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Hillcrest Solar Farm

APPENDIX

B

WETLAND AND STREAM
DELINEATION REPORT AND FORMS

Wetland and Waterbody Delineation Report

Open Road Renewables, LLC

Hillcrest Solar Farm

E317501800



Document Information

Prepared for	Open Road Renewables, LLC
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Acronyms

CWA	Clean Water Act
CWH	Cold Water Habitat
DOH	Ditches
FACU	Facultative Upland
GIS	Geographic Information Systems
GPS	Global Positioning System
HHEI	Headwater Habitat Evaluation Index
JD	Jurisdictional Determination
MW	Megawatt
NHD	National Hydrography Dataset
NLCD	National Land Cover Database
NRCS	Natural Resources Conservation Service
NWI	National Wetland Inventory
ODNR	Ohio Division of Natural Resources
OEPA	Ohio Environmental Protection Agency
OHWM	Ordinary High Water Mark
ORAM	Ohio Rapid Assessment Methodology
ORR	Open Road Renewables
OWI	Ohio Wetland Inventory
PEM	Palustrine Emergent Wetlands
PFO	Palustrine Forested Wetlands
PHWH	Primary Headwater System
POH	Ponds
Project	Hillcrest Solar Farm
PSS	Palustrine Scrub/Shrub
QHEI	Qualitative Habitat Evaluation Index
RTE	Rare, Threatened or Endangered species
SOH	Streams
TBD	To Be Determined
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish & Wildlife Service
USGS	U.S. Geological Survey
WWH	Warm Water Habitat

1 Introduction

Hillcrest Solar, LLC, an affiliate of Open Road Renewables, LLC (ORR), is proposing to construct the Hillcrest Solar Farm (Project) near Mt. Orab, Ohio, which is located approximately 30 miles east of Cincinnati. The Project is proposed as a 125 megawatt (MW) solar farm within an area of approximately 2,083 acres (3.2 square miles) on leased private lands as well as 100 foot-wide easements (Project Area). The Project Area is entirely contained within Green Township, Brown County, Ohio. Figure 1.1 shows a Project Overview of the Hillcrest Solar Farm.

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 Section 404 of the Clean Water Act (CWA). Cardno's field efforts focused on accessible areas within the Project Parcel Boundaries (Project Parcels), totaling approximately 1,855 acres on 32 leased parcels.

Proposed infrastructure for the Project will include solar panels on metal racking ("arrays"), inverter pads, buried collection lines, a Project substation, pyranometer stations, a 1,000-foot long generation tie line, and temporary equipment laydown areas. The Project will require an approximately 1,100 acre footprint for permanent infrastructure and 26 miles of new access roads for construction, operations, and maintenance.

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

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

2 Survey Methodology

This section of the report identifies the methodologies used during the desktop review and field delineations of wetland and open waterbodies within the Project Area. During April 2017, Cardno conducted surveys within 32 parcels of property that totaled approximately 1,855 acres. Surveyed areas did not include contiguous woodlots unless it was expected that infrastructure would cross through them because these features will be avoiding during construction and operation of the Project.

2.1 Desktop Review

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

2.2 Field Delineation Methodologies

Surveys were conducted in the Project Parcels to determine the extent of wetlands and waterbodies during April 2017 in accordance with applicable Federal and State regulations and guidelines. A Trimble® Global Positioning System (GPS) with sub-meter accuracy was used to collect data points for mapping. As wetland and waterbody point features were collected, they were assigned a FEATURE_ID with the format of F-XXX-YY, where:

F = Feature Type

- DOH – Ditches
- SOH – Streams
- POH – Ponds
- WOH – Wetlands

XXX = Three-digit number as the unique identifier

YY = Flag number per each unique feature identified

The information collected in the field was post-processed in the office using (ARC GIS) and verified by the field team for accuracy. Additional physical flagging was hung in areas that would not disturb the private land owners. If a feature continued outside of the Project Area, it was noted by the field teams.

2.2.1 Wetland Delineation Methodologies

Wetland delineations were 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). Together, these documents are referred to as “The Manual.” The methodology outlined in the Manual requires that three wetland criteria be met in order for a wetland to be determined to be present; that is, the area being evaluated must have a dominance of hydrophytic vegetation, hydric soils, and sufficient hydrology to be identified as a wetland.

Dominant vegetation is assessed for hydrophytic preference. 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 shows the indicator status categories for plants.

Table 2-1 Plant Indicator Categories

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.

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 was determined to be indicative of a either wetland or non-wetland.

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 facultative upland [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.

The hydric soils criterion is met when the soils identified are officially listed as hydric soils or the soils demonstrate characteristics representative of soils in reducing (hydric) conditions. The latter 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.

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.

Wetland delineation data are reported on routine wetland determination data 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 are taken with the GPS to locate delineation data collection center points.

After delineations, the identified wetlands are 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.

Category 1 consist of wetlands 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 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 Delineation Methodologies

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 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. 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.

Table 2-2 Waterbody Flow Categories

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.

All flowing waterbodies (streams and ditches, but not ponds) delineated in the Project Parcels were assessed using the Headwater Habitat Evaluation Index (HHEI). 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, scoring and associated waterbody class are provided in Table 2-3. HHEI forms typically are completed, however, only for waterbodies with a drainage area of less than one square mile.

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 only for those perennial features with drainage areas greater than one square mile and pools deeper than 40 centimeters (approximately 15 inches). In cases where a feature scored highly on the HHEI forms and failed to meet either of QHEI criteria, however, they were still evaluated with the QHEI to better record the conditions present.

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

Final HHEI Score	Definition
<30	Class I PHWH (Ephemeral streams, normally dry channel, little to no aquatic life)
30 - 50	Class II PHWH (Intermittent flow, summery-dry, warm water streams)
>50	Class II or III PHWH (depending on conditions)
>75	Class III (Perennial flow, cool-cold water Streams)

PHWH – Primary Headwater Stream

3 Desktop Assessment Results

Multiple sources were reviewed prior to field investigations to identify potential resources as part of a preliminary desktop assessment. The findings of the desktop assessment were also verified during the field surveys.

3.1 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 2011 NLCD (Homer et al. 2015) confirmed this assessment, which showed that cultivated crops accounted for approximately 83% of the total acreage in the Project Area. The second most prominent land use within the Project Area was classified as “Deciduous Forest” for approximately 10% of the acreage and was observed to occur as isolated, regularly shaped woodlots between agricultural areas. Developed, Open Space and Pasture/Hay each accounted for an additional 3% of the Project Area. The classification “Developed, Open Space” refers to “areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses” (Homer et al. 2015). All other landuse activities accounted for 1% or less of the total acreage in the Project Area. A summary is provided in Table 3-1 below.

Table 3-1 Land Use within the Project Area

Type	Study Area (acres)	Study Area (%)
Cultivated Crops	1,734.09	83%
Deciduous Forest	210.79	10%
Developed, Open Space	66.34	3%
Pasture/Hay	58.75	3%
Developed, Low Intensity	11.36	<1%
Scrub/Shrub Wetlands	0.22	<1%
Developed, Medium Intensity	1.5	<1%
Developed, High Intensity	0.22	<1%
TOTAL	2,083.27	100%

Compiled from NLCD 2011, amended 2014.

The field team observed that the land use in the Project Area closely matched the remote land use data described above.

3.2 Geology

The Project is located within the Central Lowland Physiographic Region of Ohio, and in particular the Illinoian Till Plain Section, which covers the northern portion of Brown County. The Illinoian till plain is composed of rolling ground from older till with many buried valleys. Elevations range from 600 to 1,000 feet, with moderately low relief (Ohio Division of Geological Survey, 1998, Physiographic Regions of Ohio¹).

¹ http://geosurvey.ohiodnr.gov/portals/geosurvey/PDFs/Misc_State_Maps&Pubs/physio.pdf

3.3 Hydric Soils

Based upon Table 3-2, below, approximately 14.5% (303.93 acres) of the Project Area was determined to be located in fully hydric soils. The poor draining qualities of hydric soils combined with local flat or bowl-shaped topography make these locations predisposed to wetland. Only one soil type in the Project Area is considered fully hydric (i.e., soils contain 100 percent hydric components). The Blanchester series consists of very deep, poorly drained soils formed in lacustrine deposits and the underlying till on till plains. Slope ranges from 0 to 1 percent. The remaining Project Area is located in areas of non-hydric or predominantly non-hydric soils. Project soil information was obtained from the Web Soil Survey, an application of the Natural Resource Conservation Service (USDA-NRCS 2016).

Table 3-2 Fully Hydric Soils within the Project Area

Type	Map Unit Description	Hydric Rating	Acreage	Percentage of Project Area
Bln3A	Blanchester silty clay loam, 0 to 1% slopes	100	311.43	15%
TOTAL			311.43	15%

3.4 Navigable Waters

The vast majority of the Project Area is located within the Sterling Run watershed (Hydrologic Unit Code (HUC)-12), with only extreme eastern edges of the Project within the Flat Run-North Fork Whiteoak Creek watershed and extreme northwestern edges of the Project Area in the Fivemile Creek-East Fork Little Miami River watershed. All of these streams are located within the larger Ohio River drainage basin, which ultimately drains southwest towards the Mississippi River. No navigable waterways are located within the Project Area. Sterling Run is the only feature in the Project Area with a designated use, and is identified as warm water habitat (WWH) in the Water Quality Standards²

3.5 Remote Wetland and Waterbody Identification

Prior to site investigations, the Project Area was screened using the USFWS NWI and USGS NHD remote data for potential wetlands and waterbodies in the vicinity of the Project. The NWI data shows remotely identified wetlands, which may be based on previous aerial imagery interpretation and soils surveys, while the NHD uses digital stream information to identify potential waterways.

Multiple wetlands and waterbodies were identified within the Project Area, with some additional streams and wetlands occurring in the vicinity. The majority of the waterbodies remotely identified appeared to be manipulated agricultural ditches. Additionally, the Cardno team identified several NHD features that ran directly through active agricultural areas but were not visible in any aerial imagery. These relic NHD features may have been rerouted by previous land use manipulation or even tiled, which would route them under crop areas. Most of the wetlands identified by Ohio Division of Natural Resources (ODNR) occurred in isolated woodlots, with moderate overlap with NWI features.

² <http://epa.ohio.gov/Portals/35/rules/01-17.pdf>

3.6 Desktop Review Summary

The desktop review indicated potential for wetlands to be located in multiple woodlots in the Project Area. The area also included a number of ditches and streams running between crop areas, which it was not clear remained present. 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.

4 Field Survey Results

The following is a discussion of the results of field surveys conducted in April 2017 within the Project Parcels. Certain sections of the Project Parcels were somewhat wetter than expected due to recent rains and late season snow falls saturating the clayey soils of the area. The high clay content meant that much of the Project Parcels had standing water since the ground could not soak up additional water. Such conditions may not be typical for the entire growing season in the Project Parcels, or even from year to year for the Project Parcels. However, best professional judgment was used to accurately apply the Manual when determining wetlands within the Project Parcels. Appendix A contains representative photographic documentation of the delineated wetland and waterbody features. Appendix B contains maps depicting the delineated wetlands and waterbodies. Appendix C contains the completed routine wetland data and assessment forms from the field efforts, and Appendix D contains stream assessment forms.

4.1 General Habitat within the Project Area

The data obtained during the desktop review was found to be generally consistent with the results of the field survey. As identified in Table 3-1, the predominant land use in the Project Area is agricultural (crops), followed by deciduous forest areas (woodlots), and some developed/open space.

The agricultural fields were observed to be primarily a mix of remnants from the previous year's soybean and corn crops. Additionally, some crop areas were actively planted with spring wheat. 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 man-made or modified ditches, which helped maintain drainage for proper growing conditions. In intermittent and ephemeral ditches the channels are often vegetated with reed canary grass (*Phalaris arundinacea*) and narrow-leaf cattail (*Typha angustifolia*) indicating the presence of water during portions of the year. Some ditches that rarely receive any runoff except during severe storm events lack vegetation in the channel or have a mix of grasses (*Festuca* sp. and *Fescue* sp.). The majority of ditches delineated appear to be mowed seasonally, which reduces the development of mature riparian buffers along the banks. The bank of many of the delineated ditches are covered in additional weedy species such as: Canada goldenrod (*Solidago canadensis*), pokeweed (*Phytolacca americana*), Queen Anne's lace (*Daucus carota*), common teasel (*Dipsacus fullonum*), and purple deadnettle (*Lamium purpureum*). Where limited woody vegetation and shrub growth was observed, species included willows (*Salix* sp.), black locust (*Robinia pseudoacacia*), and sycamores (*Platanus occidentalis*).

The wooded areas of the Project Area occur as isolated woodlots between cultivated fields and along roads. Many include vehicle trails, either from landowners or resulting from land management activities. Aggressive weedy species such as pokeweed and poison ivy (*Toxicodendron radicans*) often occur along the woodlot edges, with the interiors of woodlots comprised predominately of maples (*Acer* sp.), oaks (*Quercus* sp.), American elm (*Ulmus americana*), dogwoods (*Cornus* sp.), and shagbark hickories (*Carya ovata*). The woodlots in the Project Area did have a modest amount of shagbark hickories (*Carya ovata*) which may provide roosting habitat for bats. The actual utilization of available habitat could not be determined by Cardno field staff as most survey work occurred during daylight hours when bats are not expected to be active.

The habitats surveyed during field efforts appear to lack significant or obvious evidence of rare, threatened or endangered (RTE) species due to the high level of habitat fragmentation and degradation by historic manipulation of the land in the Project Area and surrounding region (e.g. agriculture). Many of the waterbodies delineated potentially provide habitat, but at reduced quality due to the surrounding land use impacting the water chemistry (i.e., high sediment loading during storms and fertilizer in runoff).

During the field surveys, Cardno staff observed minimal wildlife use in the Project Area and observed no RTE species.

4.2 Description of the Delineated Wetlands in the Project Parcels

A total of six wetlands were delineated during field surveys, for a total of 11.61 acres of wetland within the Project Parcels. Wetland WOH-001 accounted for over 8 acres, with each of the other wetlands accounting for less than 1 acre. The majority of wetlands were identified as palustrine emergent (PEM), and scored as lower quality wetlands on the ORAM (all were Category 1). Cardno anticipates that three wetlands could be jurisdictional, based on potential hydrologic connectivity to a potential Water of the U.S.; including wetlands WOH-004, WOH-005, and WOH-007. 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. Table 4-1 provides a list of the delineated wetlands and associated characteristics. Wetland acreages reported in the summaries below are representative only of the portion of the wetland located within the Project Parcels.

WOH-001 is a relatively large, 8.59-acre wet meadow complex that extends into a scrub/shrub field to the west. The bulk of the wetland is located along the edge of active farm field in a parcel south of Mount Road. There was high saturation of clay soils, and a prevalence of common rush (*Juncus effusus*) throughout the area. Conditions indicate that the wetland may include some hummocky areas (potentially historic till piles or tire ruts from previous activity) that do not retain wetland conditions year round because they contained isolated stands of broomsedge (*Andropogon virginicus*) (a FACU species). However, during the survey the majority of the wetland had pools of standing water, saturated low chroma clayey soils, crayfish burrows, and rush species throughout.

WOH-003 is a small, 0.11-acre depressional wetland located along a disused driveway, and likely formed in a blocked drainage canal. The depression naturally retained overland sheet flow runoff, and with no outlet wetland conditions. The wetland likely extends into the woodlot to the south, which also exhibits wetland conditions, but was not fully delineated in this survey.

WOH-004 is a 0.93-acre emergent wetland located along the southern end of a fallow farm field. The wetland was dominated by rushes and grasses characteristic of an overgrown field. The clayey low chroma soils were saturated and had several inches of standing water throughout.

WOH-005 is a 0.53-acre emergent wetland located at the overgrown southern end of a farm field, which appears to be unused. The wetland was dominated by rushes and grasses. The clayey low chroma soils were saturated and had several inches of standing water throughout.

WOH-006 is a 0.64-acre depressional emergent/forested wetland occurring in a woodlot at the north end of cultivated area. The woodlot was bermed on all sides, likely from previous crop management activities that led to the retention of precipitation. It is located near a spur of DOH-002, but does not connect to the ditch, and is elevated relative to the ditch. There was also a small pond (potentially man-made) at the southwest corner of the woodlot. Soils within the wetland were saturated, darkly colored clays.

WOH-007 is a 0.81-acre emergent wetland occurring along the southern edge of a cultivated area. It likely retains runoff from the surrounding cultivated area and then drains out through DOH-019. The wetland was located in a minor depression, which previously may have been an extension of DOH-019, but was blocked by woody debris and eventually filled in by soil runoff from the cultivated areas. It did not extend into the woodlot to the south though, which was raised slightly above the wetland. Within the wetland were common rush and cattails. The eastern corner of the wetland also contained a minor pond and large mound of dirt, which may have been recently excavated.

Table 4-1 Wetlands Delineated in the Project Parcels

Wetland ID	Latitude of Center Point	Longitude of Center Point	Acres within Project Parcels	Wetland Type	ORAM Score	Wetland Category	Anticipated Jurisdictional?	Drainage Basin	Parcel
WOH-001	39.08570	-83.90175	8.59	PEM/PSS	20.5	Category 1	N	Sterling Run	100190480000
WOH-003	39.09099	-83.90761	0.11	PEM	18.0	Category 1	N	Sterling Run	100190480000
WOH-004	39.08690	-83.90824	0.93	PEM	23.0	Category 1	Y	Sterling Run	100179120000/ 100179160000
WOH-005	39.08477	-83.90906	0.53	PEM	21.0	Category 1	Y	Sterling Run	100179120000/ 100179160000
WOH-006	39.09267	-83.91300	0.64	PEM/PFO	21.5	Category 1	N	Sterling Run	100188240000
WOH-007	39.08863	-83.88083	0.81	PEM	28.5	Category 1	Y	Sterling Run	100176360000
Total Acreage			11.61						

Notes:

PEM – Palustrine Emergent Wetland

PFO – Palustrine Forested Wetland

PSS – Palustrine Scrub/Shrub

ORAM – Ohio Rapid Assessment Method

4.3 Description of the Delineated Waterbodies in the Project Parcels

The waterbody delineation results are summarized in Table 4-2. Representative photographs of typical waterbodies can also be found in Appendix A. The waterbody features delineated were broken into three categories: ditches (DOH), streams (SOH), and ponds (POH).

Ditches were identified as man-made or modified channels, which were manipulated by landowners or communities to improve drainage among farm fields. 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. At the time of the survey, most were flowing though due to the recent rains and saturated soils. Most ditches also had trapezoidal cross sections, with a small bankfull width/channel at the bottom and a wider crossing distance at the top of bank. If a ditch crossed under a road, the deepest pools of water were normally located at the edges of the culvert, which occur as a result of eddies and currents of stormwater flow creating erosion.

Streams were more often considered natural channels that had indications of significant recovery since any historic modification had occurred. All streams were flowing at the time of the survey, with slightly elevated turbidity, which was attributed to runoff from nearby ditches and cultivated areas during recent rains. Streams were more likely to have vegetated riparian buffers along the banks and pools of water, which might support wildlife.

Ponds were features that appeared to hold water throughout the year. Many of the ponds observed in the vicinity of the Project Area were man-made impoundments, which may be used for holding water for irrigation or recreational fishing and aesthetics.

The OEPA's 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 bankfull width. Additional descriptive information is recorded in the forms regarding flow regime, riparian width and quality, morphology, and modification. Stream channel modification is 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. Scores are tallied for each feature, and result in a HHEI Category of Class I, II, or III as described in Section 2.2.2 above.

While delineating the waterbodies in the Project Parcels, Cardno evaluated the features for suitability as habitat for RTE species. Due to the modification and disturbance present in the surrounding area, none of the ditches were identified as highly likely to serve as habitat for any RTE species. On average, the streams had a slightly higher potential for providing suitable habitat to RTE species (such as mussels and snakes), but none were observed during the field surveys. Frequently a waterbody may be able to provide physical habitat, but lack suitable water chemistry due to intensive land use in the upland areas.

A total of 42 waterbodies were delineated in the Project Parcels, primarily identified as ditches (n=34) with 4 stream reaches and 4 ponds. Seventeen (17) of the waterbodies were identified as Class I streams according to the HHEI scoring matrix, with an additional 20 scoring as Class II. Only SOH-002 scored highly enough on the HHEI score to be considered a Class III waterbody. The vast majority of the waterbodies were considered modified (n=38).

DOH-001 is a minor ephemeral modified ditch that runs along the southern side of Mount Road. The feature is a typical stormwater management ditch, with shallow channel area and poorly defined bed and bank. The surrounding land use is active cultivation and residential, with no buffer between the land use and the ditch.

DOH-002 is a perennial modified ditch that runs southwest from Mount Road before crossing under Driver Collins Road and through a field to the west. It has a trapezoidal cross section, typical for agricultural ditches than run between cultivated areas. The top of bank width is approximately 15 feet, with the wet channel at the bottom occupying approximately 6 feet. The sloped banks are predominately covered by weedy species multiflora rose (*Rosa multiflora*), blackberries (*Rubus* sp.) and other grasses and limited shrubby vegetation. The channel itself has a limited amount of cattail growing with in it. It was suspected that regular mowing limited development of any significant vegetation. The substrate was predominately clay with minor amounts of gravel and sand – likely transported from the nearby roadways.

DOH-003 is an intermittent modified ditch located inside of a windrow between active areas of cultivation. The channel is approximately 4 feet wide and had water up to 6 inches deep in parts at the time of the survey. The ditch flows south and may seasonally overflow the excavated banks in several places, leading to the supporting the formation of wetlands of WOH-004 and WOH-005.

DOH-004 is an ephemeral modified ditch located along Driver Collins Road that discharges to DOH-003 south of WOH-005. Typical of roadside stormwater management ditches, the ditch is relatively narrow and shallow, with a poorly defined bed and bank.

DOH-005 is an ephemeral roadside stormwater ditch flowing south along Driver Collins Road before discharging into DOH-002. The ditch is relatively narrow and has a poorly defined bed and bank, primarily composed of silt and road debris.

DOH-006 is an ephemeral roadside stormwater ditch that runs along the north side of Mount Road before crossing and discharging via a culvert into DOH-002. The ditch has a top of bank measurement of approximately 3 feet.

DOH-007 is a perennial ditch that flows southwest through active areas of cultivation before flowing under Moon Road via a culvert and into SOH-004. Although technically the same feature, conditions within the channel on the east side of Moon Road require it to be identified as a different feature. The banks of DOH-007 are poorly defined and shallow, with grasses dominating. The vegetation is routinely mowed, preventing any shrubby vegetation from establishing. The ditch receives runoff from active areas of cultivation, which are approximately 10 feet from its banks on either side.

DOH-008 is a perennial ditch that flows southwest through active areas of cultivation before flowing under Moon Road via a culvert and eventually into Sterling Run. It is located east of DOH-007 and flows through the same cornfield. The banks of DOH-008 are poorly defined and shallow, with grasses dominating. Cattail was present in limited areas of the channel during the survey, but they recently had been mowed. The vegetation within the channel and on the banks is routinely mowed, preventing any shrubby vegetation from establishing. The ditch receives runoff from active areas of cultivation, which are approximately 10 feet from its banks on either side. The southern portion of the ditch begins to develop a narrow wooded buffer before flowing off site.

DOH-009 is an ephemeral ditch that begins as a swale that collects runoff from the surrounding cultivated area before developing a defined bed and bank. The channel is poorly defined, but approximately 4.5 feet at the top of bank. The majority of the channel and banks are vegetated, with grasses that appear to be regularly mowed. DOH-009 discharges directly into DOH-008.

DOH-010 is an intermittent ditch that collects runoff from active cultivated areas and flows southeast towards County Highway 8-C. The channel within the crops is approximately 4.5 feet wide, with a maximum depth of 6 inches along its course. The ditch has a shallow trapezoidal cross section, with grassy banks that appeared to be regularly mowed.

DOH-011 is an intermittent ditch that flows southwest through a forested windrow between cultivated areas. The channel is approximately 4 feet wide at top of bank, and appears to have been historically modified to increase the channel area. The narrow forested buffer between the ditch and crop area is

primarily comprised of mature trees (oaks and maples) and weedy vegetation (such as multiflora rose and blackberry). The ditch had approximately 6 inches of water flowing through it at the time of the survey.

DOH-012 is a recently excavated/cleared, man-made ephemeral ditch that collects runoff from several swales and discharges to DOH-011. At the time of the survey, the castings were still present just outside of the channel, which indicated recent excavation to clear the channel. The channel is approximately 3 feet wide at top of bank, and at the time of the survey had 6 inches of water flowing through it.

DOH-013 is a modified perennial ditch that drained several cultivated areas. The channel was approximately 5.5 feet wide at the top of bank and, at the time of the survey, had up to 9 inches of water depth in areas. The ditch lacks any significant buffer between it and the surrounding farm field, with crops likely approaching the edge during some planting seasons.

DOH-014 is a modified intermittent ditch that was excavated along the northern field edge, the same field through which DOH-013 runs. DOH-014 flows along the edge of a woodlot before discharging into DOH-013. The top of bank of the channel is approximately 3 feet wide, with up to 9 inches of water in parts of the ditch at the time of the survey. Along the northern portion bordering the woodlot, the channel was much calmer and contained a high number of tadpoles.

DOH-015 is another recently excavated, man-made ephemeral ditch along the edge of a cultivated area, with the castings still present along the banks of the ditch. The ditch is relatively deep, with depths over 15 inches. This led to the ditch scoring relatively high on the HHEI.

DOH-016 is a recently excavated, man-made ephemeral ditch along the edge of a crop area, with the castings still present along the banks of the ditch. It is not nearly as deep as DOH-015, with only 4 inches of standing water throughout.

DOH-017 is an ephemeral roadside stormwater ditch that runs along the western edge of Mobley Road. The ditch is 3.5 feet wide at top of bank, and at the time of the survey had only 3 inches of standing water throughout.

DOH-018 is an intermittent ditch that collects runoff from the surrounding crop area before flowing west into a large woodlot. The ditch is approximately 2.5 feet wide and at the time of the survey held 4 inches of standing water. The ditch has a minimal buffer between it and the field, and a poorly defined channel.

DOH-019 is an intermittent, modified agricultural ditch, with a typical trapezoidal cross section that is 12 feet wide at the top of banks. The shallow, sloped sides of the channel are covered in grasses, which appeared to be regularly mowed. The channel is also vegetated with grasses and rushes. The ditch appears to drain WOH-007, which was located along the woodlot edge to the south. DOH-019 flows north into DOH-020, and at the time of the survey had approximately 6 inches of standing water in areas.

DOH-020 is a perennial, modified agricultural ditch that flows southwest through several cultivated areas before discharging to Sterling Run. The ditch has a top of bank width of approximately 12 feet with a bankfull width of 6 feet. The sides are shallow and gently sloping, with full grass coverage. Towards the southern end of the ditch as it approaches Moon Road, several cobble check dams are in the channel, likely to help reduce erosion from flooding. The typical water depth at the time of the survey was 9 inches throughout, with some deeper pools up to a foot in the around the check dams. The northern portion of the ditch has steeper sides and a greater depth to the channel from the top of bank.

DOH-021 is an ephemeral ditch that drains a cultivated area located north of DOH-020. The channel is much narrower, and only 3 feet wide at the top of the bank. Similar to DOH-020, several large cobble check dams were in place along the course of the ditch.

DOH-022 is an ephemeral, roadside stormwater ditch that runs along the eastern edge of Mobley Road before flowing through a culvert and discharging into DOH-20 west of Mobley Road. The ditch has a poorly defined, narrow channel that is 2 feet wide at the bankfull. The channel had approximately 2 inches of water flowing in it at the time of the survey.

DOH-023 is an intermittent, modified roadside ditch that flows along the southern side of OH 286. The ditch is approximately 3.5 feet at top of bank, with a 1 foot-wide, wetted channel at its base. The sides of the channel are shallow and gently sloped and are vegetated with grasses.

DOH-024 is an intermittent, modified ditch that flows between active cultivated areas. The ditch has a shallow, poorly defined bed and bank, but is approximately 3 feet wide at top of bank. At the time of the survey, the channel had approximately 3 inches of water flowing in portions, with some areas being shallower. The ditch lacks any significant buffer between it and the surrounding cultivated area.

DOH-025 is an intermittent, modified roadside ditch that flows along the southern side of OH 286. The ditch is approximately 4 feet at the top of the bank, with a 2 foot-wide, wetted channel at its base. The sides of the channel are shallow and gently sloped, and are vegetated with grasses. The water depth along the channel varied, but did not exceed 4 inches, during the survey.

DOH-026 is an intermittent, modified roadside ditch that flows along the northern side of OH 286. The ditch is approximately 4 feet at the top of the bank, with a 2 foot-wide, wetted channel at its base. The sides of the channel are shallow and gently sloped, and are vegetated with grasses. The water depth along the channel varied, but did not exceed 4 inches, during the survey.

DOH-027 is a perennial that collects runoff from several large farm fields and swales before flowing southeast and discharging into SOH-001. The top of bank varies along the course, but is predominately 4.5 feet wide throughout. At the time of the survey, the maximum depth of water observed was approximately 9 inches. The stream has a narrow buffer between it and the surrounding farm field, which is comprised primarily of weedy grasses and some minor shrubs.

DOH-028 is an ephemeral, man-made roadside stormwater ditch that flows along the eastern side of US Highway 68. The channel is poorly defined and 1 foot-wide at the bankfull width, expanding to 3 feet in width at the top of the bank.

DOH-029 is a perennial, modified ditch that flows south through several cultivated areas. Within the fields, it is a typical agricultural ditch with trapezoidal cross section, approximately 12 feet wide at the top of the bank and with a 3 foot bankfull width. The banks are shallow and gently sloped. At the time of the survey it had approximately 6 inches of flowing water throughout. As the ditch flows south and enters into a woodlot it becomes SOH-001, which scores higher on the HHEI.

DOH-030 is an intermittent, modified ditch that flows west through cultivated areas before discharging to DOH-029. Ditch DOH-030 contained some deeper pooling areas that were approximately 9 inches deep. The ditch has a minor grassy buffer between it and the surrounding farm fields.

DOH-031 is an intermittent, modified ditch that flows within the interior of a windrow, just south of OH 286. The channel appears to be historically maintained for the purpose of draining the surrounding farm fields. The top of the bank is approximately 8 feet wide, with a bankfull width of 4.5 feet. The water was estimated to average a 1 foot deep along the majority of the feature, with some areas being a bit shallower due to sedimentation. Trees along the banks of the ditch are a mix of oaks, maples, and some cedars. The ditch flows south before branching, and then south again and discharged into DOH-032.

DOH-032 is a modified, intermittent ditch that drains runoff from the surrounding farm fields. The ditch has a typical trapezoidal cross section with a top of bank measurement of 12 feet and bankfull width of 4 feet. The greatest water depth along the channel was 1 foot, which was near the southeastern branch of the ditch where DOH-031 discharged. Due to the depth of the feature and bankfull width, the ditch scored relatively high on the HHEI, despite lacking any significant habitat.

DOH-033 is an intermittent, modified ditch that flows within the interior of a windrow, east of Driver Collins Road. The channel appears to be historically maintained for the purpose of draining the surrounding farm fields. The top of bank width is approximately 12 feet wide, with a bankfull width of 4 feet. During the survey, the water was estimated to average 9 inches deep along the majority of the feature, with some

areas being somewhat shallower due to sedimentation. Trees along the banks of the ditch are a mix of oaks, maples, and some cedars.

DOH-034 is an intermittent ditch located just west of Moon Road. The ditch is fed by overland runoff from the surrounding farm fields and associated swales. The ditch is relatively shallow, with gently sloped sides. The top of bank width is approximately 5 feet wide, and the bankfull width is approximately 3 feet wide. During the survey, flowing water was observed at 6 inches deep.

POH-001 is a relatively small, depressional pond (approximately 0.04 acres), likely made by landowners to allow for better stormwater storage on site. It is located inside of a windrow near WOH-001, and is heavily wooded. There no significant signs of wildlife within the pond during the survey.

POH-002 is another man-made impoundment of water that measures approximately 0.20 acres and is located just south of Mount Road. The pond appears to be man-made due to its triangular shape and straight edges. During the survey, numerous frogs and several painted turtles (*Chrysemys picta*) were observed within the pond.

POH-003 is a man-made impoundment located alongside Mobley Road. The pond is approximately 0.21 acres in size, and is located within an active goat pen. There are few trees around the perimeter, and it is assumed that the pond is primarily used for livestock watering.

POH-004 is a 0.16-acre impoundment located behind a house, to the west of Driver Collins Road. The pond appears to have been used primarily for recreation/aesthetics. The pond is ringed with mature oak trees.

SOH-001 is a recovered forested stream located east of Clements Road, flowing inside of a forested windrow. The stream is deeply cut, with the channel area located approximately 6 feet below the surrounding landscape. The steep cut banks were likely the result of erosion over time. The amount of forested buffer between the stream and upland landuse varies, with some portions having well over 100 feet to the nearest cultivated area and others having barely 20 feet. The forest portion contains a mix of trees and weedy species including the following: sugar maple (*Acer saccharum*), American elm (*Ulmus americana*), swamp white oak (*Quercus alba*), poison ivy (*Toxicodendron radicans*), and teasel (*Dipsacus fullonum*).

SOH-002 is a delineated portion of Sterling Run, which flows south through the Project Area to the west of Moon Road. The stream was relatively wide, with a top of bank width of approximately 40 feet and a bankfull width of 18 feet. During the survey, the water depth was estimated to be 3 feet or greater in some pooled areas. The depth and width resulted in the stream being scored moderately high on the HHEI, while the mature forest riparian buffer and mix of substrates led to it being identified as the only Class III waterbody in the Project Area. No fish were observed due to the high turbidity, but it is likely that some smaller minnows (normally tolerant of turbid waters) are present. It is unlikely that mussels are present, and none were observed during survey. The vegetation along the banks and riparian buffer are similar to those found along SOH-001.

SOH-003 is an ephemeral feature that draws surface runoff from cultivated areas upslope. Its bed and bank are poorly defined but present, and since the feature was not recently modified it was identified as a stream despite having a top of bank measurement of 4 feet and bankfull width of 1 foot. At the time of the survey, the water within SOH-003 was only 3 inches deep in areas.

SOH-004 is a natural, perennial stream reach that flows southwest from Moon Road before discharging to Sterling Run. The majority of the base flow within the stream is from DOH-007, which directly feeds the feature, but is broken out for scoring due to the significant difference in conditions between the two waterbodies. Stream SOH-004 is approximately 12 feet wide at top of bank, and had a bankfull width of 3 feet. At the time of the survey, the channel had pools of water approximately 6 inches deep and a narrow, forested buffer between it and the surrounding farm fields.

Table 4-2 Waterbodies Delineated in the Project Parcels

Stream ID	County	Linear Feet in Project Parcels	HHEI Score	QHEI Score	PHWH Class Designation	Flow Regime	Drainage Basin	Anticipated Jurisdictional?	Potential RTE Habitat	Mussels Observed	S R W	W H	E W H	M W H	S S H	C W H	L R W	P W S	A W S	I W S	B W	P C R	S C R
DOH-001	Brown	3,237	17	n/a	Class I	Ephemeral	Sterling Run	N	Low	No													
DOH-002	Brown	3,395	54	n/a	Class II	Perennial	Sterling Run	Y	Low	No													
DOH-003	Brown	2,722	49	n/a	Class II	Intermittent	Sterling Run	Y	Low	No													
DOH-004	Brown	1,393	28	n/a	Class I	Ephemeral	Sterling Run	N	Low	No													
DOH-005	Brown	520	28	n/a	Class I	Ephemeral	Sterling Run	N	Low	No													
DOH-006	Brown	1,089	28	n/a	Class I	Ephemeral	Sterling Run	N	Low	No													
DOH-007	Brown	2,034	38	n/a	Class II	Perennial	Sterling Run	Y	Low	No													
DOH-008	Brown	3,564	38	n/a	Class II	Perennial	Sterling Run	Y	Low	No													
DOH-009	Brown	517	28	n/a	Class I	Ephemeral	Sterling Run	N	Low	No													
DOH-010	Brown	4,476	37	n/a	Class II	Intermittent	Sterling Run	Y	Low	No													
DOH-011	Brown	2,139	36	n/a	Class II	Intermittent	Sterling Run	Y	Low	No													
DOH-012	Brown	797	26	n/a	Class I	Ephemeral	Sterling Run	N	Low	No													
DOH-013	Brown	1,254	42	n/a	Class II	Perennial	Sterling Run	Y	Low	No													
DOH-014	Brown	1,062	42	n/a	Class II	Intermittent	Sterling Run	N	Low	No													
DOH-015	Brown	874	31	n/a	Class II	Ephemeral	Sterling Run	N	Low	No													
DOH-016	Brown	1,017	26	n/a	Class I	Ephemeral	Sterling Run/Flat Run-North Fork Whiteoak Creek	N	Low	No													
DOH-017	Brown	1,001	26	n/a	Class I	Ephemeral	Flat Run-North Fork Whiteoak Creek	N	Low	No													
DOH-018	Brown	1,369	26	n/a	Class I	Ephemeral	Sterling Run	N	Low	No													
DOH-019	Brown	638	36	n/a	Class II	Intermittent	Sterling Run	Y	Low	No													
DOH-020	Brown	5,330	53	n/a	Class II	Perennial	Sterling Run	Y	Low	No													
DOH-021	Brown	435	28	n/a	Class I	Ephemeral	Sterling Run	N	Low	No													
DOH-022	Brown	1,677	18	n/a	Class I	Ephemeral	Sterling Run	N	Low	No													
DOH-023	Brown	539	37	n/a	Class II	Intermittent	Sterling Run	N	Low	No													
DOH-024	Brown	896	26	n/a	Class I	Intermittent	Sterling Run	N	Low	No													
DOH-025	Brown	6,293	28	n/a	Class I	Intermittent	Sterling Run/Fivemile Creek-East Fork Little Miami River	N	Low	No													
DOH-026	Brown	1,313	28	n/a	Class I	Intermittent	Sterling Run	N	Low	No													
DOH-027	Brown	3,460		n/a	Class II	Perennial	Sterling Run	Y	Low	No													
DOH-028	Brown	568	28	n/a	Class I	Ephemeral	Fivemile Creek-East Fork Little Miami River	N	Low	No													
DOH-029	Brown	2,444	43	n/a	Class II	Perennial	Sterling Run	Y	Low	No		X							X	X		X	
DOH-030	Brown	1,659	37	n/a	Class II	Intermittent	Sterling Run	Y	Low	No													
DOH-031	Brown	4,657	52	n/a	Class II	Intermittent	Sterling Run	Y	Low	No													
DOH-032	Brown	3,474	54	n/a	Class II	Intermittent	Sterling Run	Y	Low	No													

Table 4-2 Waterbodies Delineated in the Project Parcels

Stream ID	County	Linear Feet in Project Parcels	HHEI Score	QHEI Score	PHWH Class Designation	Flow Regime	Drainage Basin	Anticipated Jurisdictional?	Potential RTE Habitat	Mussels Observed	S R W	W H	E W H	M W H	S S H	C W H	L R W	P W S	A W S	I W S	B W	P C R	S C R
DOH-033	Brown	2,479	48	n/a	Class II	Intermittent	Sterling Run	N	Low	No													
DOH-034	Brown	934	28	n/a	Class I	Intermittent	Sterling Run	N	Low	No													
POH-001	Brown	n/a	n/a	n/a	n/a	Perennial	Sterling Run	N	Low	No													
POH-002	Brown	n/a	n/a	n/a	n/a	Perennial	Sterling Run	N	Low	No													
POH-003	Brown	n/a	n/a	n/a	n/a	Perennial	Sterling Run	N	Low	No													
POH-004	Brown	n/a	n/a	n/a	n/a	Perennial	Sterling Run	N	Low	No													
SOH-001	Brown	2,309	49	49.5	Class II	Perennial	Sterling Run	Y	Moderate	No		X							X	X			X
SOH-002	Brown	1,498	59	49.5	Class III	Perennial	Sterling Run	Y	Moderate	No		X							X	X			X
SOH-003	Brown	107	28	n/a	Class I	Ephemeral	Sterling Run	N	Low	No													
SOH-004	Brown	955	38	n/a	Class II	Perennial	Sterling Run	Y	Low	No													
Total Linear Feet		74,125																					

Notes:
HHEI – Headwater Habitat Evaluation Index
n/a – No QHEI performed
PHWH – Primary Headwater System
QHEI – Qualitative Habitat Evaluation Index
RTE – rare, threatened or endangered species
TBD – To Be Determined once a field delineation is conducted

QHEI – Scoring

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

HHEI – Scoring

< 30: Class I PHWH (typically ephemeral streams)	
30 to 50 Class II PHWH (intermittent warm water streams)	
> 50: Class II or III PHWH (depending on conditions)	
> 75: Class III PHWH (perennial cool water streams)	

5 Conclusions

The Project Area is dominated by agricultural land use (cultivated crops and pasture/hay) and modified waterbodies. 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 delineated wetlands are located within portions of old crop areas, which had likely been farmed at various times in the past. The wetlands are in cleared areas, and the lack of mature trees and saplings throughout indicate that they developed recently. Wetlands likely have developed in the area due to the high clay content of the soils leading to water retention for extended portions of the growing season. Due to the lack of mature habitat development and recent disturbance they all scored low enough on the ORAM to be considered Category 1 Wetlands. Even the relatively large wetland WOH-001 scored poorly due to the lack of mature habitat and evidence of recent recovery from disturbance. The proximity of the wetlands to disturbance and active land manipulation (for crops) also limits the scoring of the wetlands. Cardno anticipates that three wetlands (WOH-004, WOH-005, and WOH-007) would likely be jurisdictional.

In summary, Cardno delineated 4 streams, 34 ditches, and 4 ponds. Of those, 3 streams and 11 ditches are anticipated to be jurisdictional based on their likely hydrologic connectivity to a potential Water of the U.S. Similar to wetlands, final verification of stream boundaries for regulatory purposes can only be completed through a JD review by the USACE or its duly appointed representative.

Of the 42 total waterbody features found in the Project Parcels, 38 are modified, which indicates recent or ongoing manipulation. The modification of a waterbody reduces the likelihood of significant RTE species populations developing because the habitat or water chemistry is constantly impacted by manipulation and the surrounding land use.

During the field surveys, Cardno did not observe any RTE species in the Project Parcels or vicinity or mussel species in the waterbodies in the Project Parcels. The woodlots in the Project Parcels do have a modest amount of shagbark hickories, which may provide roosting habitat for bats, but Cardno did not observe the actual utilization of available habitat. The relative narrowness of the woodlots and fragmentation of wooded habitats by roads, residential land use, and farm fields reduces the likelihood of significant wildlife occurring in the Project Area.

The findings of this investigation represent a study of the Project Parcels for non-tidal wetlands and waterbodies. The findings depend on the season, the conditions at that time of year, site-specific influences (e.g. anthropogenic disturbance), and individual professional judgment. This report represents a professional estimate of the Project Parcels' wetlands and waterbodies 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.

6 References

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Hillcrest Solar Project

APPENDIX

A

SITE PHOTOS

Hillcrest Solar Project, Brown County Ohio
Wetland and Waterbody Field Delineation Surveys
Representative Photolog
April 2017

Photo: 210

Date: 04/05/2017

Description: Photo of typical agricultural area that dominated the Project Area. At the time of the survey, vast majority retained the debris from last season's harvest and had yet to be replanted for the upcoming spring season. Most fields were ringed with narrow strip of trees/windrow which served to identify property boundaries. The open fields were also typical for the upland locations near wetlands. Though having similar clayey soils, the hydrology and vegetation were no longer able to be classified as wetland supporting.



Photo: 226

Date: 04/05/2017

Description: Photo of typical upland woodland conditions. Many of the woodlots, in the interiors, had minor shrub development and were relatively open. Species observed included Beech (*Fagus grandifolia*), yellow troutlily (*Erythronium rostratum*), oaks (*Quercus*) and maples (*Acer*).



**Hillcrest Solar Project, Brown County Ohio
Wetland and Waterbody Field Delineation Surveys
Representative Photolog
April 2017**

Photo: 243

Date: 04/05/2017

Description: Photo of typical agricultural area that dominated the Project Area. Limited number of fields were actively planted with crops such as spring wheat.



Photo: 252

Date: 04/05/2017

Description: Typical photo of the interface between crop areas and isolated woodlots. Many of the woodlots were directly connected to the crop areas and had no buffer to the surrounding landuse. This type of interaction could prevent development of high quality habitat due to the constant impact of surrounding landuse (runoff and ground clearing disturbance).



**Hillcrest Solar Project, Brown County Ohio
Wetland and Waterbody Field Delineation Surveys
Representative Photolog
April 2017**

Photo: 247, DOH-022

Date: 04/05/2017

Description: Photo of typical ephemeral modified waterbody, ditch DOH-022. Many of the ditches were man-made features designed to collect runoff from the nearby crop areas and transport offsite to allow for better crop growth. Many of the ephemeral ditches were suspected to have extended periods of dry channels since the primary source of hydrology was precipitation. Due to recent rains and saturated soils, all were flowing at the time of the survey.



Photo: 159, SOH-003

Date: 04/04/2017

Description: There were few natural ephemeral streams identified in the Project Area, due to the likely historic conversion to a ditch. Stream SOH-003 was considered ephemeral due to the poorly defined bed and bank and evidence indicating limited hydrology. It was expected that the primary source of hydrology was the crop area located upslope (just in the back of the photo). The channel showed no signs of manipulation, which is why it was identified as natural.



**Hillcrest Solar Project, Brown County Ohio
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Photo: 217, DOH-015

Date: 04/05/2017

Description: Photo of recently modified intermittent ditch, DOH-015. The ditch was recently excavated to help the crop area dry out to allow for planting. The sidecast material is still present. Elsewhere on the site, a large excavator was present. The ditch was relatively deep, about 1 foot, which would match the depth of the excavator's bucket. It was unknown if the ditch would remain as a 'permanent' feature along the crop edge or be filled in once the area had dried.



Photo: 237, DOH-020

Date: 04/05/2017

Description: Ditch DOH-020 represented the typical modified intermittent ditch. It was a moderately sized agricultural ditch, with a trapezoidal cross section and sloped/vegetated banks. These types of ditches served to draw water from surrounding crop areas and provide improved growing conditions. Some of the ditches could go dry for periods of time, or have portions that were deep enough to always be wet due to groundwater infusion. The ditches often lacked significant vegetation along the banks due to seasonal mowing.



**Hillcrest Solar Project, Brown County Ohio
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April 2017**

Photo: 136, DOH-002

Date: 04/04/2017

Description: Photo of modified perennial ditch, DOH-002. Some of the ditches in the Project Area were identified as perennial, and likely were the modified courses of historic streams. The perennial ditches often exhibited more well developed vegetation on the banks, though some areas appeared to still be seasonally mowed. Vegetation along the banks was predominately weedy species though, including blackberries (*Rubus*), multiflora rose (*Rosa multiflora*), and grasses.



Photo: 155, SOH-002

Date: 04/05/2017

Description: Photo of perennial stream, SOH-002 which is a delineated portion of Sterling Run. The stream exhibited minimal signs of any modification, and was considered natural. The stream was wide at approximately 40 feet at top of bank., with pools of water estimated to be approximately 3 feet deep. The substrate within the stream was more varied, with higher amounts of gravel, cobble, and sand compared to the ditches which were primarily silty clays. Due to turbidity, no fish were observed swimming in the area.



**Hillcrest Solar Project, Brown County Ohio
Wetland and Waterbody Field Delineation Surveys
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April 2017**

Photo: 248, POH-003

Date: 04/05/2017

Description: Photo of modified perennial pond POH-003. The 0.21 acre pond was located inside of livestock enclosure, goats, and appeared to be used primarily for needs of the livestock. Due to the lack of riparian habitat along the edges and mowing of grasses, field teams did not observe any significant wildlife using the pond other than the livestock.



Photo: 106, POH-002

Date: 04/04/2017

Description: Photo of perennial pond POH-002. The feature was suspected of being a man-made impoundment due to the straight edges of the feature, but it did appear to be utilized by various wildlife, though no RTE. During the survey, field teams observed several painted turtles, numerous tadpoles and frogs, and mallards in and near the water.



**Hillcrest Solar Project, Brown County Ohio
Wetland and Waterbody Field Delineation Surveys
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April 2017**

Photo: 87, WOH-001

Date: 04/03/2017

Description: Photo of emergent portion of the wetland WOH-001. Wetland WOH-001 occupied the edges of an active agricultural area. At the time of the survey, the ground was saturated and standing water was observed in depressional areas. Clumps of common rush (*Juncus effusus*) were observed throughout in addition to wide spread crayfish burrows.



Photo: 84, WOH-001

Date: 04/04/2017

Description: Typical photo of crayfish burrow and evidence of recent predation. Crayfish burrows and saturated clay soils were common in the areas of WOH-001 nearest to the field.



Hillcrest Solar Project, Brown County Ohio
Wetland and Waterbody Field Delineation Surveys
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April 2017

Photo: 129, WOH-005

Date: 04/05/2017

Description: Wetland WOH-005 was typical of the emergent wetlands which appeared to have developed in recently abandoned/fallow fields. The wetlands were dominated by quick growing herbaceous species such as rushes and sedges, and had widespread pools of standing water on top of saturated clay soils. The lack of any significant shrubby vegetation, and recent aerial imagery, indicate the area was historically farmed and may still be manipulated if seasons are dryer than usual.



Photo: 223, WOH-007

Date: 04/05/2017

Description: Wetland WOH-007 appears to have developed in a blocked drainage ditch that ran along the side of an active pasture area. Due to the deposition of sediment and woody debris at the western end, water has been retained for extended periods of time within the wetland. This improved hydrology has allowed for cattail to colonize the area. The boundaries of the wetland were relatively distinct, with the wooded area being predominately upland species.

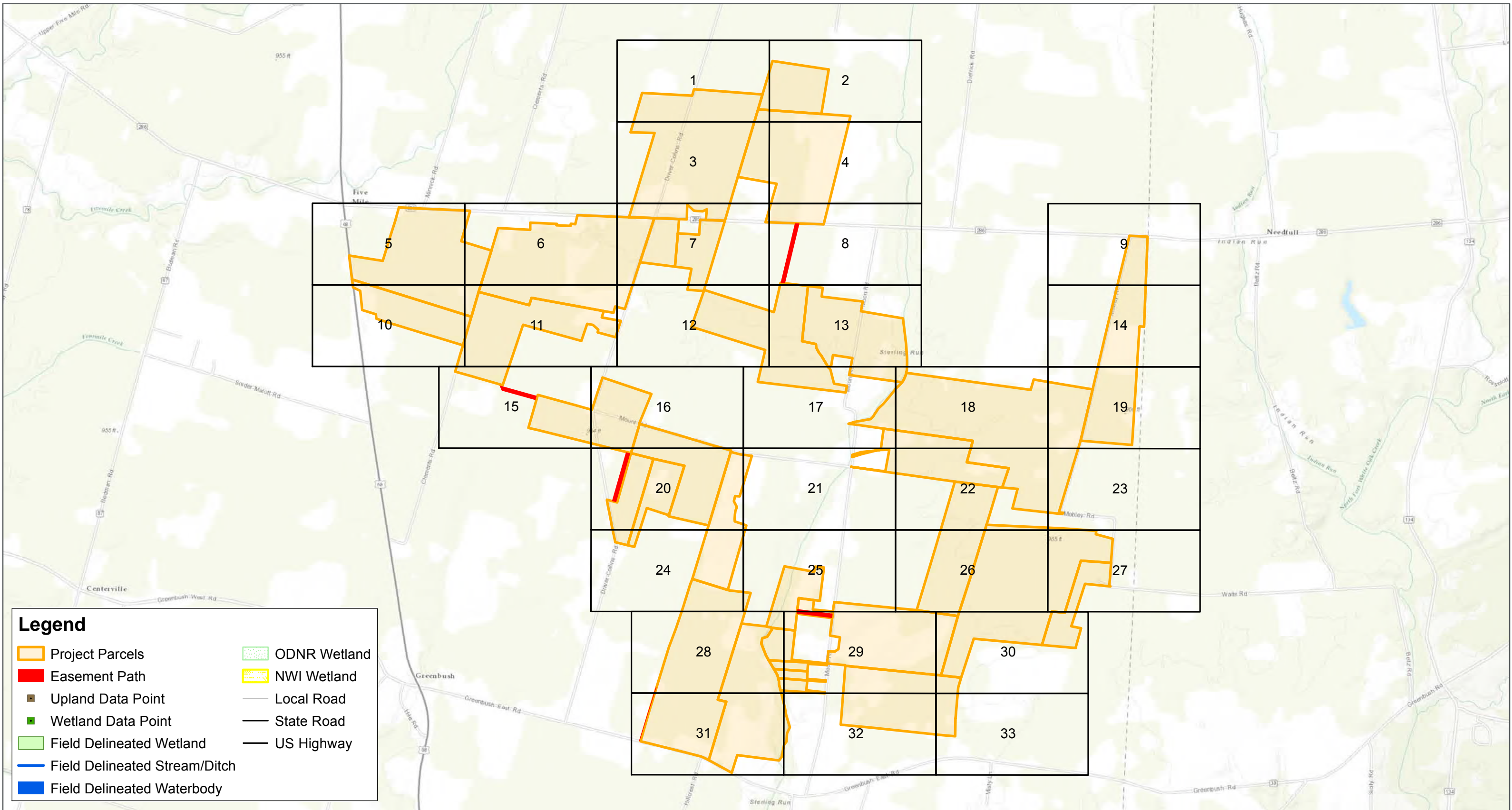


Hillcrest Solar Project

APPENDIX

B

WETLAND AND WATERBODY MAPS



Legend

Project Parcels	ODNR Wetland
Easement Path	NWI Wetland
Upland Data Point	Local Road
Wetland Data Point	State Road
Field Delineated Wetland	US Highway
Field Delineated Stream/Ditch	
Field Delineated Waterbody	

Data Source: ESRI, Open Road (2017)

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Warren County
Clinton County
Fayette County
Highland County
Clermont County
Brown County
Adams County

Locator Map

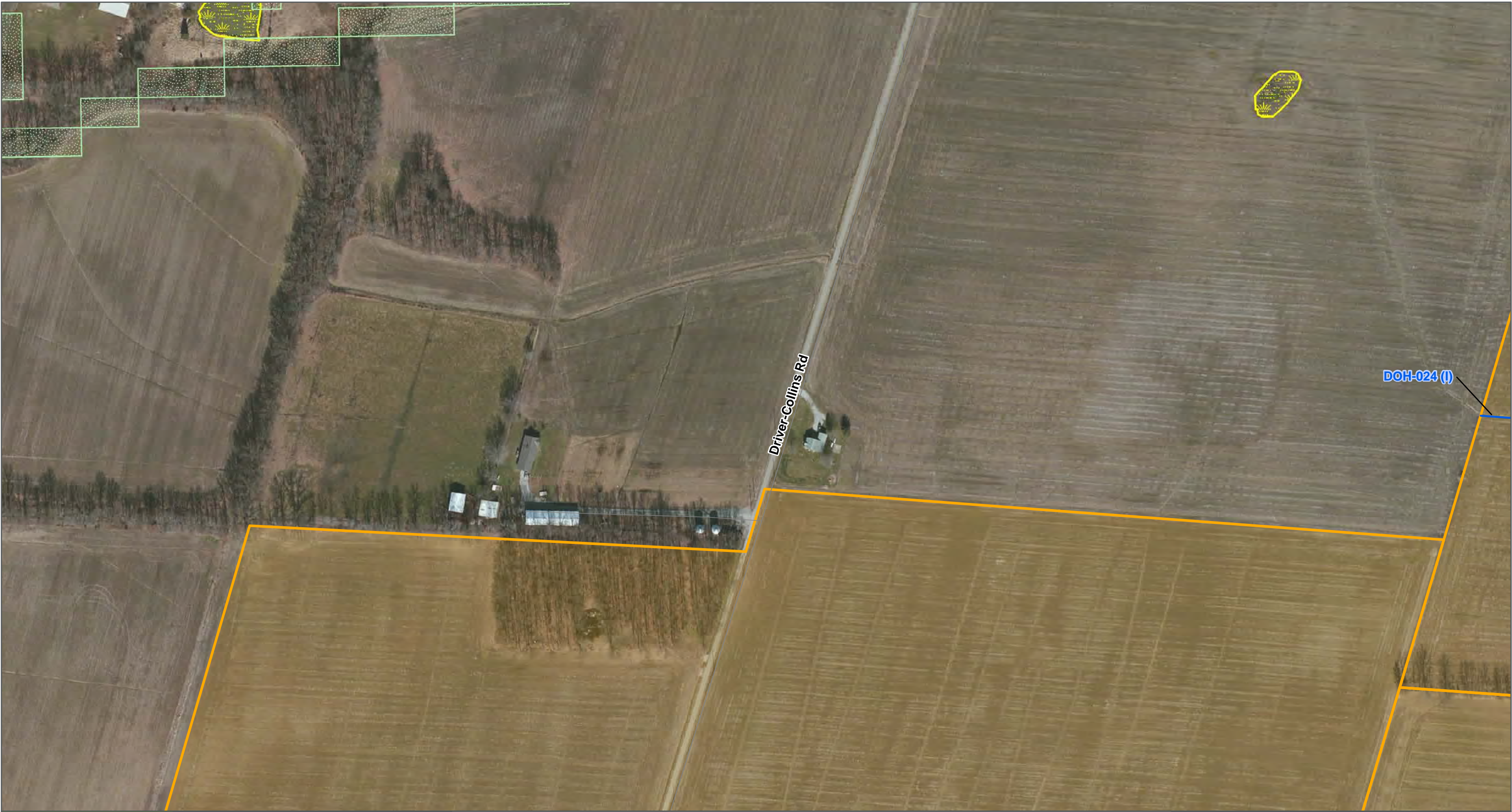
Wetland and Waterbody Maps Map Index


Republic Wind Farm
Seneca and Sandusky Counties, OH

0 1,000 2,000 3,000 4,000 5,000 Feet
0 500 1,000 1,500 Meters

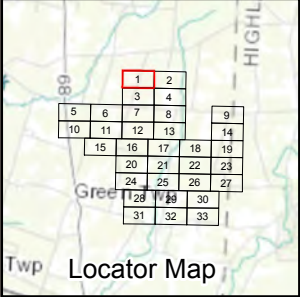
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Wetland and Waterbody Maps (Sheet 1 of 33)

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Brown County, OH

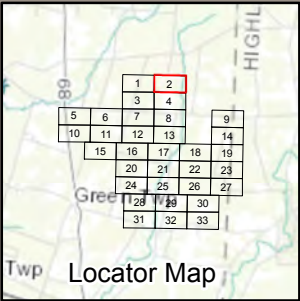


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Wetland and Waterbody Maps (Sheet 2 of 33)

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Brown County, OH

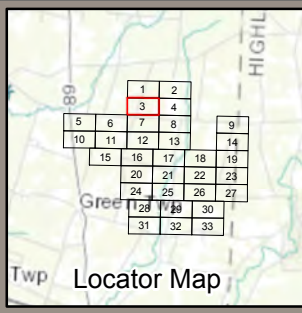


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Wetland and Waterbody Maps (Sheet 3 of 33)

Hillcrest Solar Farm
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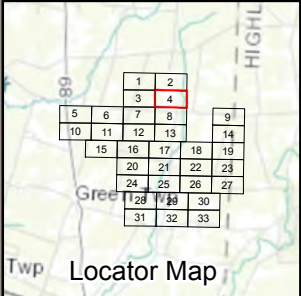
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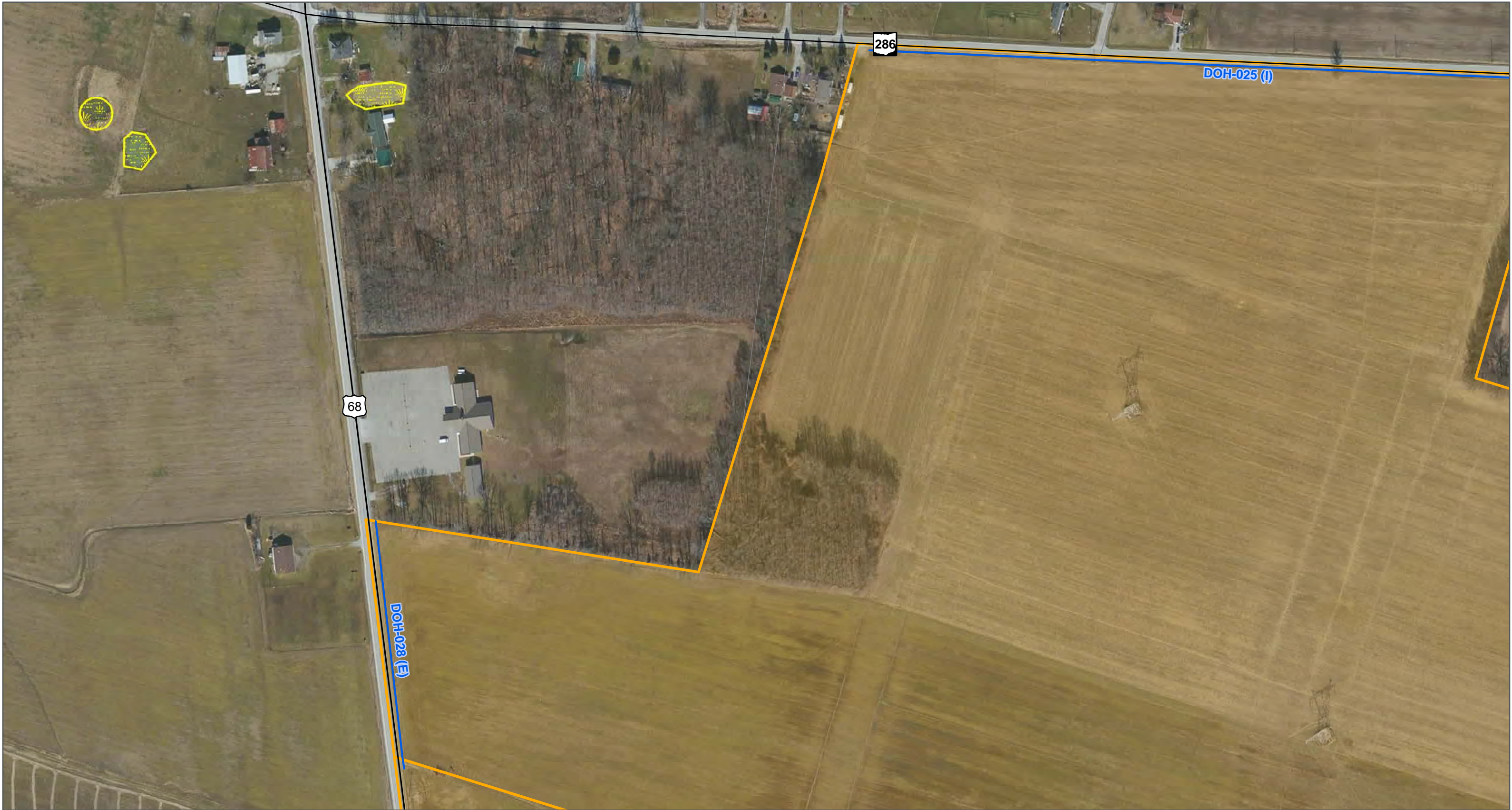
Wetland and Waterbody Maps (Sheet 4 of 33)

**Hillcrest Solar Farm
Brown County, OH**



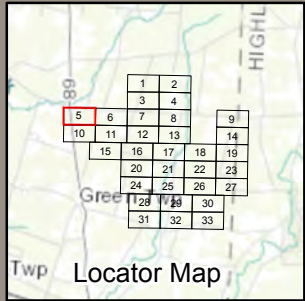


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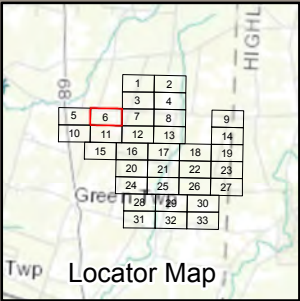


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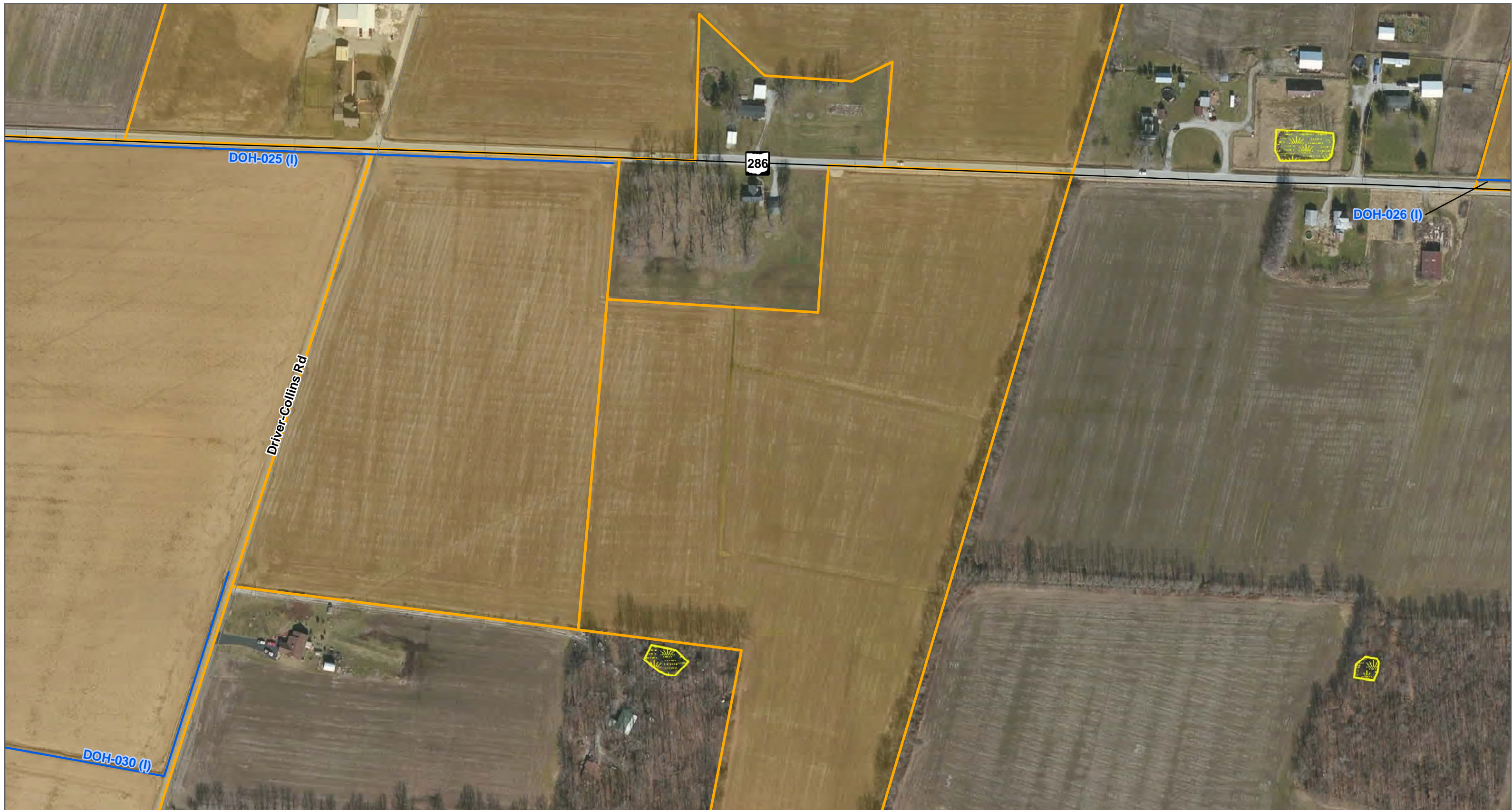


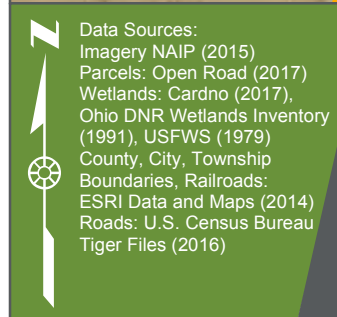
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Hillcrest Solar Farm
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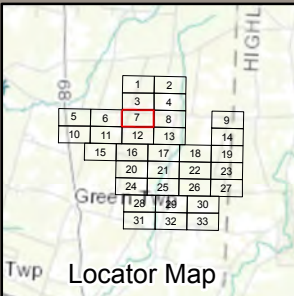
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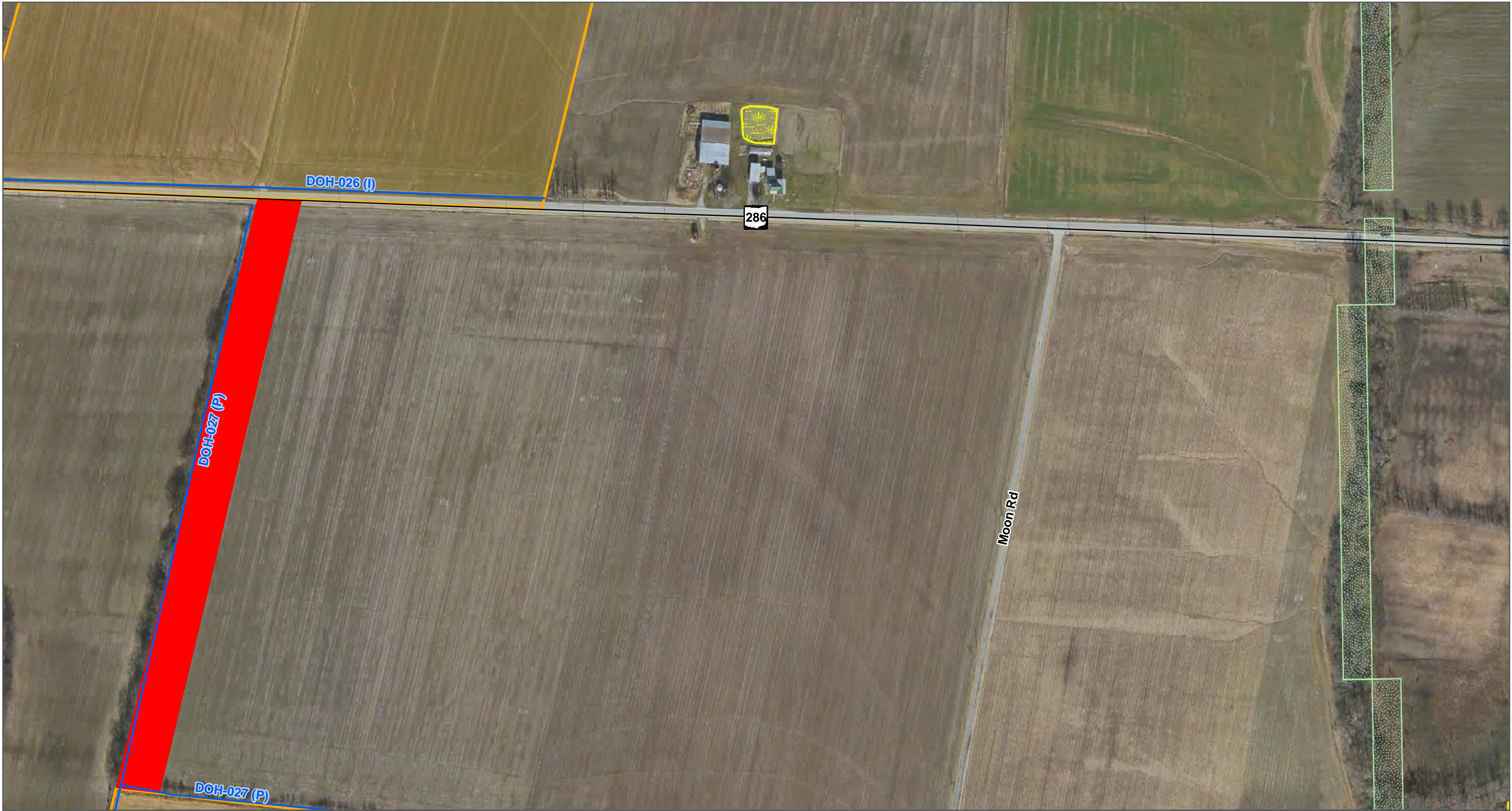
Locator Map


Wetland and Waterbody Maps (Sheet 7 of 33)

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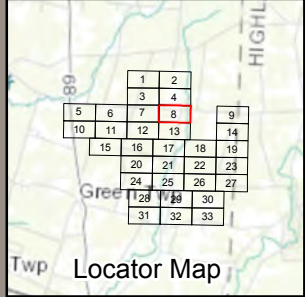


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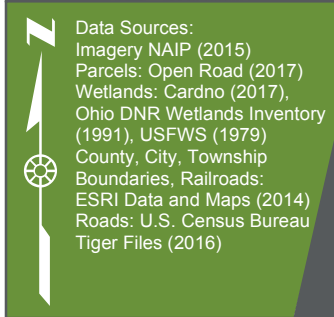
Wetland and Waterbody Maps (Sheet 8 of 33)

Hillcrest Solar Farm
Brown County, OH



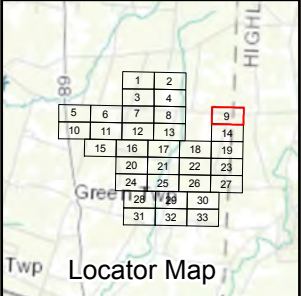
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Summary: Application - Exhibit H-02 Ecological Report electronically filed by Mr. Michael J. Settineri on behalf of Hillcrest Solar I, LLC