Exhibit R Wetland and Waterbody Delineation Report

Cardno

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Wetland and Waterbody Delineation Report

Yellow Wood Solar Energy Project

January 2021





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Project Name	Yellow Wood Solar Energy Project
Project Number	E320201702
Project Manager	Ryan Rupprecht
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Prepared for: Yellow Wood Solar Energy LLC A Subsidiary of:

Invenergy

Invenergy One South Wacker Drive, Suite 1800, Chicago, IL 60606

Prepared by:



Cardno 121 Continental Drive, Suite 308, Newark, DE 19713

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Acronyms

CWA	Clean Water Act
DOW	Division of Wildlife
EWH	Possible Exceptional Warm Water Habitat
FAC	Facultative Plants
FACU	Facultative Upland Plants
FACW	Facultative Wetland Plants
FLS	federally listed species
GIS	Geographic Information Systems
GPS	Global Positioning System
HDD	horizontal directional drill
HHEI	Headwater Habitat Evaluation Index
HUC	Hydrologic Unit Code
JD	Jurisdictional Determination
LRW	Limited Resource Water
MWH	Modified Warm Water Habitat
NHD	National Hydrography Dataset
NLCD	National Land Cover Database
NRCS	National Resource Conservation Service
NWI	National Wetlands Inventory
OBL	Obligate Wetland Plants

ODNR	Ohio Department of Natural Resources
OEPA	Ohio Environmental Protection Agency
OHWM	Ordinary High Water Mark
ORAM	Ohio Rapid Assessment Method
ORC	Ohio Revised Code
OWI	Ohio Wetland Inventory
PFO	palustrine forested
PEM	palustrine emergent
PSS	palustrine scrub shrub
Project	Yellow Wood Solar Energy
QHEI	Qualitative Habitat Evaluation Index
RTE	rare, threatened, or endangered
SBAS	Satellite-based Augmentation System
UPL	Obligate Upland Plants
USACE	United State Army Corps of Engineers
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WQC	Water Quality Certifications
WOTUS	Waters of the United States
WWH	Warm Water Habitat

1 Introduction

Yellow Wood Solar Energy LLC, an affiliate of Invenergy, is proposing to construct the Yellow Wood Solar Energy Project (Project) near Lynchburg, Ohio, and located approximately 38 miles east of Cincinnati, Ohio. The Project has a proposed generating capacity of up to 300 megawatt (MW) and is sited on approximately 3,273 acres (5.11 square miles) on leased private lands and easements (Project Area). The Project Area is located within Clark and Jefferson Townships, Clinton County, Ohio.

In support of planning for the Project, Cardno conducted a wetland delineation field survey to identify wetland or potential waterbodies of the United States, in accordance with Sections 401/404 of the Clean Water Act (CWA). Cardno's field efforts focused on accessible parcels across a broad area, totaling approximately 3,178 acres on 90 leased parcels (Survey Area). Approximately 81.7 acres of woodlots were intentionally omitted from the Survey Area, as general Project siting aims to avoid these woodlots. Approximately 12.5 acres of easement parcels were not acquired at the time of survey, and will be incorporated into future subsequent surveys. This report will be updated to reflects any future surveys. Figure 1.1 – Project Overview, shows the general location of the Project and the areas surveyed.

The Project will consist of photovoltaic panels (solar arrays), along with access roads, electrical collection lines, laydown areas, and supporting infrastructure.

This report describes the methodology used by Cardno to complete the desktop assessment of the Project Area, and results of the field survey within the Survey Area. Specifically, Section 2 of the report identifies the regulatory framework and methodology referenced during survey planning and execution. Section 3 describes the Project specific methodology used during the identification of wetlands and surface waters within the Survey Area. Section 4 of the report outlines the findings of the desktop assessment of the Survey Area. Section 5 of the report identifies the results of the field surveys. Section 6 presents the conclusions of the delineation and site survey. Section 7 provides a list of references cited in this report.

The report is accompanied by several appendices. Appendix A contains maps depicting the delineated wetlands and waterbodies. Appendix B contains representative photographic documentation of the delineated wetland and waterbody features. Appendix C contains the completed wetland data and assessment forms from the field efforts. Appendix D contains the completed stream assessment forms.



Date Created: 12/22/2020ate Revised: 12/22/2026ile Path: S:\GIS\Invenergy\Yellow Wood Solar Project\MXIS\Metalgati Reteart/Maiguages\Figure 1.1 - Project Overview.mxd

2 Regulatory Background

2.1 Regulatory Framework

2.1.1 U.S. Army Corps of Engineers

The USACE has authority over the discharge of fill or dredged material into "waters of the U.S.". This includes authority over any filling, mechanical land clearing, or construction activities that occur within the boundaries of any "waters of the U.S.". A permit must be obtained from the USACE before any of these activities occur. Permits can be divided into two general categories: Individual Permits and Nationwide Permits.

Individual Permits are required for projects that do not fall into one of the specific Nationwide Permits or are deemed to have significant environmental impacts. These permits are more difficult to obtain and receive a higher level of regulatory agency and public scrutiny and may require several months to more than a year for processing.

Nationwide Permits have been developed for projects that meet specific criteria and are deemed to have minimal impact on the aquatic environment. There are currently 52 Nationwide Permits for qualifying activities with 31 Nationwide Permit General Conditions that must be satisfied in order to receive NWP consideration from the USACE. The USACE has thirty days to review the submitted pre-construction notification (PCN) for completion. Assuming the PCN is complete and satisfactory information is submitted with the NWP application to conduct interagency coordination, the USACE has 45 days to issue the NWP verification letter with applicable special conditions. Work may proceed subject to the general, regional and special conditions of the NWP. If (1) NWP verification is not received within 45 days of receipt of a complete PCN, and (2) the NWP being utilized is not NWPs 21, 49 or 50, and (3) the activity does not require a written waiver to exceed specified limits of a NWP; then work may proceed under authority of the NWP.

2.1.1.1 Jurisdictional Determination

While Cardno cannot formally determine the jurisdictional status of a waterbody or wetland, Cardno has identified features it considers potentially jurisdictional. Any determination made by the USACE would be binding however, and may vary from Cardno's interpretation. Our interpretation is made based on available documentation from the U.S. Environmental Protection Agency (USEPA), including guidance on the "Current Implementation of Waters of the United States"¹ (WOTUS) which refers to the original 1986/1988 promulgation and subsequent Supreme Court cases which further defined the term, with the most current being the June 2020 ruling. The 2020 ruling simplified the definition of Waters of the U.S., and jurisdictionality to mean:

- 1. The territorial seas and traditional navigable waters;
- 2. Perennial and intermittent tributaries to those waters;
- 3. Certain lakes, ponds, and impoundments that contribute surface water flow in a typical year to a territorial sea or traditional navigable water; and
- 4. Wetlands adjacent to jurisdictional waters, separated by a natural berm, bank, or natural feature, or by an artificial dike or barrier, so long as the structure allows for a direct hydrological surface connection to waters described in the above sections 1 through 3.

¹ <u>https://www.epa.gov/nwpr/about-waters-united-states</u>

The 2020 ruling also details twelve (12) categories of exclusions (i.e. features not considered "waters of the U.S.")

- 1. All waters or features not defined by the 2020 rule;
- 2. Groundwater, including groundwater drained through subsurface drainage systems;
- 3. Ephemeral features that flow only in direct response to precipitation, including ephemeral streams, swales, gullies, rills, and pools;
- 4. Diffuse stormwater runoff and directional sheet flow over upland;
- 5. Ditches that are not traditional navigable waters, tributaries, or that are not constructed in adjacent wetlands, subject to certain limitations;
- 6. Prior converted cropland;
- 7. Artificially irrigated areas that would revert to upland if artificial irrigation ceases;
- 8. Artificial lakes and ponds that are not jurisdictional impoundments and that are constructed or excavated in upland or non-jurisdictional waters;
- 9. Water-filled depressions constructed or excavated in upland or in non-jurisdictional waters incidental to mining or construction activity, and pits excavated in upland or in non-jurisdictional waters for the purpose of obtaining fill, sand, or gravel;
- 10. Stormwater control features constructed or excavated in upland or in non-jurisdictional waters to convey, treat, infiltrate, or store stormwater run- off;
- 11. Groundwater recharge, water reuse, and wastewater recycling structures constructed or excavated in upland or in non-jurisdictional waters; and
- 12. Waste treatment systems.

2.1.2 Ohio Environmental Protection Agency

The OEPA is responsible for issuing Clean Water Act (CWA) Section 401 permits known as Water Quality Certifications (WQC) for all impacts to "waters of the State of Ohio." This includes authority over any dredging, filling, mechanical land clearing, impoundments or construction activities that occur within the boundaries of any "waters of the State," including those isolated waters not otherwise regulated by the USACE.

The OEPA issues Section 401 WQC in conjunction with the USACE' Section 404 permits. A Section 401 Water Quality Certification must be received before the USACE can issue any Section 404 Department of the Army Permit. The OEPA must issue Individual Section 401 WQC for all Individual Section 404 Permits. OEPA has up to 180 days to review applications for Section 401 WQC.

Water quality certification may be granted, without notification to the OEPA, if the project falls under the NWP limitations described above. In order to qualify for this granted certification, all prior-authorized and *de minimis* Ohio State Certification General Limitations and Conditions as published by the OEPA must be satisfied.

The OEPA also requires notification for all impacts to isolated wetlands and ephemeral streams, which includes a permit application and mitigation plan pursuant to Section 6111 of Ohio Revised Code (ORC).

2.2 Regulatory Methods

2.2.1 <u>Wetland Assessment</u>

Wetland delineations conducted according to the 1987 U.S. Army Corps of Engineers (USACE) *Corps of Engineers Wetlands Delineation Manual* (USACE, 1987) and the applicable regional supplements; *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Midwest Region (Version 2.0)* (USACE, 2010) (collectively, the Manual) require that three wetland criteria be met in order for a wetland to be determined to be present. The area being evaluated must have a dominance of hydrophytic vegetation, hydric soils, and sufficient hydrology to be identified as a wetland.

2.2.1.1 Hydrophytic Vegetation

The hydrophytic vegetation criterion is met when more than 50 percent of the dominant plant community is hydrophytic, as determined by species dominance and the assigned species-specific indicator status of the identified species. Table 2-1 provides the indicator status categories for plants.

Indicator Category	Indicator Symbol	Definition
Obligate Wetland Plants	OBL	Plants that occur almost always (estimated probability > 99 percent) in wetlands under natural conditions, but which may also occur rarely (estimated probability <1 percent) in nonwetlands.
Facultative Wetland Plants	FACW	Plants that occur usually (estimated probability >67 percent to 99 percent) in wetlands, but also occur (estimated probability 1 percent to 33 percent) in nonwetlands.
Facultative Plants	FAC	Plants with a similar likelihood (estimated probability 33 percent to 67 percent) of occurring in both wetlands and nonwetlands.
Facultative Upland Plants	FACU	Plants that occur sometimes (estimated probability 1 percent to <33 percent) in wetlands, but occur more often (estimated probability >67 percent to 99 percent) in nonwetlands.
Obligate Upland Plants	UPL	Plants that occur rarely (estimated probability <1 percent) in wetlands, but occur almost always (estimated probability >99 percent) in nonwetlands under natural conditions.

Table 2-1 Plant Indicator Categories

Under certain circumstances, such as after disturbance from storm events or surveys occurring outside of the prime growing season, additional methods are employed to evaluate the vegetative communities of suspected wetlands. This can include calculating a prevalence index which weights the coverage of a particular class of species (using its wetland indicator status) against the total coverage within the sampling area. If a sampling area passes this test (which requires the value to be less than or equal to 3), it can be considered a wetland. Another potential evaluation method is the presence of morphological adaptations, which can include root buttressing, shallow roots, or multi-stemmed trunks. The presence of such adaptations is considered evidence that the plants (even FACU species) have adapted to survive in prolonged inundation or root saturation. Another method is to report "Problematic Hydrophytic Vegetation." This method is used sparingly, and reflects the delineator's opinion that conditions outside of those considered normal may be present, such as vegetation being bent or damaged to such a degree that identification to species level is impracticable. Under this method, the vegetation present would be treated as consistent with a wetland, but the vegetation could not be reliably identified.

2.2.1.2 Hydric Soils

The hydric soils criterion is determined in the field when the soils fall within the hydric ranges on the Munsell Color Chart, examining soil profiles for other evidence of reducing conditions, and/or observing other indicators of anaerobic activity per the Manual.

2.2.1.3 Hydrology

The hydrology criterion is met when sufficient hydrologic indicators are present. The indicators must be representative of sufficient saturation or inundation occurring over the growing season sufficient to support a hydrophytic plant-dominated vegetative community. Such indicators may include evidence of standing water, saturated soils, geomorphic position within the landscape, drainage patterns, water-stained leaves, and morphologic adaptation of vegetation.

2.2.1.4 Ohio Rapid Assessment Method (ORAM)

After wetlands are identified using USACE criteria, wetlands are then scored using the Ohio EPA (OEPA)'s Ohio Rapid Assessment Method (ORAM). The ORAM wetland functional assessment was developed to determine the ecological "quality" and level of function of a particular wetland in order to meet requirements under Section 401 of the CWA. Wetlands are scored on the basis of hydrology, upland buffer, habitat alteration, special wetland communities, and vegetation communities. Each of these subject areas is further divided into sub-categories under ORAM v5.0 resulting in a score that describes the wetland using a range from 0 (low quality and high disturbance) to 100 (high quality and low disturbance). Wetlands scored from 0 to 29.9 are grouped into "Category 1," 30 to 59.90 are "Category 2" and 60 to 100 are "Category 3." Transitional zones exist between "Categories 1 and 2" from 30 to 34.9 and between "Categories 2 and 3" from 60 to 64.9. However, wetland scores that fall into one of these transitional ranges should be assigned to the higher category unless collected data suggests the wetland should be placed in the lower category.

The ORAM functional assessment describes Category 1 wetlands as those that are often isolated emergent marshes dominated by cattails with little or no upland buffers located in active agricultural fields. Category 2 consists of wetlands for which rare, threatened or endangered (RTE) species and their habitat are absent, but may have well developed habitat for other more common species. Category 2 wetlands constitute the broad middle category of "good" quality wetlands. A "Modified Category 2" wetland appears to have some signs of degradation but also has the potential to restore some of the lost functionality. Category 3 wetlands are typified by high levels of diversity, a high proportion of native species, and/or high functional values. Category 3 wetlands include wetlands that contain or provide habitat for threatened or endangered species, are high quality mature forested wetlands, vernal pools, bogs, fens, or which are scarce regionally and/or statewide.

2.2.2 Waterbody Assessment

Flowing water features (streams and ditches, but not ponds), in order to be classified as a waterbody, must have a defined bed and bank with indications of a channel flow, and are assigned as perennial, intermittent, or ephemeral based on the definitions in Table 2-2. Furthermore, linear waterbodies are assessed using the Headwater Habitat Evaluation Index (HHEI) from the Ohio EPA's *Field Methods for Evaluating Primary Headwater Streams in Ohio* (OEPA 2018). The HHEI allows for uniform scoring of various waterbodies using a standard methodology that identifies pertinent information about the waterbody including substrates, pool depths, and ecological value or condition. HHEI forms typically are completed for waterbodies with a drainage area of less than 1 square mile. Prior to the OEPA Field Methods 2018 update, these Primary Headwater Streams (PHW) were defined as Class I, II or III. A summary of the HHEI Scoring and 2018 definitions is provided in Table 2-3 below.

Linear waterbodies, such as ditches and streams, were surveyed by locating the path (typically the centerline if water depth was shallow, or the top-of-bank if the centerline was not accessible) and

documenting widths (both as Ordinary High Water Mark (OHWM) to OHWM and top-of-bank to top-ofbank) at each survey point. Physical flagging was hung along the waterbody features to identify their general course. Observational notes about the characteristics of each waterbody (such as flow regime and substrate) were recorded by the field team to enable the categorization of the types of waterbodies encountered. To be classified as a waterbody, however, each feature must have a defined bed and bank with indications of a channel flow; grassy swales are not waterbodies, and were not identified as such. Table 2-2 identifies the definitions used in assigning waterbody flow.

Flow Category	Definition
Perennial	Flow is continuous and likely permanent across the seasons (although it may vary). Such flow can be surface based or occur as interstitial flow, which would include the flow driving underground for a portion of the channel.
Intermittent	Flow is present during extended periods of time during some seasons, but gradually returns to a state of isolated pools in the channel or a dry channel. There may be indications of subsurface flow.
Ephemeral	Flow is often not present during the majority of the year, and only occurs after a precipitation event. Channels of ephemeral streams will be dry with no evidence of isolated pools of water.

Table 2-2 Waterbody Flow Categories

Final HHEI Score	Definition
<30	Ephemeral Aquatic Stream (natural channel). Well defined, normally dry channel; little to no aquatic life; no significant habitat for aquatic fauna
<30	Ephemeral Aquatic Stream (modified channel). Normally dry channel, historically channelized; permanent structures and channel modifications that impede or alter free-flowing water
30 - 70	Small Drainage Warm Water Stream (natural channel). Normally intermittent, but some may have perennial flow due to shallow groundwater
30 - 70	Small Drainage Warm Water Stream (modified channel). Normally intermittent, but some may have perennial flow. Historically channelized waterbodies; permanent structures and channel modifications that impede or alter free-flowing water
>70	Spring water (perennial), cool-cold water stream

Table 2-3 Headwater Habitat Evaluation Index (HHEI) Scoring

Source – OEPA 2018

Larger features are evaluated using the Qualitative Habitat Evaluation Index (QHEI). The QHEI form is used to describe similar aspects of waterbodies, but is focused on larger (often higher quality) waterbodies. Typically, QHEI forms are completed for those perennial features with drainage areas greater than 1 square mile and pools deeper than 40 centimeters (approximately 15 inches). In cases where a feature scored highly on the HHEI forms but failed to meet either of QHEI criteria, they were still evaluated with the QHEI to better record the conditions present. Table 2-4 provides an overview of the typical score ranges and waterbody classification under QHEI.

Final QHEI Score	Definition
<32	Limited Resource Water (LRW)
32 - 60	Modified Warm Water Habitat (MWH)
60 - 75	Warm Water Habitat (WWH)
>75	Possible Exceptional Warm Water Habitat (EWH)

Table 2-4 Qualitative Habitat Evaluation Index (QHEI) Scoring

2.2.3 Ohio Mussel Survey

All native mussels in the State of Ohio are protected per Ohio Revised Code Section 1533.324, as are the 10 federally protected species which may occur in the state. In order to protect these species, the Ohio Department of Natural Resources' Division of Wildlife (ODNR DOW) and USFWS developed the Ohio Mussel Survey Protocol (ODNR and USFWS 2020) to identify the presence or absence of mussels in a waterbody. The protocols identify five types of streams based on their size and potential for federally listed species (FLS), as shown in Table 2-5. Such mussel surveys are required to be conducted by trained and accredited individuals, with the group of streams determining exact scale of surveys required. The unlisted streams and Group 1 streams may have visual reconnaissance surveys completed, with the results being forwarded to ODNR who then determine need for any additional surveys. All Group 2, 3, and 4 streams require a full survey.

Group	Definition
Unlisted	Streams not listed in the Survey Protocol, having a watershed larger than 5 square miles with the potential for mussels, but no FLS are expected
Group 1	Small to mid-sized streams, FLS not expected
Group 2	Small to mid-sized streams, FLS expected
Group 3	Large Rivers, FLS not expected
Group 4	Large Rivers, FLS expected

Table 2-5 Stream Classifications according to Mussel Survey Protocol

3 Survey Methodology

This section of the report identifies the methodologies used during the desktop review of the Project Area and field delineations of wetland and open waterbodies within the Survey Area. Cardno conducted surveys within 90 parcels that totaled approximately 3,178 acres in October 2020.

3.1 Desktop Review

Prior to field surveys, Cardno conducted a desktop review of the entire Project Area using publicly available Geographic Information Systems (GIS) data to identify and classify potential wetlands and waterbodies and create field maps for use during survey. Sources of this reference material included, but were not limited to: The National Land Cover Database (NLCD); the U.S. Department of Agriculture (USDA) National Resource Conservation Service (NRCS) Soil Survey; historic aerial photographs; U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) maps; U.S. Geological Survey (USGS) topographic maps; the USGS National Hydrography Dataset (NHD); and the Ohio Wetland Inventory (OWI).

3.2 Field Delineation Methodologies

Surveys were conducted in the Survey Area to determine the extent of wetlands and waterbodies in accordance with applicable Federal and State regulations and guidelines (see Section 2 above). A Trimble® Global Positioning System (GPS) with sub-meter accuracy was used to wetland and waterbody feature boundary points and USACE data point locations. Delineated feature boundaries and USACE data points were logged with a unique identifier.

The information collected in the field was processed real-time in the field using Satellite-based Augmentation System (SBAS) and verified by the field team for accuracy. If a feature continued outside of the Survey Area, it was noted by the field teams.

After identifying the plant species present within a sampling area of a potential wetland, the dominance and indicator status for each identified unique species was determined. Based on the results, the vegetation community being evaluated were determined to be indicative of a either wetland or non-wetland.

3.2.1 Wetland Delineation Methodologies

Wetland delineation data were reported on routine wetland determination data forms, specifically the USACE forms and ORAM forms. The perimeter of each wetland was mapped using the GPS systems. Physical flagging is hung in areas that do not disturb the private land owners or endanger livestock. In addition to identifying the boundaries of wetlands, additional data points were taken with the GPS to locate delineation data collection center points. Any ponds located within the survey area were delineated in the same manner, but are not further evaluated using the USACE forms and ORAM forms.

3.2.2 Waterbody Delineation Methodologies

Ditches are generally described by state and federal regulatory agencies as man-made or modified channels, constructed to improve drainage among agricultural lands and along roadways. Modification to channels could include the mowing of bank vegetation, altering of channel morphology, or removal of debris to maintain flow conditions. Many ditches have ephemeral or intermittent flows and heavily vegetated channels.

Streams are more often considered natural channels that had indications of significant recovery since any historic modification had occurred. Streams are more likely to have vegetated riparian buffers along the banks and pools of water, which might support wildlife

Within the Survey Area, waterbodies were surveyed by locating the path (typically the centerline if water depth was shallow, or the top-of-bank if the centerline was not accessible) and documenting widths (both as Ordinary High Water Mark (OHWM) to OHWM and top-of-bank to top-of-bank) at each survey point. Physical flagging was hung along the waterbody features to identify their general course. Observational notes about the characteristics of each waterbody (such as flow regime and substrate) were recorded by the field team to enable the categorization of the types of waterbodies encountered. Grassy swales are not waterbodies, and were not identified as such.

The OEPA HHEI forms were completed for each stream and ditch and serve to record and score a variety of aspects about the feature. The HHEI forms score the types and percent composition of substrates, maximum pool depth, and average bank full width. Additional descriptive information was recorded in the forms regarding flow regime, riparian width and quality, morphology, and modification. Stream channel modification was referenced in many of the descriptions below, as either 'naturalized' or 'modified'. Naturalized features are those that have either never been modified or have historic signs of modification but appear to have recovered to a natural state. Modified features are those that appear to have recently been modified (such as through dredging or armoring of the banks) and may have little to no evidence of recovery.

Although no navigable WOTUS were identified in the Project, some could be considered tributaries that eventually flow into a WOTUS. Tributaries themselves may not be navigable, but have a significant impact on water quality 'downstream' in the WOTUS. Status as a tributary was primarily assessed on the presence or absence of a USGS NHD blue line feature and possibility for flow into a larger WOTUS. Additionally, if the waterbody or wetland abutted a potentially jurisdictional feature and had a permanent or potentially permanent hydrologic connection, then both waterbodies would be considered jurisdictional. For clarity, any features identified as jurisdictional, will be referred to as jurisdictional for the purposes of this wetland delineation report. However, final determinations of jurisdiction are the responsibility of the USACE. Any determination made by the USACE would be binding and modifications to a feature's jurisdictional status that varies from Cardno's would have to be honored.

3.2.3 Ohio Mussel Survey

Cardno field staff conducted only visual reconnaissance surveys as part of the typical delineation process. If any mussels are found during stream delineations and if the stream is to be impacted, Cardno identified the stream for a follow-up survey. The survey protocol notes that use of horizontal directional drill (HDD) to cross a stream eliminates the need for surveys, and streams with a drainage area less than 5 square miles also do not require surveys.

4 Desktop Assessment Results

Multiple sources were reviewed prior to field investigations to identify potential resources within the Project Area as part of a preliminary desktop assessment. The findings of the desktop assessment were also verified during the field surveys, within the Survey Area. Any areas within the Project Area that were not available at the time of field survey will be verified during subsequent field surveys.

4.1 National Land Cover Database Review

Based on a review of available aerial imagery, the Project Area appeared to generally occur in cultivated crop areas. Review of the 2016 NLCD (MRLC 2018) confirmed this assessment, which showed that cultivated crops accounted for approximately 91.3% of the total acreage in the Project Area. The next prominent land uses within the Project Area were classified as "Developed, Open Space" which accounted for approximately 3.0% of the acreage, "Deciduous Forest" which accounted for 2.9% or the acreage, and "Pasture/Hay" which accounted for 1.2% of the acreage. The deciduous forests were observed to occur as isolated woodlots between agricultural areas. All other land use activities accounted for approximately less than 1% of the total acreage in the Project Area. A summary is provided in Table 4-1 below.

Туре	Project Area (acres)	Project Area (%)
Cultivated Crops	2,987.3	91.3%
Developed, Open Space	97.5	3.0%
Deciduous Forest	95.4	2.9%
Pasture/Hay	37.9	1.2%
Developed, Low Intensity	24.4	0.7%
Mixed Forest	20.1	0.6%
Woody Wetlands	3.9	0.1%
Developed, High Intensity	1.6	<0.1%
Grassland/Herbaceous	1.3	<0.1%
Shrub/Scrub	1.1	<0.1%
Barren Land (Rock/Sand/Clay)	1.1	<0.1%
Developed, Medium Intensity	0.6	<0.1%
Total	3,272.2	100.0%

Table 4-1 Land Use within the Yellow Wood Solar Project Area, Clinton County, Ohio

Compiled from NLCD 2016.

* The total acreage used in these calculations differs slightly from the project area due to tiny differences inherent to the level of precision of the National Land Cover Dataset.

4.2 Geology

The Project is located in the Illinoian Till Plain Physiographic Region of Ohio, characterized as rolling ground moraine of older till, lacking ice-constructional features. The topography is characterized by modern valleys alternating between broad floodplains and bedrock gorges. The elevation for this physiographic region ranges between 600 feet and 1100 feet, with moderate relief of 200 feet (ODGS, 1998)².

4.3 Soils & Hydric Ratings

Cardno reviewed soil types for the Project Area using the Web Soil Survey, an application of the NRCS (USDA-NRCS 2018). Based upon Table 4-2, below, there were 11 soil types identified within the Project Area, two of which are hydric soils. The poor draining qualities of hydric soils combined with local flat or bowl-shaped topography can make locations predisposed to wetlands.

Туре	Map Unit Description	Hydric Rating	Acreage	Percentage of Project Area
Cle1A	Clermont silt loam, 0 to 1 percent slopes	95	2,066.4	63.2%
WsS1A1	Westboro-Schaffer silt loams, 0 to 2 percent slopes	9	797.3	24.4%
JoR1B1	Jonesboro-Rossmoyne silt loams, 2 to 6 percent slopes	0	150.6	4.6%
WsS1B1	Westboro-Schaffer silt loams, 2 to 4 percent slopes	2	98.2	3.0%
SnA	Sloan silt loam, sandy substratum, 0 to 1 percent slopes, occasionally flooded	90	64.9	2.0%
NhC2	Nicely silt loam, 6 to 12 percent slopes, eroded	0	49.4	1.5%
JrC2	Jonesboro-Rossmoyne silt loams, 6 to 12 percent slopes, eroded	0	21.4	0.7%
SmA	Sligo silt loam, 0 to 1 percent slopes, occasionally flooded	0	11.6	0.4%
HkD2	Hickory silt loam, Illinoian Till Plain, 12 to 18 percent slopes, eroded	0	6.6	0.2%
JoR1A1	Jonesboro-Rossmoyne silt loams, 0 to 2 percent slopes	4	5.7	0.2%
WmB	Williamsburg silt loam, 2 to 6 percent slopes	0	0.1	0.0%
Total			3,272.2	100.0%

Table 4-2 Soils within the Yellow Wood Project Area, Clinton County, Ohio

* The total acreage used in these calculations differs slightly from the project area due to tiny differences inherent to the level of precision of the soil data.

4.4 Navigable Waters

The Project Area is located within the three watersheds (Hydrologic Unit Code (HUC)-12), the West Fork-East Fork Little Miami River, Glady Creek-East Form Little Miami River, and Headwaters East Fork Little Miami River, which are located within the larger Little Miami River drainage basin. No navigable waterways are located within the Survey Area. No waters have a designated use in the Water Quality Standards³

² <u>http://geosurvey.ohiodnr.gov/portals/geosurvey/PDFs/Misc_State_Maps&Pubs/physio.pdf</u>

³ https://epa.ohio.gov/portals/35/rules/01-18_nov15.pdf

4.5 Remote Wetland and Waterbody Identification

Prior to site investigations, the Survey Area was screened using the USFWS NWI, USGS topographic maps, USGS NHD, and the OWI to identify potential wetlands and waterbodies in the vicinity of the Project. The NWI and OWI data show remotely identified wetlands, which may be based on previous aerial imagery interpretation and soils surveys, while the NHD uses surface water data modeling to identify potential waterways.

The desktop review indicated potential for wetlands to be located in multiple woodlots in the Project Area. The area also included a number of streams running between crop areas and through several wooded areas. NWI and OWI features are presented on the Wetland Mapbook in Appendix A. It is not uncommon for the NHD set to indicate features that are no longer present due to landowners rerouting the channel or moving it underground via tiles. Much of the Project Area, however, is cultivated crop area that limits the development of wetlands. The remotely identified features and land use information was expected given the region's heavy, historic manipulation of land use to accommodate and maintain farming operations.

5 Field Survey Results

The following presents the results of field surveys conducted in November 2020 within the Survey Area. Temperature and precipitation were considered normal during the survey periods through evaluation of the National Oceanic and Atmospheric (NOAA) National Centers for Environmental Information (NCEI) 1981 -2019 Climate Normals data tool (2020).

Appendix A contains maps depicting the delineated wetlands and waterbodies. Appendix B contains representative photographic documentation of the delineated wetland and waterbody features. Appendix C contains the completed routine wetland data and assessment forms from the field efforts, and Appendix D contains stream assessment forms.

5.1 General Habitat within the Survey Area

Field surveys determined the predominant land use within the Survey Area is agricultural (crops). The agricultural fields were observed to be primarily a mix of harvested and standing soybean and corn crops. Additionally, some crop areas were actively planted with winter wheat or being used as pasture or hayfields. It is likely that the type of crop changes seasonally, but the general extent of the cultivated area remains roughly the same. Many of the cultivated areas and roadsides have grassy swales, which helped maintain drainage for proper growing conditions. These swales often had a mix of herbaceous species including reed canary grass (*Phalaris arundinacea*) and various other grasses (*Festuca* spp. and *Fescue* spp.) and sedges (*Carex* spp.). The swales appear to be maintained including regularly mowed. Vegetation in the woodlots was characterized by a canopy of oaks (*Quercus* spp.), maples (*Acer* spp.), Hickories (*Carya* spp.), and Elms (*Ulmus* spp.), a shrub layer of honeysuckle (*Lonicera* spp.) and dogwoods (*Cornus* spp.), and an herbaceous layer of lake sedge (*Carex lacustris*), black snakeroot (*Sanicula* spp.) and woodreed (*Cinna arundinacea*). The data obtained during the field surveys was accurate to the results determined during the desktop review were found to be generally consistent with the results of the field survey.

5.2 Description of the Delineated Wetlands in the Survey Area

A total of twenty-four (24) wetlands were delineated during field surveys, for a total of 4.54 acres of wetland within the Survey Area. Twenty-two (22) wetlands were palustrine emergent wetlands (PEM), one was palustrine scrub-scrub (PSS), and one was palustrine forested (PFO). Of the twenty-four wetlands delineated, twenty-three were considered Category 1 wetlands, and one was considered Category 2 wetlands. No Category 3 wetlands were delineated within the Survey Area. Cardno anticipates that eleven (11) wetlands could be federally jurisdictional, based on potential hydrologic connectivity to a potential WOTUS. Final verification of their boundaries for regulatory purposes can only be completed through a Jurisdictional Determination (JD) review by the USACE or its duly appointed representative. Isolated wetlands not under jurisdiction of the USACE are then evaluated as waters of the state by the OEPA. Table 5-1 provides a list of the delineated wetlands and associated characteristics.

One pond with an acreage of 0.26 acres was also delineated within the Survey Area. The single pond was a feature that appeared to hold water throughout the year. Many of the ponds in the vicinity of the Survey Area are typically man-made impoundments, which may be used for holding water for irrigation or recreational fishing and aesthetics.

- Category 1 Wetlands. Nineteen (19) wetlands were identified as Category 1 wetlands using the ORAM metrics. Eleven emergent wetlands are anticipated to be considered federally jurisdictional.
- Category 2 Wetlands. One (1) wetland was identified as a Category 2 wetland using the ORAM metrics. This Category 2 wetland is not anticipated to be considered federally jurisdictional.

> Category 3 Wetlands. No Category 3 wetlands were identified.

5.3 Description of the Delineated Waterbodies in the Survey Area

The linear waterbody delineation results are summarized in Table 5-2. Representative photographs of typical waterbodies can also be found in Appendix B. The waterbody features delineated were broken into three categories: ditches, streams, and ponds.

A total of twenty-nine streams were delineated in the Survey Area. Nine streams within the survey area had a drainage area greater than a square mile (S001, S004, S006, S102, S103, S106, S201, S204, and S208). Five streams were classified as a limited resource water (LRW) (S003, S006, S008, S108, and S208) and five streams were classified as modified warm water (MWW) habitat (S001, S105, S106, S107, and S204). All streams were flowing at the time of the survey at base flow levels. Turbidity levels were not elevated, indicating minimal runoff from surrounding fields at the time of survey, likely attributed to dry conditions.

While delineating the waterbodies in the Survey Area, Cardno evaluated the features for suitability as habitat for RTE species, including listed mussels. Due to the modification and disturbance present in the surrounding area, none of the waterbodies were identified as highly likely to serve as habitat for any RTE species. Frequently a waterbody may be able to provide physical habitat, but lack suitable water chemistry due to intensive land use in the upland areas. During the field surveys, Cardno observed no individuals or populations of freshwater mussel species.

None of the delineated streams within the Survey Area meet the requirements for formal mussel survey, having drainage areas greater than 5 square miles.

Wetland ID	Latitude of Center Point	Longitude of Center Point	Acres within Survey Area	Wetland Type	ORAM Score	Wetland Category	Anticipated Jurisdictional?	Drainage Basin
P201	39.261281	-83.808609	0.26	PUB			No	N/A
W001	39.254112	-83.807548	0.09	PEM	24	Cat 1	Yes	Glady Run
W002	39.252671	-83.811406	0.04	PEM	28	Cat 1	No	Glady Run
W003	39.248836	-83.812891	1.50	PFO	31	Cat 2	No	Middle Ohio-Little Miami River
W004	39.255978	-83.829662	0.06	PEM	24	Cat 1	Yes	Middle Ohio-Little Miami River
W005	39.248112	-83.829306	0.69	PEM	22	Cat 1	Yes	Middle Ohio-Little Miami River
W006	39.253841	-83.822514	0.35	PEM	24	Cat 1	No	Middle Ohio-Little Miami River
W007	39.241408	-83.832977	0.03	PEM	22	Cat 1	No	Middle Ohio-Little Miami River
W008	39.257832	-83.837034	0.20	PEM	24	Cat 1	Yes	Middle Ohio-Little Miami River
W009	39.257729	-83.827539	0.03	PEM	20	Cat 1	Yes	Middle Ohio-Little Miami River
W010	39.260770	-83.830273	0.03	PEM	18	Cat 1	Yes	Middle Ohio-Little Miami River
W011	39.259530	-83.817410	0.01	PEM	17	Cat 1	No	Glady Run
W012	39.261368	-83.817403	0.17	PEM	22	Cat 1	Yes	Middle Ohio-Little Miami River
W013	39.259669	-83.842484	0.02	PEM	24	Cat 1	Yes	Middle Ohio-Little Miami River
W014	39.259174	-83.842262	0.00	PEM	25	Cat 1	Yes	Middle Ohio-Little Miami River
W101	39.280258	-83.818959	0.03	PSS	16	Cat 1	No	Middle Ohio-Little Miami River
W102	39.279890	-83.825437	0.02	PEM	21	Cat 1	Yes	Middle Ohio-Little Miami River
W103	39.281625	-83.841779	0.02	PEM	16	Cat 1	Yes	Middle Ohio-Little Miami River
W104	39.272930	-83.841992	0.13	PEM	23	Cat 1	No	Middle Ohio-Little Miami River
W105	39.273955	-83.845491	0.70	PEM	17	Cat 1	No	Middle Ohio-Little Miami River
W201	39.274804	-83.783950	0.13	PEM	28	Cat 1	No	East Fork Miami River
Total Acreage			4.25					

Table 5-1 Wetlands Delineated in the Yellow Wood Survey Area, Clinton County, Ohio

NOTES:

ORAM – Ohio Rapid Assessment Method PEM – Palustrine Emergent Wetland PFO – Palustrine Forested Wetland

PSS – Palustrine Scrub Shrub

PUB – Palustrine Unconsolidated Bottom

						,	•																		
Stream ID	Туре	Linear Feet	HHEI Score	QHEI Score	Flow Regime	Drainage Basin	OEPA Watershed Eligibility	Drainage Area (mi²)	Stream Name	Anticipated Jurisdictional	Potential RTE Habitat	Mussels Observed	SRW	WWH	EWH	мwн	SSH	СМН	LRW	PWS	AWS	IWS	BW	PCR	SCR
S001	Stream	1309		47	Perennial	Middle Ohio/Little Miami	Potentially Eligible	4.05	Glady Run	Yes	No	No				х									х
S002	Stream	1642	21		Intermittent	Middle Ohio/Little Miami	Potentially Eligible	0.40	UNK Trib to Middle Ohio-Little Miami River	No	No	No													
S003	Stream	2805		21	Perennial	Middle Ohio/Little Miami	Potentially Eligible	0.39	UNK Trib to Middle Ohio-Little Miami River	Yes	No	No							х						х
S004	Stream	7612		19	Perennial	Middle Ohio/Little Miami	Potentially Eligible	1.17	UNK Trib to Middle Ohio-Little Miami River	Yes	No	No													
S005	Stream	5237	55		Intermittent	Middle Ohio/Little Miami	Potentially Eligible	0.48	UNK Trib to Middle Ohio-Little Miami River	Yes	No	No													
S006	Stream	489		28	Perennial	Middle Ohio/Little Miami	Potentially Eligible	1.48	UNK Trib to Middle Ohio-Little Miami River	Yes	No	No							х						х
S007	Stream	5626	40		Intermittent	Middle Ohio/Little Miami	Potentially Eligible	0.89	UNK Trib to Middle Ohio-Little Miami River	Yes	No	No													
S008	Stream	3299		26	Perennial	Middle Ohio/Little Miami	Potentially Eligible	0.52	UNK Trib to Middle Ohio-Little Miami River	Yes	No	No							х						х
S009	Stream	1070	16		Ephemeral	Middle Ohio/Little Miami	Potentially Eligible	0.04	UNK Trib to Middle Ohio-Little Miami River	No	No	No													
S010	Stream	2626	26		Intermittent	Middle Ohio/Little Miami	Potentially Eligible	0.72	UNK Trib to Middle Ohio-Little Miami River	No	No	No													
S101	Stream	829	29		Ephemeral	Middle Ohio/Little Miami	Potentially Eligible	0.04	UNK Trib to Middle Ohio-Little Miami River	No	No	No													
S102	Stream	1571	52		Intermittent	Middle Ohio/Little Miami	Potentially Eligible	1.00	UNK Trib to Middle Ohio-Little Miami River	Yes	No	No													
S103	Stream	1852	55		Intermittent	Middle Ohio/Little Miami	Potentially Eligible	1.23	UNK Trib to Middle Ohio-Little Miami River	Yes	No	No													
S104	Stream	1142	44		Intermittent	Middle Ohio/Little Miami	Potentially Eligible	0.15	UNK Trib to Middle Ohio-Little Miami River	Yes	No	No													
S105	Stream	1995		33	Perennial	Middle Ohio/Little Miami	Potentially Eligible	0.25	UNK Trib to Middle Ohio-Little Miami River	Yes	No	No				х									х
S106	Stream	3105		38	Perennial	Middle Ohio/Little Miami	Potentially Eligible	1.84	UNK Trib to Middle Ohio-Little Miami River	Yes	No	No				х									х

 Table 4-2.
 Waterbodies Delineated in the Yellow Wood Survey Area, Clinton County, Ohio

Stream ID	Туре	Linear Feet	HHEI Score	QHEI Score	Flow Regime	Drainage Basin	OEPA Watershed Eligibility	Drainage Area (mi²)	Stream Name	Anticipated Jurisdictional	Potential RTE Habitat	Mussels Observed	SRW	wwн	EWH	MWH	SSH	смн	LRW	PWS	AWS	IWS	BW	PCR	SCR
S107	Stream	1769		32.5	Perennial	Middle Ohio/Little Miami	Potentially Eligible	0.40	UNK Trib to Middle Ohio-Little Miami River	Yes	No	No				х									х
S108	Stream	516		29.5	Perennial	Middle Ohio/Little Miami	Potentially Eligible	0.28	UNK Trib to Middle Ohio-Little Miami River	Yes	No	No							х						х
S109	Stream	111	28		Ephemeral	Middle Ohio/Little Miami	Potentially Eligible	0.30	UNK Trib to Middle Ohio-Little Miami River	No	No	No													
S110	Stream	1607	48		Intermittent	Middle Ohio/Little Miami	Potentially Eligible	0.10	UNK Trib to Middle Ohio-Little Miami River	Yes	No	No													
S111	Stream	748	27		Intermittent	Middle Ohio/Little Miami	Potentially Eligible	0.08	UNK Trib to Middle Ohio-Little Miami River	No	No	No													
S201	Stream	212	13		Ephemeral	Middle Ohio/Little Miami	Potentially Eligible	1.64	UNK Trib to East Fork Miami River	No	No	No													
S202	Stream	1404	27		Intermittent	Middle Ohio/Little Miami	Potentially Eligible	0.15	UNK Trib to Glady Run	Yes	No	No													
S203	Stream	714	19		Ephemeral	Middle Ohio/Little Miami	Potentially Eligible	0.15	UNK Trib to Glady Run	No	No	No													
S204	Stream	3203		35	Perennial	Middle Ohio/Little Miami	Potentially Eligible	2.30	Glady Run	Yes	No	No				х									х
S205	Stream	789	38		Ephemeral	Middle Ohio/Little Miami	Potentially Eligible	0.00	UNK Trib to Glady Run	No	No	No													
S206	Stream	457	45		Ephemeral	Middle Ohio/Little Miami	Potentially Eligible	0.11	UNK Trib to Glady Run	No	No	No													
S207	Stream	809	42		Ephemeral	Middle Ohio/Little Miami	Potentially Eligible	0.14	UNK Trib to Glady Run	No	No	No													
S208	Stream	2610		30	Perennial	Middle Ohio/Little Miami	Potentially Eligible	3.36	Glady Run	Yes	No	No							x						

Total Linear Feet 57,158

HHEI Scoring

<30: Ephemeral Aquatic Stream (modified channel) <30: Ephemeral Aquatic Stream (natural channel)

30 - 70: Small Drainage Warm Water Stream (modified channel)

30 - 70: Small Drainage Warm Water Stream (natural channel)

>70: Spring water (perennial), cool-cold water stream

< 32: Limited Resource Water (LRW) 32 to 60: Modified Warmwater Habitat (MWH) 60 to 75: Warmwater Habitat (WWH)

> 75: Possible Exceptional Warmwater Habitat (EWH)

Notes:

HHEI – Headwater Habitat Evaluation Index, QHEI – Qualitative Habitat Evaluation Index

PWS – Public Water Supply, AWS – Agricultural Water Supply, IWS – Industrial Water Supply, BW – Bathing Waters, PCR – Primary Contact Recreation, SCR – Secondary Contact Recreation, UNT – Unnamed Tributary

SRW - State Resource Water, WWH - Warmwater Habitat, EWH - Exceptional Warmwater Habitat, MWH - Modified Warmwater Habitat, SSH - Seasonal Salmonid Habitat, CWH - Cold Water Habitat, LRW - Limited Resource Water

6 Conclusions

The Survey Area is dominated by agricultural land use (cultivated crops) and isolated woods. Waterbodies were classified as streams, but had characteristics of manipulated, but recovering drainage ways. The history of land conversion for farming and other landscape manipulation to support farming operations has reduced the land available for wetlands to develop. The majority of wetlands were located along field boundaries and forested edges

In summary, Cardno delineated 29 streams with eighteen (18) expected to be waters of the United States due to their hydrologic connection to a WOTUS and flow regime, and eleven (11) streams and one pond which is not anticipated to be considered jurisdictional. Twenty (20) wetlands were delineated within the Survey Area totaling 4.25 acres with eleven (11) wetlands (totaling 1.33 acres) expected to be jurisdictional by the USACE. The remaining wetlands have potential to be within jurisdiction of the state. Final verification of wetland and waterbody boundaries for regulatory purposes can only be completed through a JD review by the USACE or its duly appointed representative.

The findings of this investigation represent a study of the Survey Area for wetlands and waterbodies. This report represents a professional estimate of wetlands and waterbodies within the Survey Area based upon available information and techniques. Final verification of their boundaries for regulatory purposes can only be completed through a JD review by the USACE or its duly appointed representative.

Any parcels or sections of parcels currently not within the Survey Area, but will ultimately be considered within the Project Area, will be subject to the above survey methodologies and analysis, and this report will be updated to reflect the results of those subsequent surveys

7 References

- MRLC (Multi-Resolution Land Characteristics Consortium). 2018. National Land Cover Database 2016 (NLCD 2016). Multi-Resolution Land Characteristics Consortium (MRLC). <u>https://www.mrlc.gov/data/nlcd-2011-land-cover-conus-0</u>.
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Wetland and Waterbody Delineation Report Yellow Wood Solar Energy Project

APPENDIX

WETLAND AND WATERBODY MAPS



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		AL	2	3	4	
	7	8	9	10	11	1
	15	16	17	T	18	1
	22	23	24		25	2
Legend Project Boundary Surveyed Area	28	29	30	31	32	3
 Woodlot Omitted Easement Omitted Upland Data Point Wetland Data Point 	34	35	36	37	38	3
 Field Delineated Stream Field Delineated Wetland Field Delineated Pond 		40	41	42	43	4
ODNR Wetlands NWI Wetlands Freshwater Emergent Wetland Freshwater Forested/Shrub Wetland		7	45	46	47	
Freshwater Pond Lake Riverine			48	49		

Wetland and Waterbody Maps - Overview

Yellow Wood Solar Energy Project Clinton County, Ohio

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Wetland and Waterbody Maps (Sheet 1 of 49)

Yellow Wood Solar Energy Project Clinton County, Ohio

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Wetland and Waterbody Maps (Sheet 2 of 49)

Yellow Wood Solar Energy Project Clinton County, Ohio

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Wetland and Waterbody Maps (Sheet 3 of 49)

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Wetland and Waterbody Maps (Sheet 5 of 49)

Yellow Wood Solar Energy Project Clinton County, Ohio

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Wetland and Waterbody Maps (Sheet 6 of 49)

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Wetland and Waterbody Maps (Sheet 7 of 49)

Yellow Wood Solar Energy Project Clinton County, Ohio





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Case No(s). 20-1680-EL-BGN

Summary: Application - 26 of 33 (Exhibit R – Part 1 of 6 - Wetland and Waterbody Delineation Report) electronically filed by Christine M.T. Pirik on behalf of Yellow Wood Solar Energy LLC