact by oil and gas E&P activities. The Property is biologically diverse and functioning as expected.

4. SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT (SLERA)

4.1 ERA Step 1

This ERA includes a SLERA and a BERA. The SLERA includes Steps 1 and 2 from USEPA (1997) guidance: 1) screening-level problem formulation and ecological effects evaluation, and 2) preliminary exposure estimates and risk calculations. The site-specific BERA includes Steps 3-8 from USEPA (1997) guidance. The SLERA (Section 4) and BERA (Section 5) processes, which are the USEPA eight step process for ERA, are described in the following sections and shown on Figure 7.

4.1.1 Screening Level Formulation

The screening-level portions of an ERA (Step 1 and Step 2) are problem formulation and ecological effects evaluation. At the end of Step 2, the decision is made about whether: 1) risks are negligible or 2) to proceed to a site-specific BERA.

This SLERA focuses on potential chemical stressors in soils on the Property. The term “soil” in this report refers to soils and hydrosoils on the Property. The term “sediment” in this report refers to sediment within the canals on the Property. Soil and sediment data are presented in Table 5 and sample locations are presented on Figure 8. It is appropriate to focus on soils and sediments as the primary pathway of concern for site wildlife (USEPA, 1997). There is no exposure pathway at the Property for contact with groundwater for wildlife or other animals. Groundwater is not in communication with canal surface water (ERM, Angle and Purdom, 2021). Surface water is not an assessed exposure pathway in the ERA due to the low water solubility and the low concentrations of constituents in soils and sediments. Metals concentrations in soil and sediment are low or generally consistent with background, and poorly soluble. Barium at oil and gas E&P sites is typically in the form of barite, which has low solubility in water. Hydrocarbon concentrations (TPH fractions and PAH) in soil and sediment are non-detect or at low concentrations. Additionally, for birds and mammals, surface water uptake (volume) is minor compared to soil and sediment. As such, an investigation of surface water was not warranted. Chloride and specific conductance data in surface water were collected to address plaintiffs’ claims of salt impact (see Table 6). Chloride and specific conductance results were similar at surface water sample locations in Area 2, upstream, and downstream. Chloride concentrations were less than the LDEQ Numeric Criteria for Drainage Basin Subsegment #010501.

Considered in the problem formulation portion of the screening assessment are information on the environmental setting, known contaminants, fate and transport mechanisms on site, ecotoxicity of potential contaminants, likely categories of receptors, complete exposure pathways, and identification of endpoints. Information gathered for Step 1 of the SLERA is discussed in the following sections 4.1.1.1 through 4.1.2.

4.1.1.1 Environmental Setting

The Property consists of multiple tracts approximately 13 miles west/northwest of Pierre Part within the Bayou Pigeon Oil and Gas Field in Iberia Parish, Louisiana (Figure 1). The Property encompasses approximately 3,825 acres in Sections 1, 2, 9, 10, 11, 12, 13, 14, 15, 22, 23, 26 and 27 of Township 12 South, Range 10 East. Much of the area on and adjacent to the Property is identified by the USFWS as freshwater forested wetland (Figure 2). The Property is undeveloped wetlands with portions used for oil and gas E&P operations.

The composition of surface soils underlying the Property is predominantly clay soils based upon the United States Department of Agriculture (USDA) (USDA, 1978 & USDA Web Soil Survey accessed 2021). Soils underlying the Property are Fausse soils, frequently flooded, continuously from December through June. The map unit is composed of 75% Fausse and similar soils and 25% minor components (15% Schriever and 10% Barbary). The soils are high in organic matter, phosphorous, potassium, and calcium, and receive annual deposits of clayey sediment from the Atchafalaya River. Soil boring logs and monitor well construction details document that subsurface soils to a depth of approximately 56 feet below the ground surface (bgs) consist primarily of clays. Within the canal, the shallow subsurface is characterized by soft clayey muck, peat, and wood in the uppermost 20 feet bgs. (ERM, 2021; ICON, 2020).

There is evidence of abundant and diverse wildlife and game animals on the Property, and no evidence of adverse effects on wildlife from E&P activities. Wildlife and signs of wildlife observed on the Property include raccoon, alligator, crawfish, frog, snake, fish, fox, bobcat, coyote, numerous birds, and many other species.

The Property habitat is functioning freshwater cypress-tupelo swamp wetlands and emergent wetlands. It has been alleged by the plaintiffs that E&P activities have left constituents on the Property that are a health risk or a potential health risk to ecological species. The claim made by the plaintiffs is that metals and other constituents such as salts and hydrocarbons have been left on the Property in concentrations that could affect ecological populations. This portion of the ERA is a quantitative hazard quotient (HQ) evaluation of the chemical concentrations in soils and sediments to determine if risk to the wildlife population is predicted.

An Ecological Checklist (Form 18 of RECAP; LDEQ 2003) was completed after my site inspection conducted on November 19, 2020 (Appendix D).

Factors Influencing the Ecological Status of the Property

Dominant factors influencing the ecological status of the Property include the following:

1. Historical hydrology/drainage alterations (canals, ditches, etc.) that capture water and dissolved solids (and subsequent evaporation, transpiration)
2. Proximity to Grand Lake, the Gulf of Mexico, and the Atchafalaya River, as well as regional land elevations and
3. Legacy oil and gas exploration and production and logging

These factors and their influence are discussed briefly below.

Hydrology/Drainage Alterations on the Property

The Property has been altered by construction of canals as well as other levees and drainages in the area. This control of water depth provides access for legacy and tree harvesting as well as exploration and production. This construction has served in general to increase vegetative diversity on the Property. Hydrology/drainage is a factor influencing ecological conditions on the Property.

Proximity to Grand Lake and the Gulf of Mexico as well as Regional Land Elevations

The Property is located south of Grand Lake and north of the Gulf of Mexico. These waters serve as a source of wildlife in the area (migratory birds, etc.). The Property is relatively low elevation and is subject to flooding and inundation transporting to the Property any materials that the floodwaters may carry. Much of Iberia Parish is subject to storm surge from hurricanes in the Gulf of Mexico as well as flooding by rainfall from tropical storms. For example, Hurricane Andrew made landfall at Point Chevreuil, Louisiana, on August 26, 1992, at approximately 3:30 a.m. The hurricane produced a storm tide that affected much of the Louisiana coastline, including many coastal waterways and lakes hydraulically connected to the coast. In Iberia Parish the storm surge was more than 4 to 7 feet. Wind can also cause major changes in water movement and stage in a relatively short period of time and floods caused by winds have been recorded in Iberia Parish. Recent hurricanes severely affecting Iberia Parish included Hurricanes Katrina and Rita, which occurred August 29 and September 24, 2005, respectively. Important to the area around the Property is the water storage that the wetlands on the Property provide. Water storage on the Property has produced some open water areas or habitat and herbaceous wetlands.

Legacy Oil and Gas Exploration and Production and Logging on the Property

Oil and gas exploration and production occurred on the Property in the vicinity of the Chevron well beginning in about 1958 and in the vicinity of the Apache well beginning in about 1983. The Property in this case consists of approximately 3,825 acres. In order to accommodate this activity, canals, and facilities were constructed. The construction helped to produce some of the habitat and species diversity observed on the Property. Logging activities have served to alter vegetation on the Property.

4.1.1.2 Contaminant Fate and Transport

The primary transport mechanisms on site are surface runoff and erosion (soil) and surface water transport (sediment). The effects of these mechanical actions are assessed in this ERA through chemical analyses of soils and sediments and surveys of vegetation and wildlife populations. Contaminant fate and transport due to soil chemical and physical properties is discussed in Section 4.2.3.1.

4.1.1.3 Ecotoxicity of COPECs

Ecotoxicity of COPECs on the Property has been investigated beginning with collecting soil and sediment samples (Table 5). The COPECs screened in this level of assessment are arsenic, barium, cadmium, chromium, lead, silver, strontium, selenium, mercury, zinc, TPH, and PAH. The potential for these COPECs to cause adverse effects to survival, growth, or reproduction in ecological receptors only exists if the COPECs are: 1) present and bioavailable in toxic concentrations, 2) a complete exposure pathway exists, and 3) exposure occurs.

For the screening portion of this ERA, soils were compared to conservative (protective) NOAA Screening Quick Reference Tables (SQuiRT) Freshwater Threshold Effects Concentration (TEC) sediment screening values (Buchman, 2008) and USEPA Eco-SSL soil values (USEPA, 2005a, 2005b, 2005c, 2005d, 2005e, 2006, 2007b, 2007c, 2008). These screening values are protective of mammals, birds, invertebrates, and plants, and the lowest amongst these values was used for comparison to soil and sediment concentrations. It should be noted that screening values are used to ensure that risk is not overlooked and that all potential constituents that may contribute to risk are evaluated. Soils and sediment in Area 2 were grouped as “Former E&P Area” and “North-South Canal Area” (see Figure 8). The “Former E&P Area encompasses the locations of former Chevron and Apache operations.

4.1.1.4 Potential Receptors and Routes of Exposure

The receptors selected to represent communities or populations on the Property are ones that represent the species that are present or could potentially be present in the habitat of interest. The representative receptors and routes of exposure used to estimate risk are ones for which there is sufficient ecotoxicity information available. Exposure is assessed via ingestion of COPECs through exposure to soil/sediment. This exposure pathway (soil/sediment) and exposure route (ingestion) is supported as appropriate for ERA per USEPA guidance (1997). The receptors used in this risk assessment are described in the following sections.

4.1.1.5 Wildlife (Vertebrates)

Wildlife includes four classes of vertebrates living organisms in their natural habitats: amphibians, reptiles, birds and mammals. Because these vertebrates are not domesticated, they are included in the general category of wildlife.

Vertebrate wildlife are consumers that can be assessed through estimates of COPEC doses in their diets. Wildlife are exposed to COPECs via ingestion of other organisms, soil/sediment, or water. Other pathways of wildlife COPEC exposure include dermal and inhalation. Generally, wildlife are protected by their fur or feathers from excessive dermal exposure to COPECs, therefore the dermal pathway is not included in the risk assessment. The inhalation pathway is also not included in the risk assessment, due to limited concentrations of COPECs with potential for volatilization. Therefore, this risk assessment is focused on the ingestion pathway, per USEPA guidance (1997).

Specific wildlife species, based on their feeding behaviors have been selected to be evaluated as representatives of larger wildlife communities. Mammals and birds are used as the representative wildlife species, because more toxicity data is available for these vertebrates, as compared to reptiles, fish, and amphibians.

4.1.1.6 Invertebrates

The invertebrate population exists in and on soils and sediments. The invertebrate populations include organisms such as worms, crustaceans, gastropods, arthropods, and mollusks. These organisms function in the ecosystem to digest and degrade other biologic matter and to provide a diet for larger invertebrates and vertebrates. Because they are in direct contact with soils and sediments due to their lifestyles, they are dietary sources of COPECs to higher vertebrates.

4.1.1.7 Nektonic Aquatic Species

Nektonic aquatic species are larger swimming organisms such as vertebrate fish and reptiles. Nektonic species include vertebrates such as fish, alligators, and snakes. Nektonic species are assessed qualitatively in this ERA by field observations. For example, the Property avian population is 75% tertiary (upper trophic level) consumers, which is expected in a swamp population that depends in a large part on a fish diet. This observation of the avian trophic level that depends on fish is evidence of a sufficient fish diet to support the observed wetland bird population. Examples of fish-eating birds observed at the Property include bald eagle, osprey, anhinga, belted kingfisher, black-crowned night-heron, great blue heron, great egret, little blue heron, and the snowy egret. ERM observed nektonic species during field investigations, including alligators, cottonmouth snake (*Agkistrodon piscivorous*), and fish. Also evidence of appropriate water quality for nektonic species are the measured chlorides data demonstrating low salinity of surface water, appropriate for freshwater fish and reptiles.

4.1.1.8 Plants

Plant communities including graminoids, forbs, herbs, vines, shrubs, and trees are present as expected on the Property. The plants are primary producers and form the base of the food chain by converting the sun’s energy to the carbohydrate energy that other invertebrates and vertebrates use. In this risk assessment, the plant population has been assessed through a vegetation survey at locations of former operations (Section 3.8) and through a cypress tree study presented in Section 3.2.

4.1.1.9 Exposure Pathways and Conceptual Site Model

A Conceptual Site Model (CSM) has been developed to evaluate potential ecological exposure pathways at the Property (Figure 9). A CSM (USEPA, 1997) addresses: (1) the environmental setting and COPECs at the Property; (2) COPEC fate and transport mechanisms; (3) mechanisms of ecotoxicity and likely categories of ecological receptors; (4) complete exposure pathways; and (5) selection of endpoints to screen for ecological risk.

The potentially complete exposure pathways at the Property are through shallow surface soil and sediment. The biologically active zone of soils at the Property is assumed to be from ground surface to three feet deep (LDEQ, 2003). To be inclusive of 0-3' data, soil samples collected in the 0-2' and 2-4' depth intervals were included in the evaluation. The depth of 0-3' includes the effective root zones of dominant trees on the Property of up to 20 inches (Holloway and Ritchie, 2021) and the potential burrowing depth for animals on the Property such as crawfish (approximately 28 inches, USEPA 2015).

For sediments, recommended depths from USEPA and LDEQ/LDNR were considered for the biologically active zone. The USEPA (2015) recommends a depth for the biotic zone in lentic profunal mud habitats, similar to the canal sediment bottoms on the Property, of approximately 7.9 inches (USEPA 2015). LDEQ and LDNR recommend biologically active zones for sediments in the top 0-24" (EWL Most Feasible plan, 2016).

As a conservative measure, both soils and sediments of 0-3 feet deep (LDEQ, 2003) were evaluated, since ICON's proposed remediation extends to depths beyond the biologically active zone. It should be noted that that depth of 0-3' used in this ERA for sediments is significantly deeper than the recommended USEPA (2015) depth of 7.9" for low energy canal sediment bottom habitats, and is also deeper than the 0-24" recommended by LDNR/LDEQ.

4.1.2 Effects Evaluation

Following the screening level problem formulation is a preliminary evaluation of ecological effects. Ecological effects are estimated using thresholds values for soil and sediment that are referred to as ESVs. ESVs are COPEC concentrations that are estimated to pose no risk of adverse effects to exposed wildlife. The screening level values are not used as predictors of the occurrence of ecotoxicity, but rather to protectively include all potential COPECs in the risk assessment.

The ESVs used in the SLERA are based on field studies or laboratory studies in which no adverse effects were observed. The ESV is therefore based on the highest observed exposure concentration that does not produce adverse effects. This "no observed adverse effect level" is referred to as the NOAEL. ESVs can also be based on a LOAEL, which is the lowest observed adverse effect level shown to produce adverse effects (reduced growth, impaired reproduction, increased mortality) in a receptor species. Therefore, the ESV is a dose or a concentration at or below which risk is not expected to occur.

The fact that an ESV is exceeded does not indicate the need for remediation or that there is ecological risk. ESVs are not site-specific and are intended to be overly protective. When ESVs are exceeded, a more specific ecological risk analysis can be performed. A concentration that exceeds a soil screening level (SSL) does not identify that there is risk or that there are soil concentrations that require remediation. Screening is the process of identifying and defining areas, contaminants, and conditions that do not require further attention. When COPEC concentrations fall below screening values, no further action is needed. When COPEC concentrations exceed ESVs, further evaluation is valuable, but the need for remediation is not assumed.

For the initial screening assessment in this ERA, conservative (protective) screening thresholds for soils such as USEPA SSLs (USEPA, 2005a, 2005b, 2005c, 2005d, 2005e, 2006, 2007b, 2007c, 2008; USEPA Eco-SSLs) and National Oceanic Atmospheric Administration (NOAA) freshwater sediment TECs (Buchman, 2008) for COPECs present in soil and sediment are used. The limitations of the use of screening values has been discussed by the National Research Council (2003). The screening values used for this ERA are based on ecotoxicity studies of plants, birds, invertebrates, and mammals (Inset Table 4-1).

Table 4-1: Ecological Screening Values

Constituent	Eco-SSL Avian USEPA	Eco-SSL Mammal USEPA	Eco-SSL Invertebrate USEPA	Eco-SSL Plant USEPA	TEC NOAA
Arsenic	43	46	N/S	18	9.79
Barium	N/S	2000	330	N/S	N/S
Cadmium	0.77	0.36	140	32	0.99
Chromium	26	34	N/S	N/S	43.4
Lead	11	56	1700	120	35.8
Mercury	N/S	N/S	N/S	N/S	0.18
Selenium	1.2	0.63	4.1	0.52	N/S
Silver	4.2	14	N/S	560	N/S
Strontium	N/S	N/S	N/S	N/S	N/S
Zinc	46	79	120	160	121

Notes:
Concentrations are in mg/kg dry weight.
The Soil ESV is the lowest of the Eco-SSLs, and freshwater sediment TEC.
The Sediment ESV is the freshwater sediment TEC.

4.2 ERA Step 2

4.2.1 Screening Level Exposure Estimates

The exposure assumptions used in the SLERA are intentionally overprotective. In the SLERA, receptors are assumed to be exposed to the maximum COPEC concentrations detected in soil samples and that the home range of ecological receptors is 100% on the Property, rather than elsewhere. All COPECs are assumed to be 100% bioavailable to receptors. The receptor diets are assumed to be 100% comprised of the most contaminated food source. By making these overly protective assumptions, the exposure estimates are skewed towards over-predicting risk in the SLERA. The SLERA evaluation identifies COPECs that require no further investigation and identifies COPECs that should be carried forward into the BERA.

Soil concentrations in Area 2 are reported to depths 48 feet below ground surface (bgs) and canal sediment concentrations are reported to depths 26 feet bgs. Per LDEQ RECAP (2003), soil results (0-3 feet bgs) are included in the ERA. Canal sediment results in the top 0-24” should be included in ERA, per precedent set by LDNR and LDEQ (EWL Most Feasible Plan, 2016). For this ERA, maximum soil and sediment COPEC concentrations from the 0-4 feet bgs have been used (Inset Table 4-2), in order to be inclusive of both the 0-3’ depth and the 0-24” depth. This approach (0-4’) is conservative for sediment at the bottom of a canal that will only have biological activity to an approximate depth of 7.9 inches (USEPA, 2015). Soil and sediment concentrations are summarized on Table 5 and are shown on Figures 10 through 13.See Section 4.1.1.9 for discussion of sampling depth.

Maximum detected soil metal concentrations on the Property are within the range of typical soil concentrations in Louisiana in unimpacted soils and are also below conservative ESVs (USGS, Smith, 2013; Appendix G and Inset Table 4-3). Therefore, soils, which are in the forested area adjacent to the canals, are not carried forward into the BERA. Maximum sediment metal concentrations on the Property are low and most are below conservative sediment screening values. Canal sediments are carried forward into the BERA for arsenic, barium, and zinc, based on minor exceedances of ESVs (Inset Table 4-3).

Table 4-2: Maximum Reported Concentrations by Area and Matrix

Matrix	Constituent	Maximum Reported Concentration (mg/kg dry)	Location (depth feet bgs)	Sample Date
Former E&P Area				
Soil				
	Arsenic	10.7	JLS-11 0-4'	7/30/2020
	Barium	572	JLS-12 0-4'	8/3/2020
	Cadmium	0.696	JLS-11 0-4'	7/30/2020
	Chromium	20.4	JLS-12 0-4'	8/3/2020
	Lead	21	JLS-12 0-4'	8/3/2020
	Mercury	<0.102	JLS-11 0-4'	7/30/2020
	Selenium	NA	JLS-11 0-4'	7/30/2020
	Silver	NA	JLS-11 0-4'	7/30/2020
	Strontium	125	JLS-11 0-4'	7/30/2020
	Zinc	84.1	JLS-12 0-4'	8/3/2020
Canal Sediment				
	Arsenic	24.81	JLS-2 2-4'	5/26/2020
	Barium	3220	JLS-2 0-2'	2/8/2021
	Cadmium	0.929	JLS-2 2-4'	5/26/2020
	Chromium	35.28	JLS-1 0-2'	5/26/2020
	Lead	34.6	JLS-2 2-4'	5/26/2020
	Mercury	0.0958	JLS-2 2-4'	5/26/2020
	Selenium	<31.82	JLS-23 2-4'	9/8/2020
	Silver	<2.041	JLS-2 0-2'	5/26/2020
	Strontium	149	JLS-2 2-4'	5/26/2020
	Zinc	159.1	JLS-2 0-2'	5/26/2020
North-South Canal Area				
Soil				
	Arsenic	8.83	JLS-14 2-4'	8/5/2020
	Barium	222	JLS-17 0-4'	8/7/2020
	Cadmium	0.742	JLS-14 2-4'	8/5/2020
	Chromium	19.4	JLS-17 0-4'	8/7/2020
	Lead	19.7	JLS-17 0-4'	8/7/2020
	Mercury	0.119	JLS-16 0-4'	8/6/2020
	Selenium	NA	NA	NA
	Silver	NA	NA	NA
	Strontium	46.6	JLS-15 0-4'	8/6/2020
	Zinc	78.6	JLS-14 2-4'	8/5/2020

Table 4-3: Soil and Sediment Screening Values for Estimation of Potential Ecological Risks

Constituent	Soil Ecological Screening Value	Background USGS	Screening Comparison			
			Former E&P Area		North-South Canal Area	
			Soil Concentration [Maximum Value]	Screening Exceedance [Y/N]	Soil Concentration [Maximum Value]	Screening Exceedance [Y/N]
Arsenic	18	12[a]	10.7	N	8.83	N
Barium	330	775	572	N	222	N
Cadmium	0.36	0.8	0.696	N	0.742	N
Chromium	26	84	20.4	N	19	N
Lead	11	44	21	N	20	N
Mercury	0.18	0.11	<0.102	N	0.119	N
Selenium	0.52	1.0	NA	N	NA	N
Silver	4.2	ND	NA	N	NA	N
Strontium	N/S	203	125	N	46.6	N
Zinc	46	140	84.1	N	78.6	N

Notes:
Concentrations are in mg/kg dry weight.
Soil Ecological Screening Value is the lowest of the USEPA Eco-SSLs and NOAA TEC.
Background, USGS: Background Data for Louisiana, 95% Upper Tolerance Limit, United States Geological Survey.
[a] Arsenic value is LDEQ-approved background for Louisiana.

Constituent	Sediment Ecological Screening Value	Screening Comparison	
		Former E&P Area	
		Sediment Concentration [Maximum Value]	Screening Exceedance [Y/N]
Arsenic	9.79	24.81	Y
Barium	N/S	3220	Y
Cadmium	0.99	0.929	N
Chromium	43.4	35.28	N
Lead	35.8	35	N
Mercury	0.18	0.0958	N
Selenium	N/S	<31.82	N
Silver	N/S	<2.041	N
Strontium	N/S	149	N
Zinc	121	159.1	Y

Notes:
Concentrations are in mg/kg dry weight.
Sediment Ecological Screening Value is the NOAA TEC.

4.2.2 Screening Level Risk Calculations

The HQ is used to estimate risk in the SLERA (USEPA, 1997). The HQ is estimated by comparing ESVs to exposure concentrations. The HQ is defined as the estimated environmental concentration (EEC) divided by the ESV:

$$HQ = EEC / ESV$$

The EEC is the maximum dry weight concentration detected in soil in mg COPEC/kg soil. The ESV represents the concentration below which no risk is predicted. For HQ values that exceed 1.0, the potential for adverse effects to a receptor cannot immediately be ruled out. For HQs equal to or less than 1.0, the potential for risks due to that COPEC can be considered minor and are dropped from further consideration. An HQ >1.0 does not mean that unacceptable ecological risks exist or that any remediation is needed, only that further analyses, such as a site-specific BERA, are needed.

The screening level HQs calculated by comparison of maximum canal sediment concentrations to screening values are presented in Inset Table 4-4. Appropriate sediment screening values are not available for strontium. Strontium in sediment was not carried forward in the risk assessment, due to a lack of ecological toxicity information. At this level of the screening assessment, two metals in canal sediment have HQ values greater than 1.0, and can be carried forward into the BERA: arsenic and zinc. Barium does not have a sediment screening value. Because it is generally associated with E&P activity, barium was retained as a COPEC for the BERA. No soil metals concentrations exceed screening levels, and soils are not carried forward into the BERA.

Table 4-4: COPEC Screening Hazard Quotients using Maximum Canal Sediment Concentrations

Constituent	Canal Sediment Concentration [Maximum Value] (mg/kg dry)	Location (depth feet bgs)	Lowest Ecological Screening Value (mg/kg dry)	Screening Hazard Quotient (HQ) [Based on Lowest ESV]
Arsenic	24.81	JLS-2 2-4'	9.79	2.5
Barium	3220	JLS-2 0-2'	NA	NA
Zinc	151.9	JLS-2 0-2'	121	1.3

4.2.3 Risk Characterization

Risk characterization combines data for exposures and effects into a statement about risk. If screening values are not exceeded, no risk exists due to COPEC exposures on the Property, and if screening values are exceeded, a more detailed and focused site-specific ecological risk analysis can be initiated. The term site-specific refers to data that is collected from the site to characterize the environmental conditions present. Examples of site-specific data collected by ERM for this ERA include soil and sediment chemical concentration data, site vegetation species counts, tree root studies, cypress tree measurements, surface water chlorides data, site-specific observations for salinity indicators, ecosystem services assessments, and recorded observations of site wildlife. These site-specific data support the conclusions made in the BERA.

An important part of risk characterization is based on COPEC bioavailability. Factors controlling bioavailability of COPECs in soils/sediments are discussed in the following sections.

4.2.3.1 Metals

Metals bioavailability is generally minimal in wetland settings due to physical and chemical properties of native wetland soils and sediments. The soils and sediments themselves, along with bacterial action, serve to detoxify chemicals introduced into the soils and sediments. Sediments at the Property are high in clay content, have high cation exchange capacity, and are high in moisture content. These characteristics are key in the role that wetlands play in sediment quality and in limiting bioavailability to plants and animals. A discussion of metals bioavailability for arsenic, barium, and zinc (metals in the BERA) follows in the next few paragraphs.

Arsenic

Arsenic is present naturally in soils and sediments throughout Louisiana (LDEQ 2001). In wetlands, arsenic is typically associated with sulfide mineral deposits or bound to iron oxyhydroxides (Henke, 2009; Rahman et al., 2006). Wetlands facilitate arsenic sequestration by accommodating the necessary biogeochemical conditions, including sediment redox potential, dissolved oxygen (DO) concentration, and pH (Dorman et al., 2009; Eggert et al., 2008; Spacil et al., 2011). Wetlands promote co-precipitation and sorption of arsenic with iron oxyhydroxides under oxidizing conditions, and precipitation of arsenic with sulfide and co-precipitation of arsenic with iron sulfide under reducing conditions. The biogeochemistry at the Property supports the sequestration of arsenic into non-bioavailable forms.

Barium

Based on the conditions present at the Property and analytical results, barium in soils and sediments is in the form of barite (barium sulfate; BaSO4). Barite has low water solubility (i.e. <0.003 g/L) compared to other forms of barium (greater than 87 g/L; Menzie et al. 2008). Barium exposures in sediments on this Property are not of concern because the barium at the site is barite which is of very low bioavailability (Menzie et al. 2008, Alberta Environment 2009). Barium is an alkaline earth element with a molecular weight of 137.36. Barium ions adsorb on clay particles and organic matter, and readily combine (in seconds to minutes) with sulfates to form barite. The concentrations of sulfate in waters of the Mississippi River (30-50 mg/L, Lin and Morse 1991) and surrounding waters are more than sufficient to ensure formation of barium sulfate and lack of bioavailability. Barite is non-toxic to mammals, birds, and aquatic invertebrates (Khangarot et al. 2009; Boyd et al, 1966; Brown et al., 2014; Silverman et al.; 2010, Kubiak, 2012). Barium is of low bioavailability in soil (Engdahl et al., 2008; Cappuyns, 2018; USGS, 2002; Environment International Ltd., 2010) and is not a physical or chemical toxin to ecological species inhabiting the Property (Kuperman et al., 2006). In the case of barium from produced water, some barium may initially be available when the water is produced, but will quickly bind sulfate once the formation water enters the environment (Neilsen, 1958). Barium sulfate is non-toxic in soil, sediment, and surface water due to very low water solubility and very strong affinity between barium and sulfate molecules. The strong attraction for barium to sulfate in the natural environment leads to the preferential and rapid formation of non-toxic barium sulfate in soils and sediments, rather than formation of other barium compounds (Alberta, 2009). The area on the Property containing barium in sediments or soils measured above typical Louisiana unimpacted soils is a relatively small area of the Former E&P Area of operation. There is no evidence of accumulation of barium by any species or harm due to barium on the Property, and no adverse effects due to barium on the Property are present.

Zinc

Under reducing wetland environments, zinc can be reduced to an insoluble sulfide form (ZnS, pK = 24.7). Zinc is readily precipitated with sulfide, forming insoluble sulfide species that are relatively non-bioavailable (Brookings 1988; Gillespie et al., 1999; Gillespie et al., 2000). In aerobic conditions, zinc is mostly immobile, but under acidic oxidizing conditions, zinc can form soluble and mobile species of Zn. In higher pH ranges (pH 8-11), Zn (II) combines with calcium and magnesium carbonates to form co-precipitants (hydroxyl-carbonates; Stuum and Morgan 1996). In wetlands, Zn is primarily associated with insoluble sulfides, and minimally retained in plants (Gillespie et al., 1999; Gillespie et al., 2000). Based on the conditions present on the Property, the bioavailability of zinc is likely minimal.

4.2.3.2 Total Petroleum Hydrocarbons and Polycylic Aromatic Hydrocarbons

TPH measurements are not reliable for prediction of ecotoxicity. TPH is a measure of the mass of hydrocarbon compounds in soils within a certain molecular weight range, but individual compounds are not identified in TPH analysis. TPH concentrations are not reported as particular compounds with specific toxicity to ecological species. Specific toxicity values or risk cannot be calculated based on soil TPH concentration, and EPA and LDEQ have not developed TPH toxicity values to be used in ERA.

TPH concentrations in soil and sediment may be useful for determining the extent of these constituents on the Property and the locations of the greatest concentrations. Identification and quantification of specific fractions of TPH can be used to determine the composition, weathering, and potential for toxicity. Definitive and reliable scientific values for TPH for higher tier ERA have not been developed.

TPH and PAH concentrations on the Property are low. For example, the TPH concentration at JLS-1 (2-4’) is 419 mg/kg-dry (Prelim Eco AOI-2), which is below literature values of ecological concern. PAH concentrations at the Property are low and range from ND to 0.599 mg/kg-dry. PAH are the components of TPH that have been identified in the scientific literature to pose the highest risk of ecotoxicity (Edwards, 1997). PAHs on the Property are non-detect or very low (below levels of ecological concern) where maximum concentrations of TPH were measured, and this supports a conclusion of no ecological risk due to TPH on the Property. For example, at the location of maximum detected total TPH (637 mg/kg-dry, JLS-2, 2-4’), the total detected PAH are 0.599 mg/kg-dry at 0-2’ and 0.203 mg/kg-dry at 2-4’ (sum of 16 RECAP PAH), which is well below the conservative total PAH ESVs, of 1.6 mg/kg-dry (Buchman, 2008). PAH samples at MW-1, MW-2, and MW-3 (see Figure 13) used to delineate Prelim Eco AOI-1 (which includes JLS-2, location of former Chevron E&P operations) are non-detect or less than 0.04 mg/kg-dry. This is as expected for weathered hydrocarbons that have aged for more than a decade and supports the conclusion of no ecological risk associated with the weathered TPH and PAH hydrocarbons on the Property.

5. BASELINE ECOLOGICAL RISK ASSESSMENT (BERA)

5.1 ERA Step 3

Based on the results from Step 2 of the USEPA (1997) ERA process, the following COPECs on the Property exceed conservative screening values and are retained for further investigation in the BERA: arsenic, barium, and zinc in canal sediments.

At the conclusion of Step 2, a Scientific Management Decision is made to either proceed to a site-specific BERA or to end the risk assessment at the screening level (USEPA, 1997). Based on the screening results, the Scientific Management Decision at the conclusion of Step 2 is to proceed to a site-specific BERA for sediment concentrations only. All soil concentrations are below screening values and do not require further assessment.

The BERA is a site-specific ecological evaluation based on the chemical forms of constituents present, the extent and concentrations of COPECs, the ecotoxicity of chemical species, and complete exposure pathways. The BERA assesses potential toxicological impacts to ecological populations using indicator or surrogate species.

In the BERA, site-specific data is evaluated. The bioavailability of COPECs is evaluated along with fate and transport, potential for bioconcentration, bioaccumulation, and biomagnification in the food chain. Indicator species are selected to assess ecotoxicity of COPECs. To select appropriate indicator species, trophic level relationships and the physical structure of the habitat are considered. The toxicity endpoints used in this stage of the risk assessment are values based on mortality, reproduction, or growth.

In order to assess toxicity via ingestion exposure in a variety of animal populations, several indicator species are required. The following factors are considered in the species selection process: 1) ecological relevance to site, 2) vulnerability to exposures, 3) sensitivity to toxic effects of COPECs, 4) social and economic importance, 5) protected species status, and 6) availability of species-specific toxicological information.

The following avian and mammalian indicator species were selected for the site-specific BERA: 1) American Robin, 2) Spotted Sandpiper, 3) Mallard Duck, 4) Snowy Egret, 5) Bald Eagle, 6) Least Shrew, and 7) American Mink. The following sections discuss the lifestyle of these species.

5.1.1 American Robin (Turdus migratorius)

American robins are common birds across the continental United States as well as Louisiana. These robins are both numerous and widespread, and American robin populations are stable or increasing throughout their range. Morphometrically, American robins vary somewhat over the ecoregions that they occupy. Typical life span of robins is about 2-3 years. Robins adapt to a variety of nesting and breeding habitats. Robins move in response to factors such as temperature, food availability and predation. With the onset of winter, robins generally move to moist woods where berry-producing trees and shrubs are common.

American robins are well adapted to living near people and populated areas and they can be observed foraging on lawns although they eat a lot of fruit in fall and winter. Food for American robins consists largely of both invertebrates and fruit with their digestive system modified to readily accommodate either food source. Particularly during spring and summer months, robins eat mostly earthworms as well as insects and some snails. During the fall months, robins eat a variety of fruits, including chokecherries, pin cherries, hawthorn, dogwood, and sumac fruits, as well as juniper berries. There is a suggestion in the peer reviewed literature that robins may try to augment their diet by selectively eating fruits that have insects in them.

References:

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5.1.2 Spotted Sandpiper *(Actitis macularius)*

Spotted sandpipers are widely distributed in Louisiana, and this bird has an unusual breeding system for birds -- polyandry (one female mating with more than one male bird). Spotted sandpipers have successfully occupied temperate areas for breeding. Polyandry is a successful reproductive strategy for taking advantage of the relatively long breeding season in temperate areas (compared with the breeding season in the arctic and subarctic areas used for breeding by most spotted sandpipers and related species of birds). Spotted sandpipers have been characterized as a "pioneering species" with related attributes: rapidly and frequently colonizing new sites, emigrating in response to reproductive failure, breeding at an early age, living a relatively short time (breeding females live an average of only 3.7 years), laying many eggs per female per year, and having relatively low nesting success.

Spotted sandpipers feed by probing, stalking and gathering insects. They also catch some insects on the wing. Spotted sandpipers wade in relatively shallow water and forage on sediment biota. Spotted sandpipers mostly eat insects, including beetles, crickets, dipterans, grasshoppers, midge larvae, and ants. If available, Spotted sandpipers will also eat small fish and aquatic invertebrates. Spotted sandpipers typically migrate for breeding season and their migration usually occurs at night.

References:

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5.1.3 Mallard Duck *(Anas platyrhynchos)*

In Louisiana, mallards are abundant and well recognized ducks. In comparison with other ducks, mallards are relatively large, dabbling ducks with broad wings. The male mallard's characteristic and conspicuous green head, grey flanks, and black tail-curl make it readily identifiable. The female mallard (hen) is marked in a mottled pattern of light and dark brown streaks with a dark brown streak through the eye. Both male and female mallards have a violet-blue speculum on their wings. Mallards have excellent eyesight and hearing, often providing the duck an escape opportunity when a predator approaches. The mallard is more vocal than most other ducks and uses a variety of sounds to communicate its actions and moods. Mallards are popular game birds and source of food for hunters.

The majority of mallard populations are migratory in North America. Beginning in the fall of the year, mallards leave nesting sites in the north and fly as far south as northern Mexico. Factors that influence the mallard's range or alter its patterns include human interference, habitat and food quality and abundance, and lack of a mate. Mallards are multivores and opportunistic feeders. They consume insects and aquatic invertebrates, acorns, seeds, tubers and vegetative parts of aquatic plants, as well as crops, such as corn, soybeans, rice, barley, and wheat.

References:

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Johnson, W.P. and F.C. Rohwer. 2000. Foraging behavior of green-wing teal and mallards on tidal mudflats in Louisiana. Wetlands 20: 184-188.

Nichols, J.D. et al. 1983. Factors affecting the distribution of mallards wintering in the Mississippi alluvial valley. The Auk 100: 932-946.

Tamisier, A. 1976. Diurnal activities of the green-wing teal and pintail wintering in Louisiana. Wildfowl 27: 19-32.

5.1.4 Snowy Egret *(Egretta thula)*

The snowy egret is a common wading bird in Louisiana. It ranges widely in search of food in shallow waters. The snowy egret has been described as a "dashing hunter" by ornithologists because this wading bird employs a gated walking technique that is successful in flushing small prey items in the shallow aquatic habitats where they forage. The snowy egret's black legs and yellow feet have been suggested to aid in pursuit of food as the bird wades in shallow water. Small fish are normally prey items for the snowy egret. However, farmers raising crayfish have indicated that crayfish are also a preferred food item.

Snowy egrets nest in colonies in vegetation in somewhat isolated places, such as wetlands, marshes, swamps and even elevated areas. The rookeries and resting sites often change location from year to year. During their breeding season, snowy egrets feed in areas that provide a ready source of prey items. Snowy egrets generally spend the winter months in more protected areas conserving energy.

The diet of the snowy egret consists largely of aquatic animals, including fish, frogs, worms, crustaceans, and insects. These birds use their feet to probe in sediments to find prey items that they secure with their bill. During their feeding activities, snowy egrets may exhibit a variety of behaviors that assist in successful acquisition of prey items. For example, they may stalk prey in shallow water, often running or shuffling their feet, flushing prey into view, as well "dip-fishing" by flying with their feet just above the water. Snowy egrets may also stand still in order to ambush prey, or hunt for insects mobilized up by domestic animals in open fields.

References:

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Kushlan, J.A. 1976. Feeding behavior of North American herons. The Auk 93: 86-94.

5.1.5 Bald Eagle (Haliaeetus leucocephalus)

Bald eagles are iconic birds that are becoming more widely established in Louisiana in recent years. Distinguished by their white head and tail feathers, bald eagles are powerful, brown birds that may weigh as much as 14 pounds and have a wingspan of approximately 8 feet. Male eagles are smaller, weighing up to 10 pounds and have a wingspan of about 6 feet.

Bald eagles require a good food base, perching areas, and nesting sites. Their preferred habitat includes estuaries, large lakes, reservoirs, rivers, and some coastal areas. In winter, bald eagles congregate near open water in tall trees for spotting prey and in night roosts for sheltering. In Louisiana, bald eagles live near water resources such as rivers, lakes, and marshes where they can find fish. Although bald eagles feed primarily on fish, they will also feed on waterfowl, turtles, rabbits, snakes, and other small animals as well as carrion.

Bald eagles usually mate for life, choosing the tops of large trees to build nests, which they typically use and enlarge each year. Nests may be as large as 10 feet across and weigh as much as 1000 pounds. Bald eagles travel great distances but usually return to breeding grounds within 100 miles of the place where they were raised. Breeding bald eagles typically lay one to three eggs each year, and the eggs hatch after about 35 days. The young bald eagles are flying within three months and are on their own about a month later. However, disease, lack of food, bad weather, or human interference can kill many eaglets. Recent studies show that approximately 70 percent survive their first year of life. Bald eagles may live up to 15 to 25 years in the wild.

References:

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5.1.6 Least Shrew (Cryptotis parva)

The least shrew (Cryptotis parva) is one of the smallest mammals in Louisiana. It has dense fur that is usually grayish-brown or reddish-brown with a white belly. The least shrew's eyes are relatively small and its ears are completely concealed within its short fur, resulting in very poor eyesight and hearing.

The least shrew occupies habitat from the grasslands of southern Canada through the eastern and central United States and Mexico. The least shrew mostly inhabits grasslands, marshes, and meadows. They generally prefer somewhat wet habitats, but least shrews also live in dry upland regions. A key aspect associated with distribution of least shrews is the presence of vegetation that attracts insects, which are the preferred food for this species.

The least shrew is a relatively active animal with some movement during daylight hours, but they are most active at night. The least shrew digs through loose soil and leaf litter on the ground surface for its prey. These small mammals hunt by smell and tactile stimuli. The diet of the least shrew consists mostly of small insects and other animals, such as caterpillars, beetle larvae, earthworms, centipedes, slugs, and sow bugs. Least shrews will also feed on the corpses of dead animals, and consume small amounts of seeds or fruits. Generally, the least shrew eats its prey whole, but when eating crickets and grasshoppers, they will bite off the head of its prey and eat only the internal organs. When engaging larger animals, least shrews usually attack the legs and try to cripple its adversary. In pursuing lizards, which are often too large for the least shrew to kill, they will bite the lizard’s tail, which then falls off (tail autonomy) and provides the shrew with a meal while the lizard escapes. The North American least shrew will also sometimes consume bees by living in beehives and eating larvae.

References:

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McCay, T.S. 2001. Blarina carolinensis. Mammalian Species, American Society of Mammalogists. 1-7.

5.1.7 American Mink *(Neovison vison)*

The fur of American mink is usually deep brown or black in color, although they also have white markings on their chests as well as some other parts of their bodies. These smooth-furred mammals have short limbs, slender bodies, tiny ears and lengthy necks. Adult males range in total length from 19 to 29 inches and females can grow to lengths of 18 to 28 inches. American mink males are approximately twice the size of females.

American mink inhabit much of Canada and the United States, although they have not colonized a few states and regions like Arizona and Hawaii. These nocturnal mammals usually inhabit forested areas, especially those that are near water sources including ponds, rivers, marshes and swamps. American mink often use rocks and hollow logs for denning purposes.

American mink are primarily carnivores. Mink will generally eat almost any prey item that they can catch and kill, including fish, birds, bird eggs, insects, crabs, clams, and small mammals. Food items that are preferred by American mink include rabbits, chipmunks, ducks, birds, snakes, mice, shrews, frogs, muskrats and fish. There are both seasonal and annual (temporal) differences in the diet depending on availability of prey. Mammals are the preferred food of American mink in cold weather. The distribution of prey animals such as rabbits or mice may cause American mink to move closer to their food. In food limited situations, adult mink will kill and eat young mink.

References:

Basu, N., A.M. Scheuhammer, S.J. Bursian, J. Elliott, K. Rouvinen-Watt and H.M. Chan. 2007. Mink as sentinel species in environmental health. Environmental Research 103 (2007) 130–144.

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5.2 ERA Step 4

5.2.1 Work Plan and Sampling Plan

Exposure Assessment. For assessing wildlife receptor exposures, available sediment concentration data and vegetation and wildlife survey data (ERM, 2021; ICON, 2020) for the Property were used. Chemical exposure point concentrations were estimated; chemical environmental fate and transport mechanisms were determined; potentially exposed populations were identified; and ingestion exposure routes were identified.

Under RECAP, areas of investigation (AOIs) can be used to evaluate exposure to ecological species in the exposure assessment. Preliminary AOIs were delineated in canal sediments. A preliminary AOI consists of an area of canal sediment samples with concentrations exceeding ecological screening values and delineated by canal sediment samples not exceeding ecological screening values. The Prelim Eco AOI-1 and Prelim Eco AOI-2 (see Figure 14) were used for ERA purposes to accurately estimate and evaluate ecological exposures (e.g. through concentration averaging) across a distinct relevant exposure area having similar habitat. The Prelim Eco AOI-1 and Prelim Eco AOI-2 are small areas (less than two acres and less than a half acre, respectively) that include only the sediment locations on the Property that have an exceedance of conservative sediment screening values.

For a site-specific BERA, exposure estimates can be based on the 95% UCL of the arithmetic mean of concentrations or average concentrations (USEPA 1997; LDEQ 2003). For this BERA, the 95% UCL of the arithmetic mean was used to estimate the exposure concentration for each COPEC (where sufficient data points are available), and the average concentration was also calculated for comparison and reference (Appendix H). Exposure estimates used in the site-specific BERA are presented below and the maximum value is also shown for each COPEC for comparison (Inset Table 5-1).

Table 5-1: Sediment Exposure Point Concentrations for Preliminary Ecological AOIs

	Canal Sediment		
Constituent	**95% Upper Confidence Limit (UCL) Concentration**	**Average Concentration**	**Maximum Concentration**
Prelim Eco AOI-1			
Arsenic	13.88	11.47	24.81
Barium	1341	919.7	3220
Zinc	108.3	95.16	159.1
Prelim Eco AOI-2			
Arsenic	NA	7.16	11.1
Barium	847.4	629.9	1270
Zinc	NA	100.5	107

Note:
Concentrations are in mg/kg dry weight.

5.2.2 *Measurement Endpoints*

Measurement endpoints for the BERA are Toxicity Reference Values (TRVs). TRVs are estimated to be safe doses for the wildlife being assessed. TRVs are generally based on studies that use the most toxic form of the element being assessed. For this reason, the BERA is a conservative evaluation, due to the fact that the metal compounds present in south Louisiana wetland settings (see Section 4.2.3.1) are generally less toxic than the metal compounds that the TRVs are based on (Table 7). TRVs are based are mortality, growth, and reproduction effects (EPA, 2005).

5.2.3 *Study Design*

The BERA uses more realistic input values and assumptions than are used in the SLERA. The following sections describe some of the assumptions used in the BERA, as compared to the SLERA.

Bioavailability and Bioaccumulation: Bioavailability of soil contaminants is assumed to be 100 percent in the SLERA. In the BERA, more accurate bioavailability has been estimated from a review of the scientific literature (Table 8 and Table 9).

Dietary composition: In the SLERA, the assumption is made that a species' diet is entirely comprised of the most contaminated food type available. In the BERA, the diet composition of the receptor is based on scientific research and specifically, the diet composition of animals native to Louisiana is used when that information is available (Table 10).

Area-use factor: The assumption used for home range in the SLERA is that an animal's home range is only in the area of contaminated soil and that the animal spends 100 percent of its time in the contaminated area. The area use factor in the BERA more accurately represents the actual percentage of an animal's home range that may be affected and time that the receptor would spend in the contaminated area, by incorporating home range and time estimates in the calculations (Table 11).

Life stage: The SLERA uses toxicity data from the most sensitive life stage of the receptor population. For example, if an animal is the most sensitive to a toxin in its juvenile stage of life, then data from the juvenile life stage is used for the SLERA. In the BERA, data from an average receptor age is used to estimate risk. It is an overestimation of risk to assume that the entire population at the Property is at the most sensitive life stage.

Body weight and food ingestion rates: The BERA uses the body weights and food ingestion rates from the primary scientific literature to accurately estimate risk at the Property. Body weights from studies of Louisiana animals are used when available (Table 10).

Toxicity Values: For the SLERA, toxicity is estimated for entire classifications of receptors (example: vertebrates, invertebrates) by comparing soil concentrations to screening values that are calculated to be over-inclusive. The screening values are designed to “not miss” the possibility of risk being present. For the BERA, TRVs are used for calculating risk. TRVs are species specific, and are used to calculate a more accurate risk estimate for a representative receptor population.

5.2.4 Data Quality Objectives

Data Quality Objectives are important to the acquisition of reliable data for quantitative risk assessment. Risk-based decisions must be based on data of known quality which meet LDEQ RECAP and USEPA requirements. The data for this risk assessment were determined to be usable for risk assessment.

The soil/sediment data collected and discussed in this report were collected by ERM (2020, 2021), HET (2020, 2021), and ICON (2020, 2021). The chemical analyses of metals, TPH fractions, and PAH in soil/sediment were performed by Element Materials Technology Lafayette (Element) in Lafayette, Louisiana, Pace Analytical Gulf Coast (Pace) in Baton Rouge, Louisiana, and Waypoint Analytical Louisiana, Inc. (Waypoint) in Marrero, Louisiana. Element, Pace, and Waypoint are LDEQ LELAP certified laboratories. All qualified data have been included in this risk assessment. The metals and PAH data were generated using USEPA SW-846 methods, while TPH fraction data were generated using TPH MADEP VPH and TPH MADEP EPH methods. Metals, PAH, and TPH fraction data meet the definition of definitive data. Samples were appropriately collected and identified in the field by sample identification number, and date and time of collection. Sample quantitation limits were reviewed and found to be acceptable for ERA.

5.3 ERA Step 5

5.3.1 Field Sampling Plan Verification

In Step 5, efforts are made to determine that the field sampling plan is appropriate for site conditions. That is, the sampling methods and equipment planned should be effective for the media and populations on the Property. Past experience with working in freshwater wetlands in Louisiana was used to determine the sampling efforts needed.

5.4 ERA Step 6

5.4.1 Analysis of Ecological Exposures and Effects

A review of the available sampling data (ERM, 2020, 2021; HET, 2020, 2021, ICON, 2020, 2021) identified that sufficient data are available to estimate ecological risk at the Property. Site-specific data from this step replace assumptions made during the screening-level analysis in Steps 1 and 2.

5.5 ERA Step 7

5.5.1 Risk Estimation and Characterization

Risk Characterization includes two major steps: risk estimation and risk description. In the risk estimation step of the BERA, risk is estimated and the uncertainties associated with risk assessment methods are evaluated. All input assumptions to the risk estimate are documented.

Potential exposures and ecological effects were evaluated for COPECs and receptors on the Property. The equation used for calculating potential risk (HQs) for COPECs in the site-specific BERA for the Property is as follows (USEPA 2005a):

$$\frac{\left(\left[\mathbf{Soil\ x\ Ps\ x\ FIR\ x\ AFas}\right] + \left[\sum_{\mathbf{i}}^{\mathbf{N}} \mathbf{Bi\ \ x\ Pi\ x\ FIR\ x\ AFai}\right]\right)\mathbf{\ x\ AUF}}{\mathbf{TRV}} = \mathbf{HQ}$$

HQ	=	Hazard Quotient for analyte/COPEC (unitless)
Soil	=	Concentration of analyte/COPEC in soil (mg/kg dry weight)
N	=	Number of different biota types in diet (food types)
B_i	=	Analyte/COPEC in biota type (i) (mg/kg dry weight)
P_i	=	Proportion of biota type (i) in diet
FIR	=	Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai}	=	Absorbed fraction of analyte/COPEC from biota type (i)
AF_{as}	=	Absorbed fraction of analyte/COPEC from soil (s)
TRV	=	Toxicity Reference Value, based on estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s	=	Soil ingestion as a proportion of diet
AUF	=	Area use factor (spatial factor, SF and temporal factor, TF)

Appendices I and J include all of the HQ calculations, analyses, and input values used to calculate risk estimates.

A summary of the results of the risk assessment and a discussion of uncertainties is included in Sections 5.6 and 5.7.

5.6 ERA Step 8

5.6.1 Risk Management Decision

Results of the BERA are provided in summary form for the Preliminary Ecological AOIs (Inset Table 5-2). The results of this BERA can be used to support decisions regarding any remediation needed for the Preliminary Ecological AOIs. The damage caused by any remedy must be considered and weighed against the need for that remedy (USEPA 1997), especially in the instance of sensitive habitats such as wetlands.

Table 5-2: Results (Hazard Quotients) for Preliminary Ecological AOIs

Canal Sediment Hazard Quotients (HQs)							
COPEC	Avian Receptor Species					Mammalian Receptor Species	
	American Robin	Spotted Sandpiper	Mallard Duck	Snowy Egret	American Bald Eagle	Least Shrew	American Mink
Prelim Eco AOI-1							
95% UCL as Exposure Concentration							
Arsenic	0.0362	0.0117	0.0000376	0.0000118	0.0000000350	0.0865	0.000419
Barium	0.00492	0.000757	0.00000227	0.00000877	0.0000000335	0.000646	0.00000293
Zinc	0.132	0.0566	0.000163	0.0000837	0.000000119	0.133	0.000922
Average Concentration as Exposure Concentration							
Arsenic	0.0299	0.00970	0.0000311	0.00000974	0.0000000289	0.0717	0.000346
Barium	0.00337	0.00052	0.00000156	0.00000602	0.000000023	0.000444	0.00000201
Zinc	0.116	0.0497	0.000143	0.0000734	0.000000105	0.117	0.000809
Maximum Concentration as Exposure Concentration							
Arsenic	0.0648	0.0210	0.0000673	0.0000211	0.0000000623	0.155	0.000747
Barium	0.0118	0.00182	0.00000544	0.0000211	0.0000000804	0.00155	0.00000704
Zinc	0.195	0.0831	0.000239	0.000123	0.000000176	0.195	0.00136
Prelim Eco AOI-2							
95% UCL as Exposure Concentration							
Arsenic	NA	NA	NA	NA	NA	NA	NA
Barium	0.00255	0.000121	0.000000351	0.00000135	0.00000000529	0.000208	0.000000459
Zinc	NA	NA	NA	NA	NA	NA	NA
Average Concentration as Exposure Concentration							
Arsenic	0.0153	0.00152	0.00000475	0.00000148	0.00000000450	0.0228	0.0000533
Barium	0.00189	0.0000896	0.000000261	0.00000100	0.00000000393	0.000155	0.00000034
Zinc	0.101	0.0132	0.000037	0.0000190	0.0000000277	0.0630	0.000212
Maximum Concentration as Exposure Concentration							
Arsenic	0.0238	0.00236	0.00000736	0.00000231	0.00000000700	0.0354	0.0000830
Barium	0.00382	0.000181	0.000000526	0.00000202	0.00000000792	0.000313	0.000000687
Zinc	0.107	0.0141	0.0000394	0.0000201	0.0000000295	0.0670	0.000226

Note:
The appropriate exposure concentration for a BERA is the 95% UCL of the arithmetic mean of concentrations or average concentrations (USEPA 1997; LDEQ 2003). The maximum concentration is a hypothetical exposure concentration and shown for completeness.

The calculated HQs, based on 95% UCL and average exposure concentrations in sediment, are low for all receptors, and all HQs are less than 1.0. Therefore, based on the multiple lines of field evidence demonstrating expected biological diversity for a swamp habitat in the region, and low HQ values, there is currently no risk identified and no potential for risk to the ecological receptors on the Property. There is no need for remediation or for further investigation.

In addition to all calculated risk for all receptors being below the benchmark of 1.0, based on 95% UCL and average sediment concentrations, all calculated risk values for maximum concentrations in all sediments are also below the benchmark of 1.0. See Appendix J for HQ calculations.

5.7 Uncertainty Evaluation

There are three basic categories of uncertainty: 1) conceptual model uncertainty; 2) natural variation and parameter error; and 3) model error.

Parameter error is unavoidable, because all members of a population, all soil present, all habitat features cannot be sampled. If all members of a population could be sampled, the true parameter distribution could be known. However, only a few members of the population can be sampled, leaving uncertainty concerning the true parameter value distribution. We have reduced this uncertainty for sediment concentrations by sampling the most likely impacted areas of the Property, biasing the results towards over estimation of risk.

The initial COPEC list is a source of uncertainty. All chemicals present cannot be measured and analyzed. We have addressed this uncertainty by measuring and analyzing the chemicals that have historically been an issue at oil and gas production sites. Uncertainty can arise from making estimates of toxicity based on limited data. We have limited this uncertainty by using conservative estimates of toxicity from the primary scientific literature. There is uncertainty in chemical monitoring data and in dose models. We have addressed this uncertainty by analyzing data at qualified labs, certified to do the analyses. The uncertainty in the dose model is based on limiting the model to ingestion. There are other forms of exposure, but they are minor compared to ingestion, so this portion of uncertainty is judged to be low. The uncertainty due to environmental variability, which arises from true heterogeneity in the environment and receptors, will be inherent in any calculation. There is uncertainty that could potentially be reduced by additional study, but in the instance of this assessment, there would not be much gained by additional study, due to the low HQs and lack of evidence of toxicity. For this reason, that portion of uncertainty is judged to be low.

The uncertainties in the BERA will likely tend to overestimate risk.

5.8 Summary and Conclusions

The BERA developed for the Jeanerette Lumber & Shingle Co., LLC Property was conducted in accordance with LDEQ (LDEQ 2003) and USEPA (USEPA 1997 and 1998) guidance. ERAs evaluate ecological effects caused by human activities or stressors. The term “stressor” is used here to describe any chemical, physical, or biological entity that can induce adverse effects on individuals, populations, communities, or ecosystems. Thus, the ERA process must be flexible while providing a logical and scientific structure to accommodate a broad array of stressors (USEPA, 1992).

USEPA guidance uses a tiered approach (Figure 7) to determine if site COPECs present an unacceptable risk to ecological receptors. The SLERA focused on potential chemical stressors associated with the Jeanerette Lumber & Shingle Co., LLC Property (i.e. in surface soils and sediments). The SLERA for the Property conservatively estimated potential risks by comparing maximum detected COPEC concentrations to conservatively-derived ecotoxicity screening values. The USEPA guidance provides an opportunity to develop or assemble more site-specific information for more accurate risk assessment. For the Jeanerette Lumber & Shingle Co., LLC Property, this was accomplished by proceeding with Steps 3-8 of the USEPA ERA process and production of a BERA that is specific for this site.

The data, analyses, and lines of evidence presented in the site-specific BERA demonstrate that there are no extant or potential ecological risks for the biological populations at the Jeanerette Lumber & Shingle Co., LLC Property.

6. RESPONSE TO PLAINTIFFS' CLAIMS OF ECOLOGICAL RISK AND ASSESSMENT OF NEED FOR REMEDIATION

The Plaintiffs' expert, Dr. William J. Rogers authored a report titled: **Rogers, William J. 2020. Toxicological Evaluation and Risk Assessment Jeanerette Lumber Company & Shingle Company LLC v. ConocoPhillips Company, et al.; Docket 134307, Div. "E"; 16th JDC; Bayou Pigeon Oil Field, Iberia Parish, LA. Omega EnviroSolutions, Inc., Canyon, TX. (October 2, 2020).**

The report by Dr. William J. Rogers (Rogers) addresses numerous topics, however this discussion is limited to the claims Rogers makes concerning ecological species.

Rogers claims (pg. 16-17, Rogers, 2020) that concentrations of metals, salts, and hydrocarbons in site media "pose an unacceptable health risk to … ecological populations" and that this risk will continue for a "long period of time" (opinions 4 and 5, pg. 16-17). Rogers does not present any evidence of current adverse effects to the health of any species living on the Property or evidence of this occurring in the past. Decades have elapsed since all E&P operations ceased on the Property (ERM, 2020), and during that time, we are aware of no reports made of adverse effects to the health of ecological populations on the Property. Rogers does not report any actual observations or data of damage to ecosystems, vegetation, or wildlife. Instead, Rogers' claims are based on a hypothetical desktop calculation.

The HQ calculations (Rogers, 2020, Attachment 2-C), which are Rogers' only proposed support for claiming damage to ecological populations, cannot be used to estimate ecological risk at the Property, because several factors used in the calculations do not reflect site conditions. For one example, Rogers uses a barium soil bioavailability estimate of 100%, which is not supported by any scientific reference or by any USEPA or LDEQ guidance. Rogers cites Menzie et al. (2008) as a reference for 100% barium bioavailability, however, the Menzie (2008) paper does not report 100% bioavailability of barium from soil. Instead, Menzie (2008) discusses the low solubility and low bioavailability of barite. Rogers' overstatement of barium bioavailability (100%) causes dose and exposure to be miscalculated, and an HQ estimate greater than the benchmark of 1.0. This greatly overstates risk, when the form of barium present at locations of former E&P operations is barite, which is primarily inert and non-toxic to ecological species.

Rogers' report (pp. 91-93) contains an erroneous analysis of potential responses of bald cypress trees to oilfield produced water (OPW) for the Property. He relies on several scientific studies of bald cypress, but none of these studies involved OPW, weathered OPW, or measurements of EC or salinity in soil. Specifically, the proposed plaintiffs' plan is to remediate soils to a specific, but not site-specific, EC value, and none of Rogers' referenced papers report EC in soil or salinity in soil porewater, which makes the studies not applicable for comparison to site conditions. Although 29-B salt standards do not apply to submerged wetlands (the Property is a submerged wetland), we have reviewed each of the cypress tree/salinity papers cited in the Rogers report. It should be noted that our site-specific study identified no evidence of adverse salt effects to cypress trees. Instead, our investigation identified cypress trees on the Property of expected size and without salt effects. Each of the citations in Rogers' (2020) report of potential risk of OPW (salts, etc.) to bald cypress is reviewed briefly below. These reports do not contain data supporting Rogers' conclusions regarding bald cypress on the Property or current risks associated with any salts that may be on the Property.

- **Krauss, K.W., J.A. Duberstein, T.W. Doyle, W.H. Conner, R.H. Day, L.W. Inabinette and J.L. Whitbeck. 2009. Site condition, structure, and growth of baldcypress along tidal/nontidal salinity gradients. Wetlands 29: 505-519.**

  In this study (Krauss et al. 2009), bald cypress and other vegetation were studied in coastal Louisiana, South Carolina and Georgia at selected sites along five landscape transects. The authors hypothesized in advance of this study that these sites were being degraded by proximity to estuaries and that salinity was the primary driver of environmental degradation. It was clear that other factors such as hydrology and nutrient conditions were present and operational during the field studies. The authors clearly stated that the cypress growth observed was not solely related to salinity, but was also strongly correlated with nutrient (nitrogen) concentrations. Rogers' (2020) conclusion that the decreased growth of bald cypress was due to salinity (1.3 ppt) is not supported by the data in Krauss et al. (2009). Further, Rogers' (2020) choice of a salinity concentration (1.3 ppt) and application of that salinity to this specific situation (the JLS Property) is not supported by the data in the Krauss et al. (2009) study. The Krauss et al. (2009) study cannot be used to extrapolate directly to the JLS Property because the environmental and chemical conditions in the Krauss study are not equivalent to conditions at the JLS Property. Krauss et al. (2009) did not study produced water, EC in soils, or salinity in soil porewater.

- **Conner, W.H., K.W. McLeod, and J.K. McCarron. 1997. Flooding and salinity effects on growth and survival of four common forested wetland species. Wetlands Ecology and Management 5: 99 – 109.**

  As stated in Conner et al. (1997), survival, growth, and biomass of baldcypress (*Taxodium distichum* (L.) Rich.), water tupelo (*Nyssa aquatica* L.), Chinese tallow (*Sapium sebiferum* (L.) Roxb.), and green ash (*Fraxinus pennsylvanica* Marsh.) seedlings were examined in an experiment varying water levels (watered, flooded) and salinity levels (0, 2, and 10 ppt, plus a simulated storm surge with 32 ppt saltwater). This study produced a relatively large data set for seedings from wetland plants in South Carolina. All seedlings, except for those flooded with 10 ppt saltwater, survived to the end of the experiment. Flooding with 2 ppt saltwater caused a significant reduction in diameter growth in water tupelo, green ash, and Chinese tallow, but not in baldcypress. Rogers (2020) chose to emphasize the measure of seedling height (that was significantly affected) at 2 ppt salinity, but Conner et al. (1997) pointed out that diameter growth was not affected at 2 ppt.

  Rogers (2020) also cited Conner et al. (1997) as the source of information supporting 100% mortality of baldcypress seedlings exposed to 10 ppt salinity for 6 weeks (p. 92). It is not clear that the Conner et al. (1997) paper supports this conclusion. The results for the plants from coastal South Carolina were variable and responses to salinity and flooding depended on the age of the seedlings as would be expected. Conner et al. (1997) did not study produced water, EC in soil, or salinity in soil porewater.

- **Conner, W.H. and L.W. Inabinette. 2005. Identification of salt tolerant baldcypress (Taxodium distichum (L.) Rich) for planting in coastal areas. New Forests 29: 305 – 312.**

  Conner and Inabinette (2005) were cited as the source data for 18.5 ppt salinity (max. drought) causing mortality (>80%) with 4 ½ years of exposure in a controlled field study of bald cypress seedlings. In this study, Conner and Inabinette (2005) collected bald cypress seeds from a variety of locations in the southeastern US and planted them in abandoned rice fields in South Carolina. The rice fields were flooded with saline water and survival was monitored. The data obtained and presented in Conner and Inabinette (2005) do not support Rogers' (2020) conclusions because the conditions in South Carolina rice fields do not accurately simulate conditions (hydrosoils, hydrology, water chemistry) in the JLS wetlands. No produced water, soil EC or soil porewater salinity was studied in this experiment.

- **Lauer, N. 2013. Physiological and biochemical responses of bald cypress to salt stress. Master's Thesis, Department of Biology, University of North Florida. 123 pp.**

  In Florida, Lauer (2013) noted that the vitality of bald cypress within coastal freshwater wetlands is threatened by saltwater intrusion. Biomarkers to detect sub-lethal salinity stress were developed using a controlled greenhouse study. According to Lauer (2013), bald cypress saplings maintained at elevated salinities of 4 and 8 ppt exhibited a decrease in maximum quantum yield and an increase in nonphotochemical quenching. Cypress leaves (needles) exhibited an increase in Na+, H2O2, and free proline content compared to plants maintained in freshwater in a greenhouse. These biomarkers were used to detect salinity stress within a population of cypress associated with the lower St. Johns River where saltwater intrusion is occurring. Direct application of Lauer's (2013) study to the JLS Property is not appropriate as the greenhouse conditions and exposures do not accurately simulate the natural physical and chemical conditions in the JLS wetlands. In Lauer (2013), no produced water (OPW), EC in soil, or salinity in soil porewater was studied.

- **Allen, J.A., J.L. Chambers and S.R. Pezeshki. 1997. Effects of salinity on baldcypress seedlings: Physiological responses and their relation to salinity tolerance. Wetlands 17: 310 – 320.**

  Baldcypress seedlings were collected from Louisiana and Alabama and grown in greenhouse soils with fertilizers. The seedlings were subjected to salinity and flooding treatments in the greenhouse. A variety of measurements were made of responses to salinity, and considerable variation was observed across the genetic variants. Correlations were determined for responses to treatments. The data in Allen et al. (1997) do not pertain to the JLS Property because greenhouse conditions in this experiment do not accurately simulate conditions (hydrosoil, hydrology, exposure) in the JLS wetlands. No produced water was used in the experiments by Allen et al. (1997).

- **Stiller, V. 2009. Soil salinity and drought alter wood density and vulnerability to xylem cavitation of baldcypress (Taxodium distichum (L.) Rich.) seedlings. Environmental and Experimental Botany 67: 164 – 171.**

  As stated by Stiller (2009), the objective of this study was to evaluate the vulnerability of bald cypress seedlings grown under elevated soil salinity and under drought conditions to xylem cavitation. Of particular interest was the potential for increase in wood density and cavitation resistant plants and whether drought and salinity trigger comparable responses. The plants were grown in artificial media and greenhouse conditions. No produced water was used in this greenhouse experiment. These data are not directly relevant for the JLS Property because the conditions in the greenhouse study do not accurately simulate conditions (hydrology, hydrosoil, exposure) in the JLS wetlands.

- **Allen, J.A., J.L. Chambers, and D. McKinney. 1994. Intraspecific variation in the response of Taxodium distichum seedlings to salinity. For. Ecol. Manage. 70: 203 – 214.**

  Seedlings of bald cypress from Alabama and Louisiana were evaluated for their responses to salinity and flooding stress. Based on the results, the authors recommended a breeding program to select for salt and flood tolerant strains. Seedlings were affected by increasing salinity, but, as noted by the authors, there were large interspecific variabilities in those responses. These data would not support the selection of a single value to represent the population response to salinity and flooding exposures as was done by Rogers (2020). There were no data in this paper to support Rogers' reference to 100% mortality in bald cypress seedlings in 60 days of exposure to 10 ppt salinity (p. 92). The Allen et al. (1994) study used Forty Fathoms Marine Mix as a source of salinity. No produced water, soil EC, or soil porewater salinity was studied in this investigation.

- **Conner, W.H., 1994. The effect of salinity and waterlogging on growth and survival of baldcypress and Chinese tallow seedlings. Journal of Coastal Research 10(4): 1045 – 1049.**

> Growth, biomass and survival of baldcypress (*Taxodium distichum (L.) Rich.*) and Chinese tallow *(Sapium sebiferum (L.) Roxb.*) seedlings were measured in an experiment with varying water depths and salinity levels as well as a simulated storm surge with water of salinity at 32 ppt. The seedlings were four months old. Bald cypress did not survive flooding in 10 ppt water. This study was intended to simulate potential effects of a hurricane in coastal South Carolina and the salinity used for this study was Instant Ocean Synthetic Sea Salt. This laboratory study is not directly applicable to the JLS Property because the exposures and experimental conditions do not accurately simulate conditions on the JLS Property. No produced water was used in this study and no measurements were made of soil EC or soil porewater salinity.

In summary, Rogers (2020) included in his report a brief characterization of the potential risks of bald cypress (*Taxodium distichum*) to exposures of "salts" on the Jeanerette Lumber & Shingle LLC Property. As outlined above, Rogers mischaracterized the data in the reports that he cited and that led him to the conclusion that the bald cypress on this Property is at risk. This conclusion is belied by not only the publications or reports that he used, but also the bald cypress trees extant on the Property. Recruitment of bald cypress was documented during site investigations in which young cypress were documented to be growing where water depths would permit. Also observed on the Property were more mature bald cypress trees that were also growing as expected (see Section 3.2). Rogers (p. 92) included a paragraph entitled "Evaluation of Risks of Chlorides in Oilfield Produced Water to Baldcypress." This paragraph contains a tortuous logic path winding from salinity (and flooding) effects to chlorides and then to weathered oilfield produced water. An initial scientific concern with this approach is that salinity is an undefined and generic parameter that must be evaluated carefully, specifically from a toxicological perspective (Goodfellow et al. 2000). Specifically, chlorides are anions and can only be toxicologically evaluated in the context of associated cations. In other words, chlorides simply do not exist in nature alone (they always have associated cations that influence their toxicity). Finally, Rogers' commentary on OPW released more than a decade ago is irrelevant when there are current observations of a functioning cypress swamp on the Property that does not demonstrate impacts from salinity.

We do agree with the last sentence (p. 92) of Rogers' report – "*Evaluation of risks of OPW to baldcypress should be conducted on a site-specific basis and correlated with measured exposure concentrations and field observations as appropriate.*" Importantly, this was not done by Rogers in this case. Straightforward field observations confirm that Rogers' risk assessment process and conclusions concerning cypress trees at the Property are incorrect.

Miller, Gregory W. and W. Prejean. 2020. Expert Report and Restoration Plan for the Landowners; Jeanerette Lumber and Shingle, LLC v ConocoPhillips Company, et al; Docket 134307, Div "E"; 16th JDC; Lake Bayou Pigeon Oil Field, Iberia Parish, LA. (September 22, 2020).

ICON report (Miller and Prejean 2020) contains a proposal by Mr. Miller and Mr. Prejean to restore canal sediments to an EC of 6.3 mmhos/cm for cypress tree growth and to the NOAA SQuiRT TEL for metals. We disagree with remediation of canal sediments based on any value associated with growing trees, as trees do not grow directly in water bottoms such as canals. We also disagree with Mr. Miller and Mr. Prejean's proposal to remediate based on a potential exceedance of an ecological screening value, such as the NOAA TEL. The purpose of a screening value is to determine if further investigation is needed or if no further investigation is needed (USEPA, 1997). A decision to remediate, following exceedance of a screening value, is not part of the USEPA (1997) ecological risk assessment process. Mr. Miller and Mr. Prejean did not perform an ecological risk assessment.

Mr. Miller and Mr. Prejean propose restoration of soil and sediment outside of the canals (to a maximum depth of approximately 18-20 feet below ground surface) to an EC of 6.3 mmhos/cm for cypress tree growth. We disagree with the proposal that removing soils and treed swamp up to a depth of 20 feet would benefit a sensitive setting, such a cypress-tupelo swamp wetland (USEPA, 1997). The risk of the

Miller/Prejean plan is removal and destruction of about 40 acres of cypress-tupelo swamp, emergent wetlands, and surface water habitat for birds, mammals, reptiles, fish, invertebrates, and other plants. In the best interests of preserving earth's resources and protecting Louisiana swamp biodiversity, we strongly disagree with the removal of functioning cypress-tupelo wetland habitat, as proposed by Miller and Prejean.

Based on our site inspection and ERA, we believe that the opinions provided by the plaintiffs' experts regarding exposures from legacy operations as well as impacts on the flora and fauna on the subject Property are not supported by data from the Property. There is no evidence that habitat for populations of any species has been limited on the Property by legacy oil and gas operations.

The conclusions presented in this ERA are based on: 1) data from investigations conducted in 2021 and 2021 of the wildlife and vegetation, and measurements of COPECs in soils in 2020 and 2021; 2) site inspections; 3) a SLERA; and 4) a site-specific BERA. The lines of evidence demonstrate that there are no unacceptable risks to ecological receptors at the Property.

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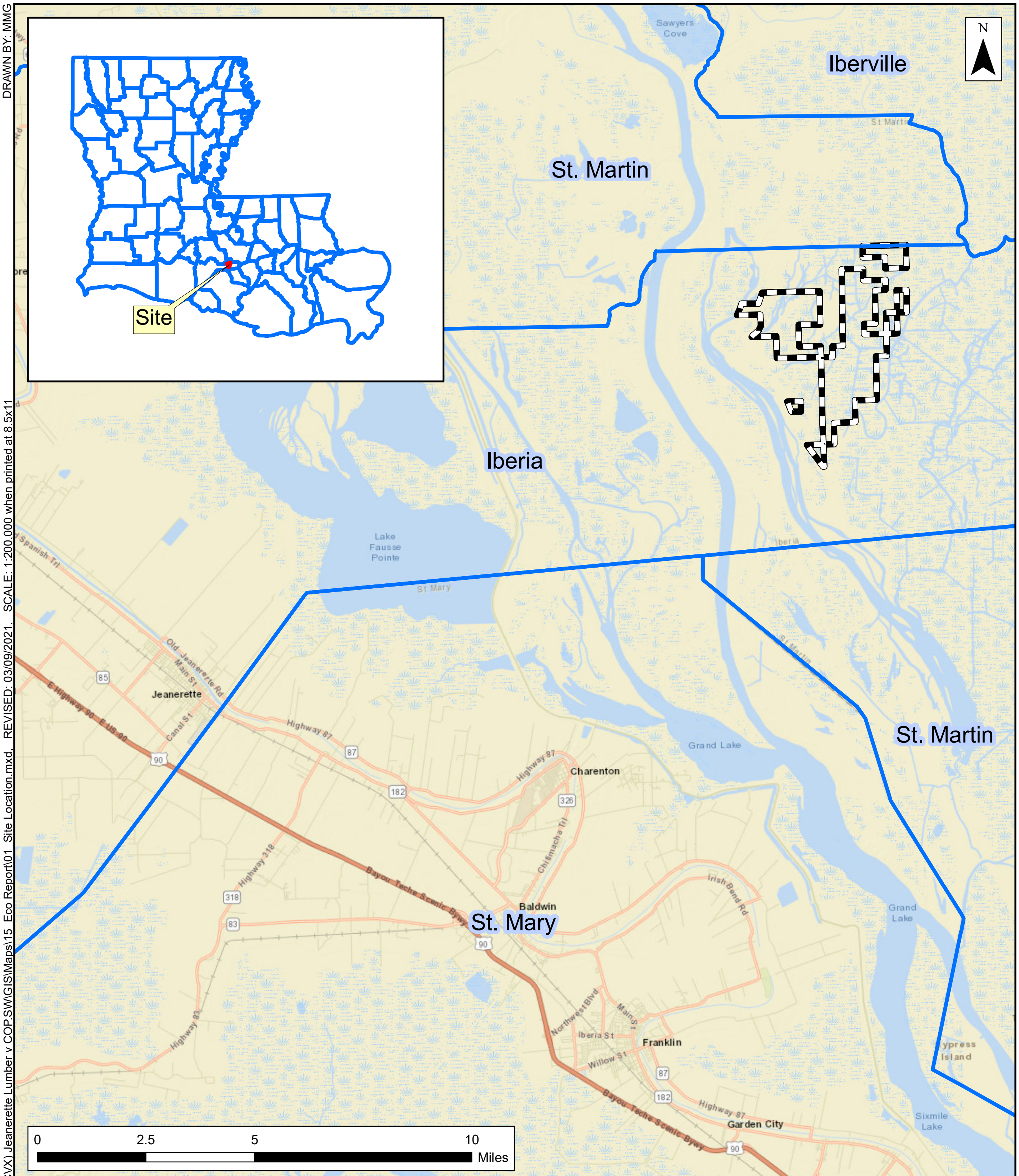
FIGURES

April 9, 2021



Parish Boundary

Property

Figure 1
Site Location
Jeanerette Lumber & Shingle Co., LLC
v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Environmental Resources Management
www.erm.com
ERM

Notes:
World Street Basemap via ArcGIS Online.

Source: Esri - ArcGIS Online; NAD 1983 UTM Zone 15N

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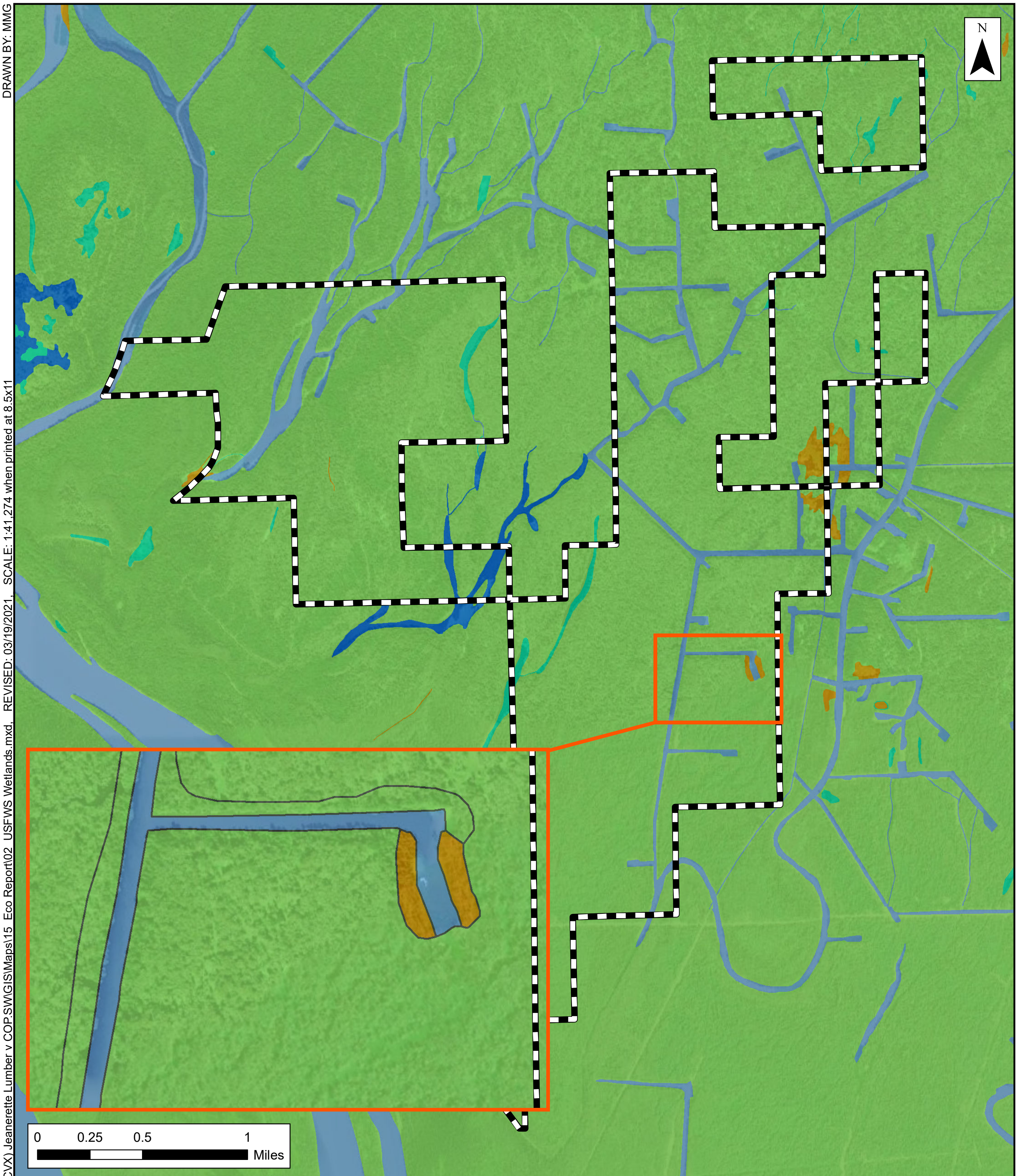

Notes:
Wetland data from US Fish and Wildlife Service.
Imagery basemap via ArcGIS Online.

Figure 2
USFWS Wetlands
Jeanerette Lumber & Shingle Co., LLC
v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Environmental Resources Management
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Source: Esri - ArcGIS Online; NAD 1983 UTM Zone 15N

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- Property
- Vegetation Observation Locations
- Cypress Tree Measurements
- ICON Canal Sediment Sample
- ICON Soil Sample
- ICON Soil Sample with Monitoring Well
- ERM Sediment Boring in Canal
- ERM Sediment Sample with Monitoring Well
- HET Canal Sediment Sample
- HET Soil Sample

Figure 3
Vegetation Observation Locations
Jeanerette Lumber & Shingle Co., LLC
v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Notes:
7/6/2019 Aerial via USGS Earth Explorer
(https://earthexplorer.usgs.gov/).

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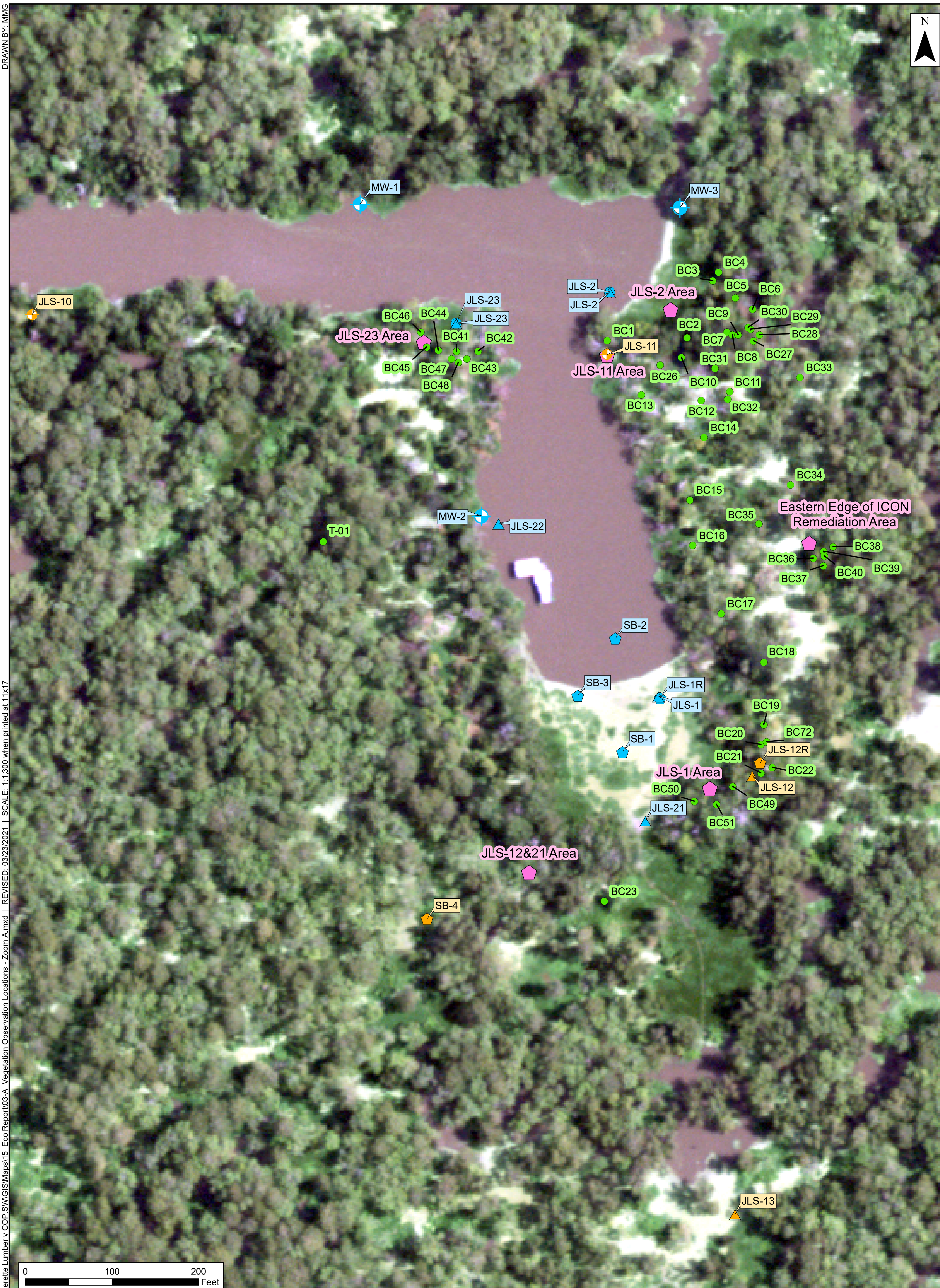

Property

Vegetation Observation Locations

Cypress Tree Measurements

ICON Canal Sediment Sample

ICON Soil Sample

ICON Soil Sample with Monitoring Well

ERM Sediment Boring in Canal

ERM Sediment Sample with Monitoring Well

HET Canal Sediment Sample

HET Soil Sample

Figure 3-A
Vegetation Observation Locations - Zoom A
Jeanerette Lumber & Shingle Co., LLC
v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Notes:
7/6/2019 Aerial via USGS Earth Explorer
(https://earthexplorer.usgs.gov/).

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Source: Esri - ArcGIS Online; NAD 1983 UTM Zone 15N

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Property

Vegetation Observation Locations

Cypress Tree Measurements

ICON Canal Sediment Sample

ICON Soil Sample

ICON Soil Sample with Monitoring Well

ERM Sediment Boring in Canal

ERM Sediment Sample with Monitoring Well

HET Canal Sediment Sample

HET Soil Sample

Figure 3-B
Vegetation Observation Locations - Zoom B
Jeanerette Lumber & Shingle Co., LLC
v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Notes:
7/6/2019 Aerial via USGS Earth Explorer
(https://earthexplorer.usgs.gov/).

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Source: Esri - ArcGIS Online; NAD 1983 UTM Zone 15N

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Property
Vegetation Observation Locations
Cypress Tree Measurements
ICON Canal Sediment Sample
ICON Soil Sample
ICON Soil Sample with Monitoring Well
ERM Sediment Boring in Canal
ERM Sediment Sample with Monitoring Well
HET Canal Sediment Sample
HET Soil Sample

Figure 3-C
Vegetation Observation Locations - Zoom C
Jeanerette Lumber & Shingle Co., LLC
v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Notes:
7/6/2019 Aerial via USGS Earth Explorer
(https://earthexplorer.usgs.gov/).

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Source: Esri - ArcGIS Online; NAD 1983 UTM Zone 15N

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- Property
- Photo Location
- Vegetation Observation Locations
- ICON Canal Sediment Sample
- ICON Soil Sample
- ICON Soil Sample with Monitoring Well
- ERM Sediment Boring in Canal
- ERM Sediment Sample with Monitoring Well
- HET Canal Sediment Sample
- HET Soil Sample

Figure 4
Vegetation Observation Photos
Jeanerette Lumber & Shingle Co., LLC
v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Notes:
7/6/2019 Aerial via USGS Earth Explorer
(https://earthexplorer.usgs.gov/).

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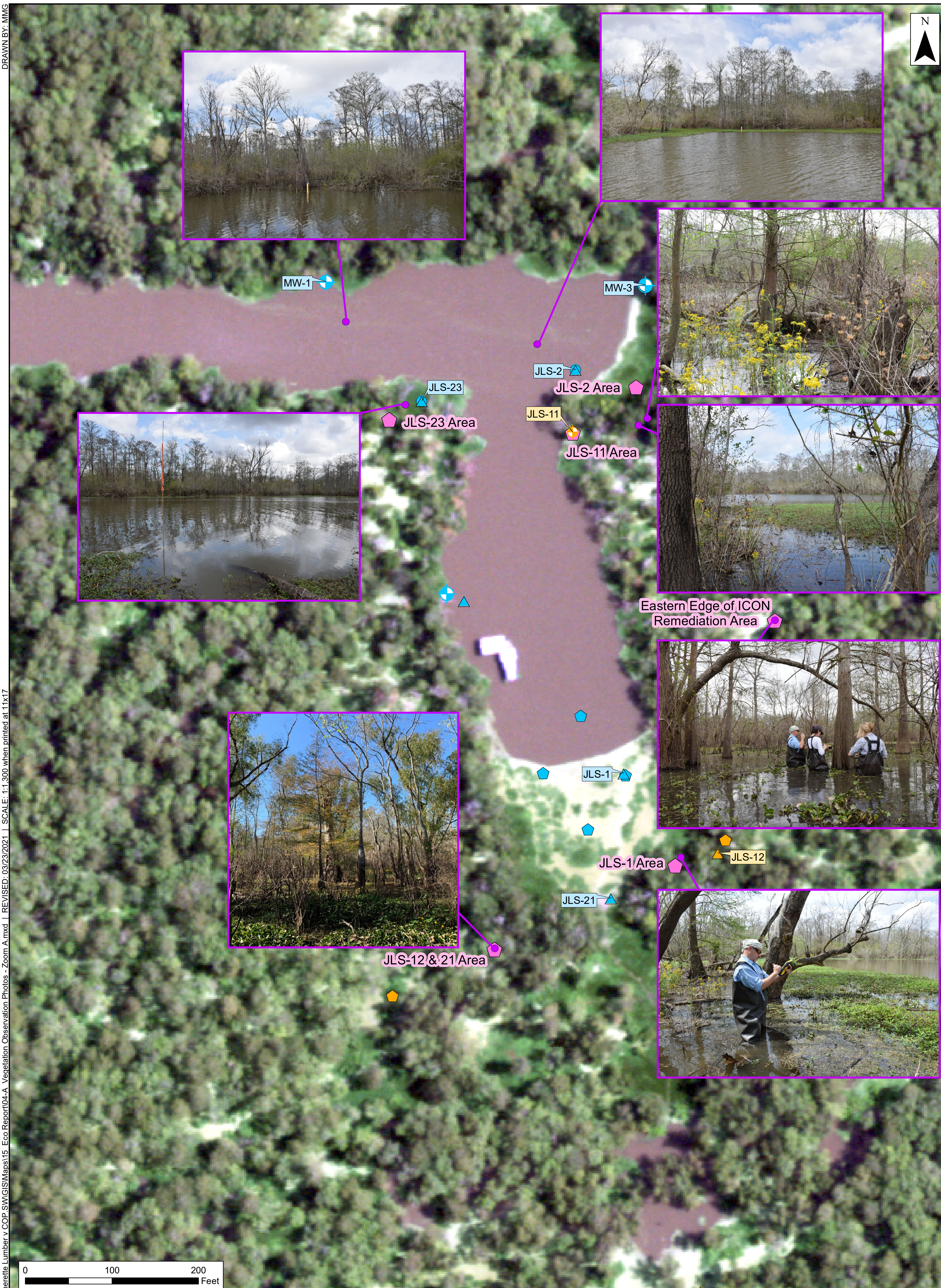

- Property
- Photo Location
- Vegetation Observation Locations
- ICON Canal Sediment Sample
- ICON Soil Sample
- ICON Soil Sample with Monitoring Well
- ERM Sediment Boring in Canal
- ERM Sediment Sample with Monitoring Well
- HET Canal Sediment Sample
- HET Soil Sample

Figure 4-A
Vegetation Observation Locations - Zoom A
Jeanerette Lumber & Shingle Co., LLC
v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Notes:
7/6/2019 Aerial via USGS Earth Explorer
(https://earthexplorer.usgs.gov/).

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Source: Esri - ArcGIS Online; NAD 1983 UTM Zone 15N

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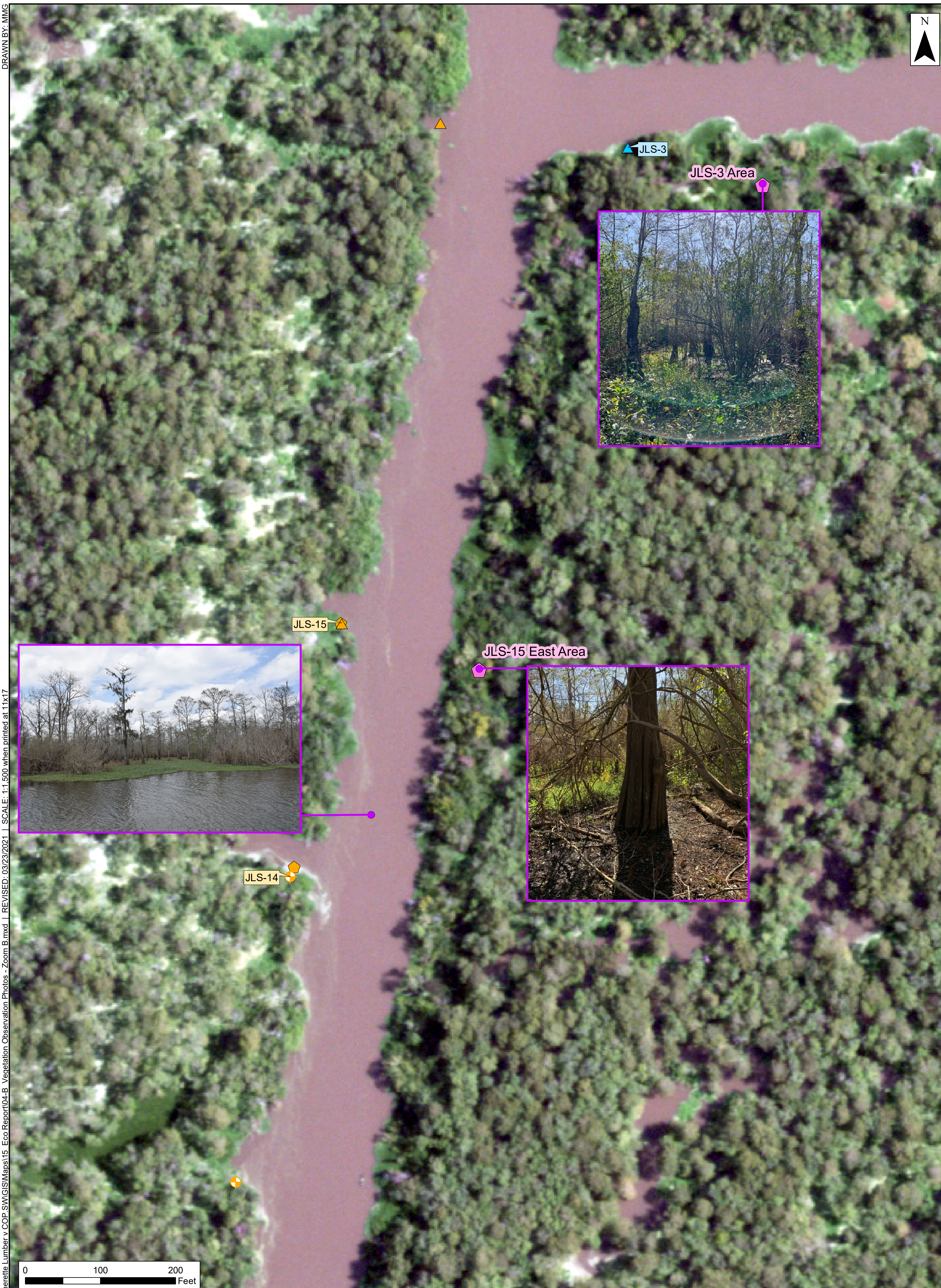

Property
Photo Location
Vegetation Observation Locations
ICON Canal Sediment Sample
ICON Soil Sample
ICON Soil Sample with Monitoring Well
ERM Sediment Boring in Canal
ERM Sediment Sample with Monitoring Well
HET Canal Sediment Sample
HET Soil Sample

Figure 4-B
Vegetation Observation Locations - Zoom B
Jeanerette Lumber & Shingle Co., LLC
v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Notes:
7/6/2019 Aerial via USGS Earth Explorer
(https://earthexplorer.usgs.gov/).

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Source: Esri - ArcGIS Online; NAD 1983 UTM Zone 15N

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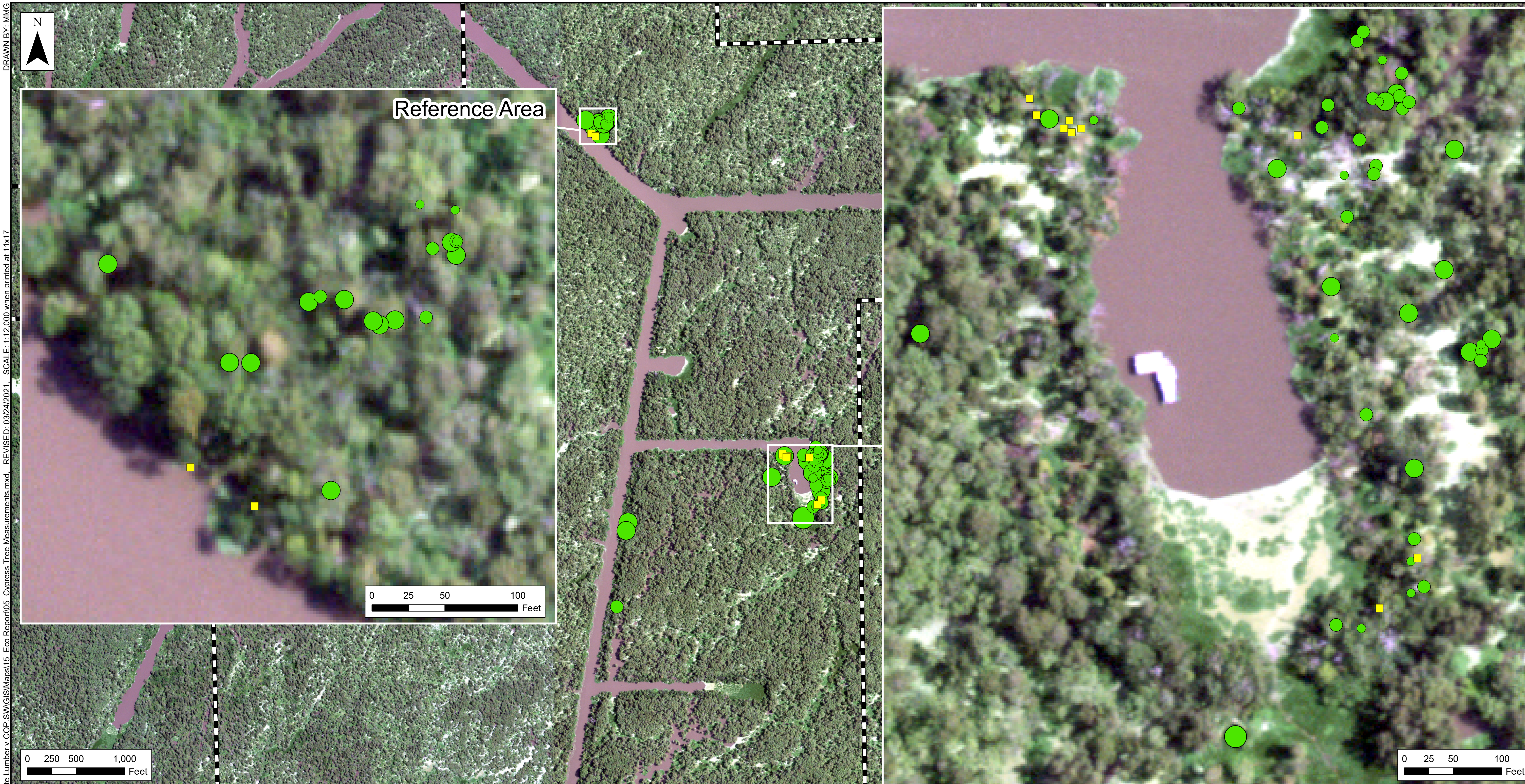

Property

Cypress Tree Measurements

Diameter at Breast Height

- 0 - 1 in Sapling
- 1 - 8 in
- 8 - 14 in
- 14 - 34 in
- 34 - 66.2 in

Figure 5
Cypress Tree Measurements
Jeanerette Lumber & Shingle Co., LLC
v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Notes:
Cypress Trees identified and measured on 3/4/2021 and 3/15/2021.
7/6/2019 Aerial via USGS Earth Explorer (https://earthexplorer.usgs.gov/).

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Source: Esri - ArcGIS Online; NAD 1983 UTM Zone 15N

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Property
Vegetation Observation Locations

Cypress Tree Measurements

Diameter at Breast Height

- 0 - 1 in Sapling
- 1 - 8 in
- 8 - 14 in
- 14 - 34 in
- 34 - 66.2 in

ICON Canal Sediment Sample
ICON Soil Sample
ICON Soil Sample with Monitoring Well
ERM Sediment Boring in Canal
ERM Sediment Sample with Monitoring Well
HET Canal Sediment Sample
HET Soil Sample

ICON Proposed Remediation

Salt
Sediment

Figure 6
Ecological Characterization in ICON Planned Remediation Area
Jeanerette Lumber & Shingle Co., LLC
v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Notes:
7/6/2019 Aerial via USGS Earth Explorer (https://earthexplorer.usgs.gov/).

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Source: Esri - ArcGIS Online; NAD 1983 UTM Zone 15N

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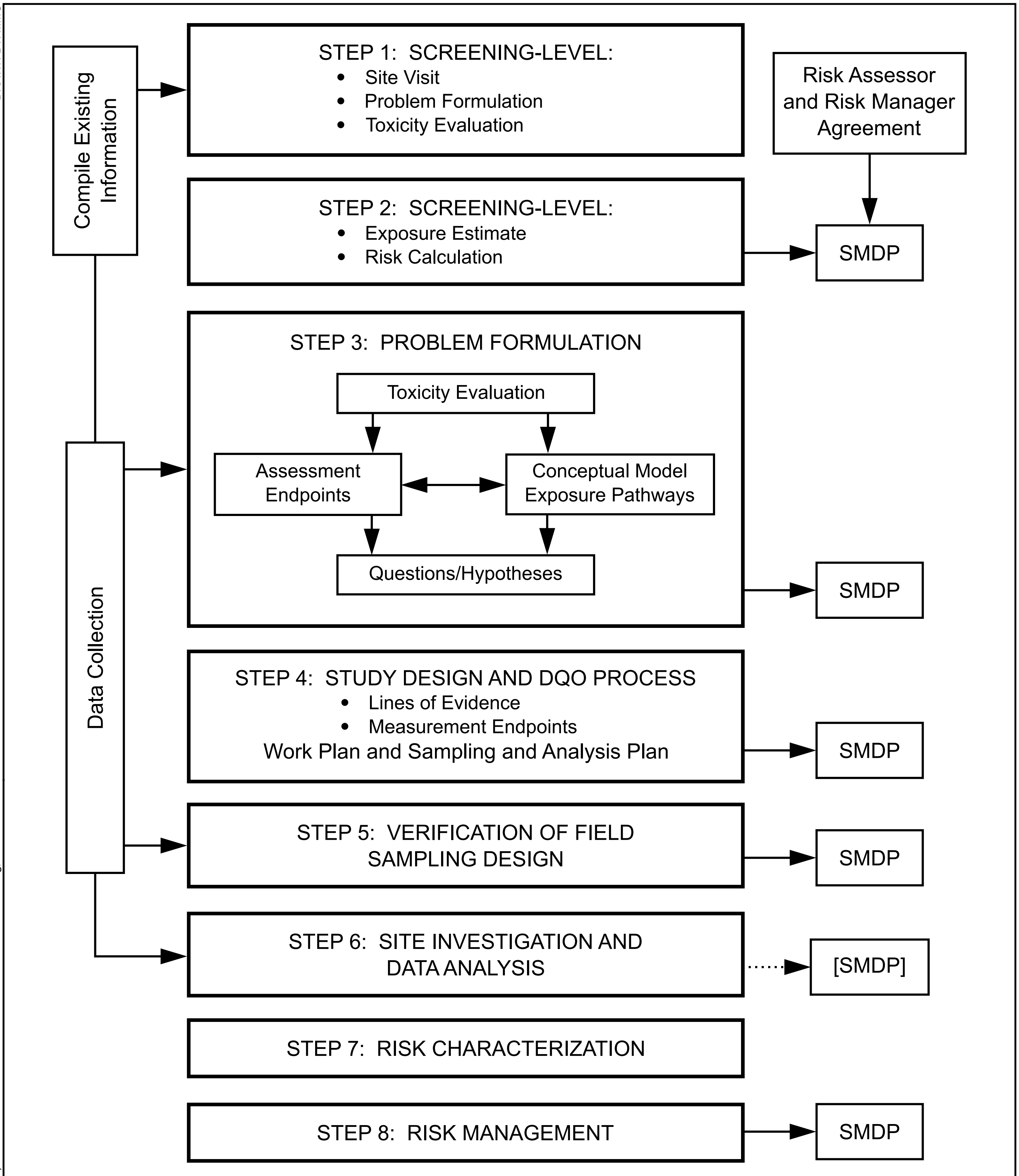

Figure 7
USEPA 8-Step Ecological Risk Assessment Process
Jeanerette Lumber & Shingle Co., LLC
v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia, Louisiana

Notes:
From EPA "Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments" June 1997

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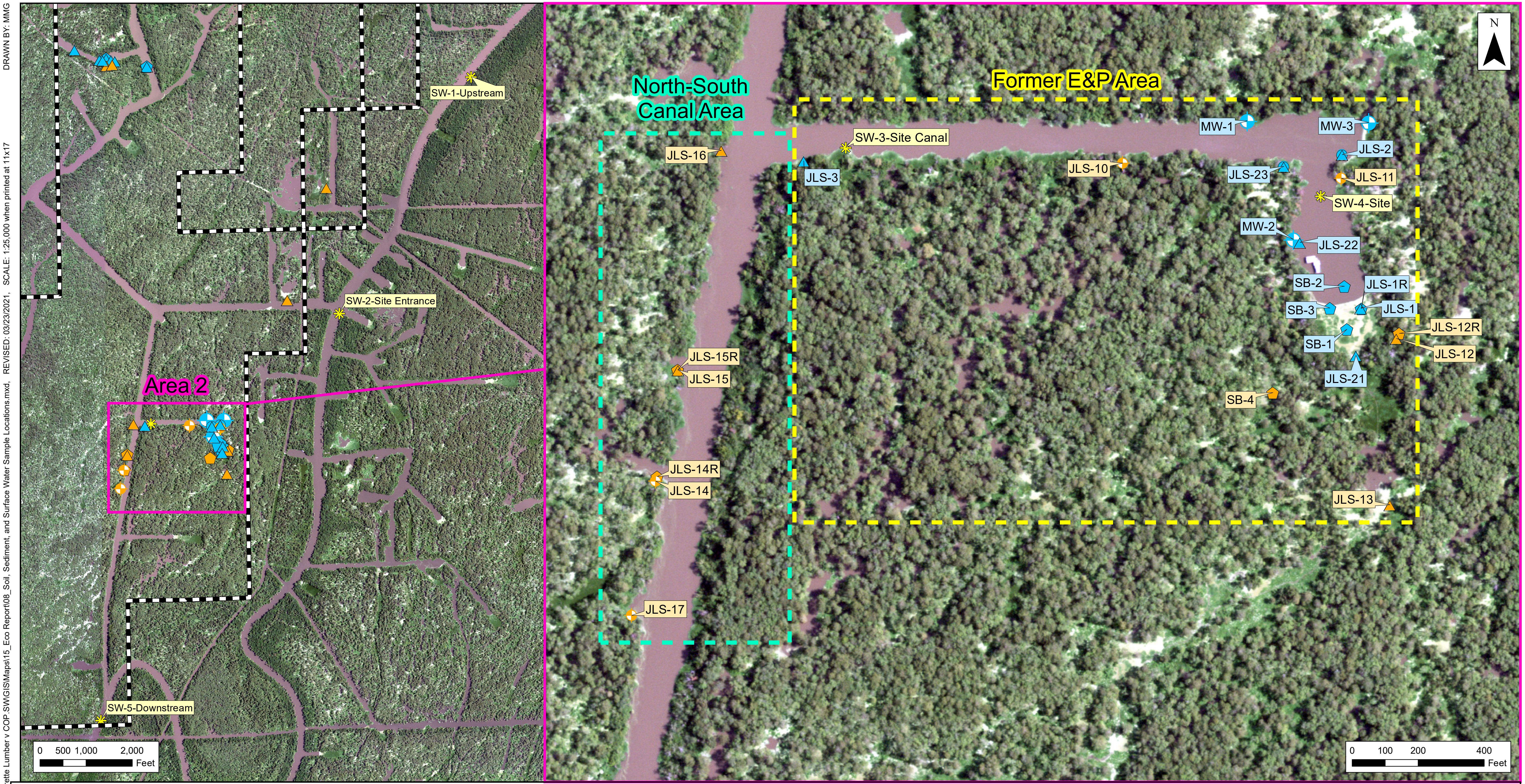

Property

ICON Canal Sediment Sample

ICON Soil Sample

ICON Soil Sample with Monitoring Well

ERM Sediment Boring in Canal

ERM Sediment Sample with Monitoring Well

HET Canal Sediment Sample

HET Soil Sample

ERM Surface Water Sample

Figure 8
Soil, Sediment, and Surface Water Sample Locations
Jeanerette Lumber & Shingle Co., LLC
v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Notes:
7/6/2019 Aerial via USGS Earth Explorer (https://earthexplorer.usgs.gov/).

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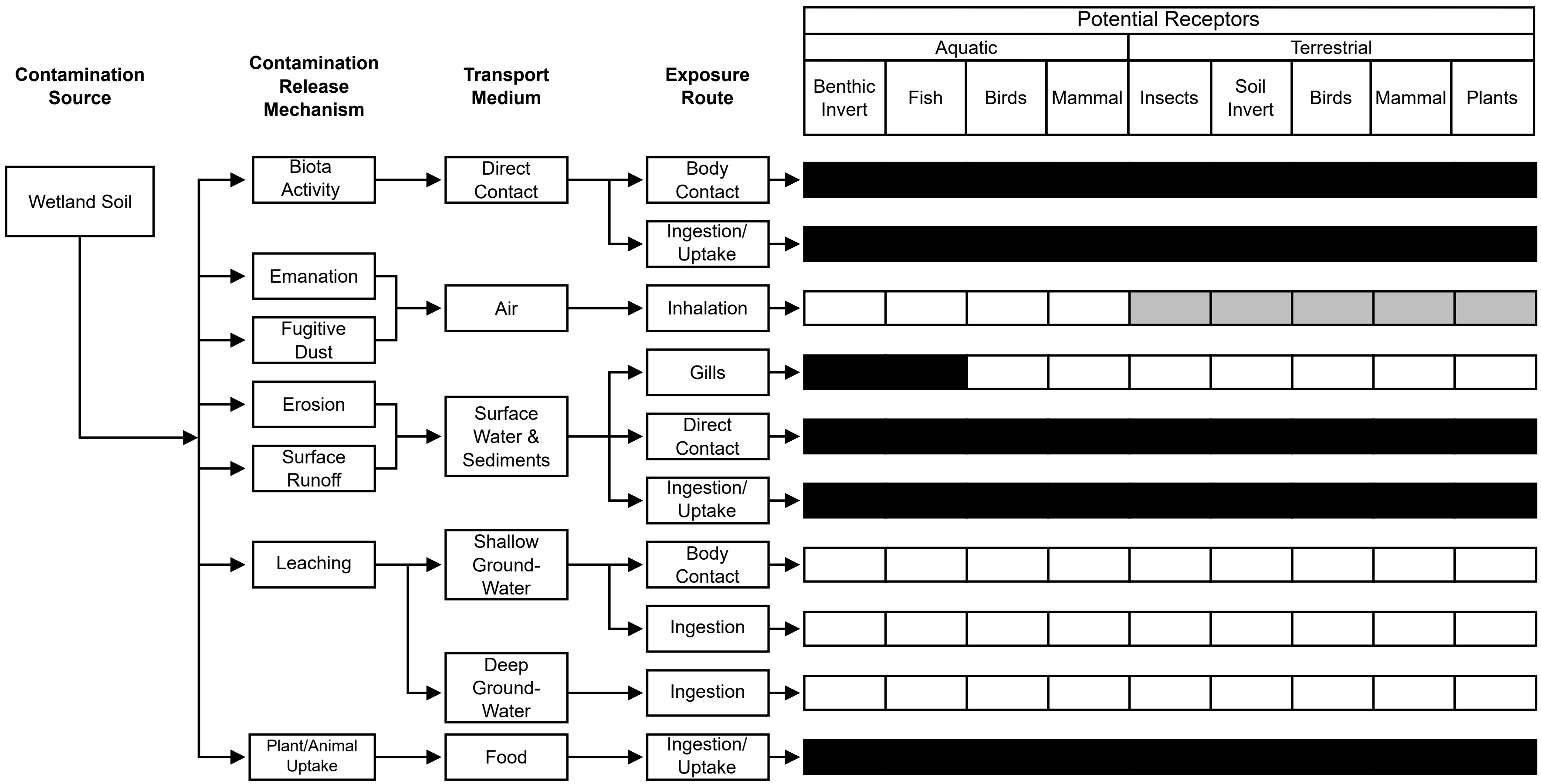

Major

Minor

Incomplete

Figure 9
Ecological Conceptual Site Model
Jeanerette Lumber & Shingle Co., LLC
v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia, Louisiana

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- Property
- ICON Canal Sediment Sample
- ICON Soil Sample
- ICON Soil Sample with Monitoring Well
- ERM Sediment Boring in Canal
- ERM Sediment Sample with Monitoring Well
- HET Canal Sediment Sample
- HET Soil Sample

Sample ID
Date Collected
Company 1 / Company 2
Interval
As: Result 1 / Result 2

Notes:
All concentrations are in mg/kg-dry.
All results from 0 to 4 feet bgs shown.
7/6/2019 Aerial via USGS Earth Explorer (https://earthexplorer.usgs.gov/).

Figure 10
Arsenic Soil/Sediment Concentrations
Jeanerette Lumber & Shingle Co., LLC
v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

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Property
ICON Canal Sediment Sample
ICON Soil Sample
ICON Soil Sample with Monitoring Well
ERM Sediment Boring in Canal
ERM Sediment Sample with Monitoring Well
HET Canal Sediment Sample
HET Soil Sample

Sample ID
Date Collected
Company 1 / Company 2
Interval
Ba: Result 1 / Result 2

Notes:
All concentrations are in mg/kg-dry.
All results from 0 to 4 feet bgs shown.
7/6/2019 Aerial via USGS Earth Explorer (https://earthexplorer.usgs.gov/).

Figure 11
Barium Soil/Sediment Concentrations
Jeanerette Lumber & Shingle Co., LLC
v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

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Source: Esri - ArcGIS Online; NAD 1983 UTM Zone 15N

Property
ICON Canal Sediment Sample
ICON Soil Sample
ICON Soil Sample with Monitoring Well
ERM Sediment Boring in Canal
ERM Sediment Sample with Monitoring Well
HET Canal Sediment Sample
HET Soil Sample

Sample ID
Date Collected
Company 1 / Company 2
Interval
Zn: Result 1 / Result 2

Notes:
All concentrations are in mg/kg-dry.
All results from 0 to 4 feet bgs shown.
7/6/2019 Aerial via USGS Earth Explorer (https://earthexplorer.usgs.gov/).

Figure 12
Zinc Soil/Sediment Concentrations
Jeanerette Lumber & Shingle Co., LLC
v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

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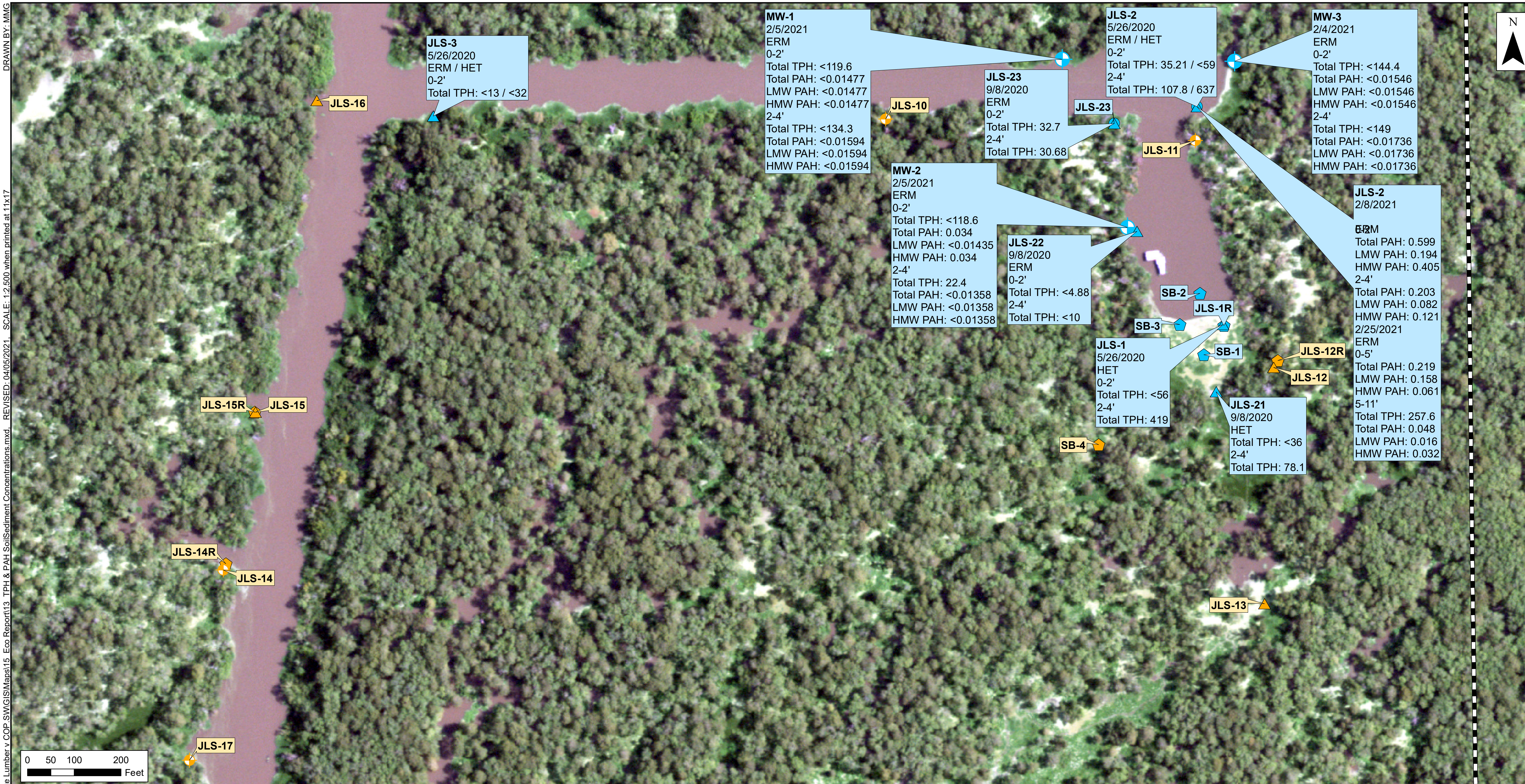

Property
ICON Canal Sediment Sample
ICON Soil Sample
ICON Soil Sample with Monitoring Well
ERM Sediment Boring in Canal
ERM Sediment Sample with Monitoring Well
HET Canal Sediment Sample
HET Soil Sample

Sample ID
Date Collected
Company 1 / Company 2
Interval
Parameter: Result 1 / Result 2

Notes:
All concentrations are in mg/kg-dry.
All results from 0 to 4 feet bgs shown.
Total TPH: Sum of aliphatic and aromatic fraction data
Total PAH: Sum of all PAH data
LMW PAH: Sum of 2-Methylnaphthalene, Acenaphthene, Acenapthylene, Anthracene, Fluorene, Naphthalene, and Phenanthrene.
HMW PAH: Sum of Benzo(a)anthracene,Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Chrysene, Dibenz(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, and Pyrene
7/6/2019 Aerial via USGS Earth Explorer (https://earthexplorer.usgs.gov/).

Figure 13
TPH & PAH Soil/Sediment Concentrations
Jeanerette Lumber & Shingle Co., LLC
v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

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Property
Preliminary Ecological AOI
Canal Sediment Sample with exceedance
Canal Sediment Sample with no exceedance
Vegetation Observation Locations

Figure 14
Preliminary Ecological AOIs
Jeanerette Lumber & Shingle Co., LLC
v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Notes:
All Arsenic, Barium, and Zinc concentrations in the 0-4' range from Canal Sediment Samples shown.
All concentrations are in mg/kg-dry.
Concentrations that exceed sediment ESV (Arsenic: 9.79, Barium: N/S, Zinc: 121) are highlighted blue
7/6/2019 Aerial via USGS Earth Explorer (https://earthexplorer.usgs.gov/).

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TABLES

April 9, 2021

Table 1
List of Vegetation Observed at the Property
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Common Name	*Scientific Name*	Wetland Classification	Growth Habit	State Status
Red maple	*Acer rubrum*	FAC	Tree	Native
Oppositeleaf spotflower	*Acmella oppositifolia*	NA	Forb/herb	Native
Alligatorweed	*Alternanthera philoxeroides*	OBL	Forb/herb	Introduced
Annual ragweed	*Ambrosia artemisiifolia*	FACU	Forb/herb	Both
Milkweed	*Asclepias sp.*	NA	NA	Both
Mosquitofern (A)	*Azolla sp.*	OBL	Forb/herb	Both
Smooth beggartick (A)	*Bidens laevis*	OBL	Forb/herb	Native
American buckwheat vine	*Brunnichia ovata*	FACW	Vine	Native
Balloon vine	*Cardiospermum halicacabum*	FAC	Forb/herb, Vine	Introduced
Sedge	*Carex sp.*	NA	Graminioid	NA
Buttonbush	*Cephalanthus occidentalis*	OBL	Tree, Shrub	Native
Carolina coralbead	*Cocculus carolinus*	FAC	Vine	Native
Flatsedge	*Cyperus sp.*	NA	Graminoid	Both
Common water hyacinth (A)	*Eichhornia crassipes*	OBL	Forb/herb	Introduced
Eastern swampprivet	*Forestiera acuminata*	OBL	Tree, Shrub	Native
Water locust	*Gleditsia aquatica*	OBL	Tree, Shrub	Native
Honey locust	*Gleditsia triacanthos*	FAC	Tree, Shrub	Native
Halberdleaf rosemallow	*Hibiscus laevis*	OBL	Forb/herb	Native
Rosemallow	*Hibiscus lasiocarpos*	NA	Subshrub, Forb/herb	Native
Crimsoneyed rosemallow	*Hibiscus moscheutos*	OBL	Subshrub, Forb/herb	Native
Rosemallow	*Hibiscus sp.*	NA	NA	NA
Floating marshpennywort (A)	*Hydrocotyle ranunculoides*	OBL	Forb/herb	Native
Possumhaw	*Ilex decidua*	FACW	Tree, Shrub	Native
Whitestar	*Ipomoea lacunosa*	FAC	Forb/herb, Vine	Native
Common duckweed (A)	*Lemna minor*	OBL	Forb/herb	Native
American spongeplant (A)	*Limnobium spongia*	OBL	Forb/herb	Native
Japanese honeysuckle	*Lonicera japonica*	FACU	Vine	Introduced
Anglestem primrose-willow	*Ludwigia leptocarpa*	OBL	Subshrub, Forb/herb	Native
Wand lythrum	*Lythrum lineare*	OBL	Forb/herb	Native
Loosestrife	*Lythrum sp.*	NA	NA	NA
Peppervine	*Nekemias arborea*	FAC	Shrub, Vine	Native
Water tupelo	*Nyssa aquatica*	OBL	Tree	Native
Cuban bulrush	*Oxycaryum cubense*	OBL	Graminoid	Native
Butterweed	*Packera glabella*	OBL	Forb/herb	Native
Horsetail paspalum	*Paspalum fluitans*	OBL	Graminoid	Native
Lanceleaf fogfruit	*Phyla lanceolata*	OBL	Forb/herb	Native
Planertree	*Planera aquatica*	OBL	Tree	Native
American Sycamore	*Platanus occidentalis*	FACW	Tree	Native
Knotweed	*Polygonum sp.*	NA	NA	NA
Southern dewberry	*Rubus trivialis*	FACU	Subshrub, Vine	Native
Black willow	*Salix nigra*	OBL	Tree	Native
Water spangles (A)	*Salvinia minima*	OBL	Forb/herb	Introduced
Lizard's tail	*Saururus cernuus*	OBL	Forb/herb	Native
Roundleaf greenbrier	*Smilax rotundifolia*	FAC	Shrub, Vine	Native
Johnson grass	*Sorghum halepense*	FACU	Graminioid	Introduced
Bald cypress	*Taxodium distichum*	OBL	Tree	Native
Spanish moss	*Tillandsia usneoide*	FAC	Forb/herb, Vine	Native
Poison ivy	*Toxicodendron radicans*	FAC	Shrub, Subshrub, Forb/herb, Vine	Native
Chinese tallow	*Triadica sebifera*	FAC	Tree	Introduced
Grape vine	*Vitis sp.*	NA	Vine	NA

Notes:
Wetland classification, growth habit, and Louisiana state native/introduced status provided by the USDA (2021) PLANTS database.
NA : Data not available. Wetland classification, growth habit, and state status data are not always applicable to taxa identified to genus.
(A): Indicates aquatic vegetation. Aquatic vegetation may be free-floating, submerged, or emergent (Clemson University, 2021).

References:
Clemson University. 2021. "Floating Aquatic Plants." Available: https://www.clemson.edu/extension/water/stormwater-ponds/problem-solving/aquatic-weeds/floating-plants/index.html. Accessed March 2021.

U.S. Department of Agriculture (USDA) Natural Resources Conservation Service. 2021. PLANTS Database. Available: https://plants.sc.egov.usda.gov/java/. Accessed March 2021.

Table 2
List of Birds Observed at the Property
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Common Name	*Scientific Name*	Diet
Barred Owl	***Strix varia***	**Mammals**
Great Blue Heron	***Ardea herodias***	**Fish**
Great Egret	***Ardea alba***	**Fish**
Prothonotary Warbler*	***Protonotaria citrea***	**Insects**
Red-shouldered Hawk	***Buteo lineatus***	**Mammals**
Snowy Egret	***Egretta thula***	**Fish**
Wood Duck	***Aix sponsa***	**Plants**
Little Blue Heron	***Egretta caerulea***	**Fish**
American Crow	*Corvus brachyrhynchos*	Omnivore
American Robin	*Turdus migratorius*	Insects
Anhinga	*Anhinga anhinga*	Fish
Bald Eagle*	*Haliaeetus leucocephalus*	Fish
Belted Kingfisher	*Megaceryle alcyon*	Fish
Black-crowned Night-heron*	*Nycticorax nycticorax*	Fish
Blue-gray Gnatcatcher	*Polioptila caerulea*	Insects
Carolina Chickadee	*Poecile carolinensis*	Insects
Carolina Wren	*Thryothorus ludovicianus*	Insects
Common Grackle	*Quiscalus quiscula*	Omnivore
Common Yellowthroat	*Geothlypis trichas*	Insects
Downy Woodpecker	*Dryobates pubescens*	Insects
Eastern Phoebe	*Sayornis phoebe*	Insects
Fish Crow	*Corvus ossifragus*	Omnivore
Hermit Thrush	*Catharus guttatus*	Insects
Mississippi Kite*	*Ictinia mississippiensis*	Insects
Northern Cardinal	*Cardinalis cardinalis*	Seeds
Northern Flicker	*Colaptes auratus*	Insects
Northern Parula*	*Setophaga americana*	Insects
Osprey	*Pandion haliaetus*	Fish
Orange-crowned Warbler	*Leiothlypis celata*	Insects
Pileated Woodpecker	*Dryocopus pileatus*	Insects
Red-bellied Woodpecker	*Melanerpes carolinus*	Insects
Red-eyed Vireo	*Vireo olivaceus*	Insects
Red-tailed Hawk	*Buteo jamaicensis*	Small Animals
Red-winged Blackbird	*Agelaius phoeniceus*	Insects
Swallow-tailed Kite*	*Elanoides forficatus*	Insects
Turkey Vulture	*Cathartes aura*	Carrion
White-throated Sparrow	*Zonotrichia albicollis*	Seeds
White-eyed Vireo*	*Vireo griseus*	Insects
Yellow-bellied Sapsucker	*Sphyrapicus varius*	Insects
Yellow-rumped Warbler	*Setophaga coronata*	Insects
Yellow-throated Vireo	*Vireo flavifrons*	Insects

Notes:
1. Species in **bold** are identified by the U.S. Fish and Wildlife Service Southeast Louisiana Refuges as swamp associates (USFWS, 2006).
2. Habitat and diet data provided by the The Cornell Lab (2021).
*: Denotes a Species of Concern due to declining populations (USFWS, 2006).

References:
The Cornell Lab. 2021. All About Birds. Available: https://www.allaboutbirds.org/news/. Accessed February 2021.
U.S. Fish and Wildlife Service (USFWS). 2006. "Atchafalaya National Wildlife Refuge Bird List". Southeast Louisiana Refuges. Available: https://www.fws.gov/southeast/pubs/atchafalaya_birdlist.pdf. Accessed March 2021.

Table 3
List of Non-Avian Wildlife Observed at the Property
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Taxa	Common Name	*Scientific Name*	Trophic Level
Reptile	American alligator	*Alligator mississippiensis*	Apex
Mammal	Coyote	*Canis latrans*	Apex
Mammal	Bobcat	*Lynx rufus*	Apex
Mammal	Red fox	*Vulpes vulpes*	Tertiary
Mammal	Northern raccoon	*Procyon lotor*	Tertiary
Reptile	Snakes	Suborder Serpentes	Tertiary
Reptile	Cottonmouth	*Agkistrodon piscivorus*	Teritiary
Reptile	Western ribbon snake	*Thamnophis proximus*	Teritiary
Amphibian	Frog	Order Anura	Secondary
Amphibian	Bronze frog	*Lithobates clamitans clamitans*	Secondary
Amphibian	Cricket frog	*Acris sp.*	Secondary
Amphibian	Blanchard's cricket frog	*Acris blanchardi*	Secondary
Amphibian	Green tree frog	*Hyla cinerea*	Secondary
Aquatic Invertebrate	Crayfish	Superfamily Astacoidea	Secondary
Fish	Fish	Subphylum Vertebrata	Secondary
Fish	Asian carp	Superfamily Cyprinidae	Secondary
Reptile	Lizards	Order Squamata	Secondary
Reptile	Green anole	*Anolis carolinensis*	Secondary
Terrestrial Invertebrate	Dragonflies	Infraorder Anisoptera	Secondary
Terrestrial Invertebrate	Eastern pondhawk	*Erythemis simplicicollis*	Secondary
Terrestrial Invertebrate	Spiders	Order Araneae	Secondary
Terrestrial Invertebrate	Fishing spider	*Dolomedes sp.*	Secondary
Terrestrial Invertebrate	Dark fishing spider	*Dolomedes tenebrosus*	Secondary
Terrestrial Invertebrate	Six-spotted Fishing Spider	*Dolomedes triton*	Secondary
Terrestrial Invertebrate	Wasp	Order Hymenoptera	Secondary
Terrestrial Invertebrate	Red paper wasp	*Polistes carolina*	Secondary
Aquatic Invertebrate	Snails	Class Gastropoda	Primary
Aquatic Invertebrate	Island apple snail	*Pomacea maculata*	Primary
Mammal	Eastern grey squirrel	*Sciurus carolinensis*	Primary
Terrestrial Invertebrate	American lady	*Vanessa virginiensis*	Primary
Terrestrial Invertebrate	Phaon crescent	*Phyciodes phaon*	Primary
Terrestrial Invertebrate	Ants	Family Formicidae	Primary
Terrestrial Invertebrate	Bees	Clade Anthophila	Primary
Terrestrial Invertebrate	Eastern carpenter bee	*Xylocopa virginica*	Primary
Terrestrial Invertebrate	Southern carpenter bee	*Xylocopa micans*	Primary
Terrestrial Invertebrate	Western honeybee	*Apis mellifera*	Primary
Terrestrial Invertebrate	Beetles	Order Cleoptera	Primary
Terrestrial Invertebrate	Alligatorweed flea beetle	*Agasicles hygrophila*	Primary
Terrestrial Invertebrate	Red-shouldered bug	*Jadera haematoloma*	Primary
Terrestrial Invertebrate	Grasshopper	Infraorder Acrididea	Primary
Terrestrial Invertebrate	Mosquitoes	Family Culicidae	Primary
Terrestrial Invertebrate	Moths	Order Lepidoptera	Primary
Terrestrial Invertebrate	Paper wasp	Family Vespidae	Primary

Notes:
Trophic levels are defined as follows:
Apex Predator: Carnivores; top predators at the top of the food chain without natural predators.
Tertiary Consumers: Carnivores and omnivores; organisms that consume primary and secondary consumers.
Secondary Consumers: Omnivores and carnivores; organisms that consume primary consumers (herbivores).
Primary Consumer: Herbivores; or organisms that consume plants and plant material (nectar, seeds, nuts, etc.).

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Table 4
Cypress Tree Survey Results
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Survey Date	Relative Location	Tree ID	DBH (in)	Water Depth (ft)
3/4/2021	Inside Remediation Area	BC1	11.5	0
3/4/2021	Inside Remediation Area	BC2	9.2	0
3/4/2021	Inside Remediation Area	BC3	13.2	0
3/4/2021	Inside Remediation Area	BC4	13.1	0
3/4/2021	Inside Remediation Area	BC5	4.5	0
3/4/2021	Inside Remediation Area	BC6	13.1	0.4
3/4/2021	Inside Remediation Area	BC7	9.2	0
3/4/2021	Inside Remediation Area	BC8	5.1	0
3/4/2021	Inside Remediation Area	BC9	15.3	0.7
3/4/2021	Inside Remediation Area	BC10	9.9	0
3/4/2021	Inside Remediation Area	BC11	11.5	0.2
3/4/2021	Inside Remediation Area	BC12	8	0
3/4/2021	Inside Remediation Area	BC13	14.6	0
3/4/2021	Inside Remediation Area	BC14	12.1	0
3/4/2021	Inside Remediation Area	BC15	14.3	0
3/4/2021	Inside Remediation Area	BC16	4.1	0
3/4/2021	Inside Remediation Area	BC17	14	0
3/4/2021	Inside Remediation Area	BC18	16.9	0
3/4/2021	Inside Remediation Area	BC19	14	0
3/4/2021	Inside Remediation Area	BC20	7.6	0
3/4/2021	Inside Remediation Area	BC21	2.1	0
3/4/2021	Inside Remediation Area	BC22	10.8	0
3/4/2021	Inside Remediation Area	BC23	66.2	1.4
3/4/2021	Inside Remediation Area	BC24	30.9	0.6
3/4/2021	Inside Remediation Area	BC25	31.8	0.9
3/15/2021	Inside Remediation Area	BC26	<1	0
3/15/2021	Inside Remediation Area	BC27	11.1	2.3
3/15/2021	Inside Remediation Area	BC28	10.2	2.1
3/15/2021	Inside Remediation Area	BC29	13.1	2.0
3/15/2021	Inside Remediation Area	BC30	17.8	1.1
3/15/2021	Inside Remediation Area	BC31	8.3	1.6
3/15/2021	Inside Remediation Area	BC32	11.1	1.8
3/15/2021	Inside Remediation Area	BC34	26.4	2.5
3/15/2021	Inside Remediation Area	BC35	17.2	2.1
3/15/2021	Inside Remediation Area	BC36	16.9	2.4
3/15/2021	Inside Remediation Area	BC37	11.1	2.4
3/15/2021	Inside Remediation Area	BC38	21.0	2.7
3/15/2021	Inside Remediation Area	BC39	6.0	2.2
3/15/2021	Inside Remediation Area	BC40	13.4	2.2
3/15/2021	Inside Remediation Area	BC46	<1	0
3/15/2021	Inside Remediation Area	BC49	<1	0
3/15/2021	Inside Remediation Area	BC50	13.4	0.6
3/15/2021	Inside Remediation Area	BC51	6.7	0.3
3/4/2021	Inside Remediation Area	BC72	<1	0

Table 4
Cypress Tree Survey Results
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Survey Date	Relative Location	Tree ID	DBH (in)	Water Depth (ft)
12/9/2020	Outside Remediation Area	T-01	18.8	0
12/9/2020	Outside Remediation Area	T-04	13.0	0
3/15/2021	Outside Remediation Area	BC33	23.2	2.8
3/15/2021	Outside Remediation Area	BC41	<1	0
3/15/2021	Outside Remediation Area	BC42	7.6	0.4
3/15/2021	Outside Remediation Area	BC43	<1	0
3/15/2021	Outside Remediation Area	BC44	15.0	0
3/15/2021	Outside Remediation Area	BC45	<1	0
3/15/2021	Outside Remediation Area	BC47	<1	0
3/15/2021	Outside Remediation Area	BC48	<1	0
3/15/2021	Reference	BC52 (REF-1)	<1	3.3
3/15/2021	Reference	BC53 (REF-2)	19.7	2.2
3/15/2021	Reference	BC54 (REF-3)	25.1	2.5
3/15/2021	Reference	BC55 (REF-4)	17.8	2.3
3/15/2021	Reference	BC56 (REF-5)	12.1	2.3
3/15/2021	Reference	BC57 (REF-6)	26.1	2.6
3/15/2021	Reference	BC58 (REF-7)	18.1	2.8
3/15/2021	Reference	BC59 (REF-8)	14.0	2.8
3/15/2021	Reference	BC60 (REF-9)	24.8	2.5
3/15/2021	Reference	BC61 (REF-10)	10.2	2.8
3/15/2021	Reference	BC62 (REF-11)	7.0	2.7
3/15/2021	Reference	BC63 (REF-12)	12.7	2.8
3/15/2021	Reference	BC64 (REF-13)	23.6	2.8
3/15/2021	Reference	BC65 (REF-14)	20.7	2.8
3/15/2021	Reference	BC66 (REF-15)	5.1	2.8
3/15/2021	Reference	BC67 (REF-16)	7.3	2.9
3/15/2021	Reference	BC68 (REF-17)	10.5	2.6
3/15/2021	Reference	BC69 (REF-18)	22.6	0.8
3/15/2021	Reference	BC70 (REF-19)	<1	0
3/15/2021	Reference	BC71 (REF-20)	15.9	1.9

Notes:
1. Circumference at breast height for bald cypress trees were field surveyed by ERM personnel on March 4 and 15, 2021, and by Holloway and Ritchie (2021) on December 9, 2020. Tree circumference was measured at 60 inches from the ground. Diameter at breast height (DBH) = CBH ÷ π.
2. Trees with a DBH <1 inch were recorded as saplings.

References:
Holloway, L and P. Ritchie. 2021. Expert Report and Vegetation Root Study on the Jeanerette Lumber and Shingle Company, LLC Property in Iberia Parish, Louisiana. Holloway Environmental Services, Inc. Harrisonburg, Louisiana. Environmental Resources Management, Inc. Metairie, Louisiana.

Table 5
Soil/Sediment Analytical Data and Screening
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

									Sample ID	Sample 1		Sample 2			JLS-1						JLS-1R					
									Area	Other		Other			Area 2						Area 2					
									Area Subgroup	Other		Other			Former E&P Area						Former E&P Area					
									Matrix	Soil		Soil			Canal Sediment						Canal Sediment					
									Sample Date	11/8/2019		11/8/2019			5/26/2020						1/13/2021					
									Interval (ft)	0-2	2-4	0-2	2-4	4-6	0-2		2-4		4-5		0-2		2-4		4-6	
Parameters	**Units**	**Eco-SSL Avian USEPA**	**Eco-SSL Mammal USEPA**	**Eco-SSL Invertebrate USEPA**	**Eco-SSL Plant USEPA**	**TEC Freshwater NOAA**	**Ecological Screening Value (Site Soil)**	**Background USGS**	**Ecological Screening Value (Canal Sediment)**	ICON	ICON	ICON	ICON	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON
Salts																										
% Moisture Primary[1]	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**43.3**	**45.3**	**60**	**62.5**	**48.5**	**73.5**	**72.1**	**71.4**	**71.3**	**70.4**	**68**	**75.7**	**76.4**	**69.7**	**71.9**	**63.1**	**79.0**
% Moisture Secondary[2]	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	**73.5**	NA	**71.1**	NA	**72.2**	NA	NA	NA	NA	NA	NA	NA
% Saturation	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	**102**	NA	**111**	NA	**124**	NA	**88.6**	NA	**94.6**	NA	**168**	NA
Cation Exchange Capacity (CEC)	meq/100g	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**65.1**	**66.8**	**57.3**	**58.1**	**23.2**	**52.6**	**61.9**	**50.4**	**61.9**	**60.4**	**63.9**	NA	NA	NA	NA	NA	NA
Electrical Conductivity	mmhos/cm	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**2.76**	**6.92**	**17.2**	**38.1**	**48.9**	**46.5**	**45.9**	**84.4**	**62.1**	**84.5**	**76.2**	NA	NA	NA	NA	NA	NA
Exchangeable Sodium Percentage	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**16.2**	**31.8**	**18.3**	**32.2**	**35.7**	**41.7**	**29.8**	**10.7**	**31.3**	**23.3**	**26**	NA	NA	NA	NA	NA	NA
Sodium Adsorption Ratio	Calc	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**26.3**	**50.7**	**39.2**	**81.6**	**93.7**	**36.6**	**37.7**	**65.3**	**50.2**	**56.8**	**56.8**	NA	NA	NA	NA	NA	NA
Soluble Calcium	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**2.09**	**2.62**	**16.7**	**23.8**	**32.6**	**102**	**94**	**146**	**134**	**153**	**160**	**94.1**	NA	**145**	NA	**159**	NA
Soluble Magnesium	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**1.17**	**1.43**	**7.29**	**10.9**	**15.5**	**62.7**	**47.6**	**73.4**	**66**	**71.2**	**81.5**	**44.1**	NA	**70.3**	NA	**84**	NA
Soluble Sodium	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**33.5**	**72.2**	**136**	**340**	**460**	**332**	**318**	**684**	**502**	**601**	**624**	**225**	NA	**394**	NA	**553**	NA
SPLP Chloride	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	**434**	NA	**539**	NA	NA	NA	NA	NA	NA	NA
SPLP Sodium	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	**257**	NA	**332**	NA	NA	NA	NA	NA	NA	NA
29-B Leachate Chloride	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	mg/Kg	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	**4390**	NA	**7230**	NA	**10200**	NA	**3490**	NA	**5560**	NA	**10900**	NA
Chloride	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	**489**	NA	**777**	NA	**764**	NA	**396**	NA	**676**	NA	**888**	NA
Alkalinity (Sat. Paste)	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	**1.9**	NA	**1.6**	NA	**1.8**	NA	**1**	NA	**1.6**	NA	**0.5**	NA
Sulfate	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	<2.00	NA	<5.00	NA	<5.00	NA	<2.00	NA	<5.00	NA	<5.00	NA
Total Organic Carbon	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH	S.U.	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	**7.25**	NA	**7.37**	NA	**7.12**	NA	**7**	NA	**7.64**	NA	**6.75**	NA
SPLP Metals																										
SPLP Arsenic	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Barium	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Cadmium	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Zinc	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals (Dry Weight)																										
Arsenic	mg/Kg-dry	43	46	N/S	18	9.79	9.79	12	9.79	**10.4**	**6.38**	**9.83**	**11.2**	**4.45**	**7.89**	**9.63**	<7	**11.1**	<7	**8.23**	NA	NA	<7	**7.34**	NA	NA
Barium	mg/Kg-dry	N/S	2000	330	N/S	N/S	330	775	N/S	**229**	**241**	**522**	**474**	**160**	**392**	**595**	**271**	**1270**	**252.7**	**656**	**307.8**	**674**	**776**	**753**	**252.6**	**421**
True Total Barium	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**481**	**1010**	**573**	**544**	**297**	**1020**	**643**	**1840**	**1890**	**855**	**801**	NA	NA	NA	NA	NA	NA
Cadmium	mg/Kg-dry	0.77	0.36	140	32	0.99	0.36	0.8	0.99	<0.494	<0.490	**0.676**	**0.512**	<0.491	<0.755	**0.702**	<0.699	**0.693**	<0.676	**0.624**	NA	NA	NA	NA	NA	NA
Chromium	mg/Kg-dry	26	34	N/S	N/S	43.4	26	84	43.4	**20.4**	**18.7**	**22.4**	**21.3**	**8.35**	**35.28**	**22.1**	**32.66**	**16.4**	**29.76**	**14.3**	NA	NA	NA	NA	NA	NA
Lead	mg/Kg-dry	11	56	1700	120	35.8	11	44	35.8	**21.6**	**21.4**	**28.4**	**25.3**	**7.77**	**20.83**	**22.1**	**19.69**	**22.1**	**20.44**	**17.2**	NA	NA	NA	NA	NA	NA
Mercury	mg/Kg-dry	N/S	N/S	N/S	N/S	0.18	0.18	0.11	0.18	<0.105	<0.108	**0.193**	**0.145**	**0.205**	**0.0698**	<0.0998	**0.0755**	<0.0985	**0.0571**	<0.0926	NA	NA	NA	NA	NA	NA
Selenium	mg/Kg-dry	1.2	0.63	4.1	0.52	N/S	0.52	1	N/S	<3.95	<3.92	<3.70	<3.87	<3.93	<3.77	<3.90	<3.5	<3.80	<3.38	<3.90	NA	NA	NA	NA	NA	NA
Silver	mg/Kg-dry	4.2	14	N/S	560	N/S	4.2	ND	N/S	NA	NA	NA	NA	NA	<1.887	NA	<1.748	NA	<1.689	NA	NA	NA	NA	NA	NA	NA
Strontium	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	203	N/S	**79.7**	**86.4**	**245**	**239**	**103**	NA	**97.3**	NA	**131**	NA	**126**	NA	NA	NA	NA	NA	NA
Zinc	mg/Kg-dry	46	79	120	160	121	46	140	121	**76.2**	**70.5**	**115**	**115**	**41.5**	**106**	**107**	**92**	**96.8**	**75.3**	**75.3**	NA	NA	NA	NA	NA	NA
Hydrocarbons (Dry Weight)																										
Oil & Grease	dry wt %	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	**0.12**	**1.07**	**1.92**	**6.67**	<0.188	NA	**0.251**	NA	<0.180	NA	NA	NA	NA	NA	NA	NA
TPH-DRO (>C10-C28)	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**661**	**751**	**2188**	**10507**	**68932**	NA	**878**	NA	**613**	NA	**266.3**	NA	NA	NA	NA	NA	NA
TPH-ORO (>C28-C35)	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**406**	**346**	**1350**	**4800**	**17204**	NA	**756**	NA	**686**	NA	**403**	NA	NA	NA	NA	NA	NA
Aliphatic C6-C8	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	<56	NA	<52	NA	<54	NA	NA	NA	NA	NA	NA	NA
Aliphatic >C8-C10	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	<56	NA	<52	NA	<54	NA	NA	NA	NA	NA	NA	NA
Aliphatic >C10-C12	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	<56	NA	<52	NA	<54	NA	NA	NA	NA	NA	NA	NA
Aliphatic >C12-C16	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	<37	NA	**77.5**	NA	<36	NA	NA	NA	NA	NA	NA	NA
Aliphatic >C16-C35	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	<37	NA	**256.7**	NA	<36	NA	NA	NA	NA	NA	NA	NA
Aromatic >C8-C10	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	<37	NA	<35	NA	<36	NA	NA	NA	NA	NA	NA	NA
Aromatic >C10-C12	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	<37	NA	<35	NA	<36	NA	NA	NA	NA	NA	NA	NA
Aromatic >C12-C16	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	<56	NA	<52	NA	<54	NA	NA	NA	NA	NA	NA	NA
Aromatic >C16-C21	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	<56	NA	<52	NA	<54	NA	NA	NA	NA	NA	NA	NA
Aromatic >C21-C35	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	<56	NA	**83.7**	NA	<54	NA	NA	NA	NA	NA	NA	NA
Total TPH (C6-C35)	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	<56	NA	**419**	NA	<54	NA	NA	NA	NA	NA	NA	NA
PAHs (Dry Weight)																										
2-Methylnaphthalene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calculated Sums (Dry Weight)																										
Total TPH Fraction	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	<56	NA	**419**	NA	<54	NA	NA	NA	NA	NA	NA	NA
Total PAH	mg/Kg-dry	N/S	N/S	N/S	N/S	1.61	N/S	N/S	1.61	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
LMW PAH	mg/Kg-dry	N/S	100	29	N/S	N/S	29	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HMW PAH	mg/Kg-dry	N/S	1.1	18	N/S	N/S	1	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 5
Soil/Sediment Analytical Data and Screening
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Sample ID										JLS-2																				JLS-3		
Area										Area 2																				Area 2		
Area Subgroup										Former E&P Area																				Former E&P Area		
Matrix										Canal Sediment																				Canal Sediment		
Sample Date										5/26/2020			5/26/2020			5/26/2020			2/4/2021	2/8/2021						2/25/2021				5/26/2020		
Interval (ft)										0-2			2-4			4-6			44	0-2		2-4	4-6	6-8		0-5		5-11		0-2		
Parameters	**Units**	**Eco-SSL Avian USEPA**	**Eco-SSL Mammal USEPA**	**Eco-SSL Invertebrate USEPA**	**Eco-SSL Plant USEPA**	**TEC Freshwater NOAA**	**Ecological Screening Value (Site Soil)**	**Background USGS**	**Ecological Screening Value (Canal Sediment)**	ERM	HET	ICON	ERM	HET	ICON	ERM	HET	ICON	ERM	ERM	ICON	ERM	ERM	ERM	ICON	ERM	ICON	ERM	ICON	ERM	HET	ICON
Salts																																
% Moisture Primary[1]	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	**75.5**	**73.7**	NA	**69.2**	**68.4**	NA	**69.4**	**67.2**	NA	**72.5**	**70.4**	**72.8**	**54.8**	**58.0**	**58.9**	**74.2**	**73.6**	**73.1**	**64.8**	NA	**55.9**	**53.9**
% Moisture Secondary[2]	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	**74.5**	NA	NA	**69.4**	NA	NA	**68.8**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**52.8**	NA
% Saturation	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	**108**	NA	NA	**110**	NA	NA	**114**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**114**	NA
Cation Exchange Capacity (CEC)	meq/100g	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**74.6**	**58.3**	**69.7**	**70.2**	**57**	**69.3**	**68.9**	**49.6**	**71.2**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**76.9**	**60.4**	**78.3**
Electrical Conductivity	mmhos/cm	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**15.2**	**12.4**	**14**	**32.8**	**36.5**	**35.4**	**44.6**	**49.2**	**46.1**	**2.27**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.81**	**0.726**	**1.78**
Exchangeable Sodium Percentage	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**10.4**	**9.84**	**30.4**	**26.2**	**2.11**	**23.5**	**30.7**	**12.6**	**35.6**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.81**	**0.748**	**1.23**
Sodium Adsorption Ratio	Calc	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**16.8**	**21.2**	**16.8**	**39.8**	**46.2**	**44.1**	**50.8**	**47.6**	**56**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**1.67**	**1.93**	**2.18**
Soluble Calcium	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**31.3**	**24.8**	**29**	**50**	**43.7**	**56.4**	**63.7**	**58.1**	**76.8**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**2.59**	**1.94**	**6.13**
Soluble Magnesium	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**13.6**	**13.8**	**12.3**	**21.1**	**24.7**	**23.3**	**27.3**	**31.6**	**32.4**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**1.63**	**1.2**	**3.25**
Soluble Sodium	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**79.5**	**93.2**	**76.2**	**237**	**270**	**278**	**342**	**319**	**414**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**2.42**	**2.42**	**4.72**
SPLP Chloride	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Sodium	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
29-B Leachate Chloride	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	mg/Kg	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	**1030**	NA	NA	**3450**	NA	NA	**5420**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**19**	NA
Chloride	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	**115**	NA	NA	**309**	NA	NA	**421**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**4.39**	NA
Alkalinity (Sat. Paste)	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	**2.9**	NA	NA	**3**	NA	NA	**2.2**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.9**	NA
Sulfate	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	<1.00	NA	NA	<2.00	NA	NA	<2.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**1.15**	NA
Total Organic Carbon	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**71600**	NA	**66000**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH	S.U.	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	**7.21**	NA	NA	**7.39**	NA	NA	**7.12**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**6.68**	NA
SPLP Metals																																
SPLP Arsenic	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.0011**	NA	<0.001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Barium	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.067**	NA	**0.04**	**0.058**	**0.099**	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Cadmium	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.001	NA	<0.001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Zinc	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.02	NA	<0.02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals (Dry Weight)																																
Arsenic	mg/Kg-dry	43	46	N/S	18	9.79	9.79	12	9.79	**15.83**	**10.9**	**14.7**	**24.81**	**13.6**	**19.4**	**17.07**	**14.08**	**19.5**	NA	NA	**14.2**	NA	NA	**25**	**10.6**	NA	**16.2**	**20.37**	**11**	**6.27**	**4.63**	**4.4**
Barium	mg/Kg-dry	N/S	2000	330	N/S	N/S	330	775	N/S	**1055**	**576**	**929**	**2353**	**854**	**1700**	**2603**	**291.8**	**1600**	NA	NA	**3220**	NA	NA	**4857**	**1940**	NA	**1230**	**2784**	**1310**	**235**	**256**	**267**
True Total Barium	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**1080**	**1140**	**1220**	**2570**	**2870**	**2800**	**3410**	**3030**	**2730**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**376**	<500	**354**
Cadmium	mg/Kg-dry	0.77	0.36	140	32	0.99	0.36	0.8	0.99	<1.031	<0.816	**0.912**	<0.804	<0.649	**0.929**	<0.858	<0.654	**0.884**	NA	NA	**0.589**	NA	NA	NA	NA	NA	NA	NA	NA	<0.576	<0.454	**0.492**
Chromium	mg/Kg-dry	26	34	N/S	N/S	43.4	26	84	43.4	**23.94**	**34.73**	**20.3**	**21.35**	**32.8**	**19.4**	**19.94**	**33**	**18.3**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**19.38**	**31.5**	**19.4**
Lead	mg/Kg-dry	11	56	1700	120	35.8	11	44	35.8	**28**	**24.24**	**25**	**34.6**	**31.59**	**33.9**	**32.2**	**26.41**	**29.8**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**19.78**	**18.64**	**19.8**
Mercury	mg/Kg-dry	N/S	N/S	N/S	N/S	0.18	0.18	0.11	0.18	<0.3661	**0.094**	<0.0992	<0.3093	**0.094**	**0.0958**	<0.3151	**0.0987**	**0.0952**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.2171	**0.0855**	<0.0988
Selenium	mg/Kg-dry	1.2	0.63	4.1	0.52	N/S	0.52	1	N/S	<8.23	<4.08	<3.65	<6.44	<3.25	<3.79	<6.88	<3.27	<3.97	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<4.61	<2.27	<3.78
Silver	mg/Kg-dry	4.2	14	N/S	560	N/S	4.2	ND	N/S	<1.031	<2.041	NA	<0.804	<1.623	NA	<0.858	<1.634	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.576	<1.134	NA
Strontium	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	203	N/S	NA	NA	<81.1	NA	NA	**149**	NA	NA	**148**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**49.4**
Zinc	mg/Kg-dry	46	79	120	160	121	46	140	121	**159.1**	**102**	**97.1**	**98.7**	**96.8**	**91.4**	**87.1**	**83**	**81.2**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**67.8**	**80.3**	**69.1**
Hydrocarbons (Dry Weight)																																
Oil & Grease	dry wt %	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**0.26**	<0.196	NA	**0.43**	<0.163	NA	**0.93**	**0.32**	**0.64**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.05**	<0.106	NA
TPH-DRO (>C10-C28)	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	**375.3**	NA	NA	**1560**	NA	NA	**2838**	NA	NA	NA	NA	NA	NA	**4623**	NA	**317**	NA	**2159**	NA	NA	**175.5**
TPH-ORO (>C28-C35)	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	**559**	NA	NA	**1367**	NA	NA	**1799**	NA	NA	NA	NA	NA	NA	**1513**	NA	**268.6**	NA	**872**	NA	NA	**310**
Aliphatic C6-C8	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	<59	NA	NA	<49	NA	NA	<48	NA	NA	NA	NA	NA	**400**	<119.5	NA	NA	NA	<172.1	NA	NA	<32	NA
Aliphatic >C8-C10	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	<59	NA	NA	<49	NA	NA	**72.8**	NA	NA	NA	NA	NA	**692**	**579**	NA	NA	NA	**257.6**	NA	NA	<32	NA
Aliphatic >C10-C12	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<23	<59	NA	<19	<49	NA	<18.38	**149**	NA	NA	NA	NA	NA	**61.1**	**27.9**	NA	NA	NA	<21.86	NA	<13	<32	NA
Aliphatic >C12-C16	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<23	<39	NA	**36.7**	**92**	NA	<18.38	**603**	NA	NA	NA	NA	NA	**196.7**	**116.4**	NA	NA	NA	<21.86	NA	<13	<21	NA
Aliphatic >C16-C35	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**35.21**	<39	NA	<19	**291.8**	NA	**34.1**	**1054**	NA	NA	NA	NA	NA	**330**	**216.2**	NA	NA	NA	<21.86	NA	<13	<21	NA
Aromatic >C8-C10	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	<39	NA	NA	<33	NA	NA	<32	NA	NA	NA	NA	NA	**478**	**319**	NA	NA	NA	<172.1	NA	NA	<21	NA
Aromatic >C10-C12	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<23	<39	NA	<19	<33	NA	<18.38	<32	NA	NA	NA	NA	NA	<13	<14	NA	NA	NA	<21.86	NA	<13	<21	NA
Aromatic >C12-C16	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<23	<59	NA	<19	**56.2**	NA	<18.38	**67**	NA	NA	NA	NA	NA	**27.2**	**30**	NA	NA	NA	<21.86	NA	<13	<32	NA
Aromatic >C16-C21	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<23	<59	NA	<19	**73.9**	NA	<18.38	**77.6**	NA	NA	NA	NA	NA	**25**	**23.48**	NA	NA	NA	<21.86	NA	<13	<32	NA
Aromatic >C21-C35	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<23	<59	NA	**71.1**	**124**	NA	<18.38	**190.4**	NA	NA	NA	NA	NA	**90.9**	**71.2**	NA	NA	NA	<21.86	NA	<13	<32	NA
Total TPH (C6-C35)	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	<59	NA	NA	**637**	NA	NA	**1994**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<32	NA
PAHs (Dry Weight)																																
2-Methylnaphthalene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.01185	NA	<0.01191	**1.5**	**1.1**	NA	**0.054**	NA	<0.01212	NA	NA	NA	NA
Acenaphthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.055**	NA	<0.02379	**0.292**	**0.236**	NA	<0.02558	NA	<0.0242	NA	NA	NA	NA
Acenaphthylene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.02367	NA	<0.02379	<0.144	<0.157	NA	<0.02558	NA	<0.0242	NA	NA	NA	NA
Anthracene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.01185	NA	<0.01191	<0.073	<0.079	NA	<0.01279	NA	<0.01212	NA	NA	NA	NA
Benzo(a)anthracene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.03578**	NA	<0.02379	<0.144	<0.157	NA	<0.02558	NA	<0.0242	NA	NA	NA	NA
Benzo(a)pyrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.01185	NA	<0.01191	<0.073	<0.079	NA	<0.01279	NA	<0.01212	NA	NA	NA	NA
Benzo(b)fluoranthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.02367	NA	<0.02379	<0.144	<0.157	NA	<0.02558	NA	<0.0242	NA	NA	NA	NA
Benzo(k)fluoranthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.01185	NA	<0.01191	<0.073	<0.079	NA	<0.01279	NA	<0.01212	NA	NA	NA	NA
Chrysene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.051**	NA	<0.02379	**0.168**	<0.157	NA	<0.02558	NA	<0.0242	NA	NA	NA	NA
Dibenz(a,h)anthracene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.02367	NA	<0.02379	<0.144	<0.157	NA	<0.02558	NA	<0.0242	NA	NA	NA	NA
Fluoranthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.153**	NA	**0.066**	**0.558**	**0.555**	NA	**0.03574**	NA	**0.01699**	NA	NA	NA	NA
Fluorene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.044**	NA	**0.02691**	**0.976**	**0.505**	NA	**0.054**	NA	<0.01212	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.01505**	NA	<0.01191	<0.073	<0.079	NA	<0.01279	NA	<0.01212	NA	NA	NA	NA
Naphthalene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.01185	NA	<0.01191	**0.392**	**0.388**	NA	<0.01279	NA	<0.01212	NA	NA	NA	NA
Phenanthrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.095**	NA	**0.055**	**0.843**	**0.821**	NA	**0.05**	NA	**0.01621**	NA	NA	NA	NA
Pyrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.15**	NA	**0.055**	**0.327**	**0.324**	NA	**0.025**	NA	**0.01476**	NA	NA	NA	NA
Calculated Sums (Dry Weight)																																
Total TPH Fraction	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**35.21**	<59	NA	**107.8**	**637**	NA	**34.1**	**1994**	NA	NA	NA	NA	NA	**2300.9**	**1383.18**	NA	NA	NA	**257.6**	NA	<13	<32	NA
Total PAH	mg/Kg-dry	N/S	N/S	N/S	N/S	1.61	N/S	N/S	1.61	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.599**	NA	**0.203**	**5.056**	**3.929**	NA	**0.219**	NA	**0.048**	NA	NA	NA	NA
LMW PAH	mg/Kg-dry	N/S	100	29	N/S	N/S	29	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.194**	NA	**0.082**	**4.003**	**3.05**	NA	**0.158**	NA	**0.016**	NA	NA	NA	NA
HMW PAH	mg/Kg-dry	N/S	1.1	18	N/S	N/S	1	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.405**	NA	**0.121**	**1.053**	**0.879**	NA	**0.061**	NA	**0.032**	NA	NA	NA	NA

Table 5
Soil/Sediment Analytical Data and Screening
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

									Sample ID	JLS-4						JLS-5		JLS-6						JLS-6R						JLS-7	
									Area	Area 1						Area 1		Area 1						Area 1						Area 1	
									Area Subgroup	Area 1						Area 1		Area 1						Area 1						Area 1	
									Matrix	Canal Sediment						Canal Sediment		Canal Sediment						Canal Sediment						Canal Sediment	
									Sample Date	5/26/2020						5/27/2020		5/27/2020						1/13/2021						5/27/2020	
									Interval (ft)	0-2		2-4		4-6		0-2		0-2		2-4		4-6		0-2		2-4		4-6		0-2	
Parameters	**Units**	**Eco-SSL Avian USEPA**	**Eco-SSL Mammal USEPA**	**Eco-SSL Invertebrate USEPA**	**Eco-SSL Plant USEPA**	**TEC Freshwater NOAA**	**Ecological Screening Value (Site Soil)**	**Background USGS**	**Ecological Screening Value (Canal Sediment)**	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON
Salts																															
% Moisture Primary[1]	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**72.6**	**72.2**	**67**	**66.1**	**56.7**	**61.1**	**61.9**	**63.2**	**63.8**	**64.4**	**63**	**61.3**	**60.2**	**57.5**	**70.7**	**69.1**	**59.6**	**58.6**	**57.9**	**56.2**	**66.5, 68**	**67.5**
% Moisture Secondary[2]	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**72.9**	NA	**60.6**	NA	**58.6**	NA	**62.7**	NA	**64.8**	NA	**63**	NA	**57.8**	NA	NA	NA	NA	NA	NA	NA	NA	NA
% Saturation	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**92.5**	NA	**95.4**	NA	**94**	NA	**125**	NA	**86**	NA	**88.6**	NA	**89.9**	NA	**89**	NA	**91.2**	NA	**93.6**	NA	**86.7**	NA
Cation Exchange Capacity (CEC)	meq/100g	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**45.2**	**68.9**	**42.4**	**62.2**	**35.7**	**55.5**	**44.3**	**72.9**	**43.5**	**58.6**	**50.9**	**65.8**	**50**	**60**	NA	NA	NA	NA	NA	NA	**53**	**60.7**
Electrical Conductivity	mmhos/cm	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**2.03**	**2.26**	**2.06**	**3.42**	**1.56**	**2.28**	**0.646**	**1.46**	**1.18**	**1.73**	**1.26**	**1.74**	**1.22**	**4.74**	NA	NA	NA	NA	NA	NA	**1.58**	**3.27**
Exchangeable Sodium Percentage	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**3.04**	**2.9**	**3.46**	**3.41**	**1.72**	**5.04**	**1.28**	**1.24**	**0.778**	**0.92**	**0.84**	**1.05**	**0.783**	**3.66**	NA	NA	NA	NA	NA	NA	**2.31**	**2.36**
Sodium Adsorption Ratio	Calc	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**6.42**	**3.9**	**6.69**	**5.53**	**7.8**	**4.84**	**2.2**	**2.95**	**1.95**	**1.89**	**2.26**	**1.84**	**2.36**	**5.37**	NA	NA	NA	NA	NA	NA	**4.75**	**4.81**
Soluble Calcium	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**4.59**	**5.32**	**4.53**	**7.64**	**3.53**	**4.66**	**1.72**	**3.78**	**4.17**	**6.23**	**3.74**	**5.76**	**4.14**	**13**	**4.39**	NA	**3.82**	NA	**2.74**	NA	**5.07**	**9.5**
Soluble Magnesium	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**1.83**	**2.62**	**1.91**	**3.8**	**1.53**	**2.56**	**0.932**	**1.89**	**1.64**	**2.72**	**1.79**	**2.62**	**1.65**	**6.99**	**2.14**	NA	**2.05**	NA	**1.68**	NA	**1.68**	**4.12**
Soluble Sodium	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**11.5**	**7.77**	**12**	**13.2**	**12.4**	**9.2**	**2.53**	**4.96**	**3.33**	**4**	**3.75**	**3.77**	**4.01**	**17**	**2.59**	NA	**3.33**	NA	**2.91**	NA	**8.73**	**12.6**
SPLP Chloride	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Sodium	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
29-B Leachate Chloride	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	mg/Kg	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**112**	NA	**149**	NA	**141**	NA	**29.6**	NA	**36.4**	NA	**45.2**	NA	**42.6**	NA	**28.2**	NA	**40**	NA	**40.7**	NA	**64.1**	NA
Chloride	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**14.5**	NA	**15.1**	NA	**11.1**	NA	**4.1**	NA	**8.93**	NA	**4.49**	NA	**3.96**	NA	**3.12**	NA	**4.62**	NA	**3.52**	NA	**7.48**	NA
Alkalinity (Sat. Paste)	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**2**	NA	**2**	NA	**1.4**	NA	**0.9**	NA	**2.4**	NA	**6.1**	NA	**6.2**	NA	**6.4**	NA	**5.6**	NA	**4.5**	NA	**6.6**	NA
Sulfate	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**1.42**	NA	**1.34**	NA	**1.49**	NA	**0.749**	NA	**5.76**	NA	**1.84**	NA	**1.37**	NA	**1.8**	NA	**1.86**	NA	**1.3**	NA	**1.64**	NA
Total Organic Carbon	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH	S.U.	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**6.91**	NA	**6.86**	NA	**6.71**	NA	**6.66**	NA	**7.18**	NA	**7.13**	NA	**7.21**	NA	**7.65**	NA	**7.79**	NA	**7.68**	NA	**7.37**	NA
SPLP Metals																															
SPLP Arsenic	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Barium	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Cadmium	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Zinc	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals (Dry Weight)																															
Arsenic	mg/Kg-dry	43	46	N/S	18	9.79	9.79	12	9.79	**7.92**	**10.4**	**7.91**	**12**	**8.01**	**11.9**	<5	**5.15**	**8.4**	**8.56**	**8.73**	**10**	**7.61**	**12.4**	NA	NA	NA	NA	**8.3**	**7.59**	**7.94**	**12**
Barium	mg/Kg-dry	N/S	2000	330	N/S	N/S	330	775	N/S	**340.5**	**386**	**406**	**583**	**376**	**537**	**203.7**	**237**	**561**	**837**	**435**	**1280**	**467**	**842**	**730**	**611**	**1257**	**842**	**1299**	**860**	**463**	**736**
True Total Barium	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**524**	**444**	**721**	**671**	**600**	**588**	<500	**293**	**976**	**996**	**2060**	**1460**	**1080**	**1020**	NA	NA	NA	NA	NA	NA	**855**	**862**
Cadmium	mg/Kg-dry	0.77	0.36	140	32	0.99	0.36	0.8	0.99	<0.73	**0.739**	**0.655**	**0.77**	<0.462	**0.748**	<0.525	**0.584**	**0.566**	**0.752**	**0.659**	**0.86**	**0.638**	**0.766**	NA	NA	NA	NA	NA	NA	<0.597	**0.796**
Chromium	mg/Kg-dry	26	34	N/S	N/S	43.4	26	84	43.4	**34.71**	**21.2**	**35.2**	**20.5**	**30.7**	**16**	**29.9**	**18.4**	**33**	**17.4**	**30**	**18.8**	**28.6**	**17.4**	NA	NA	NA	NA	NA	NA	**33.4**	**17.4**
Lead	mg/Kg-dry	11	56	1700	120	35.8	11	44	35.8	**20.4**	**21**	**21.36**	**22.6**	**16.26**	**18.2**	**17.8**	**18.6**	**20.06**	**23.1**	**22.68**	**22.6**	**20.5**	**21.5**	NA	NA	NA	NA	NA	NA	**18.8**	**20.8**
Mercury	mg/Kg-dry	N/S	N/S	N/S	N/S	0.18	0.18	0.11	0.18	**0.0788**	<0.0957	**0.0806**	<0.0957	**0.0744**	<0.0978	**0.0669**	<0.0946	**0.0903**	**0.114**	**0.1016**	**0.0982**	**0.0789**	<0.0999	NA	NA	NA	NA	NA	NA	**0.0919**	<0.0952
Selenium	mg/Kg-dry	1.2	0.63	4.1	0.52	N/S	0.52	1	N/S	<3.65	<3.94	<3.03	<3.9	<2.31	<3.94	<2.62	<3.96	<2.76	<3.71	<2.7	<3.87	<2.51	<3.74	NA	NA	NA	NA	NA	NA	<2.99	<3.79
Silver	mg/Kg-dry	4.2	14	N/S	560	N/S	4.2	ND	N/S	<1.825	NA	<1.515	NA	<1.155	NA	<1.312	NA	<1.381	NA	<1.351	NA	<1.256	NA	NA	NA	NA	NA	NA	NA	<1.493	NA
Strontium	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	203	N/S	NA	**52.1**	NA	**55.6**	NA	**51.3**	NA	**47**	NA	**63.5**	NA	**77.1**	NA	**103**	NA	NA	NA	NA	NA	NA	NA	**94.7**
Zinc	mg/Kg-dry	46	79	120	160	121	46	140	121	**104.7**	**98.5**	**96.7**	**93.4**	**72**	**70.6**	**82.2**	**76.1**	**89.8**	**92.9**	**103**	**95.4**	**88.7**	**86.2**	NA	NA	NA	NA	NA	NA	**97.6**	**117**
Hydrocarbons (Dry Weight)																															
Oil & Grease	dry wt %	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<0.184	NA	<0.127	NA	<0.121	NA	<0.134	NA	**0.626**	NA	<0.135	NA	<0.118	NA	NA	NA	NA	NA	NA	NA	<0.156	NA
TPH-DRO (>C10-C28)	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	**281.3**	NA	**307**	NA	**303**	NA	<136	NA	**1531**	NA	**605**	NA	**296**	NA	NA	NA	NA	NA	NA	NA	**735**
TPH-ORO (>C28-C35)	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	**511**	NA	**475**	NA	**365**	NA	**177**	NA	**1230**	NA	**767**	NA	**369**	NA	NA	NA	NA	NA	NA	NA	**738**
Aliphatic C6-C8	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<55	NA	<38	NA	<36	NA	<107.8	NA	<43	NA	<41	NA	<36	NA	NA	NA	NA	NA	NA	NA	<47	NA
Aliphatic >C8-C10	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<55	NA	<38	NA	<36	NA	<107.8	NA	<43	NA	<41	NA	<36	NA	NA	NA	NA	NA	NA	NA	<47	NA
Aliphatic >C10-C12	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<55	NA	<38	NA	<36	NA	<107.8	NA	<43	NA	<41	NA	<36	NA	NA	NA	NA	NA	NA	NA	<47	NA
Aliphatic >C12-C16	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<37	NA	<25	NA	<24	NA	<71.8	NA	**278.7**	NA	<27	NA	**35.8**	NA	NA	NA	NA	NA	NA	NA	**81.6**	<31
Aliphatic >C16-C35	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<37	NA	**102**	NA	**70.3**	NA	<71.8	NA	**605**	NA	**114.9**	NA	**246**	NA	NA	NA	NA	NA	NA	NA	**271.3**	NA
Aromatic >C8-C10	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<37	NA	<25	NA	<24	NA	<27	NA	<28	NA	<27	NA	<24	NA	NA	NA	NA	NA	NA	NA	<31	NA
Aromatic >C10-C12	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<37	NA	<25	NA	<24	NA	<27	NA	<28	NA	<27	NA	<24	NA	NA	NA	NA	NA	NA	NA	<31	NA
Aromatic >C12-C16	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<55	NA	<38	NA	<36	NA	<40	NA	**68.8**	NA	<41	NA	<36	NA	NA	NA	NA	NA	NA	NA	<47	NA
Aromatic >C16-C21	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<55	NA	<38	NA	<36	NA	<40	NA	**137.5**	NA	<41	NA	<36	NA	NA	NA	NA	NA	NA	NA	**71.6**	NA
Aromatic >C21-C35	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<55	NA	<38	NA	**48**	NA	<40	NA	**247.7**	NA	**88.1**	NA	**70.4**	NA	NA	NA	NA	NA	NA	NA	**128.8**	NA
Total TPH (C6-C35)	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<55	NA	**102**	NA	**118.6**	NA	<40	NA	**1338**	NA	**203**	NA	**353**	NA	NA	NA	NA	NA	NA	NA	**553**	NA
PAHs (Dry Weight)																															
2-Methylnaphthalene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calculated Sums (Dry Weight)																															
Total TPH Fraction	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<55	NA	**102**	NA	**118.6**	NA	<40	NA	**1338**	NA	**203**	NA	**353**	NA	NA	NA	NA	NA	NA	NA	**553**	**0**
Total PAH	mg/Kg-dry	N/S	N/S	N/S	N/S	1.61	N/S	N/S	1.61	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
LMW PAH	mg/Kg-dry	N/S	100	29	N/S	N/S	29	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HMW PAH	mg/Kg-dry	N/S	1.1	18	N/S	N/S	1	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

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Table 5
Soil/Sediment Analytical Data and Screening
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

									Sample ID	JLS-8		JLS-9				JLS-9R						JLS-10							JLS-11			
									Area	Area 1		Area 1				Area 1						Area 2							Area 2			
									Area Subgroup	Area 1		Area 1				Area 1						Former E&P Area							Former E&P Area			
									Matrix	Canal Sediment		Canal Sediment				Canal Sediment						Soil							Soil			
									Sample Date	5/27/2020		5/27/2020				1/13/2021						7/29/2020							7/30/2020			
									Interval (ft)	0-2		0-2		2-4		0-2		2-4		4-6		12-14		20-22		24-26	34-36		0-4	8-12	24-28	30-32
Parameters	**Units**	**Eco-SSL Avian USEPA**	**Eco-SSL Mammal USEPA**	**Eco-SSL Invertebrate USEPA**	**Eco-SSL Plant USEPA**	**TEC Freshwater NOAA**	**Ecological Screening Value (Site Soil)**	**Background USGS**	**Ecological Screening Value (Canal Sediment)**	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	ERM	ICON	ERM	ICON	ICON	ERM	ICON	ICON	ICON	ICON	ICON
Salts																																
% Moisture Primary[1]	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	59, 64.8	60.7	67.1, 67.8	65.6	65, 63.2	61.8	68.7	66.3	61.2	62.2	60	58.9	78.3	74.9	48.8	47.2	27.1	40.2	40.3	41.3	54.8	46.7	28.9
% Moisture Secondary[2]	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
% Saturation	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	119	NA	87.3	NA	84.3	NA	88.1	NA	89.3	NA	87.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cation Exchange Capacity (CEC)	meq/100g	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	59.6	78.9	51.7	56.3	50	58	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Electrical Conductivity	mmhos/cm	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	0.663	1.05	1.01	2.58	0.965	0.85	NA	NA	NA	NA	NA	NA	3.02	2.6	1.75	1.56	1.26	1.18	1.13	5.06	44.5	83.4	82
Exchangeable Sodium Percentage	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	0.773	1.02	0.253	1.47	<0.100	0.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	9.67	14.6	NA	NA
Sodium Adsorption Ratio	Calc	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	2.35	1.7	2.44	2.8	3.78	1.07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	15,4	50	NA	NA
Soluble Calcium	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	1.83	3.49	2.67	7.58	2.26	2.25	3.49	NA	3.74	NA	2.86	NA	NA	NA	NA	NA	NA	NA	NA	4.81	66.2	NA	NA
Soluble Magnesium	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	1.09	1.97	1.5	3.49	1.24	1.15	1.63	NA	1.96	NA	1.59	NA	NA	NA	NA	NA	NA	NA	NA	2.69	30.1	NA	NA
Soluble Sodium	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	2.84	2.8	3.53	6.58	5	1.4	1.43	NA	1.85	NA	1.93	NA	NA	NA	NA	NA	NA	NA	NA	29.8	347	NA	NA
SPLP Chloride	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Sodium	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
29-B Leachate Chloride	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	24.1	NA	NA	NA	NA	7400	NA
Chloride	mg/Kg	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	35.8	NA	21.4	NA	27.7	NA	15.9	NA	25.7	NA	47.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	3.08	NA	2.48	NA	3.44	NA	2	NA	2.55	NA	4.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Alkalinity (Sat. Paste)	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	5.8	NA	4.6	NA	2.8	NA	3.6	NA	6.5	NA	3.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	1.51	NA	2.16	NA	1.89	NA	2.66	NA	1.59	NA	1.73	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Organic Carbon	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH	S.U.	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	6.55	NA	7.18	NA	7.02	NA	7.25	NA	7.54	NA	7.62	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Metals																																
SPLP Arsenic	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Barium	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Cadmium	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Zinc	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals (Dry Weight)																																
Arsenic	mg/Kg-dry	43	46	N/S	18	9.79	9.79	12	9.79	6.63	7.22	10.12	12.2	9.46	10.5	8.08	NA	7.81	NA	8.93	8.76	NA	NA	NA	NA	NA	NA	NA	10.7	12.1	NA	NA
Barium	mg/Kg-dry	N/S	2000	330	N/S	N/S	330	775	N/S	217.3	204	413	983	646	1080	802	1120	894	1230	923	1260	NA	NA	NA	NA	NA	NA	NA	406	230	NA	NA
True Total Barium	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<500	307	1170	1210	1490	1340	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	478	328	NA	NA
Cadmium	mg/Kg-dry	0.77	0.36	140	32	0.99	0.36	0.8	0.99	0.534	0.676	0.617	0.687	<0.571	0.657	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.696	0.864	NA	NA
Chromium	mg/Kg-dry	26	34	N/S	N/S	43.4	26	84	43.4	28.3	19.5	34.3	17.3	26.83	16.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	17.6	17.5	NA	NA
Lead	mg/Kg-dry	11	56	1700	120	35.8	11	44	35.8	19.88	21.1	19	19.6	18.54	20.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	18.3	17.3	NA	NA
Mercury	mg/Kg-dry	N/S	N/S	N/S	N/S	0.18	0.18	0.11	0.18	0.0761	<0.09996	0.1043	<0.0963	0.1071	0.106	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.102	<0.101	NA	NA
Selenium	mg/Kg-dry	1.2	0.63	4.1	0.52	N/S	0.52	1	N/S	<2.44	<3.92	<3.04	<3.93	<2.86	<3.75	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	mg/Kg-dry	4.2	14	N/S	560	N/S	4.2	ND	N/S	<1.22	NA	<1.52	NA	<1.429	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Strontium	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	203	N/S	NA	51.2	NA	54.5	NA	51.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	125	77.5	NA	NA
Zinc	mg/Kg-dry	46	79	120	160	121	46	140	121	86.8	81.3	88.4	80.5	81.7	79.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	68.9	77.1	NA	NA
Hydrocarbons (Dry Weight)																																
Oil & Grease	dry wt %	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<0.142	NA	<0.155	NA	<0.136	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-DRO (>C10-C28)	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	<127	NA	456	NA	156	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-ORO (>C28-C35)	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	158	NA	401	NA	233.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aliphatic C6-C8	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<43	NA	<47	NA	<41	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aliphatic >C8-C10	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<43	NA	<47	NA	<41	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aliphatic >C10-C12	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<43	NA	<47	NA	<41	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aliphatic >C12-C16	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<28	NA	130	NA	35	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aliphatic >C16-C35	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<28	NA	332	NA	167.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aromatic >C8-C10	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<28	NA	<31	NA	<27	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aromatic >C10-C12	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<28	NA	<31	NA	<27	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aromatic >C12-C16	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<43	NA	<47	NA	<41	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aromatic >C16-C21	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<43	NA	70.5	NA	<41	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aromatic >C21-C35	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	56	NA	174.8	NA	58.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total TPH (C6-C35)	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	56	NA	708	NA	261.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAHs (Dry Weight)																																
2-Methylnaphthalene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calculated Sums (Dry Weight)																																
Total TPH Fraction	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	56	NA	708	NA	261.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total PAH	mg/Kg-dry	N/S	N/S	N/S	N/S	1.61	N/S	N/S	1.61	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
LMW PAH	mg/Kg-dry	N/S	100	29	N/S	N/S	29	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HMW PAH	mg/Kg-dry	N/S	1.1	18	N/S	N/S	1	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 5
Soil/Sediment Analytical Data and Screening
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Sample ID										JLS-12				JLS-12R							JLS-13						JLS-14						
Area										Area 2				Area 2							Area 2						Area 2						
Area Subgroup										Former E&P Area				Former E&P Area							Former E&P Area						North-South Canal Area						
Matrix										Soil				Soil							Soil						Soil						
Sample Date										8/3/2020				1/14/2021							8/4/2020						8/5/2020						
Interval (ft)										0-4	8-12	20-22	44-49	0-2	2-4	8-10		10-12	20-22		0-4	6-8	10-12	20-22	46-48	46-48	2-4	4-8	8-12	20-22		40-44	44-48
Parameters	**Units**	**Eco-SSL Avian USEPA**	**Eco-SSL Mammal USEPA**	**Eco-SSL Invertebrate USEPA**	**Eco-SSL Plant USEPA**	**TEC Freshwater NOAA**	**Ecological Screening Value (Site Soil)**	**Background USGS**	**Ecological Screening Value (Canal Sediment)**	ICON	ICON	ICON	ICON	HET	HET	HET	ICON	HET	HET	ICON	ICON	ICON	ICON	ICON	HET	ICON	ICON	ICON	ICON	HET	ICON	ICON	ICON
Salts																																	
% Moisture Primary[1]	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	51.5	69.5	36.4	23.7	40.2	42.7	61.3	57.4	53.2	35.4	NA	50.5	52.3	59.1	50.2	26.2	23.9	60.9	48.9	59.2	53	50.9	28.5	23.7
% Moisture Secondary[2]	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
% Saturation	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	118	138	228	NA	285	107	NA	NA	NA	NA	NA	47.4	NA	NA	NA	NA	128	NA	NA	NA
Cation Exchange Capacity (CEC)	meq/100g	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	58.1	96.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	47.5	72.7	56.7	NA	NA	NA	82.2	71.2	64.6	NA	NA	NA	NA
Electrical Conductivity	mmhos/cm	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	4.04	47.9	48.1	1.04	NA	NA	6.74	NA	10.2	49.8	49.0	3.21	6.57	42.7	13.6	1.04	1.12	1.2	0.72	7.36	1.19	1.28	0.77	0.68
Exchangeable Sodium Percentage	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	14.5	31.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	14.8	14.6	9.08	NA	NA	NA	0.33	0.76	2.17	NA	NA	NA	NA
Sodium Adsorption Ratio	Calc	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	18	76	NA	NA	3.35	12.3	NA	NA	NA	NA	NA	12.8	18.9	20.7	NA	NA	NA	2.83	2.75	2.39	NA	NA	NA	NA
Soluble Calcium	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	2.81	42.7	NA	NA	2.69	2.31	2.05	NA	2.5	45.4	NA	3.02	6.89	184	NA	1.97	NA	3.35	1.61	60.8	3.78	NA	NA	NA
Soluble Magnesium	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	1.59	20.8	NA	NA	1.6	1.14	1.06	NA	1.13	17.1	NA	1.5	3.37	50.2	NA	<0.820	NA	1.71	0.85	27	1.49	NA	NA	NA
Soluble Sodium	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	26.8	428	NA	NA	4.91	16.1	55.5	NA	87.7	433	NA	19.2	42.7	224	NA	7.69	NA	4.49	3.04	15.8	7.66	NA	NA	NA
SPLP Chloride	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	622	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11.6	NA
SPLP Sodium	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	406	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
29-B Leachate Chloride	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	mg/Kg	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	120	586	2320	NA	4240	13600	NA	NA	NA	NA	NA	57.7	NA	NA	NA	NA	93.9	NA	NA	NA
Chloride	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	5.66	20.2	63	NA	93.8	549	NA	NA	NA	NA	NA	5.64	NA	NA	NA	NA	6.18	NA	NA	NA
Alkalinity (Sat. Paste)	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	1.3	1.4	1.7	NA	1.7	1.6	NA	NA	NA	NA	NA	2.9	NA	NA	NA	NA	3.2	NA	NA	NA
Sulfate	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	3.61	0.786	0.623	NA	<1.00	<5.00	NA	NA	NA	NA	NA	1.19	NA	NA	NA	NA	2.02	NA	NA	NA
Total Organic Carbon	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH	S.U.	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	7.87	7.86	7.93	NA	7.89	7.92	NA	NA	NA	NA	NA	7.1	NA	NA	NA	NA	7.24	NA	NA	NA
SPLP Metals																																	
SPLP Arsenic	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Barium	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Cadmium	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Zinc	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals (Dry Weight)																																	
Arsenic	mg/Kg-dry	43	46	N/S	18	9.79	9.79	12	9.79	7.5	13	NA	NA	NA	NA	<5	5.17	4.96	NA	NA	6.84	9.92	9.63	NA	NA	NA	8.83	5.56	8.96	NA	NA	NA	NA
Barium	mg/Kg-dry	N/S	2000	330	N/S	N/S	330	775	N/S	572	315	NA	NA	253	251	NA	NA	NA	NA	NA	185	224	234	NA	NA	NA	186	244	238	NA	NA	NA	NA
True Total Barium	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	777	449	NA	NA	NA	NA	NA	NA	NA	NA	NA	300	351	367	NA	NA	NA	288	338	336	NA	NA	NA	NA
Cadmium	mg/Kg-dry	0.77	0.36	140	32	0.99	0.36	0.8	0.99	0.526	0.77	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.56	<0.460	0.668	NA	NA	NA	0.742	0.476	0.9	NA	NA	NA	NA
Chromium	mg/Kg-dry	26	34	N/S	N/S	43.4	26	84	43.4	20.4	15.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	17.1	14.1	16.3	NA	NA	NA	18.3	17.4	18.1	NA	NA	NA	NA
Lead	mg/Kg-dry	11	56	1700	120	35.8	11	44	35.8	21	10.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	17	17.3	16.1	NA	NA	NA	19.1	17.6	16.8	NA	NA	NA	NA
Mercury	mg/Kg-dry	N/S	N/S	N/S	N/S	0.18	0.18	0.11	0.18	<0.0998	<0.106	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.105	<0.102	<0.108	NA	NA	NA	<0.101	<0.102	<0.102	NA	NA	NA	NA
Selenium	mg/Kg-dry	1.2	0.63	4.1	0.52	N/S	0.52	1	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	mg/Kg-dry	4.2	14	N/S	560	N/S	4.2	ND	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Strontium	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	203	N/S	120	198	NA	NA	NA	NA	NA	NA	NA	NA	NA	75	61.3	94.3	NA	NA	NA	46.1	47.9	95.2	NA	NA	NA	NA
Zinc	mg/Kg-dry	46	79	120	160	121	46	140	121	84.1	36.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	77.5	52.5	67.3	NA	NA	NA	78.6	65.2	72	NA	NA	NA	NA
Hydrocarbons (Dry Weight)																																	
Oil & Grease	dry wt %	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-DRO (>C10-C28)	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-ORO (>C28-C35)	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aliphatic C6-C8	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aliphatic >C8-C10	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aliphatic >C10-C12	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aliphatic >C12-C16	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aliphatic >C16-C35	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aromatic >C8-C10	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aromatic >C10-C12	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aromatic >C12-C16	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aromatic >C16-C21	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aromatic >C21-C35	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total TPH (C6-C35)	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAHs (Dry Weight)																																	
2-Methylnaphthalene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calculated Sums (Dry Weight)																																	
Total TPH Fraction	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total PAH	mg/Kg-dry	N/S	N/S	N/S	N/S	1.61	N/S	N/S	1.61	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
LMW PAH	mg/Kg-dry	N/S	100	29	N/S	N/S	29	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HMW PAH	mg/Kg-dry	N/S	1.1	18	N/S	N/S	1	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 5
Soil/Sediment Analytical Data and Screening
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

									Sample ID	JLS-14R		JLS-15									JLS-15R							JLS-16				
									Area	Area 2		Area 2									Area 2							Area 2				
									Area Subgroup	North-South Canal Area		North-South Canal Area									North-South Canal Area							North-South Canal Area				
									Matrix	Soil		Soil									Soil							Soil				
									Sample Date	1/14/2021		8/6/2020									1/14/2021				2/3/2021			8/6/2020				
									Interval (ft)	8-10	10-12	0-4	8-12	12-16	24-26		44-46		46-48		8-10	10-12	24-26		12-14	14-16		0-4	4-6	6-8	24-28	36-40
Parameters	**Units**	**Eco-SSL Avian USEPA**	**Eco-SSL Mammal USEPA**	**Eco-SSL Invertebrate USEPA**	**Eco-SSL Plant USEPA**	**TEC Freshwater NOAA**	**Ecological Screening Value (Site Soil)**	**Background USGS**	**Ecological Screening Value (Canal Sediment)**	HET	HET	ICON	ICON	ICON	HET	ICON	HET	ICON	HET	ICON	HET	HET	HET	ICON	HET	HET	ICON	ICON	ICON	ICON	ICON	ICON
Salts																																
% Moisture Primary[1]	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**70.9**	**85.1**	**47.8**	**66.8**	**65.2**	**55.3**	**51.8**	**29.8**	**28.3**	**36.9**	**33**	**56.2**	**78.1**	**48.2**	NA	**72.5**	**50.5**	**50.2**	**50.9**	**46.7**	**64.5**	**40.8**	**44.7**
% Moisture Secondary[2]	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
% Saturation	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**158**	**181**	NA	NA	NA	**114**	NA	**136**	NA	**129**	NA	**139**	**179**	**105**	NA	**153**	**122**	NA	NA	NA	NA	NA	NA
Cation Exchange Capacity (CEC)	meq/100g	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	**71.7**	**73.1**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**71.3**	**55.9**	**84.2**	**1.06**	**0.87**
Electrical Conductivity	mmhos/cm	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**1.2**	**1.36**	**0.64**	**6.96**	**7.02**	**1.2**	**12.7**	**0.746**	**0.63**	**0.623**	**0.63**	NA	NA	**1.19**	**1.18**	**1.69**	**1.10**	**1.75**	**0.48**	**0.38**	**0.81**	NA	NA
Exchangeable Sodium Percentage	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	**0.76**	**2.43**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.92**	**1.22**	**0.93**	NA	NA
Sodium Adsorption Ratio	Calc	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	**1.73**	**2.87**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**1.35**	**1.71**	**1.62**	NA	NA
Soluble Calcium	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**3.67**	**3.63**	**1.81**	**54.5**	NA	**4.05**	NA	**1.48**	NA	**1.26**	NA	**2.75**	**4.94**	**2.57**	NA	**4.56**	**3.06**	NA	**1.47**	**0.91**	**2.72**	NA	NA
Soluble Magnesium	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**2.24**	**2.65**	**0.98**	**29.1**	NA	**1.64**	NA	<0.820	NA	<0.820	NA	**1.55**	**3.23**	**1.79**	NA	**2.68**	**1.76**	NA	**0.8**	**0.5**	**1.42**	NA	NA
Soluble Sodium	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**4.79**	**5.81**	**2.04**	**18.6**	NA	**7.62**	NA	**4.9**	NA	**4.53**	NA	**4.05**	**5.6**	**5.64**	NA	**7.21**	**4.91**	NA	**1.43**	**1.44**	**2.33**	NA	NA
SPLP Chloride	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Sodium	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
29-B Leachate Chloride	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	mg/Kg	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**85**	**118**	NA	NA	NA	**109**	NA	**47**	NA	**50.5**	NA	**46.9**	**95.1**	**111**	NA	**1210**	**467**	NA	NA	NA	NA	NA	NA
Chloride	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**6.14**	**7.17**	NA	NA	NA	**7.68**	NA	**2.18**	NA	**2.02**	NA	**6.39**	**8.16**	**6.72**	NA	**12.0**	**5.81**	NA	NA	NA	NA	NA	NA
Alkalinity (Sat. Paste)	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**2.8**	**3.2**	NA	NA	NA	**3.2**	NA	**3.6**	NA	**3.4**	NA	**2**	**3.1**	**3**	NA	**1.8**	**4.5**	NA	NA	NA	NA	NA	NA
Sulfate	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**1.58**	**2.23**	NA	NA	NA	**1.03**	NA	**1.28**	NA	**0.503**	NA	**0.819**	**3.21**	**1.1**	NA	**1.61**	**0.460**	NA	NA	NA	NA	NA	NA
Total Organic Carbon	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH	S.U.	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**7.53**	**7.64**	NA	NA	NA	**7.24**	NA	**7.23**	NA	**7.19**	NA	**8.5**	**7.96**	**8.13**	NA	**7.71**	**8.15**	NA	NA	NA	NA	NA	NA
SPLP Metals																																
SPLP Arsenic	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Barium	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Cadmium	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Zinc	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals (Dry Weight)																																
Arsenic	mg/Kg-dry	43	46	N/S	18	9.79	9.79	12	9.79	NA	NA	**7.43**	**10.2**	NA	NA	NA	NA	NA	NA	NA	**6.2**	<9	NA	NA	NA	NA	NA	**3.95**	**4.47**	**8.91**	NA	NA
Barium	mg/Kg-dry	N/S	2000	330	N/S	N/S	330	775	N/S	NA	NA	**211**	**233**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**202**	**226**	**220**	NA	NA
True Total Barium	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	**404**	**331**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**299**	**311**	**319**	NA	NA
Cadmium	mg/Kg-dry	0.77	0.36	140	32	0.99	0.36	0.8	0.99	NA	NA	**0.523**	**0.584**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.493	<0.475	**0.579**	NA	NA
Chromium	mg/Kg-dry	26	34	N/S	N/S	43.4	26	84	43.4	NA	NA	**17.8**	**17.4**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**17.7**	**15.9**	**14.4**	NA	NA
Lead	mg/Kg-dry	11	56	1700	120	35.8	11	44	35.8	NA	NA	**18.7**	**17**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**16.5**	**17.3**	**15.6**	NA	NA
Mercury	mg/Kg-dry	N/S	N/S	N/S	N/S	0.18	0.18	0.11	0.18	NA	NA	<0.0996	<0.0963	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.119**	<0.104	<0.105	NA	NA
Selenium	mg/Kg-dry	1.2	0.63	4.1	0.52	N/S	0.52	1	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	mg/Kg-dry	4.2	14	N/S	560	N/S	4.2	ND	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Strontium	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	203	N/S	NA	NA	**46.6**	**113**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**45.6**	**44.8**	**54.1**	NA	NA
Zinc	mg/Kg-dry	46	79	120	160	121	46	140	121	NA	NA	**74.8**	**58.5**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**72.9**	**62.9**	**56.5**	NA	NA
Hydrocarbons (Dry Weight)																																
Oil & Grease	dry wt %	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-DRO (>C10-C28)	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-ORO (>C28-C35)	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aliphatic C6-C8	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aliphatic >C8-C10	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aliphatic >C10-C12	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aliphatic >C12-C16	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aliphatic >C16-C35	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aromatic >C8-C10	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aromatic >C10-C12	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aromatic >C12-C16	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aromatic >C16-C21	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aromatic >C21-C35	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total TPH (C6-C35)	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAHs (Dry Weight)																																
2-Methylnaphthalene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calculated Sums (Dry Weight)																																
Total TPH Fraction	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total PAH	mg/Kg-dry	N/S	N/S	N/S	N/S	1.61	N/S	N/S	1.61	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
LMW PAH	mg/Kg-dry	N/S	100	29	N/S	N/S	29	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HMW PAH	mg/Kg-dry	N/S	1.1	18	N/S	N/S	1	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 5
Soil/Sediment Analytical Data and Screening
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Sample ID										JLS-17									JLS-18						JLS-19					
Area										Area 2									Area 1						Area 1					
Area Subgroup										North-South Canal Area									Area 1						Area 1					
Matrix										Soil									Soil						Soil					
Sample Date										8/7/2020									8/10/2020						8/10/2020					
Interval (ft)										0-4	4-8	12-16	24-26		40-42		46-48		0-2		2-4		4-6		0-2		2-4		4-6	
Parameters	**Units**	**Eco-SSL Avian USEPA**	**Eco-SSL Mammal USEPA**	**Eco-SSL Invertebrate USEPA**	**Eco-SSL Plant USEPA**	**TEC Freshwater NOAA**	**Ecological Screening Value (Site Soil)**	**Background USGS**	**Ecological Screening Value (Canal Sediment)**	ICON	ICON	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON
Salts																														
% Moisture Primary[1]	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**53**	**44.9**	**58.1**	**51.8**	**50**	**34.4**	**28.1**	**23.4**	**23.5**	**35.3**	**32.6**	**46.5**	**45.5**	**50**	**42.3**	**32.1**	**29**	**26.3**	**24.4**	**32.8**	**30.6**
% Moisture Secondary[2]	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	**36.9**	NA	**33.2**	NA	**46.6**	NA	**32.4**	NA	**28.8**	NA	**42.4**	NA
% Saturation	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	**124**	NA	**126**	NA	**42.7**	NA	**97**	NA	**94.7**	NA	**103**	NA	**101**	NA	**79**	NA	**77.4**	NA
Cation Exchange Capacity (CEC)	meq/100g	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**66**	**56.8**	NA	NA	NA	NA	NA	NA	NA	**41.7**	**43.9**	**50.9**	**55.3**	NA	**53.4**	**53**	**47.9**	**31.3**	**30.4**	NA	**32.5**
Electrical Conductivity	mmhos/cm	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**0.99**	**4.98**	**1.36**	**1.3**	**0.74**	**0.58**	**0.38**	**0.663**	**0.76**	**0.741**	**0.64**	**0.554**	**0.9**	**0.852**	**1.37**	**0.333**	**0.5**	**0.562**	**0.7**	**0.992**	**1.01**
Exchangeable Sodium Percentage	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**0.61**	**1.1**	NA	NA	NA	NA	NA	NA	NA	**0.4**	**0.66**	**0.894**	**1.05**	NA	**1.12**	**0.674**	**0.64**	**1.83**	**2.1**	NA	**2.22**
Sodium Adsorption Ratio	Calc	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**1.32**	**2.21**	NA	NA	NA	NA	NA	NA	NA	**1.75**	**1.22**	**4.69**	**1.92**	NA	**2**	**1.71**	**1.44**	**4.44**	**2.45**	NA	**2.66**
Soluble Calcium	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**4.14**	**37.2**	NA	**3.54**	NA	**0.797**	NA	**0.731**	NA	**3.29**	**2.3**	**1.45**	**2.79**	**2.33**	**4.71**	**1.24**	**1.63**	**1.47**	**1.78**	**2.77**	**2.46**
Soluble Magnesium	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**2.16**	**10.7**	NA	**1.54**	NA	<0.820	NA	<0.820	NA	**1.56**	**1.2**	<0.820	**2.59**	**1.2**	**2.63**	<0.820	**0.9**	<0.820	**1.03**	**1.25**	**1.38**
Soluble Sodium	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**2.35**	**10.8**	NA	**7.56**	NA	**4.76**	**17.1**	**6.2**	NA	**2.73**	**1.62**	**3.99**	**2.84**	**4.59**	**3.84**	**1.35**	**1.62**	**3.81**	**2.9**	**5.45**	**3.68**
SPLP Chloride	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Sodium	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
29-B Leachate Chloride	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	mg/Kg	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	**111**	NA	**45.4**	NA	**41.9**	NA	**15.4**	NA	**29.2**	NA	**51.8**	NA	**53.8**	NA	**37**	NA	**97.3**	NA
Chloride	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	**7.3**	NA	**1.91**	NA	**3.95**	NA	**1.09**	NA	**2.65**	NA	**3.95**	NA	**0.559**	NA	**2.41**	NA	**5.98**	NA
Alkalinity (Sat. Paste)	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	**3.3**	NA	**3.3**	NA	**2.1**	NA	**2**	NA	**1.3**	NA	**1.2**	NA	**0.5**	NA	**1**	NA	**1**	NA
Sulfate	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	**1.41**	NA	**0.386**	NA	**0.297**	NA	**4.47**	NA	**0.752**	NA	**1.78**	NA	**1.69**	NA	**1.46**	NA	**1.9**	NA
Total Organic Carbon	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH	S.U.	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	**7.93**	NA	**7.66**	NA	**7.49**	NA	**6.76**	NA	**6.04**	NA	**6.46**	NA	**6.36**	NA	**6.5**	NA	**6.54**	NA
SPLP Metals																														
SPLP Arsenic	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Barium	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Cadmium	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Zinc	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals (Dry Weight)																														
Arsenic	mg/Kg-dry	43	46	N/S	18	9.79	9.79	12	9.79	**6.93**	**7.69**	NA	NA	NA	NA	NA	NA	NA	**7.67**	**8.23**	**6.06**	**5.82**	**6.92**	**8.72**	**6.9**	**5.95**	**9.15**	**11.1**	**7.38**	**8.03**
Barium	mg/Kg-dry	N/S	2000	330	N/S	N/S	330	775	N/S	**222**	**238**	NA	NA	NA	NA	NA	NA	NA	**224**	**157**	**219**	**223**	**238**	**224**	**187**	**178**	**187**	**212**	**162**	**199**
True Total Barium	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**440**	**381**	NA	NA	NA	NA	NA	NA	NA	<500	**207**	<500	**288**	<500	**281**	<500	**251**	<500	**288**	<500	**275**
Cadmium	mg/Kg-dry	0.77	0.36	140	32	0.99	0.36	0.8	0.99	**0.562**	**0.578**	NA	NA	NA	NA	NA	NA	NA	**0.955**	**0.497**	<0.374	<0.485	**0.522**	**0.608**	**0.377**	<0.482	<0.271	<0.468	**0.359**	**0.568**
Chromium	mg/Kg-dry	26	34	N/S	N/S	43.4	26	84	43.4	**19.4**	**18**	NA	NA	NA	NA	NA	NA	NA	**17.3**	**9.52**	**19.8**	**13.9**	**21.6**	**14.5**	**21.2**	**13.8**	**16.4**	**10.2**	**14.57**	**9.9**
Lead	mg/Kg-dry	11	56	1700	120	35.8	11	44	35.8	**19.7**	**20.5**	NA	NA	NA	NA	NA	NA	NA	**16.2**	**12.4**	**16.92**	**15.7**	**20.4**	**16.7**	**18.1**	**14.5**	**13.36**	**12.2**	**13.07**	**11.9**
Mercury	mg/Kg-dry	N/S	N/S	N/S	N/S	0.18	0.18	0.11	0.18	<0.100	<0.018	NA	NA	NA	NA	NA	NA	NA	**0.0663**	<0.0935	**0.0656**	<0.103	**0.069**	<0.104	**0.0776**	<0.101	**0.055**	<0.0950	**0.0552**	<0.108
Selenium	mg/Kg-dry	1.2	0.63	4.1	0.52	N/S	0.52	1	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	<1.55	<3.98	<1.87	<3.88	<2	<3.8	<1.47	<3.86	<1.36	<3.74	<1.49	<3.98
Silver	mg/Kg-dry	4.2	14	N/S	560	N/S	4.2	ND	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.773	NA	<0.935	NA	<1	NA	<0.736	NA	<0.678	NA	<0.744	NA
Strontium	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	203	N/S	**44.4**	**47**	NA	NA	NA	NA	NA	NA	NA	NA	**31.1**	NA	**41.4**	NA	**43.4**	NA	**37.5**	NA	**35.2**	NA	**35.7**
Zinc	mg/Kg-dry	46	79	120	160	121	46	140	121	**76.7**	**67.5**	NA	NA	NA	NA	NA	NA	NA	**81.6**	**49.8**	**51.8**	**51.6**	**78.2**	**64.1**	**69.8**	**56.9**	**59.6**	**50.4**	**60.4**	**52.9**
Hydrocarbons (Dry Weight)																														
Oil & Grease	dry wt %	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.079	NA	<0.075	NA	<0.094	NA	<0.074	NA	<0.070	NA	<0.087	NA
TPH-DRO (>C10-C28)	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<74	NA	<92	NA	<87	NA	**368**	NA	<66	NA	<72
TPH-ORO (>C28-C35)	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**125.4**	NA	**202**	NA	**206**	NA	**458**	NA	**129.1**	NA	**147**
Aliphatic C6-C8	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	<24	NA	<22	NA	<28	NA	<22	NA	<21	NA	<26	NA
Aliphatic >C8-C10	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	<24	NA	<22	NA	<28	NA	<22	NA	<21	NA	<26	NA
Aliphatic >C10-C12	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	<24	NA	<22	NA	<28	NA	<22	NA	<21	NA	<26	NA
Aliphatic >C12-C16	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	<16	NA	<15	NA	<19	NA	<15	NA	<14	NA	<17	NA
Aliphatic >C16-C35	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	**37.7**	NA	**40**	NA	**32.6**	NA	**32.2**	NA	**44.5**	NA	**41**	NA
Aromatic >C8-C10	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	<25.2	NA	<15	NA	<19	NA	<15	NA	<14	NA	<17	NA
Aromatic >C10-C12	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	<25.2	NA	<15	NA	<19	NA	<15	NA	<14	NA	<17	NA
Aromatic >C12-C16	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	<37.7	NA	<22	NA	<28	NA	<22	NA	<21	NA	<26	NA
Aromatic >C16-C21	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	<37.7	NA	<22	NA	<28	NA	<22	NA	<21	NA	<26	NA
Aromatic >C21-C35	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	<37.7	NA	<22	NA	**31.1**	NA	**23.8**	NA	**21.9**	NA	<26	NA
Total TPH (C6-C35)	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	**59.7**	NA	**40**	NA	**64**	NA	**56.1**	NA	**66.4**	NA	**41**	NA
PAHs (Dry Weight)																														
2-Methylnaphthalene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calculated Sums (Dry Weight)																														
Total TPH Fraction	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	**59.7**	NA	**40**	NA	**64**	NA	**56.1**	NA	**66.4**	NA	**41**	NA
Total PAH	mg/Kg-dry	N/S	N/S	N/S	N/S	1.61	N/S	N/S	1.61	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
LMW PAH	mg/Kg-dry	N/S	100	29	N/S	N/S	29	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HMW PAH	mg/Kg-dry	N/S	1.1	18	N/S	N/S	1	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 5
Soil/Sediment Analytical Data and Screening
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Sample ID										JLS-20								JLS-21				JLS-22				JLS-23							
Area										Area 1								Area 2				Area 2				Area 2							
Area Subgroup										Area 1								Former E&P Area				Former E&P Area				Former E&P Area							
Matrix										Canal Sediment								Canal Sediment				Canal Sediment				Canal Sediment							
Sample Date										8/10/2020								9/8/2020				9/8/2020				9/8/2020		9/8/2020		2/2/2021			
Interval (ft)										0-2		2-4		4-6		6-7		0-2		2-4		0-2		2-4		0-2		2-4		0-2		2-3.5	
Parameters	**Units**	**Eco-SSL Avian USEPA**	**Eco-SSL Mammal USEPA**	**Eco-SSL Invertebrate USEPA**	**Eco-SSL Plant USEPA**	**TEC Freshwater NOAA**	**Ecological Screening Value (Site Soil)**	**Background USGS**	**Ecological Screening Value (Canal Sediment)**	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	ERM	ICON	ERM	ICON	ERM	ICON	ERM	ICON	ERM	ICON	ERM	ICON
Salts																																	
% Moisture Primary[1]	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**67.8**	**66.7**	**65.2**	**64.6**	**63.9**	**64**	**54**	**44.8**	**56.4**	**53.4**	**50.3**	**49.5**	**38.7**	**44.2**	**38**	**39.7**	**66.7**	**63.6**	**69.3**	**70.9**	**54.8**	**55.4**	**62.9**	**61.0**
% Moisture Secondary[2]	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**68**	NA	**65**	NA	**64.4**	NA	**50.2**	NA	**58**	NA	**59.3**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
% Saturation	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**89.5**	NA	**95.7**	NA	**102**	NA	**92.9**	NA	**163**	NA	**207**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cation Exchange Capacity (CEC)	meq/100g	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**50**	**55.9**	**53.5**	**53**	NA	**58.9**	NA	**33.3**	**62.2**	NA	**58.3**	**56.4**	**46**	**58.7**	**49.5**	NA	**75.4**	**73.4**	**76.9**	NA	NA	NA	NA	NA
Electrical Conductivity	mmhos/cm	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**1.29**	**1.88**	**1.44**	**2.32**	**1.4**	**2.06**	**1.35**	**1.2**	**3.21**	**4.35**	**4.34**	**6.12**	**1.25**	**1.29**	**2.27**	**3.3**	**1.45**	**1.42**	**3.73**	<0.10	NA	NA	NA	NA
Exchangeable Sodium Percentage	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**0.812**	**1.11**	**1.24**	**1.46**	NA	**1.73**	NA	**3.25**	**14.7**	NA	**13.2**	**16.2**	**8.7**	**3.81**	**9.97**	NA	**2.53**	**1.84**	**9.65**	NA	NA	NA	NA	NA
Sodium Adsorption Ratio	Calc	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**2.56**	**1.58**	**3.69**	**2.41**	NA	**2.97**	NA	**2.91**	**19.9**	**18.3**	**37.5**	**25**	**6.6**	**5.52**	**9.25**	**13.6**	**4.1**	**3.99**	**13.8**	**15.6**	NA	NA	NA	NA
Soluble Calcium	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**5.46**	**7.6**	**5.35**	**8.34**	**4.34**	**6.03**	**4.04**	**2.97**	**2.6**	**3.01**	**2.37**	**3.59**	**1.3**	**1.83**	**2.32**	**2.94**	**2.77**	**2.96**	**3.24**	**4.02**	NA	NA	NA	NA
Soluble Magnesium	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**2.02**	**3.22**	**1.97**	**3.64**	**1.55**	**2.94**	**1.67**	**1.53**	**0.826**	**1.48**	**0.832**	**1.85**	**0.78**	**0.96**	**1.24**	**1.49**	**1.42**	**1.42**	**1.63**	**1.96**	NA	NA	NA	NA
Soluble Sodium	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**4.96**	**3.68**	**7.06**	**5.9**	**7.26**	**6.29**	**8.28**	**4.37**	**26.1**	**27.4**	**47.5**	**41.3**	**6.73**	**6.52**	**12.3**	**20.2**	**5.94**	**5.91**	**21.5**	**26.9**	NA	NA	NA	NA
SPLP Chloride	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Sodium	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
29-B Leachate Chloride	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	mg/Kg	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**51.5**	NA	**77.3**	NA	**94.4**	NA	**95.3**	NA	**578**	NA	**906**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**5.23**	NA	**7.78**	NA	**7.83**	NA	**7.64**	NA	**27.2**	NA	**38.2**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Alkalinity (Sat. Paste)	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**5.8**	NA	**4**	NA	**3.8**	NA	**2.4**	NA	**1.2**	NA	**1.6**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**1.06**	NA	**1.01**	NA	**0.889**	NA	**2.36**	NA	**1.12**	NA	**0.643**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Organic Carbon	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**25500**	NA	**82600**	NA
pH	S.U.	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**7.18**	NA	**7.39**	NA	**7.32**	NA	**7.35**	NA	**7.75**	NA	**7.85**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Metals																																	
SPLP Arsenic	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.0012**	NA	**0.0012**	NA
SPLP Barium	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.063**	NA	**0.067**	NA
SPLP Cadmium	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Zinc	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals (Dry Weight)																																	
Arsenic	mg/Kg-dry	43	46	N/S	18	9.79	9.79	12	9.79	**8.51**	**7.91**	**8.79**	**8.47**	**8.48**	**8.41**	**8.3**	**8.04**	**4.79**	**4.7**	**6.78**	**5.37**	**4.98**	**5.75**	**5.08**	**10.2**	**6.88**	**5.14**	**12.54**	**15.8**	NA	**6.49**	NA	**4.01**
Barium	mg/Kg-dry	N/S	2000	330	N/S	N/S	330	775	N/S	**798**	**762**	**569**	**697**	**598**	**711**	**520**	**370**	**252**	**292**	**270**	**280**	**264**	**281**	**224**	**265**	**535**	**317**	**984**	**892**	NA	**418**	NA	**457**
True Total Barium	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**1170**	**1220**	**803**	**1010**	**874**	**1010**	**670**	**462**	<500	<935	<500	<988	<198	<930	<198	<951	<198	<976	**1180**	**1400**	NA	NA	NA	NA
Cadmium	mg/Kg-dry	0.77	0.36	140	32	0.99	0.36	0.8	0.99	<0.621	**0.544**	**0.606**	<0.492	**0.562**	**0.64**	<0.435	<0.493	<0.459	<1.20	<0.402	<1.25	<2.02	<1.21	<1.97	<1.17	<3.66	<1.20	<3.97	<1.24	NA	NA	NA	NA
Chromium	mg/Kg-dry	26	34	N/S	N/S	43.4	26	84	43.4	**23.11**	**16.9**	**25.52**	**19.4**	**25.24**	**19.8**	**16.37**	**11.3**	**26.6**	**17**	**29**	**17.2**	**23**	**18.6**	**20**	**19.6**	**17.24**	**20.8**	**18.66**	**16.9**	NA	NA	NA	NA
Lead	mg/Kg-dry	11	56	1700	120	35.8	11	44	35.8	**21.65**	**22.9**	**22.56**	**22.2**	**23.35**	**21.8**	**18.2**	**14.6**	**17.41**	**20.4**	**17.12**	**19**	**19.2**	**21.8**	**17.9**	**22.3**	**20.7**	**26.8**	**28.7**	**25.5**	NA	NA	NA	NA
Mercury	mg/Kg-dry	N/S	N/S	N/S	N/S	0.18	0.18	0.11	0.18	**0.0891**	<0.102	**0.0759**	<0.107	**0.0695**	<0.103	**0.0535**	<0.107	**0.0571**	<0.105	**0.0386**	<0.0929	<0.175	<0.104	<0.168	<0.0923	<0.318	<0.109	<0.3075	<0.109	NA	NA	NA	NA
Selenium	mg/Kg-dry	1.2	0.63	4.1	0.52	N/S	0.52	1	N/S	<3.11	<3.69	<2.87	<3.94	<2.77	<3.77	<2.17	<3.94	<2.29	<9.63	<2.01	<9.97	<16.15	<9.66	<15.74	<9.36	<29.37	<9.57	<31.82	<9.91	NA	NA	NA	NA
Silver	mg/Kg-dry	4.2	14	N/S	560	N/S	4.2	ND	N/S	<1.553	NA	<1.437	NA	<1.385	NA	<1.087	NA	<1.147	NA	<1.006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Strontium	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	203	N/S	NA	**67.4**	NA	**65.1**	NA	**66.7**	NA	**50.6**	NA	**120**	NA	**103**	**60.7**	**67.4**	**53.1**	**71.3**	**84.4**	**88.8**	**135.8**	**134**	NA	NA	NA	NA
Zinc	mg/Kg-dry	46	79	120	160	121	46	140	121	**89.4**	**83.8**	**93.4**	**88.7**	**89**	**88.6**	**66.7**	**56.5**	**98.2**	**80.6**	**101**	**74.6**	**87.4**	**74.4**	**82**	**79.8**	**85.6**	**132**	**76.9**	**69**	NA	NA	NA	NA
Hydrocarbons (Dry Weight)																																	
Oil & Grease	dry wt %	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<0.156	NA	<0.143	NA	<0.140	NA	<0.100	NA	<0.119	NA	<0.122	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-DRO (>C10-C28)	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	**715**	NA	**545**	NA	**481**	NA	**179**	NA	<107	NA	<99	NA	<90	NA	<17	NA	**197**	NA	**378**	NA	NA	NA	NA
TPH-ORO (>C28-C35)	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	**883**	NA	**734**	NA	**639**	NA	**359**	NA	<107	NA	<99	NA	<90	NA	<17	NA	**265.9**	NA	**364**	NA	NA	NA	NA
Aliphatic C6-C8	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<47	NA	<43	NA	<42	NA	<30	NA	<36	NA	<37	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aliphatic >C8-C10	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<47	NA	<43	NA	<42	NA	<30	NA	<36	NA	<37	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aliphatic >C10-C12	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<47	NA	<43	NA	<42	NA	<30	NA	<36	NA	<37	NA	<4.88	NA	<10	NA	<9	NA	<19.48	NA	NA	NA	NA	NA
Aliphatic >C12-C16	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**55.9**	NA	<29	NA	<28	NA	<20	NA	<24	NA	<25	NA	<4.88	NA	<10	NA	<9	NA	<19.48	NA	NA	NA	NA	NA
Aliphatic >C16-C35	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**155.6**	NA	<29	NA	**65.4**	NA	**35.5**	NA	<24	NA	**41.3**	NA	<4.88	NA	<10	NA	**32.7**	NA	<19.48	NA	NA	NA	NA	NA
Aromatic >C8-C10	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<31	NA	<29	NA	<28	NA	<20	NA	<24	NA	<25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aromatic >C10-C12	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<31	NA	<29	NA	<28	NA	<20	NA	<24	NA	<25	NA	<4.88	NA	<10	NA	<9	NA	<19.48	NA	NA	NA	NA	NA
Aromatic >C12-C16	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<47	NA	<43	NA	<42	NA	<30	NA	<36	NA	<37	NA	<4.88	NA	<10	NA	<9	NA	<19.48	NA	NA	NA	NA	NA
Aromatic >C16-C21	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<47	NA	<43	NA	<42	NA	<30	NA	<36	NA	<37	NA	<4.88	NA	<10	NA	<9	NA	<19.48	NA	NA	NA	NA	NA
Aromatic >C21-C35	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<47	NA	<43	NA	<42	NA	<30	NA	<36	NA	**37**	NA	<4.88	NA	<10	NA	<9	NA	**30.68**	NA	NA	NA	NA	NA
Total TPH (C6-C35)	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**211.6**	NA	<43	NA	**65.4**	NA	**35.5**	NA	<36	NA	**78.1**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAHs (Dry Weight)																																	
2-Methylnaphthalene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calculated Sums (Dry Weight)																																	
Total TPH Fraction	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**211.6**	NA	<43	NA	**65.4**	NA	**35.5**	NA	<36	NA	**78.1**	NA	<4.88	NA	<10	NA	**32.7**	NA	**30.68**	NA	NA	NA	NA	NA
Total PAH	mg/Kg-dry	N/S	N/S	N/S	N/S	1.61	N/S	N/S	1.61	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
LMW PAH	mg/Kg-dry	N/S	100	29	N/S	N/S	29	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HMW PAH	mg/Kg-dry	N/S	1.1	18	N/S	N/S	1	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 5
Soil/Sediment Analytical Data and Screening
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

									Sample ID	SB-1						SB-2						SB-3						SB-4					
									Area	Area 2						Area 2						Area 2						Area 2					
									Area Subgroup	Former E&P Area						Former E&P Area						Former E&P Area						Former E&P Area					
									Matrix	Canal Sediment						Canal Sediment						Canal Sediment						Soil					
									Sample Date	1/13/2021						1/13/2021						1/13/2021						3/1/2021					
									Interval (ft)	0-2		2-4		4-6		0-2		2-4		4-6		0-2		2-4		4-6		8-10'		10-12'		14-16'	20-22'
Parameters	**Units**	**Eco-SSL Avian USEPA**	**Eco-SSL Mammal USEPA**	**Eco-SSL Invertebrate USEPA**	**Eco-SSL Plant USEPA**	**TEC Freshwater NOAA**	**Ecological Screening Value (Site Soil)**	**Background USGS**	**Ecological Screening Value (Canal Sediment)**	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	ICON	HET	HET
Salts																																	
% Moisture Primary[1]	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**80.2**	**79.4**	**69.5**	**73.8**	**70.1**	**68.2**	**80.5**	**81.2**	**73.9**	**73.5**	**72.6**	**70.6**	**59.4**	**70.6**	**27.9**	**37.7**	**69.8**	**61.9**	**67.6**	**62.6**	**80.0**	**72.9**	**68.0**	**62.5**
% Moisture Secondary[2]	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
% Saturation	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**98.9**	NA	**115**	NA	**161**	NA	**98.7**	NA	**96.5**	NA	**139**	NA	**66.1**	NA	**52.8**	NA	**122**	NA	**165**	NA	**192**	NA	**144**	**140**
Cation Exchange Capacity (CEC)	meq/100g	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Electrical Conductivity	mmhos/cm	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**7.19**	**11.5**	**11.7**	**13.8**	**9.80**	**5.96**
Exchangeable Sodium Percentage	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium Adsorption Ratio	Calc	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Soluble Calcium	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**71.6**	NA	**133**	NA	**141**	NA	**52.8**	NA	**101**	NA	**117**	NA	**24.1**	NA	**13.9**	NA	**86.1**	NA	**14.3**	NA	**28.2**	NA	**30.7**	**15.5**
Soluble Magnesium	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**34.9**	NA	**55.7**	NA	**67.3**	NA	**26.4**	NA	**47.9**	NA	**61.6**	NA	**10.7**	NA	**6.12**	NA	**43.1**	NA	**8.98**	NA	**18.1**	NA	**16.4**	**10.4**
Soluble Sodium	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**129**	NA	**257**	NA	**287**	NA	**123**	NA	**277**	NA	**432**	NA	**48.8**	NA	**62**	NA	**278**	NA	**39.2**	NA	**62.1**	NA	**45.0**	**25.4**
SPLP Chloride	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Sodium	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
29-B Leachate Chloride	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	mg/Kg	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**1380**	NA	**4560**	NA	**6370**	NA	**1430**	NA	**4550**	NA	**9240**	NA	**579**	NA	**602**	NA	**8440**	NA	**1510**	NA	**1980**	NA	**1450**	**929**
Chloride	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**254**	NA	**488**	NA	**539**	NA	**215**	NA	**453**	NA	**654**	NA	**86.9**	NA	**90.5**	NA	**415**	NA	**67.0**	NA	**116**	NA	**95.4**	**55.8**
Alkalinity (Sat. Paste)	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**0.2**	NA	**0.9**	NA	**0.8**	NA	**0.8**	NA	**0.8**	NA	**0.6**	NA	**2.1**	NA	**1.6**	NA	**2.2**	NA	**1.8**	NA	**1.3**	NA	**1.4**	**1.6**
Sulfate	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**3.33**	NA	<2.00	NA	**2.69**	NA	**2.98**	NA	<2.00	NA	<5.00	NA	**2.07**	NA	**0.972**	NA	<2.00	NA	**1.01**	NA	**2.18**	NA	**2.60**	**2.37**
Total Organic Carbon	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH	S.U.	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**6.77**	NA	**7.49**	NA	**7.16**	NA	**6.91**	NA	**6.79**	NA	**7.08**	NA	**8.02**	NA	**8.16**	NA	**7.78**	NA	**8.04**	NA	**7.41**	NA	**7.81**	**7.97**
SPLP Metals																																	
SPLP Arsenic	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Barium	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Cadmium	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Zinc	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals (Dry Weight)																																	
Arsenic	mg/Kg-dry	43	46	N/S	18	9.79	9.79	12	9.79	NA	NA	<7	**5.07**	NA	NA	NA	NA	<8	**6.97**	**7.99**	NA	NA	NA	**4.06**	**4.62**	NA	NA	NA	NA	NA	NA	NA	NA
Barium	mg/Kg-dry	N/S	2000	330	N/S	N/S	330	775	N/S	**285.4**	**318**	**656**	**544**	**344**	**671**	**243.6**	**627**	**301.9**	**284**	**449**	**463**	**227.8**	**286**	**101.4**	**224**	**189.7**	**319**	NA	NA	NA	NA	NA	NA
True Total Barium	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	mg/Kg-dry	0.77	0.36	140	32	0.99	0.36	0.8	0.99	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	mg/Kg-dry	26	34	N/S	N/S	43.4	26	84	43.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	mg/Kg-dry	11	56	1700	120	35.8	11	44	35.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	mg/Kg-dry	N/S	N/S	N/S	N/S	0.18	0.18	0.11	0.18	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	mg/Kg-dry	1.2	0.63	4.1	0.52	N/S	0.52	1	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	mg/Kg-dry	4.2	14	N/S	560	N/S	4.2	ND	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Strontium	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	203	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	mg/Kg-dry	46	79	120	160	121	46	140	121	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hydrocarbons (Dry Weight)																																	
Oil & Grease	dry wt %	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-DRO (>C10-C28)	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-ORO (>C28-C35)	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aliphatic C6-C8	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aliphatic >C8-C10	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aliphatic >C10-C12	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aliphatic >C12-C16	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aliphatic >C16-C35	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aromatic >C8-C10	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aromatic >C10-C12	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aromatic >C12-C16	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aromatic >C16-C21	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aromatic >C21-C35	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total TPH (C6-C35)	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAHs (Dry Weight)																																	
2-Methylnaphthalene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calculated Sums (Dry Weight)																																	
Total TPH Fraction	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total PAH	mg/Kg-dry	N/S	N/S	N/S	N/S	1.61	N/S	N/S	1.61	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
LMW PAH	mg/Kg-dry	N/S	100	29	N/S	N/S	29	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HMW PAH	mg/Kg-dry	N/S	1.1	18	N/S	N/S	1	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 5
Soil/Sediment Analytical Data and Screening
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

									Sample ID	MW-1				MW-2			MW-3		
									Area	Area 2				Area 2			Area 2		
									Area Subgroup	Former E&P Area				Former E&P Area			Former E&P Area		
									Matrix	Canal Sediment				Canal Sediment			Canal Sediment		
									Sample Date	2/5/2021				2/5/2021			2/4/2021		
									Interval (ft)	0-2	2-4		24-26	0-2	2-4		0-2	2-4	24-26
Parameters	**Units**	**Eco-SSL Avian USEPA**	**Eco-SSL Mammal USEPA**	**Eco-SSL Invertebrate USEPA**	**Eco-SSL Plant USEPA**	**TEC Freshwater NOAA**	**Ecological Screening Value (Site Soil)**	**Background USGS**	**Ecological Screening Value (Canal Sediment)**	ERM	ERM	ICON	ERM	ERM	ERM	ICON	ERM	ERM	ERM
Salts																			
% Moisture Primary[1]	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	**55.6**	**58.6**	**57.7**	**22.0**	**54.9**	**51.4**	**44.2**	**57.9**	**62.5**	**25.2**
% Moisture Secondary[2]	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
% Saturation	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cation Exchange Capacity (CEC)	meq/100g	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Electrical Conductivity	mmhos/cm	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	**2.97**	NA	NA	NA
Exchangeable Sodium Percentage	%	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium Adsorption Ratio	Calc	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Soluble Calcium	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Soluble Magnesium	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Soluble Sodium	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Chloride	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Sodium	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
29-B Leachate Chloride	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	mg/Kg	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Alkalinity (Sat. Paste)	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	meq/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Organic Carbon	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH	S.U.	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Metals																			
SPLP Arsenic	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Barium	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Cadmium	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SPLP Zinc	mg/L	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals (Dry Weight)																			
Arsenic	mg/Kg-dry	43	46	N/S	18	9.79	9.79	12	9.79	**7.39**	**7.66**	**6.84**	**3.99**	**5.12**	**3.66**	**4.96**	**2.33**	**6.1**	**1.78**
Barium	mg/Kg-dry	N/S	2000	330	N/S	N/S	330	775	N/S	**234**	**251**	**344**	**58.1**	**239**	**230**	NA	**237.3**	**244**	**52**
True Total Barium	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	mg/Kg-dry	0.77	0.36	140	32	0.99	0.36	0.8	0.99	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	mg/Kg-dry	26	34	N/S	N/S	43.4	26	84	43.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	mg/Kg-dry	11	56	1700	120	35.8	11	44	35.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	mg/Kg-dry	N/S	N/S	N/S	N/S	0.18	0.18	0.11	0.18	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	mg/Kg-dry	1.2	0.63	4.1	0.52	N/S	0.52	1	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	mg/Kg-dry	4.2	14	N/S	560	N/S	4.2	ND	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Strontium	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	203	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	mg/Kg-dry	46	79	120	160	121	46	140	121	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hydrocarbons (Dry Weight)																			
Oil & Grease	dry wt %	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPH-DRO (>C10-C28)	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	**27**	NA	NA	NA	NA	NA	NA	NA
TPH-ORO (>C28-C35)	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	**27.7**	NA	NA	NA	NA	NA	NA	NA
Aliphatic C6-C8	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<117.8	<134.3	NA	<43.1	<118.6	<105.1	NA	<144.4	<145.1	<43.9
Aliphatic >C8-C10	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<117.8	<134.3	NA	<43.1	<118.6	<105.1	NA	<144.4	<145.1	<43.9
Aliphatic >C10-C12	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<13.24	<14	NA	<8	<12.93	<12	NA	<14	<15.55	<8
Aliphatic >C12-C16	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<13.24	<14	NA	<8	<12.93	<12	NA	<14	<15.55	<8
Aliphatic >C16-C35	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<13.24	<14	NA	<8	<12.93	**22.4**	NA	<14	<15.55	<8
Aromatic >C8-C10	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<119.6	<130.9	NA	<43.1	<92	<107.4	NA	<124	<149	<56.6
Aromatic >C10-C12	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<13.24	<14	NA	<8	<12.93	<12	NA	<14	<15.55	<8
Aromatic >C12-C16	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<13.24	<14	NA	<8	<12.93	<12	NA	<14	<15.55	<8
Aromatic >C16-C21	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<13.24	<14	NA	<8	<12.93	<12	NA	<14	<15.55	<8
Aromatic >C21-C35	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<13.24	<14	NA	<8	<12.93	<12	NA	<14	<15.55	<8
Total TPH (C6-C35)	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAHs (Dry Weight)																			
2-Methylnaphthalene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<0.00739	<0.00797	NA	<0.00418	<0.00718	<0.00679	NA	<0.00774	<0.00869	<0.00436
Acenaphthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<0.01477	<0.01594	NA	<0.00835	<0.01435	<0.01358	NA	<0.01546	<0.01736	<0.0087
Acenaphthylene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<0.01477	<0.01594	NA	<0.00835	<0.01435	<0.01358	NA	<0.01546	<0.01736	<0.0087
Anthracene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<0.00739	<0.00797	NA	<0.00418	<0.00718	<0.00679	NA	<0.00774	<0.00869	<0.00436
Benzo(a)anthracene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<0.01477	<0.01594	NA	<0.00835	<0.01435	<0.01358	NA	<0.01546	<0.01736	<0.0087
Benzo(a)pyrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<0.00739	<0.00797	NA	<0.00418	**0.00902**	<0.00679	NA	<0.00774	<0.00869	<0.00436
Benzo(b)fluoranthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<0.01477	<0.01594	NA	<0.00835	<0.01435	<0.01358	NA	<0.01546	<0.01736	<0.0087
Benzo(k)fluoranthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<0.00739	<0.00797	NA	<0.00418	**0.01246**	<0.00679	NA	<0.00774	<0.00869	<0.00436
Chrysene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<0.01477	<0.01594	NA	<0.00835	<0.01435	<0.01358	NA	<0.01546	<0.01736	<0.0087
Dibenz(a,h)anthracene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<0.01477	<0.01594	NA	<0.00835	<0.01435	<0.01358	NA	<0.01546	<0.01736	<0.0087
Fluoranthene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<0.00739	<0.00797	NA	<0.00418	<0.00718	<0.00679	NA	<0.00774	<0.00869	<0.00436
Fluorene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<0.00739	<0.00797	NA	<0.00418	<0.00718	<0.00679	NA	<0.00774	<0.00869	<0.00436
Indeno(1,2,3-cd)pyrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<0.00739	<0.00797	NA	<0.00418	**0.01222**	<0.00679	NA	<0.00774	<0.00869	<0.00436
Naphthalene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<0.00739	<0.00797	NA	<0.00418	<0.00718	<0.00679	NA	<0.00774	<0.00869	<0.00436
Phenanthrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<0.00739	<0.00797	NA	<0.00418	<0.00718	<0.00679	NA	<0.00774	<0.00869	<0.00436
Pyrene	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<0.00739	<0.00797	NA	<0.00418	<0.00718	<0.00679	NA	<0.00774	<0.00869	<0.00436
Calculated Sums (Dry Weight)																			
Total TPH Fraction	mg/Kg-dry	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	<119.6	<134.3	NA	<43.1	<118.6	**22.4**	NA	<144.4	<149	<56.6
Total PAH	mg/Kg-dry	N/S	N/S	N/S	N/S	1.61	N/S	N/S	1.61	<0.01477	<0.01594	NA	<0.00835	**0.034**	<0.01358	NA	<0.01546	<0.01736	<0.0087
LMW PAH	mg/Kg-dry	N/S	100	29	N/S	N/S	29	N/S	N/S	<0.01477	<0.01594	NA	<0.00835	<0.01435	<0.01358	NA	<0.01546	<0.01736	<0.0087
HMW PAH	mg/Kg-dry	N/S	1.1	18	N/S	N/S	1	N/S	N/S	<0.01477	<0.01594	NA	<0.00835	**0.034**	<0.01358	NA	<0.01546	<0.01736	<0.0087

Table 5
Soil/Sediment Analytical Data and Screening
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Notes:
[1] - Primary moisture value was reported by one lab and used for all wet/dry conversions. If multiple labs reported a moisture value the Primary moisture was used for the metals conversion
[2] - Secondary moisture value was reported by a separate lab and used for the wet/dry conversions for hydrocarbons.
For select ERM samples from JLS-2 and JLS-3 where % moisture was not analyzed, split samples were used for conversion to dry weight
ICON metals reported in dry weight. ERM and HET metals and ERM, ICON, and HET TPH and PAH reported in wet weight and converted to dry weight.
< - Not detected at or above the reporting limit shown
NA - Not analyzed, NS - No Standard
Bolded values were detected in the sample.
Gray cell indicates that sample location is outside of Area 2 and not evaluated.
Green cell indicates that sample depth does not contain the 0-3 feet interval of interest for ecological evaluation, and not evaluated.
Values for "Total TPH (C6-C35)" are lab-reported values for HET data, converted to dry weight.
Sum Totals for TPH Mixture, TPH Frations, PAH, LMW PAH, and HMW PAH are calculated based on individual results.
Total TPH Fraction is the sum total of aliphatic and aromatic TPH fractions.
Total PAH is the sum total of 16 PAH.
LMW PAH is the sum total of 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene.
HMW PAH is the sum total of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, and pyrene.
For comparison to soil, the ecological screening value is the lowest of the USEPA Eco-SSLs for bird, mammal, invertebrate, and plant, and the NOAA SQuiRT freshwater threshold effect concentration (TEC).
For comparison to canal sediment, the ecological screening value is the NOAA SQuiRT freshwater TEC.
Red highlight indicates exceedance of ecological screening value in soil.
Red font indicates exceedance of background in soil.
Yellow highlight indicates exceedance of ecological screening value in canal sediment.

Table 6
Surface Water Data
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Parameters	Units	LDEQ Numerical Criteria [1]	*Sample ID:*	SW-1 (UPSTREAM)	SW-2 (SITE ENTRANCE)	SW-3 (SITE CANAL)	SW-4 (SITE)	SW-5 (DOWNSTREAM)
			Sample Date:	2/25/2021	2/25/2021	2/25/2021	2/25/2021	2/25/2021
			Sampler:	ERM	ERM	ERM	ERM	ERM
Chloride[1]	mg/L	65		26.5	26.8	27.2	26.7	26.3
Specific Conductance	umhos/cm	NS		259	259	271	270	266

Notes:
[1] Listed limit is the LDEQ numerical surface water criteria for Drainage Basin Subsegment #010501.
Highlight indicates exceedance of corresponding regulatory standard.
NS - No Standard

Table 7
Toxicity Reference Values (TRVs) for BERA
Jeanerette Lumber & Shingle Co., LLC. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Constituent	TRV			
	Avian (American Robin, Spotted Sandpiper, Mallard, Snowy Egret, American Bald Eagle)		Mammal (Least Shrew, American Mink)	
	mg/kg/day	Source	mg/kg/day	Source
Arsenic	2.24	USEPA (2005)	1.04	USEPA (2005)
Barium	600[a]	Brown et al. (2014); Silverman and Tell (2010); Kubiak (2012)	5433[b]	Boyd and Abel (1966)
Zinc	66.1	USEPA (2007)	75.4	USEPA (2007)

Notes:

a - Barium sulfate; Recommended x-ray imaging dose for birds of 6,000 to 15,000 mg/kg bw. Low range value of 6,000 mg/kg bw used as proxy NOAEL; uncertainty factor of 10 for acute to chronic endpoint applied.

b - Barium sulfate; Acute (14 day) NOAEL (mortality) for rat of 163,000 mg/kg bw; uncertainty factor of 10 for species variability and 3 for acute to chronic endpoint.

Table 8
Soil/Sediment Bioavailability Factors for BERA
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

COPEC	Soil/Sediment Bioavailability Factor	Citation
Arsenic	0.01	USEPA (2005); Shaheen et al. (2016)
Barium	0.0002	Engdahl et al. (2008); Cappuyns (2018); Environment International Ltd. (2010); USGS (2002)
Zinc	0.01 - 0.1	USEPA (2005); Feijtel (1986)

Table 9
Bioconcentration Factors (BCFs) for Food Items in BERA
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

COPEC	Soil- Plant BCF	Citation	Soil-Earthworm BCF	Citation	Soil-Mammal BCF	Citation
Arsenic	0.0375	Bechtel-Jacobs (1998a; Table 6)	0.224	Sample et al. (1998a; Table 11)	0.0025	Sample et al. (1998b; Table 7)
Barium	0.0046	Nelson et al. (1984); Lamb et al. (2013)	0.0910	Sample et al. (1998a; Table C.1)	0.0566	Sample et al. (1998b; Table 7)
Zinc	0.366	Bechtel-Jacobs (1998a; Table 6)	3.201	Sample et al. (1998a; Table 11)	0.7717	Sample et al. (1998b; Table 7)

Table 9
Bioconcentration Factors (BCFs) for Food Items in BERA
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

COPEC	Soil-Bird BCF	Citation	Soil/Sediment - Benthic Invertebrate BCF	Citation	Sediment - Fish BCF	Citation
Arsenic	0.075	Vermeer and Thompson (1992); Thompson and Patton (1975); Waldichuk and Buchanan (1980)	0.127	Bechtel Jacobs (1998b; Table 2)	0.00065	Davis et al. (1996; p.420)
Barium	0.0566	Sample et al. (1998b; Table 7) Soil-mammal BCF used as surrogate.	0.023	Finerty et al. (1990); ERM (2019)	0.028	Ohio EPA (1991); Teck American, Inc. (2010); ERM (2019)
Zinc	0.0645	Beyer et al. (1985)	2.33	Bechtel Jacobs (1998b; Table 2)	0.138	Chen and Chen (1992; Table 2)

Table 10
Species Factors for BERA
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Parameter	Description	Units	American Robin	Source	Spotted Sandpiper	Source	Mallard Duck	Source
BW	Body weight of receptor	Kg	0.0773	USEPA (1993; Page 2-197); [source: Clench & Leberman (1978)]; Sample & Suter (1994; Page 21; Table 4.9); [source: Dunning 1984])	0.0425	USEPA (1993; Page 2-152) [Source: Maxson & Oring (1980)][a]	1.134	USEPA (1993; Page 2-43); [Source: Nelson & Martin (1953)][c]
Food IR	Ingestion rate of food	Kg/Kg BW/d	0.132	Nagy (2001)	0.196	Nagy (2001), Seaman (2005), Elner (2005)	0.05	Nagy (2001)
Soil / Sediment Ingestion	Ingestion Proportion of soil or sediment	Fraction of Total Diet	0.02	Sample and Suter (1994; Page 22; Table 4.9); [Source: Beyer et al. (1994)]	0.17	Beyer et al. (1994)[b]	0.033	Beyer et al. (1994)
Fd (plants)	Fraction of diet consisting of plants		0.41	USEPA (1993; Page 2-198); [Source: Wheelwright (1986)]	0		0.5	USEPA (1993; Pages 2-44 and 2-45); [Source: Dillon (1959); Swanson et al. (1985)][d]
Fd (inverts)	Fraction of diet consisting of soil invertebrates		0.59	USEPA (1993; Page 2-198); [Source: Wheelwright (1986)]	0		0	
Fd (mammals)	Fraction of diet consisting of mammals		0		0		0	
Fd (benthic inverts)	Fraction of diet consisting of benthic invertebrates		0		1	USEPA (1993; Page 2-152); [Source: Maxson & Oring (1980)]	0.5	USEPA (1993; Pages 2-44 and 2-45); [Source: Dillon (1959); Swanson et al. (1985)]d
Fd (fish)	Fraction of diet consisting of fish		0		0		0	
Fd (birds)	Fraction of diet consisting of birds		0		0		0	

Notes:
[a]Spotted Sandpiper body weight: mean body weight of adult male (37.9 g) and female (47.1 g).
[b]Stilt sandpiper is used as model for spotted sandpiper.
[c]Mallard body weight: Mean body weight of adult male (1,225 g) and adult female (1,043 g).
[d]Mallard diet: Dillon (1959) reports 92% of mallard diet consists of plants, Swanson et al. (1985) reports dietary consumption of invertebrates ranges from (67.8% to 89.4% [wet volume % esophagus contents]); a conservative dietary estimate of 0.5 (50%) plants and 0.5 (50%) invertebrates was used.

Table 10
Species Factors for BERA
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Parameter	Description	Units	Snowy Egret	Source	American Bald Eagle	Source
BW	Body weight of receptor	Kg	0.371	Parsons et al. (2000)	4.6	USEPA (1995; Table 2-8)
Food IR	Ingestion rate of food	Kg/Kg BW/d	0.116	Nagy (2001)	0.09	USFWS (2015); [Source: Buehler, 2000]
Soil / Sediment Ingestion	Ingestion Proportion of soil or sediment	Fraction of Total Diet	0.005	Sample and Suter (1994 ; Section 4.13; Page 27)[a]	0[c]	Sample and Suter (1994; Section 4.15)
Fd (plants)	Fraction of diet consisting of plants		0		0	
Fd (inverts)	Fraction of diet consisting of soil invertebrates		0		0	
Fd (mammals)	Fraction of diet consisting of mammals		0		0.068[d]	USEPA (1993; p. 2-97); [Source: Todd et al., 1982]
Fd (benthic inverts)	Fraction of diet consisting of benthic invertebrates		0.1	Smith (1997)[b]	0	
Fd (fish)	Fraction of diet consisting of fish		0.9	Smith (1997)[b]	0.767[d]	USEPA (1993; p. 2-97); [Source: Todd et al., 1982]
Fd (birds)	Fraction of diet consisting of birds		0		0.165[d]	USEPA (1993; p. 2-97); [Source: Todd et al., 1982]

Notes:
[a]Surrogate value based on great blue heron.
[b]Snowy egret diet (based on % biomass stomach contents): fish (91.4%), crayfish (6-7%); frogs (1%); invertebrates (1%; [insects, grass shrimp]).
[c]Surrogate value based on red-tailed hawk.
[d]Estimated using collection of animal carcasses near bald eagle nests in Maine.

Table 10
Species Factors for BERA
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Parameter	Description	Units	Least Shrew	Source	American Mink	Source
BW	Body weight of receptor	Kg	0.017	USEPA (1993; Page 2-213); [source: Guilday, 1957][a]	1.00	Sample and Suter (1994; Page 18; Table 4.6); [Source: Newell et al. (1987)]
Food IR	Ingestion rate of food	Kg/Kg BW/d	0.096	Nagy (2001)[b]	0.137	Sample and Suter (1994; Page 18; Table 4.6); [Source: Bleavins and Aulerich (1981)]
Soil / Sediment Ingestion	Ingestion Proportion of soil or sediment	Fraction of Total Diet	0.13	Sample and Suter (1994; Section 4.5, Page 17)[a]	0.005	Sample and Suter (1994; Page 18; Table 4.6)
Fd (plants)	Fraction of diet consisting of plants		0		0	
Fd (inverts)	Fraction of diet consisting of soil invertebrates		1	USEPA (1993; Page 2-214); [Source: Whitaker & Ferraro (1963)]; Whitaker & Ruckdeschel (2006)[a]	0	
Fd (mammals)	Fraction of diet consisting of mammals		0		0.22	Dolan (1986)
Fd (benthic inverts)	Fraction of diet consisting of benthic invertebrates		0		0.64	Dolan (1986)
Fd (fish)	Fraction of diet consisting of fish		0		0.14	Dolan (1986)
Fd (birds)	Fraction of diet consisting of birds		0		0	

Notes:
[a]Short-tailed shrew is used to represent the least shrew. Body weight is the arithmetic mean of adult male and female body weights.
[b]Ingestion rate is based on the ingestion rate of the shrew-tenrec (*Microgale dobsoni*).

Table 11
Exposure Modifying Factors (EMFs) for Receptors in BERA
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Parameter	Description	AOI	American Robin	Spotted Sandpiper	Mallard Duck	Snowy Egret	American Bald Eagle	Least Shrew	American Mink	Citations
Home Range	Home Range of receptor (acres)	NA	0.61[a]	8[b]	405[c]	490[d]	124,109[e]	0.98[f]	216[g]	USEPA 1993 [source: Pitts (1984); Howell (1942); Maxson & Oring (1980)]; Smith (2017); Gilmer (1975); Custer & Osborne (1978)] Clark (1995); Halbrook (2018)
Spatial Factor	Fraction of home range that may be contaminated Spatial Factor = Affected Area ÷ Home Range. A default of 1 is assumed where Home Range < Affected Area.	Prelim Eco AOI-1	1.0	0.25	0.0049	0.0041	0.000016	1.0	0.0093	Affected area of 2 acres was assumed for Prelim Eco AOI-1 based on estimated acreage.
		Prelim Eco AOI-2	0.82	0.063	0.0012	0.0010	0.0000040	0.51	0.0023	Affected area of 0.5 acre was assumed for Prelim Eco AOI-2 based on estimated acreage.
Temporal Factor	Fraction of time spent in presumed contaminated area	NA	0.3	0.3	0.3	0.3	0.3	0.3	0.3	
Area Use Factor (AUF)	Fraction of time population spent in presumed contaminated area relative to home range and lifespan Area Use Factor = Spatial Factor x Temporal Factor	Prelim Eco AOI-1	0.30	0.075	0.0015	0.0012	0.0000048	0.3	0.0028	
		Prelim Eco AOI-2	0.25	0.019	0.00036	0.00030	0.0000012	0.15	0.00069	

Notes:
[a]USEPA (1993) [Source: Pitts (1984); Howell (1942)]; Average of mean territory sizes.
[b]USEPA (1993) [Source: Maxson and Oring, L. et al. (1980)]
[c]USEPA (1993) [Source: Gilmer. et al. (1975)]; average of male and female home ranges.
[d]USEPA (1993) [Source: Custer & Osborn (1978)].
[e]Smith et al. (2017) average of all eagle ranges - summer and winter.
[f]Clark et al. (1995); Average of male (.56 ha) and female (.23 ha) home ranges.
[g]Halbrook (2018); Based on maximum home range of males and females.

APPENDIX A CURRICULUM VITAE

April 9, 2021

Helen R. Connelly, PhD

Principal Consultant

Helen's experience includes evaluation of human and ecological health risk due to exposure to petroleum hydrocarbons, metals, PCBs, PAHs, salts, chlorinated compounds, and other organic and inorganic compounds. She is experienced in designing and completing complex sampling and analysis plans and biological surveys in wetland, industrial, agricultural, and rural settings. Helen's skills include managing teams to accomplish large projects, working collaboratively with other consultants and experts, and completing complex ecological and human health risk assessments. Helen has successfully provided expert testimony at trial and deposition in support of litigation, and has provided expert opinions and expert reports for human and ecological exposures.

Experience: 19 years of experience in environmental toxicology, human health and ecological risk assessment

Email: hconnelly@mpisani.com

Education

- Ph.D., Veterinary Medical Sciences in Physiology, Pharmacology and Toxicology, Louisiana State University School of Veterinary Medicine, US, 1997
- B.S., Geology, Louisiana State University, 1985

Professional Affiliations and Registrations

- Adjunct Faculty, Louisiana State University Department of Environmental Sciences
- Baton Rouge Geological Society
- American Association of University Women
- Society of Environmental Toxicology and Chemistry

Languages

- English, native speaker
- French, limited working proficiency

Honors and Awards

- US Department of Energy Graduate Research Fellowship
- US Department of Energy Post-Doctoral Research Fellowship

Fields of Competence

- Environmental Toxicology
- Human Health Risk Assessment
- Ecological Risk Assessment
- Freshwater and Estuarine Field Studies
- Project Management
- LDEQ RECAP Risk Assessment
- Freshwater Fish Culturing
- Conservation Biology
- Environmental Data Analysis
- Biological Species Surveys
- Wetlands Rapid Assessments

Key Industry Sectors

- Oil and Gas
- Litigation
- Chemical Production
- Pipeline

Publications

- Connelly, H. and Means, J. International Journal of Toxicology, 2010 29: 532: Immunomodulatory Effects of Dietary Exposure to Selected Polycyclic Aromatic Hydrocarbons in the Bluegill (*Lepomis macrochirus*).

Key Projects

Airborne Sulfur Dioxide and Hydrogen Sulfide Human Health Risk Assessment
Calculated human health risk due to an airborne SO_2 and H_2S release from a major petrochemical refinery on the Gulf Coast for an expert report. Potentially exposed receptors included neighborhood residents adjacent to the refinery. Health risks were calculated by comparing LDEQ monitoring station data and air data collected in the neighborhood to calculated protective standards. Protective standards were calculated using exposure studies from a complete review of the scientific literature. Prepared two expert reports for this study. Was deposed for opinion and testified in federal court in this matter.

Coastal Sediment Human Health and Ecological Risk Assessment: PAHs, PCBs, Dioxins/Furans, TPH, and Metals
Completed a screening level human health and ecological risk assessment for a brackish to saline coastal open water area based on concentrations in sediments. Human and ecological exposures to PCBs, Dioxins/Furans, PAHs, TPH, and metals were assumed to be reasonable maximum exposures. Sampling plans for additional investigation and metals speciation were identified to further refine the next level of risk assessment.

Airborne PM10 Human Health Risk Assessment
Calculated human health risk due to an airborne catalyst release from a major petrochemical refinery on the Gulf Coast for an expert report. Potentially exposed receptors included neighborhood residents adjacent to the refinery. Risk was calculated using EPA National Ambient Air Quality Standards (NAAQS) for particulate matter (PM10), PM10 data from the nearby LDEQ monitoring station, and modeled air concentrations. Wipe sample data was collected from surfaces in the neighborhood, and were compared to US Army wipe standards. The health effects portion of this lawsuit was dropped by opposing counsel on the day that my deposition on the matter was to occur.

Benzene Human Health Risk Assessment
Prepared a human health risk assessment for recreational (swimming) exposure by children to creek surface water. Protective standards for creek surface water were calculated, using EPA guidelines, to represent concentrations that did not pose unacceptable risk of cancer. The setting for this risk assessment was a natural creek in a wooded area. There were 10 years of data for this evaluation, which reduced some levels of uncertainty normally present in a risk assessment.

Benzene Air Sampling Plan for Human Health Risk Assessment
Wrote air sampling and analysis plan to evaluate airborne volatile hydrocarbons in the area of a residence near an underground petroleum pipeline. Researched and described best current technology for air sample collection and for **identifying low** levels of compounds in air. Calculated protective health-based standards for these hydrocarbon concentrations in air based on LDEQ RECAP and EPA guidelines.

Screening Level Human Health and Ecological Risk Assessment of TPH-Impacted Canal Sediments
Initiated a preliminary human health and ecological risk screening of a heavily TPH impacted canal in St. Charles Parish. Compared sediment, water, and sheen concentrations in the samples collected to proxy MO-1 human health standards and NOAA SQUIRT standards. Attempted electrofishing sample collection, but the conductivity of the water was prohibitive.

Pipeline Spill Human Health Risk Assessment
Planned, collected and analyzed soil and ground water samples for a major petrochemical client in response to their request for RECAP compliant assistance with a gasoline pipeline spill near a sugar cane field. Analyzed reported constituent concentrations using LDEQ RECAP Screening Standards and prepared RECAP report for submittal to LDEQ.

Human Health Pipeline Worker Risk Assessment
Evaluated health risks to pipeline workers installing a pipeline thirty feet below ground surface across a Superfund site in an area with thick clays. Superfund surface contaminates included heavy metals and carcinogens. Considered inhalation, dermal and ingestion routes of exposure to workers. Used RECAP and TCEQ standards as references for toxicity assessment. Established the likely geology at depth based on research of the area. Estimated the potential for constituents to migrate from the pipeline excavation via groundwater to other areas. Wrote a letter to EPA for the client to obtain approval for the pipeline installation. EPA granted approval.

Oil Spill PAH Fish Immunotoxicity Study
Designed and successfully executed a fish toxicity study to evaluate the effects of polycyclic aromatic hydrocarbons (PAH) found in energy related wastes, such as oil spills, on the proliferative behavior of immune cells in a native bluegill fish model (Lepomis macrochirus). Worked with the Louisiana Department of Wildlife and Fisheries to collect bluegill from the LSU lakes using electrofishing. Maintained the fish in indoor tanks. Collected lymphocytes from fish after feeding them a diet of 2-methylnaphthalene, 9,10-dimethylanthracene, and 2-aminoanthracene for a period of weeks. Published the results in a peer reviewed journal article in the International Journal of Toxicology, 2010 29: 532: Immunomodulatory Effects of Dietary Exposure to Selected Polycyclic Aromatic Hydrocarbons in the Bluegill (Lepomis macrochirus). Presented this research at the Society of Environmental Toxicology and Chemistry (SETAC) annual meeting in San Francisco, 1997.

Ecological Risk Assessment for TPH and Barium Impacted Sediments in a Fresh Marsh and Flooded Forest
Executed a complex ecological risk assessment of a TPH and Barium-impacted fresh marsh and flooded forest environment for an expert report. Managed all phases of the risk assessment from the initiation of sample collection planning to the final calculations of risk. Used innovative statistical methods to identify background concentrations, extensive research to identify freshwater marsh-specific/species-specific exposure parameters, industry-specific analyses to differentiate compound toxicities, and calculations to determine the effects of organic carbon on hydrocarbon toxicity. Risk assessment included calculating hazard quotients for native species based on measured levels of metals in sediments and soils in a setting frequented by recreational hunters and fishermen.

Human Health Risk Assessment of Recreational Use of Marsh Sediments Impacted with TPH and Barium
Completed a human health risk assessment of recreational exposure to hydrocarbons and metals in a flooded fresh marsh and forest environment for an expert report. Followed LDEQ RECAP protocol to calculate standards and to assess risk in a limited access environment. The risk assessment assumed exposure to soils and sediments and used both Screening and MO-1 RECAP standards.

LDEQ RECAP MO-1 Human Health Risk Assessment of Salt and TPH Impacted Agricultural Field
Calculated human health risk using LDEQ RECAP protocol for two agricultural sites of former and current oil and gas production in the central Louisiana area. Both sites had salt impacted soils and groundwaters. Used identified background concentrations for groundwater standards. Soil was evaluated using Screening standards and MO-1 standards for metals and hydrocarbons. LDNR standards and SPLP methods were used to assess salt in soils, and to delineate areas of impact. Both projects involved collaboration with environmental scientists from many disciplines all working together on the projects. Both projects involved managing, analyzing and reporting on large data sets. Wrote portions of risk assessment for both reports, including performing the RECAP standards calculations for both reports.

Mercury Sediment Standard and Barium Ambient Water Quality Standard Development
Developed a site specific mercury sediment remediation standard for the protection of benthic invertebrates. Developed the standard according to EPA protocol using scientific studies of the effects of mercury in southern U.S. habitats. Developed a barium ambient water quality standard for protection of aquatic organisms. Followed US EPA guidelines for developing a chronic exposure standard based on a complete review of the scientific literature. Developed an EPA compliant standard that is one order of magnitude larger than current available standards.

Delineation Plan for Remediation of Sediment in Fresh to Brackish Marsh
Worked collaboratively with a team of risk assessors to develop a sampling and analysis plan to delineate areas for sediment remediation in a fresh to brackish marsh. Analytical methods involve PAH pore water analysis to estimate toxic units and metals speciation by QEMSCAN to estimate metals toxicity. Protocol development for the sampling has involved preliminary analytical method studies, preliminary model calculations, and collaboration with experts industry and academia.

Alabama Shipyard Human Health Risk Assessment
Completed an EPA compliant human health risk assessment/expert report for an operating shipyard and barge repair facility in Mobile, Alabama for litigation support. Developed RfD toxicity values for compounds that did not currently have published values. Assessed lead exposure using the Integrated Exposure Uptake Biokinetic (IEUBK) model and the Adult Lead Model.

LDEQ RECAP Human Health Risk Assessments
Established human health exposure pathways and receptors and/or calculated site specific RECAP standards for the following sites: creosoting wood treatment facility, dry cleaning establishment, former industrial waste disposal site, gasoline spill site, paper mill, and former exploration and production sites.

Shipyard Human Health Risk Assessment
Calculated the human health risk associated with exposure to sediments containing lead, arsenic, cadmium, and chromium at a former shipyard in St. Mary Parish.

Two Year Crawfish Bioaccumulation Study
Planned and executed two crawfish collection studies in surface waters in St. Charles Parish in ditches impacted with chlorinated compounds and other organic compounds. Prepared an analysis of crawfish abundance as affected by drought and surface water contaminants. Analyzed crawfish tissues for compounds detected in surface waters to determine if accumulation was occurring. Presented this research to the LSU Department of Environmental Sciences and was unanimously accepted as an adjunct faculty member based on the research.

Blue Crab Population Study
Analyzed crab weight, size, and fullness as related to crab habitat characteristics in a study area of natural bayou, lake, and marsh ecosystems, as well as man-made oilfield canals. Collected crabs and fish under a Louisiana Department of Wildlife and Fisheries collection permit as part of a team of risk assessors working on a study of heavy metal toxicity in aquatic organisms. Reported the crab and fish collection techniques in a detailed sampling methods and results report that was submitted to LDEQ, LDHH, and LDWF. Compared the measured weights, sizes and abundance of the crabs collected in this project to annual crab studies done by LDEQ, LSU and the Gulf States Marine Fisheries Commission.

Freshwater/Brackish Marsh Functions and Services Analysis
Planned and executed a field study to assess wetland functions and services in a fresh to intermediate marsh ecosystem. Evaluation methods used were based on EPA Rapid Wetlands Assessment techniques. The study area setting was man-made canals, a bayou and a lake. The field study involved trapping native bait fish and blue crabs (*Callinectes sapidus*), recording vegetation in the habitats, and recording birds and other wildlife present. At each location, an evaluation was done using a wetlands assessment tool to quantify the functioning of the ecosystem. This wetlands function assessment report was submitted to LDEQ, LDHH, and LDWF.

Personal Injury Expert Reports
Researched and prepared toxicity expert reports for human exposures to two different compounds: carbon monoxide and gluteraldehyde, both for litigation not in the petrochemical industry. Was deposed for opinion each time.

LDEQ Sample Handling Method Development
Worked with LDEQ on frozen fish tissue holding time protocol to assist client and to engage best available science. Used research regarding the history and basis for the holding time protocol, along with the most current research in the field to develop a holding time based on sound scientific information.

Crawfish Ingestion Human Health Risk Assessment
Performed a crawfish ingestion analysis based on potential shellfish consumption from a ditch impacted with low levels of chlorinated compounds and other organic compounds for presentation to LDEQ for a petrochemical client. Used LDEQ RECAP ingestion and exposure parameters to calculate crawfish consumption risk assessment.

Data Analysis/Data Management
Managed large amounts of soil, sediment, water and biological data for several projects. Data analysis includes work such as: identifying and analyzing effects of non-detected analytes on calculated results, analyzing effects of sample depths by location, calculating dry weights/wet weights, identifying data gaps and uncertainty, comparing results from different labs, identifying unusable data, calculating split averages by location, statistical comparison of site to background concentrations, calculation of mean 95%UCL, and identifying trends and patterns in constituent concentrations.

Biological and Non-Biological Field Sampling and Collection
Collected and recorded field samples under chain of custody for environmental media and biological species for many projects including: soil and sediment sampling, shallow and deep groundwater and drinking well sampling, surface water and vegetation sampling, periphyton collection, macroinvertebrate collection, crawfish trapping, blue crab trapping, electrofishing for freshwater fish species, and trawling for and netting fresh and intermediate salinity fish and other nektonic species.

LDEQ Community Relations
Assisted in writing and publishing LDEQ community relations newsletters and planning town meetings in order to communicate health risks associated with Superfund sites and other inactive and abandoned sites with nearby residents. Provided public health information to communities surrounding Superfund sites such as Old Inger, Lincoln Creosote, and Combustion.

Fresh Marsh Flooded Forest Vegetation Survey
Evaluated and recorded vegetation assemblages in six locations in the southern portion of the Louisiana Department of Wildlife and Fisheries White Lake Wetlands Conservation Area. Performed the study of the fresh marsh and wooded wetlands with natural and man-made canals with my three graduate students. Identified 35 common plant species and measured associated water salinity, turbidity, pH and temperature.

Graduate Student Mentor Masters of Natural Science Degree

Mentored and taught a total of eighteen graduate students over a three year period in the Gordon A. Cain Center Department at Louisiana State University. All eighteen candidates completed projects and final exams and were awarded Master's Degrees in Natural Sciences with a specialization in Biology. During the three year period, I taught classes in Biology, Environmental Science and Ecology, and led field and laboratory exercises during all semesters.

LDEQ MO-3 Human Health and Ecological Risk Assessment of Flooded Forest Fresh Marsh

Completed and submitted to LDEQ, at the request of LDNR, both a human health and an ecological risk assessment of sediments from canal bottoms in a fresh marsh and flooded forest environment. Sediment constituents of concern were barium, TPH, and polycyclic aromatic hydrocarbons. RECAP algorithms using recreational exposure values were used to assess potential hazard due to the human direct contact pathway. For the ecological assessment, barium exposure was assessed based on identifying the locations where soluble barium may exist (TCLP analysis) and evaluating those locations based on probable no-effects concentrations for barium in sediments. TPH and barium were evaluated for their potential for accumulation in fish, based on accumulation factors from the scientific literature. Modeled concentrations in fish were then compared to LDEQ/LDHH calculated fish tissue screening levels for human consumption. LDEQ has granted a no further action at this time status to the site, based on the MO-3 analysis.

LDNR Pit Closure Plan

Prepared and submitted to LDNR a work plan to close four pits that exceeded 29-B standards for O&G and/or barium using site specific RECAP MO-1 industrial standards. The work plan included confirmatory sampling to completely delineate the pits to 29-B standards and sampling to complete a TPH fractions and barium RECAP assessment. The rationale behind the plan was to only excavate soils if analysis showed that the soils exceed both 29-B and RECAP standards, indicating potential effects to human health and the environment. The four former pits are lushly vegetated, in a remote setting accessible only by boat, and do not include any residences. Excavation of soils that do not demonstrate health hazards can be avoided in a setting like this, limiting destruction to the ecosystem. Also included in the work plan was a vegetation survey/wetlands assessment at each of the four pits to document that the expected vegetation is present and that the ecosystem is functioning as would be expected in a freshwater wetlands environment. Vegetation as part of ecosystem function was assessed by estimating that percentage cover of each category of vegetation was appropriate to the setting, as well as by comparing the vegetation species present to species documented in the scientific literature for each habitat type. Presented the concepts and data behind this closure approach to LDNR, prior to submitting the work plan to them, in order to include all LDNR input/comments in the plan prior to submittal.

Ecological Risk Assessment Brackish Marsh Estuary

Worked collaboratively with a team of risk assessors to design and execute a complex data collection effort in a brackish marsh estuary. Sampling included soils, sediments, surface waters, fish, crabs, shrimp, and macroinvertebrates. Vegetation was recorded and analyzed for providing functions and services. Fish, crab, shrimp and macroinvertebrate population data were compared to reference marsh data identified in the primary scientific literature. PAH and metals data were evaluated for ecological risk based on metals speciation and calculation of hazard quotients. Metals speciation methods used included scanning electron microscopy. Results were used to differentiate toxic and non-toxic species of metals.

Fish and Vegetation Quantitative Assessment Freshwater Swamp and Bayou
Completed a vegetation survey and fish collection to support conclusions of a large scale ecological risk assessment in a south Louisiana bayou and cypress tupelo swamp setting. Collected and released more than a thousand native fish and observed vegetation in 30 quadrats. Vouchered each unique fish species. Collected fish from bayous, swamps and open water using cast netting, hoop nets and wire net traps, and recorded fish by genus and species. Surveyed and recorded vegetation at each location where fish were collected. Photographed each habitat, fish collection and vegetation location in detail. Worked collaboratively with a team of scientists to complete this bioassessment.

Visiting Guest Lecturer
Delivered several lecture presentations to educate peers, industry, attorneys and regulators in various fields of toxicology. Presented a talk and photos at an on-site event describing phytoremediation, natural attenuation, and constituent toxicity at a Superfund site at the request of EPA. Presentation was for public service and done at the request of community members. Worked as a member of a team along with other scientist presenters for this event. Presented methods for interpreting metals data in biological tissues for both human health and ecological risk assessments to a large group of environmental attorneys. Presented toxicity and effects of acute exposure to benzene and arsenic to members of the Louisiana Environmental Health Association at their monthly meeting at LDEQ at the request of Bill Schramm with LDEQ. Gave a lecture on accumulation of total petroleum hydrocarbons (TPH) in fish and sediments at the Louisiana 2016 Solid Waste Conference in Lafayette, Louisiana. Present annually to my co-workers the toxicology portion of the 40 hour health and safety training.

Groundwater Sampling in Vicinity of Brine Sinkhole
Worked collaboratively in the field with our in house team to participate in collecting and analyzing groundwater samples from groundwater wells onsite and offsite at a south Louisiana industrial facility. Collected from each well more than sixty samples for metals, volatiles, hydrocarbons, salt parameters, and radionuclides analysis. Collected field data on water pH, turbidity, conductivity, temperature, well depth, and water depth. Supervised as many as six other parties at each well collecting duplicate water samples. Maintained chain of custody and sample documentation prior to transport to the lab for analytical testing. Have analyzed this data, along with three additional years of data from this location to complete a human health risk assessment based on human exposure to well water.

Rapid Bioassessment of Wadeable Streams in Mississippi
Completed a Rapid Bioassessment of four wadeable streams in 100 meter reach segments. Collected macroinvertebrates, periphyton and native fish following a prescribed EPA protocol. Fish were collected by electroshocking, macroinvertebrates were collected using a jabbing dip net process and periphyton were collected by hand scraping. Each habitat was sampled in each stream according to the percentage the habitat represented of that stream. Sampling included duplicate sampling for periphyton and voucher collection for each fish species collected. Performed a scored habitat assessment comparison of the four streams and presented an evaluation of fish species diversity and richness. The entire process was photo documented in detail.

LDEQ MO-2 and MO-3 Human Health and Ecological Risk Assessments for Brine Sinkhole
Completed and submitted LDEQ RECAP compliant MO-2 and MO-3 Work Plans for a Louisiana brine mining operation for review by LDNR and LDEQ. The Work Plans encompass the results of over three years of surface water and groundwater data collection and analysis. The efforts to complete the Work Plans included analysis of over 170,000 data points of more than 300 different constituents. The intended methods were presented to LDEQ and LDNR prior to creating the actual Work Plans to obtain comments. The plans describe RECAP compliant human health risk assessment for groundwater and ecological risk assessment and human health risk assessment for the surface waters. The effort has involved statistical comparison of data sets using PROUCL software, calculation of RECAP health based standards and scientific literature review for ecological toxicity values.

Ecological Risk Assessment of TPH, Endangered Species, Crawfish, and Aquatic Organisms
Calculated ecological risk to bald eagles using EPA protocol and toxicity reference values specific to bald eagles. Estimated risk to plants and invertebrates due to exposure to TPH in soils, based on a scientific literature review of no observed effects due to soil TPH concentrations. Estimated risk to aquatic species in a local bayou based on comparison to local background, EPA National Ambient Water Quality Criteria, LDEQ Water Quality Criteria, and McDonald and Long Screening Standards.
Estimated risk to crawfish exposed to salinity in soils using reference studies of crawfish salinity exposures in south Louisiana.

Calculation of Worker Exposure to Volatiles During Oil Spill Clean-Up
Prepared opinion for Mike Pisani while he was in the midst of a trial on worker exposure to volatiles during an oil spill clean-up. Estimates of likely exposure were made using data from two other oils spills, EPA, and OSHA data. Estimated levels and durations of exposure were compared to concentrations predicted to have long term or irreversible health effects, and to levels sufficient to cause short term, reversible health effects in oil spill workers. This opinion was used by Pisani to respond to questioning during the trial.

Human Health Lead Exposure Risk Assessment
Performed EPA-compliant risk assessment for a lead-impacted bayou near a major petroleum refinery in St. Charles Parish. Calculated health risks to hunters and fishers consuming fish, crabs and game from the bayou area. Used the Integrated Exposure Uptake Biokinetic (IEUBK) model and the Adult Lead Model to assess lead human health risks.

Screening Level Chemical Plant Human Health Risk Assessment
Estimated the toxicity and calculated risk based standards for more than 150 compounds, including many tin compounds, for which no RECAP standards exist, at a chemical plant in South Louisiana. Used chemically similar compounds with known toxicities as proxies for compounds with limited toxicity information.

PCB Fingerprinting Analysis in Soils and Sediments
Compared polychlorinated biphenyl concentrations (PCB) in soils and sediments at an industrial facility to PCB concentrations in an adjacent ditch and connecting bayou to determine if site PCBs were the source of the ditch PCBs. The analysis involved a detailed review of the congeners on site by depth and by congener ratio. We provided the client with support for our conclusions in the form of statistics and graphs. We also provided an opinion as to the original Aroclor formulation that was the source of the PCBs on site. This project involved creating an extensive database from PDF files, as no Excel versions were available, as well as converting congener identifying names from different labs to consistent names for all data.

Chlorinated Groundwater Human Health Risk Assessment
Worked collaboratively with the in-house research division of a large petrochemical company in St. Charles Parish to complete the risk assessment portions of a RCRA Corrective Measures Study Work Plan. Performed a detailed QA/QC evaluation of current and historical data used in the assessment. Assessed human health risk due to exposure to chlorinated compounds in shallow and deep groundwater.

CURRICULUM VITAE

John H. Rodgers, Jr.

BIRTHDATE:	February 1, 1950
BIRTHPLACE:	Dillon County, South Carolina, U.S.A.
SSN:	Available on request
MARITAL DATA:	Wife's maiden name - Martha W. Robeson Children - Daniel Joseph Rodgers (Born January 16, 1978) Frank Clifford Rodgers (Born July 7, 1985)
HOME ADDRESS:	102 Santee Trail Clemson, SC 29631 Telephone: (864) 653-3990 Mobile: (864) 650-0210
PRESENT POSITION:	Emeritus Professor Emeritus College Clemson University
PRESENT ADDRESS:	Department of Forestry and Environmental Conservation PO Box 340317 261 Lehotsky Hall Clemson University Clemson, SC 29634-0317 Telephone: (864) 656-0492 Fax: (864) 656-1034 Mobile: (864) 650-0210 E-mail: jrodger@clemson.edu
EDUCATION:	Virginia Polytechnic Institute and State University, Blacksburg, VA,

Ph.D. Degree, Botany, Aquatic Ecology, 1977.

Clemson University, Clemson, SC,
M.S. Degree, Botany, Plant Ecology, 1974.

Clemson University, Clemson, SC,
B.S. Degree, Botany, 1972.

PROFESSIONAL EXPERIENCE:

Clemson University (1998-present):

Emeritus Professor
Emeritus College
Clemson University
2020 – present.

Professor, Department of Forestry and Environmental Conservation
Director, Ecotoxicology Program
2003 – 2020.

Director, Clemson Institute of Environmental Toxicology
Chair, Department of Environmental Toxicology
Professor, Department of Environmental Toxicology
Co - Director, Clemson Environmental Institute
1998 - 2003.

University of Mississippi:
(Department of Biology)

Professor, Department of Biology,
1989 - 1998.
Director, Ecotoxicology Program,
1995 – 1998.
Adjunct Research Professor, Research Institute for Pharmaceutical Sciences,
1989 - 1998.
Director, Biological Field Station,
1990 – 1995.
Director, Center for Water and Wetland Resources,
1993 – 1995.
Associate Director, Biological Field Station,
1989 - 1990.

University of North Texas:
(Division of Environmental Sciences,
Department of Biological Sciences)

Director, Water Research Field Station,
1987 - 1989.
Associate Professor, Department of Biological Sciences,
1985 - 1989.
Associate Director, Institute of Applied Sciences,
1982 - 1988.
Assistant Professor, Department of Biological Sciences,
1982 - 1985.
Research Scientist II, Institute of Applied Sciences,
1979 - 1981.

East Tennessee State University:
(Department of Environmental Sciences,
Aquatic Ecology Section)

Assistant Professor, 1978 - 1979.

**Virginia Polytechnic Institute
and State University:**
(Biology Department, Center for
Environmental Studies)

Postdoctoral Research Associate, 1977 - 1978.
Research Assistant- Energy Research and
Development Administration, 1975 - 1977.

Clemson University (1972-1974):
(Botany Department)

Research Assistant - Water Resources Research
Institute, 1972 - 1974.
Laboratory Teaching Assistant – Plant Physiology,
Plant Ecology, Biological Oceanology, Botany, 1972 - l974.

MILITARY
SERVICE: Distinguished Military Graduate, Clemson University, 1972.
U.S. Air Force Reserve, Second Lieutenant,
1972 - 1975.
U.S. Air Force Reserve, First Lieutenant,
1975 - 1978.
U.S. Air Force Reserve, Captain,
1978 - 1984.
U.S. Air Force (Active Duty),
June 1 - August 29, 1976.
U.S. Air Force, Honorable Discharge, 1984.
Pilot Certificate - 34 hours, Single engine aircraft.

RESEARCH
SUPPORT:

Clemson University (1972-1974):

Research Assistantship, Water Resources Institute, Project No. B-053-SC ($42,000), 1972 - 1974. Impact of Thermal Effluent from a Nuclear Power Plant on Reservoir Productivity.

Thesis Parts Award, USAEC, The E.I. DuPont de Nemours & Co., Savannah River Laboratory (Thermal Effects Laboratory), Aiken, S.C., 1973-1975. Effects of Elevated Temperatures on Periphyton Productivity in Lotic Aquatic Ecosystems.

Savannah River Laboratory, Research Assistantship, Research Contract USAEC Funding ($50,000), 1973-1975. Impacts of Ash from Coal Combustion on Swamp Receiving Systems.

Virginia Polytechnic Institute and State University:

Research Assistantship, Research Contract, American Electric Power Corporation Funding ($93,000), 1974-1975. Thermal Tolerances and Electivities of Fish Adjacent to a Coal-Fired Power Plant.

Research Assistantship, Research Contract, Energy Research and Development Administration Funding ($112,000),1975 - 1976. Structural and Functional Responses of Aquatic Communities to Power Generation.

Research Assistantship, Research Contract, Energy Research and Development Administration Funding ($132,000),1976 - 1977. Responses of Aquatic Communities to Perturbations Associated with Power Generation.

Co-principal Investigator, Research Contract, Water Resources Research Institute Funding ($68,000), 1977 - 1979. Environmental Tolerances of *Corbicula fluminea* from the New River, Virginia.

East Tennessee State University:

Principal Investigator, Research Contract, ETSU Research Development Committee Funding ($3,270), 1978 - 1979. Primary Production and Nutrient Dynamics in the Watauga River, Tennessee.

Oak Ridge Associated Universities Travel Contract, 1978 - 1979. Impacts of Power Production on Aquatic Ecosystems of Savannah River Laboratory.

University of North Texas:

Co-Principal Investigator, Research Contract, Chemical Manufacturers' Association Funding ($80,000), 1979 - 1980. Modeling the Fate of Chemicals in Aquatic Environments.

Principal Investigator, Research Contract, NTSU Faculty Research Grant Funding ($4,000), 1979 - l980. Biotransformation of Xenobiotics in Aquatic Systems.

Co-principal Investigator, Research Contract, International Paper Company Funding ($149,530), 1980 - 1981. Impacts of Paper Mill Effluent on Aquatic Ecosystems.

Co-principal Investigator, Research Contract, Victor Equipment Company Funding ($5,000), 1980. Optimization of Packaged Waste Treatment System for Metal Removal.

Co-principal Investigator, Research Contract, International Paper Company Funding ($171,830),1980 -1981. Investigation of Pre- and Post-Operational Effects of a Paper Mill on Aquatic Systems.

Principal Investigator, Research Contract, NTSU Faculty Research Grant Funding ($4,620), 1980 - 1981. Predicting Bioconcentration of Chemicals by Aquatic Organisms.

Co-principal Investigator, Research Contract, Chemical Manufacturers' Association Funding ($30,000), 1981. Validation of Chemical Fate Models for Aquatic Ecosystems.

Co-principal Investigator, Research Contract, U.S. Environmental Protection Agency Funding ($305,866), 1981 - 1983. Development of a Decision Support System for Integrated Management of Nuisance Aquatic Vegetation.

Principal Investigator, Research Contract, NTSU Faculty Research Grant Funding ($3,600), 1981-1982. Fate and Effects of the Herbicide, Endothall, in Aquatic Systems.

Co-principal Investigator, Research Contract, Chemical Manufacturers' Association Funding ($59,985), 1981 - 1982. Studies of Fate and Effects of Chemicals in Aquatic Ecosystems.

Co-principal Investigator, Research Contract, International Paper Company Funding ($113,000), 1982. Effects of Paper Mill Effluent on Aquatic Ecosystems.

Principal Investigator, Research Contract, U.S. Army Corps of Engineers Funding ($24,500), 1982. Ecosystem Study of Pat Mayse Lake, A Southwestern Reservoir.

Co-principal Investigator, Research Contract, International Paper Company Funding ($348,926), 1982 - 1985. Further Studies of Effects of Paper Mill Effluent on Aquatic Ecosystems.

Principal Investigator, Research Contract, NTSU Faculty Research Grant Funding ($3,500), 1982 - 1983. Proximate Oxygen Demand of Aquatic Plants.

Co-principal Investigator, Research Contract, U.S. Environmental Protection Agency Funding ($199,500), 1982 - 1983. Validation of Decision Support Systems for Integrated Management of Nuisance Aquatic Vegetation.

Co-principal Investigator, Research Contract, American Petroleum Institute ($83,809), 1981 - 1982. Bioavailability of Petroleum-Derived Chemicals in Aquatic Ecosystems.

Principal Investigator, Research Contract, U.S. Army Corps of Engineers Funding ($25,000), 1983. Further Studies: Pat Mayse Lake, A Southwestern Reservoir.

Principal Investigator, Research Contract, U.S. Army Corps of Engineers Funding ($1,000), 1983. Remote Sensing of Aquatic Vegetation in Pat Mayse Lake.

Co-principal Investigator, Research Contract, Shell Development Company Funding ($17,000), 1983. Impact of Petroleum Compounds on Aquatic Organisms.

Principal Investigator, Research Contract, NTSU Faculty Research Grant Funding ($4,500), 1983 - 1984. Threshold Responses of Aquatic Vegetation to Herbicides.

Co-principal Investigator, Research Contract, Shell Development Company Funding ($29,758),1984. Inter-Laboratory Comparison of Bioassays Using Freshwater and Marine Organisms.

Principal Investigator, Research Contract, U.S. Army Corps of Engineers Funding ($20,000), 1984. Water Quality Monitoring and Aquatic Vegetation in Pat Mayse Lake.

Principal Investigator, Research Contract, Pennwalt Corporation Funding ($11,500), 1984. Comparative Study of Two Aquatic Herbicides.

Principal Investigator, Research Contract, Shell Oil and Chemical Company Funding ($14,000). Aquatic Toxicology Studies for the Petrochemical Industry.

Principal Investigator, Research Contract, Dallas County Utility and Reclamation District Funding ($12,000), 1984 - 1985. Eutrophication Potential in an Impoundment Receiving Wastewater.

Co-principal Investigator, Research Contract, Shell Development Company Funding ($31,797), 1985. Development of Data on Proper Selection of Bioassay Species.

Co-principal Investigator, Research Contract, Texas Instruments, Inc. Funding (approximately $12,000, equipment), 1985. Development of Expert Systems for Water Quality Management.

Principal Investigator, Research Contract, U.S. Army Corps of Engineers Funding ($24,500), 1985. Development of a Water Quality Model and Lake Management Strategy for Pat Mayse Lake.

Co-principal Investigator, Research Foundation Award, Shell Research Foundation ($15,000), 1985. The Response of Marine and Freshwater Species to Xenobiotics.

Principal Investigator, Research Contract, NTSU Faculty Research Grant Funding ($2,700), 1986 - 1987. Experimental Analysis of Bioassay Methods.

Co-principal Investigator, Research Contract, U.S. Army Corps of Engineers Funding ($168,693), 1986 - 1987. Ecological Analysis of the Lake Ray Roberts Project Site.

Principal Investigator, Research Contract, U.S. Army Corps of Engineers Funding, ($68,000), 1986 - 1987. Coupling an Environmental Fate and Effects Model for 2, 4-D and Water Hyacinth.

Co-principal Investigator, Research Contract, Shell Research Foundation Funding ($15,000), 1986. Osmoregulation in Marine Bioassay Species.

Principal Investigator, Research Contract, American Petroleum Institute Funding ($8,000), 1986. Evaluation of Marine Bioassay Species.

Principal Investigator, Research Contract, American Petroleum Institute and U.S. Environmental Protection Agency Funding ($10,000), 1986. A Workshop on Culture and Life History of *Mysidopsis* sp.

Co-principal Investigator, Research Contract, Shell Research Foundation Funding ($20,000), 1987. Sediment Organic Carbon Content in Aquatic Systems of the U.S.

Principal Investigator, Research Contract, U.S. Army Corps of Engineers Funding ($24,500), 1987 - 1988. Endothall Fate and Effects on *Myriophyllum spicatum* in Pat Mayse Lake, Texas.

Co-principal Investigator, Research Contract Hoechst-Roussel Agri-Vet (Hoechst-Celanese) Co. Funding ($185,000), 1987 - 1988. Development of Mesocosms and Water Research Field Station.

Co-principal Investigator, Research Contract, City of Dallas Funding ($319,964), 1987 - 1989. Ecological Survey and Study of the Trinity River, Texas.

Co-principal Investigator, Research Contract, Hoechst-Roussel Agri-Vet (Hoechst-Celanese) Co. Funding ($325,000), 1988 - 1989. Fate and Effects of Tralomethrin in Mesocosms.

Co-principal Investigator, Research Contract, Hoechst Roussel Agri Vet (Hoechst-Celanese) Co. Funding ($185,000), 1988 - 1989. Further Development of Mesocosms and Water Research Field Station.

Principal Investigator, Research Contract, U.S. Army Corps of Engineers Funding ($24,500), 1988 - 1989. Further Development of a Water Quality Model and Lake Management Strategy for Pat Mayse Lake.

Principal Investigator, Research Contract, U.S. Army Corps of Engineers Funding ($24,550), 1988 - 1989. Research on SONAR in Pat Mayse Lake.

Principal Investigator, Research Contract, U.S. Army Corps of Engineers Funding ($107,000), 1988-1989. Water Research Field Station-Coupling a Herbicide Fate and Effects Model.

Principal Investigator, Research Contract, Pennwalt Corporation ($2,000), 1988-1989. Degradation of Endothall by Chlorine.

Co-principal Investigator, Research Contract, Mobay Corporation ($852,000), 1988-1990. Fate and Effects of Cyfluthrin in Mesocosms.

Co-principal Investigator, Research Contract, Shell Development Corporation ($55,000) 1989 - 1990. Bioavailability of Sediment-sorbed Chemicals to Freshwater Organisms.

University of Mississippi:

Principal Investigator, Research Contract U.S. Army Corps of Engineers - Tulsa District Funding ($24,500), 1988-1989. Limnology and Aquatic Botany of Pat Mayse Lake, Texas.

Principal Investigator, Research Contract, Shell Development Company Funding ($50,000), 1989-1990. Evaluation of Sediment Toxicity Testing Procedures.

Co-principal Investigator, Research Contract Soil Conservation Service Funding ($50,000), 1990-1991. Wetlands for Interception and Processing of Pesticides in Agricultural Runoff.

Co-principal Investigator, Research Contract Tennessee Valley Authority Funding ($171,410), 1990-1991. Analysis of Aquatic Herbicides in Lake Guntersville, Alabama for the Aquatic Plant Management Program.

Principal Investigator, Research Contract, Ciba Giegy Corporation Funding ($31,000), 1990. Effects of Atrazine on Aquatic Vascular Plants.

Co-principal Investigator, Research Contract, Dow-Elanco Corporation Funding ($40,000), 1990. Analysis of Fluridone in Florida Aquatic Plant Management Programs.

Principal Investigator, Research Contract, U.S. Environmental Protection Agency - Gulf of Mexico Program ($17,565) 1990-1991. Assistance with the Citizen's Advisory Group of the Gulf of Mexico Program.

Co-principal Investigator, CHP International, Inc. (U.S. Peace Corps) Funding ($22,000), 1990. Aquaculture Training Sessions for Volunteers for Africa.

Co-principal Investigator, University of Mississippi Funding ($1,000), 1989-1990. Water Systems for an Aquatic Toxicology Laboratory.

Principal Investigator, Internal Equipment Funding, University of Mississippi Associates Funding ($25,000), 1990-1991. Aquisition of an Ion Chromatograph/High Performance Liquid Chromatograph.

Principal Investigator, U.S. Army Corps of Engineers, Waterways Experiment Station Funding ($250,000), 1990-1993. Development of Controlled Release Herbicides for Aquatic Use.

Principal Investigator, American Petroleum Institute Funding, ($250,000), 1990 -1992. Reference Toxicants and Reference Sediments for Sediment Toxicity Testing.

Principal Investigator, Research Contract, Tennessee Valley Authority Funding ($168,000), 1991-1992. Aquatic Herbicides in Guntersville Reservoir, Alabama - National Demonstration Project.

Co-principal Investigator, Research Contract, U.S. Department of the Army, Vicksburg District, Corps of Engineers Funding ($96,036), 1991-1992. Monitoring Water Quality at Arkabutla, Enid, Grenada, and Sardis Lakes.

Principal Investigator, Research Contract, ABC Laboratories, Inc. and Zoecon Corporation Funding ($10,000), 1991. Outdoor Microcosm Study of an Insect Growth Regulator.

Co-principal Investigator, Research Contract, Shell Development Company Funding ($192,000), 1991-1993. Development of a Model Stream Facility and Evaluation of the Environmental Safety of a Surfactant.

Principal Investigator, Research Contract, U.S. Army Waterways Experiment Station Funding ($25,000), 1991-1992. Evaluation of New Herbicide Delivery System for Control of Aquatic Plants.

Principal Investigator, Research Contract, U.S. Army Waterways Experiment Station Funding ($64,000), 1992-1993. Evaluation of New Herbicide Delivery Systems for Control of Aquatic Plants.

Principal Investigator, Research Contract, American Petroleum Institute Funding ($100,000), 1992-1993. New Sediment Bioassays and Reference Sediments.

Principal Investigator, Mississippi State Department of Wildlife, Fisheries, and Parks Funding ($6,000), 1991-1993. Cooperative Agreement for Assistance with Walleye Culture.

Co-Principal Investigator, Research Contract, U.S. Army Corps of Engineers Funding ($100,848), 1992-1993. Monitoring of Water Quality at Arkabutla, Sardis, Enid, and Grenada Lakes.

Principal Investigator, Mississippi State Department of Wildlife, Fisheries and Parks Funding ($3,000), 1992-1993. Cooperative Agreement for Assistance with Walleye Culture.

Principal Investigator, Research Contract, U.S. Army Waterways Experiment Station Funding ($30,000), 1992-1994. Mobility and Bioavailability of Sediment Associated Contaminants.

Principal Investigator, Research Contract, U.S. Army Waterways Experiment Station Funding ($25,000), 1992-1993. Effects of Food Quantity on Fathead Minnow Survival, Growth and Reproduction.

Principal Investigator, Research Contract, Eastman Kodak and the Silver Coalition Funding ($53,183), 1992-1994. Evaluations of the Bioavailability and Toxicity of Silver in Sediments.

Principal Investigator, Research Contract, Shell Development Company Funding ($150,000), 1992-1993. Ecological Evaluation of a Non-ionic Surfactant in Model Stream Mesocosms.

Principal Investigator, Research Contract, Shell Development Company Funding ($30,342), 1993-1994. Assistance with Development and Construction of Constructed Wetlands for Tertiary Treatment of Refinery Effluent.

Principal Investigator, U.S. Department of Agriculture/ Cooperative State Research Service Funding ($1,377,400), 1994-1995. Center for Water and Wetland Resources (Year 4).

Co-Principal Investigator, Research Contract, International Paper Company Funding ($99,631), 1994-1995. Extensive Ecological and Toxicological Evaluation of the Arkansas River at Pine Bluff, AR.

Co-Principal Investigator, Research Contract, International Paper Company Funding ($99,631), 1994-1995. Extensive Ecological and Toxicological Evaluation of the Yazoo River near Vicksburg, MS.

Principal Investigator, Research Contract, Shell Development Company Funding ($150,000), 1994-1995. Ecological Evaluation of a Homologus Non-ionic Surfactant in Model Stream Mesocosms.

Principal Investigator, Research Contract, Shell Development Company Funding ($144,242), 1994-1996. Evaluation of Constructed Wetlands for Tertiary Treatment of Refinery Effluent.

Principal Investigator, Research Contract, Texaco, Inc. Funding ($20,000), 1995-1996. Evaluation of a Constructed Wetland for Removal of Ammonia from a Refinery Effluent.

Principal Investigator, Research Contract, Texaco, Inc. Funding ($20,000), 1995-1996. Evaluation of a Constructed Wetland for Removal of Trace Metals from a Refinery Effluent.

Clemson University (1998-present):

Principal Investigator, Assistance with Design and Construction of a Wetland for Wastewater Treatment Sponsored by Shell Oil Products from 4/1/98 to 4/1/00 ($10,000).

Principal Investigator, Evaluation of the Tombigbee River. Sponsored by Weyerhauser, Inc. 1/98 – 1/02 ($22,000).

Principal Investigator, Constructed Wetland for Wastewater Treatment at IP's Mansfield, LA Facility, Sponsored by International Paper Company 8/98 – 12/00 ($18,250).

Principal Investigator, Investigations of Pesticide Toxicity, Sponsored by Applied Biochemists, Inc. 1/00 – 1/01 ($10,000).

Principal Investigator, Wetlands for Wastewater Treatment at Savannah River Site Sponsored by DOE thru SCUREF (SC Universities Research and Education Foundation) from 1/14/99 to 2/28/00 ($28,088).

Principal Investigator, A-01 Outfall Constructed Wetlands Sponsored by DOE thru Westinghouse Savannah River thru SCUREF from 7/11/99 to 9/30/00 ($624,730).

Principal Investigator, Design and Construction of a Wetland for Effluent Treatment. Sponsored by International Paper Company 6/00 – 7/01 ($25,000).

Principal Investigator, Evaluation of Foam Products. Flexible Products, Inc Funding from 9/99 – 1/01 ($15,000).

Principal Investigator, US Department of Interior Funding ($43,106), 2002-2004. Renovating Water for Conservation and Reuse.

Co-Principal investigator, US Department of Agriculture Funding ($539,677), 2002-2004. Adhesion-Specific Nanoparticles for Removal of *Campylobacter jejuni* from Poultry.

Principal Investigator, Duke Energy Corporation Funding ($54,473). 2001. Evaluation of the Oconee Nuclear Station Conventional Waste Treatment System.

Principal Investigator, Chevron Texaco Inc. Funding ($24,000), 2001-present. Evaluation of Best Management Practices for Stormwater and Other Contaminated Waste Streams.

Principal Investigator, US Department of Energy Funding ($26,024). 2001-2003. A01 Constructed Wetland Treatment Facility Redox Probe Maintenance and Consultation for the Savannah River Site (from WSRC through SCUREF).

Principal Investigator, U.S. Department of Interior Funding ($43,106). 2002-2003. Renovating Water for Conservation and Reuse.

Principal Investigator, Sustainable Universities Initiative ($7,000). 2002-2003. A Constructed Wetland Treatment System: A Green and Sustainable Solution to Prevent Water Pollution on Campus.

Principal Investigator, Duke Energy Corporation in Cooperation with Progress Energy Funding ($187,000). 2003-2004. Treatment of Mercury, Selenium and Other Targeted Constituents in FGD Wastewater: A Constructed Wetland Pilot Study.

Principal Investigator, Chevron Corporation Funding ($33,600). 2003-2004. Panama Storm Water Treatment Wetland.

Principal Investigator, Griffin Corporation Funding ($20,000). 2002-2003. Response of Aluminum from Boat Pontoons to Komeen Exposures in Lake Murray, SC Water (with Sediments and *Hydrilla*.

Principal Investigator, Alabama Power Company Funding ($75,000). 2004-2006. Development of Strategies for Controlling Nuisiance Growths of *Lyngbya* in Alabama Power Company Reservoirs.

Principal Investigator, Department of Energy Funding ($125,000) 2004-2005. Designing constructed wetlands to treat gas storage produced waters.

Principal Investigator, Duke Energy Corporation in Cooperation with Progress Energy Funding ($105,000). 2004-2005. Continuing Studies of Treatment of Mercury, Selenium and Other Targeted Constituents in FGD Wastewater Using a Constructed Wetland Treatment System.

Principal Investigator, U.S. Department of Energy Funding ($300,000) 2005-2008. Innovative Techniques for Remediation of Nontraditional Waters for Reuse in Coal-Fired Power Plants.

Principal Investigator, Duke Energy Corporation and ENTRIX Funding ($100,000) 2006-2007. Further Evaluations of Constructed Wetland Treatment Systems for Flue Gas Desulfurization Waters.

Co-Principal Investigator, Chevron-Texaco Funding ($50,000) 2006-2007. Evaluation of Boron Biogeochemistry in Constructed Wetlands.

Co-Principal Investigator, Monsanto Company Funding ($300,000) 2006-2008. Potential Effects of Glyphosate Formulations on Amphibians.

Principal Investigator, Florida Department of Environmental Protection Funding ($60,000) 2006-2008. Effects of Invasive Algae in Crystal River, FL and Potential Control Strategies to Protect the Florida Manatee.

Co-Principal Investigator, Chevron-Texaco Funding ($50,000) 2008. Specifically Designed Constructed Wetland Treatment Systems for Produced Water in Chad.

Principal Investigator, Duke Energy Corporation and ENTRIX Funding ($30,000) 2007-2008. Additional Evaluations of Constructed Wetland Treatment Systems for Flue Gas Desulfurization Waters.

Co-Principal Investigator, Clemson University Funding ($50,000) 2006-2008. Evaluation of Constructed Wetland Treatment Systems for Parking Lot Stormwater (with Dr. Rockie English).

Principal Investigator, Applied Biochemists, Inc. Funding ($36,000) 2008-2009. Approaches for Mitigation of Risks from Harmful Algal Blooms.

Co-Principal Investigator, Chevron-Texaco Funding ($50,000) 2008. Specifically Designed Constructed Wetland Treatment Systems for Specific Produced Water (San Ardo, CA).

Co-Principal Investigator, U.S. Department of Energy Funding ($800,000) 2009. Evaluation of Constructed Wetland Treatment Systems for Produced Waters. Innovative Water Management Technology to Reduce Environmental Impacts of Produced Water (DE-NT0005682). Clemson University

Co-Principal Investigator, Chevron-Texaco Funding ($50,000) 2009. Specifically Designed Constructed Wetland Treatment Systems for Produced Water in Chad.

Co-Principal Investigator, U.S. Department of Energy Funding ($800,000) 2010. Carbon Capture and Sequestration Education (in partnership with the Southern States Energy Board). Clemson University

Co-Principal Investigator, Diamond-V Funding ($115,237) 2010. Enhancing Selenium Treatment in Waters. Clemson University

Co-Principal Investigator, U.S. Department of Energy Funding ($100,000) 2012. Evaluation of Constructed Wetland Treatment Systems for Produced Waters. Innovative Water Management Technology to Reduce Environmental Impacts of Produced Water (DE-NT0005682). Clemson University

Co-Principal Investigator, Shell Canada and Suncor Funding ($680,238) 2013-2017. Treatment of Oil Sands Process Water Through Wetlands for Risk Mitigation. Clemson University

Principal Investigator, Anderson Regional Joint Water System Funding ($135,704) 2014-2016. Assistance with Taste and Odor Issues in Source Water. Clemson University

Principal Investigator, LONZA Corporation Funding ($105,000) 2013-2016. Control of Noxious and Invasive Algae in Water Resources. Clemson University

Principal Investigator, Aquatic Plant Management Society Funding ($60,000) 2017-2019. Managing invasive *Nitellopsis obtusa*. Clemson University.

HONORS AND AWARDS:

Phi Sigma Doctoral Research Award, April, 1977.

Sigma Xi Doctoral Research Award, May, 1978.

Who's Who in the South and Southwest, 1979.

Personalities of the South, 1981.

International Who's Who, 1981.

Directory of Distinguished Americans, 1981.

Men of Achievement (International Biographical Center), 1981.

Phi Kappa Phi Honor Society, 1982.

Gordon Research Conference Travel Award, 1982.

NTSU President's Award to the Institute of Applied Sciences, 1985.

Mortar Board NTSU "Top Prof" Teaching Award, 1985.

Elected to NTSU Graduate Faculty, 1987.

Co-author - Best Student Paper (Burton Suedel and Phil Clifford), published in 1992 in *Environmental Toxicology and Chemistry*.

Certificate of Appreciation, 1993 Mississippi Region 7 Science and Engineering Fair. 1993.

Designated "Distinguished Southerner" by Editors Of *Southern Living*. Article on Water Watchdogs In April, 1994 edition of *Southern Living*.

Co-author - Best Student Paper (Arthur Dunn), Mid-South Aquatic Plant Management Society. Birmingham, AL. 1994.

Certificate of Appreciation, Environmental Biology Review Panel, U.S. EPA, January, 1995.

President, Oxford Exchange Club – Prevention of Child Abuse, 1996-1998.

Board of Directors, Society of Environmental Toxicology and Chemistry, 1989-1991; 1995-2001. Executive Committee 1997-2000. Vice President 1998-1999. President 1999-2000.

Member, Expert Advisory Committee, Canadian Network of Toxicology Centres. Environment Canada and Health and Welfare, 1992-2000.

Chair, Expert Advisory Committee, Canadian Network of Toxicology Centres, Environment Canada and Health and Welfare, 1996-1999.

Vice President's Award, Savannah River Technology Center. A-01 Outfall Wetland Treatment Confirmation Study, 2000.

Who's Who Among America's Teachers, 7th ed. 2002. p. 400.

Certificate of Appreciation for Outstanding Service to the Society of Environmental Toxicology and Chemistry, 2003.

Member, Canadian Foundation for Innovation, Science Review Panel, 2008 - 2009.

Chair, Canadian Foundation for Innovation, Science Review Panel, 2009.

Member of the Year, South Carolina Aquatic Plant Management Society, 2009.

Nominated for Governor's Research Award, 2010.

President's (USA) 'Closing the Circle' Environmental Award (with Savannah River Site) for Wetland Research and Application, 2010.

Clemson University Board of Trustees Award for Faculty Excellence, 2010.

Nominated for the 2011 Alumni Award for Outstanding Achievement in Research at Clemson University, 2011.

Aquatic Plant Management Society, T. Wayne Miller, Jr. Distinguished Service Award for Strategic Planning, Salt Lake City, Utah, July 24, 2012.

Co-Author (A.J. Calomeni), Best Technical Poster Award. Mid-West Aquatic Plant Management Society, Cleveland, OH. 2013.

Co-Author (A.J. Calomeni), Best Technical Poster Award. Aquatic Plant Management Society, San Antonio, TX. 2013.

Council for Agricultural Science and Technology, Certificate of Excellence – Educational Materials Award for Benefits of Controlling Nuisance Aquatic Plants and Algae in the United States, 2014.

Aquatic Plant Science Award. Northeast Aquatic Plant Management Society, Saratoga Springs, NY, January, 2015.

Co-Author (A.J. Calomeni) 3rd prize Student Presentation Presented at the 55th Annual Meeting of the Aquatic Plant Management Society, Myrtle Beach, SC. July 12-15, 2015.

Co-Author (T. Geer) 1st Prize Student Poster Presented at the 55th Annual Meeting of the Aquatic Plant Management Society, Myrtle Beach, SC. July 12-15, 2015.

APMS Technical Contributor Award, Presented at the 55th Annual Meeting of the Aquatic Plant Management Society, Myrtle Beach, SC. July 12-15, 2015.

Lifetime Research Achievement Award, Presented by Lonza, Inc. February, 2018

Co-author - Best Paper Award Journal of Aquatic Plant Management July 2019 With Dr. Alyssa Calomeni.

RESEARCH AND TEACHING INTERESTS:

Teaching Interests:
I have taught General Botany, General Biology Environmental Biology, Assessment of Water Quality, Water Quality Management, Environmental Analysis, Aquatic Toxicology, Limnology, Microbial Ecology, Radioisotopes, and Research Techniques, Aquatic Botany, Aquatic Microbiology, Sediment Toxicology, and Analysis of Biological Data, Ecological Risk Assessment, Plant Physiology, and Water Chemistry. My teaching interests also include: Plant Ecology, Wetland Ecology, and Phycology.

Research Interests:
Effects of heated effluents and other perturbations on primary productivity of vascular and non-vascular plants in terrestrial and aquatic systems.

In situ measurements of assimilatory sulfate reduction by periphytic organisms (algae, bacteria, and fungi), sulfur content and cycling in aquatic systems.

Physical models of aquatic systems as tools for the study of acute and chronic effects of industrial and power plant effluents on structural and functional aspects of aquatic microbial communities with emphasis on photosynthesis and sulfate assimilation.

Production, decomposition and role in nutrient cycling of aquatic macrophytes.

Impact of ash from industrial and power production processes on receiving systems and indigenous biota.

Decomposition and role of autochthonous and allochthonous detritus in aquatic and terrestrial systems with emphasis on the influences of macro-invertebrates, bacteria and fungi.

Invasion rates, population dynamics and elemental accumulation of the Asiatic Clam (*Corbicula fluminea*).

Extracellular products and other organic compounds as regulating factors of structural and functional aspects of aquatic microbial communities.

Benthic metabolism and physical and biological sediment characterization (using SCUBA--implemented techniques) as an index of eutrophication rates.

Electron transport system activity of benthic microflora as a pollution monitoring tool.

Serum enzymes of fish as an indicator of the quality and quantity of mixed effluents and their effects on receiving systems.

Ecosystem responses to stress in aquatic systems; Ecological risk assessment.

Relationships between carbon quantity and quality in ecosystems.

Responses of microbes (algae, bacteria, and fungi) to magnetic fields.

Ecological impacts associated with pulp and paper mills.

Biology and ecology of *Taxodium distichum* (Bald cypress) swamps in the Southwest.

Development of models for integrated control of nuisance aquatic vegetation and aquatic ecosystem management.

Microcosms and mesocosms as tools for ecological and environmental research.

Reservoir limnology and eutrophication.

Secondary aquatic plant products and biocontrol of aquatic plants.

Bioavailability of xenobiotic chemicals (e.g. pesticides) to aquatic organisms.

Sediments as sources and sinks for contaminants in aquatic ecosystems.

Population biology and physiological ecology of aquatic plants.

Artificial Intelligence in ecological problem solving.

Constructed wetlands for rehabilitation and wastewater treatment.

Metal speciation and bioavailability.

ORGANIZATIONS:

American Society of Limnology and Oceanography, Ecological Society of America, American Water Resources Association, North American Benthological Society, Water Pollution Control Federation, Phi Sigma Society Alpha Psi (VPI&SU) Chapter, Sigma Xi (VPI&SU) Chapter, American Institute of Biological Sciences, American Association for Advancement of Science, Phi Kappa Phi (NTSU) Chapter, Aquatic Plant Management Society, Society of Environmental Toxicology and Chemistry.

OTHER
PROFESSIONAL
ACTIVITIES:

Consulting Aquatic Ecologist Microbiology Department, Clemson University, 1973-1975.

Investigator on Facilities Use Agreement #15 at Savannah River Laboratory in conjunction with Clemson University and VPI & SU, 1973-1975.

Consulting Aquatic Ecologist to American Electric Power Service Corporation, Canton, Ohio, 1974 - 1975.

Investigator on Facilities Use Agreement #28 at Savannah River Laboratory in conjunction with University of Texas, School of Public Health and VPI&SU, 1975 - 1979.

Consulting Microbial Ecologist to Bioengineering Research and Development Group, Oak Ridge National Laboratory, Oak Ridge, Tennessee, 1977.

Consulting Aquatic Ecologist to Virginia State Water Control Board, Richmond, 1977.

Invited lecturer in Plant Ecology and Environmental Biology, Botany Department, Clemson University, 1977.

Consulting Aquatic Ecologist to Center for Environmental Studies VPI&SU, 1978 - 1979.

Participant in Savannah River National Environmental Research Park meeting on Aquatic Research, Aiken, S.C., 1978.

Grant Proposal Review for the Division of Environmental Biology of the National Science Foundation, 1978 - 1987.

Consulting Aquatic Ecologist to Tennessee Eastman Company, Kingsport, Tennessee, 1978 - 1979.

ETSU Research Development Committee Presidential Appointment 1978 - 1979.

Consulting Aquatic Ecologist to Victor Equipment Company, Denton, Texas, 1980 -1983.

Review of publications for American Society for Testing and Materials.

Consulting Aquatic Ecologist to Environmental Biology Group, Oak Ridge National Laboratory, Oak Ridge, Tennessee, 1980.

Gordon Research Conference Participant (Environmental Sciences - Water), 1980.

Participant in Workshop on the role of aquatic microcosms in evaluating ecosystem effects of chemicals under the Toxic Substances Control Act (USEPA sponsored), 1980.

NTSU representative to Texas Systems of Natural Laboratories. (Presidential Appointment), 1981 - 1986.

Consulting Aquatic Ecologist to Environmental Systems Branch, U.S. Environmental Protection Agency, 1981.

School of Community Service Computing Services Advisory Council (Dean's Appointment), 1981-1986.

NTSU Biosafety Committee (Presidential Appointment), 1980 - 1987.

Peer Review of Research Program for Environmental Systems Branch of the U.S. Environmental Protection Agency (with H.T. Odum), 1981.

Participant in Workshop on Modeling the Fate of Chemicals in the Aquatic Environment (USEPA sponsored), Pellston, MI, 1981.

Co-chaired session on Microcosm Testing in Aquatic Toxicology at the Society of Environmental Toxicology and Chemistry's Annual Meeting, Washington, D.C., 1981.

Elected to Editorial Board of Environmental Toxicology and Chemistry, 1981- 1983.

Research advisor to the Ecosystem Branch of the U.S. Environmental Protection Agency, Las Vegas, 1982.

Gordon Research Conference Participant (Environmental Sciences-Water), 1982.

President, Sigma Xi, NTSU Club, 1982-1983.

Chair, Employment Service Committee of the Society of Environmental Toxicology and Chemistry, 1982 - 1984.

Review of manuscripts for Ecological Society of America, 1981 - present.

College of Arts and Sciences Committee on Interdisciplinary Research (Dean's Appointment), 1983.

Department of Biological Sciences Radiation Safety Officer, 1983 - 1987.

Participant, Workshop on Bioavailability of Chemicals from Dredged Materials (U.S. Army Corps of Engineers sponsored) Vicksburg, Mississippi,1984.

Consulting Aquatic Ecologist to the City of Reno, Nevada, 1983 - Mitigation of Impacts of Population Growth and Development on Lake Tahoe, Truckee River and Pyramid Lake.

Consulting Aquatic Ecologist to the Las Colinas Development, 1983 - Impacts of Development on the Trinity River and Watershed.

School of Community Services Committee on Resources and Nontraditional Education (Dean's Appointment), l983 - l984.

Peer review of research programs of the Naragansett Bay, R.I., U.S. Environmental Protection Agency Research Laboratory (elected chairman of the review team), 1984.

North Texas State University Committee on Science and Technology (Presidential Appointment), 1984.

President, J.K. G. Silvey Society, North Texas State University, 1983 - 1984.

Invited Attendee, Society of Petroleum Industry Biologists, Annual Meeting, Houston, Texas, 1984.

Chair of the Annual Meeting of the Society of Environmental Toxicology and Chemistry, St. Louis, Missouri, Nov. 10-14, 1985.

Participant - Workshop on the Bioavailability of Sorbed Chemicals (U.S. Environmental

Protection Agency and American Petroleum Institute sponsored) Florissant, Colorado, 1984.

Faculty Committee Member, Cooperative Education Program of the Institute of Applied Sciences, 1984.

Faculty Representative for the Sciences, elected to NTSU Faculty Senate, 1986.

Served as Chairman of Placement Committee of Aquatic Plant Management Society, 1987.

Peer review of research programs of the Gulf Breeze, FL., U.S. Environmental Protection Agency Research Laboratory (with H. Bergman and K. Solomon), 1987.

Consulting aquatic ecologist to the City of Dallas (Water Utilities), Algal Workshop, 1987.

Consulting aquatic toxicologist to the American Petroleum Institute, Bioavailability of Chemicals Sorbed to Sediments, 1987.

Consulting aquatic ecologist to the Association of Central Oklahoma Governments, Use Attainability Study of Crutcho Creek and the North Canadian River, 1987.

Chair, Professional Opportunities Committee (Placement) of the Aquatic Plant Management Society, 1987.

Co-chair (with L. Goodman), Workshop on Mysid Culture and Testing, at the Eighth Annual Meeting of the Society of Environmental Toxicology and Chemistry, Pensacola, FL, 1987.

Co-chair, sessions on Perspectives of Water Quality-Based Permitting and Field Validation of Laboratory Results, at the Eighth Annual Meeting of the Society of Environmental Toxicology and Chemistry, Pensacola, FL, 1987.

Appointed to the South Carolina Aquatic Plant Management Commission, 1987.

Presented short courses on Aquatic Plant Management in Texas, 1987.

Presented seminars at short courses on Aquatic Plant Management in Florida, Ft. Lauderdale and Orlando, FL, l987.

Advisor on American Petroleum Institute Study of Bioavailability of Sediment Bound Chemicals (with P. Chapman and C. Missimer), 1987 - 1988.

Participated in a Workshop on Mesocosm Research Sponsored by USEPA, Duluth, MN, 1987.

Promotion review team member for P.R. Parrish, Environmental Research Laboratory, Gulf Breeze, FL, 1987.

Chair, session on Sediment Criteria Development and Testing at the South Central Chapter Meeting of the Society of Environmental Toxicology and Chemistry, Houston, TX, 1987.

Scientific Advisory Group, Proctor and Gamble Corporation, Cincinnati, Ohio, 1988,

Scientific Advisory Group, Botanical Research Institute of Texas (BRIT). Fort Worth, TX, 1988.

Adjunct Faculty, University of Guelph. Guelph, Ontario, Canada, 1988-1990.

Invited participant, North American Benthological Society Annual Meeting. Blacksburg, VA, May 22, 1990.

Invited participant, Association of Southeastern Biologists Special Workshop on Teaching the Limnology Laboratory. Baltimore, MD, April 20, 1990.

Invited participant, Aquatic Plant Management Meeting. Mobile, AL, July 16, 1990.

Chair, Education Committee of the Society of Environmental Toxicology and Chemistry, 1989-1991.

Chair, Professional Opportunities Committee of the Aquatic Plant Management Society, 1989-1991.

Chair, Discussion session on Wetlands Toxicology at the Society of Environmental Toxicology and Chemistry Annual Meeting. Washington, D.C., November 12, 1990.

Member, Aquatic Effects Dialogue Group of the Conservation Foundation, 1989-1991.

Member, Advisory Group to the World Wildlife Fund,1989-1991.

Consulting Aquatic Ecologist and Toxicologist to Proctor and Gamble Company. Cincinnati, OH, 1989-1991.

Served on a discussion panel on the Future of Aquatic Plant Management with emphasis on regulatory issues regarding herbicides at the 25th Annual Meeting of the Aquatic Plant Control Research Program - U.S. Army Corps of Engineers. Orlando, FL, November 26-30, 1990.

Served on a discussion panel on the Future of Aquatic Plant Management with Emphasis on Simulation Technology and Modeling at the 25th Annual Meeting of the Aquatic Plant Control Research Program - U.S. Army Corps of Engineers. Orlando, FL. November 26-30, 1990.

Consulting Aquatic Toxicologist, U.S. Environmental Protection Agency, Ecorisk Program evaluation. 1990-1991.

Consulting Aquatic Toxicologist, International Paper Company. 1990-1991.

Consulting Aquatic Toxicologist, State of Mississippi. 1990-1991.

Consulting Aquatic Toxicologist, Environment Canada, Health and Welfare Canada - Canadian Network of Toxicology Centers, Expert Advisory Committee. 1991- 2001.

Consulting Aquatic Toxicologist, Ecorisk Forum on the Rocky Mountain Arsenal Refuge Technical Expert Advisory Panel. 1991-1992.

Consulting Biologist and Ecotoxicologist, Arkansas Department of Higher Education and Arkansas State University Ph.D. Program Development. 1991- 1998.

Invited participant, Tiered Testing Issues for Freshwater and Marine Sediments, sponsored by U.S. EPA Office of Water and Office of Research and Development. Washington, D.C., September 16-18, 1992.

Invited speaker, Workshop on the Bioavailability and Toxicity of Copper, sponsored by the University of Florida, Center for Aquatic Plants. Gainesville, FL, September 2-3, 1992.

Peer reviewer for U.S. EPA, Framework for Ecological Assessment, Risk Assessment Forum. Washington, D.C., 1992 (EPA/130/R-92/001 - February 1992).

Invited speaker, 4th Annual Meeting of the Soil and Water Conservation Society. Baltimore, MD, August 9-12, 1992.

Participant, U.S. EPA Workshop on Bioaccumulation of Hydrophobic Chemicals. Washington, D.C., June,1992.

Invited lecturer and participant, Young Scholars Program, NSF funded. Oxford, MS, 1992.

Counselor for summer interns with the Minorities Science Program, University of Mississippi funded. Oxford, MS, 1992.

Peer Review, Biology Peer Review Panel, U.S. EPA. Knoxville, TN, January, 1993.

Conference Co-organizer, First International Conference on Transport, Fate, and Effects of Silver in the Environment. University of Wisconsin, Madison, WI, August 8-10, 1993.

Chair, Exhibits Committee, 14th Annual Meeting of the Society of Environmental Toxicology and Chemistry. Houston, TX, November, 1993.

Consulting Aquatic Ecologist and Toxicologist to Weyerhaeuser Corporation. Columbus, MS, 1994 – 1999.

Member, Student Scholarship Committee, Mid-South Aquatic Plant Mangement Society. 1994 – 1997.

OSHA Safety Course. Norco, LA, 1994. Joint Agency Task Force Member, Guntersville Project. Guntersville, AL, April, 1994.

Featured speaker, Seminar on Pollution Prevention for Silver Imaging Systems. Lake Buena Vista, FL. May, 1994.

Conference Organizer, Second International Conference on Transport, Fate and Effects of Silver in the Environment. University of Wisconsin, Madison, WI, September 11-14, 1994.

Chair - Subcommittee, National Institute of Environmental Health Sciences (NIEHS) - Superfund Hazardous Substances Basic Research Program. Research Triangle Park, NC, October 16-19, 1994.

Discussion Panel Participant, 2nd International Conference on Environmental Fate and Effects Of Bleached Pulp Mill Effluents. Vancouver, B.C., Canada, November, 1994.

Genetic Toxicology Course (Audit). Oxford, MS, 1995.

Board of Directors, Society of Environmental Toxicology and Chemistry (elected), 1995.

Participant, U.S. EPA Environmental Biology Review Panel. Fort Worth, TX, January, 1995.

Participant, Society of Environmental Toxicology and Chemistry Workshop on Wetlands. Butte, MT, August, 1995.

Conference Organizer, Third International Conference on Transport, Fate and Effects of Silver in the Environment. Washington, D.C., August, 1995.

Featured Speaker, 1995 Scholars Conference, University of Mississippi. Oxford, MS, October, 1995.

Participant, Society of Environmental Toxicology and Chemistry Workshop on Whole-Effluent Toxicology. Pellston, MI, October, 1995.

Invited Participant, Round Table Discussion of Surfactant Toxicity in Aquatic Systems. Thornton, England, May, 1996.

Keynote Speaker, Mid-South Society of Environmental Toxicology and Chemistry (inaugural meeting). Memphis, TN, May, 1996.

Invited Speaker on Endocrine Disruption, Seminar on Emerging Water Issues, International Paper Company. Memphis, TN, June, 1996.

Instructor, Short Course on Constructed Wetlands, U.S. Army Waterways Experiment Station. Berkeley, CA. July, 1996.

Short Course on Constructed Wetland Design and Monitoring. Houston, TX, July, 1996.

Conference Organizer, Fourth International Conference on Transport, Fate and Effects of Silver in the Environment. Madison, WI, August, 1996.

Friends of Lake Keowee (FOLKS), Board of Directors (elected) and Member of the Technical Committee, 2003-present.

Bob C. Campbell Geology Museum, Clemson University, Board of Directors Member, 2003-present.

Associate Editor, Journal of Toxicology and Environmental Health Part B : Critical Reviews. 1999-2006.

Chair, Science Advisory Panel for the California Environmental Protection Agency – Aquatic Pesticides Committee, 2002-2004.

Member, Science Advisory Panel, USDA Jimmy Carter Plant Materials Center, Americus, GA. 2003-present.

Member, Science Advisory Panel for the USEPA/ SETAC Whole Effluent Toxicity Testing Committee, 1998-2004.

Member, Science Advisory Panel for Proposal and Research Review, Water Environment Federation, 2001-present.

Member, Science Advisory Panel for the National Council for Air and Stream Improvement – Long Term Receiving Water Studies, 1999-present.

Member, Board of Directors – Aquatic Plant Management Society, (elected) 2003-2006.

Co-editor (with Dr. J.W. Castle), Special Issue of Environmental Geoscience on Constructed Wetland Treatment Systems, 2009.

Review of WET testing protocols, US EPA, 2009.

Member, Board of Directors – South Carolina Aquatic Plant Management Society, (elected) 2007-2009.

Vice-President and Annual Meeting Program Chair – South Carolina Aquatic Plant Management Society, (elected) 2008-2009.

Chair, ad hoc Committee on NPDES Permitting, South Carolina Aquatic Plant Management Society, 2008-2009.

Chair, Peer Review Panel, Canadian Foundation for Innovation, 2009.

Chair, Strategic Planning Committee, Aquatic Plant Management Society, 2008-2012.

Leader, Constructed Wetland Treatment Systems: A Short Course; presented at Synterra, Inc., Greenville, SC, June 14-18, 2010.

Chair, Peer Review Panel, Canadian Foundation for Innovation, 2010.

Peer Review Panel, Canadian Research Chairs, 2010.

Appointed Canada Review of University Environmental Programs, 2011.

Chair, Session on Components to reconstruct a successful wetland ecosystem at Key Factors to SuccessfullyReconstruct Boreal Wetland Ecosystems – An International Workshop. Chantilly, France. April 16-17, 2012.

Consulting Environmental Toxicologist, US Environmental Protection Agency, Science Advisory Panel, Problem Formulation and Risk Assessment, Washington,DC, June 11-14, 2012.

Invited speaker, California Weed Conference, University of California, Davis. September 22-24, 2014. Also presented seminar to Weed Science Department on Algal Management.

Invited Seminar, Western Carolina University, Constructed Wetland Treatment Systems – Putting Biogeochemistry to Work. September, 2014.

Invited Seminar, Presentations on Adaptive Water Resource Management and Noxious Algal Management, Michigan DEQ, September 29, 2014

Chair, Session on Microbial Control Challenges in Industrial Water, Recent Advances in Microbial Control, Society of Industrial Microbiology, San Francisco, CA (November 9-12, 2014).

Expert Panel, Nico Mines Constructed Wetlands Treatment System. Feb. 2015.

Chair, Tenure and Promotion Committee, Department of Forestry and Environmental Conservation, 2015 - .

Science Advisory Panel, Aquatic Ecosystem Restoration Foundation, 2010-present.

Science Advisory Panel, National Council for Air and Stream Improvement, 1999- present.

Vice-president, Aquatic Plant Management Society, elected 2015.

President, Aquatic Plant Management Society, 2017 – 2018.

Consulting Ecotoxicologist and Risk Assessor, U.S. Environmental Protection Agency Science Advisory Panel, 2019 – present.

Clemson University Representative to the South Carolina Harmful Algal Bloom Network, 2019 – present.

BOOKS, BOOK CHAPTERS, AND MONOGRAPHS

M.Sc. Thesis: Rodgers, J.H., Jr. 1974. Thermal Effects on Primary Productivity of Phytoplankton, Periphyton, and Macrophytes in Lake Keowee, S.C. Botany Department, Clemson University. 88 pp.

Bi- weekly in situ determinations of Carbon-14 assimilation rates were made using SCUBA and chambers in a reservoir receiving thermal effluent from a nuclear power plant. Emphasis was placed upon relative contributions of each group of plants to the overall lake productivity and statistical correlations of productivity with water temperatures (1972-1974).

Ph.D. Dissertation: Rodgers, J.H., Jr.1977. Aufwuchs Communities of Lotic Systems: Nontaxonomic Structure and Function. Biology Department and Center for Environmental Studies, VPI&SU. 336 pp.

Six model streams were constructed to assess effects of typical industrial and municipal effluents on primary productivity, assimilatory sulfate reduction and structural aspects of assemblages of attached microorganisms. Net microbial productivity of aufwuchs and primary productivity were estimated by assimilatory (S35) sulfate reduction and carbon-14 fixation, respectively, with heterotrophic productivity being the difference. Concurrent laboratory studies verified the efficacy of these procedures. The ability of methods to discern perturbations was tested. Direct correlations between structural measurements and functions were ascertained by regression

analysis. Field investigations of aufwuchs communities were inconclusive due to variability and the heterogeneous distribution of aufwuchs communities (1974 - 1977).

Guthrie, R.K., D.S. Cherry, and J.H. Rodgers, Jr. 1974. The Impact of Ash Basin Effluent on Biota in the Drainage System. *Proc. Seventh Mid-Atlantic Industrial Waste Conference*: pp. 17-43. Drexel University, Philadelphia, Pa.

Dickson, K.L., J. Cairns, Jr., J.R. Clark and J.H. Rodgers, Jr. 1978. Evaluating Pollution Stress on Ecosystems. In: K.C. Flynn and W.T. Mason (eds.) *The Freshwater Potomac - Aquatic Communities and Environmental Stress*. The Interstate Commission on the Potomac River Basin, Rockville, Maryland. pp. 80 - 83.

Rodgers, J.H., Jr., D.S. Cherry, K.L. Dickson, and J. Cairns, Jr. 1979. Invasion, Population Dynamics and Elemental Accumulation of *Corbicula fluminea* in the New River at Glen Lyn, Virginia. In: *Proc. First International Corbicula Symposium* J.C. Britton (ed.). Texas Christian University Research Foundation Publishers, Fort Worth, TX, pp. 99-110.

Rodgers, J.H., Jr., K.L. Dickson, and J. Cairns, Jr. 1979. A Review and Analysis of Some Methods Used to Measure Functional Aspects of Periphyton. In: R.L. Weitzel (ed.) *Methods and Measurements of Periphyton Communities:Review*. American Society for Testing and Materials, Philadelphia, Pennsylvania (ASTM STP 690), pp. 142-167.

Rodgers, J.H., Jr., D.S. Cherry, R.L. Graney, K.L. Dickson, and J. Cairns, Jr. 1980. Comparison of Heavy Metal Interactions in Acute and Artificial Stream Bioassay Techniques for the Asiatic Clam (*Corbicula fluminea*). In: J.G. Eaton, P.R. Parish, and A.C. Hendricks (eds.) *Aquatic Toxicology*. American Society for Testing and Materials, Philadelphia, PA. (ASTM STP 707), pp. 266-280.

Cherry, D.S., J.H. Rodgers, Jr., R.L. Graney, and J. Cairns, Jr. 1980. *Dynamics and Control of the Asiatic Clam in the New River,Virginia*. Bulletin 123, Virginia Water Resources Research Center. Virginia Polytechnic Institute and State University, Blackburg, VA. 72 pp.

Dillon, C.R. and J.H. Rodgers, Jr. 1980. *Thermal Effects on Primary Productivity of Phytoplankton. Periphyton. and Macrophytes in Lake Keowee. S.C.* Technical Report No. 81, Clemson University Water Resources Research Institute, Clemson, S.C. 115 pp.

Rodgers, J.H., Jr., J.R. Clark, K.L. Dickson, and J. Cairns, Jr. 1980. Nontaxonomic analyses of structure and function of aufwuchs communities in lotic microcosms. In: J.P. Geisy, Jr. (ed.). *Microcosms in Ecological Research*. USDOE (CONF-781101) pp. 625-643.

Lee, C.M., H. Bergman, W. Wood, and J.H. Rodgers, Jr. 1982. Workshop Summary and Conclusions. In: K.L. Dickson, A.W. Maki and J. Cairns, Jr. (eds.) *Modeling the Fate of Chemicals in the Aquatic Environment*, Ann Arbor: Ann Arbor Science Publ. pp. 397-407.

Cairns, J., Jr., A.L. Buikema, Jr., D.S. Cherry, E.E. Herricks, R.A. Matthews, B.R. Neiderlahner, J.H. Rodgers, Jr. and W.H. Van der Schalie. 1982. *Biological Monitoring in Water Pollution*. Pergamon Press: New York. 116 pp.

Rodgers, J.H., Jr., M.E. McKevitt, D.O. Hammerland, K.L. Dickson and J. Cairns, Jr. 1983. Primary production and decomposition of submergent and emergent aquatic plants of two Appalachian rivers. In: T.D. Fontaine III and S.M. Bartell (eds.) *Dynamics of Lotic Ecosystems*. Ann Arbor Science Publ. pp. 298-301.

Staples, C.A., K.L. Dickson, F.Y. Saleh, and J.H. Rodgers, Jr. 1983. A microcosm study of lindane and naphthalene partitioning for model validation. In: W. Bishop, R.D. Caldwell, and B.B. Heidolph (eds.) *Aquatic Toxicology and Hazard Assessment*. STP 802 ASTM Publications, Philadelphia, PA. pp. 26-41.

Rodgers, J.H., Jr. K.L. Dickson, and M.J. Defoer. 1983. Bioconcentration of lindane and naphthalene in bluegills (*Lepomis macrochirus*). In: W. Bishop, R.D. Cardwell, and B.B. Heidolph (eds.) *Aquatic Toxicology and Hazard Assessment*. STP 802. ASTM Publications, Philadelphia, PA. pp. 300-311.

Saleh, F.Y., K.L. Dickson, and J.H. Rodgers, Jr. 1984. Transport Processes of Naphthalene in the Aquatic Environment. In: L. Pawlowski, A.J. Verdier, and W.J. Lacy (eds.) *Chemistry for Environmental Protection*. Elsevier Publisher. pp. 119-131.

Vance, B.D. and J.H. Rodgers, Jr. 1984. *General Botany*, 2nd Ed. Hunter Textbooks, Inc., Winston - Salem, NC. 93 pp.

Staples, C.A., K.L. Dickson, J.H. Rodgers, Jr., and F.Y. Saleh. 1985. A Model for Predicting the Influence of Suspended Sediments on Bioavailability of Neutral Organics in the Water Compartment. In: R.D. Cardwell, R.C. Bahner and R.E. Purdy (eds.) *Aquatic Toxicology and Hazard Assessment*. ASTM STP 845, ASTM Philadelphia, PA. pp. 417-428.

Dickson, K.L. and J.H. Rodgers, Jr. 1985. Assessing the Hazards of Effluents in the Aquatic Environment. In: H. Bergman, A. Maki and R. Kimerle (eds.) *Assessing the Hazards of Effluents to Aquatic Life*. Pergamon Press.

Rodgers, J.H., Jr., K.L. Dickson, F.Y. Saleh, and C.A. Staples. 1987. Bioavailability of Sediment-bound Chemicals to Aquatic Organisms; Some Theory, Evidence and Research Needs. In: K.L. Dickson, A.W. Maki and W.A. Brungs (eds.) *Fate and Effects of Sediment-Bound Chemicals in Aquatic Systems*. Pergamon: Elmsford, N.Y. pp. 245-266.

Anderson, J., W. Birge, J. Gentile, J. Lake, J.H. Rodgers, Jr. and R. Swartz. 1987. Biological Effects, Bioaccumulation, and Ecotoxicology of Sediment-associated Chemicals. In: K.L. Dickson, A.W. Maki, and W.A. Brungs (eds.) *Fate and Effects of Sediment-Bound Chemicals in Aquatic Systems*. Pergamon: Elmsford, N.Y. pp. 267-296.

Rodgers, J.H. Jr., P.A. Clifford and R.M. Stewart. 1991. Enhancement of HERBICIDE, the Aquatic Herbicide Fate and Effects Model. In: *Proceedings, 25th Annual Meeting, Aquatic Plant Control Research Program.* Misc. Paper A-91-3. pp. 279-282. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Rodgers, J.H. Jr. 1991. Herbicide Registration for Aquatic Use: A Look to the Future. In: *Proceedings, 25th Annual Meeting, Aquatic Plant Control Research Program.* Misc. Paper A-91-3. pp. 245-248. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Graney, R.L., J.H. Kennedy and J.H. Rodgers, Jr. (eds.). 1993. *Aquatic Mesocosm Studies in Ecological Risk Assessment.* Lewis Publishers, Baca Raton, FL. 723 pp.

Rodgers, J.H., Jr., A.W. Dunn and A.B. Jones. 1993. Triclopyr Concentrations in Eurasian Watermilfoil: Uptake Under Differing Exposure Scenarios. In: *Proceedings, 28th Annual Meeting, Aquatic Plant Control Research Program.* Misc. Paper A-94-2. pp. 249-259. U.S. Army Waterways Experiment Station, Baltimore, MD. November 15-18, 1993.

Rodgers, J.H., Jr. and A.W. Dunn. 1994. TVA - Guntersville Reservoir Herbicide Monitoring Survey 1991-1992. A Report to the Tennessee Valley Authority and U.S. Army Corps of Engineers Joint Agency Program. 116 p.

Solomon, K., D. Bright, P. Hodson, K.-J. Lehtinen, B. McKague and J. Rodgers, Jr. 1999. Evaluation of ecological risks associated with the use of chlorine dioxide for the bleaching of pulp. Report prepared for the Alliance for Environmental Technology. 86 pp.

Rodgers, J.H., Jr. and J.F. Thomas. 2004. Evaluations of the Fate and Effects of Pulp and Paper Mill Effluents from a Watershed Multistressor Perspective: Progress to Date and Future Opportunities. In: Pulp and Paper Mill Effluent Environmental Fate and Effects. D. L. Borton, T. J. Hall, R.P. Fisher, and J.F. Thomas (eds.). DEStech Publications, Lancaster, PA. pp.135-146.

Rodgers, J.H., Jr. and M.L. Pietruzewski. 2020. Ecology and Management of Algae and Harmful Algal Blooms. In: Biology and Control of Aquatic Plants – A Best Management Practices Handbook. L.A. Gettys, W.T. Haller and D.G. Petty, Eds. Aquatic Ecosystem Restoration Foundation, 3272 Sherman Ridge Rd. Marietta, GA 30064.

PAPERS AND PUBLICATIONS:

Rodgers, J.H., Jr., G.L. Powell, and J.F. Geldard. 1973. Triple-label Liquid Scintillation Radioassay: Possible or Impossible? Seventh Annual Regional Meeting (Oct . 5) Wilmington, N.C. 43 pp.

Rodgers, J.H., Jr. and R.S. Harvey. 1976. The Effect of Current on Periphyton Productivity

Determined Using Carbon-14. Water Res. Bull. 12(6): 1109-1118.

Cherry, D.S., R.K. Guthrie, J.H. Rodgers, Jr., K.L. Dickson, and J. Cairns, Jr. 1976. Responses of Mosquito Fish (*Gambusia affinis*) to Ash Effluent and Thermal Stress. Trans. Am. Fish Soc. 105(6):686-694.

Rodgers, J.H., Jr., D.S. Cherry, J.R. Clark, K.L. Dickson, and J. Cairns, Jr. 1977. The Invasion of Asiatic Clam, *Corbicula manilensis* (Philippi), in the New River, Virginia. The Nautilus 91(2):43-46.

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L.J. Moore, L. Fuentes, J. Rodgers, Jr., W. Bowerman, G. Yarrow, W. Chao and K. Leith. 2008. Comparative toxicity of the original formulation of Roundup® herbicide to three anuran species in laboratory tests. Presented at the 29th Annual Meeting of the Society of Environmental Toxicology and Chemistry. Nov. 16-20, 2008. Tampa, FL.

L. Fuentes, L.J. Moore, J. Rodgers, Jr., , W. Bowerman, G. Yarrow, W. Chao and K. Leith. 2008. Role of sediments in modifying the toxicity of Roundup WeatherMax® to anuran species: A laboratory study. Presented at the 29th Annual Meeting of the Society of Environmental Toxicology and Chemistry. Nov. 16-20, 2008. Tampa, FL.

V. Molina, B.M. Johnson, W.M. Bishop, J. Rodgers, Jr. and A.R. Johnson. 2008. Evaluation of methods for cell disruption and microcystin measurement in *Microcystin aeruginosa*. Presented at the 29th Annual Meeting of the Society of Environmental Toxicology and Chemistry. Nov. 16-20, 2008. Tampa, FL.

M. Osborne-Koch, D. Eggert, and J. Rodgers, Jr. 2008. Comparative responses (survival and reproduction) of *Ceriodaphnia dubia* to aqueous exposures of sodium selenate and sodium selenite. Presented at the 29th Annual Meeting of the Society of Environmental Toxicology and Chemistry. Nov. 16-20, 2008. Tampa, FL.

D. A. Eggert, G. M. Huddleston, J. Heatley and J. Rodgers, Jr. 2008. Responses of mature *Schoenoplectus californicus* and *Typha latifolia* to boron exposures in flue gas desulfurization (FGD) waters in the laboratory and the field. Presented at the 29th Annual Meeting of the Society of Environmental Toxicology and Chemistry. Nov. 16-20, 2008. Tampa, FL.

B.M. Johnson, W.M. Bishop and J. Rodgers, Jr. 2008. Management of *Lyngbya wollei*, an invasive cyanobacterium, in Kings Bay, Crystal River, FL: Restoration of ecosystem services. Presented at the 29th Annual Meeting of the Society of Environmental Toxicology and Chemistry. Nov. 16-20, 2008. Tampa, FL.

A.D. McQueen, J.H. Rodgers, Jr., and W.R. English. Mitigating risks of campus parking lot stormwater: Use of constructed wetland treatment systems. Presented at the 29th Annual Meeting of the Society of Environmental Toxicology and Chemistry. Nov. 16-20, 2008. Tampa, FL.

J. Horner, P. Pham, J.W. Castle, J.H. Rodgers, Jr., C. Murray-Gulde and J.E. Myers. 2008. Performance of a pilot-scale constructed wetland treatment system for beneficial reuse of oil field produced water. Presented at the 29th Annual Meeting of the Society of Environmental Toxicology and Chemistry. Nov. 16-20, 2008. Tampa, FL.

Bishop, W.M., B.M. Johnson and J.H. Rodgers, Jr. 2009. Targeted management of problematic algae. Presented at the 10th Annual Meeting of the Northeast Aquatic Plant Management Society. Jan. 19-21, 2009. Saratoga Springs, NY.

J.H. Rodgers, Jr., B.M. Johnson and W.M. Bishop. 2009. Do algae spill their guts when treated with algaecides?: A look at the data and implications for decision making. Presented at the 10th Annual Meeting of the Northeast Aquatic Plant Management Society. Jan. 19-21, 2009. Saratoga Springs, NY.

B.M. Johnson and J.H. Rodgers, Jr. 2009. A risk and management assessment for *Lyngbya wollei* in Kings Bay/Crystal River, Florida. Presented at the 10th Annual Meeting of the Northeast Aquatic Plant Management Society. Jan. 19-21, 2009. Saratoga Springs, NY.

J.H. Rodgers, Jr., B.M. Johnson and W.M. Bishop. 2009. Do algae spill their guts when treated with algaecides?: A look at the data and implications for decision making. Presented at the 29th Annual Meeting of the Midwest Aquatic Plant Management Society. March 1-4, 2009. Lisle, IL.

Bishop, W.M., B.M. Johnson and J.H. Rodgers, Jr. 2009. Targeted management of problematic algae. Presented at the 29th Annual Meeting of the Midwest Aquatic Plant Management Society. March 1-4, 2009. Lisle, IL.

B.M. Johnson and J.H. Rodgers, Jr. 2009. A risk and management assessment for *Lyngbya wollei* in Kings Bay/Crystal River, Florida. Presented at the 29th Annual Meeting of the Midwest Aquatic Plant Management Society. March 1-4, 2009. Lisle, IL.

Rodgers, J.H., Jr., J.W. Castle, J. Horner, M. Spacil, D. Eggert, B. Alley, A. Beebe, P. Pham, Y. Song, J.E. Myers, C. Murray Gulde, M. Huddleston, and D. Mooney. 2009. Constructed wetland treatment systems for renovation of energy produced water for beneficial reuse. Presented at the 17th Annual David S. Snipes/Clemson Hydrogeology Symposium. April 2, 2009. Clemson, SC.

Horner, J., M.P. T. Pham, S. Chandler, J.W. Castle, J.H. Rodgers, Jr., C. Murray Gulde and J.E. Myers. 2009. Performance of a pilot-scale constructed wetland treatment system for beneficial reuse of oilfield produced water. Presented at the 17th Annual David S. Snipes/Clemson Hydrogeology Symposium. April 2, 2009. Clemson, SC.

Spacil, M. and J.H. Rodgers, Jr. 2009. Treatment of selenium in simulated refinery effluent using a pilot-scale constructed wetland treatment system. Presented at the 17th Annual David S.

Snipes/Clemson Hydrogeology Symposium. April 2, 2009. Clemson, SC.

Rodgers, J.H., W. Bishop and B. Johnson. 2009. Chelated copper: How they work and differences in formulations. Presented at the 31st Annual Meeting of the South Carolina Aquatic Plant Management Society, Inc. August 12-14, 2009. Clemson, SC.

Johnson, B., W. Bishop and J.H. Rodgers, Jr. 2009. Responses of *Microcystis* to laboratory exposures of algaecides. Presented at the 31st Annual Meeting of the South Carolina Aquatic Plant Management Society, Inc. August 12=14, 2009. Clemson, SC.

Bishop, W., B. Johnson and J.H. Rodgers, Jr. 2009. Comparison of laboratory and field responses of *Lyngbya magnifica* to similar algaecide exposures. Presented at the 31st Annual Meeting of the South Carolina Aquatic Plant Management Society, Inc. August 12-14, 2009. Clemson, SC.

Rodgers, J.H. 2009. Is an NPDES (National Pollutant Discharge Elimination System) permit in your future? Presented at the 31st Annual Meeting of the South Carolina Aquatic Plant Management Society, Inc. August 12-14, 2009. Clemson, SC.

Rodgers, J.H. and J.W. Castle. 2009. Constructed wetlands application to uranium acid mine drainage (AMD) treatment: Theory and experience. Presented at the Workshop on Constructed Wetland Treatment Systems for Impaired Waters in Saskatchewan. Saskatchewan Research Council. September 15-19, 2009. Saskatoon, Saskatchewan, CANADA.

Castle, J. W. and J.H. Rodgers, Jr. 2009. Geochemical reactions in constructed wetlands for treatment of uranium, arsenic, radionuclides and low pH AMD streams.
Presented at the Workshop on Constructed Wetland Treatment Systems for Impaired Waters in Saskatchewan. Saskatchewan Research Council. September 15-19, 2009. Saskatoon, Saskatchewan, CANADA.

Castle, J. W. and J.H. Rodgers, Jr. 2009. Role of toxin-producing algae in phanerozoic mass extinctions: Evidence from modern environments and the geologic record. (Abstract No. 163685) Presented at the Annual Meeting of the Geological Society of America. October 19, 2009. Portland. OR.

Rodgers, J.H., B. Johnson and W. Bishop. 2009. Do algae spill their guts when treated with algaecides? A look at the data and implications for decision making. Presented at the 29th International Sumposium of the North American Lake Management Society. October 27-31, 2009. Hartford, Connecticut.

Bishop, W., B. Johnson and J.H. Rodgers, Jr. 2009. Responses of Cyanobacteria to algaecides: Efficacy and microcystin measurements. Presented at the 29th International Symposium of the North American Lake Management Society. October 27-31, 2009. Hartford, Connecticut.

Johnson, B., W. Bishop and J.H. Rodgers, Jr. 2009. A risk and management assessment for a filamentous Cyanobacterium in Kings Bay/Crystal River, Florida. Presented at the 29th International Sumposium of the North American Lake Management Society. October 27-31, 2009. Hartford, Connecticut.

Rodgers, J.H., Jr. 2009. Role of Cyanobacteria in mass extinctions – review of paper by Castle and Rodgers. National Public Radio (NPR) Science Friday (Joe Palka), October 23, 2009.

Castle, J.W. and J.H. Rodgers, Jr. 2009. Role of Cyanobacteria in mass extinctions – implications for the present time and the future. New York Public Radio, Leonard Lapate Show. (New York City) October 29, 2009.

Castle, J.W. and J.H. Rodgers, Jr. 2009. Constructed wetland treatment systems for environmentally friendly drilling. Presented at the16th Annual Petroleum and Biofuels Conference. November 3-5, 2009. Houston, TX.

Rodgers, J.H., Jr., W. Bishop and B.M. Johnson. 2010. Algae on the move: Recent expansions of noxious algae. Presented at the 30th Annual Conference of the Midwest Aquatic Plant Management Society, February 28 – March 3, 2010. Indianapolis, IN.

Bishop, W., B.M. Johnson and J.H. Rodgers, Jr. 2010. Comparative responses of target and non-target species to exposures of Algimycin-PWF. Presented at the 30th Annual Conference of the Midwest Aquatic Plant Management Society, February 28 – March 3, 2010. Indianapolis, IN.

Castle, J.W., J.R. Wagner, J.H. Rodgers, Jr. and G.R. Hill. 2010. Technology training of engineers, geologists, and technicians for commercial deployment of carbon capture and sequestration: SECARB-Ed. Presented at the 18th Annual David S. Snipes / Clemson Hydrogeology Symposium. April 1, 2010. Clemson, SC.

Castle, J.W., J.H. Rodgers, Jr., B. Alley, M. Spacil, A. Beebe, M. Pardue and Y. Song, 2010. Biogeochemical processes for treating oil and gas produced waters using hybrid constructed wetland treatment systems. Presented at the American Association of Petroleum Geologists 2010 Annual Convention and Exhibition. April 11 – 14, 2010. New Orleans, LA.

Alley, B., A. Beebe, J.H. Rodgers, Jr. and J.W. Castle. 2010. A comparative characterization of produced waters from conventional and unconventional fossil fuel resources. Presented at the American Association of Petroleum Geologists 2010 Annual Convention and Exhibition. April 11 – 14, 2010. New Orleans, LA.

Horner, J., M. Pardue, M.P. Pham, J.W. Castle, J.H. Rodgers, Jr., J.E. Myers and C.M. Gulde. 2010. Design and performance of a pilot-scale constructed wetland treatment system for removing oil and grease from oilfield produced waters. Presented at the American Association of Petroleum Geologists 2010 Annual Convention and Exhibition. April 11 – 14, 2010. New

Orleans, LA.

Castle, J. W., and Rodgers, J. H., Jr. 2009. Role of Toxin-Producing Algae in Phanerozoic Mass Extinctions: Evidence from Modern Environments and the Geologic Record," Geological Society of America Abstracts with Programs, October 2009, v. 41, no. 7, p. 240.

Rodgers, J.H., W.M. Bishop and B.M. Johnson. 2010. Algae on the move: Recent range expansion of *Prymnesium parvum*. Presented at the 50th Annual Meeting of the Aquatic Plant Management Society. Bonita Springs, FL. July 11-14, 2010.

Bishop, W.M. and J.H. Rodgers, Jr. 2010. Responses of *Lyngbya wollei* to copper-based algaecides: The critical burden concept. Presented at the 50th Annual Meeting of the Aquatic Plant Management Society. Bonita Springs, FL. July 11-14, 2010.

Rodgers, J. H., Jr., and Castle, J. W. 2010. "Characteristics of Produced Waters and Biogeochemical Processes for Effective Management Using Constructed Wetland Treatment Systems," Goldschmidt International Conference on Earth, Energy, and the Environment, Knoxville, TN, June 2010. Abstract published in Geochimica et Cosmochimica Acta, v. 74, issue 12, Supplement 1, p. A876.

Castle, J. W., Rodgers, J. H., Jr., Spacil, M., Horner, J. E, Alley, B., and Pardue, M. 2010. "Pilot-Scale Constructed Wetland Treatment Systems for Oil & Gas Produced Waters," 17th Annual International Petroleum and Biofuels Environmental Conference: Environmental Issues and Solutions in Exploration, Production, Refining & Distribution of Petroleum, San Antonio, TX, September 2010.

Castle, J. W., Rodgers, J. H., Jr., Spacil, M., Horner, J. E, Alley, B., and Pardue, M. 2010. "Pilot-Scale Constructed Wetland Systems for Treating Energy-Produced Waters," Ground Water Protection Council Annual Forum, Water & Energy in Changing Climates, Pittsburgh, PA, September 2010.

Bishop, W., and J.H. Rodgers, Jr. 2010. Responses of *Lyngbya wollei* to copper-based algaecides: The critical burden concept. Presented at the 29th Annual Meeting of the Mid-South Aquatic Plant Management Society. October 12-14, 2010. Guntersville, AL.

Rodgers, J.H., Jr. 2010. Evaluation of the NPDES Permitting System. Presented at the 29th Annual Meeting of the Mid-South Aquatic Plant Management Society, October 12-14, 2010. Guntersville, AL.

Castle, J. W., Rodgers, J. H., Jr., Spacil, M., Alley, B., and Pardue, M. 2010. "A Pilot-Scale Study to Apply Biogeochemical Processes of Natural Wetlands to Treating Impaired Waters Using Constructed Wetland Treatment Systems," Geological Society of America Annual National Meeting, Denver, CO, November 2010, Abstract published in Geological Society of

America Abstracts with Programs, v. 42, no. 5, p. 640.

Rodgers, J.H. 2010. Common algal problems and their management. Presented at the 2010 NC Turfgrass Conference & Show. (Dec. 13-15, 2010) Greensboro, NC.

Rodgers, J.H. 2010. Changing regulation of aquatic herbicides applications: How NPDES affects you. Presented at the 2010 NC Turfgrass Conference & Show. (Dec. 13-15, 2010) Greensboro, NC.

Rodgers, J.H. and B. Willis. 2011. Algae on the move: Recent range expansion of Prymnesium parvum. Presented at the 31st Annual Meeting of the Midwest Aquatic Plant Management Society, Grand Rapids, MI. Feb. 27 - Mar.2, 2011.

Rodgers, J.H. 2011. Responses of *Lyngbya wollei* to copper=based algaecides: The critical burden concept. Presented at the 12th Annual Meeting of the Northeast Aquatic Plant Management Society, Portsmouth, NH. Jan. 18 - 20, 2011.

Rodgers, J.H., W.M. Bishop and B.E. Willis. 2011. Algae on the move: Recent range expansion of Prymnesium parvum. Presented at the 12th Annual Meeting of the Northeast Aquatic Plant Management Society, Portsmouth, NH. Jan. 18 - 20, 2011.

Beebe, D. A., Castle, J. W., and Rodgers, J. H. 2010. "Evaluation of Clinoptilolite for Use as a Sorptive Microbial Carrier in Constructed Wetland Treatment Systems Designed to Treat Ammonia," Geological Society of America, South-Central Annual Meeting, New Orleans, LA, March 2011.

Alley, B., D.A. Beebe, J.H. Rodgers, Jr., and J.W. Castle. 2011. Chemical and physical characterization of produced waters from conventional and unconventional fossil fuel resources. Presented at the 19th Annual David S, Snipes/ Clemson Hydrogeology Symposium. Clemson University, Clemson, SC. April 7, 2011.

Beebe, D. A., J.W. Castle and J.H. Rodgers, Jr. 2011. Clinoptilolite as a dual purpose sorbent and microbial carrier in constructed wetland treatment systems designed to remove ammonia. Presented at the 19th Annual David S, Snipes/ Clemson Hydrogeology Symposium. Clemson University, Clemson, SC. April 7, 2011.

Jurinko, K., C.L. Ritter, J.W. Castle and J.H. Rodgers, Jr. 2011. Biogeochemical process in a pilot-scale constructed wetland treatment system designed to remove metals from produced water. Presented at the 19th Annual David S, Snipes/ Clemson Hydrogeology Symposium. Clemson University, Clemson, SC. April 7, 2011.

Pardue, M.J., J.W. Castle and J.H. Rodgers, Jr. 2011. Evaluation of a pilot-scale constructed wetland treatment system for treatment of a specific oilfield produced water. Presented at the 19th

Annual David S, Snipes/ Clemson Hydrogeology Symposium. Clemson University, Clemson, SC. April 7, 2011.

Ritter, C.L., K.N. Jurinko, J.W. Castle and J.H. Rodgers, Jr. 2011. Biogeochemical processes in a constructed wetland treatment system designed for removal of selenium from energy produced water. Presented at the 19th Annual David S, Snipes/ Clemson Hydrogeology Symposium. Clemson University, Clemson, SC. April 7, 2011.

Castle, J. W., R. W. Falta, J. R. Wagner and J. H. Rodgers, Jr. 2011. Introduction to carbon capture and sequestration. Carbon Capture and Storage (CCS) Short Course. Presented at the 19th Annual David S, Snipes/ Clemson Hydrogeology Symposium. Clemson University, Clemson, SC. April 7, 2011.

Castle, J. W., R. W. Falta, J. R. Wagner and J. H. Rodgers, Jr. 2011. Role of water in carbon capture and sequestration. Carbon Capture and Storage (CCS) Short Course. Presented at the 19th Annual David S, Snipes/ Clemson Hydrogeology Symposium. Clemson University, Clemson, SC. April 7, 2011.

Castle, J. W., R. W. Falta, J. R. Wagner and J. H. Rodgers, Jr. 2011. Carbon capture and sequestration: Opportunities and challenges. Carbon Capture and Storage (CCS) Short Course. Presented at the 19th Annual David S, Snipes/ Clemson Hydrogeology Symposium. Clemson University, Clemson, SC. April 7, 2011.

John H. Rodgers, Jr. and Ben E. Willis. 2012. Algae on the move: Recent range expansion of *Prymnesium parvum.* Presented at the 32nd Annual Meeting of the Midwest aquatic plant Management Society. February 26-29, 2012. Milwaukee WI.

John H. Rodgers, Jr. , West M. Bishop and Ben E. Willis . 2011. Algae on the move: Recent range expansion of *Prymnesium parvum*. Presented at the 13th Annual Meeting of the Northeast Aquatic Plant Management Society. January 17-19, 2011. New Castle, NH.

Rodgers, J.H., R. Brown, D. Issacs, N. Long, W.A. Ratajczyk and J.C. Schmidt. 2011. Algae taste-and-odor issues in a drinking water supply lake: Intervention and results. Presented at the 51st Annual Meeting of the Aquatic Plant Management Society, Baltimore, MD. July 24-27, 2011.

Rodgers, J. H., Jr., J.W. Castle, M. M. Spacil and Christina Ritter. 2011. Treating Selenium in Energy-Derived Produced Waters for Surface Water Discharge Using Constructed Wetland Treatment Systems. Presented at the Annual Meeting of the Geological Society of America. October 9-13, 2011. Minneapolis, MN.

John H. Rodgers, Jr., J.W. Castle, M. M. Spacil and Christina Ritter. 2011. Constructed Wetland Treatment Systems for Energy-Derived Produced Waters: Treating Selenium for Surface Water

Discharge. Presented at the 32nd Annual Meeting of the Society of Environmental Toxicology and Chemistry. November 13-17, 2011. Boston, MA.

Beebe, D. A., Song, Y., Castle, J. W., and Rodgers, J. H. Jr. 2011. Pilot Study of Constructed Wetland Treatments Systems for Ammonia in Water Produced from Oil Extraction. Presented at the 32nd Annual Meeting of the Society of Environmental Toxicology and Chemistry. November 13-17, 2011. Boston, MA.

Bethany L. Alley[1], John H. Rodgers, Jr. [1], and James W. Castle . 2011 Renovating Fresh Oilfield Produced Waters for Beneficial Uses: Managing Constructed Wetland Treatment Systems for Performance. Presented at the 32nd Annual Meeting of the Society of Environmental Toxicology and Chemistry. November 13-17, 2011. Boston, MA.

Rodgers, J.H. 2011. Presidential address: Aquatic plant management: The new normal. Presented at the 33rd Annual Meeting of South Carolina Aquatic Plant Management Society, Inc., Clemson, SC, August 17-19, 2011.

Willis, B. and J.H. Rodgers. 2011. Measuring copper residues from algaecide and herbicide applications. Presented at the 33rd Annual Meeting of South Carolina Aquatic Plant Management Society, Inc., Clemson, SC, August 17-19, 2011.

Rodgers, J.H. and R. Richardson. 2011. Update on NPDES for the SCAPMS region. Presented at the 33rd Annual Meeting of South Carolina Aquatic Plant Management Society, Inc., Clemson, SC, August 17-19, 2011.

Rodgers, J.H. 2012. Algae and Taste-and-Odor Issues in a drinking water supply lake: Intervention and Results. Presented at the Midwest Aquatic Plant Management Society, 32nd Annual Conference, Milwaukee, WI. February 26-29, 2012.

Rodgers, J.H. 2012. Use of peroxyhydrate algicide (Phycomycin) in water resource management. Presented at the 22nd Annual Conference of the Pennsylvania Lake Management Society. State College, PA. March 7-8, 2012.

Rodgers, J.H. 2012. Problematic cyanobacteria in water resources: Strategy for Intervention and Case Studies. Presented at the 22nd Annual Conference of the Pennsylvania Lake Management Society. State College, PA. March 7-8, 2012.

Rodgers, J.H. 2012. Toxicology of herbicides. Presented at Minnesota Aquatic and Invasive Species Workshop. Minneapolis, MN. March 19-20, 2012.

Pardue, M., J.W.Castle, G.M. Huddleston and J.H. Rodgers. 2012. Treatment of oilfield produced water using a constructed wetland treatment system. Presented at the 20th Annual David S. Snipes / Clemson Hydrogeology Symposium. Clemson, SC. April 12, 2012.

Alley, B., B. Willis, J.H. Rodgers, Jr. and J.W. Castle. 2012. Water depth and treatment performance of free water surface constructed wetland treatment systems for simulated fresh oil-field produced water. Presented at the 20th Annual David S. Snipes / Clemson Hydrogeology Symposium. Clemson, SC. April 12, 2012.

Beebe, A., B. Alley, J.W. Castle, and J.H. Rodgers, Jr. 2012. Evaluation of coal-bed methane produced water in western Alabama for use as a water resource during drought. Presented at the 20th Annual David S. Snipes / Clemson Hydrogeology Symposium. Clemson, SC. April 12, 2012.

Van Heest, P., J.H. Rodgers, Jr., J.W. Castle, and M.M. Spacil. 2012. Treatment of selenium in pilot-scale constructed wetland treatment systems: Effects of temperature and nutrient-amendment mass loading. Presented at the 20th Annual David S. Snipes / Clemson Hydrogeology Symposium. Clemson, SC. April 12, 2012.

Willis, B. and J.H. Rodgers, Jr. 2012. Bioavailability and analytical measurements of copper residuals in sediments. Presented at the 20th Annual David S. Snipes / Clemson Hydrogeology Symposium. Clemson, SC. April 12, 2012.

Rodgers, J.H., Jr. 2012. Criteria used to measure wetland reconstruction success. Presented at Key Factors to Successfully Reconstruct Boreal Wetland Ecosystems – An International Workshop. Chantilly, France. April 16-17, 2012.

Rodgers, J.H., Jr., R. Brown, D. Isaacs, K. Gazaille, W. Ratajczyk, and J. Schmidt. 2012. Targeted algal management: Some case studies. Presented at the 52nd Annual meeting of the Aquatic Plant Management Society, Salt Lake City, UT, July 22-25, 2012.

Rodgers, J.H. Jr. 2012. Update: NPDES Permits for Pesticides, Presented at the 34th Annual Meeting of the SC Aquatic Plant Management Society. Spring Maid Beach, SC. October 17-19, 2012.

Rodgers, J.H., Jr. and J.W. Castle. 2012. Water in carbon capture and sequestration: Challenges and opportunities. Presented at the 33rd Annual Meeting of the Society of Environmental Toxicology and Chemistry. Long Beach, CA. Nov. 11-15, 2012.

Spacil, M.M., J.H. Rodgers, Jr., J.W. Castle and W.Y. Chao. 2012. Treatment of Selenium in produced water using a pilot-scale constructed wetland treatment system. Presented at the 33rd Annual Meeting of the Society of Environmental Toxicology and Chemistry. Long Beach, CA. Nov. 11-15, 2012.

Rodgers, J.H., Jr. 2012. Strategies for design of active and passive constructed wetlands for oil sands process waters. Invited presentation at Olds College, Olds, Alberta, CANADA. Nov. 15, 2013.

Willis, B. and J.H. Rodgers, Jr. 2012. Accumulation and Effects of Residual Copper in Sediments of a Pond Following an Algaecide Application. Presented at the 34th Annual South Carolina Aquatic Plant Management Society Meeting. Myrtle Beach, SC. October 18, 2011.

Rodgers, J.H. 2012. The use of algaecides in adaptive water resource management. Presented at the 32nd International Symposium of the North American Lake Management Society. Madison, WI. Nov. 7-9, 2012.

Rodgers, J. H. and A. Calomeni. 2013. The use of algaecides in adaptive water resource management: Some case studies. Presented at the Meeting of the Midwest Aquatic Plant Management Society. Cleveland, OH. March 3-5, 2013. Won the poster contest.

Rodgers, J.H. 2013. The use of algaecides in adaptive water resource management. Presented at the Annual Meeting of the Western Aquatic Plant Management Society. Coeur d'Alene, ID. March 25-27, 2013.

Rodgers, J.H. and A.J. Calomeni. 2013. The use of algaecides in adaptive water resource management. Presented at the Annual Meeting of the Aquatic Plant Management Society. San Antonio, TX. July 14-17, 2013

Rodgers, J.H., Jr. and A.J. Calomeni. 2013. The use of algaecides in adaptive water resource management. Presented at the 32nd Annual Meeting of the Mid South Aquatic Plant Management Society. Tunica, MS. Sep. 16-18, 2013.

Rodgers, J.H. and A.J. Calomeni. 2013. The use of algaecides in adaptive water resource management. Presented at the 38th Annual Meeting of the Florida Aquatic Plant Management Society. Daytona Beach, FL. Oct. 13-16, 2013

Alley, B.L., J.H. Rodgers, Jr., and J.W. Castle. 2013. Seasonal performance of a hybrid pilot-scale constructed wetland treatment system for simulated fresh oilfield produced water. Presented at the 21st Annual David S. Snipes/Clemson Hydrogeology Symposium. Clemson, SC. April 4, 2013.

Beebe, A., J.W. Castle and J.H. Rodgers, Jr. 2013. Effects of evapotranspiration on water treatment performance in constructed wetlands. Presented at the 21st Annual David S. Snipes/Clemson Hydrogeology Symposium. Clemson, SC. April 4, 2013.

Coffey, R.E., J.W. Castle and J.H. Rodgers, Jr. 2013. A demonstration constructed wetland treatment system for unconventional gas produced water. Presented at the 21st Annual David S. Snipes/Clemson Hydrogeology Symposium. Clemson, SC. April 4, 2013.

Huddleston, M., J.H. Rodgers, Jr., J.W. Castle. And M. Spacil. 2013. Treatment of Selenium as a

constituent of ecological concern in energy-produced waters. Presented at the 21st Annual David S. Snipes/Clemson Hydrogeology Symposium. Clemson, SC. April 4, 2013.

Schwindaman, J.P., J.W. Castle and J.H. Rodgers, Jr. 2013. Fate and distribution of Arsenic in a pilot-scale constructed wetland treatment system for simulated Bangladesh groundwater. Presented at the 21st Annual David S. Snipes/Clemson Hydrogeology Symposium. Clemson, SC. April 4, 2013.

Huddleston, M., J.H. Rodgers, Jr., J.W. Castle. And M. Spacil. 2013. Treatment of Selenium as a constituent of ecological concern in energy-produced waters. Presented at the SME Symposium on Environmental Considerations in Energy Production. Charleston, WV. April 14-18, 2013.

Rodgers, J.H., Jr. and A. Calomeni. 2013. Targeted algal management at Lake John Hay. Presented at the 36th Annual Meeting of the South Carolina Aquatic Plant Management Society, Myrtle Beach, SC. Oct. 23-25, 2013.

Haakensen, M., V. Pittit, J. Castle and J.H. Rodgers, Jr. 2013. Effects of freeze-thaw and biochar on sequestration and localization of elements within oxidizing and reducing pilot constructed wetland treatment systems. Presented at the 34th Annual Meeting of the Society of Environmental Toxicology and Chemistry (SETAC North America), Nashville, TN. 17-21 Nov. 2013.

Calomeni, A. and J.H. Rodgers, Jr. 2013. Assessment of six indicators for algal cell viability. Presented at the 34th Annual Meeting of the Society of Environmental Toxicology and Chemistry (SETAC North America), Nashville, TN. 17-21 Nov. 2013.

Huddleston, G.M., J.H. Rodgers, Jr. and A. McQueen. 2013. A proposed framework for an Environmental and Toxicology Assessment of an unleaded piston engine aviation fuel. Presented at the 34th Annual Meeting of the Society of Environmental Toxicology and Chemistry (SETAC North America), Nashville, TN. 17-21 Nov. 2013.

Tsai, K.P. and J.H. Rodgers, Jr. 2013. Toxicity of copper sulfate and copper-ethanolamine to *Microcystis aeruginosa* and *Pseudokirchneriella subcapitata* at different initial cell densities. Presented at the 34th Annual Meeting of the Society of Environmental Toxicology and Chemistry (SETAC North America), Nashville, TN. 17-21 Nov. 2013.

Rodgers, J.H. 2014. Control of noxious algae in water resources. Webinar at Synterra, Greenville, SC (May 29, 2014).

Calomeni, A.J. and J.H. Rodgers, Jr. 2014. Assessment of six indicators for algal cell viability. Presented at the 54th Annual Meeting of the Aquatic Plant Management Society, Savannah, GA 14-16 July 2014.

Rodgers, J.H., Jr., A.J. Calomeni and K.I Iwinski. 2014. Enhancement of targeted algl management. Presented at the 54th Annual Meeting of the Aquatic Plant Management Society, Savannah, GA 14-16 July 2014.

Rodgers, J. H., Jr., K. Getsinger, E. Dibble, and D. Spenser. 2014. Benefits of controlling nuisance aquatic plants and algae in the United States. Presented at the 54th Annual Meeting of the Aquatic Plant Management Society, Savannah, GA 14-16 July 2014.

Rodgers, J.H., Jr., A.J. Calomeni and K.I Iwinski. 2014. Post-treatment fate of copper applied as algaecides and herbicides. Presented at the 54th Annual Meeting of the Aquatic Plant Management Society, Savannah, GA 14-16 July 2014.

Calomeni, A.J. and J.H. Rodgers, Jr. 2014. Evaluation of algaecide applications for treatment of *Lyngbya wollei* in Lay Lake. Presented at the 36th Annual Meeting of the South Carolina Aquatic Plant Management Society, Myrtle Beach, SC 8-10 Oct. 2014.

Rodgers, J. H., Jr., K. Getsinger, E. Dibble, and D. Spenser. 2014. Benefits of controlling nuisance aquatic plants and algae in the United States. Presented at the 36th Annual Meeting of the South Carolina Aquatic Plant Management Society, Myrtle Beach, SC 8-10 Oct. 2014.

Rodgers, J.H. 2014. In house vs. outhouse microbial control for industrial waters. Presented at Microbial Control Challenges in Industrial Water, Recent Advances in Microbial Control, Society of Industrial Microbiology, San Francisco, CA (November 9-12, 2014).

Calomeni, A.J. and J.H. Rodgers, Jr. 2014. Responses of *Planktothrix agardhii* and *Pseudokirchneriella subcapitata* to copper sulfate ($CuSO_4 \cdot H_2O$) and a chelated copper compound (Cutrine®-Ultra). Presented at the 35th Annual Meeting of the Society of Environmental Toxicology and Chemistry, Vancouver, BC 9-13 Nov. 2014.

Kinley, C., J.H. Rodgers, Jr., K.J. Iwinski, A.D. McQueen and A.J. Calomeni. 2014. Evaluation of the I_3- method to confirm sodium carbonate peroxyhydrate algaecide exposures. Presented at the 35th Annual Meeting of the Society of Environmental Toxicology and Chemistry, Vancouver, BC 9-13 Nov. 2014.

Rodgers, J.H., K. Getsinger, E. Dibble and D. Spenser. 2015. Benefits of controlling nuisance aquatic plants and algae in the United States. Keynote Presentation at the Northeast Aquatic Plant Management Society. Saratoga Springs, NY 20-22 Jan. 2015.

Kinley, C. and J.H. Rodgers, Jr. 2015. Evaluation of the I_3- method to confirm SCP-based algaecide exposures. Presented at the Annual Meeting of the Northeast Aquatic Plant Management Society. Saratoga Springs, NY 20-22 Jan. 2015.

Calomeni, A.J. and J.H. Rodgers, Jr. 2015. Evaluation of algaecide applications for treatment of

Lyngbya wollei in Lay Lake. Presented at the Annual Meeting of the Northeast Aquatic Plant Management Society. Saratoga Springs, NY 20-22 Jan. 2015.

Calomeni, A. and J.H. Rodgers, Jr. 2015. Evaluation of algaecide applications for treatment of Lyngbya wollei in Lay Lake. Presented at the 35th Annual Meeting of the Midwest Aquatic Plant Management Society, Indianapolis, IN. 22-25 Feb. 2015.

Iwinski, K. and J.H. Rodgers, Jr. 2015. Copper residuals, in situ sediment benthic abundance, and sediment toxicity: Comparison of copper algaecide treated coves and untreated coves in a southern reservoir. Presented at the 35th Annual Meeting of the Midwest Aquatic Plant Management Society, Indianapolis, IN. 22-25 Feb. 2015.

Rodgers, J.H., Jr. K. Getsinger, E. Dibble, and D. Spenser. 2015. Benefits of controlling nuisance aquatic plants and algae in the United States. Presented at the 35th Annual Meeting of the Midwest Aquatic Plant Management Society, Indianapolis, IN. 22-25 Feb. 2015.

McQueen, A., J.H. Rodgers, Jr. and J.W. Castle. 2015. Photocatalysis of commercial naphthenic acids using fixed-film TiO_2. Presented at the 23rd Annual David S. Snipes/Clemson Hydrogeology Symposium. Clemson, SC. March 26, 2015.

Kickhaefer, R., J.W. Castle and J.H. Rodgers, Jr. 2015. Water characteristics affecting photo-catalytic oxidation of commercial naphthenic acids. Presented at the 23rd Annual David S. Snipes/Clemson Hydrogeology Symposium. Clemson, SC. March 26, 2015.

Muller, S., J.W. Castle and J.H. Rodgers, Jr. 2015. White-rot fungal degradation of naphthenic acids. Presented at the 23rd Annual David S. Snipes/Clemson Hydrogeology Symposium. Clemson, SC. March 26, 2015.

Rodgers, J.H., Jr. 2015. Adaptive water resource management and noxious algae management. Presented at the Workshop on Solving Problems Caused by Cyanobacteria and Algae Using Adaptive Water Resource Management. Colorado State University, Ft. Collins, CO, April 7, 2015.

Rodgers, J.H., Jr. 2015. Get to know the algae up close and personal. Presented at the Workshop on Solving Problems Caused by Cyanobacteria and Algae Using Adaptive Water Resource Management. Colorado State University, Ft. Collins, CO, April 7, 2015.

Rodgers, J.H., Jr. 2015. Problem definition and triggers – monitoring, permits, bid documents, etc. Presented at the Workshop on Solving Problems Caused by Cyanobacteria and Algae Using Adaptive Water Resource Management. Colorado State University, Ft. Collins, CO, April 7, 2015.

Rodgers, J.H., Jr. 2015. Case study: Hartwell Lake, SC. Presented at the Workshop on Solving

Problems Caused by Cyanobacteria and Algae Using Adaptive Water Resource Management. Colorado State University, Ft. Collins, CO, April 7, 2015.

Calomeni, A.J. and J.H. Rodgers, Jr. 2015. Responses of a Cyanobacterium (*Plantothrix agardhii*) and a green alga (*Pseudokirchneriella subcapitata*) to a chelated and non-chelated copper algaecide. Presented at the 55th Annual Meeting of the Aquatic Plant Management Society, Myrtle Beach, SC. July 12-15, 2015.

Geer, T.D., K.J. Iwinski, A.J. Calomeni and J.H. Rodgers, Jr. 2015. Sediment copper concentrations, in situ benthic invertebrate abundance, and sediment toxicity: Comparison of coves treated with copper-based algaecides and untreated coves in a Southern reservoir. Presented at the 55th Annual Meeting of the Aquatic Plant Management Society, Myrtle Beach, SC. July 12-15, 2015.

Iwinski, K.J., A.J. Calomeni, T.D. Geer and J.H. Rodgers, Jr. 2015. Cellular and aqueous microcystin-LR following exposures of *Microcystis aeruginosa* to copper algaecides. Presented at the 55th Annual Meeting of the Aquatic Plant Management Society, Myrtle Beach, SC. July 12-15, 2015.

Rodgers, J.H., Jr., K. Wardlaw, T. Geer, A. Calomeni and G.M. Huddleston III. 2015. Control of algae producing taste and odor in the drinking water supply for the Anderson Regional Joint Water System. Presented at the 55th Annual Meeting of the Aquatic Plant Management Society, Myrtle Beach, SC. July 12-15, 2015.

Iwinski K.J., Calomeni A.J., Geer T.D., Rodgers Jr. J.H. November 4, 2015. Cellular and Aqueous Microcystin-LR Following Laboratory Exposures of *Microcystis aeruginosa* to Copper Algaecides. Poster presented at the 36th Annual Meeting of the Society of Environmental Toxicology and Chemistry, Salt Lake City, UT.

McQueen, A.D**.**, Kinley C.M., Kiekhaefer, R.L., Calomeni A.J., Rodgers J.H Jr., Castle, J.W., Nov 1-5, 2015. Photocatalytic Degradation of Commercial Naphthenic Acids in Water Using Fixed-film TiO_2. Platform Presentation at the Annual Meeting of the Society of Environmental Toxicology and Chemistry (SETAC North America) in Salt Lake City, UT.

Kinley C.M., McQueen, A.D., Rodgers J.H Jr., Nov 1-5, 2015. Comparative responses of freshwater organisms to exposures of a commercial naphthenic acid. Poster presentation at the Annual Meeting of the Society of Environmental Toxicology and Chemistry (SETAC North America) in Salt Lake City, UT.

Rodgers, J.H., Jr., A. Calomeni, K. Iwinski, R. Wersal and W. Ratajczyk. 2016. Environmental Issues for Large Operational Programs in North America. 21st Century Challenges in Aquatic Weed Management, presented at the 56th Annual Weed Science Society of America and the 69th Annual Meeting of the Southern Weed Science Society. (February 8 to 11, 2016), San Juan, Puerto Rico.

Iwinski, K.J., A.J. Calomeni, C.M. Kinley, T.D. Geer, and J.H. Rodgers, Jr. 2016. Comparison of Laboratory and Field Responses of a Microcystin Producing Cyanobacterium (*Microcystis aeruginosa*) to a Copper-Based Algaecides. Presented at the 36th Annual Meeting of the Midwest Aquatic Plant Management Society, (March 6-9) Grand Rapids, MI.

Rodgers, J.H., K.J. Iwinski and A.J. Calomeni. 2016. Responses of Starry Stonewort (*Nitellopsis obtusa*) from an Indiana Lake to exposures of copper-based algaecides (Clearigate and Cutrine-Ultra) and flumioxazin (Clipper). Presented at the 36th Annual Meeting of the Midwest Aquatic Plant Management Society, (March 6-9) Grand Rapids, MI.

Geer, T.D. and J.H. Rodgers, Jr. 2016. Laboratory Studies of Sodium Carbonate Peroxyhydrate Toxicity to Freshwater Organisms. Presented at the 36th Annual Meeting of the Midwest Aquatic Plant Management Society, (March 6-9) Grand Rapids, MI.

Calomeni,A.J., K.J. Iwinski, C. Kinley, T.D. Geer, M. Hendrikse. 2016. Predicting Copper Bioavailability in Six-and-Twenty Creek Cove Sediments of Hartwell Lake (Anderson, SC). Presented at the 36th Annual Meeting of the Midwest Aquatic Plant Management Society, (March 6-9) Grand Rapids, MI.

Iwinski, K.J., A.D. McQueen, C.M. Kinley, A.J. Calomeni, T.D. Geer and J.H. Rodgers. 2016. Sediment Copper Concentrations, *in situ* Benthic Abundance, and Sediment Toxicity: Comparison of Coves Treated with Copper-Based Algaecides and Untreated Coves in a Southern Reservoir. Presented at the 36th Annual Meeting of the Midwest Aquatic Plant Management Society, (March 6-9) Grand Rapids, MI.

Calomeni, A.C. and J.H. Rodgers, Jr. 2016. Management Options for *Prymnesium parvum*. Presented at the 35th Annual Meeting of the Western Aquatic Plant Management Society. (March 21 – March 23, 2016) San Diego Del Mar, Del Mar, CA.

Gaspari, D.P., M. Hendrikse, J.W. Castle and J.H. Rodgers, Jr. 2016. Thin film photocatalysis: a method for degrading recalcitrant organic constituents in complex wastewaters. Presented at the 24th Annual Meeting of the David S. Snipes/Clemson Hydrology Symposium. (March 31, 2016) Clemson, SC.

Muller, S.L., J.W. Castle and J.H. Rodgers, Jr. 2016. Cometabolic remediation of a recalcitrant organic compound. Presented at the 24th Annual Meeting of the David S. Snipes/Clemson Hydrology Symposium. (March 31, 2016) Clemson, SC.

Rodgers, J.H., Jr., Wardlaw, K., Geer, T.D., Calomeni, A., Huddleston, G.M. III, Willett, S., Barrington, J., Melton, D. 2016. Reduction of Taste and Odor in Source Water for the Anderson Regional Joint Water System. Presented at the American Water Works Association Sustainable Water Management Conference, Providence, RI, March 7-10, 2016.

Huddleston, G.M. III, Rodgers, J.H., Jr., Wardlaw, K., Geer, T.D., Calomeni, A., Willett, S., Barrington, J., Melton, D., Bowen, M., Spacil, M. 2016. Taste and Odor Control in Source Water for the Anderson Regional Joint Water System. Presented at the South Carolina

Environmental Conference, Myrtle Beach, SC, March 13-15, 2016.

Huddleston, G.M. III, Rodgers, J.H., Jr., Wardlaw, K., Geer, T.D., Calomeni, A., Goldsby, T. 2016. Adaptive Water Resources Management for Problem Algae. Presented at the 38th Annual Alabama Rural Water Association Technical Training Conference, Mobile, AL, March 20-23, 2016.

Rodgers, J.H., Jr., K. Iwinski, A . Calomeni, T. Geer and C. Kinley. 2016. Managing Starry Stonewort (*Nitellopsis obtusa*) in Lake Koronis, Minnesota. Presented at the Koronis Lake Management Association Meeting, Paynesville, Minnesota. April 26, 2016.

Rodgers, J.H., Jr., A. Calomeni, K. Iwinski, T. Geer and C. Kinley. 2016. Copper fate and effects: Use of copper formulations as algaecides and herbicides in aquatic systems. Presented at the Michigan Inland Lakes Convention: Science and Leadership: A formula for successful lake protection and management. Boyne Mountain Resort, Boyne Falls, MI. April 28-30, 2016.

Iwinski, K.J. and J.H. Rodgers, Jr. 2016. Responses of the Cyanobacterium *Microcystis aeruginosa* to Copper-based Algaecides. Presented at the US Algal Toxin Conference 2016, Akron Global Water Alliance, Akron, OH. May 9 – 11, 2016.

Calomeni, A., K.J. Iwinski and J.H. Rodgers, Jr. 2016. Evaluation of Algaecide Applications for Treatment of *Lyngbya wollei* in Lay Lake. Presented at the US Algal Toxin Conference 2016, Akron Global Water Alliance, Akron, OH. May 9 – 11, 2016.

Iwinski, K.J., C.M. Kinley, A. Calomeni, T. Geer and J.H. Rodgers, Jr. 2016. Influence of copper algaecide concentration and formulation on aqueous microcystin-LR degradation. Presented at the 56th Annual Meeting of the Aquatic Plant Management Society, Grand Rapids, MI. July 17- 20, 2016.

Rodgers, J.H., Jr., A. Calomeni, K.J. Iwinski, T.Geer, M. Huddleston, S. Willett, and J. Barrington. 2016. Control of taste and odor producing algae in source water for Anderson Regional Joint Water System. Presented at the 56th Annual Meeting of the Aquatic Plant Management Society, Grand Rapids, MI. July 17-20, 2016.

Geer, T., C.M. Kinley, K.J. Iwinski, A. Calomeni and J.H. Rodgers, Jr. 2016. Influence of dissolved and particulate organic carbon on exposures of and SCP-algaecide and consequent responses of *Microcystis aeruginosa*. Presented at the 56th Annual Meeting of the Aquatic Plant Management Society, Grand Rapids, MI. July 17-20, 2016.

Geer T.D., Kinley C.M., Iwinski K.J., Calomeni A.J**.,** Rodgers Jr. J.H. 2017. Laboratory Studies of Sodium Carbonate Peroxyhydrate Toxicity to Freshwater Organisms. Presented at the 38th Annual Meeting of the South Carolina Aquatic Plant Management Society, Myrtle Beach, SC. January 18, 2017.

Kinley C.M., Geer T.D., Iwinski K.J., Hendriske M.H., Rodgers Jr. J.H. 2017. Density dependence of copper exposures to *Microcystis aeruginosa*: implications for microcystin-LR release. Presentation at the 38th Annual Meeting of the South Carolina Aquatic Plant Management Society, Myrtle Beach, SC. January 18, 2017.

Calomeni A.J., Iwinski K.J., Kinley C.M., Geer T.D., Hendriske M.H., McQueen A.D., Rodgers Jr. J.H. 2017. Factors Influencing Copper Fate Following Algaecide Applications. Presented at the 38th Annual Meeting of the South Carolina Aquatic Plant Management Society, Myrtle Beach, SC. January 18, 2017.

Hendriske M.H., Calomeni A.J., Iwinski K.J., Kinley C.M., Geer,T.D., McQueen A.D., Rodgers Jr. J.H. 2017. A New Perspective on Release of Microcystin from *Microcystis aeruginosa* Following Copper-Based Algaecide Treatment. Platform presentation at the 38th Annual Meeting of the South Carolina Aquatic Plant Management Society, Myrtle Beach, SC. January 18, 2017.

Geer T.D., Calomeni A.J., Kinley C.M., Iwinski K.J., Rodgers Jr. J.H. 2017. Predicting In Situ Responses of Taste and Odor Producing Algae in a Southeastern U.S. Reservoir to a Sodium Carbonate Peroxyhydrate Algaecide Using a Laboratory Exposure-Response Model. Presented at the 37th Annual Meeting of the Midwest Aquatic Plant Management Society. Milwaukee, WI. March 1, 2017.

Kinley C.M., Geer T.D., Iwinski K.J., Hendriske M., Rodgers Jr. J.H. 2017. Density dependence of copper exposures to *Microcystis aeruginosa*: Implications for microcystin-LR release. Presented at the 37th Annual Meeting of the Midwest Aquatic Plant Management Society, Milwaukee, WI. March 1, 2017.

Rodgers Jr. J.H, Calomeni A.J., Iwinski K.J., Kinley C.M., Geer T.D. 2017. Leaky Cyanobacterial Cells and Algaecide Treatments: A Look at the Data and Implications for Decision Making. US EPA Cyanobacterial Harmful Algal Blooms Webinar. May 23, 2017.

Calomeni A.J., Rodgers Jr. J.H. 2017. Characterization of Copper Algaecide (Copper Ethanolamine) Dissipation Rates Following Pulse Exposures. Presented at the Akron Global Water Alliance. USA Water Conference. Akron, OH. June 1, 2017.

Rodgers Jr. J.H., Calomeni A.J. 2017. Intervention to Reduce Taste and Odor in Source Waters for the Anderson Regional Joint Water System. Presented at the Akron Global Water Alliance. USA Water Conference. Akron, OH. June 1, 2017.

Geer T.D., Calomeni A.J., Kinley C.M., Iwinski K.J., Rodgers Jr. J.H. 2017. Predicting In Situ Responses of Taste and Odor Producing Algae in a Southeastern U.S. Reservoir to a Sodium Carbonate Peroxyhydrate Algaecide Using a Laboratory Exposure-Response Model. Presented at the 57th Annual Meeting of the Aquatic Plant Management Society. Daytona Beach, FL. July 17, 2017.

Calomeni A.J., Kinley C.M., Geer T.D., Iwinski K.J., Hendrikse M., Rodgers Jr. J.H. 2017. Relationship Among Aqueous Copper Half-Lives and Responses of Fathead Minnow (*Pimephales promelas*) to a Series of Copper Sulfate Pentahydrate Concentrations. Presented at the 57th Annual Meeting of the Aquatic Plant Management Society. Daytona Beach, FL. July 18, 2017.

Kinley C.M., Geer T.D., Iwinski K.J., Hendriske M., Rodgers Jr. J.H. 2017. Density dependence of copper exposures to *Microcystis aeruginosa*: Implications for microcystin-LR release. Presented at the 57th Annual Meeting of the Aquatic Plant Management Society, Daytona, FL. July 16-19, 2017.

Rodgers Jr. J.H., Geer T.D., Calomeni A.J., Iwinski K.J., Kinley C.M. 2017. Intervening in Major Algal "Blooms" in Florida. Presented at the 57th Annual Meeting of the Aquatic Plant Management Society. Daytona Beach, FL. July 19, 2017.

Geer T.D., Rodgers Jr. J.H., Farnum K. 2017. Managing *Nitellopsis obtusa* (Starry Stonewort) in Lake Koronis, MN: A Pilot Project Using an Integrated Approach. Presented at the 36th Annual Meeting of the MidSouth Aquatic Plant Management Society, Birmingham, AL. November 6-8, 2017.

Geer T.D., Calomeni A.J., Kinley C.M., Iwinski K.J., Rodgers Jr. J.H. Predicting *In Situ* Responses of Taste and Odor Producing Algae in a Southeastern U.S. Reservoir to a Sodium Carbonate Peroxyhydrate Algaecide Using a Laboratory Exposure-Response Model. 2017. Presentation at the 36th Annual Meeting of the MidSouth Aquatic Plant Management Society, Birmingham, AL. November 6-8, 2017.

Geer T.D., Rodgers Jr. J.H. 2017. Techniques for Problematic Algae Management. Presentation at the 36th Annual Meeting of the MidSouth Aquatic Plant Management Society, Birmingham, AL. November 6-8, 2017.

Hendrikse M., Gaspari, D.P., McQueen A.D., Kinley C.M., Calomeni A.J., Geer T.D., Haakensen M., Headley J.V., Rodgers J., Castle J.W. 2017. Mitigating Risks Associated with Oil Sands Process-Affected Waters using a Pilot-Scale Hybrid Constructed Wetland Treatment System. Poster presented at the 38th Annual Meeting of the Society of Environmental Toxicology and Chemistry, Minneapolis, MN. November 12 - 16, 2017.

McQueen A.D., Kinley C.M., Iwinski K.J., Calomeni A.J., Rodgers J.H. 2017. Effects of Acid Volatile Sulfides (AVS) from Na2S- Amended Sediment on *Hyalella azteca*. Poster presented at the 38th Annual Meeting of the Society of Environmental Toxicology and Chemistry, Minneapolis, MN. November 12 -16, 2017.

Kinley C.M., Geer T.D., Iwinski K.J., Hendriske M., Rodgers Jr. J.H. 2017. Density dependence of copper exposures to *Microcystis aeruginosa*: implications for microcystin-LR release. Poster presented at the 38th Annual Meeting of the Society of Environmental Toxicology and Chemistry, Minneapolis, MN. November 12-16, 2017.

Geer T.D., Calomeni A.J., Kinley C.M., Iwinski K.J., Rodgers J.H. 2017. Predicting In Situ Responses of Taste-and Odor Producing Algae in a Southeastern US Reservoir to a Sodium Carbonate Peroxyhydrate Algaecide. Poster presented at the 38th Annual Meeting of the Society of Environmental Toxicology and Chemistry, Minneapolis, MN. November 15, 2017.

Geer T.D., Rodgers Jr. J.H., McComas S. 2018. Management of *Nitellopsis obtusa* (Starry Stonewort) in a Recently Infested Minnesota Lake Using a Copper-Based Algaecide. Presented at the 19th Annual Meeting of the Northeast Aquatic Plant Management Society, New Castle, NH. January 11, 2018.

Geer T.D., Rodgers Jr. J.H., McComas S. 2018. Management of *Nitellopsis obtusa* (Starry Stonewort) in a Recently Infested Minnesota Lake Using a Copper-Based Algaecide. Presented at the 38th Annual Meeting of the Midwest Aquatic Plant Management Society, Cleveland, OH. February 26 – March 1, 2018.

Rodgers, J.H., T.D. Geer and C. Kinley. 2018. Strategies for Intervening in *Nitellopsis obtusa* (Starry Stonewort) Infestations. Presented at the 38th Annual Meeting of the Midwest Aquatic Plant Management Society, Cleveland, OH. February 26 – March 1, 2018.

Rodgers, J.H. 2018. APMS Update. Presented at the 38th Annual Meeting of the Midwest Aquatic Plant Management Society, Cleveland, OH. February 26 – March 1, 2018.

Rodgers, J.H., T.D. Geer and C. Kinley. 2018. Emerging methods for control of Starry Stonewort (*Nitellopsis obtusa*). Presented at the Aquatic Invasive Species Summit III. Minneapolis, MN. February 28 – March 1, 2018.

John H. Rodgers, Jr. Clemson University, Department of Forestry and Environmental Conservation, Clemson, SC "Presidential Address" Presented at the 58th Annual Meeting of the Aquatic Plant Management Society, Buffalo, NY July 15-18, 2018.

Hendrikse, M., Ciera Kinley, Kyla Iwinski-Wood, Tyler Geer, Andrew McQueen, Alyssa Calomeni, Jenny Liang, Vanessa Friesen, Monique Simair, John H. Rodgers, Jr. Clemson University, Department of Forestry and Environmental Conservation, Clemson, SC, Applied Polymer Systems, Woodstock, GA, U.S. Army Corps of Engineers, Vicksburg, MS, Contango Strategies Ltd., Saskatoon, Saskatchewan, Canada. "Microcystin-LR Degradation Following Copper-based Algaecide Exposures" Presented at the 58th Annual Meeting of the Aquatic Plant Management Society, Buffalo, NY July 15-18, 2018.

Geer, T.D. , S. McComas, and John H. Rodgers, Jr. Clemson University, Department of Forestry and Environmental Conservation, Clemson, SC. Blue Water Science, Saint Paul, MN "Rapid Response to an Early Detection of *Nitellopsis obtusa* (Starry Stonewort) in Lake Sylvia, Minnesota, Using a Copper-Based Algaecide" Presented at the 58th Annual Meeting of the Aquatic Plant Management Society, Buffalo, NY July 15-18, 2018.

Rodgers, J.H., Jr. and T.D. Geer. 2018. APMS Update: A Message from the Immediate Past-President. Presented at the 40th Annual meeting of the South Carolina Aquatic Plant Management Society, North Myrtle Beach, SC October 3-5, 2018.

Geer, T.D., S. McComas, and J.H. Rodgers, Jr. 2018. Rapid Response Due to an Early Detection of *Nitellopsis obtusa* (Starry Stonewort). Presented at the 40th Annual meeting of the South Carolina

Aquatic Plant Management Society, North Myrtle Beach, SC October 3-5, 2018.

Rodgers, J.H., Jr. and T.D. Geer. 2018. Managing *Lyngbya* in Southern Water Resources. Presented at the 37th Annual Meeting of the MidSouth Aquatic Plant Management Society, Chattanooga, TN November 5-7, 2018.

Geer, T.D., S. McComas and J.H. Rodgers, Jr. 2018. Fate and Effects of a Copper-based Algaecide to Mitigate a Recent Invasion of *Nitellopsis obtusa* (Starry Stonewort). Presented at the 39th Annual Meeting of the Society of Environmental Toxicology and Chemistry, Sacramento, CA November 4-8, 2018.

Geer T.D., Rodgers Jr. J.H., McComas S. 2019. Ongoing Management of an Incipient *Nitellopsis obtusa* (Starry Stonewort) Infestation in Lake Sylvia, Minnesota, Using a Copper-Based Algaecide. Presented at the 20th Annual Meeting of the Northeast Aquatic Plant Management Society, Albany, NY. January 9, 2019.

Rodgers, Jr., J.H. and T.D. Geer. 2019. Save our lakes: Intervention in HABs and Invasive Algae in Michigan. Michigan Lake Stewardship Associations, 58th Annual Conference, Crystal Mountain Resort, Thompsonville, Michigan. May 3-4, 2019.

T.D. Geer, S. McComas and J.H. Rodgers, Jr. 2019. Ongoing management of an incipient *Nitellopsis obtusa* (Starry Stonewort) Infestation in Lake Sylvia, Minnesota, using a copper-based algaecide. Michigan Lake Stewardship Associations, 58th Annual Conference, Crystal Mountain Resort, Thompsonville, Michigan. May 3-4, 2019.

Rodgers, Jr., J.H. and T.D. Geer. 2019. A Short Course on Algae Ecology and Management. Presented for UPL at Clemson University. May 15-16, 2019.

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APPENDIX B SITE PHOTOGRAPHS

April 9, 2021

Appendix B-1: Vegetation Observations

Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.

Bayou Pigeon Oil & Gas Field

Iberia Parish, Louisiana

Vegetation
In Prelim Eco AOI-1 Area

Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.

Bayou Pigeon Oil & Gas Field

Iberia Parish, Louisiana

JLS-2

March 15, 2021

Photo ID: 0013 JW

JLS-2

March 15, 2021

Photo ID: 0014 JW

JLS-2 Area

March 15, 2021

Photo ID: 0040 JW

JLS-2 Area

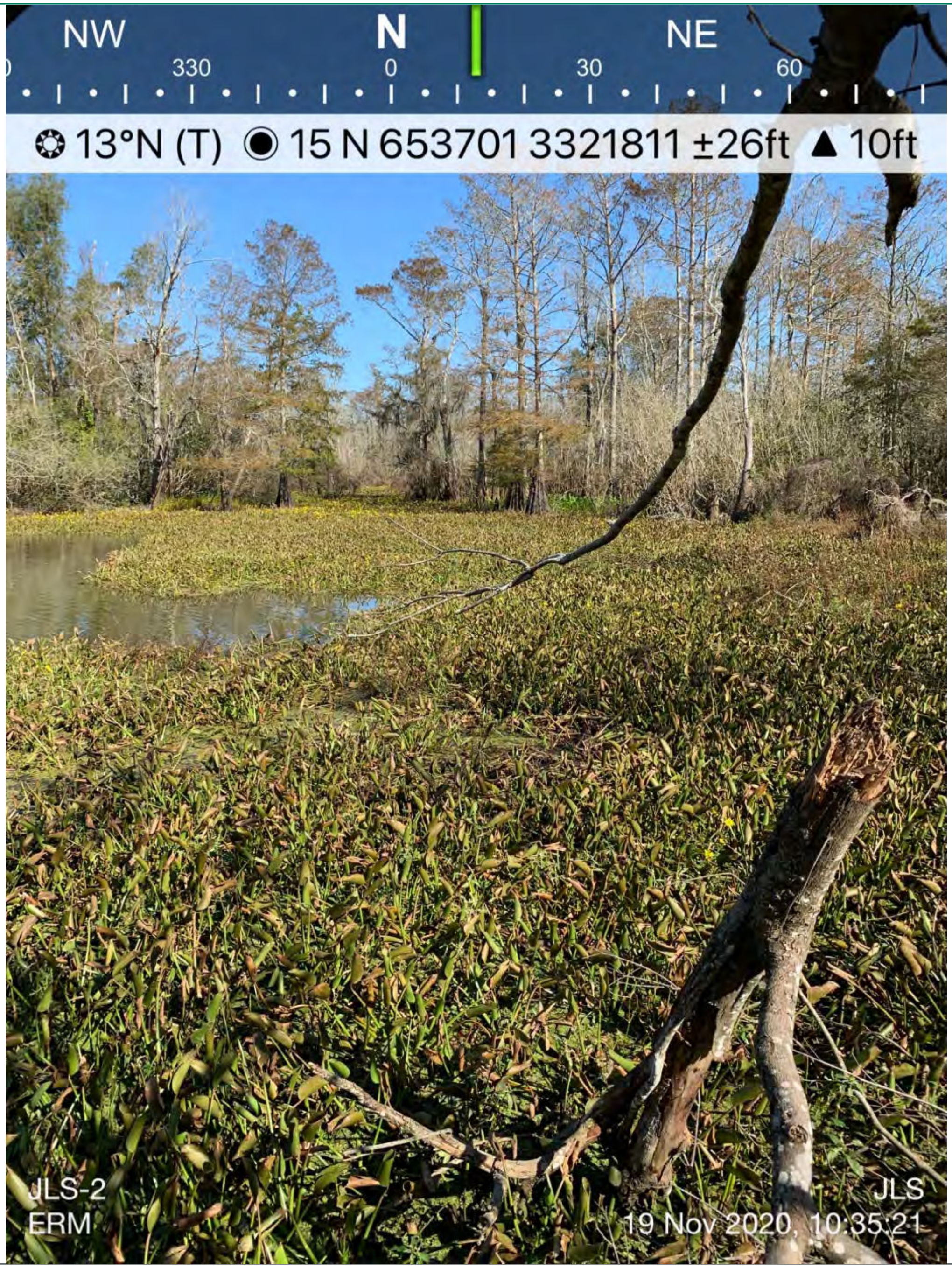
November 19, 2020

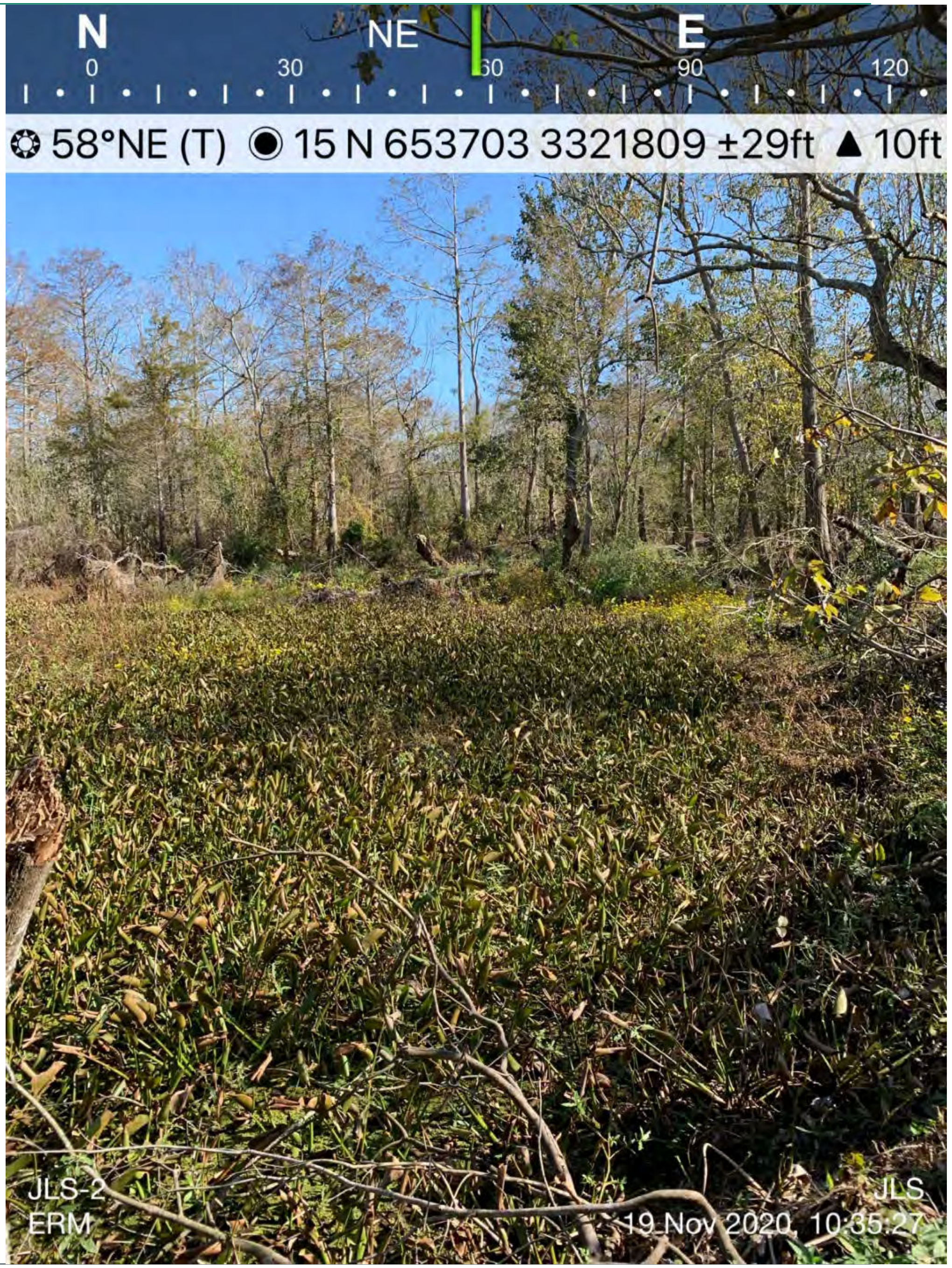
Photo ID: 10:41:58 HC
Photo ID: 10:42:06 HC

JLS-2 Area

November 19, 2020

Photo ID: 10:35:21 HC
Photo ID: 10:35:27 HC





JLS-2

Cypress-Tupelo Swamp

November 19, 2020

Photo ID: 4434 DA

JLS-2 Area

Cypress-Tupelo Swamp

November 19, 2020

Photo ID: 4436 DA

MW-3

March 15, 2021

Photo ID: 0105 JW

MW-1

March 15, 2021

Photo ID: 0108 JW

JLS-11

November 19, 2020

Photo ID: 10:22:42 HC
Photo ID: 10:33:45 HC

JLS-11

November 19, 2020

Photo ID: 10:33:51 HC
Photo ID: 10:33:58 HC

JLS-23

March 15, 2021

Photo ID: 0067 JW

JLS-23

March 15, 2021

Photo ID: 0069 JW

Vegetation in Prelim Eco AOI-2 Area

Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.

Bayou Pigeon Oil & Gas Field

Iberia Parish, Louisiana

JLS-1

March 15, 2021

Photo ID: 0094 JW

JLS-1

March 15, 2021

Photo ID: 0096 JW

JLS-21 Area

November 19, 2020

Photo ID: 09:30:05 HC
Photo ID: 09:30:12 HC

JLS-21

October 27, 2020

Photo ID: 11:45:02 JS

JLS-21 Area

November 19, 2020

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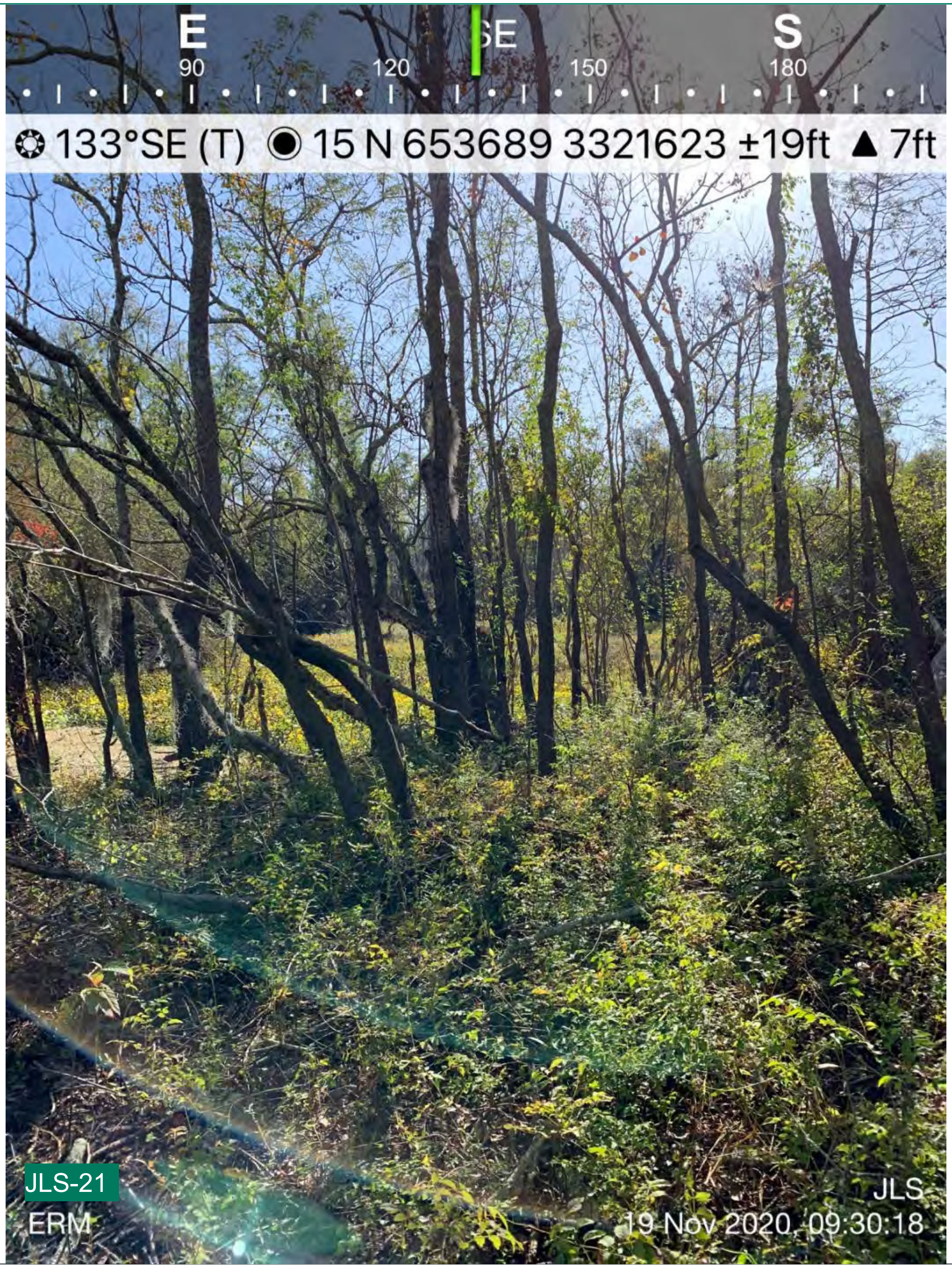

JLS-21 Area

November 19, 2020

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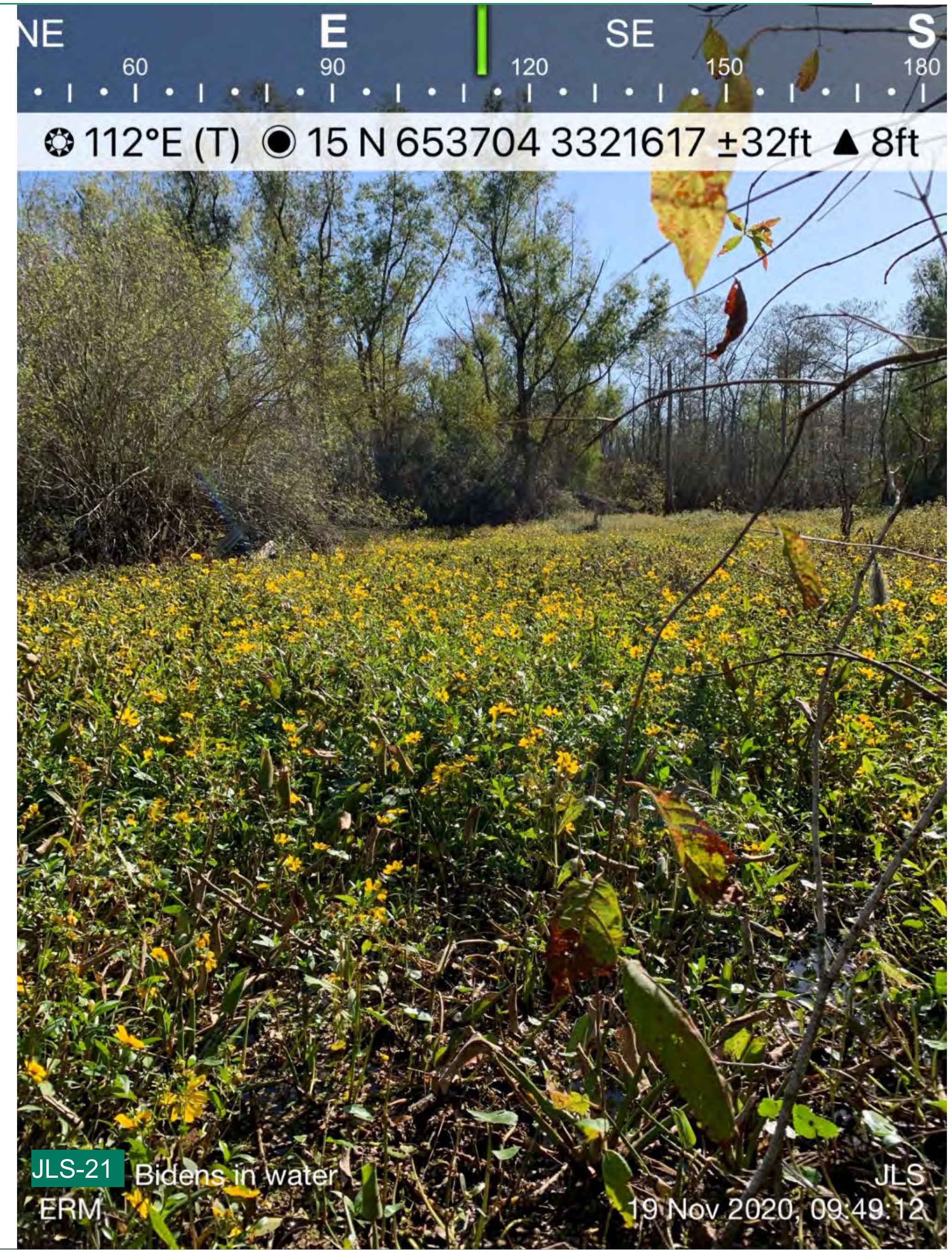

JLS-21 Area

November 19, 2020

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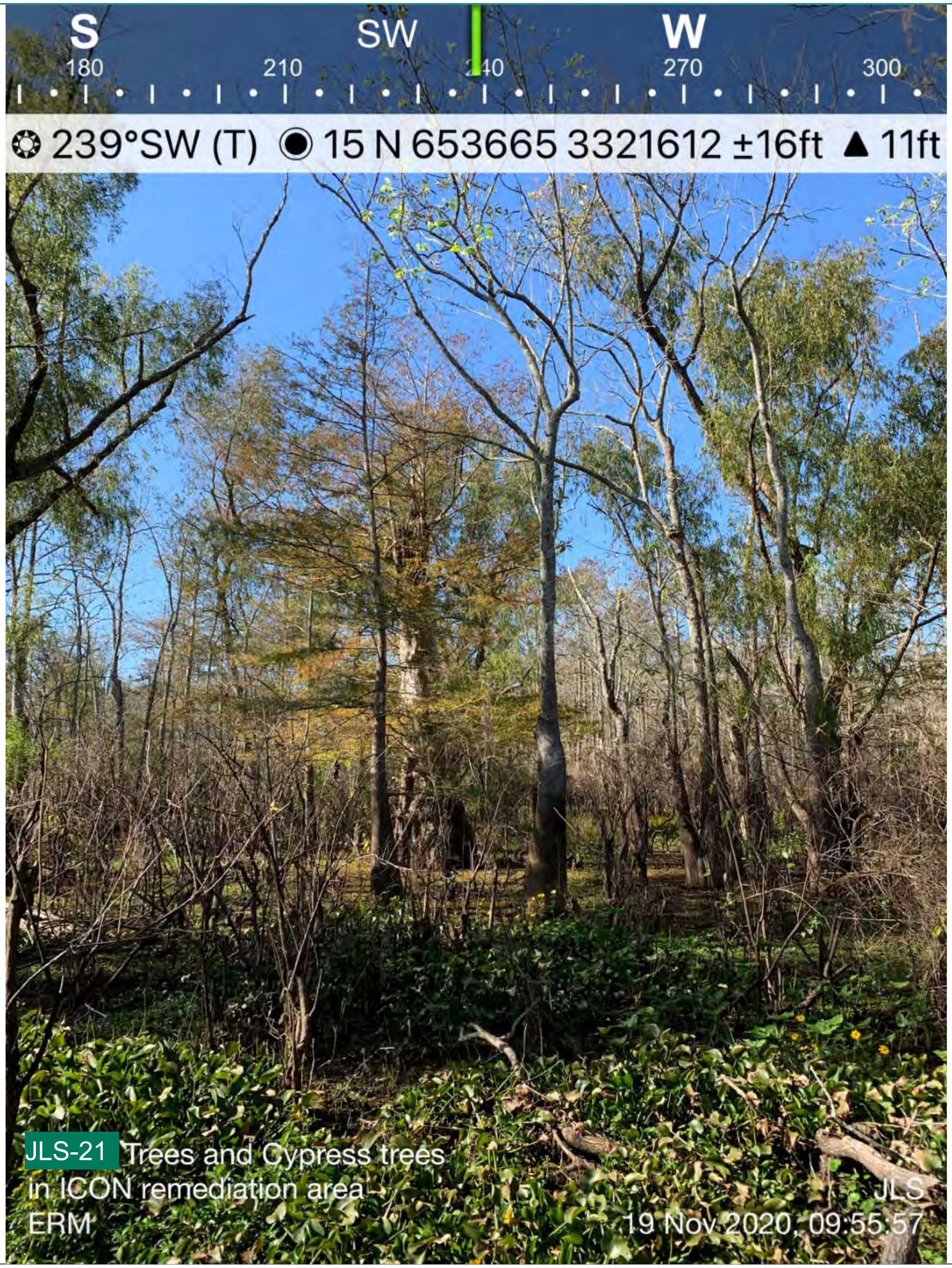

JLS-21 Area

November 19, 2020

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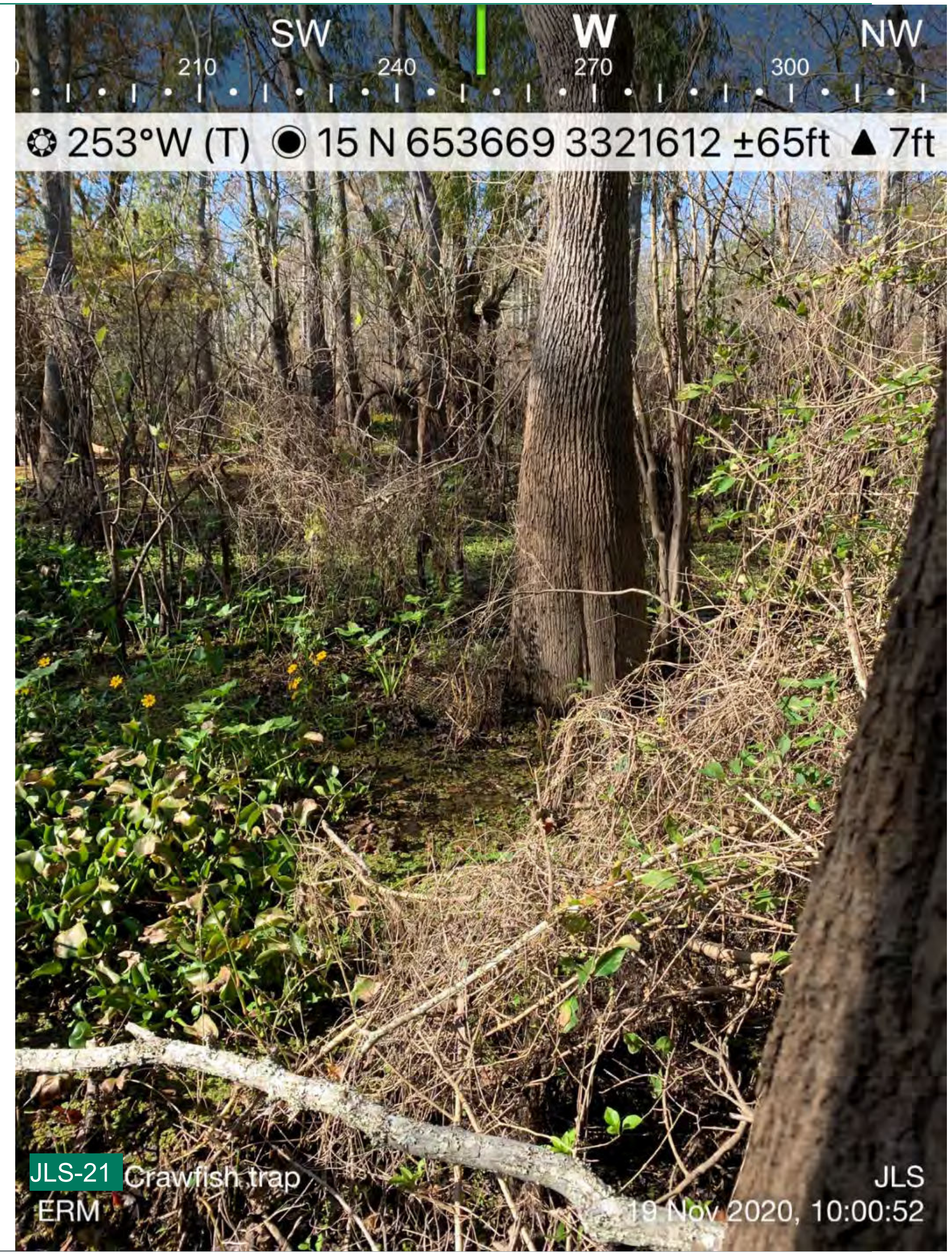


JLS-21 Area

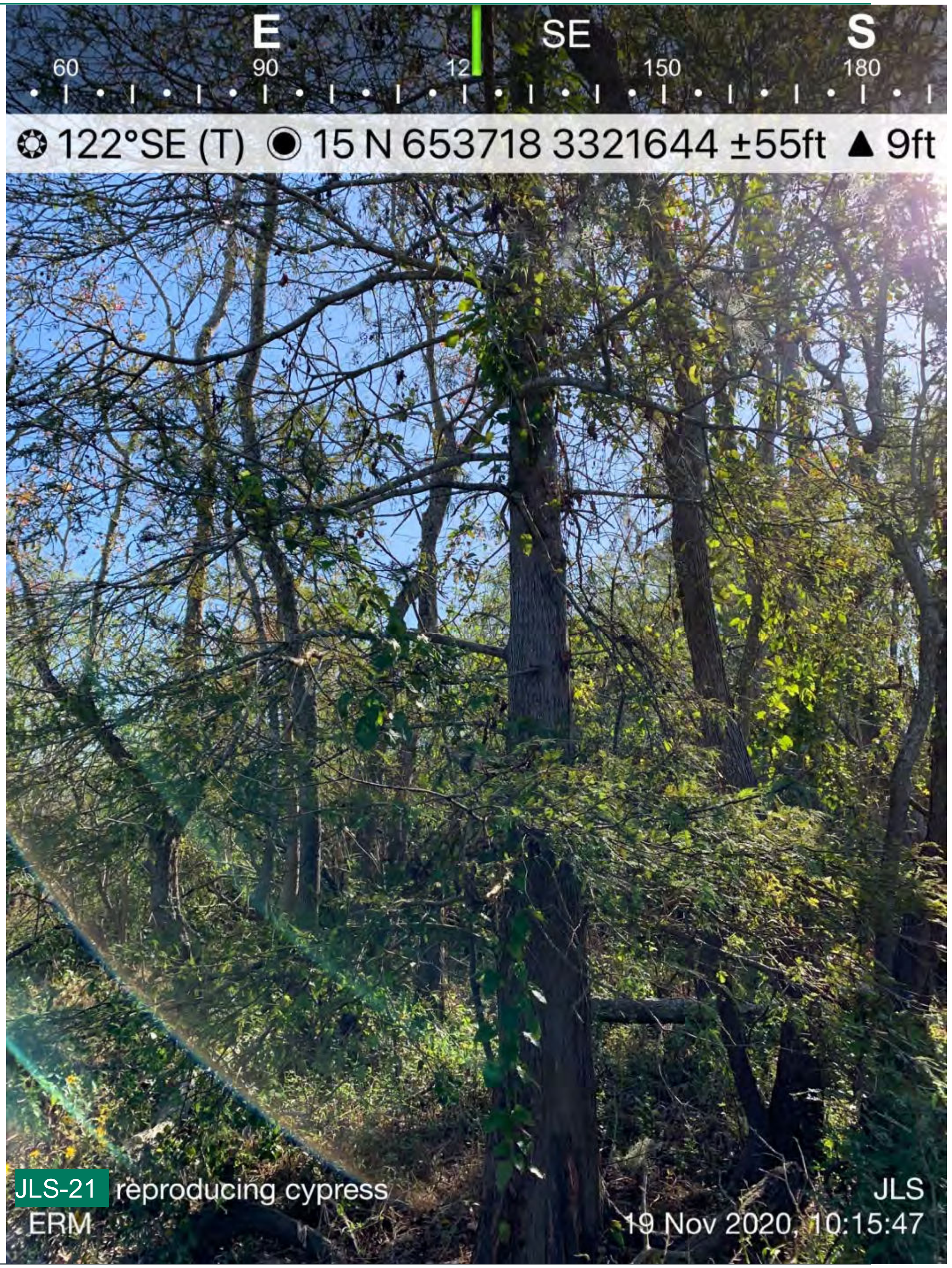
November 19, 2020

Photo ID: 10:06:13 HC
Photo ID: 10:07:49 HC

JLS-21 Area

November 19, 2020

Photo ID: 10:09:07 HC
Photo ID: 10:15:47 HC



Vegetation in North-South Canal Area, JLS-3, and Reference Area

Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.

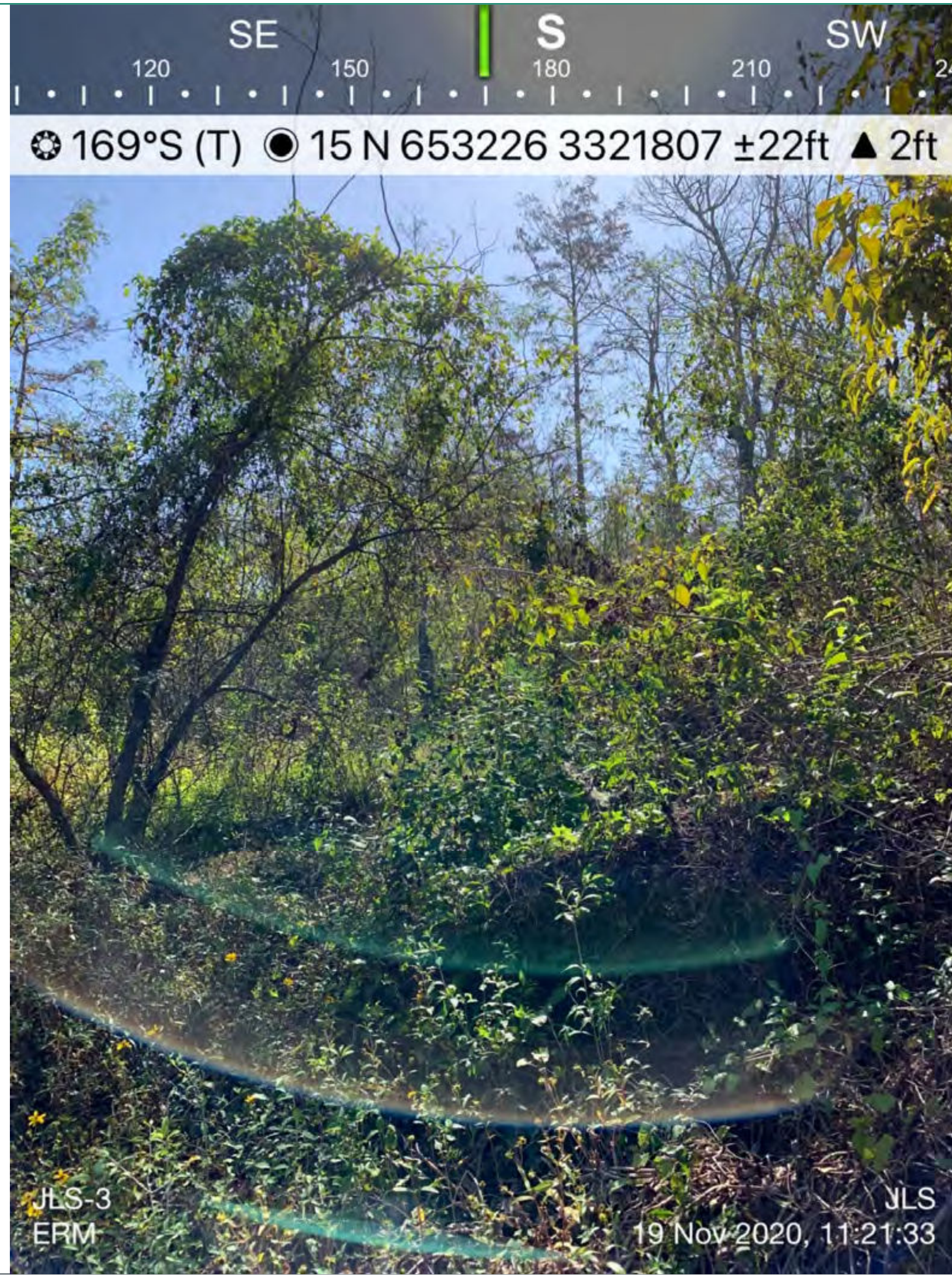
Bayou Pigeon Oil & Gas Field

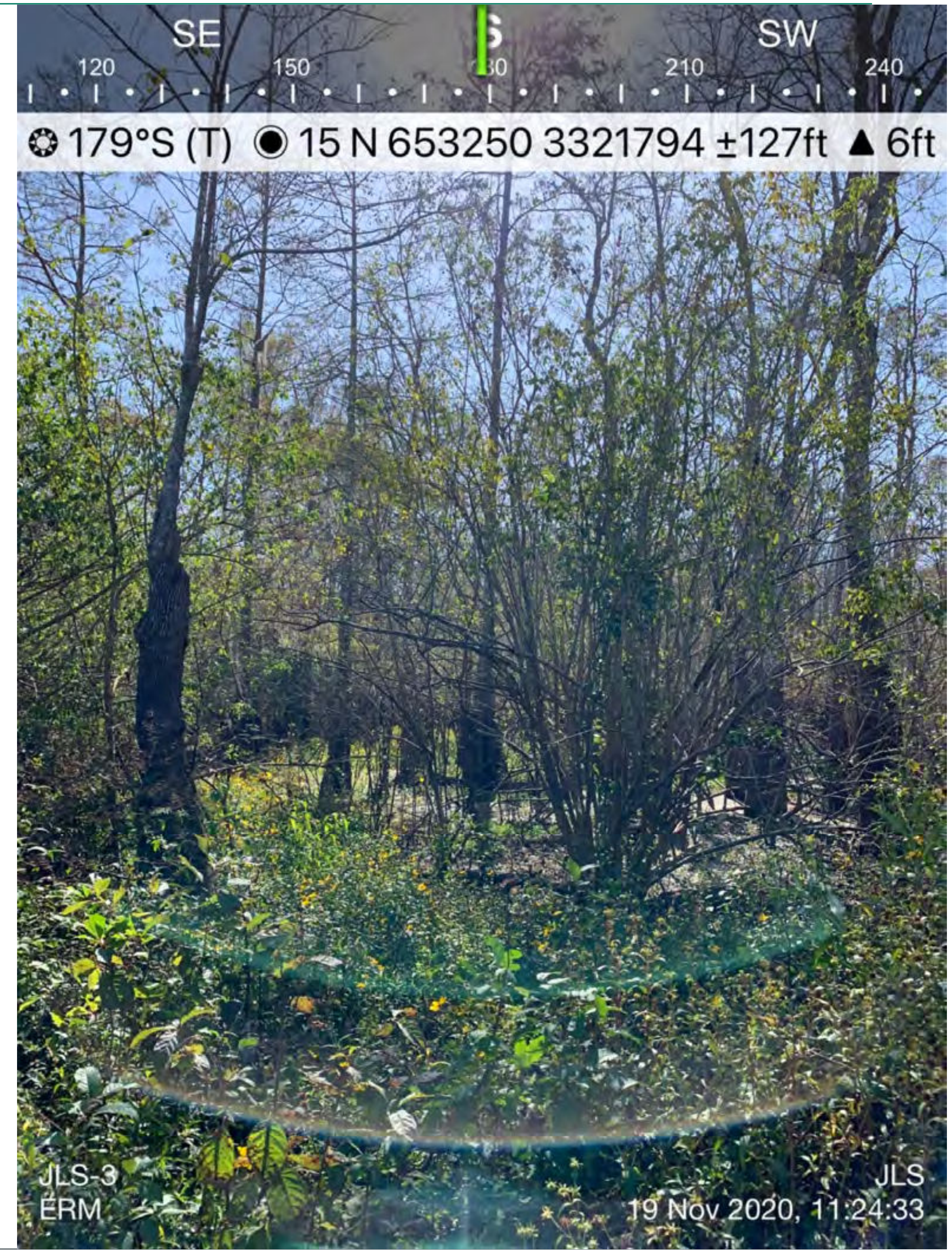
Iberia Parish, Louisiana

JLS-3 Area

November 19, 2020

Photo ID: 11:21:33 HC
Photo ID: 11:24:33 HC

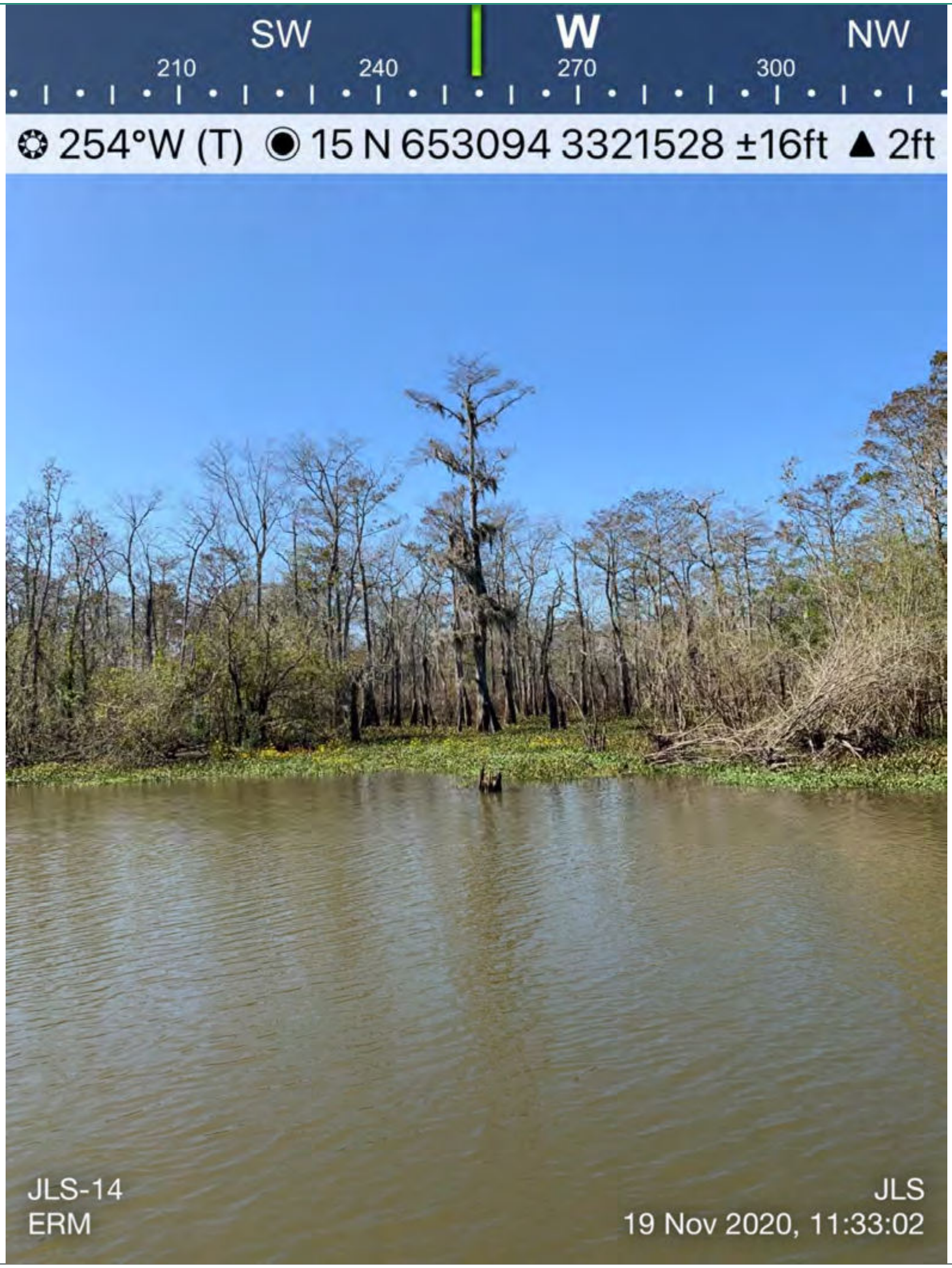


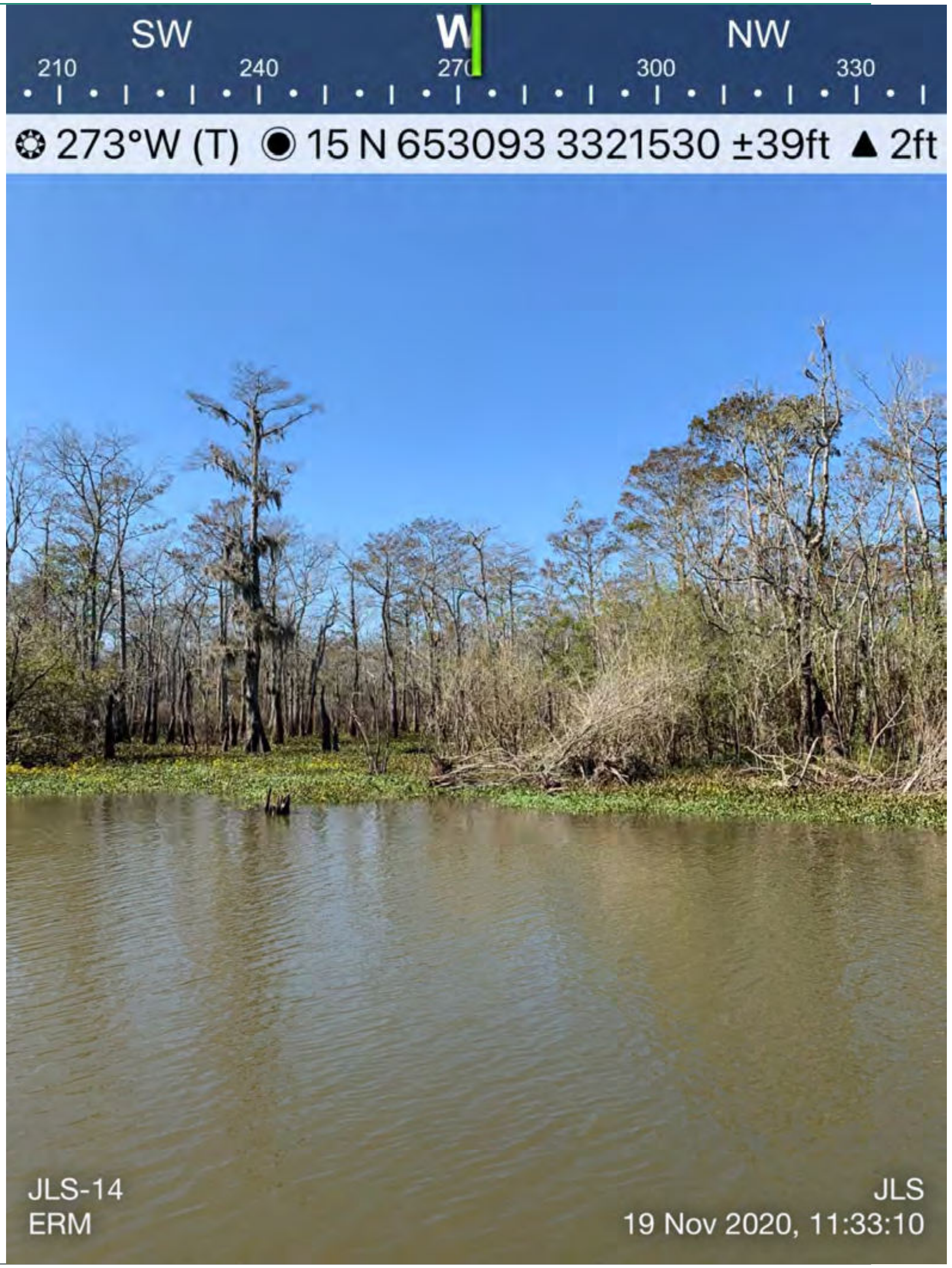


JLS-14 Area

November 19, 2020

Photo ID: 11:33:02 HC
Photo ID: 11:33:10 HC

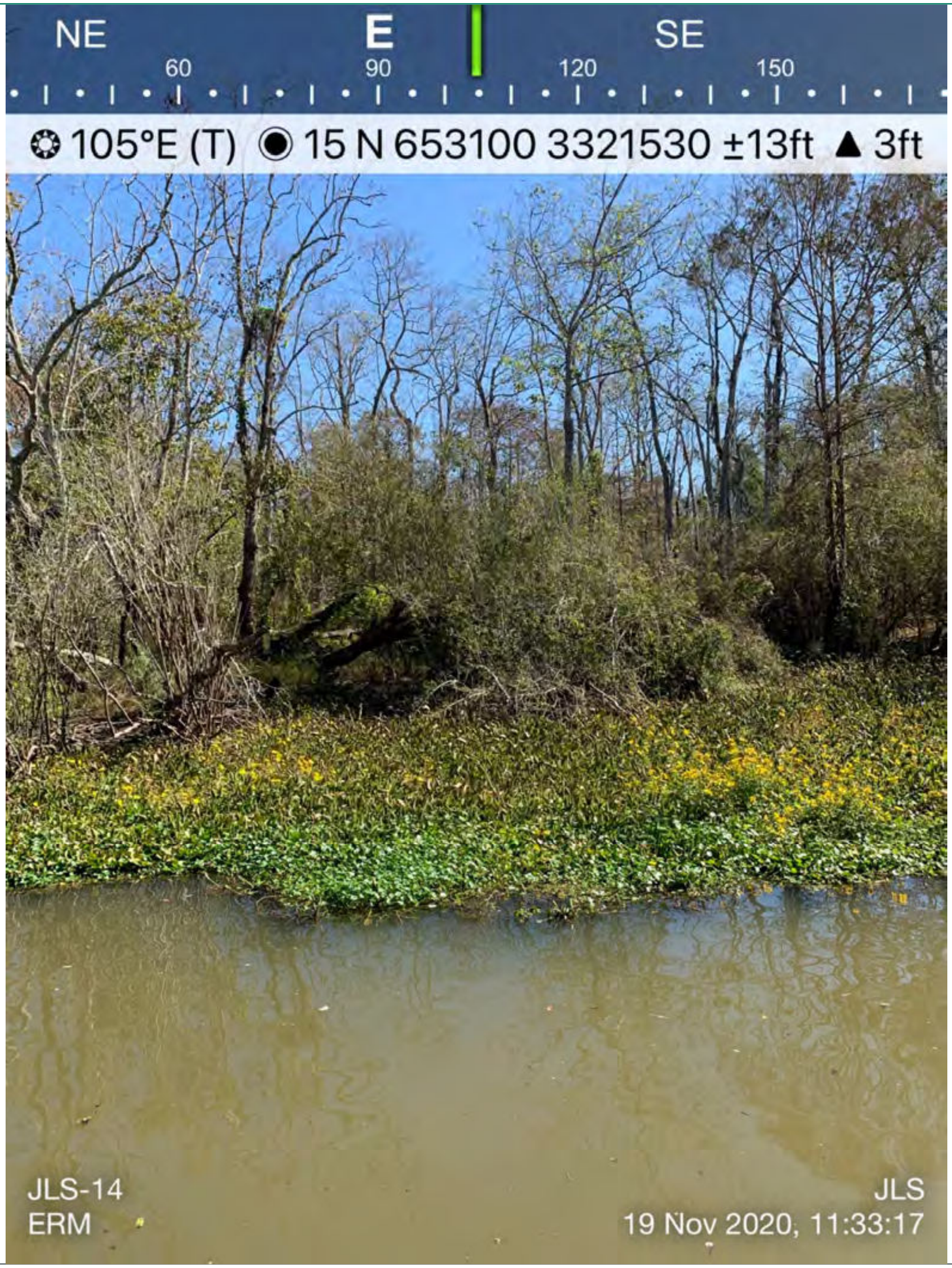


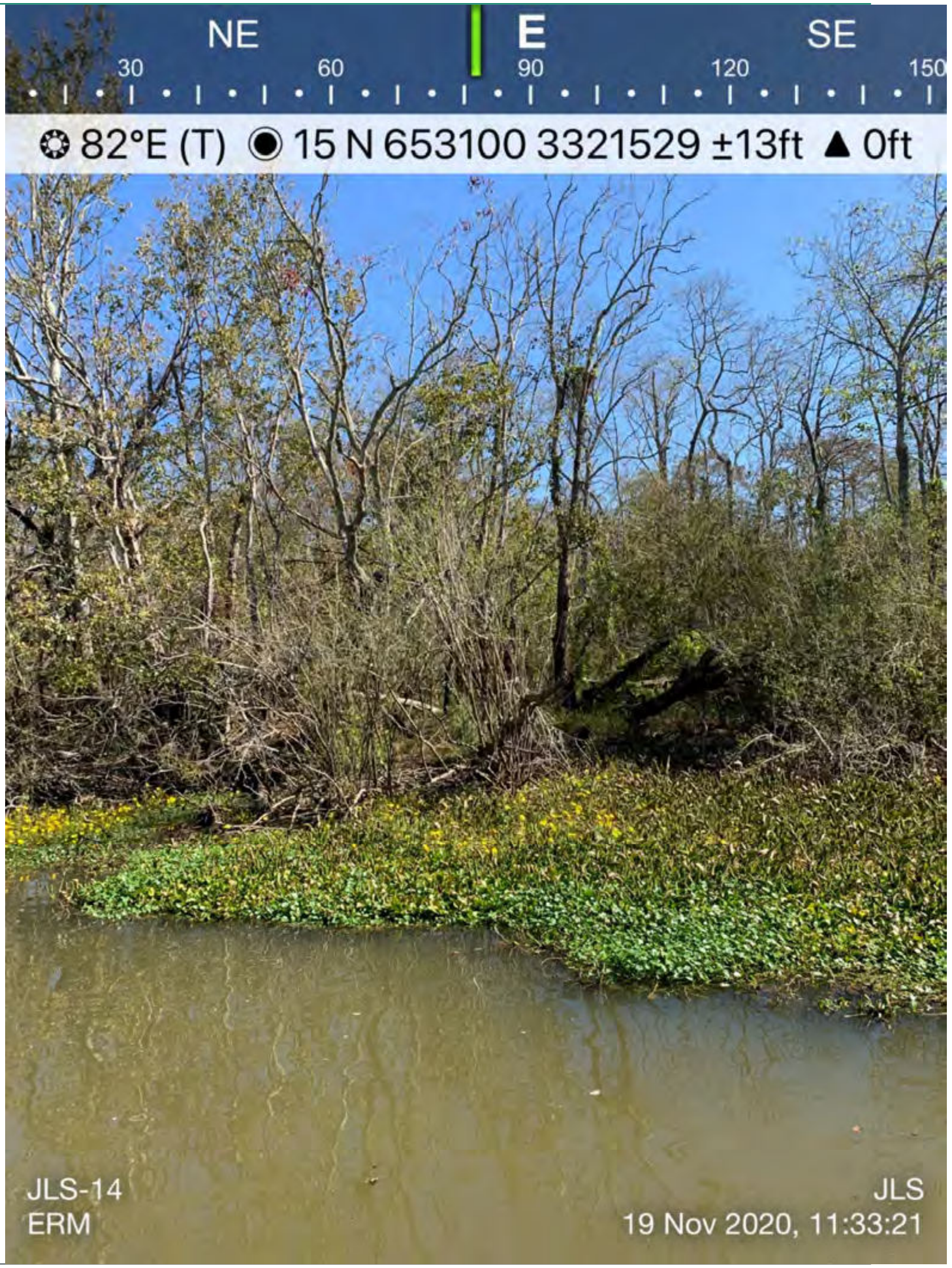


JLS-14 Area

November 19, 2020

Photo ID: 11:33:17 HC
Photo ID: 11:33:21 HC

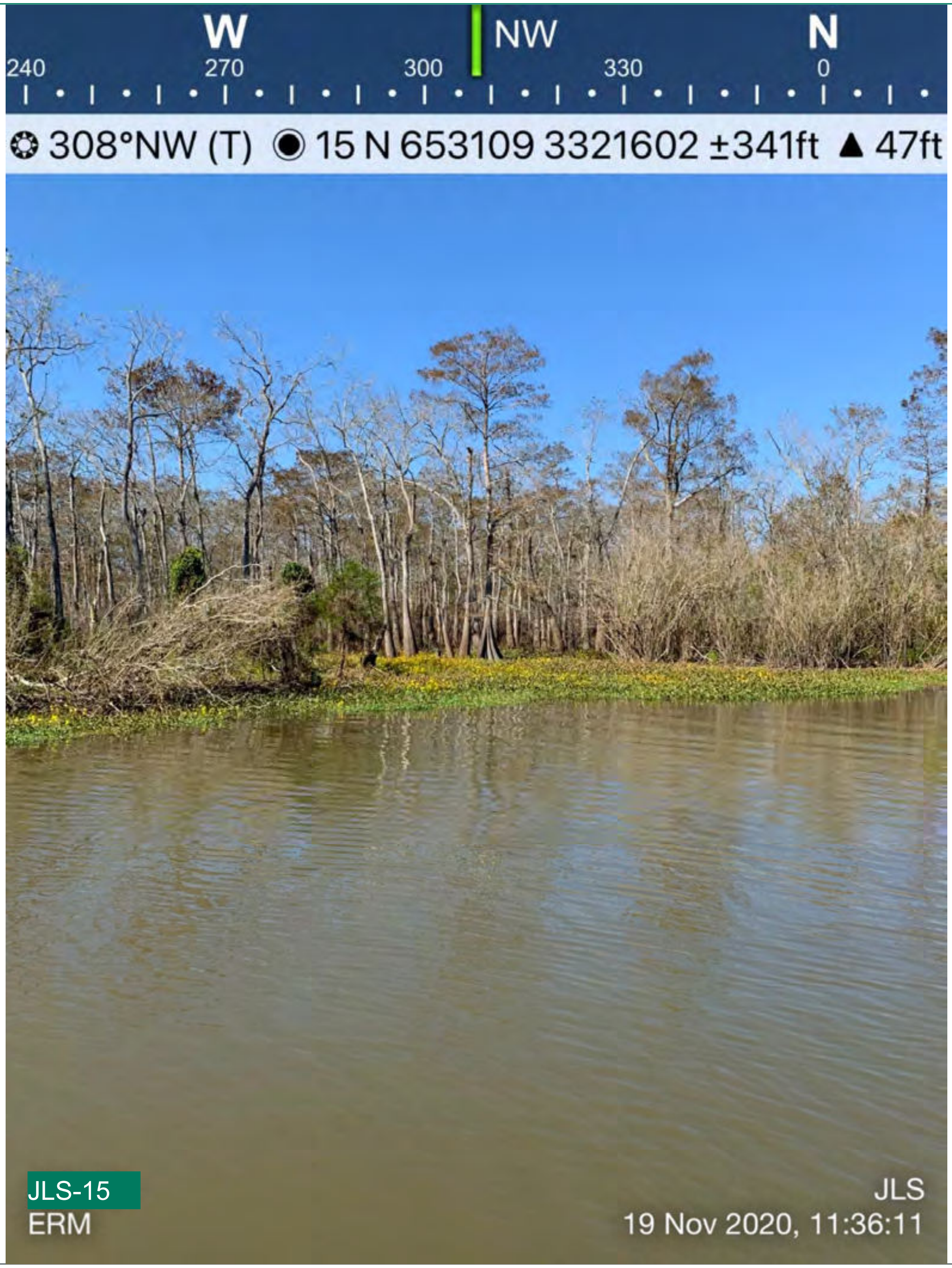


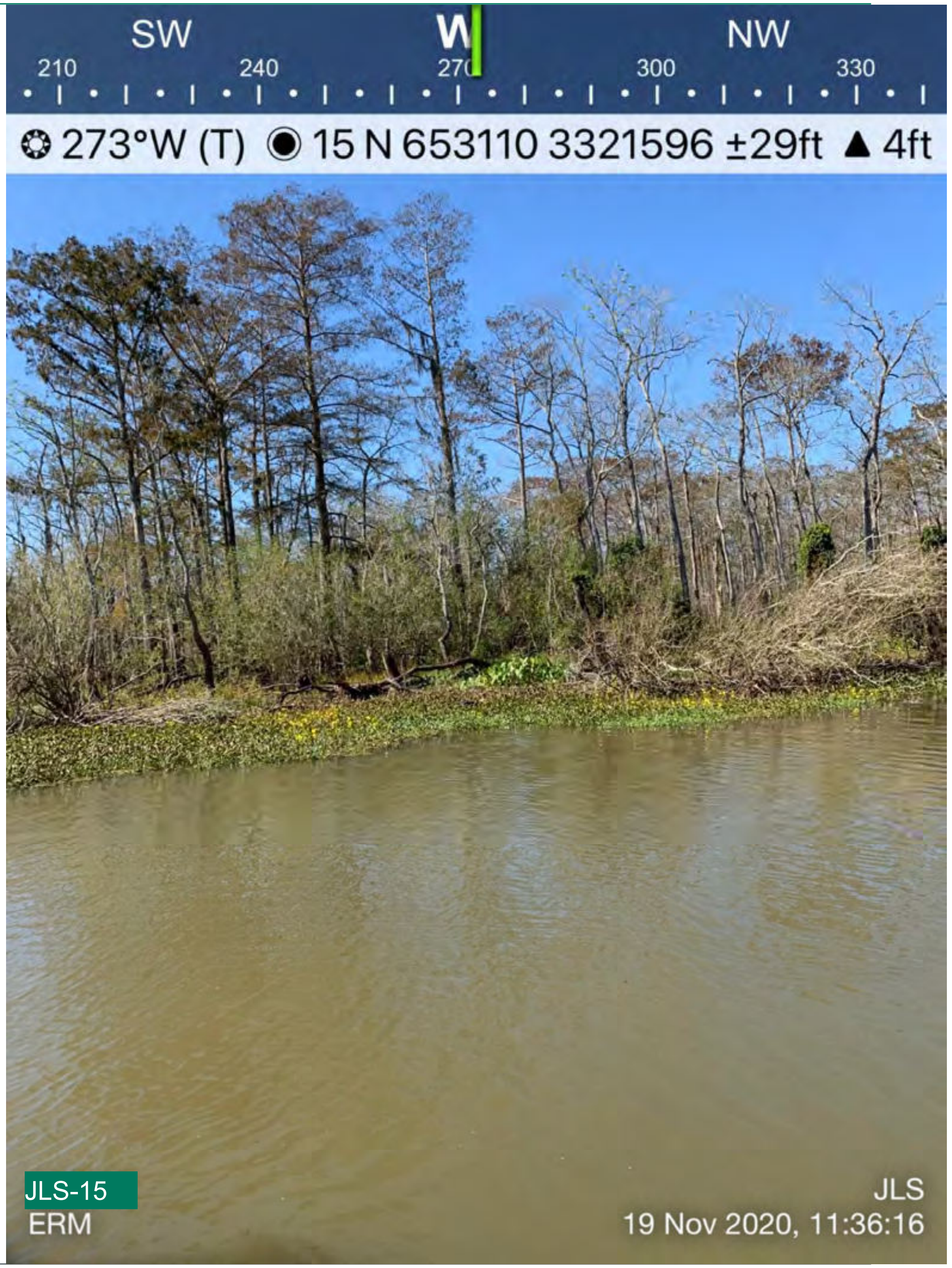


JLS-15 Area

November 19, 202

Photo ID: 11:36:11 HC
Photo ID: 11:36:16 HC





JLS-15

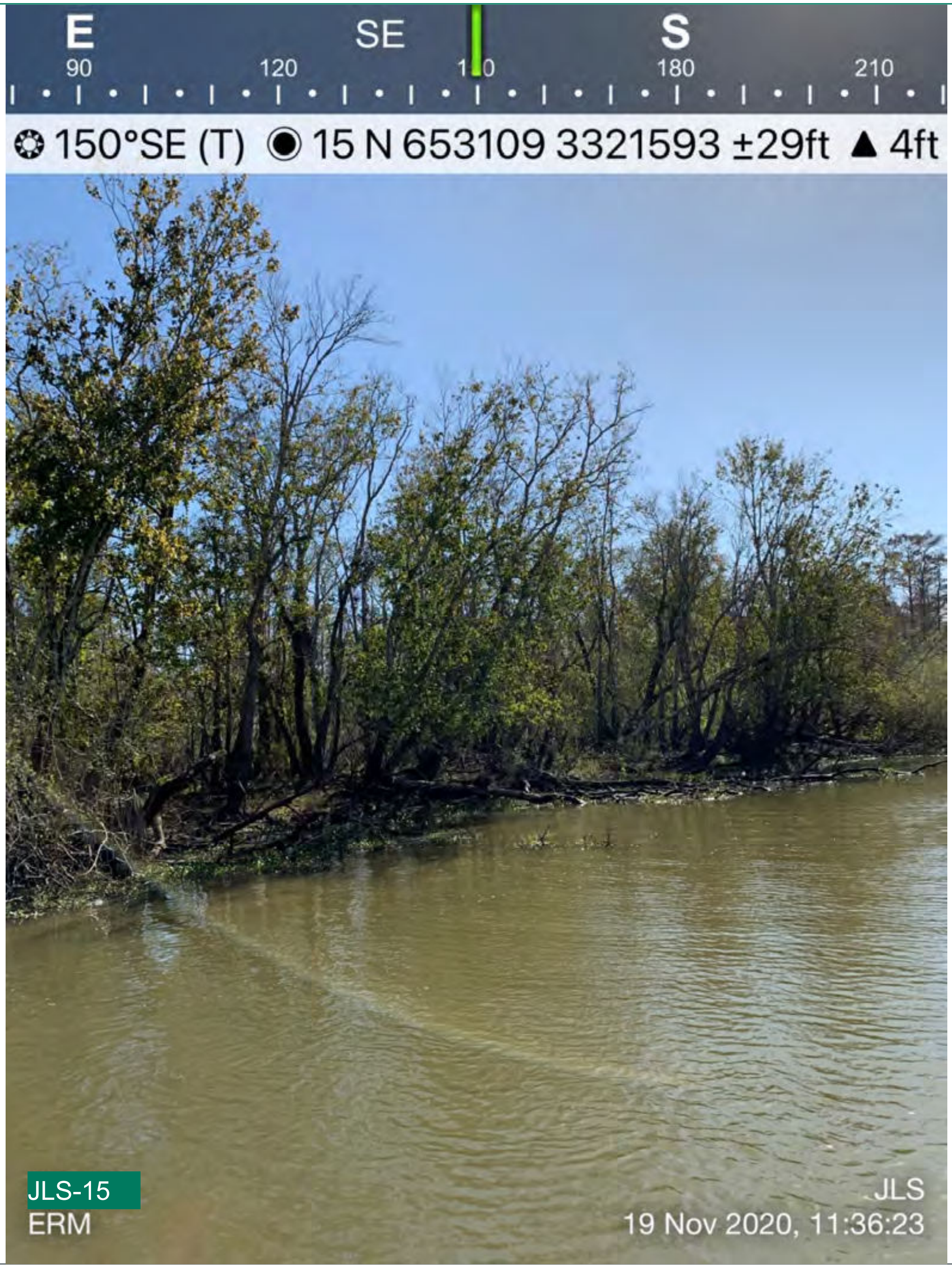
March 15, 2021

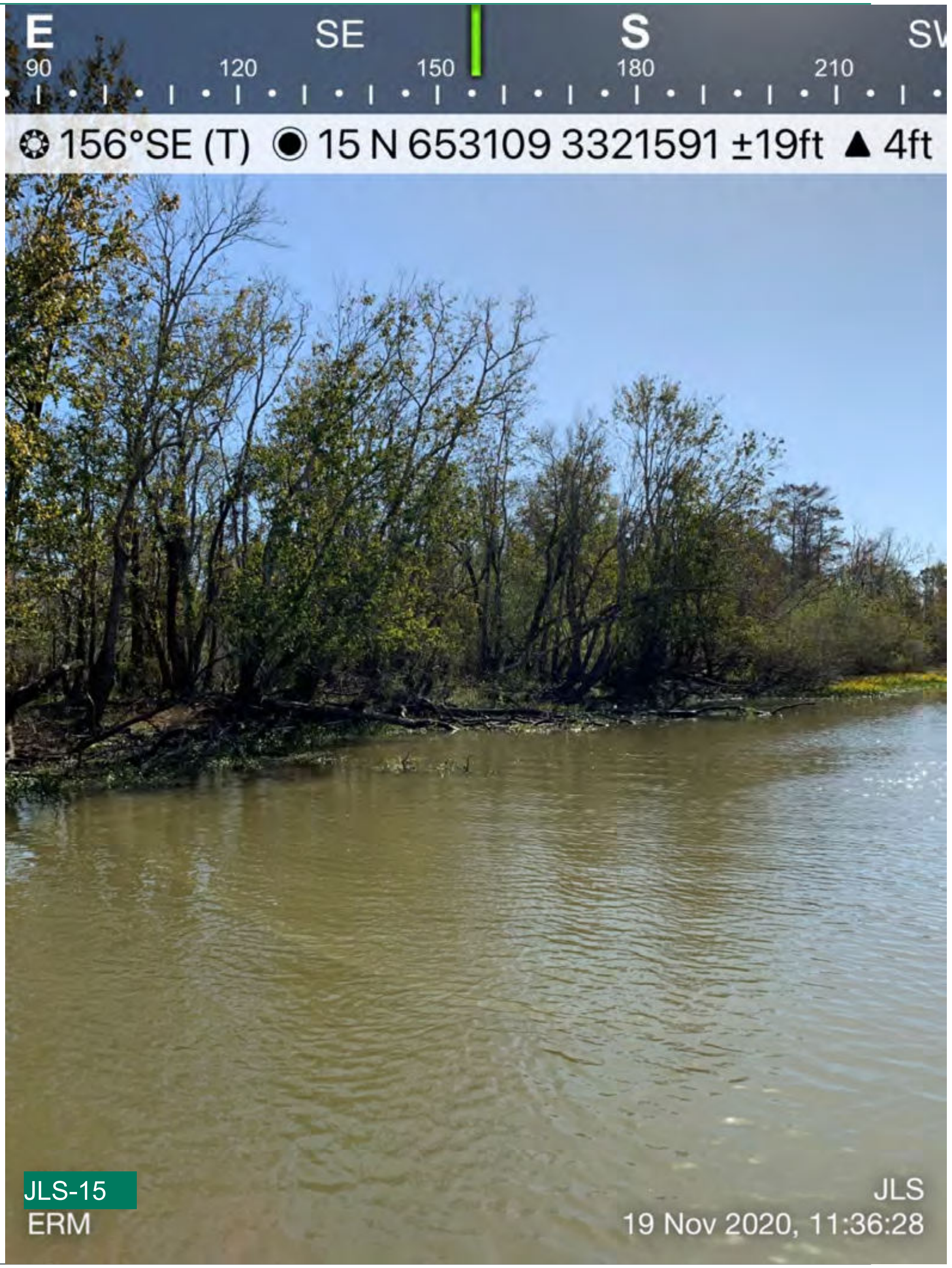
Photo ID: 0111 JW

JLS-15 Area

November 19, 2020

Photo ID: 11:36:23 HC
Photo ID: 11:36:28 HC





JLS-15 Area

November 19, 2020

Photo ID: 11:44:00 HC

JLS-15 Area

November 19, 2020

Photo ID: 11:44:06 HC
Photo ID: 11:45:28 HC

JLS-15 Area

November 19, 2020

Photo ID: 11:45:32 HC

Cypress Reference Area

March 15, 2021

Photo ID: 0115 JW

Plant Growth and Reproduction

Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.

Bayou Pigeon Oil & Gas Field

Iberia Parish, Louisiana

JLS-11

Butterweed

Packera glabella

March 15, 2021

Photo ID: 0021 JW

JLS-21

Whitestar

Ipomoea lacunosa

October 27, 2020

Photo ID: 09.26.09 JS
Photo ID: 09.26.14 JS

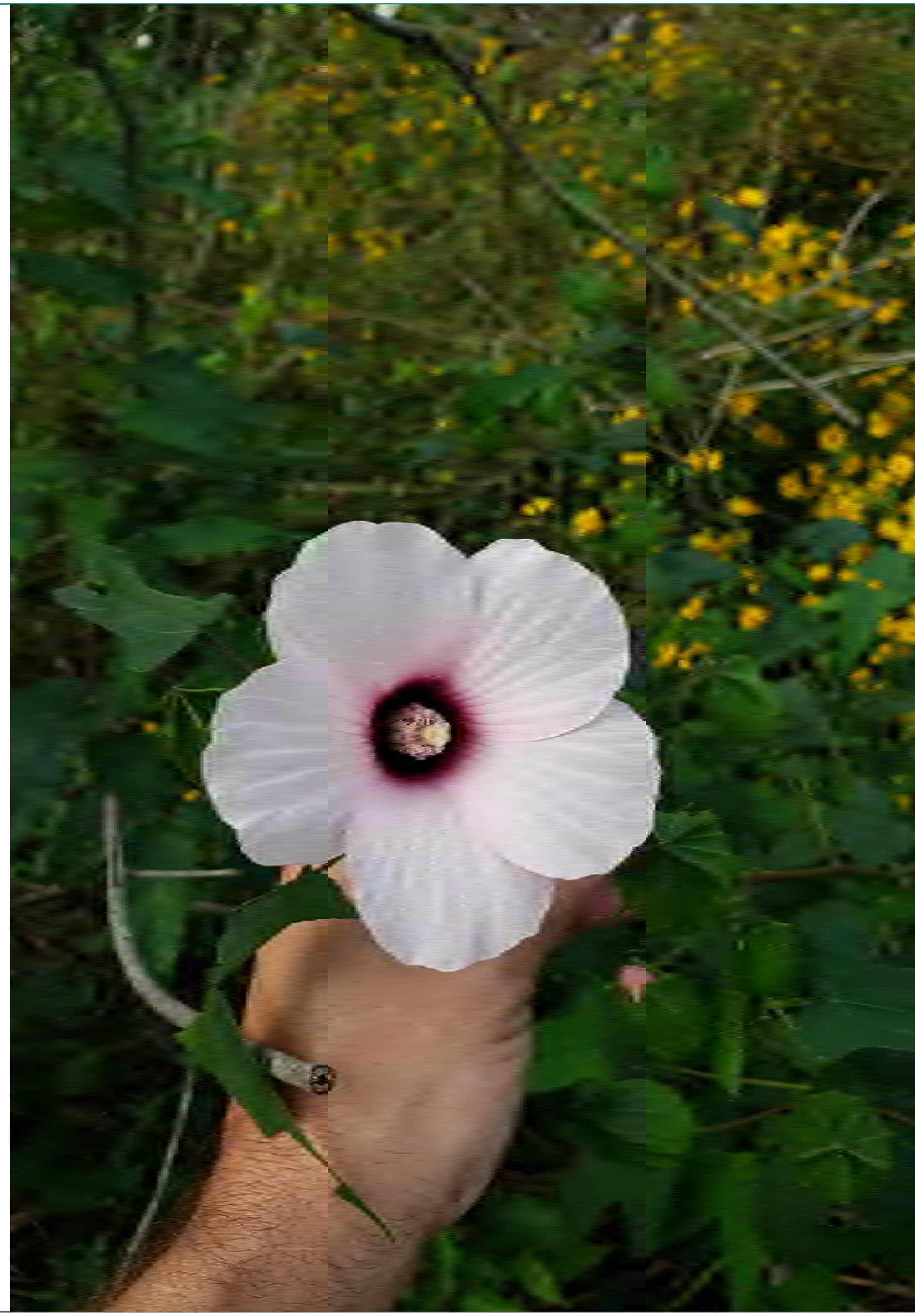
JLS-23

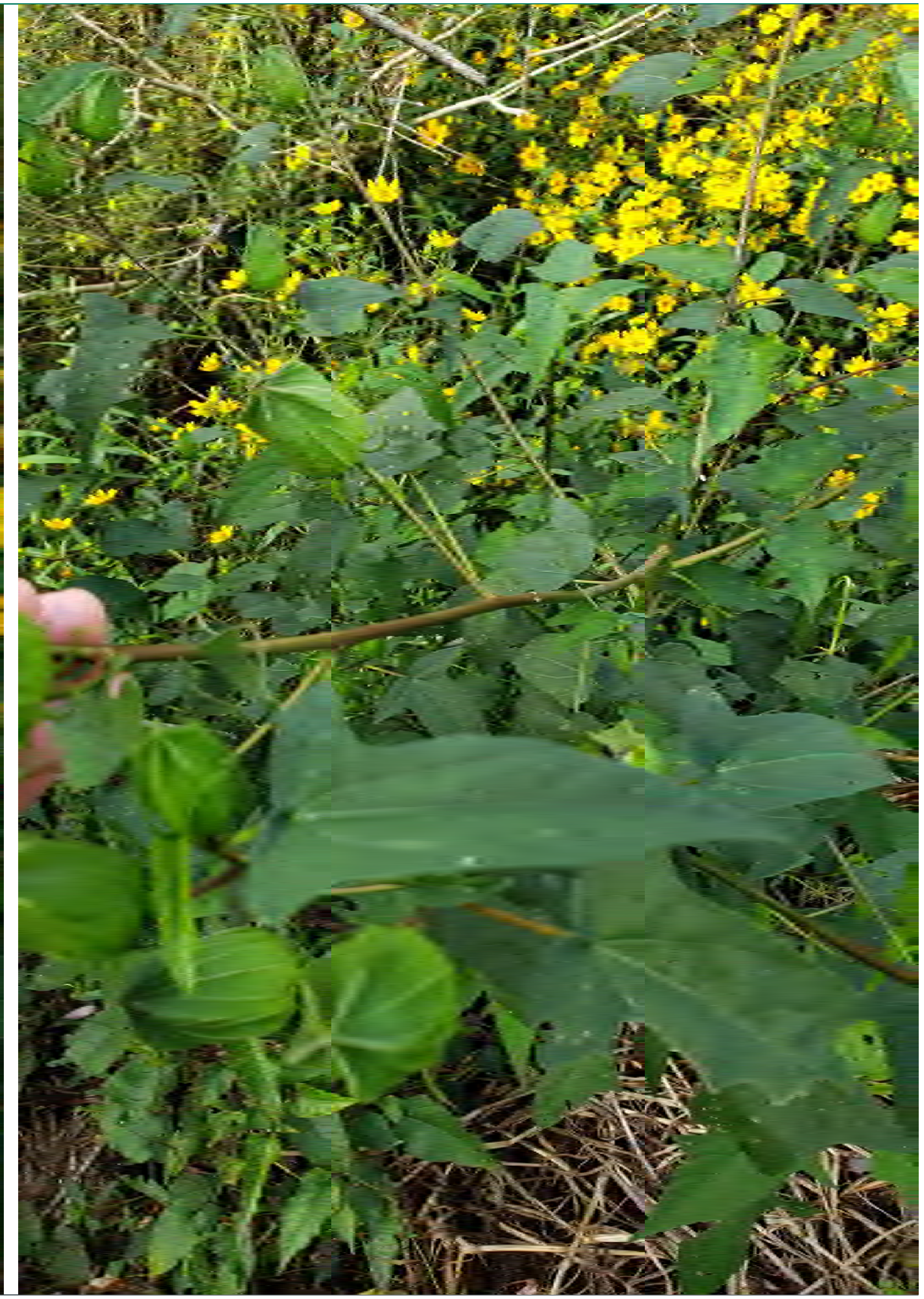
Rosemallow

Hibiscus lasiocarpos

October 27, 2020

Photo ID: 10.10.49 JS
Photo ID: 10.10.52 JS





JLS-10

Horsetail Paspalum

Paspalum fluitans

October 27, 2020

Photo ID: 10.36.02 JS
Photo ID: 10.36.05 JS

JLS-23

Annual Ragweed

Ambrosia artemisiifolia

March 15, 2021

Photo ID:12.53.25-1 JS
Photo ID: 12.53.30 JS

JLS-10

American Buckwheat Vine

Brunnichia ovata

July 29, 2020

Photo ID: Buckwheat vine JS

JLS-21

Aquatic Vegetation

March 4, 2021

Photo ID: 12.23.09-1 JS

JLS-21 Area

Southern Dewberry

Rubus trivialis

March 4, 2021

Photo ID: 12.26.20 JS

JLS-11

Eastern Swampprivet

Forestiera acuminata

March 4, 2021

Photo ID: 10.27.01-1 JS

Cypress Reference Area

Aquatic Vegetation

March 15, 2021

Photo ID: 14.17.01-1 JS

Cypress Reference Area

Planertree

Planera aquatica

March 15, 2021

Photo ID: 14.09.17-1 JW

Appendix B-2: Bald Cypress Observations

Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.

Bayou Pigeon Oil & Gas Field

Iberia Parish, Louisiana

Cypress Saplings

Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.

Bayou Pigeon Oil & Gas Field

Iberia Parish, Louisiana

Cypress Sapling

Cypress Trees Near Eastern Boundary Area Planned for Remediation by ICON

March 15, 2021

Photo ID: 0018 JW

Cypress Sapling

Cypress Trees Near Eastern Boundary Area Planned for Remediation by ICON

March 15, 2021

Photo ID: 0062 JW

Cypress Sapling

Cypress Trees Near Canal in Area Planned for Remediation by ICON

March 4, 2021

Photo ID: 12.00.16 JS

Cypress Sapling

Reference Area

March 15, 2021

Photo ID: 0146 JW

Small Cypress Trees

Jeanerette Lumber & Shingle Co., LLC v.
ConocoPhillips Company, et al.

Bayou Pigeon Oil & Gas Field

Iberia Parish, Louisiana

Small Cypress Tree

Cypress Trees Near Eastern Boundary Area Planned for Remediation by ICON

March 15, 2021

Photo ID: 0031 JW

Small Cypress Tree

Cypress Trees Near Eastern Boundary Area Planned for Remediation by ICON

March 15, 2021

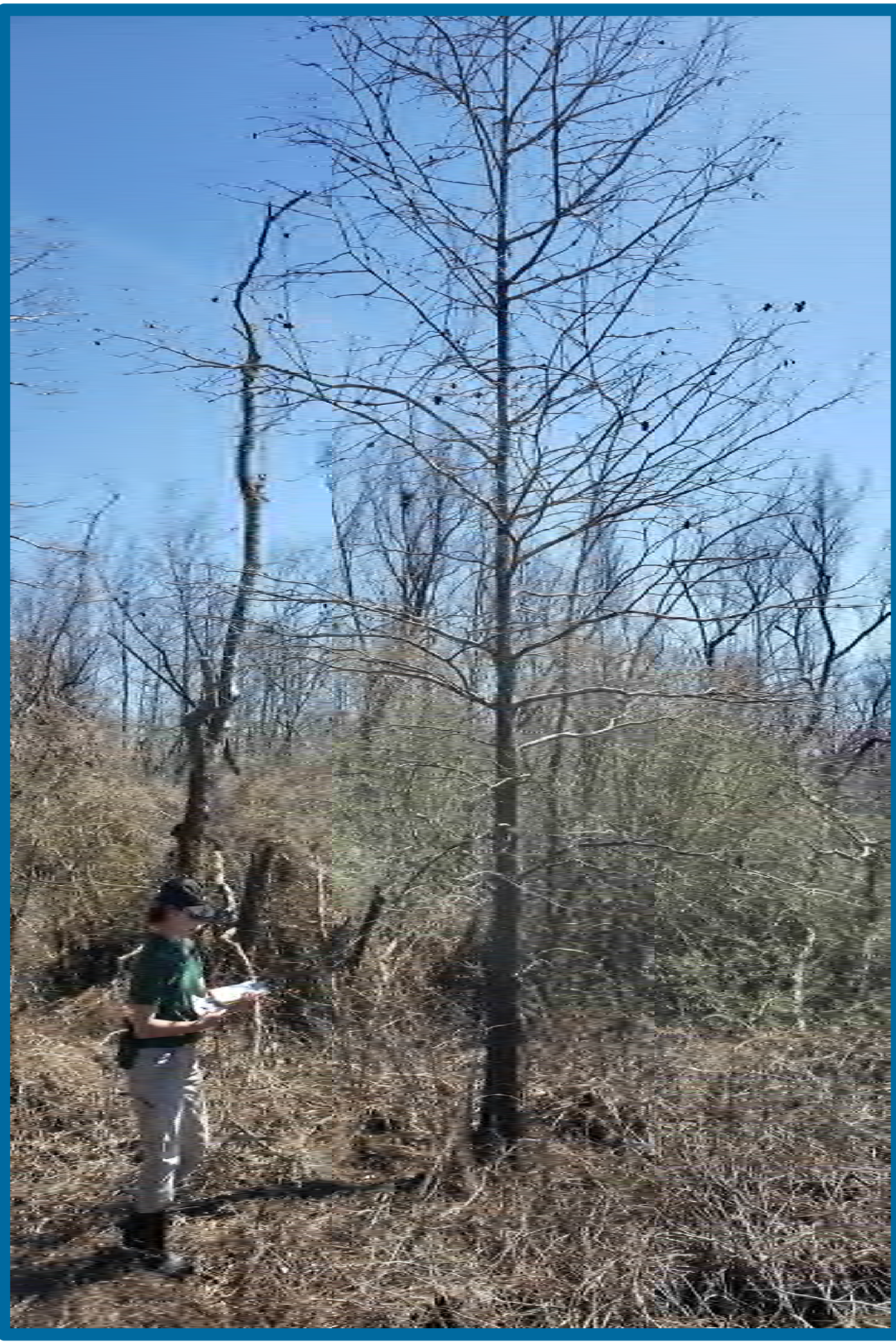
Photo ID: 0055 JW

Small Cypress Trees

Cypress Trees Near Canal in Area Planned for Remediation by ICON

March 4, 2021

Photo ID: 11.40.54 JS
Photo ID: 12.03.04 JS



Small Cypress Tree

Reference Area

March 15, 2021

Photo ID: 0144 JW

Small Cypress Tree

Reference Area

March 15, 2021

Photo ID: 0141 JW

Small Cypress Tree

Reference Area

March 15, 2021

Photo ID: 0136 JW

Medium Cypress Trees

Jeanerette Lumber & Shingle Co., LLC v.
ConocoPhillips Company, et al.

Bayou Pigeon Oil & Gas Field

Iberia Parish, Louisiana

Medium Cypress Tree

Cypress Trees Near Eastern Boundary Area Planned for Remediation by ICON

March 15, 2021

Photo ID: 0033 JW

Medium Cypress Tree

Cypress Trees Near Eastern Boundary Area Planned for Remediation by ICON

March 15, 2021

Photo ID: 0048 JW

Medium Cypress Tree

Cypress Trees Near Eastern Boundary Area Planned for Remediation by ICON

March 15, 2021

Photo ID: 0051 JW

Medium Cypress Trees

Cypress Trees Near Canal in Area Planned for Remediation by ICON

March 4, 2021

Photo ID: 11.32.27-1 JS
Photo ID: 11.36.17-1 JS

Medium Cypress Trees

Cypress Trees Near Canal in Area Planned for Remediation by ICON

March 4, 2021

Photo ID: 11.53.16 JS
Photo ID: 13.46.50 JS

Medium Cypress Tree

Reference Area

March 15, 2021

Photo ID: 0133 JW

Medium Cypress Tree

Reference Area

March 15, 2021

Photo ID: 0123 JW

Large Cypress Trees

Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.

Bayou Pigeon Oil & Gas Field

Iberia Parish, Louisiana

Large Cypress Tree

Cypress Trees Near Eastern Boundary Area Planned for Remediation by ICON

March 15, 2021

Photo ID: 0037 JW

Large Cypress Tree

Cypress Trees Near Eastern Boundary Area Planned for Remediation by ICON

March 15, 2021

Photo ID: 0047 JW

Large Cypress Tree

Cypress Trees Near Eastern Boundary Area Planned for Remediation by ICON

March 15, 2021

Photo ID: 0054 JW

Large Cypress Trees

Cypress Trees Near Canal in Area Planned for Remediation by ICON

March 4, 2021

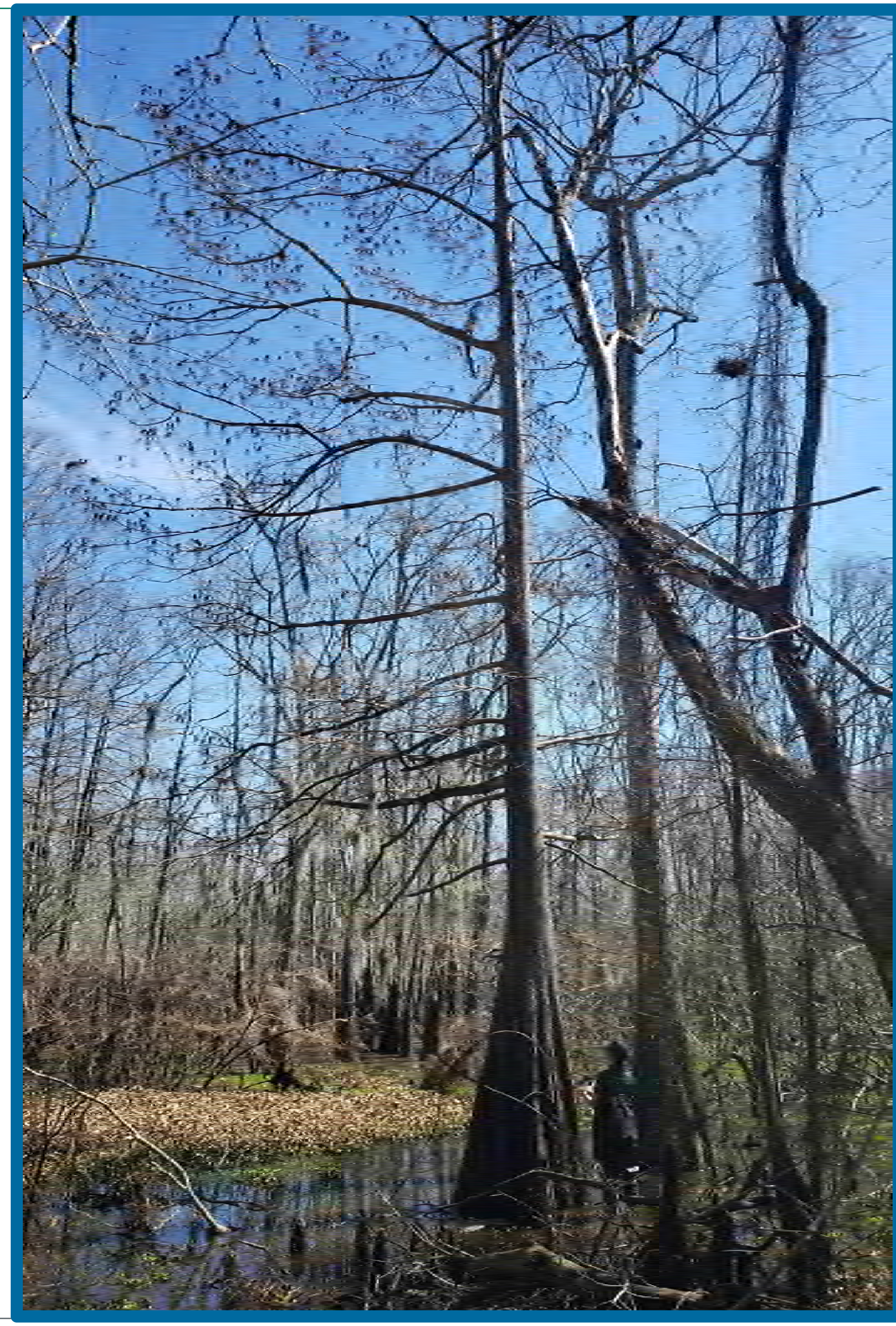
Photo ID: 12.47.56 JS
Photo ID: 12.54.07 JS

Large Cypress Trees

Cypress Trees Near Canal in Area Planned for Remediation by ICON

March 4, 2021

Photo ID: 13.33.40 JS



Large Cypress Tree

Reference Area

March 15, 2021

Photo ID: 0120 JW

Large Cypress Tree

Reference Area

March 15, 2021

Photo ID: 0130 JW

Appendix B-3: Wildlife Observations

Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.

Bayou Pigeon Oil & Gas Field

Iberia Parish, Louisiana

JLS-11

Paper Wasp

Subfamily Polistinae

July 30, 2020

Photo ID: Polistes sp. JS

JLS-23

Eastern Carpenter Bee

Xylocopa virginica

March 4, 2021

Photo ID: Eastern Carpenter JS

JLS-14 Area

Phaon Crescent

Phyciodes phaon

March 4, 2021

Photo ID: Phaon Crescent JS

JLS-23

Western Honeybee

Apis mellifera

March 4, 2021

Photo ID: Western Honeybee JS

JLS-14 Area

Southern Carpenter Bee

Xylocopa micans

March 4, 2021

Photo ID: Southern Carpenter JS

JLS-14 Area

Wasp

Order Hymenoptera

March 4, 2021

Photo ID: Wasp JS

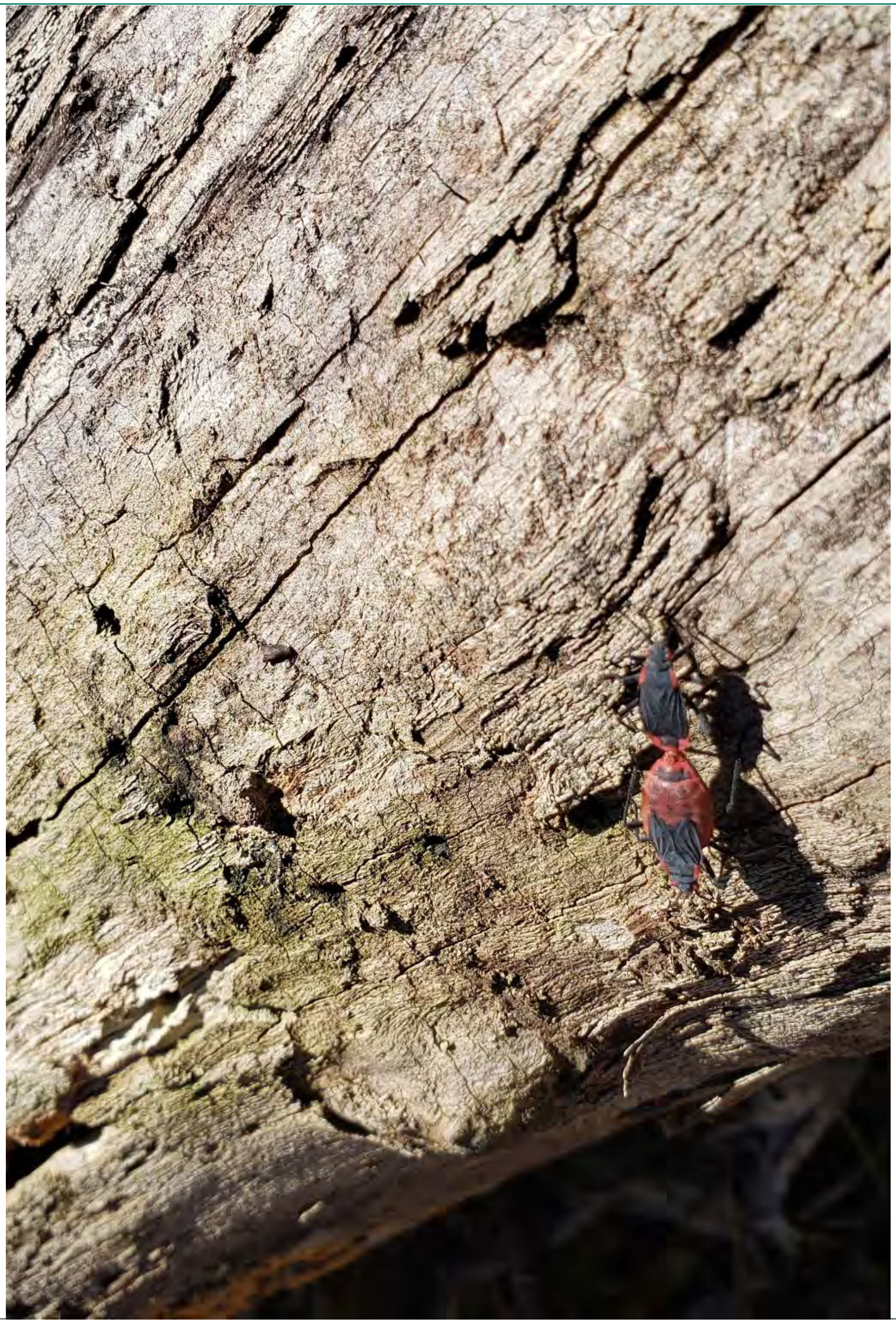
JLS-11

Red-shouldered Bug

Jadera haematoloma

March 4, 2021

Photo ID: 11.38.21-1 JS
Photo ID: 11.38.31-1 JS



JLS-21 Area

Six-Spotted Fishing Spider

Dolomedes triton

March 4, 2021

Photo ID: 12.47.08 JS

JLS-14 Area

Apple Snail

Pomacea maculata

March 4, 2021

Photo ID: 13.43.26 JS

JLS-11 Area

Snail

Class Gastropoda

March 15, 2021

Photo ID: 11.46.43 JS

JLS-12

American Lady

Vanessa virginiensis

March 4, 2021

Photo ID: American Lady JS

JLS-23

Fishing Spider

Dolomedes sp.

March 15, 2021

Photo ID: 0075 JW

JLS-11

Dragonfly

Infraorder Anisoptera

March 4, 2021

Photo ID: Dragonfly JS

JLS-12 Area

Eastern Pondhawk

Erythemis simplicicollis

March 15, 2021

Photo ID: 0059 JW

JLS-11

Crayfish claw

Superfamily Astacoidea

March 4, 2021

Photo ID: 12.25.27 JS

JLS-12 Area

Crayfish tower

Superfamily Astacoidea

March 15, 2021

Photo ID: 0060 JW

JLS-21

Blanchard's Cricket Frog

Acris blanchardi

March 4, 2021

Photo ID: 12.24.12 JS
Photo ID: 12.24.15 JS

JLS-21

Blanchard's Cricket Frog

Acris blanchardi

March 4, 2021

Photo ID: 12.24.42 JS

JLS-11 Area

Blanchard's Cricket Frog

Acris blanchardi

March 15, 2021

Photo ID: 0043 JW

Cypress Reference Area

Green Tree Frog

Dryophytes cinereus

March 15, 2021

Photo ID: 14.14.21-1 JS

JLS-11 Area

Western Ribbon Snake

Thamnophis proximus

March 15, 2021

Photo ID: 8916 JS

JLS-14 Area

Green Anole

Anolis carolinensis

March 4, 2021

Photo ID: Green Anole JS

JLS-23

Green Anole
Anolis carolinensis

March 15, 2021

Photo ID: 0092 JW

JLS-12 Area

Nest

March 4, 2021

Photo ID: Nest JS

JLS-12 Area

Carolina Chickadee

Poecile carolinensis

March 4, 2021

Photo ID: Carolina Chickadee JS

JLS-22 Area

Hermit Thrush

Catharus guttatus

March 4, 2021

Photo ID: Hermit Thrush JS

JLS-22 Area

American Robin

Turdus migratorius

March 4, 2021

Photo ID: American robin JS

JLS-23 Area

Orange-crowned Warbler

Leiothlypis celata

March 4, 2021

Photo ID: Orange-crowned JS

JLS-11

White-throated Sparrow

Zonotrichia albicollis

March 15, 2021

Photo ID: 8927 JS

JLS-11

Yellow-rumped Warbler

Setophaga coronata

March 4, 2021

Photo ID: Yellow-rumped JS

JLS-12 Area

Northern Cardinal

Cardinalis cardinalis

March 4, 2021

Photo ID: Northern Cardinal JS

Entrance Canal

Pileated Woodpecker

Dryocopus pileatus

March 4, 2021

Photo ID: Pileated Woodpecker JS

JLS-21 Area

Common Grackle

Quiscalus quiscula

March 4, 2021

Photo ID: Common Grackle JS

JLS-12

Black-crowned Night Heron

Nycticorax nycticorax

October 27, 2020

Photo ID: Black-crowned JS

Canal

Great Egret

Ardea alba

March 4, 2021

Photo ID: Great Egret JS

Overhead

Swallow-tailed Kite

Elanoides forficatus

July 29, 2020

Photo ID: Swallow-tailed Kite JS

Overhead

Turkey Vulture

Cathartes aura

March 4, 2021

Photo ID: Turkey Vulture JS

Overhead

Bald Eagle (Immature)

Haliaeetus leucocephalus

March 4, 2021

Photo ID: Bald Eagle JS

JLS-11

Barred Owl

Strix varia

March 15, 2021

Photo ID: 8921 JS

JLS-22 Area

Eastern Grey Squirrel

Sciurus carolinensis

March 4, 2021

Photo ID: Eastern Grey Squirrel JS

APPENDIX C FIELD NOTES

April 9, 2021

Location JLS Date 11/19/2027

Project / Client 0519829

JLS-2, -11, -1, -13, -17

-15, -3

8:30 Meet at dock

Helen Connelly

Angela Laverto

Dave Angle

Patrick Ritchie

Javon Jones

Jesse Stevenson > Graphic

Jeff Woodbury

Drone - 2 employees

Johnny Carter

9:00 Leave landing

several

Great blue herons flying

Snowy egrets flying

Hawk on tree top

Bayou Pigeon we

are taking 's

about 5' deep

Bald eagle fly over

28

Location JLS Date 11/19/20

Project / Client 0519829

9:30 at JLS 1

Veg survey from water edge inshore ~30'

At water's edge

4 photos at JLS 1

water hycintch

bidens

salvinia

alligator weed

saw alligator

~~periwinkles~~ pennywort

chinese tallow

spoil on shore-edge

bank lots of juvenile cypress

honey locust / thorns

peppervine

cypress saplings

3-4 yr old

Location JLS Date 11/19/20 29

Project / Client 0519829

tupelo gum tree

spanish moss

green ash

black willow

lichens

poison ivy

ballon vine

black willow

smartweed

spot flower (opposite leaf)

ground is moist

mature cypress

grasshopper

carex sp.

grape vine

johnson grass

red maple

photo honey locust

photo of bidens in water

2 photos cypress trees near JLS 1 (in remediation area)

30 Location JLS Date 11/19/20
Project / Client 0519829

10:00
photo of crawfish trap hanging on cypress

photo of crawfish trap
swamp privet
photo juvenile cypress tree
photo fungus at JLS-1
photo cypress JLS-1 cubaensis (cluster floresence)

10:15 photo of cypress reproducing

Water depth 7'

HL

Location JLS Date 11/19/20 31
Project / Client 0519829

10:20 Head to JLS-2
3 photos of Ang, Helen, Dave at JLS-2

We are at JLS-11

Ballon vine - reproducing
cypress trees - reproducing
Black willow
two anoles carolininus
grasshoppers
dragonflies
beetles
swamp privet
down trees
moist soil
chinese tallow
water hyacinth
alligator weed

HL

32 Location JLS Date 11/19/20
Project / Client 0519829

honey locust
opposite leaf loose-strife
bina bidens
grape vine
frog fruit
pepper vine
japenese vine
juvenile cypress
bees
fish
smartweed
red maple

3 photos of JLS-11

10:30 JLS-2
2 photos at JLS-2

JLS

Location JLS Date 11/19/20 33
Project / Client 0519829

JLS-2 vegetation
ants
water hyacinth
salvinia
red maple
mosquitoes
cypress trees · reproducing
bidens
black willow
ballon vine
grape vine
hybiscus
similar to JLS-11
down trees
rotting logs
tupelo
moths
3 photos near JLS-2
lizards
mosquitos
swamp mallow

JLS

34 Location JLS Date 11/19/20
Project / Client 0519829

photo across from
JLS-2
cypress swamp
4' deep water

11:05 JLS-13
photo from boat
water too low
to take boat in
jug line for
fish
jumping fish

11:15
JLS-10
one photo
soils are background
vegetation looks
similiar to JLS-1
and JLS-2

KL [signature]

Location JLS Date 11/19/20 35
Project / Client 0519829

11:20 Head to
JLS-3
one photo at JLS-3
hyacinth
bidens
honey locust
water hyacinth
swamp mallow
smartweed
chinese tallow
red maple
cypress
tupelo
salvinia
juvenile cypress
spiders
bees
photo of JLS-3
balloon vine
grape vine
mosquitos
down trees
wet soil
lizard's tail
KL [signature]

Location JLS Date 11/19/20

Project / Client 0519829

14 HC

11:30
Heading to JLS-15
4 photos JLS-14
both sides of
canal

JLS-15
4 photos both
sides of canal
cypress trees
Reported by Jeff
saw alligator
2 snakes - Keel scale
not Keel scale
small frog (tree)
mosquitos
raccoon feces
crawfish tower
lizards tail
1145
2 photos inland
@ JLS-15
cypress + tupelos
maples

[initials and signature]

Location VLS Date 11/19/20

Project / Client 0519829

soil very wet and
submerged
pennywort
2 photos cypress
snowy egret flying

[initials and signature]

46 Location 3/15/21 Date JLS

Project / Client 0519829

10:00 Safety Meeting
Jody Shughart, Carly
Sibilia, John Rodgers,
Calvin Barnhill, Richard
Kennedy, Jeff ~~Impact~~ Woodbury HC

10:30 Head to JLS-2
location

JLS-11 11:01
Northern Parula

(P) 2photos JLS-2 well location
1 in sediment
(P) 3 photo into forest
behind JLS-2
Jeff photo'd these

(P) cypress saplings
2 photos at
near JLS-11
20cm tall
.1 inch circumfer.

JL

Location JLS Date 3/15/21 47

Project / Client 0519829

crawfish claw
bees

2 photos of pollinators
near JLS-11

11:14 heading to edge of JLS-2
remed. area
(P) 3 photos of 4 on Helen
Walking into Canerva
edge of remed.
area
(P) W ribbon snake
2 photos
red bellied woodpecker

11:23 measure cypress submerged area
CBH at cypress
at edge of remed
area
.35" CBH
@ height 60"
27" water depth

JL

48 Location JLS Date 3-15-21

Project / Client 0519829

32" CBH
water depth
25"
cypress tree #2 @ Remed.
photos by Jeff area

Northern parula

cypress tree #3
CBH 41"
depth water 24"
photo by Jeff.

Red winged blackbird

cypress tree #4
CBH 56"
Water depth 13"
photo by Jeff

Bronze frog

Location JLS Date 3-15-21 49

Project / Client 0519829

11:30 AM
no observation
of leaf burn

cypress tree #5
CBH 26"
water depth 19"
photo by Jeff Woodbury

11:34 AM
tree #6
35" CBH
water depth 21"
photo by Jeff Wood.
photo by Jeff of

common grackle
red wasp
dragonflies

(P) Jeff photo of us
in submerged
tree #4 73" CBH
33.5" depth
photo Jeff

50 Location VLS Date 3/15/21

Project / Client 0519829

(P) photo: barred owl
Jody + Jeff (2)

~~gpt~~
2 photo cricket frog
Jeff ↑
2 Photos Jeff walking
photo
fishing spider

Northern flicker bird

American crow

(P) photo snails
photo walking

tree #7
83" CBH
water depth 30"
photo
by Jeff

Location: VLS Date 3/15/21 51

Project / Client 0519829

11:55 AM

tree #8
CBH: 53.5"
water depth: 25"

photo by Jeff
damselflies - Jeff
photo

tree #9 photo Jeff
CBH: 53"
water depth 29"

tree #10
photo: Jeff
CBH ~~53"~~ 35"
water depth 29"

tree #11
CBH 66"
wtr depth 32"

Northern cardinal

52 Location JLS Date 3/15/21
Project / Client 0519829

tree # 12 CBH 19"
water depth 25.5"
photo: Jeff

tree # 13
CBH 42"
water depth 26"

photo walking
2 photos green dragon fly

photo crawfish tower

photo red mushroom
(photo go Monmouth)
(Jeff)

Helen photo scat
for carly to ID

JL

Location JLS Date 3/15/21 53
Project / Client 0519829

white throated sparrow
12:15
Jeff photo
red shouldered beetles

12:30
JLS-23 veg. survey
2 lizard photos
juvenile cypress sapling
CBH .1"
Ⓟ ① no water depth
Jeff photo into water
at JLS-23
facing canal
② photos
then facing forest

2 photos Jeff of scat
1st 2" long owl pellets
2nd 1" long bobcat

JL

Project / Client 0519829

12:40 recorded by C + J
2 cypress sapling
photo: Jeff
CBH .1
no water

Jody + Carly 2 cypress
CBH that
I didn't record

12:45 Veg survey
GPS coordinate
JLS-23-V
3321798.62 N
653628.56 E
photo - 3 of us by
Jeff
butter weed - yellow top
Am. buckwheat vine
bald cypress
floating marsh pennywort
bidens

H L L

Project / Client 0519829

photo Jeff dark fishing spider
duckweed
salvinia
photo Jeff smilax / hempvine
photo Jeff ladies' eardrops
cypress sapling (P)
water hyacinth
Chinese tallow
red maple
water locust photo
dragonflies
photo red maple
common ragweed photo
ludwigea photo
leptocarpta 2 photos
Helen photo cypress bark high water debrided
cyperis sp. photo
swamp privet photo
anole
photo: water locust pods
milkweed
photo juvenile cypress recorded
photo red fox scat

H L L

56

Location JLS Date 3/15/21

Project / Client 0519829

red-tailed hawk
osprey

Jeff photo anole
Jeff photo frog

1:15 at JLS-1
2 photos by Jeff at
JLS-1 at sediment
2 photos behind JLS-1-V
3321641.84N 653729.05E @ Jeff
in forest
GPS coordinate

Jeff photo juvenile
cypress
2 CBH
11" water depth

KL

Location JLS Date 3/15/21 57

Project / Client 0519829

floating marsh pennywort
limnobium
alligatorweed
biden
alligator weed flea beetle
salvinia minor (photo Jeff)
azolla
~~ludwigea~~ ludwigea leptocarpa
water locust
butterweed
duckweed lemna minor
mature cypress
water hyacinth
photo Jeff cypress tree at JLS-1-V
CBH 42"
depth water 7"
depth

photo Jeff
cypress CBH 21"
tree water depth 3.5"

Spanish moss
swamp privet

KL

black willow
water locust
hybiscus
swamp mallow
chinese tallow
photo Jeff crawfish

1:37 PM head to monitor
wells Jeff photo'ing them
MW-1 and MW-3
Jeff photos 2 photos
3 photos

1:45 PM head to
JLS-15 area

~~3~~4 photos in JLS-15
area (ICON named
area) cypress
swamp

3 photos by Jeff
of shoreline
1:56 PM @ JLS-REF-V
Jeff: photo boats from
spoil
20 gauge shells
belted kingfisher

at REF location
cypress - REF - 1
CBH 2.5"
water depth 39"
Jeff photo

cypress - REF - 2
CBH ~~60~~ 62"
wtr depth 26"

Jeff photo
cypress - REF - 3
CBH 78.5"
wtr depth 30"

photo Jeff unidentified tree

Location JLS Date 3/15/21

Project / Client 0519829

photo — cypress - REF - 4
CBH 55.5"
wtr depth 28"

2 photos — promonthery warbler

cypress-REF-5 CBH - 38"
wtr depth 28"

Jeff 2 photo — green tree frog

white eyed vireo

red shouldered hawk

photo group
cypress - REF - ~~4~~ 6 (HC)
CBH 82"
photo — wtr depth 31"

2 photo azolla

HL ✓

Location JLS Date 3/15/21

Project / Client 0519829

photo Jeff — cypress REF-~~6~~ 7 (HC)
CBH 57"
depth 33"

cypress REF-~~6~~ ~~7~~ 8 (HC)
CBH 43.5"
depth 32.5"

cypress REF-~~8~~ 9 (HC)
CBH 76"
depth 29.5"

photo — cypress REF-~~9~~ 10 (HC)
CBH 32"
depth 33"

photo — cypress REF-11
CBH 22"
depth 32"

HL ✓

62

Location JLS Date 3/15/21

Project / Client 0519829

cypress - REF-12
CBH 40"
photo depth 33"

photo cypress REF-13
CBH 73.5"
depth 34"

cypress REF-14
CBH 64.5"
depth 34

photo cypress REF-15
CBH 15.5"
depth 33.5"

photo
bio. green

photo cypress REF-16
CBH 23"
depth 35"

JL

63

Location JLS Date 3/15/21

Project / Client 0519829

cypress REF-~~16~~ 17
photo CBH 33"
depth - 31"

yellow bellied
sap sucker

photo cypress REF-18
CBH 71"
depth 9"

cypress REF-19
CBH .1"
photo depth - none

2 photo racoon skat

cypress REF-20
CBH - 50"
depth 23"

2:45 Head to dock

JL

APPENDIX D RECAP FORM 18

April 9, 2021

RECAP FORM 18
ECOLOGICAL CHECKLIST

Section 1 - Facility Information

1. Name of facility: Jeanerette Lumber & Shingle Co., LLC Property

2. Location of facility: Bayou Pigeon Oil & Gas Field

   Parish: Iberia Parish

3. Mailing address: NA

4. Type of facility and/or operations associated with AOC:
   Industrial oil and gas exploration and production (E&P)

5. Name of AOC or AOI: Prelim Eco AOI-1, Prelim Eco AOI-2

6. If available, attach a USGS topographic map of the facility and/or aerial or other photographs of the release site and surrounding areas.

Section 2 - Land Use Information

1. Describe land use at and in the vicinity of the AOC/AOI: The Property lies in Sections 1, 2, 9, 10, 11, 12, 13, 14, 15, 22, 23, 26 and 27 of Township 12 South, Range 10 East within the Bayou Pigeon Oil and Gas Field, Iberia Parish, Louisiana. The Property is a mixture of oil and gas exploration and production (E&P) industrial, recreation, and undeveloped uses. The Prelim Eco AOI-1 is located within a canal, at an elbow associated with Chevron well SN 70817, and Prelim Eco AOI-2 is located near the southern end of the canal in the vicinity of Apache well SN 187214. The canal segment south of the elbow contains a built structure for recreational fishing and further south in the canal is Apache well SN 187214. The on-shore areas adjacent to the canal, in the areas investigated by ERM, are undeveloped forested wetlands (cypress-tupelo swamp) and emergent wetlands.

2. Describe land use adjacent to the facility:
   Land use within and surrounding the overall Property is undeveloped wetlands, interspersed with a network of canals and oil and gas E&P industrial use. The Property lies within the Federal Emergency Management Agency (FEMA) 100-year flood zone.

3. Provide the following information regarding the nearest surface water body which has been impacted or has the potential to be impacted by COC migrating from the AOC/AOC:

a) Name of the surface water body: The Prelim Eco AOI-1 and Prelim Eco AOI-2 lie within a freshwater canal that is connected to network of freshwater canals. Prelim Eco AOI-1 and Prelim Eco AOI-2 lie within LDEQ Drainage Basin Subsegment #010501 (Lower Atchafalaya Basin Floodway – From Whiskey Bay Pilot Channel at mile 54 to US-90 bridge in Morgan City and includes Grand Lake and Six-Mile Lake). Major surface water bodies in the area include Grand Lake and Smith Bayou to the west and Little Pigeon Bayou to the east.

b) Type of surface water body:

[ ] freshwater river or stream
[X] freshwater swamp/marsh/wetland
[ ] saltwater or brackish swamp/marsh/wetland
[ ] lake or pond
[ ] bayou or estuary
[ ] drainage ditch

[X] other: canal

c) Designated use of the segment/subsegment of the surface water body (LAC 33:IX): Primary and secondary contact recreation, fish and wildlife propagation, and drinking water supply.

d) Distance from the AOC/AOI to nearest surface water body: The Prelim Eco AOI-1 and Prelim Eco AOI-2 lie within a canal.

4. Do any potentially sensitive environmental areas exist adjacent to or in proximity to the site, e.g., federal and state parks, national and state monuments, wetlands, etc? [X] Yes [ ] No

If yes, explain:
The Property is wetlands (non-tidal forested cypress-tupelo swamp and emergent) based on US Fish and Wildlife Service National Wetland Inventory data.

Section 3 - Release Information

1. Nature of the release: Investigation of potential releases associated with industrial oil and gas exploration and production (E&P) activities.

2. Location of the release (within the facility): Sample locations within Prelim Eco AOI-1 and Prelim Eco AOI-2 and vicinity were analyzed.

3. Location of the release with respect to the facility property boundaries: Potential limited within property boundaries.

4. Constituents known or suspected to have been released: Oil and gas exploration production materials.

5. Indicate which media are known or suspected to be impacted and if sampling data are available:

[X]	soil 0 - 3 feet bgs	[X] yes	[ ] no	*suspected, sampling data available*
[X]	soil 0 - 15 feet bgs	[X] yes	[ ] no	*suspected, sampling data available*
[X]	soil >15 feet bgs	[X] yes	[ ] no	*suspected, sampling data available*
[X]	groundwater	[X] yes	[ ] no	*suspected, sampling data available*
[X]	surface water/sediment	[X] yes	[ ] no	*suspected, sampling data available*

6. Has migration occurred outside the facility property boundaries? [ ] yes [X] no
If yes, describe the designated use of the offsite land impacted:

Section 4 - Criteria for Further Assessment

If the AOI meets **all** of the criteria presented below, then typically no further ecological evaluation shall be required. If the AOI **does not** meet **all** of the criteria, then a screening level ecological risk shall be conducted. The Submitter should make the initial decision regarding whether or not a screening level ecological risk assessment is warranted based on compliance of the AOI with criteria listed below. After review of the ecological checklist and other available site information, the Department will make a final determination on the need for a screening level ecological risk assessment. If site conditions at the AOI change such that one or more of the criteria are not met, then a screening level ecological risk assessment shall be conducted. Answers shall be based on current site conditions (i.e., shall not consider future remedial actions or institutional or engineering controls).

Indicate if the AOI meets the following criteria:

(1) The area of impacted soil is approximately 5 acres or less in size (based on the AOI identified for the human

health assessment) and it is not expected that the COC will migrate such that the soil AOI becomes greater than 5 acres in size. [X] yes [ ] no

(2) There is no current release or demonstrable long-term threat of release (via runoff or groundwater discharge) of COC from the AOI to a surface water body. [X] yes [ ] no

(3) Recreational species, commercial species, threatened or endangered species, and/or their habitats are not currently being exposed, or expected to be exposed, to COC present at or migrating from the AOI.
[X] yes [ ] no

(4) There are no obvious impacts to ecological receptors or their habitats and none are expected in the future.
[X] yes [ ] no

Is further ecological evaluation required at this AOI? [ ] yes [X] no
An ecological risk assessment based on the data collected from the site is being conducted as a part of this investigation.

Section 5 - Site Summary

Section 6 - Submitter Information

Date: 11/20/2021

Name of person submitting this checklist: Helen R. Connelly, PhD

Affiliation: Environmental Resources Management

Signature: HL C/ Date: 11/20/2021

Additional Preparers: ______

APPENDIX E FLORA AND FAUNA

April 9, 2021

![U.S. Fish and Wildlife Service — National Wetlands Inventory]

Appendix E-1. NWI Wetlands in the Proposed Remediation Area
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

March 9, 2021

Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

National Wetlands Inventory (NWI)
This page was produced by the NWI mapper

**USER REPORT: BATON ROUGE SE, BATON ROUGE SW,
LAKE CHARLES SE, LAKE CHARLES SW**

I. INTRODUCTION

The U.S. Fish and Wildlife Service's National Wetland Inventory is producing maps showing the location and classification of wetlands and deepwater habitats of the United States. The Classification of Wetlands and Deepwater Habitats of the United States by Cowardin et al is the classification system used to define and classify wetlands. Photointerpretation conventions, hydric soils lists, and wetland plant lists are also available to enhance the use and application of the classifications system.

A. PURPOSE

The purpose of the notes to users is threefold: (1) to provide localized information regarding the production of NWI maps, including specific imagery and interpretation discussion; (2) to provide a descriptive cross-reference from wetland codes on the map to common terminology and representative plant species; and (3) to explain local geography, climate, and wetland communities.

B. The maps in this report have been grouped because of physiographic similarities. The major ecological regions in the Coastal Louisiana are palustrine forested areas and estuarine salt marsh. The Lake Charles SE and SW 1:100,000 scale maps and the Baton Rouge SE and SW 1:100,000 scale maps are predominately palustrine forested and share the same vegetation species and soil types.

II. Field Reconnaissance

DRAFT

A. Project Area 1:100,000 Scale Maps:

Lake Charles SW	(32 quads)
Lake Charles SE	(32 quads)
Baton Rouge SW	(32 quads)
Baton Rouge SE	(32 quads)

E. COLLATERAL DATA

1. 7'5" and 15' U.S.G.S. topographic quads

2. 1:250K U.S.G.S. topographic maps

3. Chabreck, R.H. and G. Linscombe. 1978. Vegetative Type Map of the Louisiana Coastal Marshes, Louisiana Department of Wildlife and Fisheries, New Orleans.

4. Hydric Soils List of the State of Louisiana. 1985 (S.C.S.).

5. Wetland Plant List of the State of Louisiana. 1986 U.S. Fish and Wildlife Service.

6. Soil Surveys of the following parishes and counties:

Arcadia	Newton
Ascension	Orleans
Assumption	St. Charles
Calcasieu	St. James
Cameron	St. John Baptist
E. Baton Rouge	St. Landry
Iberia	St. Martin
Iberville	Tangipahoa
Jasper	Vermillion
Jefferson	W. Baton Rouge
Jefferson Davis	
Lafayette	
N. Iberia	

7. Lazarine, P. Common Wetland Plants of Southeast Texas. U.S. Army Corps of Engineers, Galveston, TX

8. A Guide to Selected Florida Wetland Plants and Communities. 1988. U.S. Army Corps of Engineers, Jacksonville, FL

9. Gosselink, J.G., C.L. Cordes, and J. W. Parsons. (1979) An Ecological Characterization Study of the Chenier Plain Coastal Ecosystem of Louisiana and Texas. U.S. Fish and Wildlife Service, Department of Interior, Slidell, LA

The swamps and marshes around Lakes Maurepas and Pontchartrain are important overwintering areas for ducks and rookery sites for wading birds. Lake Pontchartrain contains commercially exploited Rangia clam beds and is an important fish and shellfish nursery ground.

B. Climate:

The region has a subtropical marine climate influenced by the Gulf of Mexico. The summers are long and warm. Winters are mild with only occasional freezing temperatures. Annual average rainfall is approximately 40-60 inches. Heaviest rainfalls occur during the growing season, June through August.

C. Vegetation:

The western portion of the study area is in Bailey's Beech-Sweetgum-Magnolia-Pine-Oak Forest Section. Common trees are oaks, sweetgum and magnolias. The Atchafalaya and Mississippi floodplains which occupy most of the eastern portion fall within the Southern Flood Plain Forest Section. Characteristic trees include red maple, hydrophilic oaks, willow, sweetgum, hickory, hackberry, locust, cottonwood, elm, sycamore and ashes. There is usually a well-developed lower stratum of vegetation that includes shrubs, palmettos and herbaceous plants. Extensive swamps are dominated by baldcypress and tupelo. In the Atchafalaya Basin, cypress-tupelo sloughs intermingle with the hardwood forest, creating an alternating hardwood ridge and cypress-tupelo swale pattern. Pines occur in temporary wetlands and uplands, and live oaks are found in well-drained upland areas. Where the native loblolly pine (Pinus taeda) has been logged over, it has often been replanted with slash pine (Pinus elliotii). Lianas and epiphytes, especially Spanish moss, are common.

D. Soils:

The soils are derived primarily from Coastal Plain sediments. Clayey soils predominate in the Lake Charles SE and Lake Charles SW 1:100,000 maps where rice is the major agricultural crop. In the eastern Baton Rouge portion, which is mostly alluvial plain formed by the sediments of the Mississippi and Atchafalaya Rivers, loamy soils occur on the natural levees of the rivers and smaller bayous. Sugarcane is the major crop here. Clayey soils are found in the backwater swamps and are primarily forested.

The forested wetlands are primarily temporarily-flooded hardwoods (PFO1A), which occur in the floodplains of the smaller rivers, and semi-permanently flooded cypress-tupelo swamps (PFO2/1F), which appear in the floodplains of the larger rivers and around Lake Maurepas (PFO2/1T). Seasonally-flooded hardwoods (PFO1C) occur predominately in the Atchafalaya Basin along with the cypress-tupelo sloughs. Temporarily-flooded pine forest (PFO4A) and mixed-pine forest (PFO4/1A) are found on the poorly-drained plains on either side of the Sabine River and north of Lakes Maurepas and Pontchartrain.

Most of the scrub shrub areas are fields undergoing secondary succession or clearings succeeding back to forest or pine plantations that have not yet reached 20 ft. in height. Naturally occurring shrub can be found in the flood plain of rivers at the transition-zone between saltmarsh and cypress swamp. The most common species here are Baccharis sp. and wax myrtle (Myrica cerifera).

C. Riverine System

The riverine system contains both tidal (R1UBV) and lower perennial (R2UBH) subsystems. The tidal riverine systems extend only a short distance above the estuarine/riverine interface. These R1 systems are usually characterized by adjacent emergent (PEM) or shrubby (PSS) marsh, while the R2 systems usually support cypress-tupelo floodplains (PFO). The Mississippi and Atchafalaya Rivers are lower perennial rivers throughout these maps. Many of the natural streams have been ditched, dredged and connected to irrigation canals especially in the western regions. In some places different drainages have been connected. Some irrigation ditches carry water only seasonally (R4SBCx).

D. Lacustrine System

The largest freshwater lake is Lake Maurepas which is tidally influenced (L1UBV). Freshwater lakes are not prominent features in this landscape and most of the non-tidal lakes (L1UBH) are located in the Atchafalaya Basin. Many of these lakes contain aquatic bed, but unless it was visible on the photography, the lake was labelled L1UBH.

WETLAND CLASSIFICATION CODES AND WATER REGIME DESCRIPTIONS

NWI CODE (Water Regime)	NWI DESCRIPTION	COMMON DESCRIPTION	VEGETATION/ SUBSTRATE	SOILS
R1UB (V)	Riverine, tidal, perennial, unconsolidated bottom	River, canal	Sand, mud	
R1US (N)	Riverine, tidal, unconsolidated shore	Sand bar	Sand, gravel	
R1AB4 (H)	Riverine, tidal,	River, canal	Eichornia crassipes (water hyacinth) Lemna sp. (duckweed)	
R2UB (H)	Riverine, lower perennial, unconsolidated bottom	River, canal	Sand, mud	
R2AB4 (H)	Riverine, lower perennial, floating aquatic bed	River, canal	Eichornia crassipes (water hyacinth) Lemna sp. (duckweed)	
R2US (A,C)	Riverine, lower perennial, unconsolidated shore	Sand bar	Sand, gravel	
R4SB (C,F)	Riverine, intermittent stream bed	Stream, canal	Sand, mud, gravel	

WETLAND CLASSIFICATION CODES AND WATER REGIME DESCRIPTIONS

NWI CODE (Water Regime)	NWI DESCRIPTION	COMMON DESCRIPTION	VEGETATION/ SUBSTRATE	SOILS
PAB4 (H,G,V)	Palustrine, aquatic bed, floating vascular	Pond	Lemna sp. (duckweed) Azolla caroliniana (mosquito fern) Pistia stratiotes (water lettuce) Eichornia crassipes (water hyacinth) Salvinia sp. (water fern)	
PEM1 (A)	Palustrine, emergent, persistent, temporarily flooded	Wet prairies	Juncus sp. (rush) Cyperus sp. (flat sedge) Carex sp. (sedges) Eleocharis sp. (spike rush) Setaria sp. (foxtail) Panicum vigatum (switch grass)	Jasco Harahan Caddo-Messer Carrol Iberia Frost Haplaquall Sharkey Calhoun Frozard Crowley-Vidrine Judice Kinder Leton Midland Morey Mowata Baldwin Latanier Lebeau

WETLAND CLASSIFICATION CODES AND WATER REGIME DESCRIPTIONS

NWI CODE (Water Regime)	NWI DESCRIPTION	COMMON DESCRIPTION	VEGETATION/ SUBSTRATE	SOILS
PSS1A PSS1/4A	Palustrine, scrub shrub, broad-leaved deciduous/mixed broad-leaved deciduous and pine	Scrub, shrubby forest	Baccharis sp. (saltbush) Sambucus canandensis (elderberry) Rubus sp. (blackberry) Pinus elliotii (slash pine) Pinus taeda (loblolly pine) Myrica cerifera (wax myrtle)	Gladewater Iuka Mantachie Bleakwood Urbo Waller Caddo-Messer Judice Leton Midland Morey Mowata Una Carrol Iberia Wrightsville Baldwin Frost Haplaquall Sharkey Calhoun Commerce Falaya Frozard Latanier Lebeau Convent Robinsonville Tunica Fountain Myatt Ochlockonee Vacherie

WETLAND CLASSIFICATION CODES AND WATER REGIME DESCRIPTIONS

NWI CODE (Water Regime)	NWI DESCRIPTION	COMMON DESCRIPTION	VEGETATION/ SUBSTRATE	SOILS
PFO1A	Palustrine, forested,	Bottom-land	Quercus nigra (water oak) Q. phellos (willow oak) Liquidamber styraciflua (sweetgum) Populus deltoides (E. cottonwood) Fraxinus pennsylvanicus (green ash) Q. falcata (S. red oak) Salix sp. (willow) Plantanus occidentalis (sycamore) Celtus laevigata (sugarberry) Q. lyrata (overcup oak) Sapium sebiferum (Chinese tallow) Carya sp. (hickory) Acer rubrum (red maple) Ulmus sp. (elm) Morus sp. (mulberry) Acer negundo (box elder) Ostrya virginiana (ironwood) Serenoa repens (palmetto)	Gladewater Iuka Mantachie Bleakwood Urbo Waller Caddo-Messer Judice Leton Midland Morey Mowata Una Carrol Iberia Wrightsville Baldwin Frost Haplaquall Sharkey Calhoun Commerce Falaya Frozard Latanier Lebeau Convent Robinsonville Tunica Fountain Myatt Ochlockonee Vacherie

WETLAND CLASSIFICATION CODES AND WATER REGIME DESCRIPTIONS

NWI CODE (Water Regime)	NWI DESCRIPTION	COMMON DESCRIPTION	VEGETATION/ SUBSTRATE	SOILS
PFO2F (C,R,T) PFO2/1F (C,R,T) PFO1/2F (C,R,T)	Palustrine, forested, needle-leaved deciduous/needle-leaved-deciduous and broad-leaved deciduous mixed	Cypress swamp, Cypress-tupelo swamp, slough	Taxodium distichum (baldcypress) Nyssa aquatica (water tupelo) Nyssa sylvatica (blackgum) Salix sp. (willow) Fraxinus pennsylvanica (green ash) Carya aquatica (water hickory)	Deweyville Arat Barbary Fausse

V. Water Regime Description

Tidal

Salt and Brackish Areas - Marine and Estuarine Systems

(L) Subtidal-The substrate is permanently flooded with tidal water.

(M) Irregularly Exposed- Land surface is exposed by tides less often than daily. This corresponds to the area on NOS charts from seaward edge of light green tone (mean low water) to depth contour approximating extreme low water.

(N) Regularly Flooded-Tidal water alternately floods and exposes the land surface at least once daily.

(P) Irregularly Flooded- Tidal water floods land surface less often than daily. The area must flood by tide at least once yearly as a result of extreme high spring tide.

Freshwater Tidal Areas - Lacustrine, Palustrine and Riverine Systems.

(N) Regularly Flooded- Fresh tidal water alternately floods and exposes the land surface at least once daily.

(R) Seasonally Flooded- Tidal

(S) Temporarily Flooded- Tidal

(T) Semi-permanently Flooded- Tidal

(V) Permanently Flooded- Tidal

Non-Tidal

(A) Temporarily Flooded- Surface water present for brief periods during growing season, but water table usually lies well below soil surface. Plants that grow both in uplands and wetlands are characteristic of this water regime.

(B) Saturated- The substrate is saturated to surface for extended periods during the growing season, but surface water is seldom present.

Collateral data included USGS topographic maps, SCS soil surveys, local climate, vegetation, and ecological information.

The user of the map is cautioned that, due to the limitation of mapping primarily through aerial photointerpretation, a small percentage of wetlands may have gone unidentified. Since the photography was taken during a particular time and season, there may be discrepancies between the map and current field conditions. Changes in landscape which occurred after the photography was taken would result in such discrepancies.

Aerial photointerpretation and drafting were completed by Geonex,Inc., St. Petersburg, Florida.

VIII. SPECIAL MAPPING PROBLEMS

None.

IX. MAP ACQUISITION

To discuss any questions concerning these maps or to place a map order, please contact:

John Hefner
Regional Wetland Coordinator
U.S. Fish and Wildlife Service - Region IV
R.B. Russell Federal Building
75 Spring Street S.W.
Atlanta, GA 30303

To order maps only, contact:

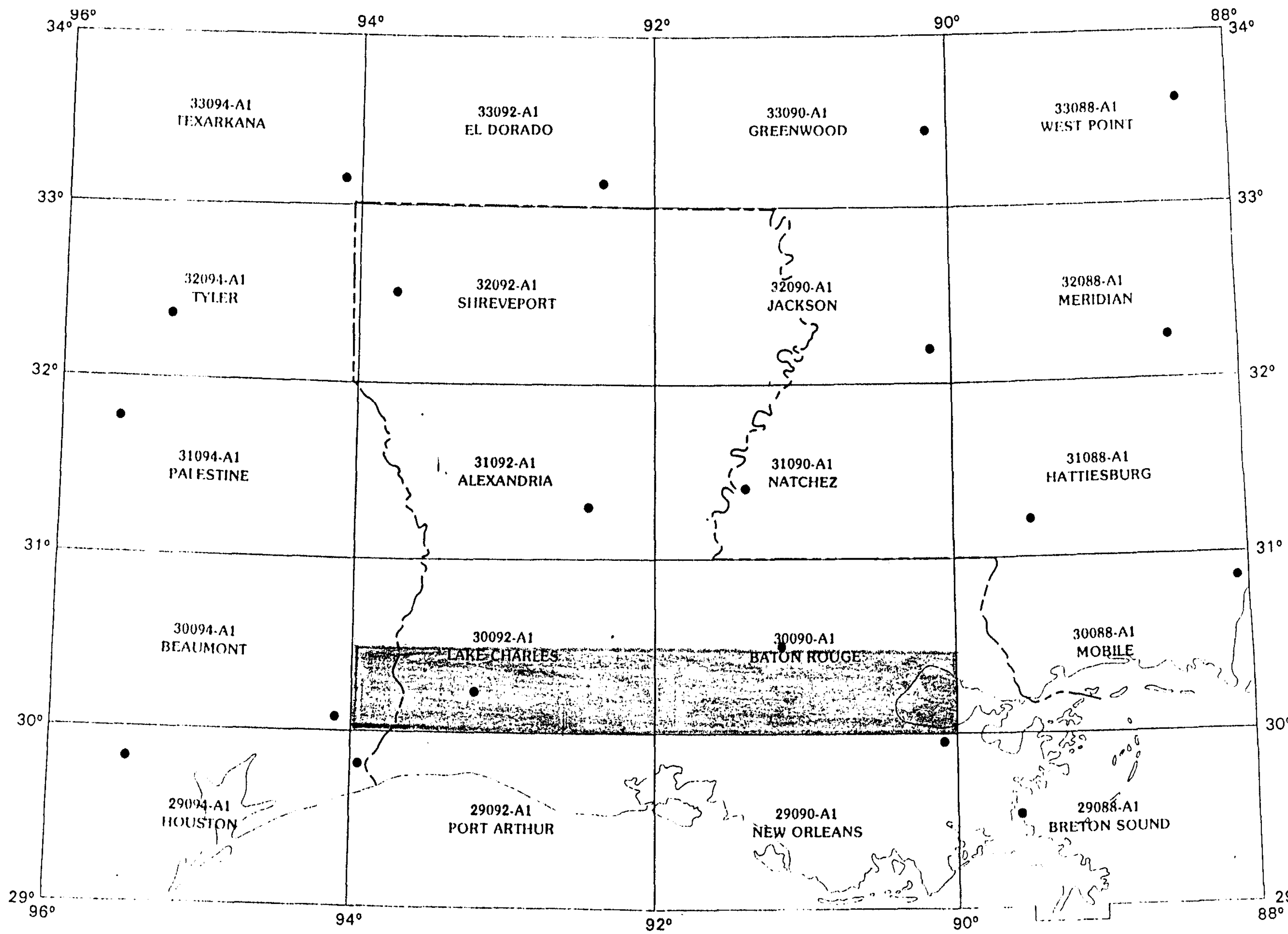
Earth Science Information Center (ESIC)
National Cartographic Information Center
U.S. Geological Survey
507 National Center
Reston, VA 22092

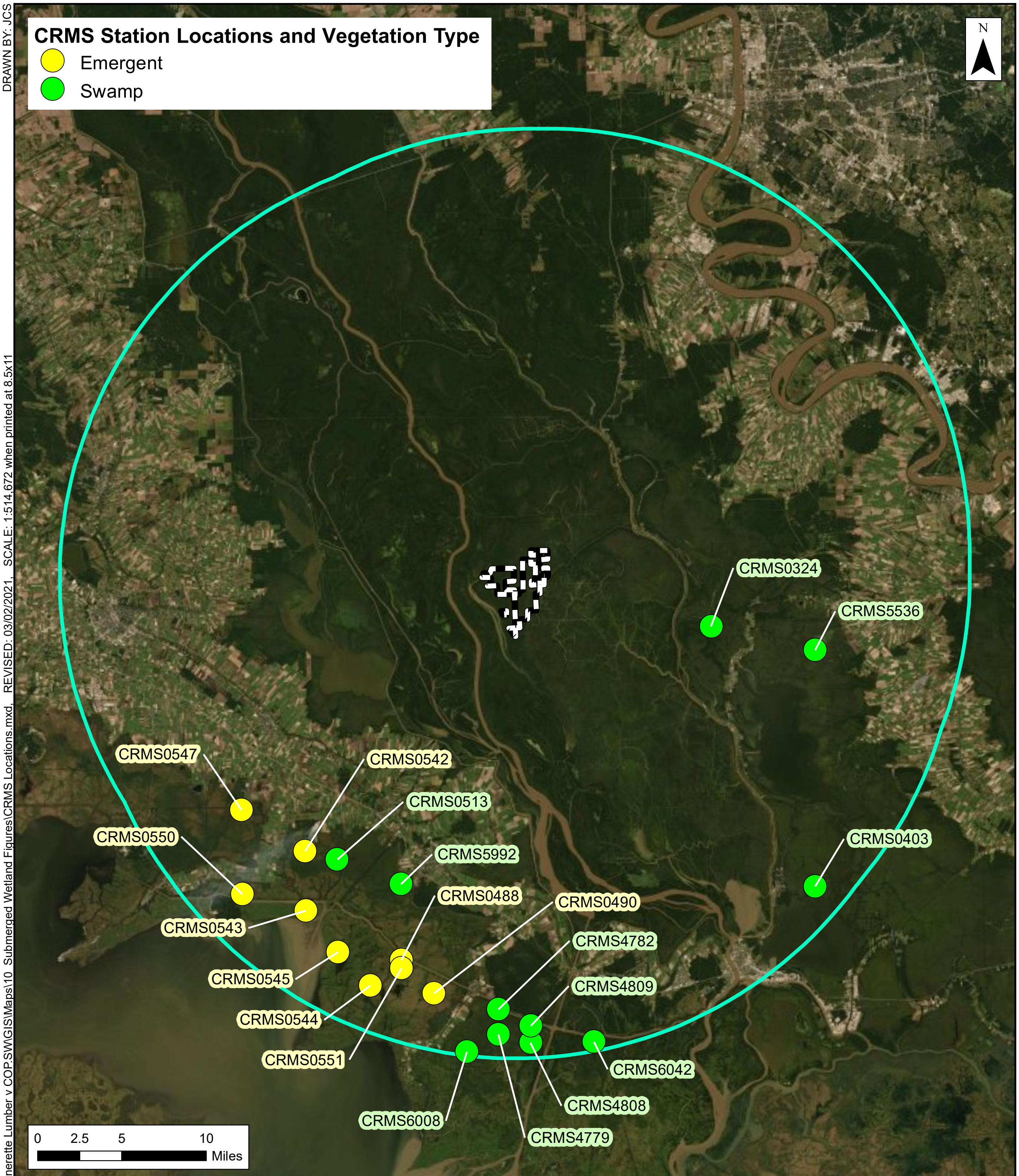
1-(800)-872-6277

Maps are identified by the name of the corresponding USGS 1:24,000 scale topographic quadrangle name. Topographic map indices are available from the U.S. Geological Survey.

la-baton.rpt
SV/drs.nwi

1:250 000 SCALE





Property

25 Mile Property Radius

Appendix E-3

CRMS Stations within 25 Miles of the Property

Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Notes:
CRMS Station locations
(https://www.lacoast.gov/crms_viewer)
Imagery Basemap via ArcGIS Online.

Environmental Resources Management
www.erm.com
ERM

Source: Esri - ArcGIS Online; NAD 1983 UTM Zone 15N

Appendix E-4
List of Vegetation Recorded at Nearby CRMS Stations
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Common Name	Scientific Name	Wetland Classification	Growth Habit	Property	CRMS0324	CRMS0403	CRMS5536
Boxelder	*Acer negundo*	FAC	Tree		✓		
Red maple	*Acer rubrum*	FAC	Tree	✓	✓	✓	✓
Sugar maple	*Acer saccharum*	FACU	Tree, Shrub		✓		
Oppositeleaf spotflower	*Acmella oppositifolia var. repens*	FACW	Forb/herb	✓			
Washerwoman	*Alternanthera caracasana*	NA	Forb/herb				✓
Alligatorweed	*Alternanthera philoxeroides*	OBL	Forb/herb	✓	✓	✓	✓
Southern amaranth	*Amaranthus australis*	OBL	Subshrub, Forb/herb		✓		✓
Pigweed	*Amaranthus sp.*	NA	NA		✓		✓
Annual ragweed	*Ambrosia artemisiifolia*	FACU	Forb/herb	✓			
Milkweed	*Asclepias sp.*	NA	NA	✓			
Mosquitofern	*Azolla sp.*	OBL	Forb/herb	✓			
Herb-of-grace	*Bacopa monnieri*	OBL	Forb/herb				✓
Smooth beggartick	*Bidens laevis*	OBL	Forb/herb	✓	✓	✓	✓
Smallspike false nettle	*Boehmeria cylindrica*	FACW	Forb/herb		✓	✓	✓
False nettle	*Boehmeria sp.*	NA	Forb/herb		✓	✓	✓
American buckwheat vine	*Brunnichia ovata*	FACW	Vine	✓	✓		
Trumpet creeper	*Campsis radicans*	FAC	Vine		✓		
Balloon vine	*Cardiospermum halicacabum*	FAC	Forb/herb, Vine	✓			
Ravenfoot sedge	*Carex crus-corvi*	OBL	Graminoid		✓		
Giant sedge	*Carex gigantea*	OBL	Graminoid		✓		
Hop sedge	*Carex lupulina*	OBL	Graminoid		✓		
Sedge	*Carex sp.*	NA	Graminoid	✓	✓	✓	✓
Water hickory	*Carya aquatica*	OBL	Tree		✓		
Southern catalpa	*Catalpa bignonioides*	UPL	Tree		✓		
Sugarberry	*Celtis laevigata*	FACW	Tree, Shrub		✓		
Hackberry	*Celtis sp.*	NA	Tree		✓		
Common buttonbush	*Cephalanthus occidentalis*	OBL	Tree, Shrub	✓	✓	✓	✓
Buttonbush	*Cephalanthus sp.*	NA	NA	✓	✓	✓	✓
Carolina coralbead	*Cocculus carolinus*	FAC	Vine	✓			
Coco yam	*Colocasia esculenta*	FACW	Forb/herb		✓	✓	
Stiff dogwood	*Cornus foemina*	FACW	Tree, Shrub		✓		
Dogwood	*Cornus sp.*	NA	Tree, Shrub		✓		
Green hawthorn	*Crataegus viridis*	FACW	Tree, Shrub		✓		
Fern flatsedge	*Cyperus filicinus*	OBL	Graminoid		✓		✓
Giant flatsedge	*Cyperus giganteus*	OBL	Graminoid		✓		
Haspan flatsedge	*Cyperus haspan*	OBL	Graminoid		✓		✓
Fragrant flatsedge	*Cyperus odoratus*	FACW	Graminoid			✓	✓
Flatsedge	*Cyperus sp.*	NA	Graminoid	✓	✓	✓	✓
Strawcolored flatsedge	*Cyperus strigosus*	FACW	Graminoid			✓	✓
Green flatsedge	*Cyperus virens*	FACW	Graminoid		✓	✓	✓
Common persimmon	*Diospyros virginiana*	FAC	Tree		✓		
Barnyardgrass	*Echinochloa crus-galli*	FACW	Graminoid		✓		
Coast cockspur grass	*Echinochloa walteri*	OBL	Graminoid			✓	
Creeping burhead	*Echinodorus cordifolius*	OBL	Forb/herb		✓		
Common water hyacinth	*Eichhornia crassipes*	OBL	Forb/herb	✓			
Baldwin's spikerush	*Eleocharis baldwinii*	OBL	Graminoid			✓	
Dwarf spikerush	*Eleocharis parvula*	OBL	Graminoid			✓	✓
Spikerush	*Eleocharis sp.*	NA	Graminoid			✓	✓
Scouringrush horsetail	*Equisetum hyemale var. affine*	NA	Forb/herb				✓
Eastern swampprivet	*Forestiera acuminata*	OBL	Tree, Shrub	✓	✓		
Carolina ash	*Fraxinus caroliniana*	OBL	Tree, Shrub		✓		
Green ash	*Fraxinus pennsylvanica*	FACW	Tree		✓		
Pumpkin ash	*Fraxinus profunda*	OBL	Tree		✓		✓
Ash	*Fraxinus sp.*	NA	Tree		✓		✓
Water locust	*Gleditsia aquatica*	OBL	Tree, Shrub	✓			
Honey locust	*Gleditsia triacanthos*	FAC	Tree, Shrub	✓			
Water-spider orchid	*Habenaria repens Nutt.*	OBL	Forb/herb			✓	✓
Swamp rosemallow	*Hibiscus grandiflorus*	OBL	Shrub, Subshrub		✓		
Rosemallow	*Hibiscus lasiocarpos*	NA	Subshrub, Forb/herb	✓			
Crimsoneyed rosemallow	*Hibiscus moscheutos ssp. lasiocarpos*	OBL	Subshrub, Forb/herb	✓	✓		
Rosemallow	*Hibiscus sp.*	NA	NA	✓	✓		
Floating marshpennywort	*Hydrocotyle ranunculoides*	OBL	Forb/herb	✓	✓	✓	✓
Hydrocotyle	*Hydrocotyle sp.*	NA	Forb/herb	✓		✓	
Manyflower marshpennywort	*Hydrocotyle umbellata*	OBL	Forb/herb		✓	✓	✓
Gulf swampweed	*Hygrophila lacustris*	OBL	Forb/herb		✓		
Spider lily	*Hymenocallis occidentalis*	OBL	Forb/herb		✓	✓	✓
Possumhaw	*Ilex decidua*	FACW	Tree, Shrub	✓	✓		
Yaupon	*Ilex vomitoria*	FAC	Tree, Shrub		✓		
Whitestar	*Ipomoea lacunosa*	FAC	Forb/herb, Vine	✓			
Virginia iris	*Iris virginica*	OBL	Forb/herb			✓	
Virginia sweetspire	*Itea virginica*	FACW	Shrub			✓	✓
Common rush	*Juncus effusus*	OBL	Graminoid		✓	✓	✓
Looseflower water-willow	*Justicia ovata var. lanceolata*	OBL	Forb/herb		✓	✓	
Virginia saltmarsh mallow	*Kosteletzkya virginica*	OBL	Subshrub, Forb/herb		✓		
Southern cutgrass	*Leersia hexandra*	OBL	Graminoid		✓	✓	✓
Catchfly grass	*Leersia lenticularis*	OBL	Graminoid		✓		
Cutgrass	*Leersia sp.*	NA	Graminoid		✓	✓	✓
Common duckweed	*Lemna minor*	OBL	Forb/herb	✓			
Duckweed	*Lemna sp.*	NA	Forb/herb	✓			
Malabar sprangletop	*Leptochloa fusca*	FACW	Graminoid				✓
Carolina grasswort	*Lilaeopsis carolinensis*	OBL	Forb/herb				✓
American spongeplant	*Limnobium spongia*	OBL	Forb/herb	✓		✓	
Cardinal flower	*Lobelia cardinalis*	FACW	Forb/herb			✓	
Japanese honeysuckle	*Lonicera japonica*	FACU	Vine	✓			
Cylindicfruit primrose-willow	*Ludwigia glandulosa*	OBL	Forb/herb		✓		
Large-flower primrose-willow	*Ludwigia grandiflora*	OBL	Subshrub, Forb/herb			✓	✓
Anglestem primrose-willow	*Ludwigia leptocarpa*	OBL	Subshrub, Forb/herb	✓	✓	✓	✓
Marsh seedbox	*Ludwigia palustris*	OBL	Forb/herb			✓	
Floating primrose-willow	*Ludwigia peploides*	OBL	Forb/herb		✓	✓	✓
Creeping primrose-willow	*Ludwigia repens*	OBL	Forb/herb		✓		
Primrose-willow	*Ludwigia sp.*	NA	NA		✓	✓	✓
Southern watergrass	*Luziola fluitans*	OBL	Graminoid			✓	

Appendix E-4
List of Vegetation Recorded at Nearby CRMS Stations
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

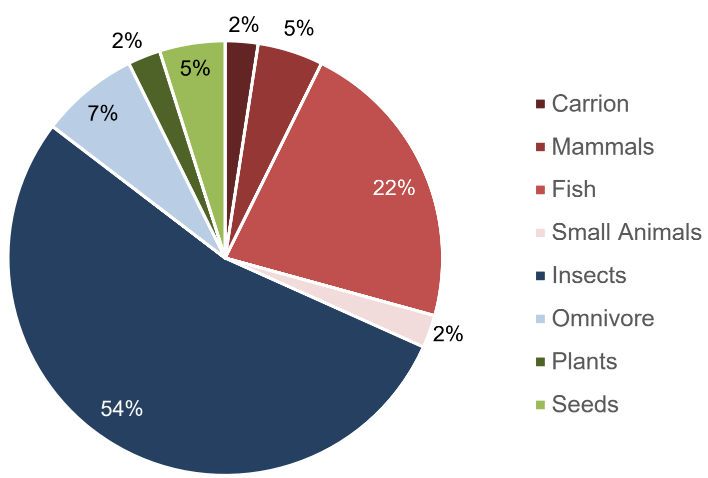
Common Name	Scientific Name	Wetland Classification	Growth Habit	Property	CRMS0324	CRMS0403	CRMS5536
Peruvian watergrass	*Luziola peruviana*	FACW	Graminoid			✓	✓
Taperleaf water horehound	*Lycopus rubellus*	OBL	Forb/herb		✓	✓	
Waterhorehound	*Lycopus sp.*	NA	Forb/herb		✓	✓	✓
Wand lythrum	*Lythrum lineare*	OBL	Forb/herb	✓			
Loosestrife	*Lythrum sp.*	NA	NA	✓			
Southern crab apple	*Malus angustifolia*	NA	Tree, Shrub		✓		
Climbing hempvine	*Mikania scandens*	FACW	Forb/herb, Vine		✓		✓
Parrot feather watermilfoil	*Myriophyllum aquaticum*	OBL	Forb/herb			✓	✓
Cutleaf watermilfoil	*Myriophyllum pinnatum*	OBL	Forb/herb			✓	
Peppervine	*Nekemias arborea*	FAC	Shrub, Vine	✓	✓		
Water tupelo	*Nyssa aquatica*	OBL	Tree	✓	✓	✓	✓
Royal fern	*Osmunda regalis var. spectabilis*	NA	Forb/herb		✓		
Cuban bulrush	*Oxycaryum cubense*	OBL	Graminoid	✓			✓
Butterweed	*Packera glabella*	OBL	Forb/herb	✓	✓		✓
Bitter panicgrass	*Panicum amarum*	FAC	Graminoid		✓		
Maidencane	*Panicum hemitomon*	OBL	Graminoid		✓		
Horsetail paspalum	*Paspalum fluitans*	OBL	Graminoid	✓			✓
Savannah-panicgrass	*Phanopyrum gymnocarpon*	OBL	Graminoid		✓		
Lanceleaf fogfruit	*Phyla lanceolata*	OBL	Forb/herb	✓		✓	
Canadian clearweed	*Pilea pumila*	FACW	Forb/herb		✓	✓	✓
Planertree	*Planera aquatica*	OBL	Tree	✓	✓		
American sycamore	*Platanus occidentalis*	FACW	Tree	✓			
Resurrection fern	*Pleopeltis polypodioides*	FACU	Forb/herb, Vine		✓	✓	✓
Camphor pluchea	*Pluchea camphorata*	FACW	Forb/herb		✓		
Sweetscent	*Pluchea odorata*	FACW	Subshrub, Forb/herb		✓		
Camphorweed	*Pluchea sp.*	NA	NA		✓		
Denseflower knotweed	*Polygonum glabrum*	OBL	Forb/herb		✓		
Dotted smartweed	*Polygonum punctatum var. punctatum*	OBL	Forb/herb		✓	✓	✓
Knotweed	*Polygonum sp.*	NA	Forb/herb	✓	✓	✓	✓
Pickerelweed	*Pontederia cordata*	OBL	Forb/herb		✓	✓	
Red oak	*Quercus falcata*	FACU	Tree		✓		
Laurel oak	*Quercus laurifolia*	FACW	Tree		✓		
Water oak	*Quercus nigra*	FAC	Tree		✓		
Oak	*Quercus sp.*	NA	Tree		✓		
Starrush whitetop	*Rhynchospora colorata*	FACW	Graminoid		✓		
Shortbristle horned beaksedge	*Rhynchospora corniculata*	OBL	Graminoid		✓	✓	✓
Beaksedge	*Rhynchospora sp.*	NA	Graminoid		✓	✓	✓
Blackberry	*Rubus sp.*	NA	NA		✓		
Southern dewberry	*Rubus trivialis*	FACU	Subshrub, Vine	✓	✓		
Dwarf palmetto	*Sabal minor*	FACW	Tree, Shrub		✓		
American cupscale	*Sacciolepis striata*	OBL	Graminoid		✓	✓	✓
Bulltongue arrowhead	*Sagittaria lancifolia ssp. media*	NA	Forb/herb		✓		
Delta arrowhead	*Sagittaria platyphylla*	OBL	Forb/herb		✓	✓	✓
Arrowhead	*Sagittaria sp.*	NA	Forb/herb		✓	✓	✓
Black willow	*Salix nigra*	OBL	Tree	✓			✓
Water spangles	*Salvinia minima*	OBL	Forb/herb	✓			
Black edlerberry	*Sambucus nigra*	FACW	Tree, Shrub				✓
Elderberry	*Sambucus sp.*	NA	Tree				✓
Lizard's tail	*Saururus cernuus*	OBL	Forb/herb	✓	✓	✓	✓
Roundleaf greenbrier	*Smilax rotundifolia*	FAC	Shrub, Vine	✓	✓		
Greenbrier	*Smilax sp.*	NA	Shrub, Vine	✓	✓		
Seaside goldenrod	*Solidago sempervirens*	FACW	Forb/herb		✓		
Goldenrod	*Solidago sp.*	NA	Forb/herb		✓		
Johnson grass	*Sorghum halepense*	FACU	Graminioid	✓			
False buttonweed	*Spermacoce sp.*	NA	NA			✓	
Chickenspike	*Sphenoclea zeylanica*	OBL	Forb/herb				✓
Bald cypress	*Taxodium distichum*	OBL	Tree	✓	✓	✓	✓
Eastern marsh fern	*Thelypteris palustris*	OBL	Forb/herb			✓	✓
Spanish moss	*Tillandsia usneoide*	FAC	Forb/herb, Vine	✓			
Eastern poison ivy	*Toxicodendron radicans*	FAC	Shrub, Subshrub, Forb/herb, Vine	✓	✓		
Virginia marsh St. Johnswort	*Triadenum virginicum*	OBL	Forb/herb			✓	✓
Chinese tallow	*Triadica sebifera*	FAC	Tree	✓	✓	✓	
Southern cattail	*Typha domingensis*	OBL	Forb/herb			✓	✓
Broadleaf cattail	*Typha latifolia*	OBL	Forb/herb				✓
Cattail	*Typha sp.*	NA	Forb/herb		✓	✓	✓
American elm	*Ulmus americana*	FAC	Tree		✓		✓
Cedar elm	*Ulmus crassifolia*	FAC	Tree		✓		
Slippery elm	*Ulmus rubra*	FAC	Tree		✓		✓
Elm	*Ulmus sp.*	NA	Tree		✓		✓
Graybark grape	*Vitis cinerea*	FAC	Vine		✓		
Muscadine	*Vitis rotundifolia*	FAC	Vine		✓		
Grape vine	*Vitis sp.*	NA	NA	✓			
Giant cutgrass	*Zizaniopsis miliacea*	OBL	Graminoid		✓		

Notes:
1. Wetland classification and growth habit based on USDA (2021) PLANTS database.
2. Herbaceous and forest species lists for CRMS Stations (0324, 0403, and 5536) were downloaded from the Coastal Information Management System (CIMS) on January 6, 2021 (CPRA 2021).
NA : Data not available. Species-specific wetland classification, growth habit, and state status data are not always applicable to taxa identified to genus.

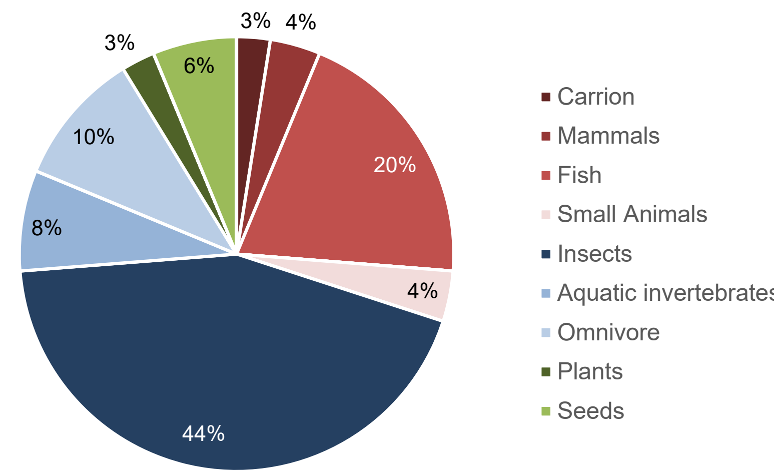
References:

Coastal Protection and Restoration Authority (CPRA). 2021. Data. Available: https://cims.coastal.louisiana.gov/monitoring-data/. Accessed January 2021.
U.S. Department of Agriculture (USDA) Natural Resources Conservation Service. 2021. PLANTS Database. Available: https://plants.sc.egov.usda.gov/java/. Accessed January 2021.

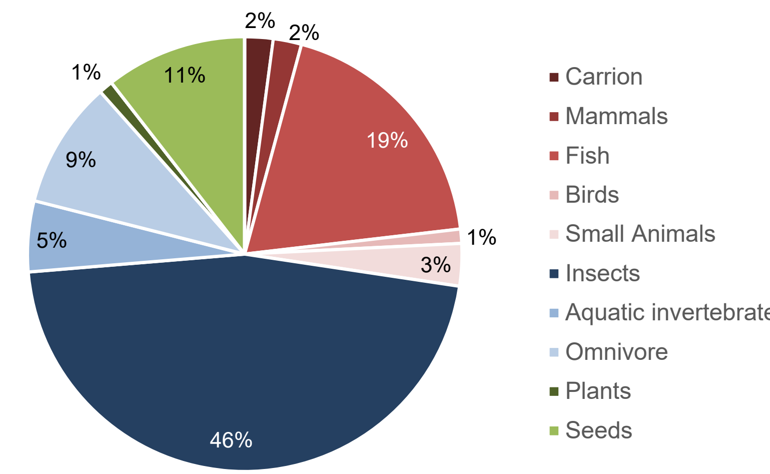
A. Property



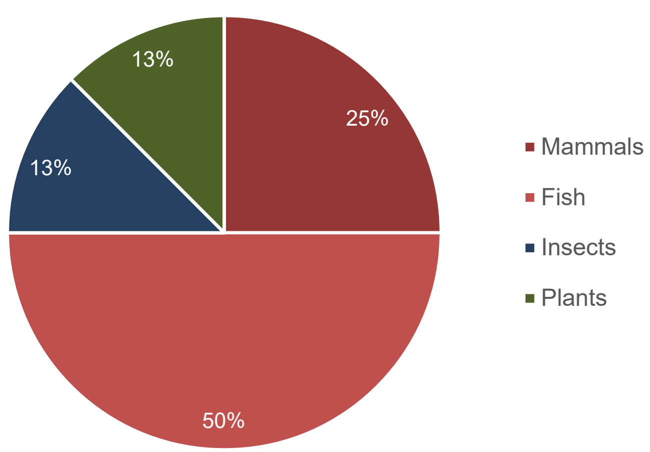
B. Elm Hall Wildlife Management Area



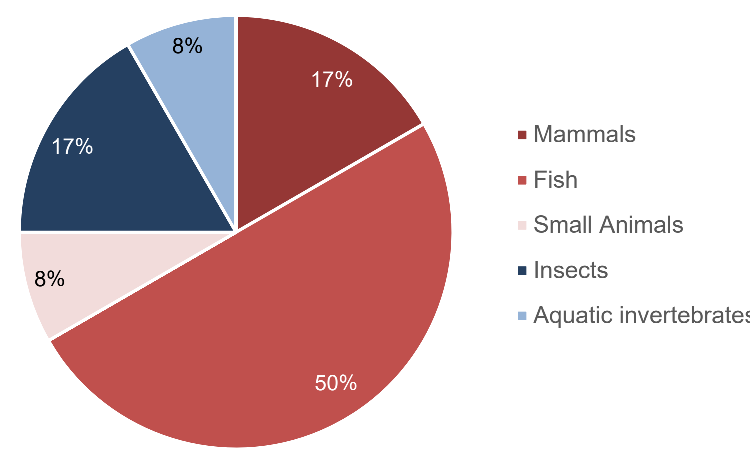
C. Attakapas Island Wildlife Management Area



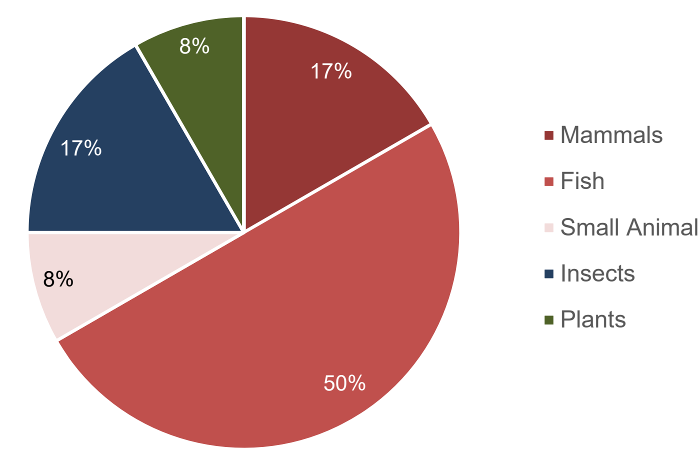
D. Property - Swamp Species



E. Elm Hall Wildlife Management Area - Swamp Species



F. Attakapas Island Wildlife Management Area - Swamp Species



Trophic Level Legend
Tertiary Consumers: Carnivores and omnivores; organisms that consume primary and secondary consumers. Includes apex predators, which are carnivores with no natural predators.
Secondary Consumers: Omnivores and carnivores; organisms that consume primary consumers (herbivores).
Primary Consumer: Herbivores; or organisms that consume plants and plant material (nectar, seeds, nuts, etc.).

Notes
1. Swamp species are those identified by the U.S. Fish and Wildlife Service (USFWS) Southeast Louisiana Refuges as swamp associates (USFWS, 2006).
2. The species list for Elm Hall Wildlife Management Area was derived from an eBird Hotspot Checklist for Lake Verrett, Assumption, Louisiana.
3. The species list for Attakapas Wildlife Management Area was derived from an eBird Hotspot Checklist for the Atchafalaya Basin West Containment Levee at Charenton, St. Mary, Louisiana.
4. Diet for each species is provided by The Cornell Lab (2021).

References
The Cornell Lab. 2021. All About Birds. Available: https://www.allaboutbirds.org/news/. Accessed February 2021.
U.S. Fish and Wildlife Service (USFWS). 2006. "Atchafalaya National Wildlife Refuge Bird List". Southeast Louisiana Refuges. Available: https://www.fws.gov/southeast/pubs/atchafalaya_birdlist.pdf. Accessed March 2021.

Appendix E-6
List of Birds Recorded in Nearby Protected Areas
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Common Name	*Scientific Name*	Diet	Property	Elm Hall	Attakapas Island
Barred Owl	***Strix varia***	**Mammals**	✓	✓	✓
Great Blue Heron	***Ardea herodias***	**Fish**	✓	✓	✓
Great Egret	***Ardea alba***	**Fish**	✓	✓	✓
Green Heron	***Butorides virescens***	**Fish**		✓	✓
Little Blue Heron	***Egretta caerulea***	**Fish**	✓	✓	✓
Prothonotary Warbler	***Prothonotaria citrea***	**Insects**	✓	✓	✓
Red-shouldered Hawk	***Buteo lineatus***	**Mammals**	✓	✓	✓
Snowy Egret	***Egretta thula***	**Fish**	✓	✓	✓
Spotted Sandpiper	***Actitis macularius***	**Small Animals**		✓	✓
Tricolored Heron	***Egretta tricolor***	**Fish**		✓	✓
Wood Duck	***Aix sponsa***	**Plants**	✓		✓
Yellow-crowned Night Heron	***Nyctanassa violacea***	**Aquatic Invertebrates**		✓	
Yellow-throated Warbler	***Setophaga dominica***	**Insects**		✓	✓
American Coot	*Fulica americana*	Plants		✓	
American Crow	*Corvus brachyrhynchos*	Omnivore	✓	✓	✓
American Goldfinch	*Spinus tristis*	Seeds			✓
American Kestrel	*Falco sparverius*	Small Animals		✓	
American Pipit	*Anthus rubescens*	Insects		✓	
American Robin	*Turdus migratorius*	Insects	✓		
American White Pelican	*Pelecanus erythrorhynchos*	Fish		✓	✓
Anhinga	*Anhinga anhinga*	Fish	✓	✓	✓
Bald Eagle	*Haliaeetus leucocephalus*	Fish	✓	✓	✓
Barn Swallow	*Hirundo rustica*	Insects		✓	✓
Belted Kingfisher	*Megaceryle alcyon*	Fish	✓		✓
Black Vulture	*Coragyps atratus*	Carrion		✓	✓
Black-crowned night heron	*Nycticorax nycticorax*	Fish			✓
Black-crowned Night-heron	*Nycticorax nycticorax*	Fish	✓		
Blue Jay	*Cyanocitta cristata*	Omnivore		✓	✓
Blue-gray Gnatcatcher	*Polioptila caerulea*	Insects	✓	✓	✓
Blue-headed Vireo	*Vireo solitarius*	Insects		✓	✓
Boat-tailed Grackle	*Quiscalus major*	Omnivore		✓	
Bonaparte's Gull	*Chroicocephalus philadelphia*	Aquatic invertebrates		✓	
Brown Pelican	*Pelecanus occidentalis*	Fish		✓	✓
Brown Thrasher	*Toxostoma rufum*	Omnivore			✓
Brown-headed Cowbird	*Molothrus ater*	Seeds			✓
Canada Goose	*Branta canadensis*	Seeds			✓
Carolina Chickadee	*Poecile carolinensis*	Insects	✓	✓	✓
Carolina Wren	*Thryothorus ludovicianus*	Insects	✓	✓	✓
Caspian Tern	*Hydropogne caspia*	Fish		✓	✓
Cattle Egret	*Bubulcus Ibis*	Insects		✓	✓
Chimney Swift	*Chaetura pelagica*	Insects		✓	✓
Chipping Sparrow	*Spizella passerina*	Seeds			✓
Cliff Swallow	*Petrochelidon pyrrhonota*	Insects		✓	✓
Common Grackle	*Quiscalus quiscula*	Omnivore	✓	✓	✓
Common Tern	*Sterna hirundo*	Fish			✓
Common Yellowthroat	*Geothlypis trichas*	Insects	✓	✓	✓
Cooper's Hawk	*Accipiter cooperii*	Birds			✓
Double-crested cormorant	*Phalacrocorax auritus*	Fish		✓	✓
Downy Woodpecker	*Dryobates pubescens*	Insects	✓	✓	✓
Eastern Bluebird	*Sialia sialis*	Insects			✓
Eastern Kingbird	*Tyrannus tyrannus*	Insects		✓	✓
Eastern Meadowlark	*Sturnella magna*	Insects			✓
Eastern Phoebe	*Sayornis phoebe*	Insects	✓	✓	✓
Eastern Screech Owl	*Megascops asio*	Small Animals			✓
Eurasian Collared-Dove	*Streptopelia decaocto*	Seeds		✓	✓
European Starling	*Sturnus vulgaris*	Insects		✓	✓
Fish Crow	*Corvus ossifragus*	Omnivore	✓	✓	✓
Forster's Tern	*Sterna forsteri*	Fish		✓	✓
Gadwall	*Mareca strepera*	Plants		✓	
Gray Catbird	*Dumetella carolinensis*	Insects			✓
Great Horned Owl	*Bubo virginianus*	Mammals		✓	
Hairy Woodpecker	*Dryobates villosus*	Insects			✓
Hermit Thrush	*Catharus guttatus*	Insects	✓		✓
Hooded Warbler	*Setophaga citrina*	Insects			✓

Appendix E-6
List of Birds Recorded in Nearby Protected Areas
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Common Name	*Scientific Name*	Diet	Property	Elm Hall	Attakapas Island
House Finch	*Haemorhous mexicanus*	Seeds			✓
House Sparrow	*Passer domesticus*	Omnivore		✓	✓
Inca Dove	*Columbina inca*	Seeds		✓	✓
Indigo Bunting	*Passerina cyanea*	Insects			✓
Killdeer	*Charadrius vociferous*	Insects		✓	✓
Laughing Gull	*Leucophaeus atricilla*	Aquatic invertebrates		✓	✓
Loggerhead Shrike	*Lanius ludovicianus*	Insects			✓
Mississippi Kite	*Ictinia mississippiensis*	Insects	✓	✓	✓
Mourning Dove	*Zenaida macroura*	Seeds		✓	✓
Muscovy Duck	*Cairina moschata*	Omnivore		✓	
Neotropic Cormorant	*Phalacrocorax brasilianus*	Fish		✓	✓
Northern Cardinal	*Cardinalis cardinalis*	Seeds	✓	✓	✓
Northern Flicker	*Colaptes auratus*	Insects	✓	✓	
Northern Mockingbird	*Mimus polyglottos*	Omnivore		✓	✓
Northern Parula	*Setophaga americana*	Insects	✓	✓	✓
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	Insects		✓	✓
Orange-crowned Warbler	*Leiothlypis celata*	Insects	✓	✓	✓
Orchard Oriole	*Icterus spurius*	Insects			✓
Osprey	*Pandion haliaetus*	Fish	✓	✓	✓
Palm Warbler	*Setophaga palmarum*	Insects			✓
Pied-billed Grebe	*Podilymbus podiceps*	Aquatic invertebrates		✓	✓
Pileated Woodpecker	*Dryocopus pileatus*	Insects	✓	✓	✓
Pine Warbler	*Setophaga pinus*	Insects		✓	
Purple Martin	*Progne subis*	Insects		✓	✓
Red-bellied Woodpecker	*Melanerpes carolinus*	Insects	✓	✓	✓
Red-breasted Merganser	*Mergus serrator*	Fish		✓	
Red-eyed Vireo	*Vireo olivaceus*	Insects	✓		✓
Red-headed Woodpecker	*Melanerpes erythrocephalus*	Omnivore			✓
Red-tailed Hawk	*Buteo jamaicensis*	Small Animals	✓	✓	✓
Red-winged Blackbird	*Agelaius phoeniceus*	Insects	✓	✓	✓
Ring-billed Gull	*Larus delawarensis*	Omnivore			✓
Rock Pigeon	*Columba livia*	Seeds		✓	
Roseate Spoonbill	*Platalea ajaja*	Aquatic invertebrates			✓
Ruby-crowned Kinglet	*Regulus calendula*	Insects		✓	✓
Ruddy Duck	*Oxyura jamaicensis*	Aquatic invertebrates		✓	
Savannah Sparrow	*Passerculus sandwichensis*	Insects		✓	✓
Sedge Wren	*Cistothorus platensis*	Insects		✓	
Swallow-tailed Kite	*Elanoides forficatus*	Insects	✓	✓	✓
Tennessee Warbler	*Leiothlypis peregrina*	Insects			✓
Tree Swallow	*Tachycineta bicolor*	Insects		✓	✓
Tufted Titmouse	*Baeolophus bicolor*	Insects		✓	✓
Turkey Vulture	*Cathartes aura*	Carrion	✓	✓	✓
White Ibis	*Eudocimus albus*	Aquatic invertebrates		✓	✓
White-eyed Vireo	*Vireo griseus*	Insects	✓		✓
White-throated Sparrow	*Zonotrichia albicollis*	Seeds	✓		✓
Wilson's Snipe	*Gallinago delicata*	Aquatic invertebrates			✓
Yellow-bellied Sapsucker	*Sphyrapicus varius*	Insects	✓	✓	
Yellow-billed Cuckoo	*Coccyzus americanus*	Insects			✓
Yellow-rumped Warbler	*Setophaga coronata*	Insects	✓	✓	✓
Yellow-throated Vireo	*Vireo flavifrons*	Insects	✓		

Notes
1. Species shown in **bold** have been identified by the U.S. Fish and Wildlife Service (USFWS) Southeast Louisiana Refuges as swamp associates
2. The species list for Elm Hall Wildlife Management Area was derived from an eBird Hotspot Checklist for Lake Verrett, Assumption, Louisiana.
3. The species list for Attakapas Wildlife Management Area was derived from an eBird Hotspot Checklist for the Atchafalaya Basin West Containment
4. Diet for each species is provided by The Cornell Lab (2021).
✓: Indicates that the species has been recorded at that location.

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APPENDIX F SUBMERGED WETLAND DESIGNATION

April 9, 2021

ERM

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Date	30 March 2021
Reference	Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al. Bayou Pigeon Oil & Gas Field Iberia Parish, Louisiana
Subject	Submerged Wetland Evaluation

1. INTRODUCTION

The Jeanerette Lumber & Shingle Co., LLC property (Site) consists of approximately 3,850 acres located in Iberia Parish, approximately 25 miles northwest of Morgan City, Louisiana (Figure F1). This memorandum documents the evaluation of wetlands for the subject Site.

2. REGULATORY

Submerged wetlands are defined under Statewide Order 29-B as wetland areas that are normally inundated with water. For the purposes of this evaluation, normally inundated is interpreted to mean that the area is inundated more than 50% of the time.

3. SITE SETTING

The Site falls within the Louisiana Coastal Zone, as established by Louisiana Revised Statutes Article 49, §214.24. The Site is located within a large contiguous area of swamp within the Atchafalaya Basin and is only accessible by boat.

This evaluation is focused on an area identified by ICON Environmental (ICON) for remediation on the eastern edge of the Site, located in a series of canals and slips off Little Tensas Bayou. The area is an approximately 40-acre portion of the 3,850-acre Site.

3.1 Wetlands

The United States Fish and Wildlife Service (FWS) National Wetlands Inventory (NWI) characterizes the wetlands in the vicinity of the ICON proposed remediation area as predominately swamp (PFO1/2F and PFO1Cs), with smaller areas of freshwater emergent wetland (PEM1Cs) along the spoil banks of the area. A canal and slip, described as riverine, (P2UBHx) bisect the area (Figure F2). A description of each wetland type's USFWS Classification Code is included below:

- **PFO1/2F**: Palustrine (P), Forested (FO), Broad-leaved/needle-leaved deciduous (1/2), semipermanently flooded (F).
- **PF01Cs**: Palustrine (P), Forested (FO), Broad-leaved deciduous (1), seasonally flooded (C).
- **PEM1Cs:** Palustrine (P), Emergent (EM), persistent (1), seasonally flooded (C).

- **R2UBHx**: Riverine (R), Lower Perennial (2), unconsolidated bottom (UB), permanently flooded (H), excavated (x).

The water regimes described for this area include:

- **Permanently Flooded**: Water covers the substrate throughout the year in all years.
  11% of the 40-acre area is classified as permanently flooded.

- **Semipermanently Flooded**: Surface water persists throughout the growing season in most years. When surface water is absent, the water table is usually at or very near the land surface.
  81% of the 40-acre area is classified as semi-permanently flooded.

- **Seasonally Flooded**: Surface water is present for extended periods especially early in the growing season, but is absent by the end of the growing season in most years. The water table after flooding ceases is variable, extending from saturated to the surface to a water table well below the ground surface.
  8% of the 40-acre area is classified as seasonally flooded.

3.2 Soils

Surficial geology at the area are labeled as Hb - backswamp deposits (Baton Rouge 100k Geological Map). These are described as, “Holocene deposits of the Mississippi and Atchafalaya River. They consist of fine-grained, usually clayey and often organically rich sediments that underlie flood basins between meander-belts.” The soils on the Site are classified by USDA/NRCS (2020) as Fausse soils, which are frequently flooded hydric soils that are very poorly drained, and the water table is typically at the surface. A map showing the soil survey for the area is shown on Figure F3.

3.3 Vegetative communities

As per the USFWS’s User Report for the Baton Rouge and Lake Charles Regions, the forested wetlands on the Site are characterized as cypress-tupelo swamps dominated by bald cypress (*Taxodium distichum*) and water tupelo (*Nyssa aquatica*).

The natural vegetative communities documented on Site include Bald Cypress-Tupelo Swamp and large mats of floating emergent marsh, or flotant (LDWF, 2009). The forty-nine plant taxa observed on the Site are primarily found in freshwater wetland habitats (LDWF, 2009; Chabreck, 1972; Penfound, 1938). The majority (73%) of the vegetation identified are hydrophytic or growing partially or wholly in water, with 47% of Site vegetation categorized as always in wetlands (USDA, 2021). The data support classification of the Site as wetland.

4. INUNDATION ANALYSIS

Four elevation transects were performed by T. Baker Smith on March 4, 2021. Transects focused on spoil banks adjacent to canals and were conducted perpendicular to these areas until elevations leveled off in the lower swamps beyond (Figure F4).

4.1 Regional Water Level Data

Mean daily water levels (i.e., gauge height in feet) were downloaded for the U.S. Army Corps of Engineers (USACE) gauging stations located within the Atchafalaya Basin levee system. Gauging stations were chosen based on proximity to the Site and hydraulic connectivity with the Site. A summary of gauging stations is presented below and a figure showing their locations is included as Figure F5.

- Old River (FWS) at GIWW Junction (49645), approximately 10 miles southeast of the area. Gauge data was available from April 3, 1997 to June 21, 2009.
- Chicot Pass near West Fork (03465), approximately 5 miles northwest of the area. Gauge data was available from September 13, 2011 to March 18, 2021.
- Keelboat Pass below Lake Chicot (03615), approximately 3 miles northwest of the area. Gauge data was available from January 2010 to March 18, 2021.
- Bayou Sorrel (FWS) (49615), approximately 9 miles north of the area. Gauge data was available from December 8, 2018 to March 18, 2021.
- Buffalo Cove at Round Island near Charenton (49235), approximately 7 miles southwest of the area. Gauge data was available from March 22, 2008 to December 15, 2015.

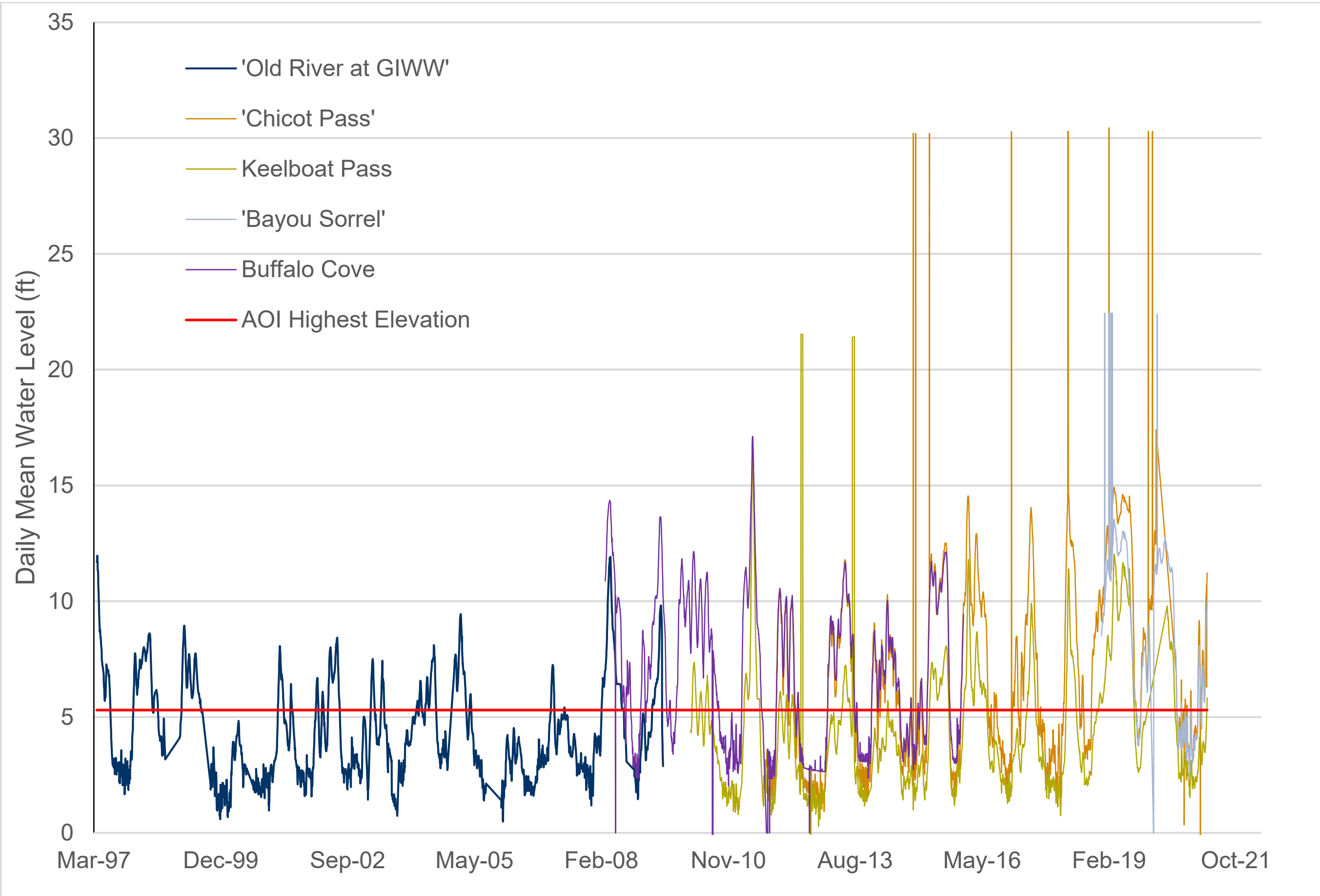

Table E2: Mean daily water levels for five USACE gauge stations. Data available for download: Rivergages.com: Providing River Gage Data for Rivers, Streams and Tributaries (army.mil).

4.2 Submergence Frequency

Inundation was assessed across the area for frequency of inundation by comparing surveyed elevations on-Site and mean, daily water level data at each USACE gauge location (Table E2). The highest elevation surveyed within the area was 5.3 ft and was located on a spoil bank on the eastern portion of the 40-acre area.

Submergence frequency for the area was calculated based upon the number of days where the mean daily water level was above 5.3 ft divided by the total number of days in each dataset. The resulting percentage thus provides an estimate of the submergence frequency across the entire area.

$$Submergence\ Frequency = \frac{Number\ of\ Days\ with\ Water\ Level\ above\ 5.3\ ft}{Total\ Number\ of\ Days\ in\ Dataset}\ x\ 100$$

The submergence frequencies based on water level data from each monitoring station are summarized in Table E3.

Table E3. Submergence frequency on Site based on mean daily water levels at five U.S. Army Corps of Engineers gauging stations.

Gauge Location	Date Range	Days Submerged	Total Days	Submergence Frequency
Old River (FWS) at GIWW Junction	Apr 1997 – June 2009	1,145	3,834	29.86%
Chicot Pass near West Fork	Sep 2011 – Mar 2021	1,874	3,296	56.86%
Keelboat Pass below Lake Chicot	Jan 2010 – Mar 2021	1,185	3,758	31.53%
Bayou Sorrel (FWS)	Dec 2018 – Mar 2021	518	726	71.35%
Buffalo Cove at Round Island	Mar 2008 – Dec 2015	1,691	2,727	62.01%

Estimated submergence frequencies of the entire 40-acre area range from 29% to 71%, depending on which water-level gauge is used for the evaluation. Three gauges show the entire 40-acre area as inundated more than 50% of the time. Two gauges show the highest elevations in the area as inundated about 30% of the time with 95% of the area inundated over 50% of the time. These higher elevations represent narrow bands of spoil material deposited during the dredging of the canals.

4.3 Field Observations

Inundation at the area has been observed during field visits from May 2020 to March 2021. The area was completely inundated on visits in May and July 2020. The swamp beyond the spoil banks was not observed to be inundated once in October 2020, however, conditions were still so saturated that the area was not traversable on foot.

May 26, 2020: Inundation on highest portion of the area (vegetated areas) facing south towards JLS-2 location. Note the trees on the spoil bank are all in standing water. Photographed by J. Shugart.

July 31, 2020: Marsh master and boat on JLS-11 location facing east. Photographed by J. Shugart.

4.4 Aquatic Vegetation

Aquatic vegetation, or macrophytes, can either be emergent (i.e., with upright portions above the water surface), submerged, or floating (EPA, 2021). Submerged aquatic vegetation floats on the water's surface, but is anchored to the substrate by roots, where free-floating aquatic plants grow entirely suspended on surface water (Clemson University, 2021). Presence of submerged or floating aquatic vegetation can therefore serve as an indication of the Site's hydrology.

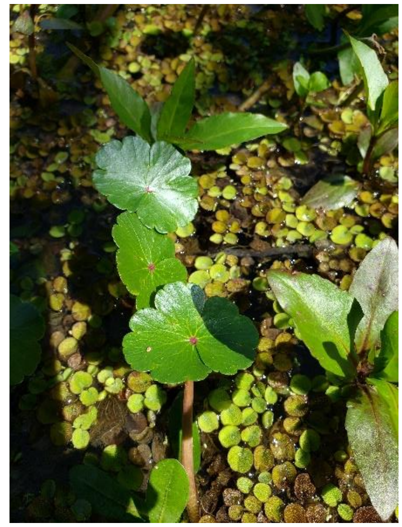

Figure 3. Examples of floating aquatic vegetation. Pictured: water spangles (*Salvinia minima)* and floating marshpennywort (*Hydrocotyle ranunculoides*). Photographed by J. Shugart on March 4, 2021.

Site vegetation surveys were conducted by ERM on March 4 and 15, 2021. In addition to emergent wetland species, floating aquatic vegetation such as mosquitofern (*Azolla sp.*), common duckweed (*Lemna minor*), American spongeplant (*Limnobium spongia*), common water hyacinth (*Eichhornia crassipes*), floating marshpennywort (*Hydrocotyle ranunculoides*), smooth beggartick (*Bidens laevis*), and water spangles (*Salvinia minima*) were observed on Site. United States Department of Agriculture (USDA) classifies these species as obligate wetland plants for the Atlantic and Gulf Coastal Plain region.

In addition to acting as an indicator of hydrology, submerged and floating aquatic vegetation can also provide insight into the health of the ecosystem. Where aquatic vegetation is abundant, it can have influence on habitat structure, fishability, recreational use and nutrient dynamics. Submerged aquatic vegetation is considered a vital coastal resource for fish and wildlife, and can mitigate the effects of erosion of marsh shorelines (DeMarco et al., 2018; Jerabek et al., 2017).

5. CONCLUSION

Based on a desktop analysis of water level and elevation data, the 40-acre area portion of the Site is primarily characterized as submerged wetlands. Depending on conditions year by year, however, approximately 2 acres of elevated spoil banks may or may not be inundated over 50% of the time. During the multiple Site investigations, inundation indicators such as the presence of surface water, abundant aquatic vegetation, and watermarks on trees well above land surface elevation, were observed across the entire area. The desktop analysis and field observations therefore support the 40-acre area's classification as submerged wetlands.

Jody Shugart

Jody Shugart, P.G.

ATTACHMENTS

Figure F1 Site Location

Figure F2 USFWS Wetlands

Figure F3 Soil Survey

Figure F4 Elevation Survey

Figure F5 USACE Water Level Gauges

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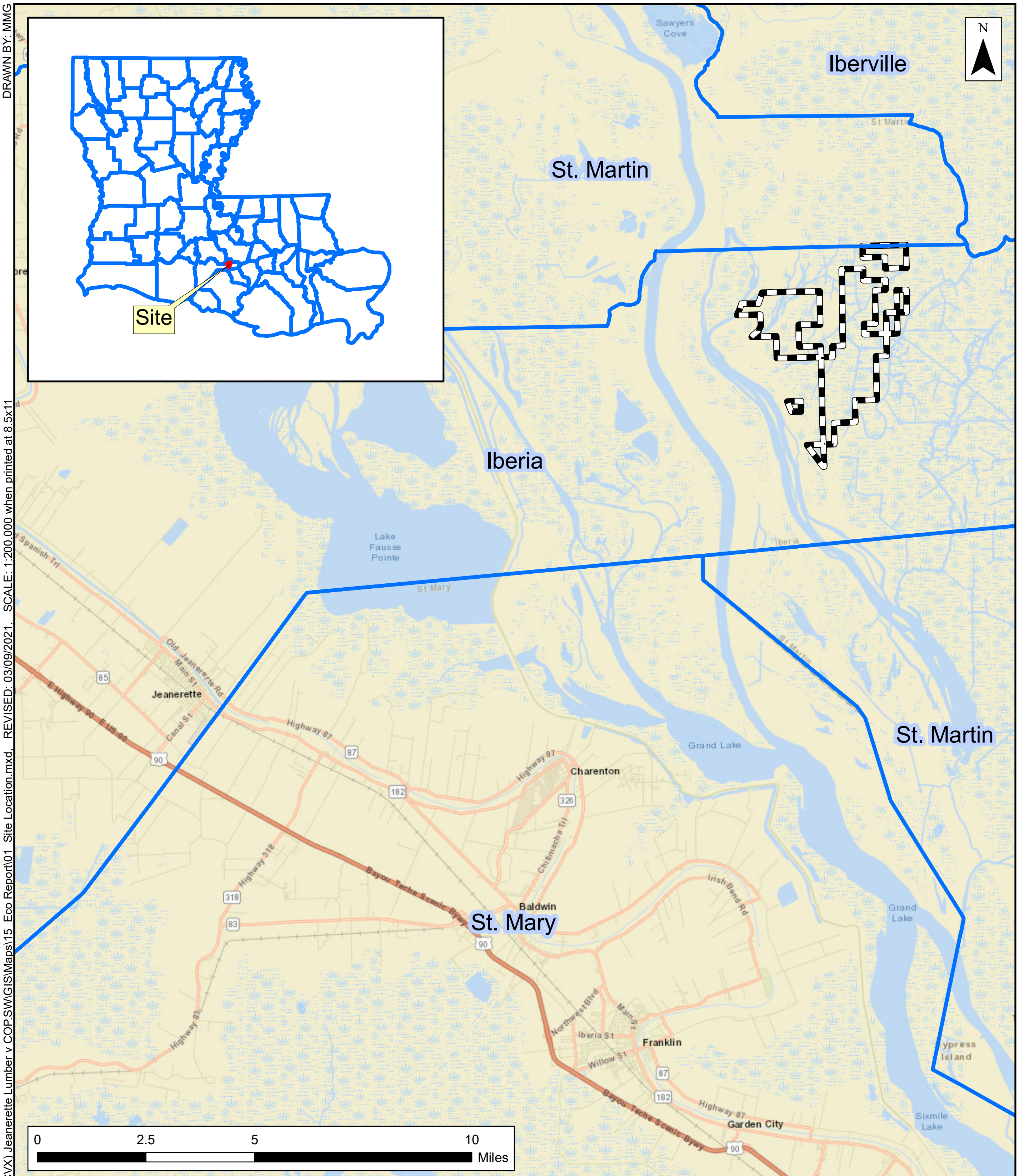

Parish Boundary

Property

Figure F1
Site Location
Jeanerette Lumber & Shingle Co., LLC
v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Environmental Resources Management
www.erm.com
ERM

Notes:
World Street Basemap via ArcGIS Online.

Source: Esri - ArcGIS Online; NAD 1983 UTM Zone 15N

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Property
Freshwater Emergent Wetland
Freshwater Forested/Shrub Wetland
Riverine

Figure F2
USFWS Wetlands
Jeanerette Lumber & Shingle Co., LLC
v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Notes:
Wetland data from US Fish and Wildlife Service.
Imagery basemap via ArcGIS Online.

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Source: Esri - ArcGIS Online; NAD 1983 UTM Zone 15N

Property

ICON Proposed Soil and Sediment Remediation Area

Soil Survey

FE - Fausse soils, 0 to 1 percent slopes, frequently flooded

W - Water

Figure F3
Soil Survey
Jeanerette Lumber & Shingle Co., LLC
v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Notes:
Aerial via ESRI
Soil data from USDA

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Property

ICON Proposed Soil and Sediment Remediation Area

Elevation Survey Point

Elevation Survey Point

Notes:
Aerial via ESRI
Surveyed elevations by T. Baker Smith (3/4/2021)

Figure F4
Elevation Survey
Jeanerette Lumber & Shingle Co., LLC
v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

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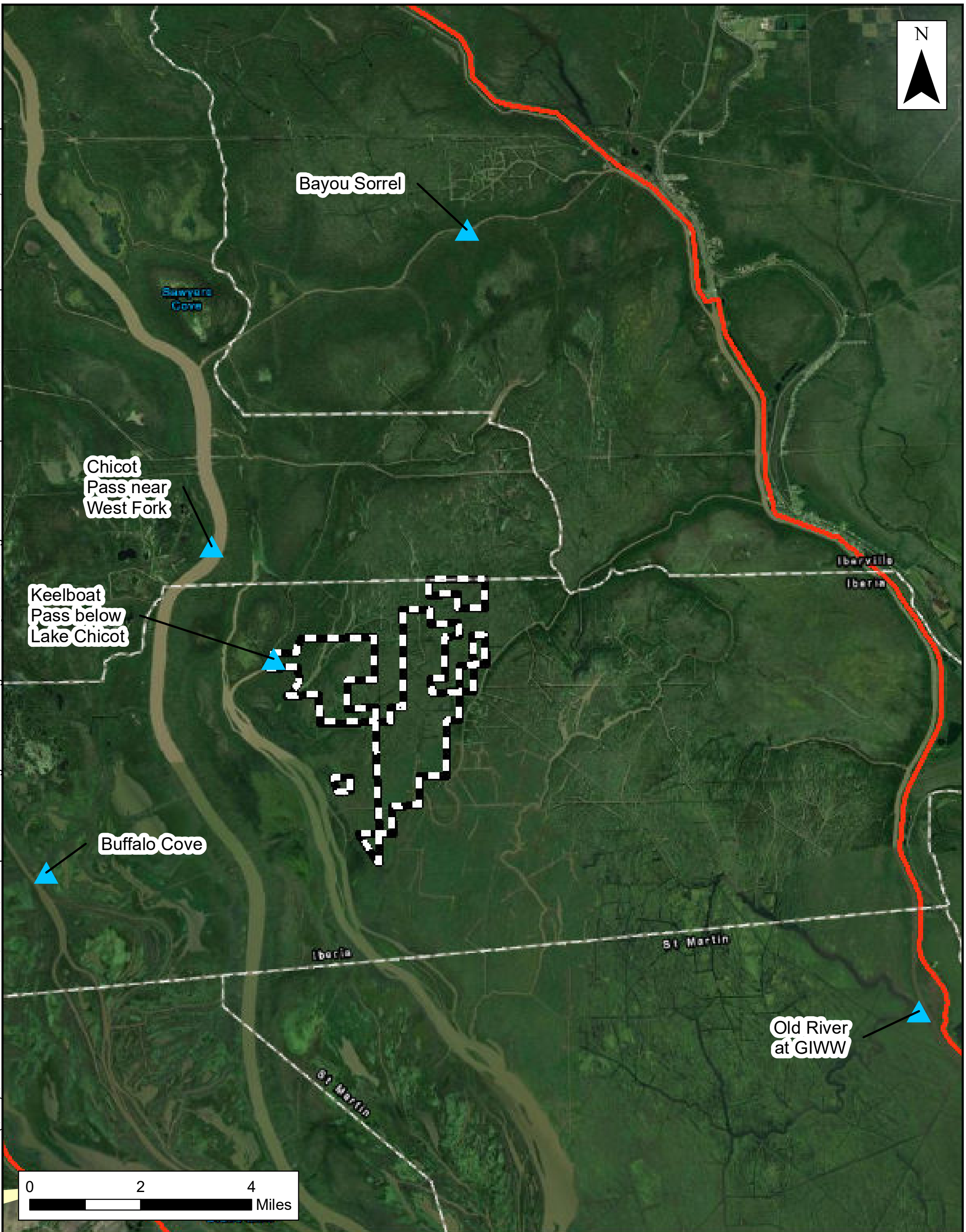

Property Boundary
USACE Levee System
USACE Structures
USACE Surface Water Gauge

Notes:
USACE Levee system from National Levee Database (https://levees.sec.usace.army.mil/)
USACE Water Management Units form USACE, Undated, List of Projects
USACE Structures from USACE New Orleans District "The Atchafalaya Basin Project"

Figure F5
USACE Water Level Gauges
Jeanerette Lumber v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Environmental Resources Management
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Source: Esri - World Imagery Map; NAD 1983 UTM Zone 15N

APPENDIX G BACKGROUND CALCULATIONS

April 9, 2021

Appendix G-1
Louisiana Background Data Collected by USGS
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

SiteID	StateID	CollDate	Depth (cm)	Ag (mg/kg)	D_Ag (mg/kg)	As (mg/kg)	D_As (mg/kg)	Ba (mg/kg)	D_Ba (mg/kg)
120	LA	7/30/2008	0-5	1	0	4.9	1	514	1
140	LA	8/6/2008	0-5	1	0	2	1	111	1
204	LA	7/26/2008	0-5	1	0	5.7	1	296	1
332	LA	8/2/2008	0-5	1	0	2.5	1	187	1
460	LA	7/26/2008	0-5	1	0	3	1	210	1
588	LA	8/6/2008	0-5	1	0	4.8	1	138	1
824	LA	7/30/2008	0-5	1	0	4.2	1	448	1
1072	LA	7/28/2008	0-5	1	0	10	1	652	1
1144	LA	7/30/2008	0-5	1	0	11.4	1	654	1
1356	LA	8/2/2008	0-5	1	0	2.1	1	232	1
1612	LA	8/5/2008	0-5	1	0	5.1	1	520	1
1740	LA	8/3/2008	0-5	1	0	5.4	1	641	1
1848	LA	7/28/2008	0-5	1	0	5.5	1	542	1
2168	LA	7/29/2008	0-5	1	0	10.7	1	765	1
2380	LA	8/4/2008	0-5	1	0	1.9	1	236	1
2636	LA	8/6/2008	0-5	1	0	1.7	1	304	1
2872	LA	7/28/2008	0-5	1	0	7.4	1	712	1
2892	LA	8/6/2008	0-5	1	0	3.2	1	231	1
3404	LA	8/4/2008	0-5	1	0	2.9	1	425	1
3640	LA	7/31/2008	0-5	1	0	6.9	1	576	1
3896	LA	7/27/2008	0-5	1	0	1.3	1	104	1
3980	LA	8/1/2008	0-5	1	0	9.4	1	514	1
4216	LA	7/30/2008	0-5	1	0	5.4	1	648	1
4236	LA	8/6/2008	0-5	1	0	3.6	1	180	1
4300	LA	8/1/2008	0-5	1	0	4.3	1	624	1
4428	LA	8/2/2008	0-5	1	0	3.3	1	102	1
4492	LA	8/6/2008	0-5	1	0	5.6	1	342	1
4664	LA	7/31/2008	0-5	1	0	3.9	1	471	1
4684	LA	8/6/2008	0-5	1	0	2.6	1	75	1
4920	LA	7/31/2008	0-5	1	0	1	1	283	1
5240	LA	8/1/2008	0-5	1	0	10.1	1	2690	1
5452	LA	8/2/2008	0-5	1	0	4	1	363	1
5688	LA	7/31/2008	0-5	1	0	1.5	1	228	1
5708	LA	8/6/2008	0-5	1	0	6.8	1	378	1
5836	LA	8/4/2008	0-5	1	0	10.8	1	603	1
5944	LA	7/26/2008	0-5	1	0	3.8	1	264	1
6264	LA	7/29/2008	0-5	1	0	7	1	842	1
6476	LA	8/2/2008	0-5	1	0	2.8	1	103	1
6712	LA	7/31/2008	0-5	1	0	5.9	1	376	1
6968	LA	7/28/2008	0-5	1	0	5.8	1	728	1
7500	LA	8/4/2008	0-5	1	0	2.9	1	196	1
7736	LA	7/31/2008	0-5	1	0	5.6	1	269	1
7992	LA	7/28/2008	0-5	1	0	11.5	1	632	1
8012	LA	8/6/2008	0-5	1	0	3.8	1	368	1
8076	LA	8/1/2008	0-5	1	0	6.9	1	688	1
8312	LA	7/30/2008	0-5	1	0	7.6	1	692	1
8332	LA	8/6/2008	0-5	1	0	10.1	1	471	1
8396	LA	8/3/2008	0-5	1	0	9.3	1	606	1
8524	LA	8/4/2008	0-5	1	0	4.4	1	348	1

SiteID	StateID	CollDate	Depth (cm)	Ag (mg/kg)	D_Ag (mg/kg)	As (mg/kg)	D_As (mg/kg)	Ba (mg/kg)	D_Ba (mg/kg)
8780	LA	8/6/2008	0-5	1	0	3.2	1	273	1
8908	LA	8/4/2008	0-5	1	0	8.7	1	484	1
9016	LA	7/30/2008	0-5	1	0	3.3	1	687	1
9336	LA	7/30/2008	0-5	1	0	5.4	1	599	1
9548	LA	8/3/2008	0-5	1	0	1.6	1	408	1
9804	LA	8/6/2008	0-5	1	0	1.9	1	88	1
9932	LA	8/4/2008	0-5	1	0	12.7	1	649	1
10040	LA	7/29/2008	0-5	1	0	8.2	1	638	1
10060	LA	8/6/2008	0-5	1	0	1.2	1	64	1
10572	LA	7/31/2008	0-5	1	0	6.3	1	185	1
10808	LA	7/31/2008	0-5	1	0	4.4	1	203	1
11064	LA	7/28/2008	0-5	1	0	14.5	1	606	1
11148	LA	8/1/2008	0-5	1	0	4.3	1	634	1
11340	LA	8/4/2008	0-5	1	0	5.6	1	452	1
11468	LA	7/26/2008	0-5	1	0	3.4	1	206	1
11596	LA	8/4/2008	0-5	1	0	1.1	1	156	1
11724	LA	8/4/2008	0-5	1	0	17.4	1	710	1
11832	LA	7/30/2008	0-5	1	0	5.1	1	217	1
11852	LA	8/2/2008	0-5	1	0	32.6	1	198	1
12088	LA	7/29/2008	0-5	1	0	8.4	1	703	1
12408	LA	7/30/2008	0-5	1	0	8.7	1	710	1
12620	LA	8/2/2008	0-5	1	0	2	1	149	1
12856	LA	7/31/2008	0-5	1	0	2	1	144	1
12876	LA	8/6/2008	0-5	1	0	4.1	1	211	1
13004	LA	8/3/2008	0-5	1	0	6.5	1	731	1
13112	LA	7/31/2008	0-5	1	0	3.7	1	163	1
120	LA	7/30/2008	0-15	1	0	4.8	1	448	1
140	LA	8/6/2008	0-30	1	0	1.8	1	132	1
204	LA	7/26/2008	0-5	1	0	6.1	1	271	1
332	LA	8/2/2008	0-15	1	0	1	1	147	1
460	LA	7/26/2008	0-10	1	0	3.1	1	199	1
588	LA	8/6/2008	0-20	1	0	5.3	1	168	1
824	LA	7/30/2008	0-20	1	0	4	1	353	1
1072	LA	7/28/2008	0-20	1	0	6.8	1	474	1
1144	LA	7/30/2008	0-20	1	0	11	1	667	1
1356	LA	8/2/2008	0-20	1	0	1.4	1	226	1
1612	LA	8/5/2008	0-30	1	0	6.8	1	503	1
1740	LA	8/3/2008	0-20	1	0	7.9	1	624	1
1848	LA	7/28/2008	0-10	1	0	5	1	607	1
2168	LA	7/29/2008	0-8	1	0	9.6	1	775	1
2380	LA	8/4/2008	0-20	1	0	2.5	1	254	1
2636	LA	8/6/2008	0-15	1	0	1.4	1	267	1
2872	LA	7/28/2008	0-10	1	0	5.7	1	565	1
2892	LA	8/6/2008	0-20	1	0	3	1	234	1
3404	LA	8/4/2008	0-30	1	0	3.2	1	447	1
3640	LA	7/31/2008	0-30	1	0	6.9	1	468	1
3896	LA	7/27/2008	0-20	1	0	2.3	1	111	1
3980	LA	8/1/2008	0-10	1	0	8.7	1	535	1
4216	LA	7/30/2008	0-20	1	0	5.7	1	629	1
4236	LA	8/6/2008	0-20	1	0	3.8	1	154	1

SiteID	StateID	CollDate	Depth (cm)	Ag (mg/kg)	D_Ag (mg/kg)	As (mg/kg)	D_As (mg/kg)	Ba (mg/kg)	D_Ba (mg/kg)
4300	LA	8/1/2008	0-5	1	0	5.6	1	592	1
4428	LA	8/2/2008	0-20	1	0	1.8	1	86	1
4492	LA	8/6/2008	0-10	1	0	5.3	1	291	1
4664	LA	7/31/2008	0-15	1	0	3.9	1	432	1
4684	LA	8/6/2008	0-30	1	0	5.7	1	68	1
4920	LA	7/31/2008	0-5	1	0	1.4	1	364	1
5240	LA	8/1/2008	0-15	1	0	14	1	2530	1
5452	LA	8/2/2008	0-20	1	0	4	1	339	1
5688	LA	7/31/2008	0-30	1	0	2.7	1	242	1
5708	LA	8/6/2008	0-20	1	0	6.6	1	318	1
5836	LA	8/4/2008	0-20	1	0	13.7	1	686	1
5944	LA	7/26/2008	0-20	1	0	4.5	1	304	1
6264	LA	7/29/2008	0-20	1	0	7.5	1	847	1
6476	LA	8/2/2008	0-20	1	0	2.9	1	97	1
6712	LA	7/31/2008	0-25	1	0	6.7	1	354	1
6968	LA	7/28/2008	0-25	1	0	8.4	1	667	1
7500	LA	8/4/2008	0-15	1	0	3	1	205	1
7736	LA	7/31/2008	0-15	1	0	5.6	1	287	1
7992	LA	7/28/2008	0-8	1	0	11.4	1	647	1
8012	LA	8/6/2008	0-20	1	0	3.9	1	370	1
8076	LA	8/1/2008	0-20	1	0	7.3	1	694	1
8312	LA	7/30/2008	0-30	1	0	4.9	1	657	1
8332	LA	8/6/2008	0-70	1	0	10.4	1	536	1
8396	LA	8/3/2008	0-30	1	0	8.9	1	597	1
8524	LA	8/4/2008	0-20	1	0	3.9	1	387	1
8780	LA	8/6/2008	0-10	1	0	3.8	1	232	1
8908	LA	8/4/2008	0-20	1	0	8.8	1	479	1
9016	LA	7/30/2008	0-30	1	0	3.3	1	238	1
9336	LA	7/30/2008	0-20	1	0	6.9	1	646	1
9548	LA	8/3/2008	0-20	1	0	5.8	1	403	1
9804	LA	8/6/2008	0-15	1	0	2	1	74	1
9932	LA	8/4/2008	0-30	1	0	11.1	1	648	1
10040	LA	7/29/2008	0-30	1	0	9.6	1	708	1
10060	LA	8/6/2008	0-25	1	0	1.2	1	74	1
10572	LA	7/31/2008	0-10	1	0	6.3	1	187	1
10808	LA	7/31/2008	0-10	1	0	3.4	1	162	1
11064	LA	7/28/2008	0-8	1	0	13.9	1	654	1
11148	LA	8/1/2008	0-20	1	0	4.8	1	575	1
11340	LA	8/4/2008	0-30	1	0	6.4	1	402	1
11468	LA	7/26/2008	0-30	1	0	3.4	1	223	1
11596	LA	8/4/2008	0-30	1	0	1.9	1	170	1
11724	LA	8/4/2008	0-50	1	0	18	1	617	1
11832	LA	7/30/2008	0-20	1	0	4.9	1	243	1
11852	LA	8/2/2008	0-20	1	0	38.2	1	180	1
12088	LA	7/29/2008	0-30	1	0	8	1	638	1
12408	LA	7/30/2008	0-30	1	0	8.6	1	749	1
12620	LA	8/2/2008	0-25	1	0	1.8	1	159	1
12856	LA	7/31/2008	0-20	1	0	1.9	1	141	1
12876	LA	8/6/2008	0-10	1	0	3.3	1	218	1
13004	LA	8/3/2008	0-20	1	0	6.7	1	701	1
13112	LA	7/31/2008	0-20	1	0	3.8	1	169	1

SiteID	StateID	CollDate	Depth (cm)	Cd (mg/kg)	D_Cd (mg/kg)	Cr (mg/kg)	D_Cr (mg/kg)	Pb (mg/kg)	D_Pb (mg/kg)
120	LA	7/30/2008	0-5	0.3	1	66	1	90.8	1
140	LA	8/6/2008	0-5	0.1	0	19	1	6.7	1
204	LA	7/26/2008	0-5	0.3	1	35	1	18.7	1
332	LA	8/2/2008	0-5	0.1	0	20	1	10.7	1
460	LA	7/26/2008	0-5	0.1	0	27	1	15.3	1
588	LA	8/6/2008	0-5	0.1	0	31	1	10.1	1
824	LA	7/30/2008	0-5	0.1	0	39	1	18.3	1
1072	LA	7/28/2008	0-5	0.6	1	70	1	47.2	1
1144	LA	7/30/2008	0-5	0.4	1	71	1	20.9	1
1356	LA	8/2/2008	0-5	0.1	0	18	1	10.9	1
1612	LA	8/5/2008	0-5	0.3	1	62	1	35	1
1740	LA	8/3/2008	0-5	1.1	1	65	1	25.4	1
1848	LA	7/28/2008	0-5	0.4	1	38	1	26	1
2168	LA	7/29/2008	0-5	0.3	1	40	1	19.6	1
2380	LA	8/4/2008	0-5	0.1	0	30	1	14.1	1
2636	LA	8/6/2008	0-5	0.1	0	23	1	11.3	1
2872	LA	7/28/2008	0-5	0.3	1	52	1	24.1	1
2892	LA	8/6/2008	0-5	0.1	0	34	1	9.8	1
3404	LA	8/4/2008	0-5	0.1	0	24	1	17.5	1
3640	LA	7/31/2008	0-5	0.2	1	48	1	24.8	1
3896	LA	7/27/2008	0-5	0.1	1	12	1	25.7	1
3980	LA	8/1/2008	0-5	0.4	1	80	1	41.7	1
4216	LA	7/30/2008	0-5	0.2	1	39	1	18.9	1
4236	LA	8/6/2008	0-5	0.2	1	28	1	26.3	1
4300	LA	8/1/2008	0-5	0.2	1	58	1	19.2	1
4428	LA	8/2/2008	0-5	0.1	0	21	1	11.1	1
4492	LA	8/6/2008	0-5	0.1	0	32	1	21.3	1
4664	LA	7/31/2008	0-5	0.1	0	20	1	13.9	1
4684	LA	8/6/2008	0-5	0.1	0	22	1	7.6	1
4920	LA	7/31/2008	0-5	0.1	0	5	1	9.3	1
5240	LA	8/1/2008	0-5	0.3	1	23	1	31.8	1
5452	LA	8/2/2008	0-5	0.1	1	34	1	19.2	1
5688	LA	7/31/2008	0-5	0.1	0	25	1	13.6	1
5708	LA	8/6/2008	0-5	0.1	1	66	1	27.6	1
5836	LA	8/4/2008	0-5	1	1	67	1	30.5	1
5944	LA	7/26/2008	0-5	0.2	1	15	1	26.2	1
6264	LA	7/29/2008	0-5	0.2	1	38	1	13.6	1
6476	LA	8/2/2008	0-5	0.1	0	18	1	11.3	1
6712	LA	7/31/2008	0-5	0.2	1	19	1	12.7	1
6968	LA	7/28/2008	0-5	0.4	1	60	1	27.9	1
7500	LA	8/4/2008	0-5	0.1	0	15	1	10.8	1
7736	LA	7/31/2008	0-5	0.1	0	30	1	16.4	1
7992	LA	7/28/2008	0-5	0.5	1	47	1	46.7	1
8012	LA	8/6/2008	0-5	0.1	0	28	1	17.8	1
8076	LA	8/1/2008	0-5	0.5	1	57	1	22.2	1
8312	LA	7/30/2008	0-5	0.3	1	54	1	17.5	1
8332	LA	8/6/2008	0-5	0.1	1	72	1	19.6	1
8396	LA	8/3/2008	0-5	0.4	1	75	1	25.9	1
8524	LA	8/4/2008	0-5	0.1	0	31	1	18.9	1

SiteID	StateID	CollDate	Depth (cm)	Cd (mg/kg)	D_Cd (mg/kg)	Cr (mg/kg)	D_Cr (mg/kg)	Pb (mg/kg)	D_Pb (mg/kg)
8780	LA	8/6/2008	0-5	0.1	1	19	1	14.6	1
8908	LA	8/4/2008	0-5	0.1	1	39	1	19.7	1
9016	LA	7/30/2008	0-5	0.1	0	27	1	17.2	1
9336	LA	7/30/2008	0-5	0.1	1	37	1	31.3	1
9548	LA	8/3/2008	0-5	0.1	0	22	1	22.2	1
9804	LA	8/6/2008	0-5	0.1	0	25	1	10	1
9932	LA	8/4/2008	0-5	0.2	1	46	1	17.5	1
10040	LA	7/29/2008	0-5	1.1	1	55	1	80.6	1
10060	LA	8/6/2008	0-5	0.1	0	10	1	8.1	1
10572	LA	7/31/2008	0-5	0.1	0	38	1	16	1
10808	LA	7/31/2008	0-5	0.1	0	31	1	22.4	1
11064	LA	7/28/2008	0-5	0.8	1	61	1	34.1	1
11148	LA	8/1/2008	0-5	0.2	1	55	1	32.1	1
11340	LA	8/4/2008	0-5	0.1	0	22	1	11.8	1
11468	LA	7/26/2008	0-5	0.1	0	35	1	19.8	1
11596	LA	8/4/2008	0-5	0.1	0	19	1	9.3	1
11724	LA	8/4/2008	0-5	0.1	1	32	1	11.8	1
11832	LA	7/30/2008	0-5	0.1	0	33	1	13.3	1
11852	LA	8/2/2008	0-5	0.1	0	77	1	36.2	1
12088	LA	7/29/2008	0-5	0.3	1	60	1	19.8	1
12408	LA	7/30/2008	0-5	0.5	1	59	1	23.2	1
12620	LA	8/2/2008	0-5	0.1	0	18	1	9.3	1
12856	LA	7/31/2008	0-5	0.1	0	24	1	8.8	1
12876	LA	8/6/2008	0-5	0.1	0	27	1	11.4	1
13004	LA	8/3/2008	0-5	0.1	0	44	1	13.3	1
13112	LA	7/31/2008	0-5	0.1	0	23	1	16.2	1
120	LA	7/30/2008	0-15	0.2	1	67	1	35.2	1
140	LA	8/6/2008	0-30	0.1	0	11	1	8.1	1
204	LA	7/26/2008	0-5	0.3	1	37	1	22.5	1
332	LA	8/2/2008	0-15	0.1	0	16	1	9.3	1
460	LA	7/26/2008	0-10	0.1	0	33	1	13.4	1
588	LA	8/6/2008	0-20	0.1	0	25	1	11.5	1
824	LA	7/30/2008	0-20	0.1	0	32	1	16.8	1
1072	LA	7/28/2008	0-20	0.6	1	57	1	35.7	1
1144	LA	7/30/2008	0-20	0.4	1	61	1	22.5	1
1356	LA	8/2/2008	0-20	0.1	0	21	1	11.1	1
1612	LA	8/5/2008	0-30	0.2	1	84	1	31	1
1740	LA	8/3/2008	0-20	0.8	1	62	1	28	1
1848	LA	7/28/2008	0-10	0.3	1	45	1	26.8	1
2168	LA	7/29/2008	0-8	0.3	1	53	1	15.5	1
2380	LA	8/4/2008	0-20	0.1	0	23	1	13.6	1
2636	LA	8/6/2008	0-15	0.1	0	19	1	9.4	1
2872	LA	7/28/2008	0-10	0.3	1	37	1	23.4	1
2892	LA	8/6/2008	0-20	0.1	0	19	1	11.2	1
3404	LA	8/4/2008	0-30	0.1	0	29	1	16	1
3640	LA	7/31/2008	0-30	0.2	1	37	1	20.8	1
3896	LA	7/27/2008	0-20	0.1	1	19	1	23.6	1
3980	LA	8/1/2008	0-10	0.4	1	79	1	33.3	1
4216	LA	7/30/2008	0-20	0.2	1	51	1	18.4	1
4236	LA	8/6/2008	0-20	0.2	1	30	1	25.5	1

SiteID	StateID	CollDate	Depth (cm)	Cd (mg/kg)	D_Cd (mg/kg)	Cr (mg/kg)	D_Cr (mg/kg)	Pb (mg/kg)	D_Pb (mg/kg)
4300	LA	8/1/2008	0-5	0.2	1	60	1	20	1
4428	LA	8/2/2008	0-20	0.1	0	18	1	9.7	1
4492	LA	8/6/2008	0-10	0.1	0	31	1	20.3	1
4664	LA	7/31/2008	0-15	0.1	0	6	1	16.4	1
4684	LA	8/6/2008	0-30	0.1	0	13	1	8.2	1
4920	LA	7/31/2008	0-5	0.1	0	7	1	10.9	1
5240	LA	8/1/2008	0-15	0.3	1	35	1	18.4	1
5452	LA	8/2/2008	0-20	0.1	1	31	1	17.5	1
5688	LA	7/31/2008	0-30	0.1	0	22	1	16.3	1
5708	LA	8/6/2008	0-20	0.1	0	69	1	24.6	1
5836	LA	8/4/2008	0-20	0.8	1	78	1	31.4	1
5944	LA	7/26/2008	0-20	0.2	1	28	1	31.9	1
6264	LA	7/29/2008	0-20	0.3	1	37	1	18.5	1
6476	LA	8/2/2008	0-20	0.1	0	24	1	10.4	1
6712	LA	7/31/2008	0-25	0.2	1	35	1	12.1	1
6968	LA	7/28/2008	0-25	0.3	1	47	1	27	1
7500	LA	8/4/2008	0-15	0.1	0	17	1	11.6	1
7736	LA	7/31/2008	0-15	0.1	0	26	1	18	1
7992	LA	7/28/2008	0-8	0.4	1	53	1	44.2	1
8012	LA	8/6/2008	0-20	0.1	0	39	1	19.6	1
8076	LA	8/1/2008	0-20	0.4	1	47	1	22.2	1
8312	LA	7/30/2008	0-30	0.3	1	52	1	16	1
8332	LA	8/6/2008	0-70	0.1	1	84	1	20.5	1
8396	LA	8/3/2008	0-30	0.3	1	60	1	24.5	1
8524	LA	8/4/2008	0-20	0.1	0	22	1	16.2	1
8780	LA	8/6/2008	0-10	0.1	1	24	1	12.8	1
8908	LA	8/4/2008	0-20	0.1	0	35	1	16.1	1
9016	LA	7/30/2008	0-30	0.1	0	25	1	10.9	1
9336	LA	7/30/2008	0-20	0.1	0	51	1	19	1
9548	LA	8/3/2008	0-20	0.1	0	21	1	14	1
9804	LA	8/6/2008	0-15	0.1	0	19	1	7.2	1
9932	LA	8/4/2008	0-30	0.2	1	39	1	20.1	1
10040	LA	7/29/2008	0-30	1	1	78	1	41.6	1
10060	LA	8/6/2008	0-25	0.1	0	16	1	4.4	1
10572	LA	7/31/2008	0-10	0.1	0	38	1	17.4	1
10808	LA	7/31/2008	0-10	0.1	0	26	1	20.3	1
11064	LA	7/28/2008	0-8	0.8	1	56	1	38	1
11148	LA	8/1/2008	0-20	0.2	1	65	1	20.9	1
11340	LA	8/4/2008	0-30	0.1	0	23	1	14.1	1
11468	LA	7/26/2008	0-30	0.1	0	24	1	19.7	1
11596	LA	8/4/2008	0-30	0.1	0	13	1	10.5	1
11724	LA	8/4/2008	0-50	0.2	1	22	1	13.2	1
11832	LA	7/30/2008	0-20	0.1	0	32	1	15.2	1
11852	LA	8/2/2008	0-20	0.1	0	75	1	37.4	1
12088	LA	7/29/2008	0-30	0.3	1	41	1	19	1
12408	LA	7/30/2008	0-30	0.5	1	63	1	23.9	1
12620	LA	8/2/2008	0-25	0.1	0	17	1	8.8	1
12856	LA	7/31/2008	0-20	0.1	0	17	1	9.6	1
12876	LA	8/6/2008	0-10	0.1	0	22	1	13.2	1
13004	LA	8/3/2008	0-20	0.1	0	47	1	13.8	1
13112	LA	7/31/2008	0-20	0.1	0	33	1	15.2	1

SiteID	StateID	CollDate	Depth (cm)	Se (mg/kg)	D_Se (mg/kg)	Sr (mg/kg)	D_Sr (mg/kg)	Zn (mg/kg)	D_Zn (mg/kg)
120	LA	7/30/2008	0-5	1	1	87.3	1	87	1
140	LA	8/6/2008	0-5	0.2	0	11	1	8	1
204	LA	7/26/2008	0-5	0.7	1	45	1	38	1
332	LA	8/2/2008	0-5	0.2	0	15.6	1	10	1
460	LA	7/26/2008	0-5	0.3	1	22.8	1	21	1
588	LA	8/6/2008	0-5	0.2	0	14.2	1	24	1
824	LA	7/30/2008	0-5	0.4	1	82.8	1	28	1
1072	LA	7/28/2008	0-5	0.7	1	122	1	135	1
1144	LA	7/30/2008	0-5	0.5	1	121	1	98	1
1356	LA	8/2/2008	0-5	0.2	0	21.2	1	15	1
1612	LA	8/5/2008	0-5	0.7	1	95.5	1	119	1
1740	LA	8/3/2008	0-5	1	1	96.4	1	111	1
1848	LA	7/28/2008	0-5	0.4	1	149	1	90	1
2168	LA	7/29/2008	0-5	0.2	1	167	1	70	1
2380	LA	8/4/2008	0-5	0.2	0	25.7	1	9	1
2636	LA	8/6/2008	0-5	0.2	0	32.4	1	9	1
2872	LA	7/28/2008	0-5	0.3	1	177	1	77	1
2892	LA	8/6/2008	0-5	0.2	0	30.8	1	11	1
3404	LA	8/4/2008	0-5	0.3	1	52	1	38	1
3640	LA	7/31/2008	0-5	0.5	1	142	1	140	1
3896	LA	7/27/2008	0-5	0.5	1	112	1	19	1
3980	LA	8/1/2008	0-5	0.7	1	96.3	1	112	1
4216	LA	7/30/2008	0-5	0.5	1	150	1	71	1
4236	LA	8/6/2008	0-5	0.2	0	24.6	1	98	1
4300	LA	8/1/2008	0-5	0.4	1	114	1	73	1
4428	LA	8/2/2008	0-5	0.2	0	12.9	1	25	1
4492	LA	8/6/2008	0-5	0.4	1	48	1	18	1
4664	LA	7/31/2008	0-5	0.2	0	203	1	55	1
4684	LA	8/6/2008	0-5	0.2	0	9.1	1	16	1
4920	LA	7/31/2008	0-5	0.2	0	31.2	1	8	1
5240	LA	8/1/2008	0-5	0.2	0	160	1	54	1
5452	LA	8/2/2008	0-5	0.2	0	75.5	1	33	1
5688	LA	7/31/2008	0-5	0.4	1	34.7	1	15	1
5708	LA	8/6/2008	0-5	0.9	1	78.3	1	75	1
5836	LA	8/4/2008	0-5	1.2	1	92.3	1	121	1
5944	LA	7/26/2008	0-5	0.3	1	104	1	37	1
6264	LA	7/29/2008	0-5	0.2	0	182	1	45	1
6476	LA	8/2/2008	0-5	0.2	0	11.3	1	10	1
6712	LA	7/31/2008	0-5	0.2	1	275	1	53	1
6968	LA	7/28/2008	0-5	0.6	1	124	1	95	1
7500	LA	8/4/2008	0-5	0.2	0	21.6	1	17	1
7736	LA	7/31/2008	0-5	0.3	1	37.2	1	21	1
7992	LA	7/28/2008	0-5	0.7	1	127	1	119	1
8012	LA	8/6/2008	0-5	0.4	1	44.7	1	32	1
8076	LA	8/1/2008	0-5	0.8	1	135	1	87	1
8312	LA	7/30/2008	0-5	0.4	1	160	1	75	1
8332	LA	8/6/2008	0-5	0.3	1	98	1	76	1
8396	LA	8/3/2008	0-5	0.9	1	104	1	118	1
8524	LA	8/4/2008	0-5	0.2	0	69.9	1	34	1

SiteID	StateID	CollDate	Depth (cm)	Se (mg/kg)	D_Se (mg/kg)	Sr (mg/kg)	D_Sr (mg/kg)	Zn (mg/kg)	D_Zn (mg/kg)
8780	LA	8/6/2008	0-5	0.2	0	30.6	1	76	1
8908	LA	8/4/2008	0-5	0.3	1	70.7	1	51	1
9016	LA	7/30/2008	0-5	0.3	1	27.9	1	14	1
9336	LA	7/30/2008	0-5	0.4	1	143	1	55	1
9548	LA	8/3/2008	0-5	0.2	0	74.9	1	17	1
9804	LA	8/6/2008	0-5	0.2	0	11.9	1	7	1
9932	LA	8/4/2008	0-5	0.4	1	136	1	56	1
10040	LA	7/29/2008	0-5	1.1	1	124	1	148	1
10060	LA	8/6/2008	0-5	0.2	0	7	1	4	1
10572	LA	7/31/2008	0-5	0.3	1	20.1	1	13	1
10808	LA	7/31/2008	0-5	0.4	1	32.7	1	65	1
11064	LA	7/28/2008	0-5	0.7	1	152	1	385	1
11148	LA	8/1/2008	0-5	0.5	1	131	1	88	1
11340	LA	8/4/2008	0-5	0.2	0	83.5	1	19	1
11468	LA	7/26/2008	0-5	0.6	1	20.5	1	24	1
11596	LA	8/4/2008	0-5	0.2	0	15.4	1	8	1
11724	LA	8/4/2008	0-5	0.2	0	213	1	30	1
11832	LA	7/30/2008	0-5	0.3	1	27.4	1	20	1
11852	LA	8/2/2008	0-5	1	1	28.1	1	55	1
12088	LA	7/29/2008	0-5	0.4	1	145	1	79	1
12408	LA	7/30/2008	0-5	0.7	1	143	1	86	1
12620	LA	8/2/2008	0-5	0.2	0	12.6	1	5	1
12856	LA	7/31/2008	0-5	0.2	0	16	1	11	1
12876	LA	8/6/2008	0-5	0.2	0	30.5	1	73	1
13004	LA	8/3/2008	0-5	0.2	0	136	1	40	1
13112	LA	7/31/2008	0-5	0.4	1	19.3	1	15	1
120	LA	7/30/2008	0-15	0.8	1	98.8	1	92	1
140	LA	8/6/2008	0-30	0.2	0	13	1	10	1
204	LA	7/26/2008	0-5	0.7	1	49.6	1	38	1
332	LA	8/2/2008	0-15	0.2	0	18	1	10	1
460	LA	7/26/2008	0-10	0.3	1	23.4	1	15	1
588	LA	8/6/2008	0-20	0.2	0	16.8	1	27	1
824	LA	7/30/2008	0-20	0.4	1	65.5	1	23	1
1072	LA	7/28/2008	0-20	0.4	1	82.5	1	228	1
1144	LA	7/30/2008	0-20	0.4	1	114	1	105	1
1356	LA	8/2/2008	0-20	0.2	1	26.1	1	10	1
1612	LA	8/5/2008	0-30	0.7	1	96.4	1	121	1
1740	LA	8/3/2008	0-20	1	1	104	1	123	1
1848	LA	7/28/2008	0-10	0.3	1	181	1	70	1
2168	LA	7/29/2008	0-8	0.2	0	173	1	71	1
2380	LA	8/4/2008	0-20	0.2	0	26.3	1	9	1
2636	LA	8/6/2008	0-15	0.2	0	28.1	1	7	1
2872	LA	7/28/2008	0-10	0.4	1	172	1	72	1
2892	LA	8/6/2008	0-20	0.2	0	31.5	1	11	1
3404	LA	8/4/2008	0-30	0.3	1	53.1	1	36	1
3640	LA	7/31/2008	0-30	0.3	1	139	1	127	1
3896	LA	7/27/2008	0-20	0.5	1	128	1	18	1
3980	LA	8/1/2008	0-10	0.6	1	101	1	114	1
4216	LA	7/30/2008	0-20	0.4	1	144	1	65	1
4236	LA	8/6/2008	0-20	0.3	1	21.2	1	88	1

SiteID	StateID	CollDate	Depth (cm)	Se (mg/kg)	D_Se (mg/kg)	Sr (mg/kg)	D_Sr (mg/kg)	Zn (mg/kg)	D_Zn (mg/kg)
4300	LA	8/1/2008	0-5	0.4	1	124	1	72	1
4428	LA	8/2/2008	0-20	0.2	0	16.3	1	13	1
4492	LA	8/6/2008	0-10	0.6	1	52	1	19	1
4664	LA	7/31/2008	0-15	0.2	0	225	1	60	1
4684	LA	8/6/2008	0-30	0.2	0	8.9	1	18	1
4920	LA	7/31/2008	0-5	0.2	1	32.4	1	9	1
5240	LA	8/1/2008	0-15	0.2	0	156	1	52	1
5452	LA	8/2/2008	0-20	0.2	1	82.9	1	37	1
5688	LA	7/31/2008	0-30	0.4	1	40.3	1	15	1
5708	LA	8/6/2008	0-20	0.6	1	78.7	1	67	1
5836	LA	8/4/2008	0-20	1.1	1	115	1	134	1
5944	LA	7/26/2008	0-20	0.3	1	100	1	31	1
6264	LA	7/29/2008	0-20	0.3	1	159	1	63	1
6476	LA	8/2/2008	0-20	0.2	0	10	1	6	1
6712	LA	7/31/2008	0-25	0.3	1	290	1	46	1
6968	LA	7/28/2008	0-25	0.7	1	133	1	93	1
7500	LA	8/4/2008	0-15	0.2	0	21.4	1	14	1
7736	LA	7/31/2008	0-15	0.3	1	38	1	21	1
7992	LA	7/28/2008	0-8	0.7	1	117	1	123	1
8012	LA	8/6/2008	0-20	0.4	1	47	1	31	1
8076	LA	8/1/2008	0-20	0.9	1	133	1	90	1
8312	LA	7/30/2008	0-30	0.4	1	174	1	74	1
8332	LA	8/6/2008	0-70	0.2	1	113	1	86	1
8396	LA	8/3/2008	0-30	1	1	93.9	1	117	1
8524	LA	8/4/2008	0-20	0.2	0	75.2	1	34	1
8780	LA	8/6/2008	0-10	0.2	0	29.1	1	80	1
8908	LA	8/4/2008	0-20	0.3	1	68.2	1	32	1
9016	LA	7/30/2008	0-30	0.2	0	26	1	12	1
9336	LA	7/30/2008	0-20	0.5	1	139	1	71	1
9548	LA	8/3/2008	0-20	0.2	0	85.7	1	23	1
9804	LA	8/6/2008	0-15	0.2	0	10.3	1	6	1
9932	LA	8/4/2008	0-30	0.3	1	134	1	68	1
10040	LA	7/29/2008	0-30	1	1	132	1	140	1
10060	LA	8/6/2008	0-25	0.2	0	8.1	1	4	1
10572	LA	7/31/2008	0-10	0.3	1	20.4	1	14	1
10808	LA	7/31/2008	0-10	0.4	1	31.7	1	57	1
11064	LA	7/28/2008	0-8	0.6	1	143	1	220	1
11148	LA	8/1/2008	0-20	0.5	1	115	1	80	1
11340	LA	8/4/2008	0-30	0.2	0	87.1	1	22	1
11468	LA	7/26/2008	0-30	0.5	1	21.5	1	23	1
11596	LA	8/4/2008	0-30	0.2	0	18.9	1	8	1
11724	LA	8/4/2008	0-50	0.2	0	196	1	36	1
11832	LA	7/30/2008	0-20	0.4	1	28.9	1	14	1
11852	LA	8/2/2008	0-20	1.2	1	31.6	1	61	1
12088	LA	7/29/2008	0-30	0.4	1	152	1	78	1
12408	LA	7/30/2008	0-30	0.6	1	151	1	93	1
12620	LA	8/2/2008	0-25	0.2	0	12.2	1	5	1
12856	LA	7/31/2008	0-20	0.2	1	14.3	1	9	1
12876	LA	8/6/2008	0-10	0.3	1	27	1	50	1
13004	LA	8/3/2008	0-20	0.2	0	132	1	49	1
13112	LA	7/31/2008	0-20	0.4	1	19.9	1	17	1

Outlier Tests for Selected Variables excluding nondetects

User Selected Options

Date/Time of Computation	ProUCL 5.17/14/2020 1:20:12 PM
From File	ProUCL data_USGS Bkg_Top 5 cm and A horizon_LA.xls
Full Precision	OFF

Rosner's Outlier Test for 5 Outliers in As (mg/kg)

Total N	**150**
Number NDs	**0**
Number Detects	**150**
Mean of Detects	**5.988**
SD of Detects	**4.832**
Number of data	**150**
Number of suspected outliers	**5**
NDs not included in the following:	

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	5.988	4.816	38.2	143	6.689	3.52	3.89
2	5.772	4.056	32.6	68	6.615	3.51	3.89
3	5.591	3.41	18	141	3.639	3.51	3.89
4	5.506	3.263	17.4	66	3.645	3.51	3.88
5	5.425	3.121	14.5	61	2.908	3.51	3.88

For 5% significance level, there are 4 Potential Outliers
38.2, 32.6, 18, 17.4

For 1% Significance Level, there are 2 Potential Outliers
38.2, 32.6

Rosner's Outlier Test for 5 Outliers in Ba (mg/kg)

Total N	**150**
Number NDs	**0**
Number Detects	**150**
Mean of Detects	**429.3**
SD of Detects	**333.7**
Number of data	**150**
Number of suspected outliers	**5**
NDs not included in the following:	

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	429.3	332.6	2690	31	6.798	3.52	3.89
2	414.1	278.1	2530	106	7.609	3.51	3.89
3	399.8	217.2	847	112	2.059	3.51	3.89
4	396.8	214.8	842	37	2.073	3.51	3.88
5	393.7	212.3	775	89	1.796	3.51	3.88

For 5% significance level, there are 2 Potential Outliers
2690, 2530

For 1% Significance Level, there are 2 Potential Outliers
2690, 2530

Rosner's Outlier Test for 5 Outliers in Cd (mg/kg)

Total N	**150**
Number NDs	**77**
Number Detects	**73**
Mean of Detects	**0.34**
SD of Detects	**0.243**
Number of data	**73**
Number of suspected outliers	**5**
NDs not included in the following:	

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	0.34	0.241	1.1	6	3.149	3.275	3.635
2	0.329	0.227	1.1	33	3.391	3.265	3.635
3	0.318	0.209	1	19	3.257	3.265	3.625
4	0.309	0.194	1	68	3.565	3.255	3.618
5	0.299	0.176	0.8	34	2.847	3.255	3.615

For 5% significance level, there are 4 Potential Outliers
1.1, 1.1, 1, 1

For 1% Significance Level, there is no Potential Outlier

Rosner's Outlier Test for 5 Outliers in Cr (mg/kg)

Total N	**150**
Number NDs	**0**
Number Detects	**150**
Mean of Detects	**37.67**
SD of Detects	**19.3**
Number of data	**150**
Number of suspected outliers	**5**
NDs not included in the following:	

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	37.67	19.24	84	86	2.408	3.52	3.89
2	37.36	18.99	84	122	2.456	3.51	3.89
3	37.05	18.66	80	22	2.302	3.51	3.89
4	36.76	18.38	79	97	2.298	3.51	3.88
5	36.47	18.1	78	110	2.294	3.51	3.88

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

Rosner's Outlier Test for 5 Outliers in Pb (mg/kg)

Total N	**150**
Number NDs	**0**
Number Detects	**150**
Mean of Detects	**20.12**
SD of Detects	**11.61**
Number of data	**150**
Number of suspected outliers	**5**
NDs not included in the following:	

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	20.12	11.57	90.8	1	6.107	3.52	3.89
2	19.64	10.09	80.6	57	6.042	3.51	3.89
3	19.23	8.776	47.2	8	3.187	3.51	3.89
4	19.04	8.495	46.7	43	3.256	3.51	3.88
5	18.85	8.206	44.2	118	3.089	3.51	3.88

For 5% significance level, there are 2 Potential Outliers
90.8, 80.6

For 1% Significance Level, there are 2 Potential Outliers
90.8, 80.6

Rosner's Outlier Test for 5 Outliers in Hg (mg/kg)

Total N	**150**
Number NDs	**7**
Number Detects	**143**
Mean of Detects	**0.114**
SD of Detects	**0.634**
Number of data	**143**
Number of suspected outliers	**5**
NDs not included in the following:	

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	0.114	0.631	6.24	103	9.702	3.5	3.87
2	0.0708	0.369	4.43	30	11.81	3.492	3.87
3	0.0399	0.0242	0.13	24	3.719	3.492	3.87
4	0.0393	0.0231	0.11	42	3.066	3.49	3.86
5	0.0388	0.0223	0.11	96	3.188	3.49	3.86

For 5% significance level, there are 3 Potential Outliers
6.24, 4.43, 0.13

For 1% Significance Level, there are 2 Potential Outliers
6.24, 4.43

Rosner's Outlier Test for 5 Outliers in Se (mg/kg)

Total N	**150**
Number NDs	**53**
Number Detects	**97**
Mean of Detects	**0.511**
SD of Detects	**0.253**
Number of data	**97**
Number of suspected outliers	**5**
NDs not included in the following:	

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	0.511	0.252	1.2	21	2.733	3.371	3.741
2	0.504	0.244	1.2	92	2.846	3.368	3.738
3	0.497	0.235	1.1	36	2.567	3.368	3.738
4	0.49	0.228	1.1	70	2.677	3.361	3.728
5	0.484	0.22	1	1	2.348	3.358	3.728

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

Rosner's Outlier Test for 5 Outliers in Sr (mg/kg)

Total N	**150**
Number NDs	**0**
Number Detects	**150**
Mean of Detects	**81.84**
SD of Detects	**61.29**
Number of data	**150**
Number of suspected outliers	**5**
NDs not included in the following:	

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	81.84	61.08	290	114	3.408	3.52	3.89
2	80.44	59.05	275	39	3.295	3.51	3.89
3	79.13	57.02	225	103	2.558	3.51	3.89
4	78.13	55.92	213	66	2.412	3.51	3.88
5	77.21	54.97	203	28	2.288	3.51	3.88

For 5% Significance Level, there is no Potential Outlier

For 1% Significance Level, there is no Potential Outlier

Rosner's Outlier Test for 5 Outliers in Zn (mg/kg)

Total N	**150**
Number NDs	**0**
Number Detects	**150**
Mean of Detects	**55.21**
SD of Detects	**51.06**
Number of data	**150**
Number of suspected outliers	**5**
NDs not included in the following:	

#	Mean	sd	Potential outlier	Obs. Number	Test value	Critical value (5%)	Critical value (1%)
1	55.21	50.89	385	61	6.481	3.52	3.89
2	52.99	43.42	228	83	4.031	3.51	3.89
3	51.81	41.08	220	136	4.094	3.51	3.89
4	50.67	38.79	148	57	2.509	3.51	3.88
5	50	38.07	140	20	2.364	3.51	3.88

For 5% significance level, there are 3 Potential Outliers
385, 228, 220

For 1% Significance Level, there are 3 Potential Outliers
385, 228, 220

Background Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	ProUCL 5.17/14/2020 1:22:06 PM
From File	ProUCL data_USGS Bkg_Top 5 cm and A horizon_LA.xls
Full Precision	OFF
Confidence Coefficient	95%
Coverage	95%
Different or Future K Observations	1
Number of Bootstrap Operations	2000

As (mg/kg)

General Statistics

Total Number of Observations	150	Number of Distinct Observations	86
Minimum	1	First Quartile	3.2
Second Largest	32.6	Median	5.05
Maximum	38.2	Third Quartile	7.375
Mean	5.988	SD	4.832
Coefficient of Variation	0.807	Skewness	3.415
Mean of logged Data	1.557	SD of logged Data	0.683

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	1.868	d2max (for USL)	3.343

Normal GOF Test

Shapiro Wilk Test Statistic	0.738	**Normal GOF Test**
5% Shapiro Wilk P Value	0	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.158	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0727	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	15.01	90% Percentile (z)	12.18
95% UPL (t)	14.01	95% Percentile (z)	13.94
95% USL	22.14	99% Percentile (z)	17.23

Gamma GOF Test

A-D Test Statistic	0.659	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.764	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0636	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.0774	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.302	k star (bias corrected MLE)	2.261
Theta hat (MLE)	2.601	Theta star (bias corrected MLE)	2.649
nu hat (MLE)	690.7	nu star (bias corrected)	678.2
MLE Mean (bias corrected)	5.988	MLE Sd (bias corrected)	3.983

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	13.56	90% Percentile	11.32
95% Hawkins Wixley (HW) Approx. Gamma UPL	13.73	95% Percentile	13.67
95% WH Approx. Gamma UTL with 95% Coverage	15.02	99% Percentile	18.85
95% HW Approx. Gamma UTL with 95% Coverage	15.31		
95% WH USL	28.48	95% HW USL	30.91

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.979	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk P Value	0.334	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0534	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.0727	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	17	90% Percentile (z)	11.39
95% UPL (t)	14.76	95% Percentile (z)	14.6
95% USL	46.59	99% Percentile (z)	23.26

Nonparametric Distribution Free Background Statistics
Data appear Gamma Distributed at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	146	95% UTL with 95% Coverage	14.5
Approx, f used to compute achieved CC	1.537	Approximate Actual Confidence Coefficient achieved by UTL	0.874
		Approximate Sample Size needed to achieve specified CC	181
95% Percentile Bootstrap UTL with 95% Coverage	14.5	95% BCA Bootstrap UTL with 95% Coverage	14.5
95% UPL	13.79	90% Percentile	10.71
90% Chebyshev UPL	20.53	95% Percentile	13.25
95% Chebyshev UPL	27.12	99% Percentile	25.45
95% USL	38.2		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Ba (mg/kg)

General Statistics

Total Number of Observations	150	Number of Distinct Observations	134
Minimum	64	First Quartile	207
Second Largest	2530	Median	373
Maximum	2690	Third Quartile	624
Mean	429.3	SD	333.7
Coefficient of Variation	0.777	Skewness	3.749
Mean of logged Data	5.832	SD of logged Data	0.697

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	1.868	d2max (for USL)	3.343

Normal GOF Test

Shapiro Wilk Test Statistic	0.704	**Normal GOF Test**
5% Shapiro Wilk P Value	0	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.138	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0727	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	1053	90% Percentile (z)	856.9
95% UPL (t)	983.4	95% Percentile (z)	978.1
95% USL	1545	99% Percentile (z)	1206

Gamma GOF Test

A-D Test Statistic	1.966	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.764	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0888	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.0774	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.328	k star (bias corrected MLE)	2.285

Theta hat (MLE)	184.4	Theta star (bias corrected MLE)	187.8
nu hat (MLE)	698.3	nu star (bias corrected)	685.6
MLE Mean (bias corrected)	429.3	MLE Sd (bias corrected)	284

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	971	90% Percentile	809.4
95% Hawkins Wixley (HW) Approx. Gamma UPL	988.3	95% Percentile	976.8
95% WH Approx. Gamma UTL with 95% Coverage	1075	99% Percentile	1345
95% HW Approx. Gamma UTL with 95% Coverage	1102		
95% WH USL	2032	95% HW USL	2225

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.944	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk P Value	6.1525E-6	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0997	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.0727	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	1254	90% Percentile (z)	833.5
95% UPL (t)	1086	95% Percentile (z)	1074
95% USL	3508	99% Percentile (z)	1727

Nonparametric Distribution Free Background Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	146	95% UTL with 95% Coverage	775
Approx, f used to compute achieved CC	1.537	Approximate Actual Confidence Coefficient achieved by UTL	0.874
		Approximate Sample Size needed to achieve specified CC	181
95% Percentile Bootstrap UTL with 95% Coverage	775	95% BCA Bootstrap UTL with 95% Coverage	775
95% UPL	739.1	90% Percentile	694.7
90% Chebyshev UPL	1434	95% Percentile	729.7
95% Chebyshev UPL	1889	99% Percentile	1705
95% USL	2690		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Cd (mg/kg)

General Statistics

Total Number of Observations	150	Number of Missing Observations	0
Number of Distinct Observations	9		
Number of Detects	73	Number of Non-Detects	77
Number of Distinct Detects	9	Number of Distinct Non-Detects	1
Minimum Detect	0.1	Minimum Non-Detect	0.1
Maximum Detect	1.1	Maximum Non-Detect	0.1
Variance Detected	0.0591	Percent Non-Detects	51.33%
Mean Detected	0.34	SD Detected	0.243
Mean of Detected Logged Data	-1.291	SD of Detected Logged Data	0.646

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	1.868	d2max (for USL)	3.343

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.786	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	1.266E-14	Data Not Normal at 5% Significance Level

Lilliefors Test Statistic	0.25	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.104	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Kaplan Meier (KM) Background Statistics Assuming Normal Distribution

KM Mean	0.217	KM SD	0.207
95% UTL95% Coverage	0.603	95% KM UPL (t)	0.56
90% KM Percentile (z)	0.482	95% KM Percentile (z)	0.557
99% KM Percentile (z)	0.698	95% KM USL	0.908

DL/2 Substitution Background Statistics Assuming Normal Distribution

Mean	0.191	SD	0.223
95% UTL95% Coverage	0.607	95% UPL (t)	0.561
90% Percentile (z)	0.477	95% Percentile (z)	0.558
99% Percentile (z)	0.709	95% USL	0.936

DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.18	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.76	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.177	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.105	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.521	k star (bias corrected MLE)	2.426
Theta hat (MLE)	0.135	Theta star (bias corrected MLE)	0.14
nu hat (MLE)	368.1	nu star (bias corrected)	354.3
MLE Mean (bias corrected)	0.34		
MLE Sd (bias corrected)	0.218	95% Percentile of Chisquare (2kstar)	10.84

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.173
Maximum	1.1	Median	0.0531
SD	0.235	CV	1.363
k hat (MLE)	0.548	k star (bias corrected MLE)	0.542
Theta hat (MLE)	0.315	Theta star (bias corrected MLE)	0.318
nu hat (MLE)	164.5	nu star (bias corrected)	162.6
MLE Mean (bias corrected)	0.173	MLE Sd (bias corrected)	0.234
95% Percentile of Chisquare (2kstar)	4.045	90% Percentile	0.459
95% Percentile	0.644	99% Percentile	1.096

The following statistics are computed using Gamma ROS Statistics on Imputed Data

Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	0.718	0.777	95% Approx. Gamma UPL	0.604	0.637
95% Gamma USL	1.968	2.548			

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.217	SD (KM)	0.207
Variance (KM)	0.0427	SE of Mean (KM)	0.017
k hat (KM)	1.099	k star (KM)	1.081
nu hat (KM)	329.6	nu star (KM)	324.4
theta hat (KM)	0.197	theta star (KM)	0.2
80% gamma percentile (KM)	0.346	90% gamma percentile (KM)	0.489
95% gamma percentile (KM)	0.631	99% gamma percentile (KM)	0.96

The following statistics are computed using gamma distribution and KM estimates
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	0.572	0.571	95% Approx. Gamma UPL	0.512	0.509
95% KM Gamma Percentile	0.508	0.504	95% Gamma USL	1.129	1.197

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.915	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	4.3261E-5	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.147	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.104	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects

Mean in Original Scale	0.195	Mean in Log Scale	-2.171
SD in Original Scale	0.221	SD in Log Scale	1.071
95% UTL95% Coverage	0.843	95% BCA UTL95% Coverage	0.8
95% Bootstrap (%) UTL95% Coverage	0.8	95% UPL (t)	0.675
90% Percentile (z)	0.45	95% Percentile (z)	0.664
99% Percentile (z)	1.377	95% USL	4.089

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean of Logged Data	-1.81	95% KM UTL (Lognormal)95% Coverage	0.578
KM SD of Logged Data	0.676	95% KM UPL (Lognormal)	0.502
95% KM Percentile Lognormal (z)	0.497	95% KM USL (Lognormal)	1.565

Background DL/2 Statistics Assuming Lognormal Distribution

Mean in Original Scale	0.191	Mean in Log Scale	-2.166
SD in Original Scale	0.223	SD in Log Scale	0.966
95% UTL95% Coverage	0.696	95% UPL (t)	0.57
90% Percentile (z)	0.395	95% Percentile (z)	0.561
99% Percentile (z)	1.084	95% USL	2.895

DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.

Nonparametric Distribution Free Background Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)

Order of Statistic, r	146	95% UTL with95% Coverage	0.8
Approx, f used to compute achieved CC	1.537	Approximate Actual Confidence Coefficient achieved by UTL	0.874
Approximate Sample Size needed to achieve specified CC	181	95% UPL	0.8
95% USL	1.1	95% KM Chebyshev UPL	1.121

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Cr (mg/kg)

General Statistics

Total Number of Observations	150	Number of Distinct Observations	64
Minimum	5	First Quartile	22
Second Largest	84	Median	33
Maximum	84	Third Quartile	52.75
Mean	37.67	SD	19.3
Coefficient of Variation	0.512	Skewness	0.637
Mean of logged Data	3.488	SD of logged Data	0.557

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	1.868	d2max (for USL)	3.343

Normal GOF Test

Shapiro Wilk Test Statistic	0.918	**Normal GOF Test**	
5% Shapiro Wilk P Value	5.049E-11	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.126	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.0727	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	73.73	90% Percentile (z)	62.41
95% UPL (t)	69.73	95% Percentile (z)	69.43
95% USL	102.2	99% Percentile (z)	82.58

Gamma GOF Test

A-D Test Statistic	1.034	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.757	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0655	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.0769	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.707	k star (bias corrected MLE)	3.637
Theta hat (MLE)	10.16	Theta star (bias corrected MLE)	10.36
nu hat (MLE)	1112	nu star (bias corrected)	1091
MLE Mean (bias corrected)	37.67	MLE Sd (bias corrected)	19.75

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	75.05	90% Percentile	64.16
95% Hawkins Wixley (HW) Approx. Gamma UPL	76.4	95% Percentile	74.92
95% WH Approx. Gamma UTL with 95% Coverage	81.67	99% Percentile	98
95% HW Approx. Gamma UTL with 95% Coverage	83.64		
95% WH USL	140.4	95% HW USL	151

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.957	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk P Value	9.2132E-4	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0673	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.0727	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	92.55	90% Percentile (z)	66.78
95% UPL (t)	82.47	95% Percentile (z)	81.75
95% USL	210.4	99% Percentile (z)	119.5

Nonparametric Distribution Free Background Statistics

Data appear Approximate Gamma Distribution at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	146	95% UTL with 95% Coverage	78
Approx, f used to compute achieved CC	1.537	Approximate Actual Confidence Coefficient achieved by UTL	0.874
		Approximate Sample Size needed to achieve specified CC	181
95% Percentile Bootstrap UTL with 95% Coverage	78	95% BCA Bootstrap UTL with 95% Coverage	78
95% UPL	75.9	90% Percentile	66.1
90% Chebyshev UPL	95.78	95% Percentile	75
95% Chebyshev UPL	122.1	99% Percentile	82.04
95% USL	84		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers

and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Pb (mg/kg)

General Statistics

Total Number of Observations	150	Number of Distinct Observations	114
Minimum	4.4	First Quartile	12.73
Second Largest	80.6	Median	18.15
Maximum	90.8	Third Quartile	24.05
Mean	20.12	SD	11.61
Coefficient of Variation	0.577	Skewness	2.792
Mean of logged Data	2.878	SD of logged Data	0.484

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	1.868	d2max (for USL)	3.343

Normal GOF Test

Shapiro Wilk Test Statistic	0.794	**Normal GOF Test**
5% Shapiro Wilk P Value	0	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.146	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0727	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	41.81	90% Percentile (z)	35
95% UPL (t)	39.4	95% Percentile (z)	39.22
95% USL	58.94	99% Percentile (z)	47.13

Gamma GOF Test

A-D Test Statistic	1.111	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.756	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0779	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.0768	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.217	k star (bias corrected MLE)	4.137
Theta hat (MLE)	4.771	Theta star (bias corrected MLE)	4.863
nu hat (MLE)	1265	nu star (bias corrected)	1241
MLE Mean (bias corrected)	20.12	MLE Sd (bias corrected)	9.891

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	38.55	90% Percentile	33.37
95% Hawkins Wixley (HW) Approx. Gamma UPL	38.71	95% Percentile	38.65
95% WH Approx. Gamma UTL with 95% Coverage	41.77	99% Percentile	49.91
95% HW Approx. Gamma UTL with 95% Coverage	42.12		
95% WH USL	69.98	95% HW USL	73.25

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.988	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk P Value	0.873	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0427	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.0727	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	43.92	90% Percentile (z)	33.07
95% UPL (t)	39.73	95% Percentile (z)	39.43
95% USL	89.68	99% Percentile (z)	54.83

Nonparametric Distribution Free Background Statistics
Data appear Lognormal at 5% Significance Level

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	146	95% UTL with 95% Coverage	44.2
Approx, f used to compute achieved CC	1.537	Approximate Actual Confidence Coefficient achieved by UTL	0.874
		Approximate Sample Size needed to achieve specified CC	181
95% Percentile Bootstrap UTL with 95% Coverage	44.2	95% BCA Bootstrap UTL with 95% Coverage	44.2
95% UPL	39.62	90% Percentile	32.22
90% Chebyshev UPL	55.07	95% Percentile	37.73
95% Chebyshev UPL	70.9	99% Percentile	64.23
95% USL	90.8		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Hg (mg/kg)

General Statistics

Total Number of Observations	150	Number of Missing Observations	0
Number of Distinct Observations	14		
Number of Detects	143	Number of Non-Detects	7
Number of Distinct Detects	14	Number of Distinct Non-Detects	1
Minimum Detect	0.01	Minimum Non-Detect	0.01
Maximum Detect	6.24	Maximum Non-Detect	0.01
Variance Detected	0.401	Percent Non-Detects	4.667%
Mean Detected	0.114	SD Detected	0.634
Mean of Detected Logged Data	-3.34	SD of Detected Logged Data	0.874

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	1.868	d2max (for USL)	3.343

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.143	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.482	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0745	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Kaplan Meier (KM) Background Statistics Assuming Normal Distribution

KM Mean	0.109	KM SD	0.617
95% UTL95% Coverage	1.261	95% KM UPL (t)	1.134
90% KM Percentile (z)	0.9	95% KM Percentile (z)	1.124
99% KM Percentile (z)	1.544	95% KM USL	2.171

DL/2 Substitution Background Statistics Assuming Normal Distribution

Mean	0.109	SD	0.619
95% UTL95% Coverage	1.265	95% UPL (t)	1.137
90% Percentile (z)	0.902	95% Percentile (z)	1.127
99% Percentile (z)	1.549	95% USL	2.178

DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	26.29	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.816	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.347	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.0827	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.538	k star (bias corrected MLE)	0.531
Theta hat (MLE)	0.212	Theta star (bias corrected MLE)	0.215
nu hat (MLE)	153.8	nu star (bias corrected)	151.9
MLE Mean (bias corrected)	0.114		
MLE Sd (bias corrected)	0.156	95% Percentile of Chisquare (2kstar)	3.994

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.109
Maximum	6.24	Median	0.03
SD	0.619	CV	5.672
k hat (MLE)	0.532	k star (bias corrected MLE)	0.525
Theta hat (MLE)	0.205	Theta star (bias corrected MLE)	0.208
nu hat (MLE)	159.5	nu star (bias corrected)	157.6
MLE Mean (bias corrected)	0.109	MLE Sd (bias corrected)	0.151
95% Percentile of Chisquare (2kstar)	3.966	90% Percentile	0.292
95% Percentile	0.412	99% Percentile	0.705

The following statistics are computed using Gamma ROS Statistics on Imputed Data
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	0.307	0.253	95% Approx. Gamma UPL	0.259	0.213
95% Gamma USL	0.824	0.722			

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.109	SD (KM)	0.617
Variance (KM)	0.381	SE of Mean (KM)	0.0505
k hat (KM)	0.0313	k star (KM)	0.0351
nu hat (KM)	9.389	nu star (KM)	10.53
theta hat (KM)	3.487	theta star (KM)	3.108
80% gamma percentile (KM)	0.00312	90% gamma percentile (KM)	0.0919
95% gamma percentile (KM)	0.481	99% gamma percentile (KM)	2.692

The following statistics are computed using gamma distribution and KM estimates
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	0.305	0.252	95% Approx. Gamma UPL	0.258	0.212
95% KM Gamma Percentile	0.255	0.21	95% Gamma USL	0.819	0.717

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.803	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	0	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.144	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0745	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects

Mean in Original Scale	0.109	Mean in Log Scale	-3.427
SD in Original Scale	0.619	SD in Log Scale	0.942
95% UTL95% Coverage	0.189	95% BCA UTL95% Coverage	0.0955
95% Bootstrap (%) UTL95% Coverage	0.11	95% UPL (t)	0.155
90% Percentile (z)	0.109	95% Percentile (z)	0.153
99% Percentile (z)	0.291	95% USL	0.757

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean of Logged Data	-3.399	95% KM UTL (Lognormal)95% Coverage	0.177
KM SD of Logged Data	0.891	95% KM UPL (Lognormal)	0.147
95% KM Percentile Lognormal (z)	0.145	95% KM USL (Lognormal)	0.657

Background DL/2 Statistics Assuming Lognormal Distribution

Mean in Original Scale	0.109	Mean in Log Scale	-3.431
SD in Original Scale	0.619	SD in Log Scale	0.948
95% UTL95% Coverage	0.19	95% UPL (t)	0.156
90% Percentile (z)	0.109	95% Percentile (z)	0.154
99% Percentile (z)	0.294	95% USL	0.77

DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.

Nonparametric Distribution Free Background Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)

Order of Statistic, r	146	95% UTL with95% Coverage	0.11
Approx, f used to compute achieved CC	1.537	Approximate Actual Confidence Coefficient achieved by UTL	0.874
Approximate Sample Size needed to achieve specified CC	181	95% UPL	0.09
95% USL	6.24	95% KM Chebyshev UPL	2.807

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Se (mg/kg)

General Statistics

Total Number of Observations	150	Number of Missing Observations	0
Number of Distinct Observations	11		
Number of Detects	97	Number of Non-Detects	53
Number of Distinct Detects	11	Number of Distinct Non-Detects	1
Minimum Detect	0.2	Minimum Non-Detect	0.2
Maximum Detect	1.2	Maximum Non-Detect	0.2
Variance Detected	0.0641	Percent Non-Detects	35.33%
Mean Detected	0.511	SD Detected	0.253
Mean of Detected Logged Data	-0.782	SD of Detected Logged Data	0.467

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	1.868	d2max (for USL)	3.343

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.857	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	1.499E-13	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.237	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0902	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Kaplan Meier (KM) Background Statistics Assuming Normal Distribution

KM Mean	0.401	KM SD	0.251
95% UTL95% Coverage	0.871	95% KM UPL (t)	0.819
90% KM Percentile (z)	0.724	95% KM Percentile (z)	0.815
99% KM Percentile (z)	0.986	95% KM USL	1.242

DL/2 Substitution Background Statistics Assuming Normal Distribution

Mean	0.366	SD	0.283
95% UTL95% Coverage	0.895	95% UPL (t)	0.836
90% Percentile (z)	0.729	95% Percentile (z)	0.832
99% Percentile (z)	1.025	95% USL	1.313

DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.705	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.755	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.205	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.0911	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.672	k star (bias corrected MLE)	4.534
Theta hat (MLE)	0.109	Theta star (bias corrected MLE)	0.113
nu hat (MLE)	906.4	nu star (bias corrected)	879.7
MLE Mean (bias corrected)	0.511		
MLE Sd (bias corrected)	0.24	95% Percentile of Chisquare (2kstar)	17.02

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.358
Maximum	1.2	Median	0.3
SD	0.293	CV	0.82
k hat (MLE)	1.007	k star (bias corrected MLE)	0.991
Theta hat (MLE)	0.356	Theta star (bias corrected MLE)	0.361
nu hat (MLE)	302	nu star (bias corrected)	297.3
MLE Mean (bias corrected)	0.358	MLE Sd (bias corrected)	0.36
95% Percentile of Chisquare (2kstar)	5.956	90% Percentile	0.826
95% Percentile	1.076	99% Percentile	1.656

The following statistics are computed using Gamma ROS Statistics on Imputed Data
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	1.223	1.361	95% Approx. Gamma UPL	1.066	1.163
95% Gamma USL	2.796	3.588			

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.401	SD (KM)	0.251
Variance (KM)	0.0632	SE of Mean (KM)	0.0206
k hat (KM)	2.549	k star (KM)	2.502
nu hat (KM)	764.6	nu star (KM)	750.6
theta hat (KM)	0.157	theta star (KM)	0.16
80% gamma percentile (KM)	0.585	90% gamma percentile (KM)	0.741
95% gamma percentile (KM)	0.888	99% gamma percentile (KM)	1.211

The following statistics are computed using gamma distribution and KM estimates
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	0.9	0.909	95% Approx. Gamma UPL	0.824	0.827
95% KM Gamma Percentile	0.818	0.821	95% Gamma USL	1.587	1.676

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.924	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	7.3138E-6	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.18	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0902	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects

Mean in Original Scale	0.386	Mean in Log Scale	-1.177

SD in Original Scale	0.266	SD in Log Scale	0.688
95% UTL95% Coverage	1.113	95% BCA UTL95% Coverage	1
95% Bootstrap (%) UTL95% Coverage	1	95% UPL (t)	0.965
90% Percentile (z)	0.744	95% Percentile (z)	0.955
99% Percentile (z)	1.526	95% USL	3.071

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean of Logged Data	-1.074	95% KM UTL (Lognormal)95% Coverage	0.945
KM SD of Logged Data	0.545	95% KM UPL (Lognormal)	0.844
95% KM Percentile Lognormal (z)	0.837	95% KM USL (Lognormal)	2.109

Background DL/2 Statistics Assuming Lognormal Distribution

Mean in Original Scale	0.366	Mean in Log Scale	-1.319
SD in Original Scale	0.283	SD in Log Scale	0.82
95% UTL95% Coverage	1.238	95% UPL (t)	1.044
90% Percentile (z)	0.765	95% Percentile (z)	1.031
99% Percentile (z)	1.803	95% USL	4.151

DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.

Nonparametric Distribution Free Background Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)

Order of Statistic, r	146	95% UTL with95% Coverage	1
Approx, f used to compute achieved CC	1.537	Approximate Actual Confidence Coefficient achieved by UTL	0.874
Approximate Sample Size needed to achieve specified CC	181	95% UPL	1
95% USL	1.2	95% KM Chebyshev UPL	1.501

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Sr (mg/kg)

General Statistics

Total Number of Observations	150	Number of Distinct Observations	131
Minimum	7	First Quartile	26.15
Second Largest	275	Median	76.9
Maximum	290	Third Quartile	131.8
Mean	81.84	SD	61.29
Coefficient of Variation	0.749	Skewness	0.706
Mean of logged Data	4.039	SD of logged Data	0.939

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	1.868	d2max (for USL)	3.343

Normal GOF Test

Shapiro Wilk Test Statistic	0.898	**Normal GOF Test**
5% Shapiro Wilk P Value	1.332E-15	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.162	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0727	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	196.3	90% Percentile (z)	160.4
95% UPL (t)	183.6	95% Percentile (z)	182.6
95% USL	286.7	99% Percentile (z)	224.4

Gamma GOF Test

A-D Test Statistic	3.313	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.77	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.128	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.078	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.514	k star (bias corrected MLE)	1.488
Theta hat (MLE)	54.05	Theta star (bias corrected MLE)	54.99
nu hat (MLE)	454.2	nu star (bias corrected)	446.4
MLE Mean (bias corrected)	81.84	MLE Sd (bias corrected)	67.09

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	214	90% Percentile	170.9
95% Hawkins Wixley (HW) Approx. Gamma UPL	223	95% Percentile	213.7
95% WH Approx. Gamma UTL with 95% Coverage	241.3	99% Percentile	310.6
95% HW Approx. Gamma UTL with 95% Coverage	254.7		
95% WH USL	504.7	95% HW USL	587.8

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.912	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk P Value	2.240E-12	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.141	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.0727	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	328.1	90% Percentile (z)	189.2
95% UPL (t)	270.1	95% Percentile (z)	266.1
95% USL	1311	99% Percentile (z)	504.6

Nonparametric Distribution Free Background Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	146	95% UTL with 95% Coverage	203
Approx, f used to compute achieved CC	1.537	Approximate Actual Confidence Coefficient achieved by UTL	0.874
		Approximate Sample Size needed to achieve specified CC	181
95% Percentile Bootstrap UTL with 95% Coverage	203	95% BCA Bootstrap UTL with 95% Coverage	203
95% UPL	181.5	90% Percentile	159.1
90% Chebyshev UPL	266.3	95% Percentile	179.2
95% Chebyshev UPL	349.9	99% Percentile	250.5
95% USL	290		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Zn (mg/kg)

General Statistics

Total Number of Observations	150	Number of Distinct Observations	86
Minimum	4	First Quartile	16.25
Second Largest	228	Median	39
Maximum	385	Third Quartile	78.75
Mean	55.21	SD	51.06
Coefficient of Variation	0.925	Skewness	2.454
Mean of logged Data	3.589	SD of logged Data	0.985

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	1.868	d2max (for USL)	3.343

Normal GOF Test

Shapiro Wilk Test Statistic	0.811	**Normal GOF Test**
5% Shapiro Wilk P Value	0	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.158	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0727	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	150.6	90% Percentile (z)	120.6
95% UPL (t)	140	95% Percentile (z)	139.2
95% USL	225.9	99% Percentile (z)	174

Gamma GOF Test

A-D Test Statistic	1.524	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.775	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0841	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.0783	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.328	k star (bias corrected MLE)	1.306
Theta hat (MLE)	41.58	Theta star (bias corrected MLE)	42.28
nu hat (MLE)	398.3	nu star (bias corrected)	391.7
MLE Mean (bias corrected)	55.21	MLE Sd (bias corrected)	48.31

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	149.4	90% Percentile	119
95% Hawkins Wixley (HW) Approx. Gamma UPL	154.8	95% Percentile	150.7
95% WH Approx. Gamma UTL with 95% Coverage	169.4	99% Percentile	223
95% HW Approx. Gamma UTL with 95% Coverage	177.9		
95% WH USL	365.8	95% HW USL	425.3

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.949	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk P Value	5.4134E-5	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.11	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.0727	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Background Statistics assuming Lognormal Distribution

95% UTL with 95% Coverage	228.1	90% Percentile (z)	128
95% UPL (t)	186	95% Percentile (z)	183.1
95% USL	976	99% Percentile (z)	358.4

Nonparametric Distribution Free Background Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	146	95% UTL with 95% Coverage	140
Approx, f used to compute achieved CC	1.537	Approximate Actual Confidence Coefficient achieved by UTL	0.874
		Approximate Sample Size needed to achieve specified CC	181
95% Percentile Bootstrap UTL with 95% Coverage	140	95% BCA Bootstrap UTL with 95% Coverage	140
95% UPL	134.5	90% Percentile	118.1
90% Chebyshev UPL	208.9	95% Percentile	130.9
95% Chebyshev UPL	278.5	99% Percentile	224.1
95% USL	385		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.

Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.

APPENDIX H 95% UCL CALCULATIONS

April 9, 2021

Appendix H-1
ProUCL Data for Prelim Eco AOI-1
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Sample ID	Area	Matrix	Sample Date	Interval (ft)	Sampler	Arsenic (mg/kg-dry)	D_Arsenic (mg/kg-dry)	Barium (mg/kg-dry)	D_Barium (mg/kg-dry)	Zinc (mg/kg-dry)	D_Zinc (mg/kg-dry)
JLS-2	Area 2	Canal Sediment	5/26/2020	0-2	ERM	15.83	1	1055	1	159.1	1
JLS-2	Area 2	Canal Sediment	5/26/2020	0-2	HET	10.9	1	576	1	102	1
JLS-2	Area 2	Canal Sediment	5/26/2020	0-2	ICON	14.7	1	929	1	97.1	1
JLS-2	Area 2	Canal Sediment	5/26/2020	2-4	ERM	24.81	1	2353	1	98.7	1
JLS-2	Area 2	Canal Sediment	5/26/2020	2-4	HET	13.6	1	854	1	96.8	1
JLS-2	Area 2	Canal Sediment	5/26/2020	2-4	ICON	19.4	1	1700	1	91.4	1
JLS-2	Area 2	Canal Sediment	2/8/2021	0-2	ERM	NA	NA	NA	NA	NA	NA
JLS-2	Area 2	Canal Sediment	2/8/2021	0-2	ICON	14.2	1	3220	1	NA	NA
JLS-2	Area 2	Canal Sediment	2/8/2021	2-4	ERM	NA	NA	NA	NA	NA	NA
JLS-2	Area 2	Canal Sediment	2/21/2021	0-5	ERM	NA	NA	NA	NA	NA	NA
JLS-2	Area 2	Canal Sediment	2/21/2021	0-5	ICON	16.2	1	1230	1	NA	NA
JLS-22	Area 2	Canal Sediment	9/8/2020	0-2	ERM	4.98	1	264	1	87.4	1
JLS-22	Area 2	Canal Sediment	9/8/2020	0-2	ICON	5.75	1	281	1	74.4	1
JLS-22	Area 2	Canal Sediment	9/8/2020	2-4	ERM	5.08	1	224	1	82	1
JLS-22	Area 2	Canal Sediment	9/8/2020	2-4	ICON	10.2	1	265	1	79.8	1
JLS-23	Area 2	Canal Sediment	9/8/2020	0-2	ERM	6.88	1	535	1	85.6	1
JLS-23	Area 2	Canal Sediment	9/8/2020	0-2	ICON	5.14	1	317	1	132	1
JLS-23	Area 2	Canal Sediment	9/8/2020	2-4	ERM	12.54	1	984	1	76.9	1
JLS-23	Area 2	Canal Sediment	9/8/2020	2-4	ICON	15.8	1	892	1	69	1
JLS-23	Area 2	Canal Sediment	2/2/2021	0-2	ERM	NA	NA	NA	NA	NA	NA
JLS-23	Area 2	Canal Sediment	2/2/2021	0-2	ICON	6.49	1	418	1	NA	NA
JLS-23	Area 2	Canal Sediment	2/2/2021	2-3.5	ERM	NA	NA	NA	NA	NA	NA
JLS-23	Area 2	Canal Sediment	2/2/2021	2-3.5	ICON	4.01	1	457	1	NA	NA

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.13/23/2021 12:46:21 AM
From File	ProUCL Data_Prelim Eco AOI-1.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (mg/kg-dry)

General Statistics

Total Number of Observations	18	Number of Distinct Observations	18
		Number of Missing Observations	5
Minimum	4.01	Mean	11.47
Maximum	24.81	Median	11.72
SD	5.86	Std. Error of Mean	1.381
Coefficient of Variation	0.511	Skewness	0.523

Normal GOF Test

Shapiro Wilk Test Statistic	0.926	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.897	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.172	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.202	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	13.88	95% Adjusted-CLT UCL (Chen-1995)	13.93
		95% Modified-t UCL (Johnson-1978)	13.9

Gamma GOF Test

A-D Test Statistic	0.577	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.743	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.161	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.205	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.847	k star (bias corrected MLE)	3.243
Theta hat (MLE)	2.982	Theta star (bias corrected MLE)	3.538
nu hat (MLE)	138.5	nu star (bias corrected)	116.7
MLE Mean (bias corrected)	11.47	MLE Sd (bias corrected)	6.371
		Approximate Chi Square Value (0.05)	92.79
Adjusted Level of Significance	0.0357	Adjusted Chi Square Value	90.75

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	14.43	95% Adjusted Gamma UCL (use when n<50)	14.76

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.925	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.897	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.158	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.202	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.389	Mean of logged Data	2.304
Maximum of Logged Data	3.211	SD of logged Data	0.553

Assuming Lognormal Distribution

95% H-UCL	15.42	90% Chebyshev (MVUE) UCL	16.27
95% Chebyshev (MVUE) UCL	18.4	97.5% Chebyshev (MVUE) UCL	21.36
99% Chebyshev (MVUE) UCL	27.18		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	13.74	95% Jackknife UCL	13.88
95% Standard Bootstrap UCL	13.65	95% Bootstrap-t UCL	14.08
95% Hall's Bootstrap UCL	14.14	95% Percentile Bootstrap UCL	13.55
95% BCA Bootstrap UCL	13.81		
90% Chebyshev(Mean, Sd) UCL	15.62	95% Chebyshev(Mean, Sd) UCL	17.49
97.5% Chebyshev(Mean, Sd) UCL	20.1	99% Chebyshev(Mean, Sd) UCL	25.22

Suggested UCL to Use

95% Student's-t UCL	13.88

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Barium (mg/kg-dry)

General Statistics

Total Number of Observations	18	Number of Distinct Observations	18
		Number of Missing Observations	5
Minimum	224	Mean	919.7
Maximum	3220	Median	715
SD	801.6	Std. Error of Mean	188.9
Coefficient of Variation	0.872	Skewness	1.789

Normal GOF Test

Shapiro Wilk Test Statistic	0.796	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.897	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.211	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.202	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1248	95% Adjusted-CLT UCL (Chen-1995)	1316
		95% Modified-t UCL (Johnson-1978)	1262

Gamma GOF Test

A-D Test Statistic	0.458	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.754	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.127	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.207	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.802	k star (bias corrected MLE)	1.538
Theta hat (MLE)	510.5	Theta star (bias corrected MLE)	597.8
nu hat (MLE)	64.86	nu star (bias corrected)	55.38
MLE Mean (bias corrected)	919.7	MLE Sd (bias corrected)	741.5
		Approximate Chi Square Value (0.05)	39.28
Adjusted Level of Significance	0.0357	Adjusted Chi Square Value	37.98

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	1297	95% Adjusted Gamma UCL (use when n<50)	1341

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.953	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.897	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.114	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.202	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.412	Mean of logged Data	6.522
Maximum of Logged Data	8.077	SD of logged Data	0.788

Assuming Lognormal Distribution

95% H-UCL	1452	90% Chebyshev (MVUE) UCL	1452
95% Chebyshev (MVUE) UCL	1698	97.5% Chebyshev (MVUE) UCL	2040
99% Chebyshev (MVUE) UCL	2712		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1230	95% Jackknife UCL	1248
95% Standard Bootstrap UCL	1215	95% Bootstrap-t UCL	1465
95% Hall's Bootstrap UCL	1727	95% Percentile Bootstrap UCL	1261
95% BCA Bootstrap UCL	1290		
90% Chebyshev(Mean, Sd) UCL	1486	95% Chebyshev(Mean, Sd) UCL	1743
97.5% Chebyshev(Mean, Sd) UCL	2100	99% Chebyshev(Mean, Sd) UCL	2800

Suggested UCL to Use

95% Adjusted Gamma UCL	1341

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Zinc (mg/kg-dry)

General Statistics

Total Number of Observations	14	Number of Distinct Observations	14
		Number of Missing Observations	9
Minimum	69	Mean	95.16
Maximum	159.1	Median	89.4
SD	24.08	Std. Error of Mean	6.434
Coefficient of Variation	0.253	Skewness	1.747

Normal GOF Test

Shapiro Wilk Test Statistic	0.824	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.245	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	106.6	95% Adjusted-CLT UCL (Chen-1995)	109
		95% Modified-t UCL (Johnson-1978)	107.1

Gamma GOF Test

A-D Test Statistic	0.653	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.734	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.206	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.228	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	20.06	k star (bias corrected MLE)	15.81
Theta hat (MLE)	4.744	Theta star (bias corrected MLE)	6.02
nu hat (MLE)	561.6	nu star (bias corrected)	442.6
MLE Mean (bias corrected)	95.16	MLE Sd (bias corrected)	23.93
		Approximate Chi Square Value (0.05)	394.8
Adjusted Level of Significance	0.0312	Adjusted Chi Square Value	388.8

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	106.7	95% Adjusted Gamma UCL (use when n<50)	108.3

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.904	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.194	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.226	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.234	Mean of logged Data	4.53
Maximum of Logged Data	5.07	SD of logged Data	0.224

Assuming Lognormal Distribution

95% H-UCL	106.6	90% Chebyshev (MVUE) UCL	112.1
95% Chebyshev (MVUE) UCL	119.9	97.5% Chebyshev (MVUE) UCL	130.7
99% Chebyshev (MVUE) UCL	151.9		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	105.7	95% Jackknife UCL	106.6
95% Standard Bootstrap UCL	105.5	95% Bootstrap-t UCL	114.6
95% Hall's Bootstrap UCL	168.6	95% Percentile Bootstrap UCL	105.9
95% BCA Bootstrap UCL	109.2		
90% Chebyshev(Mean, Sd) UCL	114.5	95% Chebyshev(Mean, Sd) UCL	123.2
97.5% Chebyshev(Mean, Sd) UCL	135.3	99% Chebyshev(Mean, Sd) UCL	159.2

Suggested UCL to Use

95% Adjusted Gamma UCL	108.3

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Sample ID	Area	Matrix	Sample Date	Interval (ft)	Sampler	Arsenic (mg/kg-dry)	D_Arsenic (mg/kg-dry)	Barium (mg/kg-dry)	D_Barium (mg/kg-dry)	Zinc (mg/kg-dry)	D_Zinc (mg/kg-dry)
JLS-1	Area 2	Canal Sediment	5/26/2020	0-2	HET	7.89	1	392	1	106	1
JLS-1	Area 2	Canal Sediment	5/26/2020	0-2	ICON	9.63	1	595	1	107	1
JLS-1	Area 2	Canal Sediment	5/26/2020	2-4	HET	7	0	271	1	92	1
JLS-1	Area 2	Canal Sediment	5/26/2020	2-4	ICON	11.1	1	1270	1	96.8	1
JLS-1R	Area 2	Canal Sediment	1/13/2021	0-2	HET	NA	NA	307.8	1	NA	NA
JLS-1R	Area 2	Canal Sediment	1/13/2021	0-2	ICON	NA	NA	674	1	NA	NA
JLS-1R	Area 2	Canal Sediment	1/13/2021	2-4	HET	7	0	776	1	NA	NA
JLS-1R	Area 2	Canal Sediment	1/13/2021	2-4	ICON	7.34	1	753	1	NA	NA

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.13/23/2021 12:47:14 AM
From File	ProUCL Data_Prelim Eco AOI-2.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Barium (mg/kg-dry)

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	271	Mean	629.9
Maximum	1270	Median	634.5
SD	324.8	Std. Error of Mean	114.8
Coefficient of Variation	0.516	Skewness	0.969

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.911	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.201	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	847.4	95% Adjusted-CLT UCL (Chen-1995)	860.8
		95% Modified-t UCL (Johnson-1978)	854

Gamma GOF Test

A-D Test Statistic	0.276	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.719	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.152	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.295	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.441	k star (bias corrected MLE)	2.859
Theta hat (MLE)	141.8	Theta star (bias corrected MLE)	220.3
nu hat (MLE)	71.06	nu star (bias corrected)	45.75
MLE Mean (bias corrected)	629.9	MLE Sd (bias corrected)	372.5
		Approximate Chi Square Value (0.05)	31.23
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	28.23

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	922.6	95% Adjusted Gamma UCL (use when n<50)	1021

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.949	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.171	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.602	Mean of logged Data	6.329
Maximum of Logged Data	7.147	SD of logged Data	0.523

Assuming Lognormal Distribution

95% H-UCL	1031	90% Chebyshev (MVUE) UCL	984.3
95% Chebyshev (MVUE) UCL	1145	97.5% Chebyshev (MVUE) UCL	1367
99% Chebyshev (MVUE) UCL	1804		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	818.7	95% Jackknife UCL	847.4
95% Standard Bootstrap UCL	808.1	95% Bootstrap-t UCL	884.3
95% Hall's Bootstrap UCL	938.9	95% Percentile Bootstrap UCL	817.9
95% BCA Bootstrap UCL	839.8		
90% Chebyshev(Mean, Sd) UCL	974.4	95% Chebyshev(Mean, Sd) UCL	1130
97.5% Chebyshev(Mean, Sd) UCL	1347	99% Chebyshev(Mean, Sd) UCL	1772

Suggested UCL to Use

95% Student's-t UCL	847.4

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

APPENDIX I HAZARD QUOTIENT INPUT FACTORS

April 9, 2021

Appendix I-1
Summary: Barium Soil/Sediment to Plant Bioconcentration Factors
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Plant	Geometric Mean Soil/Sediment to Plant Bioconcentration Factor conc. in plant ÷ conc. in sediment	Reference
Swiss Chard	0.0041	Nelson et al., 1984
Rye Grass	0.0043	Nelson et al., 1984
Plant Shoots	0.0056	Lamb et al., 2013
Geometric Mean Ba Soil/Sediment to Plant BCF	0.0046	

Notes:
Ba=Barium
BCF=Bioconcentration Factor

References:
Nelson et al. 1984. Extractability and Plant Uptake of Trace Elements from Drilling Fluids. Journal of Environmental Quality, Vol. 13, No. 4.

Lamb, D. et al. 2013. Bioavailability of Barium to Plants and Invertebrates in Soils Contaminated by Barite. Environ. Sci. Technol. 47: 4670 - 4676.

Appendix I-2
Barium in Soils and Plants and Bioconcentration Factor Calculations (Nelson et al., 1984)
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Treatment	Barium in Swiss Chard (mg/kg)	Barium in Soil (mg/kg)	Soil to Plant BCF (Ba in Swiss Chard ÷Total Ba in Soil)
Control	206	350	0.59
BM1	196	101000	0.0019
BM2	226	252000	0.00090
NS2	165	215000	0.00077
MX1	464	91000	0.0051
MX2	262	227000	0.0012
		Geometric Mean Ba Plant BCF	0.0041

Treatment	Barium in Rye Grass (mg/kg)	Barium in Soil (mg/kg)	Soil to Plant BCF (Ba in Rye Grass÷Total Ba in Soil)
Control	188	350	0.54
BM1	172	101000	0.0017
BM2	275	252000	0.0011
NS2	-	215000	NA
MX1	142	91000	0.0016
MX2	216	227000	0.0010
		Geometric Mean Barium Soil to Plant BCF	0.0043

Notes:
The controls are not included in BCF calculations, because they represent the Ba in plants at background.
Ba=Barium
BCF=Bioconcentration Factor

Reference:
Nelson et al. 1984. Extractability and Plant Uptake of Trace Elements from Drilling Fluids. Journal of Environmental Quality, Vol. 13, No. 4.

Appendix I-3
Barium in Soils and Plants and Bioconcentration Factor Calculations (Lamb et al., 2013)
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Total Barium[a] Soil (mg/kg)	Barium Shoot Concentration (mg/kg)	Barium Soil to Plant BCF
mg/kg	**mg/kg**	**(conc. in plant ÷ conc. in soil)**
700	18	0.026
1300	122	0.094
5300	87	0.016
7700	79	0.010
5700	65	0.011
10100	79	0.0078
10100	133	0.013
6700	132	0.020
269000	92	0.00034
292000	68	0.00023
265000	65	0.00025
Geometric Mean Barium Soil to Plant BCF		0.0056

Notes:
BCF=Bioconcentration Factor
[a]Analyzed by XRF (X-ray diffraction analysis)

Reference:
Lamb, D. et al. 2013. Bioavailability of Barium to Plants and Invertebrates in Soils Contaminated by Barite. Environ. Sci. Technol. 47: 4670 - 4676.

Appendix I-4
Summary: Barium Sediment to Benthic Invertebrate Bioconcentration Factors
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Location	**Barium Geometric Mean Sediment to Benthic Invertebrate BCF**	**Reference**
South Louisiana (Abdominal)	0.0013	Finerty et al., 1990
South Louisiana (Hepatopancreas)	0.012	Finerty et al., 1990
EWL, LA (EWL Site)	0.091	ERM, 2019
EWL, LA (EWL Reference)	0.21	ERM, 2019
Total Means: Barium Sediment to Benthic Invertebrate BCF	0.023	

Notes:
BCF=Bioconcentration Factor
EWL, LA=East White Lake, Louisiana

References:
Finerty, M.W., Madden, J.D., Feagley, and Grodner, R.M. 1990. Tissues of Wild and Pond-raised Crayfish in Southern Louisiana, Effect of Environs and Seasonality on Metal Residues. Arch. Environ. Contam. Toxicol. 19: 94-100.

ERM. 2019. East White Lake Ecological Risk Assessment, Section 16 Property, East White Lake Oil and Gas Field, Vermilion Parish, Louisiana. September 16, 2019.

Appendix I-5
Barium in Sediments and Invertebrates and Bioconcentration Factor Calculations (Finerty et al., 1990)
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Sample ID	Crawfish Mean Abdominal Barium (mg/kg)	Crawfish Mean Hepatopancreas Barium (mg/kg)	Mean Sediment Barium (mg/kg)	Abdominal BCF (conc. in crawfish ÷ conc. in sed.)	Hepatopancreas BCF (conc. in crawfish ÷ conc. in sed.)
VER	0.782	8.223	333.5	0.0023	0.025
AP	-	4.84	556.4	-	0.0087
CRS	0.532	6.869	519.3	0.0010	0.013
LB	1.288	6.177	297.6	0.0043	0.021
STM	0.043	2.193	945.9	0.000045	0.0023
UB	2.383	6.558	282.2	0.0084	0.023
Geometric Mean Barium Sediment to Benthic Invertebrate BCF				0.0013	0.012

Notes:
Outlier removed: Barium soil outlier significantly below background (13.39 mg/kg).
BCF=Bioconcentration Factor

Reference:

Finerty, M.W., Madden, J.D., Feagley, and Grodner, R.M. 1990. Tissues of Wild and Pond-raised Crayfish in Southern Louisiana, Effect of Environs and Seasonality on Metal Residues. Arch. Environ. Contam. Toxicol. 19: 94-100.

Appendix I-6
Barium in Sediments and Crabs and Bioconcentration Factor Calculations (ERM, 2019)
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Area	Sample ID	Barium Concentration in Crab Tissue	Barium Concentration in Sediment	Barium Sediment to Crab BCF (conc. in crab tissue ÷ conc. in sediment)
EWL Site	EWL-T-01A-C	13.1		
EWL Site	EWL-T-01-C	22.6		
EWL Site	EWL-T-02-C	16.5		
EWL Site	EWL-T-03-C	34.1		
EWL Site	EWL-T-04-C	20.7		
EWL Site	EWL-T-05-C	19.5		
EWL Site	EWL-T-06-C	22.9		
EWL Site	EWL-T-07-C	20.4		
EWL Site	EWL-T-08-C	23.5		
EWL Site	EWL-T-09-C	16.1		
EWL Site	EWL-T-10-C	37.7		
EWL Site	EWL-T-11-C	24.3		
EWL Site	EWL-T-12-C	24.9		
EWL Site Geometric Mean		**21.9**	**241**	**0.091**
EWL Reference	EWL-TR-01-C	16.8		
EWL Reference	EWL-TR-02-C	20.8		
EWL Reference	EWL-TR-03A-C	25.8		
EWL Reference	EWL-TR-03-C	20.4		
EWL Reference	EWL-TR-04-C	22.4		
EWL Reference	EWL-TR-05-C	21.1		
EWL Reference	EWL-TR-06-C	29.3		
EWL Reference	EWL-TR-07-C	14.3		
EWL Reference	EWL-TR-08-C	21.8		
EWL Reference	EWL-TR-09-C	23.6		
EWL Reference Geometric Mean		**21.3**	**101**	**0.21**

Notes:
Concentrations are in mg/kg wet weight.
Concentrations for crab are for tissue.
Crab sampling was performed in December 2010/January 2011.
Sediment data are from 0-2 feet and collected in 2010 at EWL.
BCF=Bioconcentration Factor
EWL=East White Lake

Reference:
ERM. 2019. East White Lake Ecological Risk Assessment, Section 16 Property, East White Lake Oil and Gas Field, Vermilion Parish, Louisiana. September 16, 2019.

Appendix I-7
Bayou Pigeon Oil & Gas Field
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Location	Geometric Mean Barium Sediment to Fish BCF	Reference
Ottawa River, Ten Mile Creek, Ohio	0.012	Ohio EPA, 1991
Upper Columbia River, Washington	0.0068	Teck American, Inc. 2010
EWL, LA (EWL Site)	0.071	ERM, 2019
EWL, LA (EWL Reference)	0.11	ERM, 2019
Barium Sediment to Fish BCF	**0.028**	

Notes:
BCF=Bioconcentration Factor
EWL, LA= East White Lake, Louisiana

References:

Ohio EPA. 1991. Fish Tissue Bottom Sediment Surface Water Organic & Metal Chemical Evaluation, Ottawa River, Ten Mile Creek, Toledo, Ohio, Division Of Water Quality Planning And Assessment. US Geological Survey. Pearl, Mississippi.

Teck American, Inc. 2010. Upper Columbia River Screening-Level Ecological Risk Assessment (SLERA) Teck American, Inc., Spokane, WA.

ERM. 2019. East White Lake Ecological Risk Assessment, Section 16 Property, East White Lake Oil and Gas Field, Vermilion Parish, Louisiana. September 16, 2019.

Appendix I-8
Barium in Fish and Sediments in Rivers in Ohio and Washington and Bioconcentration Factor Calculations (Ohio EPA, 1991; Teck American, Inc., 2010)
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Ottawa River / Ten Mile Creek[a]	Site Location	Detroit Ave	Adj. Dura Landfill	Suder Ave	Dst Summit St	Sylvania Ave	Highland Meadows Golf
Whole body common carp conc.	mg/kg	1.94	0.843	0.79	1.38	1.22	1.34
Sediment composite conc.	mg/kg	96.9	126	143	175	55	72.6
BCF	fish conc.÷ sed. conc.	0.020	0.0067	0.0055	0.0079	0.022	0.018
						Geometric Mean Barium Sediment to Fish BCF	**0.012**

Upper Columbia River[b]	Reach #	6b	6a	5	4a	3	2	1
Mean fish tissue conc. in reach	mg/kg-dry	10.6	10.6	10.4	9.2	8.0	6.7	7.6
Avg. sediment conc. by location	mg/kg-dry	1517	798	1067	1190	1382	1543	2008
BCF	fish conc.÷ sed. conc.	0.0070	0.013	0.010	0.0077	0.0058	0.0043	0.0038
							Geometric Mean Barium Sediment to Fish BCF	**0.0068**

Note:
BCF=Bioconcentration Factor

References:
[a]Ohio EPA. 1991. Fish Tissue Bottom Sediment Surface Water Organic & Metal Chemical Evaluation, Ottawa River, Ten Mile Creek, Toledo, Ohio, Division Of Water Quality Planning And Assessment. US Geological Survey. Pearl, Mississippi.

[b]Teck American, Inc. 2010. Upper Columbia River Screening-Level Ecological Risk Assessment (SLERA) Teck American, Inc., Spokane, WA.

Appendix I-9
Barium in EWL Fish and Sediments and Bioconcentration Factor Calculations (ERM, 2019)
Appendix I-7
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Bayou Pigeon Oil & Gas Field	Sample ID	Barium Concentration in Fish Tissue	Barium Concentration in Sediment	Barium Sediment to Fish BCF Conc. in Fish Tissue ÷ Conc. in Sediment
EWL Site	EWL-T-01A-F	NA		
EWL Site	EWL-T-01-F	16.4		
EWL Site	EWL-T-02-F	Table I-8		
EWL Site	EWL-T-03-F	15.9		
EWL Site	EWL-T-04-F	17.1		
EWL Site	EWL-T-05-F	you Pigeon Oil & Gas Field		
EWL Site	EWL-T-06-F	16.4		
EWL Site	EWL-T-07-F	17.0		
EWL Site	EWL-T-08-F	17.1		
EWL Site	EWL-T-09-F	16.7		
EWL Site	EWL-T-10-F	20.1		
EWL Site	EWL-T-11-F	18.0		
EWL Site	EWL-T-12-F	14.7		
EWL Site Geometric Mean		**16.9**	**241**	**0.070**
EWL Reference	EWL-TR-01-F	NA		
EWL Reference	EWL-TR-02-F	9.1		
EWL Reference	EWL-TR-03A-F	NA		
EWL Reference	EWL-TR-03-F	9.5		
EWL Reference	EWL-TR-04-F	13.4		
EWL Reference	EWL-TR-05-F	13.0		
EWL Reference	EWL-TR-06-F	10.8		
EWL Reference	EWL-TR-07-F	11.5		
EWL Reference	EWL-TR-08-F	11.9		
EWL Reference	EWL-TR-09-F	12.1		
EWL Reference Geometric Mean		**11.3**	**101**	**0.11**

Notes:
Concentrations are in mg/kg wet weight.
Concentrations for shad fish are for tissue.
Fish sampling was performed in December 2010/January 2011.
Sediment data are from 0-2 feet and collected in 2010 at EWL.
BCF=Bioconcentration Factor
EWL=East White Lake

Reference:
ERM. 2019. East White Lake Ecological Risk Assessment, Section 16 Property, East White Lake Oil and Gas Field, Vermilion Parish, Louisiana. September 16, 2019.

Appendix I-10
Summary: Soil/Sediment Barium Bioavailability Factors
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Geometric Mean Barium Soil/Sediment Bioavailability Factor	Reference
0.00072	Engdahl, A. et al., 2008
0.00013	Environment International Ltd, 2010
0.000086	USGS, 2002
0.00020	**Geometric Mean Barium Soil Bioavailability Factor**

Note:
Soil bioavailability factors in each study are based on mean soil and porewater concentrations.

References:

Engdahl, A. et al. 2008. Oskarshamm and Forsmark site investigation, Chemical composition of suspended material, sediment and pore water in lakes and sea bays. Swedish Nuclear Fuel and Waste Management Co., P-08-81: 80 pgs.

Environment International Ltd. 2010. Upper Columbia River in-Situ Porewater Assessment Sampling and Quality Assurance Plan, Washington State Attorney General's Office.

USGS. 2002. Vertical Distribution of Trace-Element Concentrations and Occurrence of Metallurgical Slag Particles in Accumulated Bed Sediments of Lake Roosevelt, Washington. Scientific Investigations Report 2004-5090.

Appendix I-11
Barium in Soils/Sediments/Porewaters and Soil Bioavailability Calculations (Engdahl et al., 2008)
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Barium Sediment Concentration								
	Sample ID	Eck	Eck	Lab	Lab	Bol	Bol	Geometric Mean Ba Sediment Concentration
Sample Depth	*cm*	0-5	25-30	0-5	25-30	0-5	25-30	86
Concentration	mg/kg-dry	40	46	59	59	220	280	
Barium Porewater Concentration								
	Sample ID	Eck	Eck	Lab	Lab	Bol	Bol	Geometric Mean Ba Porewater Concentration
Sample Depth	*cm*	0-5	25-30	0-5	25-30	0-5	25-30	0.062
Concentration	mg/L	0.03	0.06	0.06	0.08	0.04	0.17	
Barium Soil Bioavailability								
	Sample ID	Eck	Eck	Lab	Lab	Bol	Bol	**Geometric Mean Barium Soil/Sed. Bioavailability Factor**
Porewater conc. ÷ Sediment conc.	unitless	0.0008	0.0013	0.0009	0.0013	0.0002	0.0006	**0.00072**

Note:
Ba=Barium

Reference:
Engdahl, A. et al. 2008. Oskarshamm and Forsmark site investigation, Chemical composition of suspended material, sediment and pore water in lakes and sea bays. Swedish Nuclear Fuel and Waste Management Co., P-08-81: 80 pgs.

Appendix I-12
Barium in Soils/Sediments/Porewaters and Soil Bioavailability Calculations (Environment International Ltd, 2010)
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

	Barium Soil Concentrations (mg/kg)							
Sample ID	UDE 2 SED	BSB 2 SED	BSB 1 SED	DE 2 SED	DE 1 SED	MSB 1 SED	MSB 2 SED	UDE 1 SED
	347	1010	1250	845	415	268	468	678
	Barium Porewater Concentrations (mg/L)							
Collected AM	0.109	0.058	0.154	0.129	0.115	0.040	0.047	0.029
Collected PM	0.129	0.055	0.146	0.173	0.117	0.039	0.044	0.029
Mean of AM and PM	0.119	0.057	0.150	0.151	0.116	0.0392	0.046	0.029
	Barium Soil/Sediment Bioavailability Factor							
porewater conc.÷ soil conc.	0.00034	0.000056	0.00012	0.00018	0.00028	0.00015	0.00010	0.000042
	Geometric Mean Soil/Sediment Barium Bioavailability Factor							**0.00013**

Reference:

Environment International Ltd. 2010. Upper Columbia River in-Situ Porewater Assessment Sampling and Quality Assurance Plan, Washington State Attorney General's Office.

Appendix I-13
Barium in Lake Roosevelt in Soils/Sediments/Porewaters and Soil Bioavailability Calculations (USGS, 2002)
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Sample ID	Depth	Barium Porewater	Barium Sediment	Barium Soil/Sediment Bioavailability Factor
	cm	mg/L	mg/kg	(porewater conc. ÷ sediment conc.)
1	1-2	0.091	1100	0.000083
	9-11	0.14	1100	0.00013
2	1-2	0.11	1200	0.000092
	9-11	0.18	1500	0.00012
3	1-2	0.068	1200	0.000057
	9-11	0.08	1300	0.000062
Geometric Mean Barium Soil/Sediment Bioavailability Factor				**0.000086**

Reference:
USGS. 2002. Vertical Distribution of Trace-Element Concentrations and Occurrence of Metallurgical Slag Particles in Accumulated Bed Sediments of Lake Roosevelt, Washington. Scientific Investigations Report 2004-5090.

Appendix I-14
Calculation of Arsenic Soil-to-Bird Bioconcentration Factor
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Matrix[a]	Year	Number of Birds	Arsenic (mg/kg wet)	Arsenic Soil-to-Bird BCF
Sediment			5	
Bird Liver Concentration				
Western Grebe	1976	6	1.11	0.222
Western Grebe	1981-1982	6	0.08	0.016
Glaucous-winged Gull	1976	6	1.63	0.326
Glaucous-winged Gull	1981-1982	6	0.14	0.028
Marbled Murrelet	1976	6	3.23	0.646
Marbled Murrelet	1981-1982	25	0.78	0.156
American Wigeon	1981-1982	14	0.09	0.018
Mallard	1981-1982	17	0.14	0.028
Bufflehead	1981-1982	20	0.22	0.044
Soil-to-bird BCF (Geometric Mean)				0.075

Notes:
a) Sediment and bird liver concentrations are averages.

References:

Vermeer, K. and J.A.J. Thompson. 1992. Arsenic and Copper Residues in Waterbirds and Their Food Down Inlet from the Island Copper Mill. Bulletin of Environmental Contamination and Toxicology 48:733-378.

Thompson, J.A.J. and D.W. Patton. 1975. Chemical delineation of a submerged mine tailings plume in Rupert and Holberg inlets. BC Fish Mar Serv Tech Rept No. 506.

Waldichuk, M. and R.J. Buchanan. 1980. Significance of environmental changes due to mine waste disposal into Rupert Inlet. Fisheries and Oceans, Vancouver, British Columbia.

Appendix I-15
Calculation of Zinc Soil-to-Bird Bioconcentration Factor
Jeanerette Lumber & Shingle Co., LLC v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field
Iberia Parish, Louisiana

Matrix[a]	**Zinc (mg/kg dry)**	
Location:	Bake Oven Knob	Palmerton
Soil horizon		
01	460	9900
02	960	24000
A1	230	2900
A2	83	480
Average Soil Concentration	433	9320
Songbird Carcass (average)	120	140
Soil-to-bird BCF	0.277	0.0150
Soil-to-bird BCF (Geometric Mean)	0.0645	

Notes:
a) Each soil sample is a pool of 10 samples.
Bake Oven Knob birds: catbird, wood thrush, black-and-white warbler,
Palmerton birds: Carolina chickadee, catbird, brown thrasher, robin, wood thrush, black-and-white warbler, yellow-throated warbler, common grackle, rufous-sided towhee, and field sparrow.

Reference:

Beyer, W.N., Pattee, O.H., Sileo, L., Hoffman, D.J., and B.M. Mulhern. 1985. Metal Contamination in Wildlife Living Near Two Zinc Smelters. Environmental Pollution (Series A) 38: 63-86.

Endpoint	Result	Units	Exposure	Duration	Media	Salinity	Organism Scientific Name	Common Name	Life Stage	Effect	Reference
AQUATIC STUDIES											
Freshwater											
EC50	32	mg/L	direct contact	48 hrs	water	freshwater	*Daphnia magna Straus*	water flea	not reported	immobility	1. Khangarot,B.S., and P.K. Ray, 1989
EC50	33.65	mg/L	direct contact	48 hrs	water	freshwater	*Tubifex tubifex*	Tubificid Worm	not reported	immobility	2. Khangarot,B.S., 1991
EC50	33.65	mg/L	direct contact	96 hrs	water	freshwater	*Tubifex tubifex*	Tubificid Worm	not reported	immobility	2. Khangarot,B.S., 1991
EC50	44.98	mg/L	direct contact	24 hrs	water	freshwater	*Tubifex tubifex*	Tubificid Worm	not reported	immobility	2. Khangarot,B.S., 1991
EC50	52.82	mg/L	direct contact	24 hrs	water	freshwater	*Daphnia magna Straus*	water flea	not reported	immobility	1. Khangarot,B.S., and P.K. Ray, 1989
EC50	634-798	mg/L	direct contact	48 hr	water	freshwater	*C. subglobosa Sowerby*	freshwater ostracod	various	immobility	3. Khangarot, B.S. and Das, S., 2009
LC50	> 7500	mg/L	direct contact	96 hrs	water	freshwater	*Salmo gairdneri* Richardson	rainbow trout	2.5 - 4.0 cm	mortality	4. Faulk, M. et al., 1973
LC50	76000	mg/L	direct contact	96 hrs	water	freshwater	*Oncorhynchus mykiss*	rainbow trout	1 gram weight	mortality	5. Sprague, J. et al., 1979
LC0	100000	mg/L	direct contact	96 hrs	water	freshwater	*Poecilia sp.*	Mollies	not reported	mortality	6. Grantham,C.K., and J.P. Sloan, 1975
Saltwater											
NOAEL	10	mg/L	direct contact	7 days	water	34 ppt salinity	*Cancer anthonyi*	yellow crab	embryo	mortality/reproduct.	7. Macdonald J.M. et al., 1988
NOAEL	200	mg/L	direct contact	24 hours	water	marine	*Mallotus villosus*	capelin	larvae	survival	8. Payne, J.F. et al., 2006
LC50	1000	mg/L	direct contact	7 days	water	34 ppt salinity	*Cancer anthonyi*	yellow crab	embryo	mortality	7. Macdonald J.M. et al., 1988
NOAEL	1000	mg/L	direct contact	24 hours	water	marine	*Chionoecetes opilio*	snow crab	larvae	survival	8. Payne, J.F. et al., 2006
NOAEL	1000	mg/L	direct contact	24 hours	water	marine	jellyfish	jellyfish	planktonic	survival	8. Payne, J.F. et al., 2006
NOAEL	1000	mg	ingestion	4x/one month	water	marine	*Pseudopleuronectes americanus*	winter flounder	300 gram weight	survival	8. Payne, J.F. et al., 2006
EC50	16200	mg/L	direct contact	96 hour	water	28-31 ppt salinity	*Pandalus danae*	dock shrimp	larvae	swimming	9. Carls, M.G. et al., 1984
EC50	71400	mg/L	direct contact	96 hour	water	28-31 ppt salinity	*Metacarcinus magister*	dungeness crab	larvae	swimming	9. Carls, M.G. et al., 1984
NOAEL	200000	mg/L	direct contact	10 month	water	seawater	*Tautogolabrus adspersus*	cunner	70.7 +/-20.8 gms	growth	10. Payne, J. et al., 2011
TERRESTRIAL STUDIES											
Mammals											
NOAEL	8	mg/kg	ingestion	apprx 60 days [a]	diet	NA	CF-1 mice	mice	weanling	growth/repro/mortal	11. Hutcheson, D., 1975
LD50	364000	mg/kg	intragastric	28 -52 hours	dosed	NA	CBL-Wistar Albino Rats	rat	130-160 gm wght	mortality	12. Boyd, M.D. and Abel, M., 1966
LD0	163000	mg/kg	intragastric	14 days	dosed	NA	CBL-Wistar Albino Rats	rat	130-160 gm wght	mortality	12. Boyd, M.D. and Abel, M., 1966
Terrestrial Invertebrates											
NOAEL	10000	mg/kg	direct contact		sandy loam soil	NA	*Folsomia Candida*	soil arthropod	adult	mortality	13. Kuperman, R.G. et al., 2006
NOAEL	10000	mg/kg	direct contact		sandy loam soil	NA	*Eisenia Fetida*	earth worm	adult	mortality	13. Kuperman, R.G. et al., 2006
NOAEL	10000	mg/kg	direct contact		sandy loam soil	NA	*Enchytraeus Crypticus*	white worm	adult	mortality	13. Kuperman, R.G. et al., 2006
NOAEL	1000000	mg/kg	direct contact	14 days	clayey soil	NA	*Onychiurus folsomi*	springtail insect	not reported	mortality	14. Menzie et al., 2008
NOAEL	300000	mg/kg	direct contact	14 days	loamy soil	NA	*Eisenia andrei*	worm	not reported	mortality	14. Menzie et al., 2008

Notes

a) Three generations of mice

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1. Khangarot,B.S., and P.K. Ray, 1989, Investigation of Correlation Between Physicochemical Properties of Metals and Their Toxicity to the Water Flea Daphnia magna Straus, Ecotoxicol. Environ. Saf.18(2): 109-121 (from ECOTOX)
2. Khangarot,B.S., 1991, Toxicity of Metals to a Freshwater Tubificid Worm, Tubifex tubifex (Muller), Bull. Environ. Contam. Toxicol.46:906-912 (from ECOTOX)
3. Khangarot, B.S. and Das, S., 2009, Acute toxicity of metals and reference toxicants to a freshwater ostracod, Cypris subglobosa Sowerby, 1840 and correlation to EC50 values of other test models, Journal of Hazardous Materials 172, 641–649
4. Faulk, M. et al., Acute Toxicity of Petrochemical Drilling Fluids Components and Wastes to Fish, 1973, Environment Canada,Technical Report Series
5. Sprague, J. et al., 1979, Separate and Joint Toxicity to Rainbow Trout of Substances Used in Drilling Fluids for Oil Exploration, Environ. Pollut. 0013-9327
6. Grantham,C.K., and J.P. Sloan, 1975, EPA 560/1-75-004, 1975, Toxicity Study Drilling Fluid Chemicals on Aquatic LifeConf.Proc.on Environ.Aspects of Chemical Use in Well-Drilling Operations, Research Triangle Inst., NC (from ECOTOX)
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9. Carls, M.G. et al., 1984, Toxic Contributions of Specific Drilling Mud Components to Larval Shrimp and Crabs, Marine Environmental Research 12, 45-62.
10. Payne, J. et al., 2011, Produced Water: Overview of Composition, Fates, and Effects, Chapter 21 Risks to Fish Associated with Barium in Drilling Fluids and Produced Water: A Chronic Toxicity Study with Cunner (Tautogolabrus adspersus)
11. Hutcheson, D. et al., 1975, Studies of Nutritional Safety of Some Heavy Metals in Mice, The Journal of Nutrition, Vol 105, no.6.
12. Boyd, M.D. and Abel, M., 1966, The Acute Toxicity of Barium Sulfate Administered Intragastrically, Canad. Med. Ass. J.
13. Kuperman, R.G. et al., 2006, Toxicity Benchmarks for Antimony, Barium, and Beryllium Determin. using Reproduc. Endpoints for Folsomia Candida, Eisenia Fetida, and Enchytraeus Crypticus, Environ. Toxicol. and Chem., Vol. 25, No. 3, pp. 754–762
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Endpoint	Derivation of Endpoint	Description of Endpoint/Organisms Protected	Result *mg/kg-dry*	Species	Media	Reference
HC5	Median HC5 (hazardous conc. 5%) for 343 different sensitive species	Conc. at which 5% of sensitive species exhibit reduction in abundance	130	sensitive benthic invertebrates	marine sediment	1
HC28	Median HC28 for 343 different sensitive species	Community HC5, protects 95% of community, concentrations below which harmful effects unlikely	2218	sensitive benthic invertebrates	marine sediment	1
HC56	Median HC56 for 343 different sensitive species	Community HC10, protects 90% of community, concentrations below which harmful effects are unlikely	4876	sensitive benthic invertebrates	marine sediment	1
F-PNEC$_{13}$	Median F-PNEC for 191 most common species (lowest value at which abundance effects are observed in 13% of species)	F-PNEC below which harmful effects for 95% of the macro benthos (> 1 mm) community are unlikely	1718	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{13}$	Median F-PNEC for 2206 species (lowest value at which abundance effects are observed in 13% of species)	F-PNEC in mud sediment below which harmful effects for 95% of the community are unlikely	2645	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{10}$	Median F-PNEC for 2206 species (lowest value at which abundance effects are observed in 10% of species)	F-PNEC in mud-fine sand sediment below which harmful effects for 95% of the community are unlikely	2263	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{9}$	Median F-PNEC for 2206 species (lowest value at which abundance effects are observed in 9% of species)	F-PNEC in fine sand-sand sediment below which harmful effects for 95% of the community are unlikely	1951	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{mean}$	Mean of grain sized based median F-PNECs for 2206 species	F-PNEC in sediments below which harmful effects for 95% of the community are unlikely	2286	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{5}$	Median F-PNEC at 5% protection level for 191 most common species using bootstrapping method	Median F-PNEC for 191 most common species (lowest value at which abundance effects are observed in 5% of species)	1718	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{5}$95%-low	Confidence Interval (95%-low) F-PNEC at 5% protection level for 191 most common species using bootstrapping method	95% lower confidence limit F-PNEC$_{5}$	1644	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{5}$95%-high	Confidence Interval (95%-high) F-PNEC at 5% protection level for 191 most common species using bootstrapping method	95% upper confidence limit F-PNEC$_{5}$	2020	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{13}$	Median F-PNEC adjusted for non-sensitive species for 191 most common species using bootstrapping method	Median F-PNEC$_{13}$ (Adjusted protection value from PNEC$_{5}$ to PNEC$_{13}$ to account for non-sensitive species)	2283	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{13}$95%-low	Confidence Interval (95%-low) F-PNEC at 13% protection level for 191 most common species using bootstrapping method	95% lower confidence limit F-PNEC$_{13}$	1938	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{13}$95%-high	Confidence Interval (95%-high) F-PNEC at 13% protection level for 191 most common species using bootstrapping method	95% upper confidence limit F-PNEC$_{13}$	2522	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{5}$	F-PNEC at 5% protection level for 191 most common species using logistic function	Median F-PNEC for 191 most common species (lowest value at which abundance effects are observed in 5% of species)	1148	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{13}$	F-PNEC adjusted for non-sensitive species for 191 most common species using logisitic function	Median F-PNEC for the adjusted 5% protection level (5% adjusted to 13% to account for non-sensitive species)	1793	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{5}$-mud	Median F-PNEC at 5% protection level in mud substrate for 191 most common species using bootstrapping method	Median F-PNEC for 191 most common species (lowest value at which abundance effects are observed in 5% of species)	1977	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{5}$95%-low-mud	Confidence Interval (95%-low) F-PNEC at 5% protection level for 191 most common species using bootstrapping method	95% lower confidence limit for F-PNEC$_{5}$95%-low-mud	1808	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{5}$95%-high-mud	Confidence Interval (95%-high) F-PNEC at 5% protection level for 191 most common species using bootstrapping method	95% upper confidence limit for F-PNEC$_{5}$95%-high-mud	2275	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{13}$-mud	Median F-PNEC adjusted for non-sensitive species in mud substrate for 191 most common species using bootstrapping method	Median F-PNEC for the adjusted 5% protection level in mud substrate (5% adjusted to 13% to account for non-sensitive species)	2645	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{13}$95%-low-mud	Confidence Interval (95%-low) F-PNEC in mud substrate for 191 most common species using bootstrapping method	95% lower confidence limit for F-PNEC$_{13}$95%-low-mud	2409	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{13}$95%-high-mud	Confidence Interval (95%-high) F-PNEC in mud substrate for 191 most common species using bootstrapping method	95% upper confidence limit for F-PNEC$_{13}$95%-high-mud	3181	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{5}$-mud-fine-sand	Median F-PNEC at 5% protection level in mud-fine sand substrate for 191 most common species using bootstrapping method	Median F-PNEC for 191 most common species (lowest value at which abundance effects are observed in 5% of species)	1720	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{5}$95%-low-mud-fine sand	Confidence Interval (95%-low) F-PNEC at 5% protection level for 191 most common species using bootstrapping method	95% lower confidence limit for F-PNEC$_{5}$95%-low-mud-fine sand	1372	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{5}$95%-high-mud-fine sand	Confidence Interval (95%-high) F-PNEC at 5% protection level for 191 most common species using bootstrapping method	95% upper confidence limit for F-PNEC$_{5}$95%-high-mud-fine sand	2200	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{10}$-mud-fine sand	Median F-PNEC adjusted for non-sensitive species for 191 most common species using bootstrapping method	Median F-PNEC for the adjusted 5% protection level (5% adjusted to 10% to account for non-sensitive species)	2263	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{10}$95%-low-mud-fine sand	Confidence Interval (95%-low) F-PNEC in mud-fine sand substrate for 191 most common species using bootstrapping method	95% lower confidence limit for F-PNEC$_{10}$95%-low-mud-fine sand	2141	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{10}$95%-high-mud-fine sand	Confidence Interval (95%-high) F-PNEC in mud-fine sand substrate for 191 most common species using bootstrapping method	95% upper confidence limit for F-PNEC$_{10}$95%-high-mud-fine sand	2490	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{5}$-fine sand-sand	Median F-PNEC at 5% protection level in fine sand-sand substrate for 191 most common species using bootstrapping method	Median F-PNEC for 191 most common species (lowest value at which abundance effects are observed in 5% of species)	1711	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{5}$95%-low-fine sand-sand	Confidence Interval (95%-low) F-PNEC at 5% protection level for 191 most common species using bootstrapping method	95% lower confidence limit for F-PNEC$_{5}$95%-low-mud-fine sand	1498	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{5}$95%-high-fine sand-sand	Confidence Interval (95%-high) F-PNEC at 5% protection level for 191 most common species using bootstrapping method	95% upper confidence limit for F-PNEC$_{5}$95%-high-mud-fine sand	1929	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{10}$-fine sand-sand	Median F-PNEC adjusted for non-sensitive species for 191 most common species using bootstrapping method	Median F-PNEC for the adjusted 5% protection level (5% adjusted to 9% to account for non-sensitive species)	1951	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{10}$95%-fine sand-sand	Confidence Interval (95%-low) F-PNEC in fine sand-sand substrate for 191 most common species using bootstrapping method	95% lower confidence limit for F-PNEC$_{9}$95%-low-mud-fine sand	1816	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{10}$95%-fine sand-sand	Confidence Interval (95%-high) F-PNEC in fine sand-sand substrate for 191 most common species using bootstrapping method	95% upper confidence limit for F-PNEC$_{9}$95%-high-mud-fine sand	2254	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{13}$-mud	Probable no effects concentration derived using logistic function (5% is adjusted to 13% to account for non-sensitive species)	Actual conc. level below which harmful effects on the benthic community are unlikley to be observed in 95% of the community	2200	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{10}$-mud-fine sand	Probable no effects concentration derived using logistic function (5% is adjusted to 10% to account for non-sensitive species)	Actual conc. level below which harmful effects on the benthic community are unlikley to be observed in 95% of the community	1931	macro benthos (> 1 mm)	marine sediment	2
F-PNEC$_{9}$-fine sand-sand	Probable no effects concentration derived using logistic function (5% is adjusted to 9% to account for non-sensitive species)	Actual conc. level below which harmful effects on the benthic community are unlikley to be observed in 95% of the community	1942	macro benthos (> 1 mm)	marine sediment	2
HC$_{5}$-median	Median hazardous concentration causing effects in 5% of the invertebrate sediment population	Median concentration causing reduction in density of 5% of a marine benthic organism population	765	benthic sediment species	marine sediment	3
HC$_{10}$-median	Median hazardous concentration causing effects in 10% of the invertebrate sediment population	Median concentration causing reduction in density of 10% of a marine benthic organism population	3424	benthic sediment species	marine sediment	3
HC$_{5}$-mode	The mode hazardous concentration causing effects in 5% of the invertebrate sediment population	Mode concentration causing reduction in density of 5% of a marine benthic organism population	401	benthic sediment species	marine sediment	3
HC$_{10}$-mode	The mode hazardous concentration causing effects in 10% of the invertebrate sediment population	Mode concentration causing reduction in density of 10% of a marine benthic organism population	1085	benthic sediment species	marine sediment	3

Reference:

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APPENDIX J HAZARD QUOTIENT CALCULATIONS

April 9, 2021

Appendix J-1-1
Canal Sediment HQ Calculations (95% UCL Conc.): Prelim Eco AOI-1 (0-4'): American Robin
Jeanerette Lumber & Shingle Co., L.L.C. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field, Iberia Parish, Louisiana

American Robin		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.0773	BW
Soil ingestion proportion	0.02	Ps
Food ingestion Rate (kg/kgBW/d)	0.132	FIR
Proportion of diet, plants	0.41	Pp
Proportion of diet, soil inverts	0.59	Pi
Spatial factor	1	SF
Temporal factor	0.3	TF
Area use factor	0.3	AUF

Calculations based on 95% UCL values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**95% UCL Canal Sediment Concentration (0-4')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF soil inverts**	**Soil/ Sediment**	**Plants**	**Soil Inverts**	**HQ**
Arsenic	13.88	2.24	0.01	0.0375	0.224	0.000366	0.0282	0.242	0.0362
Barium	1341	600	0.0002	0.0046	0.091	0.000708	0.334	9.5	0.00492
Zinc	108.3	66.1	0.1	0.366	3.201	0.0286	2.15	27	0.132

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a\ x\ P_s\ x\ FIR\ x\ AF_{as}] + [\sum_i^N B_i\ x\ P_i\ x\ FIR\ x\ AF_{ai}\ ]\right)\ x\ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

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Appendix J-1-2
Canal Sediment HQ Calculations (95% UCL Conc.): Prelim Eco AOI-1 (0-4'): Spotted Sandpiper
Jeanerette Lumber & Shingle Co., L.L.C. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field, Iberia Parish, Louisiana

Spotted Sandpiper			
Parameter	**Value**	**Symbol**	
Body weight (kg)	0.0425	BW	
Soil ingestion proportion	0.17	Ps	
Food ingestion Rate (kg/kgBW/d)	0.196	FIR	**Calculations based on 95% UCL values**
Proportion of diet, benthic inverts	1	Pbi	
Spatial factor	0.25	SF	
Temporal factor	0.3	TF	
Area use factor	0.075	AUF	

			Absorbed Fraction (AF)		Absorbed Concentration from Medium and Biota		
COPEC	**95% UCL Canal Sediment Concentration (0-4')**	**TRV**	**Soil bio-factor**	**BCF benthic inverts**	**Soil/ Sediment**	**Benthic Inverts**	**HQ**
Arsenic	13.88	2.24	0.01	0.127	0.00462	0.346	0.0117
Barium	1341	600	0.0002	0.023	0.00894	6.05	0.000757
Zinc	108.3	66.1	0.1	2.33	0.361	49.5	0.0566

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Appendix J-1-3
Canal Sediment HQ Calculations (95% UCL Conc.): Prelim Eco AOI-1 (0-4'): Mallard Duck
Jeanerette Lumber & Shingle Co., L.L.C. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field, Iberia Parish, Louisiana

Mallard Duck		
Parameter	**Value**	**Symbol**
Body weight (kg)	1.134	BW
Soil ingestion proportion	0.033	Ps
Food ingestion Rate (kg/kgBW/d)	0.05	FIR
Proportion of diet, plants	0.5	Pp
Proportion of diet, benthic inverts	0.5	Pbi
Spatial factor	0.0049	SF
Temporal factor	0.3	TF
Area use factor	0.0015	AUF

Calculations based on 95% UCL values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	95% UCL Canal Sediment Concentration (0-4')	TRV	Soil bio-factor	BCF plants	BCF benthic inverts	Soil/ Sediment	Plants	Benthic Inverts	HQ
Arsenic	13.88	2.24	0.01	0.0375	0.127	0.000229	0.013	0.0441	0.0000376
Barium	1341	600	0.0002	0.0046	0.023	0.000443	0.154	0.771	0.00000227
Zinc	108.3	66.1	0.1	0.366	2.33	0.0179	0.991	6.31	0.000163

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai} \;]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Appendix J-1-4
Canal Sediment HQ Calculations (95% UCL Conc.): Prelim Eco AOI-1 (0-4'): Snowy Egret
Jeanerette Lumber & Shingle Co., L.L.C. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field, Iberia Parish, Louisiana

Snowy Egret		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.371	BW
Soil ingestion proportion	0.005	Ps
Food ingestion Rate (kg/kgBW/d)	0.116	FIR
Proportion of diet, benthic inverts	0.1	Pbi
Proportion of diet, fish	0.9	Pf
Spatial factor	0.0041	SF
Temporal factor	0.3	TF
Area use factor	0.0012	AUF

Calculations based on 95% UCL values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	95% UCL Canal Sediment Concentration (0-4')	TRV	Soil bio-factor	BCF benthic inverts	BCF fish	Soil/ Sediment	Benthic Inverts	Fish	HQ
Arsenic	13.88	2.24	0.01	0.127	0.00065	0.0000805	0.0204	0.000942	0.0000118
Barium	1341	600	0.0002	0.023	0.028	0.000156	0.358	3.92	0.00000877
Zinc	108.3	66.1	0.1	2.33	0.138	0.00628	2.93	1.56	0.0000837

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Appendix J-1-5
Canal Sediment HQ Calculations (95% UCL Conc.): Prelim Eco AOI-1 (0-4'): American Bald Eagle
Jeanerette Lumber & Shingle Co., L.L.C. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field, Iberia Parish, Louisiana

American Bald Eagle		
Parameter	**Value**	**Symbol**
Body weight (kg)	4.6	BW
Soil ingestion proportion	0	Ps
Food ingestion Rate (kg/kgBW/d)	0.09	FIR
Proportion of diet, mammals	0.068	Pm
Proportion of diet, birds	0.165	Pb
Proportion of diet, fish	0.767	Pf
Spatial factor	0.000016	SF
Temporal factor	0.3	TF
Area use factor	0.0000048	AUF

Calculations based on 95% UCL values

			Absorbed Fraction (AF)				Absorbed Concentration from Medium and Biota				
COPEC	95% UCL Canal Sediment Concentration (0-4')	TRV	Soil bio-factor	BCF mammals	BCF birds	BCF fish	Soil/ Sediment	Mammals	Birds	Fish	HQ
Arsenic	13.88	2.24	-	0.0025	0.075	0.00065	-	0.000212	0.0155	0.000623	0.000000035
Barium	1341	600	-	0.0566	0.0566	0.028	-	0.465	1.13	2.59	3.35E-08
Zinc	108.3	66.1	-	0.7717	0.0645	0.138	-	0.511	0.104	1.03	0.000000119

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}\ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Appendix J-1-6
Canal Sediment HQ Calculations (95% UCL Conc.): Prelim Eco AOI-1 (0-4'): Least Shrew
Jeanerette Lumber & Shingle Co., L.L.C. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field, Iberia Parish, Louisiana

Least Shrew		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.017	BW
Soil ingestion proportion	0.13	Ps
Food ingestion Rate (kg/kgBW/d)	0.096	FIR
Proportion of diet, soil inverts	1	Pi
Spatial factor	1	SF
Temporal factor	0.3	TF
Area use factor	0.3	AUF

Calculations based on 95% UCL values

			Absorbed Fraction (AF)		Absorbed Concentration from Medium and Biota		
COPEC	**95% UCL Canal Sediment Concentration (0-4')**	**TRV**	**Soil bio-factor**	**BCF soil inverts**	**Soil/ Sediment**	**Soil Inverts**	**HQ**
Arsenic	13.88	1.04	0.01	0.224	0.00173	0.298	0.0865
Barium	1341	5433	0.0002	0.091	0.00335	11.7	0.000646
Zinc	108.3	75.4	0.1	3.201	0.135	33.3	0.133

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai} \ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Appendix J-1-7
Canal Sediment HQ Calculations (95% UCL Conc.): Prelim Eco AOI-1 (0-4'): American Mink
Jeanerette Lumber & Shingle Co., L.L.C. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field, Iberia Parish, Louisiana

American Mink		
Parameter	**Value**	**Symbol**
Body weight (kg)	1	BW
Soil ingestion proportion	0.005	Ps
Food ingestion Rate (kg/kgBW/d)	0.137	FIR
Proportion of diet, mammals	0.22	Pm
Proportion of diet, benthic inverts	0.64	Pbi
Proportion of diet, fish	0.14	Pf
Spatial factor	0.0093	SF
Temporal factor	0.3	TF
Area use factor	0.0028	AUF

Calculations based on 95% UCL values

			Absorbed Fraction (AF)				Absorbed Concentration from Medium and Biota				
COPEC	95% UCL Canal Sediment Concentration (0-4')	TRV	Soil bio-factor	BCF mammals	BCF benthic inverts	BCF fish	Soil/ Sediment	Mammals	Benthic Inverts	Fish	HQ
Arsenic	13.88	1.04	0.01	0.0025	0.127	0.00065	0.0000951	0.00105	0.155	0.000173	0.000419
Barium	1341	5433	0.0002	0.0566	0.023	0.028	0.000184	2.29	2.7	0.72	0.00000293
Zinc	108.3	75.4	0.1	0.7717	2.33	0.138	0.00742	2.52	22.1	0.287	0.000922

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}\;]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Appendix J-2-1
Canal Sediment HQ Calculations (Average Conc.): Prelim Eco AOI-1 (0-4'): American Robin
Jeanerette Lumber & Shingle Co., L.L.C. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field, Iberia Parish, Louisiana

American Robin		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.0773	BW
Soil ingestion proportion	0.02	Ps
Food ingestion Rate (kg/kgBW/d)	0.132	FIR
Proportion of diet, plants	0.41	Pp
Proportion of diet, soil inverts	0.59	Pi
Spatial factor	1	SF
Temporal factor	0.3	TF
Area use factor	0.3	AUF

Calculations based on average values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	Average Canal Sediment Concentration (0-4')	TRV	Soil bio-factor	BCF plants	BCF soil inverts	Soil/ Sediment	Plants	Soil Inverts	HQ
Arsenic	11.47	2.24	0.01	0.0375	0.224	0.000303	0.0233	0.2	0.0299
Barium	919.7	600	0.0002	0.0046	0.091	0.000486	0.229	6.52	0.00337
Zinc	95.16	66.1	0.1	0.366	3.201	0.0251	1.88	23.7	0.116

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}\ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Spotted Sandpiper		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.0425	BW
Soil ingestion proportion	0.17	Ps
Food ingestion Rate (kg/kgBW/d)	0.196	FIR
Proportion of diet, benthic inverts	1	Pbi
Spatial factor	0.25	SF
Temporal factor	0.3	TF
Area use factor	0.075	AUF

Calculations based on average values

			Absorbed Fraction (AF)		**Absorbed Concentration from Medium and Biota**		
COPEC	**Average Canal Sediment Concentration (0-4')**	**TRV**	**Soil bio-factor**	**BCF benthic inverts**	**Soil/ Sediment**	**Benthic Inverts**	**HQ**
Arsenic	11.47	2.24	0.01	0.127	0.00382	0.286	0.0097
Barium	919.7	600	0.0002	0.023	0.00613	4.15	0.00052
Zinc	95.16	66.1	0.1	2.33	0.317	43.5	0.0497

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a\ x\ P_s\ x\ FIR\ x\ AF_{as}] + [\sum_i^N B_i\ x\ P_i\ x\ FIR\ x\ AF_{ai}\ ]\right)\ x\ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Appendix J-2-3
Canal Sediment HQ Calculations (Average Conc.): Prelim Eco AOI-1 (0-4'): Mallard Duck
Jeanerette Lumber & Shingle Co., L.L.C. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field, Iberia Parish, Louisiana

Mallard Duck		
Parameter	**Value**	**Symbol**
Body weight (kg)	1.134	BW
Soil ingestion proportion	0.033	Ps
Food ingestion Rate (kg/kgBW/d)	0.05	FIR
Proportion of diet, plants	0.5	Pp
Proportion of diet, benthic inverts	0.5	Pbi
Spatial factor	0.0049	SF
Temporal factor	0.3	TF
Area use factor	0.0015	AUF

Calculations based on average values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	Average Canal Sediment Concentration (0-4')	TRV	Soil bio-factor	BCF plants	BCF benthic inverts	Soil/ Sediment	Plants	Benthic Inverts	HQ
Arsenic	11.47	2.24	0.01	0.0375	0.127	0.000189	0.0108	0.0364	0.0000311
Barium	919.7	600	0.0002	0.0046	0.023	0.000304	0.106	0.529	0.00000156
Zinc	95.16	66.1	0.1	0.366	2.33	0.0157	0.871	5.54	0.000143

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a\ x\ P_s\ x\ FIR\ x\ AF_{as}] + [\sum_i^N B_i\ x\ P_i\ x\ FIR\ x\ AF_{ai}\ ]\right)\ x\ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Appendix J-2-4
Canal Sediment HQ Calculations (Average Conc.): Prelim Eco AOI-1 (0-4'): Snowy Egret
Jeanerette Lumber & Shingle Co., L.L.C. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field, Iberia Parish, Louisiana

Snowy Egret		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.371	BW
Soil ingestion proportion	0.005	Ps
Food ingestion Rate (kg/kgBW/d)	0.116	FIR
Proportion of diet, benthic inverts	0.1	Pbi
Proportion of diet, fish	0.9	Pf
Spatial factor	0.0041	SF
Temporal factor	0.3	TF
Area use factor	0.0012	AUF

Calculations based on average values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	Average Canal Sediment Concentration (0-4')	TRV	Soil bio-factor	BCF benthic inverts	BCF fish	Soil/ Sediment	Benthic Inverts	Fish	HQ
Arsenic	11.47	2.24	0.01	0.127	0.00065	0.0000665	0.0169	0.000778	0.00000974
Barium	919.7	600	0.0002	0.023	0.028	0.000107	0.245	2.69	0.00000602
Zinc	95.16	66.1	0.1	2.33	0.138	0.00552	2.57	1.37	0.0000734

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}\;]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Appendix J-2-5
Canal Sediment HQ Calculations (Average Conc.): Prelim Eco AOI-1 (0-4'): American Bald Eagle
Jeanerette Lumber & Shingle Co., L.L.C. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field, Iberia Parish, Louisiana

American Bald Eagle		
Parameter	**Value**	**Symbol**
Body weight (kg)	4.6	BW
Soil ingestion proportion	0	Ps
Food ingestion Rate (kg/kgBW/d)	0.09	FIR
Proportion of diet, mammals	0.068	Pm
Proportion of diet, birds	0.165	Pb
Proportion of diet, fish	0.767	Pf
Spatial factor	0.000016	SF
Temporal factor	0.3	TF
Area use factor	0.0000048	AUF

Calculations based on average values

			Absorbed Fraction (AF)				Absorbed Concentration from Medium and Biota				
COPEC	**Average Canal Sediment Concentration (0-4')**	**TRV**	**Soil bio-factor**	**BCF mammals**	**BCF birds**	**BCF fish**	**Soil/ Sediment**	**Mammals**	**Birds**	**Fish**	**HQ**
Arsenic	11.47	2.24	-	0.0025	0.075	0.00065	-	0.000175	0.0128	0.000515	0.0000000289
Barium	919.7	600	-	0.0566	0.0566	0.028	-	0.319	0.773	1.78	0.000000023
Zinc	95.16	66.1	-	0.7717	0.0645	0.138	-	0.449	0.0911	0.907	0.000000105

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}\;]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Least Shrew			
Parameter	**Value**	**Symbol**	
Body weight (kg)	0.017	BW	
Soil ingestion proportion	0.13	Ps	
Food ingestion Rate (kg/kgBW/d)	0.096	FIR	**Calculations based on average values**
Proportion of diet, soil inverts	1	Pi	
Spatial factor	1	SF	
Temporal factor	0.3	TF	
Area use factor	0.3	AUF	

			Absorbed Fraction (AF)		Absorbed Concentration from Medium and Biota		
COPEC	**Average Canal Sediment Concentration (0-4')**	**TRV**	**Soil bio-factor**	**BCF soil inverts**	**Soil/ Sediment**	**Soil Inverts**	**HQ**
Arsenic	11.47	1.04	0.01	0.224	0.00143	0.247	0.0717
Barium	919.7	5433	0.0002	0.091	0.0023	8.03	0.000444
Zinc	95.16	75.4	0.1	3.201	0.119	29.2	0.117

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a\ x\ P_s\ x\ FIR\ x\ AF_{as}] + [\sum_i^N B_i\ x\ P_i\ x\ FIR\ x\ AF_{ai}\ ]\right)\ x\ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Appendix J-2-7
Canal Sediment HQ Calculations (Average Conc.): Prelim Eco AOI-1 (0-4'): American Mink
Jeanerette Lumber & Shingle Co., L.L.C. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field, Iberia Parish, Louisiana

American Mink		
Parameter	**Value**	**Symbol**
Body weight (kg)	1	BW
Soil ingestion proportion	0.005	Ps
Food ingestion Rate (kg/kgBW/d)	0.137	FIR
Proportion of diet, mammals	0.22	Pm
Proportion of diet, benthic inverts	0.64	Pbi
Proportion of diet, fish	0.14	Pf
Spatial factor	0.0093	SF
Temporal factor	0.3	TF
Area use factor	0.0028	AUF

Calculations based on average values

			Absorbed Fraction (AF)				Absorbed Concentration from Medium and Biota				
COPEC	Average Canal Sediment Concentration (0-4')	TRV	Soil bio-factor	BCF mammals	BCF benthic inverts	BCF fish	Soil/ Sediment	Mammals	Benthic Inverts	Fish	HQ
Arsenic	11.47	1.04	0.01	0.0025	0.127	0.00065	0.0000786	0.000864	0.128	0.000143	0.000346
Barium	919.7	5433	0.0002	0.0566	0.023	0.028	0.000126	1.57	1.85	0.494	0.00000201
Zinc	95.16	75.4	0.1	0.7717	2.33	0.138	0.00652	2.21	19.4	0.252	0.000809

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai} \ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Appendix J-3-1
Canal Sediment HQ Calculations (Maximum Conc.): Prelim Eco AOI-1 (0-4'): American Robin
Jeanerette Lumber & Shingle Co., L.L.C. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field, Iberia Parish, Louisiana

American Robin		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.0773	BW
Soil ingestion proportion	0.02	Ps
Food ingestion Rate (kg/kgBW/d)	0.132	FIR
Proportion of diet, plants	0.41	Pp
Proportion of diet, soil inverts	0.59	Pi
Spatial factor	1	SF
Temporal factor	0.3	TF
Area use factor	0.3	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Maximum Canal Sediment Concentration (0-4')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF soil inverts**	**Soil/ Sediment**	**Plants**	**Soil Inverts**	**HQ**
Arsenic	24.81	2.24	0.01	0.0375	0.224	0.000655	0.0504	0.433	0.0648
Barium	3220	600	0.0002	0.0046	0.091	0.0017	0.802	22.8	0.0118
Zinc	159.1	66.1	0.1	0.366	3.201	0.042	3.15	39.7	0.195

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a\ x\ P_s\ x\ FIR\ x\ AF_{as}] + [\sum_i^N B_i\ x\ P_i\ x\ FIR\ x\ AF_{ai}\ ]\right)\ x\ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Spotted Sandpiper		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.0425	BW
Soil ingestion proportion	0.17	Ps
Food ingestion Rate (kg/kgBW/d)	0.196	FIR
Proportion of diet, benthic inverts	1	Pbi
Spatial factor	0.25	SF
Temporal factor	0.3	TF
Area use factor	0.075	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)		Absorbed Concentration from Medium and Biota		
COPEC	**Maximum Canal Sediment Concentration (0-4')**	**TRV**	**Soil bio-factor**	**BCF benthic inverts**	**Soil/ Sediment**	**Benthic Inverts**	**HQ**
Arsenic	24.81	2.24	0.01	0.127	0.00827	0.618	0.021
Barium	3220	600	0.0002	0.023	0.0215	14.5	0.00182
Zinc	159.1	66.1	0.1	2.33	0.53	72.7	0.0831

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Mallard Duck		
Parameter	**Value**	**Symbol**
Body weight (kg)	1.134	BW
Soil ingestion proportion	0.033	Ps
Food ingestion Rate (kg/kgBW/d)	0.05	FIR
Proportion of diet, plants	0.5	Pp
Proportion of diet, benthic inverts	0.5	Pbi
Spatial factor	0.0049	SF
Temporal factor	0.3	TF
Area use factor	0.0015	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Maximum Canal Sediment Concentration (0-4')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF benthic inverts**	**Soil/ Sediment**	**Plants**	**Benthic Inverts**	**HQ**
Arsenic	24.81	2.24	0.01	0.0375	0.127	0.000409	0.0233	0.0788	0.0000673
Barium	3220	600	0.0002	0.0046	0.023	0.00106	0.37	1.85	0.00000544
Zinc	159.1	66.1	0.1	0.366	2.33	0.0263	1.46	9.27	0.000239

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai} \ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Snowy Egret		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.371	BW
Soil ingestion proportion	0.005	Ps
Food ingestion Rate (kg/kgBW/d)	0.116	FIR
Proportion of diet, benthic inverts	0.1	Pbi
Proportion of diet, fish	0.9	Pf
Spatial factor	0.0041	SF
Temporal factor	0.3	TF
Area use factor	0.0012	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	Maximum Canal Sediment Concentration (0-4')	TRV	Soil bio-factor	BCF benthic inverts	BCF fish	Soil/ Sediment	Benthic Inverts	Fish	HQ
Arsenic	24.81	2.24	0.01	0.127	0.00065	0.000144	0.0366	0.00168	0.0000211
Barium	3220	600	0.0002	0.023	0.028	0.000374	0.859	9.41	0.0000211
Zinc	159.1	66.1	0.1	2.33	0.138	0.00923	4.3	2.29	0.000123

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}\;]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Appendix J-3-5
Canal Sediment HQ Calculations (Maximum Conc.): Prelim Eco AOI-1 (0-4'): American Bald Eagle
Jeanerette Lumber & Shingle Co., L.L.C. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field, Iberia Parish, Louisiana

American Bald Eagle		
Parameter	**Value**	**Symbol**
Body weight (kg)	4.6	BW
Soil ingestion proportion	0	Ps
Food ingestion Rate (kg/kgBW/d)	0.09	FIR
Proportion of diet, mammals	0.068	Pm
Proportion of diet, birds	0.165	Pb
Proportion of diet, fish	0.767	Pf
Spatial factor	0.000016	SF
Temporal factor	0.3	TF
Area use factor	0.0000048	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)				Absorbed Concentration from Medium and Biota				
COPEC	**Maximum Canal Sediment Concentration (0-4')**	**TRV**	**Soil bio-factor**	**BCF mammals**	**BCF birds**	**BCF fish**	**Soil/ Sediment**	**Mammals**	**Birds**	**Fish**	**HQ**
Arsenic	24.81	2.24	-	0.0025	0.075	0.00065	-	0.00038	0.0276	0.00111	0.0000000623
Barium	3220	600	-	0.0566	0.0566	0.028	-	1.12	2.71	6.22	8.04E-08
Zinc	159.1	66.1	-	0.7717	0.0645	0.138	-	0.751	0.152	1.52	0.000000176

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}\ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Appendix J-3-6
Canal Sediment HQ Calculations (Maximum Conc.): Prelim Eco AOI-1 (0-4'): Least Shrew
Jeanerette Lumber & Shingle Co., L.L.C. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field, Iberia Parish, Louisiana

Least Shrew		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.017	BW
Soil ingestion proportion	0.13	Ps
Food ingestion Rate (kg/kgBW/d)	0.096	FIR
Proportion of diet, soil inverts	1	Pi
Spatial factor	1	SF
Temporal factor	0.3	TF
Area use factor	0.3	AUF

Calculations based on maximum values

COPEC	Maximum Canal Sediment Concentration (0-4')	TRV	Absorbed Fraction (AF): Soil bio-factor	Absorbed Fraction (AF): BCF soil inverts	Absorbed Concentration from Medium and Biota: Soil/ Sediment	Absorbed Concentration from Medium and Biota: Soil Inverts	HQ
Arsenic	24.81	1.04	0.01	0.224	0.0031	0.534	0.155
Barium	3220	5433	0.0002	0.091	0.00804	28.1	0.00155
Zinc	159.1	75.4	0.1	3.201	0.199	48.9	0.195

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}\ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Appendix J-3-7
Canal Sediment HQ Calculations (Maximum Conc.): Prelim Eco AOI-1 (0-4'): American Mink
Jeanerette Lumber & Shingle Co., L.L.C. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field, Iberia Parish, Louisiana

American Mink		
Parameter	**Value**	**Symbol**
Body weight (kg)	1	BW
Soil ingestion proportion	0.005	Ps
Food ingestion Rate (kg/kgBW/d)	0.137	FIR
Proportion of diet, mammals	0.22	Pm
Proportion of diet, benthic inverts	0.64	Pbi
Proportion of diet, fish	0.14	Pf
Spatial factor	0.0093	SF
Temporal factor	0.3	TF
Area use factor	0.0028	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)				Absorbed Concentration from Medium and Biota				
COPEC	Maximum Canal Sediment Concentration (0-4')	TRV	Soil bio-factor	BCF mammals	BCF benthic inverts	BCF fish	Soil/ Sediment	Mammals	Benthic Inverts	Fish	HQ
Arsenic	24.81	1.04	0.01	0.0025	0.127	0.00065	0.00017	0.00187	0.276	0.000309	0.000747
Barium	3220	5433	0.0002	0.0566	0.023	0.028	0.000441	5.49	6.49	1.73	0.00000704
Zinc	159.1	75.4	0.1	0.7717	2.33	0.138	0.0109	3.7	32.5	0.421	0.00136

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Appendix J-4-1
Canal Sediment HQ Calculations (95% UCL Conc.): Prelim Eco AOI-2 (0-4'): American Robin
Jeanerette Lumber & Shingle Co., L.L.C. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field, Iberia Parish, Louisiana

American Robin		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.0773	BW
Soil ingestion proportion	0.02	Ps
Food ingestion Rate (kg/kgBW/d)	0.132	FIR
Proportion of diet, plants	0.41	Pp
Proportion of diet, soil inverts	0.59	Pi
Spatial factor	0.82	SF
Temporal factor	0.3	TF
Area use factor	0.25	AUF

Calculations based on 95% UCL values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**95% UCL Canal Sediment Concentration (0-4')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF soil inverts**	**Soil/ Sediment**	**Plants**	**Soil Inverts**	**HQ**
Arsenic	NA	2.24	0.01	0.0375	0.224	NA	NA	NA	NA
Barium	847.4	600	0.0002	0.0046	0.091	0.000447	0.211	6.01	0.00255
Zinc	NA	66.1	0.1	0.366	3.201	NA	NA	NA	NA

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai} \ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Appendix J-4-2
Canal Sediment HQ Calculations (95% UCL Conc.): Prelim Eco AOI-2 (0-4'): Spotted Sandpiper
Jeanerette Lumber & Shingle Co., L.L.C. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field, Iberia Parish, Louisiana

Spotted Sandpiper			
Parameter	**Value**	**Symbol**	
Body weight (kg)	0.0425	BW	
Soil ingestion proportion	0.17	Ps	
Food ingestion Rate (kg/kgBW/d)	0.196	FIR	**Calculations based on 95% UCL values**
Proportion of diet, benthic inverts	1	Pbi	
Spatial factor	0.063	SF	
Temporal factor	0.3	TF	
Area use factor	0.019	AUF	

			Absorbed Fraction (AF)		Absorbed Concentration from Medium and Biota		
COPEC	**95% UCL Canal Sediment Concentration (0-4')**	**TRV**	**Soil bio-factor**	**BCF benthic inverts**	**Soil/ Sediment**	**Benthic Inverts**	**HQ**
Arsenic	NA	2.24	0.01	0.127	NA	NA	NA
Barium	847.4	600	0.0002	0.023	0.00565	3.82	0.000121
Zinc	NA	66.1	0.1	2.33	NA	NA	NA

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Appendix J-4-3
Canal Sediment HQ Calculations (95% UCL Conc.): Prelim Eco AOI-2 (0-4'): Mallard Duck
Jeanerette Lumber & Shingle Co., L.L.C. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field, Iberia Parish, Louisiana

Mallard Duck		
Parameter	**Value**	**Symbol**
Body weight (kg)	1.134	BW
Soil ingestion proportion	0.033	Ps
Food ingestion Rate (kg/kgBW/d)	0.05	FIR
Proportion of diet, plants	0.5	Pp
Proportion of diet, benthic inverts	0.5	Pbi
Spatial factor	0.0012	SF
Temporal factor	0.3	TF
Area use factor	0.00036	AUF

Calculations based on 95% UCL values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**95% UCL Canal Sediment Concentration (0-4')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF benthic inverts**	**Soil/ Sediment**	**Plants**	**Benthic Inverts**	**HQ**
Arsenic	NA	2.24	0.01	0.0375	0.127	NA	NA	NA	NA
Barium	847.4	600	0.0002	0.0046	0.023	0.00028	0.0975	0.487	0.000000351
Zinc	NA	66.1	0.1	0.366	2.33	NA	NA	NA	NA

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Appendix J-4-4
Canal Sediment HQ Calculations (95% UCL Conc.): Prelim Eco AOI-2 (0-4'): Snowy Egret
Jeanerette Lumber & Shingle Co., L.L.C. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field, Iberia Parish, Louisiana

Snowy Egret		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.371	BW
Soil ingestion proportion	0.005	Ps
Food ingestion Rate (kg/kgBW/d)	0.116	FIR
Proportion of diet, benthic inverts	0.1	Pbi
Proportion of diet, fish	0.9	Pf
Spatial factor	0.001	SF
Temporal factor	0.3	TF
Area use factor	0.0003	AUF

Calculations based on 95% UCL values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**95% UCL Canal Sediment Concentration (0-4')**	**TRV**	**Soil bio-factor**	**BCF benthic inverts**	**BCF fish**	**Soil/ Sediment**	**Benthic Inverts**	**Fish**	**HQ**
Arsenic	NA	2.24	0.01	0.127	0.00065	NA	NA	NA	NA
Barium	847.4	600	0.0002	0.023	0.028	0.0000983	0.226	2.48	0.00000135
Zinc	NA	66.1	0.1	2.33	0.138	NA	NA	NA	NA

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai} \ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Appendix J-4-5
Canal Sediment HQ Calculations (95% UCL Conc.): Prelim Eco AOI-2 (0-4'): American Bald Eagle
Jeanerette Lumber & Shingle Co., L.L.C. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field, Iberia Parish, Louisiana

American Bald Eagle		
Parameter	**Value**	**Symbol**
Body weight (kg)	4.6	BW
Soil ingestion proportion	0	Ps
Food ingestion Rate (kg/kgBW/d)	0.09	FIR
Proportion of diet, mammals	0.068	Pm
Proportion of diet, birds	0.165	Pb
Proportion of diet, fish	0.767	Pf
Spatial factor	0.000004	SF
Temporal factor	0.3	TF
Area use factor	0.0000012	AUF

Calculations based on 95% UCL values

			Absorbed Fraction (AF)				Absorbed Concentration from Medium and Biota				
COPEC	**95% UCL Canal Sediment Concentration (0-4')**	**TRV**	**Soil bio-factor**	**BCF mammals**	**BCF birds**	**BCF fish**	**Soil/ Sediment**	**Mammals**	**Birds**	**Fish**	**HQ**
Arsenic	NA	2.24	-	0.0025	0.075	0.00065	-	NA	NA	NA	NA
Barium	847.4	600	-	0.0566	0.0566	0.028	-	0.294	0.712	1.64	5.29E-09
Zinc	NA	66.1	-	0.7717	0.0645	0.138	-	NA	NA	NA	NA

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}\;]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Appendix J-4-6
Canal Sediment HQ Calculations (95% UCL Conc.): Prelim Eco AOI-2 (0-4'): Least Shrew
Jeanerette Lumber & Shingle Co., L.L.C. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field, Iberia Parish, Louisiana

Least Shrew		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.017	BW
Soil ingestion proportion	0.13	Ps
Food ingestion Rate (kg/kgBW/d)	0.096	FIR
Proportion of diet, soil inverts	1	Pi
Spatial factor	0.51	SF
Temporal factor	0.3	TF
Area use factor	0.15	AUF

Calculations based on 95% UCL values

			Absorbed Fraction (AF)		Absorbed Concentration from Medium and Biota		
COPEC	**95% UCL Canal Sediment Concentration (0-4')**	**TRV**	**Soil bio-factor**	**BCF soil inverts**	**Soil/ Sediment**	**Soil Inverts**	**HQ**
Arsenic	NA	1.04	0.01	0.224	NA	NA	NA
Barium	847.4	5433	0.0002	0.091	0.00212	7.4	0.000208
Zinc	NA	75.4	0.1	3.201	NA	NA	NA

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}\ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Appendix J-4-7
Canal Sediment HQ Calculations (95% UCL Conc.): Prelim Eco AOI-2 (0-4'): American Mink
Jeanerette Lumber & Shingle Co., L.L.C. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field, Iberia Parish, Louisiana

American Mink		
Parameter	**Value**	**Symbol**
Body weight (kg)	1	BW
Soil ingestion proportion	0.005	Ps
Food ingestion Rate (kg/kgBW/d)	0.137	FIR
Proportion of diet, mammals	0.22	Pm
Proportion of diet, benthic inverts	0.64	Pbi
Proportion of diet, fish	0.14	Pf
Spatial factor	0.0023	SF
Temporal factor	0.3	TF
Area use factor	0.00069	AUF

Calculations based on 95% UCL values

			Absorbed Fraction (AF)				Absorbed Concentration from Medium and Biota				
COPEC	95% UCL Canal Sediment Concentration (0-4')	TRV	Soil bio-factor	BCF mammals	BCF benthic inverts	BCF fish	Soil/ Sediment	Mammals	Benthic Inverts	Fish	HQ
Arsenic	NA	1.04	0.01	0.0025	0.127	0.00065	NA	NA	NA	NA	NA
Barium	847.4	5433	0.0002	0.0566	0.023	0.028	0.000116	1.45	1.71	0.455	0.000000459
Zinc	NA	75.4	0.1	0.7717	2.33	0.138	NA	NA	NA	NA	NA

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai} \ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

American Robin		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.0773	BW
Soil ingestion proportion	0.02	Ps
Food ingestion Rate (kg/kgBW/d)	0.132	FIR
Proportion of diet, plants	0.41	Pp
Proportion of diet, soil inverts	0.59	Pi
Spatial factor	0.82	SF
Temporal factor	0.3	TF
Area use factor	0.25	AUF

Calculations based on average values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	Average Canal Sediment Concentration (0-4')	TRV	Soil bio-factor	BCF plants	BCF soil inverts	Soil/ Sediment	Plants	Soil Inverts	HQ
Arsenic	7.16	2.24	0.01	0.0375	0.224	0.000189	0.0145	0.125	0.0153
Barium	629.9	600	0.0002	0.0046	0.091	0.000333	0.157	4.46	0.00189
Zinc	100.5	66.1	0.1	0.366	3.201	0.0265	1.99	25.1	0.101

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a\ x\ P_s\ x\ FIR\ x\ AF_{as}] + [\sum_i^N B_i\ x\ P_i\ x\ FIR\ x\ AF_{ai}]\right)\ x\ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Appendix J-5-2
Canal Sediment HQ Calculations (Average Conc.): Prelim Eco AOI-2 (0-4'): Spotted Sandpiper
Jeanerette Lumber & Shingle Co., L.L.C. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field, Iberia Parish, Louisiana

Spotted Sandpiper		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.0425	BW
Soil ingestion proportion	0.17	Ps
Food ingestion Rate (kg/kgBW/d)	0.196	FIR
Proportion of diet, benthic inverts	1	Pbi
Spatial factor	0.063	SF
Temporal factor	0.3	TF
Area use factor	0.019	AUF

Calculations based on average values

			Absorbed Fraction (AF)		Absorbed Concentration from Medium and Biota		
COPEC	**Average Canal Sediment Concentration (0-4')**	**TRV**	**Soil bio-factor**	**BCF benthic inverts**	**Soil/ Sediment**	**Benthic Inverts**	**HQ**
Arsenic	7.16	2.24	0.01	0.127	0.00239	0.178	0.00152
Barium	629.9	600	0.0002	0.023	0.0042	2.84	0.0000896
Zinc	100.5	66.1	0.1	2.33	0.335	45.9	0.0132

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}\ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Appendix J-5-3
Canal Sediment HQ Calculations (Average Conc.): Prelim Eco AOI-2 (0-4'): Mallard Duck
Jeanerette Lumber & Shingle Co., L.L.C. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field, Iberia Parish, Louisiana

Mallard Duck		
Parameter	**Value**	**Symbol**
Body weight (kg)	1.134	BW
Soil ingestion proportion	0.033	Ps
Food ingestion Rate (kg/kgBW/d)	0.05	FIR
Proportion of diet, plants	0.5	Pp
Proportion of diet, benthic inverts	0.5	Pbi
Spatial factor	0.0012	SF
Temporal factor	0.3	TF
Area use factor	0.00036	AUF

Calculations based on average values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	Average Canal Sediment Concentration (0-4')	TRV	Soil bio-factor	BCF plants	BCF benthic inverts	Soil/ Sediment	Plants	Benthic Inverts	HQ
Arsenic	7.16	2.24	0.01	0.0375	0.127	0.000118	0.00671	0.0227	0.00000475
Barium	629.9	600	0.0002	0.0046	0.023	0.000208	0.0724	0.362	0.000000261
Zinc	100.5	66.1	0.1	0.366	2.33	0.0166	0.92	5.85	0.000037

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}\;]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Snowy Egret		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.371	BW
Soil ingestion proportion	0.005	Ps
Food ingestion Rate (kg/kgBW/d)	0.116	FIR
Proportion of diet, benthic inverts	0.1	Pbi
Proportion of diet, fish	0.9	Pf
Spatial factor	0.001	SF
Temporal factor	0.3	TF
Area use factor	0.0003	AUF

Calculations based on average values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	Average Canal Sediment Concentration (0-4')	TRV	Soil bio-factor	BCF benthic inverts	BCF fish	Soil/ Sediment	Benthic Inverts	Fish	HQ
Arsenic	7.16	2.24	0.01	0.127	0.00065	0.0000415	0.0105	0.000486	0.00000148
Barium	629.9	600	0.0002	0.023	0.028	0.0000731	0.168	1.84	0.000001
Zinc	100.5	66.1	0.1	2.33	0.138	0.00583	2.72	1.45	0.000019

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}\;]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Appendix J-5-5
Canal Sediment HQ Calculations (Average Conc.): Prelim Eco AOI-2 (0-4'): American Bald Eagle
Jeanerette Lumber & Shingle Co., L.L.C. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field, Iberia Parish, Louisiana

American Bald Eagle		
Parameter	**Value**	**Symbol**
Body weight (kg)	4.6	BW
Soil ingestion proportion	0	Ps
Food ingestion Rate (kg/kgBW/d)	0.09	FIR
Proportion of diet, mammals	0.068	Pm
Proportion of diet, birds	0.165	Pb
Proportion of diet, fish	0.767	Pf
Spatial factor	0.000004	SF
Temporal factor	0.3	TF
Area use factor	0.0000012	AUF

Calculations based on average values

			Absorbed Fraction (AF)				Absorbed Concentration from Medium and Biota				
COPEC	Average Canal Sediment Concentration (0-4')	TRV	Soil bio-factor	BCF mammals	BCF birds	BCF fish	Soil/ Sediment	Mammals	Birds	Fish	HQ
Arsenic	7.16	2.24	-	0.0025	0.075	0.00065	-	0.00011	0.00797	0.000321	0.0000000045
Barium	629.9	600	-	0.0566	0.0566	0.028	-	0.218	0.529	1.22	3.93E-09
Zinc	100.5	66.1	-	0.7717	0.0645	0.138	-	0.475	0.0963	0.957	2.77E-08

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a\ x\ P_s\ x\ FIR\ x\ AF_{as}] + [\sum_i^N B_i\ x\ P_i\ x\ FIR\ x\ AF_{ai}]\right)\ x\ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Least Shrew		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.017	BW
Soil ingestion proportion	0.13	Ps
Food ingestion Rate (kg/kgBW/d)	0.096	FIR
Proportion of diet, soil inverts	1	Pi
Spatial factor	0.51	SF
Temporal factor	0.3	TF
Area use factor	0.15	AUF

Calculations based on average values

			Absorbed Fraction (AF)		Absorbed Concentration from Medium and Biota		
COPEC	Average Canal Sediment Concentration (0-4')	TRV	Soil bio-factor	BCF soil inverts	Soil/ Sediment	Soil Inverts	HQ
Arsenic	7.16	1.04	0.01	0.224	0.000894	0.154	0.0228
Barium	629.9	5433	0.0002	0.091	0.00157	5.5	0.000155
Zinc	100.5	75.4	0.1	3.201	0.125	30.9	0.063

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai} \;]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Appendix J-5-7
Canal Sediment HQ Calculations (Average Conc.): Prelim Eco AOI-2 (0-4'): American Mink
Jeanerette Lumber & Shingle Co., L.L.C. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field, Iberia Parish, Louisiana

American Mink		
Parameter	**Value**	**Symbol**
Body weight (kg)	1	BW
Soil ingestion proportion	0.005	Ps
Food ingestion Rate (kg/kgBW/d)	0.137	FIR
Proportion of diet, mammals	0.22	Pm
Proportion of diet, benthic inverts	0.64	Pbi
Proportion of diet, fish	0.14	Pf
Spatial factor	0.0023	SF
Temporal factor	0.3	TF
Area use factor	0.00069	AUF

Calculations based on average values

			Absorbed Fraction (AF)				Absorbed Concentration from Medium and Biota				
COPEC	Average Canal Sediment Concentration (0-4')	TRV	Soil bio-factor	BCF mammals	BCF benthic inverts	BCF fish	Soil/ Sediment	Mammals	Benthic Inverts	Fish	HQ
Arsenic	7.16	1.04	0.01	0.0025	0.127	0.00065	0.000049	0.00054	0.0797	0.0000893	0.0000533
Barium	629.9	5433	0.0002	0.0566	0.023	0.028	0.0000863	1.07	1.27	0.338	0.00000034
Zinc	100.5	75.4	0.1	0.7717	2.33	0.138	0.00688	2.34	20.5	0.266	0.000212

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}\;]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Appendix J-6-1
Canal Sediment HQ Calculations (Maximum Conc.): Prelim Eco AOI-2 (0-4'): American Robin
Jeanerette Lumber & Shingle Co., L.L.C. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field, Iberia Parish, Louisiana

American Robin		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.0773	BW
Soil ingestion proportion	0.02	Ps
Food ingestion Rate (kg/kgBW/d)	0.132	FIR
Proportion of diet, plants	0.41	Pp
Proportion of diet, soil inverts	0.59	Pi
Spatial factor	0.82	SF
Temporal factor	0.3	TF
Area use factor	0.25	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	Maximum Canal Sediment Concentration (0-4')	TRV	Soil bio-factor	BCF plants	BCF soil inverts	Soil/ Sediment	Plants	Soil Inverts	HQ
Arsenic	11.1	2.24	0.01	0.0375	0.224	0.000293	0.0225	0.194	0.0238
Barium	1270	600	0.0002	0.0046	0.091	0.000671	0.316	9	0.00382
Zinc	107	66.1	0.1	0.366	3.201	0.0282	2.12	26.7	0.107

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Appendix J-6-2
Canal Sediment HQ Calculations (Maximum Conc.): Prelim Eco AOI-2 (0-4'): Spotted Sandpiper
Jeanerette Lumber & Shingle Co., L.L.C. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field, Iberia Parish, Louisiana

Spotted Sandpiper			
Parameter	**Value**	**Symbol**	
Body weight (kg)	0.0425	BW	
Soil ingestion proportion	0.17	Ps	
Food ingestion Rate (kg/kgBW/d)	0.196	FIR	**Calculations based on maximum values**
Proportion of diet, benthic inverts	1	Pbi	
Spatial factor	0.063	SF	
Temporal factor	0.3	TF	
Area use factor	0.019	AUF	

			Absorbed Fraction (AF)		**Absorbed Concentration from Medium and Biota**		
COPEC	**Maximum Canal Sediment Concentration (0-4')**	**TRV**	**Soil bio-factor**	**BCF benthic inverts**	**Soil/ Sediment**	**Benthic Inverts**	**HQ**
Arsenic	11.1	2.24	0.01	0.127	0.0037	0.276	0.00236
Barium	1270	600	0.0002	0.023	0.00846	5.73	0.000181
Zinc	107	66.1	0.1	2.33	0.357	48.9	0.0141

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai}]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Mallard Duck		
Parameter	**Value**	**Symbol**
Body weight (kg)	1.134	BW
Soil ingestion proportion	0.033	Ps
Food ingestion Rate (kg/kgBW/d)	0.05	FIR
Proportion of diet, plants	0.5	Pp
Proportion of diet, benthic inverts	0.5	Pbi
Spatial factor	0.0012	SF
Temporal factor	0.3	TF
Area use factor	0.00036	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Maximum Canal Sediment Concentration (0-4')**	**TRV**	**Soil bio-factor**	**BCF plants**	**BCF benthic inverts**	**Soil/ Sediment**	**Plants**	**Benthic Inverts**	**HQ**
Arsenic	11.1	2.24	0.01	0.0375	0.127	0.000183	0.0104	0.0352	0.00000736
Barium	1270	600	0.0002	0.0046	0.023	0.000419	0.146	0.73	0.000000526
Zinc	107	66.1	0.1	0.366	2.33	0.0177	0.979	6.23	0.0000394

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Appendix J-6-4
Canal Sediment HQ Calculations (Maximum Conc.): Prelim Eco AOI-2 (0-4'): Snowy Egret
Jeanerette Lumber & Shingle Co., L.L.C. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field, Iberia Parish, Louisiana

Snowy Egret		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.371	BW
Soil ingestion proportion	0.005	Ps
Food ingestion Rate (kg/kgBW/d)	0.116	FIR
Proportion of diet, benthic inverts	0.1	Pbi
Proportion of diet, fish	0.9	Pf
Spatial factor	0.001	SF
Temporal factor	0.3	TF
Area use factor	0.0003	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)			Absorbed Concentration from Medium and Biota			
COPEC	**Maximum Canal Sediment Concentration (0-4')**	**TRV**	**Soil bio-factor**	**BCF benthic inverts**	**BCF fish**	**Soil/ Sediment**	**Benthic Inverts**	**Fish**	**HQ**
Arsenic	11.1	2.24	0.01	0.127	0.00065	0.0000644	0.0164	0.000753	0.00000231
Barium	1270	600	0.0002	0.023	0.028	0.000147	0.339	3.71	0.00000202
Zinc	107	66.1	0.1	2.33	0.138	0.00621	2.89	1.54	0.0000201

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}\;]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Appendix J-6-5
Canal Sediment HQ Calculations (Maximum Conc.): Prelim Eco AOI-2 (0-4'): American Bald Eagle
Jeanerette Lumber & Shingle Co., L.L.C. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field, Iberia Parish, Louisiana

American Bald Eagle		
Parameter	**Value**	**Symbol**
Body weight (kg)	4.6	BW
Soil ingestion proportion	0	Ps
Food ingestion Rate (kg/kgBW/d)	0.09	FIR
Proportion of diet, mammals	0.068	Pm
Proportion of diet, birds	0.165	Pb
Proportion of diet, fish	0.767	Pf
Spatial factor	0.000004	SF
Temporal factor	0.3	TF
Area use factor	0.0000012	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)				Absorbed Concentration from Medium and Biota				
COPEC	**Maximum Canal Sediment Concentration (0-4')**	**TRV**	**Soil bio-factor**	**BCF mammals**	**BCF birds**	**BCF fish**	**Soil/ Sediment**	**Mammals**	**Birds**	**Fish**	**HQ**
Arsenic	11.1	2.24	-	0.0025	0.075	0.00065	-	0.00017	0.0124	0.000498	0.0000000070
Barium	1270	600	-	0.0566	0.0566	0.028	-	0.44	1.07	2.45	7.92E-09
Zinc	107	66.1	-	0.7717	0.0645	0.138	-	0.505	0.102	1.02	2.95E-08

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \ x \ P_s \ x \ FIR \ x \ AF_{as}] + [\sum_i^N B_i \ x \ P_i \ x \ FIR \ x \ AF_{ai} \ ]\right) x \ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Least Shrew		
Parameter	**Value**	**Symbol**
Body weight (kg)	0.017	BW
Soil ingestion proportion	0.13	Ps
Food ingestion Rate (kg/kgBW/d)	0.096	FIR
Proportion of diet, soil inverts	1	Pi
Spatial factor	0.51	SF
Temporal factor	0.3	TF
Area use factor	0.15	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)		Absorbed Concentration from Medium and Biota		
COPEC	**Maximum Canal Sediment Concentration (0-4')**	**TRV**	**Soil bio-factor**	**BCF soil inverts**	**Soil/ Sediment**	**Soil Inverts**	**HQ**
Arsenic	11.1	1.04	0.01	0.224	0.00139	0.239	0.0354
Barium	1270	5433	0.0002	0.091	0.00317	11.1	0.000313
Zinc	107	75.4	0.1	3.201	0.134	32.9	0.067

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a\ x\ P_s\ x\ FIR\ x\ AF_{as}] + [\sum_i^N B_i\ x\ P_i\ x\ FIR\ x\ AF_{ai}\ ]\right)\ x\ AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

Appendix J-6-7
Canal Sediment HQ Calculations (Maximum Conc.): Prelim Eco AOI-2 (0-4'): American Mink
Jeanerette Lumber & Shingle Co., L.L.C. v. ConocoPhillips Company, et al.
Bayou Pigeon Oil & Gas Field, Iberia Parish, Louisiana

American Mink		
Parameter	**Value**	**Symbol**
Body weight (kg)	1	BW
Soil ingestion proportion	0.005	Ps
Food ingestion Rate (kg/kgBW/d)	0.137	FIR
Proportion of diet, mammals	0.22	Pm
Proportion of diet, benthic inverts	0.64	Pbi
Proportion of diet, fish	0.14	Pf
Spatial factor	0.0023	SF
Temporal factor	0.3	TF
Area use factor	0.00069	AUF

Calculations based on maximum values

			Absorbed Fraction (AF)				Absorbed Concentration from Medium and Biota				
COPEC	Maximum Canal Sediment Concentration (0-4')	TRV	Soil bio-factor	BCF mammals	BCF benthic inverts	BCF fish	Soil/ Sediment	Mammals	Benthic Inverts	Fish	HQ
Arsenic	11.1	1.04	0.01	0.0025	0.127	0.00065	0.000076	0.000836	0.124	0.000138	0.000083
Barium	1270	5433	0.0002	0.0566	0.023	0.028	0.000174	2.17	2.56	0.682	0.000000687
Zinc	107	75.4	0.1	0.7717	2.33	0.138	0.00733	2.49	21.9	0.283	0.000226

Notes:
Canal sediment concentrations are in mg/kg dry weight.

$$\frac{\left([Soil_a \; x \; P_s \; x \; FIR \; x \; AF_{as}] + [\sum_i^N B_i \; x \; P_i \; x \; FIR \; x \; AF_{ai}\;]\right) x \; AUF}{TRV} = HQ$$

Where:

HQ_a = Hazard Quotient for analyte a (COPEC a) (unitless)
$Soil_a$ = Concentration of analyte a (COPEC a) in soil (mg/kg dry weight)
N = Number of different biota types in diet (food types)
B_i = Analyte a (COPEC a) in biota type (i) (mg/kg dry weight)
P_i = Proportion of biota type (i) in diet
FIR = Food ingestion rate (kg food [dry weight]/kg BW [wet weight]/day); BW = body weight
AF_{ai} = Absorbed fraction of analyte a (COPEC a) from biota type (i)
AF_{as} = Absorbed fraction of analyte a (COPEC a) from soil (s)
TRV_a = The estimated no adverse effect dose (mg/kg BW/day) for the surrogate species
P_s = Soil ingestion as a proportion of diet
AUF = Area use factor ([spatial factor, SF] x [temporal factor, TF])

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