N DUNCAN ROAD SOLAR, LLC

SPECIAL USE PERMIT APPLICATION PACKAGE

CHAMPAIGN COUNTY, ILLINOIS

CHAMPAIGN COUNTY ZONING ORDINANCE SECTION 6.1.5

NOVEMBER 12, 2025 | FINAL VERSION

Prepared By: Kimley-Horn and Associates, Inc. and N Duncan Road Solar, LLC

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LIST OF EXHIBITS

1.0 INTRODUCTION

N Duncan Road Solar, LLC (Applicant), a subsidiary of ReWild Renewables, LLC, hereby submits this application for a Special Use Permit (Application) to construct, operate, and maintain the N Duncan Road Solar project (Project). The proposed Project is a Photovoltaic Solar Farm with a nameplate generating capacity of up to approximately 5 MW AC on approximately 46 acres (Project Area) in unincorporated Champaign County, Illinois. The subject parcel hosting the proposed Project is identified as PIN 12-14-28-201-002. The Project's proposed site layout meets all requirements of Photovoltaic (PV) Solar Farm projects per Section 6.1.5 of the Champaign County Zoning Ordinance (Zoning Ordinance) and all other applicable provisions of the Zoning Ordinance and requests no waivers or variances.

The Project will be sited on the western portion of an approximately 113-acre property southwest of the intersection of N Duncan Road and W Ford Harris Road. The Project has partnered with the landowner, T & S Franey LLC, who owns the subject parcel which will host the Project's infrastructure. The Project Area can be characterized as cultivated agricultural fields.

The proposed access of the site is located off of N Duncan Road to the east of the development. N Duncan Road is a Hensley Township road. If requested, the Applicant shall enter into a road use agreement of reasonable form and will obtain all required access permits from the applicable jurisdictions. The Applicant has already been in contact with both the Champaign County Highway Department and the City of Champaign Public Works Division, and both entities have confirmed that no road use agreement is necessary considering the quality of the County/City roads that will be used to access the Project.

The Project will deliver power to the electrical grid through a point of interconnection to an Ameren owned utility pole at the southwest corner of the property via the utility infrastructure off N Duncan Road. The Project has executed an Interconnection Agreement with Ameren, the local electric utility.

The Applicant has considered the Zoning Ordinance, most recently revised and adopted 02/23/2023, to ensure the Project meets or exceeds all the requirements of a PV Solar Farm as described in Section 6.1.5 and any other applicable provisions of the Zoning Ordinance and submits this Application, along with a formal executed application found in **Exhibit A – Special Use Permit Application** and supporting exhibits found in this Application package, to obtain a Special Use Permit from Champaign County. If the Application is approved, construction of the Project is anticipated to commence in the fall of 2026, after harvest activities on the property are complete.

2.0 PROJECT DESCRIPTION

The Project Area is currently cultivated agricultural fields. The participating parcel is zoned as AG-2, Agriculture District within Champaign County. Adjacent properties are primarily used for agricultural purposes, with a vineyard to the east of the proposed Project parcel. More generally the subject parcel sits northeast of the City of Champaign, just east of Interstate 74.

The proposed Project will be a +/- 42.9-acre (area within the fence) ground mounted solar energy system comprised of solar photovoltaic modules, a racking system, inverters, and underground electrical conduits connecting PV array blocks to the inverters. Finally, a medium voltage electrical trench will run underground and adjacent to the access road until rising on a series of utility poles utilized by the Project for safety, reliability, and metering before interconnecting with the existing Ameren utility grid. Civil and electrical design standards have been utilized which meet or exceed all local, County, State, and Federal codes and requirements.

Proposed site access to existing roads will be limited to the driveway shown within **Exhibit B – Special Use Permit Plans**. The access road, which includes a gated entrance, will be utilized for construction and maintenance access. Security fencing per National Electric Code will enclose the perimeter of the Project, with road access secured through the locked gate, with lock keys/combination provided to emergency service departments. The internal access road will be used to provide access to Project equipment for future operations and maintenance. Site access roads are typically gravel and their specific design will be verified upon final design with the geotechnical engineer and local road agent recommendations in the construction set of plans developed for submittal with the building permit application.

2.1 PROJECT CONSTRUCTION

Construction of the Project is intended to commence as early as the fall of 2026.

All equipment uses and operations will be conducted to avoid impeding the flow of traffic on adjacent roadways. Contractor shall maintain access to adjacent landowners for the duration of the Project construction. The Contractor shall be fully responsible to provide signs, barricades, warning lights, guard rails, and employ flaggers as necessary when construction endangers either vehicular or pedestrian traffic. These devices shall remain in place until the traffic may proceed normally again. Equipment will operate in the road right-of-way only to add gravel and make improvements to the proposed site access driveway. Project construction shall ensure all equipment is properly maintained and equipped with manufacturer's standard noise control devices. Dust and noise from construction will be mitigated with industry best management practices.

The Applicant is in the process of coordinating a memorandum of understanding with the business manager of the IBEW Local 601 to coordinate a commitment for the project to be constructed under a tri-trades agreement involving the International Union of Operating Engineers, the Laborers International Union of North America, and the International Brotherhood of Electrical Workers. The Applicant has committed to use best efforts to negotiate within the Project's economics to cause the contractor for the Project to execute a project labor agreement with the tri-trades, which shall comply with and allow for qualification of the Company and the Project and their respective assets to tax benefits, credits, and the like under the Internal Revenue Code of 1986, as amended, and the Inflation Reduction Act of 2022, as applicable.

2.2 HEALTH AND SAFETY

During the Building Permit process, the Project will coordinate with the appropriate fire, police, and other emergency personnel to ensure adequate plans and systems are in place in the unlikely event a safety issue emerges. Appropriate signage containing necessary contact and safety information for the PV Solar Farm will be displayed in accordance with local code and coordination with staff. Upon request, a walk-through of the site with the local authorities and emergency agencies will be scheduled once construction is complete. Emergency personnel will be given the key or code to access the facility.

2.3 OPERATIONS AND MAINTENANCE

Once constructed, the PV Solar Farm will operate throughout the year, passively generating renewable energy. The site and equipment will be designed, approved, maintained, and inspected to ensure safety and security. Maintenance activities during operation are expected to be minimal with occasional service for inverters and transformers along with vegetation maintenance. Solar panels are monitored remotely, so no full-time employees will be onsite. Traffic is not anticipated to increase during the operation period of the Project due to the minimal maintenance required, expected only a few times per year.

To prevent shading of the panels for solar energy production and promote healthy vegetation growth, an on-going vegetation management program will be implemented for all vegetated areas within the fenced boundary and buffer areas. After construction is complete and stabilized vegetation has been established within the fenced Project area, the Project will conduct vegetative management at appropriate frequency based on weather and moisture conditions. This management schedule will continue through the operational life of the Project. Reference **Exhibit C – Vegetation Maintenance Plan** for more information.

A noise study was completed to ensure compliance with the noise regulations of the Illinois Pollution Control Board. The study results indicate that the operational noise level at the nearest residential land use will be below the required thresholds. Thus, compliance is expected at the closest noise-sensitive uses. Reference **Exhibit D – Noise Assessment** for more information.

3.0 OTHER PERMITTING AND AUTHORITIES WITH JURISDICTION

3.1 FEDERAL AVIATION ADMINISTRATION (FAA)

The FAA's policy for Commercial Solar Farm Projects only requires glint and glare screening for solar projects located on federally-obligated towered airports. Since this Project is not on or near an airport, it does not require a glint and glare screening. The Applicant notes that there is a small runway to the south which hosts the Champaign County Radio Control Club. The club primarily focuses on radio controlled model airplanes, though many members participate in other facets of the hobby such as radio controlled helicopters, control line airplanes, radio controlled cars, boats and model rocketry.

Based on the result of the FAA Notice Criteria Tool, the coordinates of this Project and proposed structure heights do not exceed Notice Criteria. Thus, the Project is in compliance with FAA standards. As part of typical site discovery for the development of solar projects, the Applicant has worked through the Federal Aviation Administration's aeronautical study process and received a "determination of no hazard to air navigation" for the proposed project. The determination can be reviewed in **Exhibit E – FAA No Hazard Determination**.

3.2 FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)

The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) portal was consulted to determine if any FEMA 100-year floodplains are on the site. There are no FEMA 100-year floodplain areas located throughout the site as it is designated as Zone X. Appropriate notations have been made throughout the design, but the County may reference **Exhibit F – FEMA FIRMette** for additional information.

3.3 U.S. FISH & WILDLIFE SERVICE (USFWS)

The Project will be designed such that federally listed species will not be materially impacted or affected. Solar projects typically impose only minimal impacts on wildlife species. N Duncan Road Solar, LLC evaluated the Project's potential to impact federally protected species. The assessment, performed by Kimley-Horn, identified 5 species of plants and animals that may be present within the Project area: *Myotis sodalis* (Indiana Bat), *Grus americana* (Whooping crane), *Simpsonaias ambigua* (Salamander Mussel), *Danaus plexippus* (Monarch butterfly), and *Platanthera leucophaea* (Eastern Prairie Fringed Orchid). The design of the Project has mitigated any potential impacts to the potential species within the Project Area. The Applicant has provided the USFWS with a "No Effect" determination for these species. Reference **Exhibit G – USFWS "No Effect" Determination** for a copy of the determination referenced above.

3.4 U.S. ARMY CORP OF ENGINEERS (USACE)

Per the site field delineation performed by Olson Ecological Solutions on 11/15/2023 and 11/16/2023, one wetland was identified within the Project area. A No Permit Required (NPR) determination has been received from the USACE, dated 04/22/2025. Thus, no additional correspondence with USACE is required. See **Exhibit H – USACE Determination and Wetland Delineation Report** for additional information.

3.5 ILLINOIS DEPARTMENT OF NATURAL RESOURCES STATE ECOLOGICAL REVIEW (IDNR EcoCAT)

The Applicant consulted with IDNR for potential impacts to state threatened or endangered species. This consultation is conducted pursuant to IDNR's Ecological Compliance Assessment Tool (EcoCAT) process. EcoCAT contains the Section, Township, and Range data of the Project and generates a Project map. Species of concern within the identified Project Area (and/or which may be affected by migrating through or, by reason of the Project, avoiding the identified area) are examined as part of the EcoCAT review process. EcoCAT requires that state agencies and units of local governments consider the potential adverse effects of proposed actions on Illinois endangered and threatened species and sites listed on the Illinois Natural Areas Inventory.

The Applicant submitted an EcoCAT review request to IDNR on 02/19/2025. The Applicant received a formal response letter from IDNR's EcoCAT review, indicating that there is no record of endangered species or natural areas within the Project area. In other words, pursuant to 17 Ill. Adm. Code Part 1075, the IDNR consultation is terminated. Reference **Exhibit I – IDNR Clearance Letter** for additional information.

3.6 ILLINOIS STATE HISTORIC PRESERVATION OFFICE REVIEW (SHPO)

Under the Illinois State Agency Historic Resources Protection Act, the Illinois SHPO division at IDNR is responsible for studying possible Project effects on archaeological and/or cultural resources. Agencies requiring SHPO evaluation concurrent with their review include the Illinois Environmental Protection Agency, IDNR, and USACE.

The Project contacted the SHPO to determine if any historic or archaeological sites are located within the Project Area. A response letter provided by the SHPO, dated 04/30/2025 which notes that a Phase I archeological survey is requested to “located, identify, and record” any archeological resources that may or may not be present on site. If any resources are present, Applicant will work the SHPO officer to define necessary setbacks and other relevant requirements of the SHPA office, such information shall be included in the construction plan set that will accompany building permit application. Reference **Exhibit J – SHPO Survey Request** for more information.

3.7 ILLINOIS ENVIRONMENTAL PROTECTION AGENCY (IEPA)

IEPA’s Bureau of Water is responsible for overseeing the issuance of permits within the National Pollutant Discharge Elimination System (NPDES) program that regulates construction stormwater discharges. Permits require a Storm Water Pollution Prevention Plan (SWPPP), which is a site-specific document that outlines the measures a project will take to reduce pollutants in the stormwater discharges from a construction site. Stormwater controls reduce silt transport and sedimentation during precipitation events, ensuring no negative impacts on the neighboring properties.

Prior to construction, the Project will prepare a SWPPP as well as sediment and erosion control plans for submittal and approval for an NPDES Permit that will correspond with the construction level plans. The SWPPP will ensure construction activity compliance with guidelines and regulations for controlling sediment and erosion runoff. No construction will be complete prior to the approval of a site NPDES Permit.

At this time, the Project has prepared a preliminary Stormwater Report which confirmed that there is no increase in stormwater runoff when comparing pre-construction to post-construction conditions. As a result, no permanent stormwater features are anticipated to be necessary for this Project. It should be noted that there will be temporary stormwater features (silt fence, stabilized construction entrance/exit, hay bales, etc.) installed per construction standards during the approximately six-month construction period. Please reference **Exhibit K – Preliminary Stormwater Report** for more information.

3.8 ILLINOIS DEPARTMENT OF AGRICULTURE (IDOA)

The Illinois Renewable Energy Facilities Agricultural Impact Mitigation Act (505 ILCS 147/1 et seq.)) requires the owner of a commercial solar energy facility to have an Agricultural Impact Mitigation Agreement (AIMA) in place within 45 days prior to the commencement of Project construction. The intent of the AIMA is to preserve and/or restore the integrity of affected agricultural land during construction and decommissioning activities.

Illinois State Legislature passed Amendment to House Bill 4412 in January 2023. The Amendment requires that facility owners enter into an AIMA prior to the date of the required public hearing. N Duncan Road Solar, LLC has entered into an AIMA. Reference **Exhibit L – Fully Executed AIMA** for more information.

3.9 CITY OF CHAMPAIGN

The Applicant has coordinated with the City of Champaign in order to incorporate comments and feedback from the municipality into the Project development materials. A phone/video conference was held on October 24th, 2025, during which the Applicant met with both the Planning Manager and Zoning Administrator. Further, the City of Champaign received an initial draft of this Application when it was issued informally to Champaign County on October 20, 2025. Pursuant to Section 6.1.5(B)(2)(c), Applicant agrees that it shall submit this Application to the City of Champaign contemporaneously with its submittal to the County.

The lone, material item discussed with the City was regarding subdivision of the property as driven by a long term lease. The Applicant and City have agreed to pursue subdivision of the property only if the County grants approval of this application.

4.0 LOCAL OUTREACH AND ABUTTER COMMINICATIONS

While the Applicant recognizes that there are many potential stakeholders across Champaign County, it is Rewild Renewable's process and responsibility to place special focus on property owners, residents, and businesses in the area of the proposed development. To that end, the Applicant recognizes two particular entities in moderate proximity to the Project: Alto Vineyards, a third-generation family-owned vineyard and winery operating in Champaign since 2001 which does business approximately 1,500 feet east of the Project Area, and the nineteen-lot residential neighborhood south of the host property with access via Meridian Drive, approximately 1,000 feet south of the Project entrance. Beyond the care taken with respect to screening, location of equipment pads, and general project design, the Applicant has reached out numerous times to these stakeholders including but not limited to, (i) an introduction letter dated October 18, 2025, which included project plans, (ii) a follow up letter dated October 29, 2025, and (iii) a virtual project meeting held on November 6, 2025, where the Applicant introduced the company and the project, reviewed the plans, and held an open question and answer session.

Discussions were held directly with Ms. Karen Renzaglia of Alto Vineyards, Mr. Gary Shirley of 3002 Meridian Drive, Mr. and Mrs. Timothy Fritchley of 3009 Meridian Drive, and Mr. Steve Skoulikas of 3206 Meridian Drive. Discussions focused on a general introduction of solar and specific conversations around sound and glare among other questions typical of a Illinois community solar project. All parties expressed support for the proposed Project.

4.0 CHAMPAIGN COUNTY ZONING ORDINANCE AND OTHER LOCAL APPROVALS

The Project will comply with the Champaign County Zoning Ordinance (Zoning Ordinance), as amended through February 23, 2023, particularly Section 6.1.5, as described below and as shown on **Exhibit B – Special Use Permit Plans**.

The Project Area is located on agricultural land currently zoned as Agriculture District (AG-2). The Project will be a ground-mounted PV Solar Farm, as the term is defined in Section 3.0 of the Zoning Ordinance, comprised of solar PV modules, racking system, inverters and medium voltage transformers, and underground electrical conduits connecting PV array blocks to inverters. An access road with a gated entrance shall be located for site maintenance, maintenance of inverters, as well as construction access.

PV Solar Farms such as is herein proposed by the Applicant are governed by Section 6.1.5 Photovoltaic (PV) Solar Farm County Board Special Use Permit. Below, Applicant has provided each of the applicable requirements and standards of Section 6.1.5 and, as necessary, provides a response as to how the Project or Application conforms with the requirement.

For the administrative record, excerpts from the §6.1.5 are reproduced with reference information below in *italics* and the Applicant's response and commentary follows in standard text.

4.1 --- §6.1.5(A) PV SOLAR FARM

§ *6.1.5 (A): In what follows, PV SOLAR FARM should be understood to include COMMUNITY PV SOLAR FARM unless specified otherwise in the relevant section or paragraph.*

The Applicant hereby confirms that the proposed Project is intended for use as a community solar farm and meets the requirements of 20 ILCS 3855/1-10 for a "community renewable generation project." However, The Applicant notes for the record that the County's definition is out of date, as the current definition has been revised to increase the maximum capacity of a project to 5 MW AC.

4.2 --- §6.1.5(B) GENERAL STANDARD CONDITIONS

§ *6.1.5 (B)(1): The area of the PV SOLAR FARM County BOARD SPECIAL USE Permit must include the following minimum areas:*

§ *6.1.5 (B)(1) a. All land that will be exposed to a noise level greater than that authorized to Class A land as established by 35 Ill. Admin. Code Parts 900, 901 and 910 under paragraph 6.1.5 I.*

§ *6.1.5 (B)(1) b. All necessary access lanes or driveways and any required new PRIVATE ACCESSWAYS. For purposes of determining the minimum area of the SPECIAL USE Permit, access lanes or driveways shall be provided a minimum 40 feet wide area.*

§ *6.1.5 (B)(1) c. All necessary PV SOLAR FARM STRUCTURES and ACCESSORY STRUCTURES including electrical distribution lines, inverters, transformers, common switching stations, and substations not under the ownership of a PUBLICLY REGULATED UTILITY and all waterwells that will provide water for the PV SOLAR FARM. For purposes of determining the minimum area of the SPECIAL USE Permit, underground cable installations shall be provided a minimum 40 feet wide area.*

§ *6.1.5 (B)(1) d. All aboveground STRUCTURES and facilities shall be of a type and shall be located in a manner that is consistent with the Agricultural Impact Mitigation Agreement with the Illinois Department of Agriculture as required by paragraph 6.1.5R.*

The Applicant hereby confirms that the Project Area and the subject parcel hosting the Project Area will host all land described as necessary for inclusion in in §6.1.5(B)(1)(a)-(d) . The Applicant hereby confirms that the standards described above that are not indicated within the Special Use Permit Plan set shall be included in the construction plan set that will accompany building permit application. For expanded discussion on noise levels, please see further commentary under §6.1.5(I). For expanded discussion on the AIMA, please see further commentary under §6.1.5(R).

§ *6.1.5 (B)(2)(a): The PV SOLAR FARM County BOARD SPECIAL USE Permit shall not be located in the following areas: a. Less than one and one-half miles from an incorporated municipality that has a zoning ordinance except for any power lines of 34.5 kVA or less and any related proposed connection to an existing substation. Any request for a waiver of this minimum separation shall include the following:*

Applicant requests a waiver under this Section 6.1.5(B)(2)(a). The Project meets all criteria for a waiver and Applicant acknowledge and agrees to the notice requirements provided under Section 6.1.5(B)(2)(a). The Project is located between ½ miles and 1 ½ miles of the City of Champaign. No part of the Project is located within the contiguous growth area in the Champaign County Land Resource Management Plan. No part of the Project is located within ½ miles of the City of Champaign.

Pursuant to Section 6.1.5(B)(2)(b), Applicant understands that the County Zoning Administrator will notify the City of Champaign of the Project when the County receives this Application.

Pursuant to Section 6.1.5(B)(2)(c), Applicant agrees that it shall submit this Application to the City of Champaign contemporaneously with its submittal to the County.

Pursuant to Section 6.1.5(B)(2)(d), Applicant shall comply with relevant subdivision approval requirements.

Pursuant to Section 6.1.5(B)(2)(e), Applicant agrees that consideration of this Application shall be held over two Board meetings unless waived by the City of Champaign.

Pursuant to Section 6.1.5(B)(2)(f-h), Applicant understands and agrees to the County's procedure for notifying and including the City of Champaign as defined in those paragraphs, to the extent authorized by law.

As the Project meets all criteria for a waiver under Section 6.1.5(B)(2)(a), Applicate requests that such waiver be granted.

- *6.1.5 (B)(3)(a): The PV SOLAR FARM SPECIAL USE Permit application shall include documentation that the applicant or PV SOLAR FARM is in the queue to acquire an interconnection agreement to the power grid.*

Not applicable. See following response.

- *6.1.5 (B)(3)(b): Documentation of an executed interconnection agreement with the appropriate electric utility shall be provided prior to issuance of a Zoning Compliance Certificate to authorize operation of the PV SOLAR FARM.*

The Applicant hereby confirms that the Project has executed an interconnection agreement with Ameren and provides it to the County herein as **Exhibit N – Executed Interconnection Agreement**.

- *6.1.5 (B)(4)(a): The owners of the subject property and the Applicant, its successors in interest, and all parties to the decommissioning plan and site reclamation plan hereby recognize and provide for the right of agricultural activities to continue on adjacent land consistent with the Right to Farm Resolution 3425.*

The Applicant hereby recognizes and provides for the right of agricultural activities to continue on adjacent land consistent with the Right to Farm Resolution 3425.

4.3 --- §6.1.5(C) MINIMUM LOT STANDARDS

§ *6.1.5 (C)(1): There are no minimum LOT AREA, AVERAGE LOT WIDTH, SETBACK, YARD, or maximum LOT COVERAGE requirements for a PV SOLAR FARM or for LOTS for PV SOLAR FARM substations and/or for PV SOLAR FARM maintenance and management facilities.*

The Applicant hereby acknowledges the above statements on lot standards and the Special Use Permit Plan set demonstrates compliance therewith.

§ *6.1.5 (C)(2): There is no maximum LOT AREA requirement on BEST PRIME FARMLAND.*

The Applicant hereby acknowledges the above statements on lot standards and the Special Use Permit Plan set demonstrates compliance therewith.

4.4 --- §6.1.5(D) MINIMUM STANDARD CONDITIONS FOR SEPARATIONS FOR PV SOLAR FARMS FROM AJACENT USES AND STRUCTURES

§ *6.1.5 (D): The location of each PV SOLAR FARM shall provide the following required separations as measured from the exterior of the above ground portion of the PV SOLAR FARM STRUCTURES and equipment including fencing*:

§ *6.1.5 (D)(1): PV SOLAR FARM fencing shall be set back from the street centerline a minimum of 40 feet from a MINOR STREET and a minimum 55 feet from a COLLECTOR STREET and a minimum of 60 feet from a MAJOR STREET unless a greater separation is required for screening pursuant to Section 6.1.5M.2.a. but in no case shall the perimeter fencing be less than 10 feet from the RIGHT OF WAY of any STREET.*

The Applicant hereby confirms that the design proposed in the Special Use Permit Plan set accompanying this application package meets or exceeds the above standard.

§ *6.1.5 (D)(2): For properties participating in the solar farm: No required separation from any existing DWELLING or existing PRINCIPAL BUILDING except as required to ensure that a minimum zoning LOT is provided for the existing DWELLING or PRINCIPAL BUILDING.*

The Applicant hereby confirms that the design proposed in the Special Use Permit Plan set accompanying this application package meets or exceeds the above standard.

§ *6.1.5 (D)(3)(a): For properties not participating in the solar farm: For any adjacent LOT that is 10 acres or less in area (not including the STREET RIGHT OF WAY): (a) For any adjacent LOT that is bordered (directly abutting and/or across the STREET) on no more than two sides by the PV SOLAR FARM, the separation shall be no less than 240 feet from the property line. (b) For any adjacent LOT that is bordered (directly abutting and/or across the STREET) on more than two sides by the PV SOLAR FARM, the separation shall exceed 240 feet as deemed necessary by the BOARD.*

There are no such properties that are not participating in the solar farm. There is a neighboring parcel which fits the above description—12-14-28-201-003—but it is owned by the participating landowner of the parcel hosting the Project and is therefore subject to Section 6.1.5(D)(2) and not this requirement.

- § *6.1.5 (D)(3)(b): For any adjacent LOT that is more than 10 acres in area (not including the STREET RIGHT OF WAY), the separation shall be no less than 255 feet from any existing DWELLING or existing PRINCIPAL BUILDING and otherwise the perimeter fencing shall be a minimum of 10 feet from a SIDE or REAR LOT LINE. This separation distance applies to properties that are adjacent to or across a STREET from a PV SOLAR FARM.*

The Applicant hereby confirms that the design proposed in the Special Use Permit Plan set accompanying this application package meets or exceeds the above standard.

- § *6.1.5 (D)(3)(c): Additional separation may be required to ensure that the noise level required by 35 Ill. Admin. Code Parts 900, 901 and 910 is not exceeded or for other purposes deemed necessary by the BOARD.*

The Applicant hereby confirms that no additional separation is required as relevant noise level limitations are not exceeded. Please refer to **Exhibit D – Noise Memo** for more information.

- § *6.1.5 (D)(4): A separation of at least 500 feet from any of the following unless the SPECIAL USE Permit application includes results provided from an analysis using the Solar Glare Hazard Analysis Tool (SGHAT) for the Airport Traffic Control Tower cab and final approach paths, consistent with the Interim Policy, Federal Aviation Administration (FAA) Review of Solar Energy Projects on Federally Obligated Airports, or the most recent version adopted by the FAA, and the SGHAT results show no detrimental affect with less than a 500 feet separation from any of the following: a. any AIRPORT premises or any AIRPORT approach zone within five miles of the end of the AIRPORT runway; or b. any RESTRICTED LANDING AREA that is NONCONFORMING or which has been authorized by SPECIAL USE Permit and that existed on or for which there had been a complete SPECIAL USE Permit application received by April 22, 2010, or any approach zone for any such RESTRICTED LANDING AREA; or c. any RESIDENTIAL AIRPORT that existed on or for which there had been a complete SPECIAL USE Permit application received by April 22, 2010, or any approach zone for any such RESIDENTIAL AIRPORT.*

The Applicant hereby confirms that it has corresponded with the FAA and, consistent with current FAA policy, has confirmed that the design proposed in the Special Use Permit Plan set accompanying this application package meets or exceeds the above standard. The FAA has issued concurrence via the documents provided in **Exhibit E – FAA No Hazard Determination**.

- § *6.1.5 (D)(5): A separation of at least 500 feet between substations and transmission lines of greater than 34.5 kVA to adjacent dwellings and residential DISTRICTS.*

The Project does not include construction of a substation or transmission lines.

- § *6.1.5 (D)(6): Electrical inverters shall be located as far as possible from property lines and adjacent DWELLINGS consistent with good engineering practice. Inverter locations that are less than 275 feet from the perimeter fence shall require specific approval and may require special sound deadening construction and noise analysis.*

Applicant requests specific approval of the inverter locations as they are within 275 feet of the nearest perimeter fence. However, the closest property line to the inverter is 604 feet away. **Exhibit D – Noise**

Memo demonstrates that the that this distance is sufficient to meet all applicable sound requirements without additional sound deadening construction.

§ *6.1.5 (D)(7): Separation distances for any PV SOLAR FARM with solar equipment exceeding 8 feet in height, with the exception of transmission lines which may be taller, shall be determined by the BOARD on a case-by-case basis.*

The proposed panels exceed 8 feet in height (Applicant proposed a maximum height of 15 feet contemplates used of panels that are 12 feet in height). Per the provided Special Use Permit Plan set, at the closest distance, panels are located approximately 940 feet from the closest non-participating residence and will be well screened by a combination of existing and proposed vegetative screening.

As proposed, the Project meets and exceeds relevant maximum setback limitations under state law (55 ILCS 5/5-12020(e)) and exceeds County standards. Given the rural nature of the site, Applicant requests the County apply its standard separation distances for this Project and decline adoption of standards that would exceed those standards.

§ *6.1.5 (D)(8): PV SOLAR FARM solar equipment other than inverters shall be no less than 26 feet from the property line of any lot more than 10 acres in area.*

The Applicant hereby confirms that the design proposed in the Special Use Permit Plan set accompanying this application package meets or exceeds the above standard.

4.5 --- §6.1.5(E) STANDARD CONDITIONS FOR DESIGN AND INSTALLATION OF ANY PV SOLAR FARM

§ *6.1.5 (E)(1): Any building that is part of a PV SOLAR FARM shall include as a requirement for a Zoning Compliance Certificate, a certification by an Illinois Professional Engineer or Illinois Licensed Structural Engineer or other qualified professional that the constructed building conforms to Public Act 96-704 regarding building code compliance and conforms to the Illinois Accessibility Code.*

There are no buildings proposed as part of the Project.

§ *6.1.5 (E)(2): Electrical Components: a. All electrical components of the PV SOLAR FARM shall conform to the National Electrical Code as amended and shall comply with Federal Communications Commission (FCC) requirements; b. Burying power and communication wiring underground shall be minimized consistent with best management practice regarding PV SOLAR FARM construction and minimizing impacts on agricultural drainage tile.*

The Applicant hereby confirms that the design proposed in the Special Use Permit Plan set accompanying this application package meets or exceeds the above standard. Please refer to **Exhibit O – Critical Component Data Sheets** for more information on code compliance, and please refer to **Exhibit L – Fully Executed AIMA** for more information on design and construction standards Applicant has committed to with respect to drain tiles.

§ *6.1.5 (E)(3): Maximum Height. The height limitation established in Section 5.3 shall not apply to a PV SOLAR FARM. The maximum height of all above ground STRUCTURES shall be identified in the application and as approved in the SPECIAL USE Permit.*

The Applicant hereby establishes that the maximum height of above ground structures, excepting utility poles and related interconnection equipment, shall not exceed fifteen (15) feet.

§ *6.1.5 (E)(4): Warnings. A reasonably visible warning sign concerning voltage must be placed at the base of all pad-mounted transformers and substations.*

The Applicant hereby confirms that the standard described above shall be included in the construction plan set that will accompany building permit application.

§ *6.1.5 (E)(5): No construction may intrude on any easement or right-of-way for a GAS PIPELINE or HAZARDOUS LIQUID PIPELINE, an underground water main or sanitary sewer, a drainage district ditch or tile, or any other public utility facility unless specifically authorized by a crossing agreement that has been entered into with the relevant party.*

Applicant shall comply with this requirement to the extent necessary. At this time, Applicant anticipates that it will need approval from Ameren to cross an electric transmission corridor.

4.6 --- §6.1.5(F) STANDARD CONDITIONS TO MITIGATE DAMAGE TO FARMLAND

§ *6.1.5 (F)(1): All underground wiring or cabling for the PV SOLAR FARM shall be at a minimum depth of 5 feet below grade or deeper if required to maintain a minimum one foot of clearance between the wire or cable and any agricultural drainage tile or a lesser depth if so authorized by the Agricultural Impact Mitigation Agreement with the Illinois Department of Agriculture as required by paragraph 6.1.5 (R).*

The Applicant hereby confirms that the standard described above shall be included in the construction plan set that will accompany building permit application.

§ *6.1.5 (F)(2)(a): Protection of agricultural drainage tile; The applicant shall endeavor to locate all existing agricultural drainage tile prior to establishing any construction staging areas, construction of any necessary PV SOLAR FARM access lanes or driveways, construction of any PV SOLAR FARM STRUCTURES, any common switching stations, substations, and installation of underground wiring or cabling. The applicant shall contact affected landowners and tenants and the Champaign County Soil and Water Conservation District and any relevant drainage district for their knowledge of tile line locations prior to the proposed construction. Drainage districts shall be notified at least two weeks prior to disruption of tile.*

The Applicant hereby confirms that the information provided in **Exhibit P – Drain Tile Memo** will be updated with an on-the-ground survey performed by industry professionals. A copy of this survey will be made available upon request of the County and Drainage Districts will be notified in advance of any disruption if applicable.

Further, the Applicant has received a Natural Resource Information Report for the Project from the Champaign County Soil and Water District which has been provided for review in **Exhibit Q – Natural Resource Information Report**.

§ *6.1.5 (F)(2)(b): Protection of agricultural drainage tile; The location of drainage district tile lines shall be identified prior to any construction and drainage district tile lines shall be protected from disturbance as follows: (a) All identified drainage district tile lines and any known existing drainage district tile easement shall be staked or flagged prior to construction to alert construction crews of the presence of drainage district tile and the related easement; (b) Any drainage district tile for which there is no existing easement shall be protected from disturbance by a 30 feet wide no-construction buffer on either side of the drainage district tile. The no-construction buffer shall be staked or flagged prior to the start of construction and shall remain valid for the lifetime of the PV SOLAR FARM SPECIAL USE Permit and during any deconstruction activities that may occur pursuant to the PV SOLAR FARM SPECIAL USE Permit; (c) Construction shall be prohibited within any existing drainage district easement and also prohibited within any 30 feet wide no-construction buffer on either side of drainage district tile that does not have an existing easement unless specific construction is authorized in writing by all commissioners of the relevant drainage district. A copy of the written authorization shall be provided to the Zoning Administrator prior to the commencement of construction.*

The Applicant hereby confirms that the standard described above shall be included in the construction plan set that will accompany building permit application.

§ *6.1.5 (F)(2)(c): Protection of agricultural drainage tile; Any agricultural drainage tile located underneath construction staging areas, access lanes, driveways, any common switching stations, and substations shall be replaced as required in Section 6.3 of the Champaign County Storm Water Management and Erosion Control Ordinance.*

The Applicant hereby confirms that the standard described above shall be included in the construction plan set that will accompany building permit application.

§ *6.1.5 (F)(2)(d): Any agricultural drainage tile that must be relocated shall be relocated as required in the Champaign County Storm Water Management and Erosion Control Ordinance.*

The Applicant hereby confirms that the standard described above shall be included in the construction plan set that will accompany building permit application.

§ *6.1.5 (F)(2)(e): Conformance of any relocation of drainage district tile with the Champaign County Storm Water Management and Erosion Control Ordinance shall be certified by an Illinois Professional Engineer. Written approval by the drainage district shall be received prior to any backfilling of the relocated drain tile and a copy of the approval shall be submitted to the Zoning Administrator. As-built drawings shall be provided to both the relevant drainage district and the Zoning Administrator of any relocated drainage district tile.*

The Applicant hereby confirms that the standard described above shall be included in the construction plan set that will accompany building permit application.

§ *6.1.5 (F)(2)(f): All tile lines that are damaged, cut, or removed shall be staked or flagged in such manner that they will remain visible until the permanent repairs are completed.*

The Applicant hereby confirms that the standard described above shall be included in the construction plan set that will accompany building permit application.

§ *6.1.5 (F)(2)(g): All exposed tile lines shall be screened or otherwise protected to prevent the entry into the tile of foreign materials, loose soil, small mammals, etc.*

The Applicant hereby confirms that the standard described above shall be included in the construction plan set that will accompany building permit application.

§ *6.1.5 (F)(2)(h): Permanent tile repairs shall be made within 14 days of the tile damage provided that weather and soil conditions are suitable or a temporary tile repair shall be made. Immediate temporary repair shall also be required if water is flowing through any damaged tile line. Temporary repairs are not needed if the tile lines are dry and water is not flowing in the tile provided the permanent repairs can be made within 14 days of the damage. All permanent and temporary tile repairs shall be made as detailed in the Agricultural Impact Mitigation Agreement with the Illinois Department of Agriculture as required by paragraph 6.1.5 (R) and shall not be waived or modified except as authorized in the SPECIAL USE Permit.*

The Applicant hereby confirms that the standard described above shall be included in the construction plan set that will accompany building permit application.

§ *6.1.5 (F)(2)(i): All damaged tile shall be repaired so as to operate as well after construction as before the construction began.*

The Applicant hereby confirms that the standard described above shall be included in the construction plan set that will accompany building permit application.

§ *6.1.5 (F)(2)(j): Following completion of the PV SOLAR FARM construction, the applicant shall be responsible for correcting all tile line repairs that fail, provided that the failed repair was made by the Applicant.*

The Applicant hereby confirms that the standard described above shall be included in the construction plan set that will accompany building permit application.

§ *6.1.5 (F)(3): All soil conservation practices (such as terraces, grassed waterways, etc.) that are damaged by PV SOLAR FARM construction and/or decommissioning shall be restored by the applicant to the pre-PV SOLAR FARM construction condition in a manner consistent with the Agricultural Impact Mitigation Agreement with the Illinois Department of Agriculture as required by paragraph 6.1.5 (R).*

The Applicant hereby confirms that the standard described above shall be included in the construction plan set that will accompany building permit application.

§ *6.1.5 (F)(4): Topsoil replacement. For any open trenching required pursuant to PV SOLAR FARM construction, the topsoil shall be stripped and replaced as follows: a. The top 12 inches of topsoil shall first be stripped from the area to be trenched and from an adjacent area to be used for subsoil storage. The topsoil shall be stored in a windrow parallel to the trench in such a manner that that it will not become intermixed with subsoil materials; b. All subsoil material that is removed from the trench shall be placed in the second adjacent stripped windrow parallel to the trench but separate* *from the topsoil windrow; c. In backfilling the trench, the stockpiled subsoil material shall be placed back into the trench before replacing the topsoil; d. The topsoil must be replaced such that after settling occurs, the topsoil's original depth and contour (with an allowance for settling) will be restore; e. All topsoil shall be placed in a manner consistent with the Agricultural Impact Mitigation Agreement with the Illinois Department of Agriculture as required by paragraph 6.1.5 (R).*

The Applicant hereby confirms that the standard described above shall be included in the construction plan set that will accompany building permit application.

§ *6.1.5 (F)(5): Mitigation of soil compacting and rutting. a. The Applicant shall not be responsible for mitigation of soil compaction and rutting if exempted by the PV SOLAR FARM lease; b. Unless specifically provided for otherwise in the PV SOLAR FARM lease, the Applicant shall mitigate soil compaction and rutting for all areas of farmland that were traversed with vehicles and construction equipment or where topsoil is replaced in open trenches; c. All mitigation of soil compaction and rutting shall be consistent with the Agricultural Impact Mitigation Agreement with the Illinois Department of Agriculture as required by paragraph 6.1.5 (R).*

The Applicant hereby confirms that the standard described above shall be included in the construction plan set that will accompany building permit application.

§ *6.1.5 (F)(6): Land leveling. a. The Applicant shall not be responsible for leveling of disturbed land if exempted by the PV SOLAR FARM lease; b. Unless specifically provided for otherwise in the PV SOLAR FARM lease, the Applicant shall level all disturbed land as follows: (a) Following the completion of any open trenching, the applicant shall restore all land to its original pre- construction elevation and contour; (b) Should uneven settling occur or surface drainage problems develop as a result of the trenching within the first year after completion, the applicant shall again restore the land to its original pre-construction elevation and contour; c. All land leveling shall be consistent with the Agricultural Impact Mitigation Agreement with the Illinois Department of Agriculture as required by paragraph 6.1.5R.*

The Applicant hereby confirms that the standard described above shall be included in the construction plan set that will accompany building permit application.

§ *6.1.5 (F)(7)(a): Permanent Erosion and Sedimentation Control Plan; a. Prior to the approval of any Zoning Use Permit, the Applicant shall provide a permanent soil erosion and sedimentation plan for the PV SOLAR FARM including any access road that conforms to the relevant Natural Resources Conservation Service guidelines and that is prepared by an Illinois Licensed Professional Engineer.*

The Applicant has provided for review herein **Exhibit K – Preliminary Stormwater Report, Exhibit C – Vegetation Management Plan,** and **Exhibit R – Preliminary Operations & Maintenance Plan** which preliminarily denote the permanent erosion control plan throughout the lifecycle of the project.

§ *6.1.5 (F)(7)(b):* Permanent Erosion and Sedimentation Control Plan; b. As-built documentation of all permanent soil erosion and sedimentation improvements for the PV SOLAR FARM including any access road prepared by an Illinois Licensed Professional Engineer shall be submitted and accepted by the Zoning Administrator prior to approval of any Zoning Compliance Certificate.

The Applicant hereby accepts this standard as a condition of approval typical of solar projects in the State of Illinois.

§ *6.1.5 (F)(8): Retention of all topsoil. No topsoil may be removed, stripped, or sold from the proposed SPECIAL USE Permit site pursuant to or as part of the construction of the PV SOLAR FARM.*

Applicant confirms that the no topsoil will be removed, stripped or sold and that topsoil shall be managed as authorized by the Zoning Ordinance and the AIMA.

§ *6.1.5 (F)(9): Minimize disturbance to BEST PRIME FARMLAND; a. Any PV SOLAR FARM to be located on BEST PRIME FARMLAND shall minimize the disturbance to BEST PRIME FARMLAND as follows: (a) The disturbance to BEST PRIME FARMLAND caused by construction and operation of the PV SOLAR FARM shall be minimized at all times consistent with good engineering practice; (b) Disturbance to BEST PRIME FARMLAND shall be offset by establishment of a vegetative ground cover within the PV SOLAR FARM that includes the following: i. The vegetative ground cover shall use native plant species as much as possible and shall be based on a site assessment of the site geography and soil conditions; ii. The species selected shall serve a secondary habitat purpose as much as possible; iii. Maintenance of the vegetative ground cover shall use a combination of management approaches to ensure safe, cost-effective, reliable maintenance while minimizing environmental risks; iv. The plan to establish and maintain a vegetative ground cover that includes native plant species as much as possible shall be detailed in a landscape plan included in the PV SOLAR FARM SPECIAL USE Permit application. The landscape plan shall include the weed control plan required by Section 6.1.5 P.3.*

The Applicant confirms that the Project will adhere to the County best prime farmland requirements. The provided vegetation management plan lists seed mixes that were designed based on the specific site soil conditions and consist of native pollinators which meets or exceeds the standards listed in this section of the Zoning Ordinance.

4.7 --- §6.1.5(G) STANDARD CONDITIONS FOR USE OF PUBLIC STREETS

§ *6.1.5 (G)(1) Any PV SOLAR FARM Applicant proposing to use any County Highway or a township or municipal STREET for the purpose of transporting PV SOLAR FARM or Substation parts and/or equipment for construction, operation, or maintenance of the PV SOLAR FARM or Substation(s), shall identify all such public STREETS and pay the costs of any necessary permits and the costs to repair any damage to the STREETS caused by the PV SOLAR FARM construction, as follows: Prior to the close of the public hearing before the BOARD, the Applicant shall enter into a Roadway Upgrade and Maintenance agreement approved by the County Engineer and State's Attorney; or Township Highway Commissioner; or municipality where relevant, except for any COMMUNITY PV SOLAR FARM for which the relevant highway authority has agreed in writing to waive the requirements of subparagraphs 6.1.5G.1, 6.1.5G.2, and 6.1.5G.3, and the signed and executed Roadway Upgrade and Maintenance agreements must provide for the following minimum conditions.*

The Applicant hereby recognizes the minimum conditions of §6.1.5(G)(1)(a) through (bb) and will enter into a Roadway Upgrade and Maintenance Agreement or similar document to memorialize such conditions if the relevant highway authority requires such. It is the Applicant's experience that such Agreements are likely to be waived as the Champaign County Highway Department County Engineer has informed Applicant that such agreement is not likely to be required for smaller projects similar to the project proposed herein.

§ *6.1.5 (G)(2): A condition of the County Board SPECIAL USE Permit approval shall be that the Zoning Administrator shall not authorize a Zoning Use Permit for the PV SOLAR FARM until the County Engineer and State's Attorney, or Township Highway Commissioner, or municipality where relevant,* *has approved a Transportation Impact Analysis provided by the Applicant and prepared by an independent engineer that is mutually acceptable to the Applicant and the County Engineer and State's Attorney, or Township Highway Commissioner, or municipality where relevant, that includes the following [information].*

The Applicant hereby recognizes the minimum required information listed in §6.1.5(G)(2)(a-d) and confirms that the details provided in **Exhibit S – Transportation Access Plan** meets or exceeds the requirement. The construction phase of the solar farm is anticipated to be completed within 6 months, with minimal traffic impact. Upon completion of construction, the operational phase of the site is anticipated to generate no more than quarterly visits to the site for typical maintenance.

§ *6.1.5 (G)(3): At such time as decommissioning takes place, the Applicant or its successors in interest shall enter into a Roadway Use and Repair Agreement with the appropriate highway authority.*

The Applicant hereby agrees to such a standard and will enter into a Roadway Upgrade and Maintenance Agreement or similar document if the relevant highway authority requires such.

4.8 --- §6.1.5(H) THROUGH §6.1.5(L)

§ *6.1.5 (H)(1-3): Standard Conditions for Coordination with Local Fire Protection District: (1) The Applicant shall submit to the local fire protection district a copy of the site plan. (2) Upon request by the local fire protection district, the Owner or Operator shall cooperate with the local fire protection district to develop the fire protection district's emergency response plan. (3) Nothing in this section shall alleviate the need to comply with all other applicable fire laws and regulations.*

The Applicant hereby accepts the requirements outlined in 6.1.5 (H)(1-3) as a condition of approval and shall seek comments from local fire protection district. All reasonable comments received shall be included in the construction plan set that will accompany building permit application.

§ *6.1.5 (I)(1-4): Standard Conditions for Allowable Noise Level: (1) Noise levels from any PV SOLAR FARM shall be in compliance with the applicable Illinois Pollution Control Board (IPCB) regulations (35 Illinois Administrative Code, Subtitle H: Noise, Parts 900, 901, 910).(2) The Applicant shall submit manufacturer's sound power level characteristics and other relevant data regarding noise characteristics of proposed PV SOLAR FARM equipment necessary for a competent noise analysis.* (3) *The Applicant, through the use of a qualified professional, as part of the siting approval application process, shall appropriately demonstrate compliance with the above noise requirements as follows: [truncated for space]. (4) After construction of the PV SOLAR FARM, the Zoning Administrator shall take appropriate enforcement action as necessary to investigate noise complaints in order to determine the validity of the complaints and take any additional enforcement action as proves warranted to stop any violation that is occurring, including but not limited to the following: [truncated for space].*

The Applicant hereby recognizes the required information listed in §6.1.5(I)(1-3) and confirms that the details provided in **Exhibit D – Noise Assessment** meets or exceeds the requirements. Further, the Applicant recognizes §6.1.5(I)(4) as a condition of approval.

§ *6.1.5 (J): Standard Conditions for Endangered Species Consultation: The Applicant shall apply for consultation with the Endangered Species Program of the Illinois Department of Natural Resources. The Application shall include a copy of the Agency Action Report from the Endangered Species Program of the Illinois Department of Natural Resources or, if applicable, a copy of the Detailed Action Plan Report submitted to the Endangered Species Program of the Illinois Department of Natural Resources and a copy of the response from the Illinois Department of Natural Resources.*

The Applicant has completed consultation with the Endangered Species Program of the Illinois Department of Natural Resources and has provided the resulting Natural Resource Review Results in **Exhibit I – IDNR Clearance Letter** which concludes that there will be no effect resulting from the Project.

- *6.1.5 (K): Standard Conditions for Historic and Archaeological Resources Review: The Applicant shall apply for consultation with the State Historic Preservation Officer of the Illinois Department of Natural Resources. The Application shall include a copy of the Agency Action Report for the State Historic Preservation Officer of the Illinois Department of Natural Resources.*

The Applicant has consulted with the State Historic Preservation Officer of the Illinois Department of Natural Resources and has provided the resulting Survey Request in **Exhibit J – SHPO Survey Request** which notes that a Phase I archeological survey is requested to “located, identify, and record” any archeological resources that may or may not be present on site. If any resources are present, Applicant will work the SHPO officer to define necessary setbacks and other relevant requirements of the SHPA office, such information shall be included in the construction plan set that will accompany building permit application.

- *6.1.5 (L): Standard Conditions for Acceptable Wildlife Impacts: The PV SOLAR FARM shall be located, designed, constructed, and operated so as to avoid and if necessary mitigate the impacts to wildlife to a sustainable level of mortality.*

The Applicant hereby confirms that the design will be located and installed to minimize impacts to wildlife. The Applicant has completed consultation with the Endangered Species Program of the Illinois Department of Natural Resources and has provided the resulting Natural Resource Review Results in **Exhibit I – IDNR Clearance Letter** which concludes that there will be no effect resulting from the Project.

4.9 --- §6.1.5(M) SCREENING AND FENCING

- *6.1.5 (M)(1): Perimeter Fencing: a. PV SOLAR FARM equipment and structures shall be fully enclosed and secured by a fence with a minimum height of 7 feet. b. Knox boxes and keys shall be provided at locked entrances for emergency personnel access. c. Vegetation between the fencing and the LOT LINE shall be maintained such that NOXIOUS WEEDS ae controlled or eradicated consistent with the Illinois Noxious Weed Law (505 ILCS 100/1 et. seq.). Management of the vegetation shall be explained in the application.*

The Applicant hereby confirms that the design proposed in the Special Use Permit Plan set accompanying this application package meets or exceeds the above standard. Further, the Applicant directs the Board’s attention to **Exhibit C – Vegetation Management Plan** for a detailed explanation concerning the requirements of §6.1.5(M)(1).

- *6.1.5 (M)(2)a(a): A visual screen shall be provided around the perimeter of the PV SOLAR FARM as follows: (a) The visual screen shall be provided for any part of the PV SOLAR FARM that is visible to and located within 1,000 feet of an existing DWELLING or residential DISTRICT except that the visual screen may not be required within the full 1,000 feet of an existing DWELLING or residential DISTRICT provided the Applicant submits a landscape plan prepared by an Illinois Registered Landscape Architect and the BOARD finds that the visual screen in the landscape plan provides adequate screening. However, the visual screen shall not be required if the PV SOLAR FARM is not visible to a DWELLING or residential DISTRICT by virtue of the existing topography.*

The Applicant recognized the importance of proper screening as defined in the County Ordinance. In summary, the Applicant states that the Project's nearest solar panel (i) to the public way known as North Duncan Road or County Road 900E is approximately 1,500 feet to the west and (ii) to the nearest dwelling is approximately 925 feet north. Focusing on the dwelling, there are two existing and mature tree lines in between the parcel hosting the Project (12-14-28-201-002) and the parcel hosting the dwelling (12-14-28-251-002).

In order to meet the requirements of this §6.1.5(M)(2)a(a) the Applicant has proposed a detailed Landscape Plan as part of the Special Use Permit Plan set accompanying this application package which meets or exceeds the above standard.

§ *6.1.5 (M)(2)a(b): A visual screen shall be provided around the perimeter of the PV SOLAR FARM as follows: (b) The visual screen shall be waived if the owner(s) of a relevant DWELLING(S) have agreed in writing to waive the screening requirement and a copy of the written waiver is submitted to the BOARD or GOVERNING BODY.*

The Applicant does not ask for this visual screen requirement to be waived.

§ *6.1.5 (M)(2)a(c)(i): The visual screen shall be a vegetated buffer as follows: i. A vegetated visual screen buffer that shall include a continuous line of native evergreen foliage and/or native shrubs and/or native trees and/or any existing wooded area and/or plantings of tall native greases and other native flowering plants and/or an area of agricultural crop production that will conceal the PV SOLAR FARM from view from adjacent abutting property may be authorized as an alternative visual screen subject to specific conditions.*

The Applicant hereby confirms that the design proposed in the Special Use Permit Plan set accompanying this application package meets or exceeds the above standard. The screening consists of existing buffer that will be enhanced, as necessary, by proposed plantings.

§ *6.1.5 (M)(2)a(c)(ii): The visual screen shall be a vegetated buffer as follows: ii. Any vegetation that is part of the approved visual screen buffer shall be maintained in perpetuity of the PV SOLAR FARM. If the evergreen foliage below a height of 7 feet disappears over time, the screening shall be replaced.*

The Applicant hereby accepts this requirement as a condition of approval.

§ *6.1.5 (M)(2)a(c)(iii): The visual screen shall be a vegetated buffer as follows: (iii) The continuous line of native evergreen foliage and/or native shrubs and/or native trees shall be planted at a minimum height of 5 feet tall and shall be planted in multiple rows as required to provide a 50% screen within 2 years of planting. The planting shall otherwise conform to Natural Resources Conservation Service Practice Standard 380 Windbreak/Shelterbreak Establishment except that the planting shall be located as close as possible to the PV SOLAR FARM fence while still providing adequate clearance for maintenance.*

The Applicant hereby confirms that the design proposed in the Special Use Permit Plan set accompanying this application package meets or exceeds the above standard.

- § *6.1.5 (M)(2)a(c)(iv): The visual screen shall be a vegetated buffer as follows: (iv) A planting of tall native grasses and other native flowing plants may be used as a visual screen buffer for any PV module installation that is no more than 8 feet tall provided that the width of planting shall be authorized by the BOARD and the planting shall otherwise be planted and maintained per the recommendations of the Natural Resources Conservation Service Practice Standard 327 Conservation Cover and further provided that the PV SOLAR FARM perimeter fence is opaque.*

Not applicable, Applicant is requesting facilities of over eight feet in height.

- § *6.1.5 (M)(2)a(c)(v): The visual screen shall be a vegetated buffer as follows: (v) An area of agricultural crop production may also be authorized by the BOARD as an alternative visual screen buffer with a width of planting as authorized by the BOARD provided that the PV SOLAR FARM perimeter fence is opaque. Any area of crop production that is used as a vegetated visual screen shall be planted annually and shall be replanted as necessary to ensure a crop every year regardless of weather or market conditions.*

Not applicable. Applicant is not seeking to use an agricultural crop buffer.

- § *6.1.5 (M)(2)a(c)(vi): The visual screen shall be a vegetated buffer as follows: (vi) Any vegetated screen buffer shall be detailed in a landscape plan drawing that shall be included with the PV SOLAR FARM SPECIAL USE Permit application.*

The Applicant hereby confirms that the design proposed in the Special Use Permit Plan set accompanying this application package meets or exceeds the above standard.

4.10 --- §6.1.5(N) THROUGH §6.1.5(T)

- § *6.1.5 (N): Standard Conditions to Minimize Glare: (1) The design and construction of the PV SOLAR FARM shall minimize glare that may affect adjacent properties and the application shall include an explanation of how glare will be minimized; (2) After construction of the PV SOLAR FARM, the Zoning Administrator shall take appropriate enforcement action as necessary to investigate complaints of glare in order to determine the validity of the complaints and take any additional enforcement action as proves warranted to stop any significant glare that is occurring, including but not limited to the following:*

The Applicant hereby recognizes the required information listed in §6.1.5(N)(1) and confirms that the details provided in **Exhibit T – Glare Study** meets or exceeds the requirements. Further, the Applicant recognizes §6.1.5(N)(2) as a condition of approval.

- § *6.1.5 (O): Standard Condition for Liability Insurance: (1) The Owner or Operator of the PV SOLAR FARM shall maintain a current general liability policy covering bodily injury and property damage with minimum limits of at least $5 million per occurrence and $5 million in the aggregate. (2) The general liability policy shall identify landowners in the SPECIAL USE Permit as additional insured.*

The Applicant hereby recognizes and accepts the required information listed in §6.1.5(O) and confirms that proof of required coverage and additional insured will accompany the building permit application.

- § *6.1.5 (P): Operational Standard Conditions: (1) Maintenance; (2) Materials Handling, Storage and Disposal; (3) Vegetation Management [truncated for space].*

The Applicant hereby recognizes and accepts the required information listed in §6.1.5(P) and confirms that such requirement will be included in the Project's operations and maintenance manual, a sample of which has been provided in **Exhibit R – Preliminary Operations & Maintenance Plan**. Further, the Applicant directs the Board's attention to **Exhibit C – Vegetation Management Plan** for a detailed explanation concerning the requirements of §6.1.5(P)(3).

- § *6.1.5 (Q): Standard Condition for Decommissioning and Site Reclamation Plan: (1) The Applicant shall submit a signed decommissioning and site reclamation plan conforming to the requirements of paragraph 6.1.1A. (2) In addition to the purposes listed in subparagraph 6.1.1A.4., the decommissioning and site reclamation plan shall also include provisions for anticipated repairs to any public STREET used for the purpose of reclamation of the PV SOLAR FARM and all costs related to removal of access driveways. (3) The decommissioning and site reclamation plan required in paragraph 6.1.1A. shall also include the following: [truncated for space].*

The Applicant hereby recognizes and accepts the required information listed in §6.1.5(Q) and confirms that such requirement will be included in the Project's final Decommissioning Plan, a sample of which has been provided in **Exhibit U – Preliminary Decommissioning Plan**.

- § *6.1.5 (R): Agricultural Impact Mitigation Agreement with the Illinois Department of Agriculture: (1) If provided by state law, the Applicant shall enter into an Agricultural Impact Mitigation Agreement with the Illinois Department of Agriculture. (2) The Applicant shall bear full responsibility for coordinating any special conditions required in the SPECIAL USE Permit in order to ensure compliance with the signed Agricultural Impact Mitigation Agreement with the Illinois Department of Agriculture. (3) All requirements of the signed Agricultural Impact Mitigation Agreement with the Illinois Department of Agriculture shall become requirements of the COUNTY Board SPECIAL USE Permit. (4) Champaign County shall have the right to enforce all requirements of the signed Agricultural Impact Mitigation Agreement with the Illinois Department of Agriculture.*

The Applicant hereby recognizes and accepts the required information listed in §6.1.5(R) directs the Board to **Exhibit L – Fully Executed AIMA** for evidence of the document.

- § *6.1.5 (S): Complaint Hotline: (1) Prior to the commencement of construction on the PV SOLAR FARM and during the entire term of the COUNTY Board SPECIAL USE Permit and any extension, the Applicant and Owner shall establish a telephone number hotline for the general public to call with any complaints or questions. (2) The telephone number hotline shall be publicized and posted at the operations and maintenance center and the construction marshalling yard. (3) The telephone number hotline shall be manned during usual business hours and shall be an answering recording service during other hours. (4) Each complaint call to the telephone number hotline shall be logged and identify the name and address of the caller and the reason for the call. (5) All calls shall be recorded and the recordings shall be saved for transcription for a minimum of two years.*

The Applicant hereby confirms that the requirement described above and details regarding the complaint hotline shall be included in the building permit application package.

- § *6.1.5 (T): Standard Conditions for Expiration of PV SOLAR FARM COUNTY Board SPECIAL USE Permit A PV SOLAR FARM COUNTY Board SPECIAL USE Permit designation shall expire in 10 years if no Zoning Use Permit is granted.*

The Applicant hereby acknowledges the statement above.

4.11 --- §6.1.5(U) APPLICATION REQUIREMENTS

- § *6.1.5 (U)(1): In addition to all other information required on the SPECIAL USE Permit application and required by Section 9.1.11A.2.*

- § *6.1.5 (U)(1)a: A PV SOLAR FARM Project Summary, including, to the extent available: (a) A general description of the project, including its approximate DC and AC generating capacity; the maximum number and type of solar devices, and the potential equipment manufacturer(s). (b) The specific proposed location of the PV SOLAR FARM including all tax parcels on which the PV SOLAR FARM will be constructed. (c) The specific proposed location of all tax parcels required to be included in the PV SOLAR FARM COUNTY Board SPECIAL USE Permit. (d) A description of the Applicant, Owner and Operator, including their respective business structures.*

The Applicant hereby provides the following information:

(a) The Project currently contemplated as a +/- 7.5 MW DC and +/- 5.0 MW AC photovoltaic electric generating solar power plant; there is no battery energy storage contemplated as a part of the Project. The exact number of panels is not yet known, as this is dependent on the chosen panel and final engineering. While equipment purchases will not be made until a permit is granted and the Project progresses toward final engineering, attached as **Exhibit O – Critical Component Data Sheets** are cut sheets of potential equipment models.

(b) The Project is being hosted by the parcel known as PIN: 12-14-28-201-002. The Project Area is displayed on the Special Use Permit Plan set. The approximately 40 acres being considered for development are located between the electric transmission corridor which bisects the parcel and the southern property line. The point of access and point of interconnection are the same, at the southeast corner of the parcel at these approximate coordinates: Lat - 40°10'3.97"N and Long - 88°17'46.25"W.

(c) There is only one tax parcel considered for this project, PIN: 12-14-28-201-002 is located off N. Duncan Road, just west of the intersection of N Duncan Road and W Ford Harris Road.

(d) The applicant is N Duncan Road Solar, LLC a Delaware limited liability company which serves as project company for the Project. The owner and operator is ReWild Renewables, LLC, a Delaware limited liability company that operates as a renewable energy development company with a home office in Portsmouth, NH. ReWild Renewables, LLC owns 1000 units in North Duncan Road Solar, LLC, which constitutes 100% of the membership interests of this project company.

- § *6.1.5 (U)(1)b: The name(s), address(es), and phone number(s) of the Applicant(s), Owner and Operator, and all property owner(s) for the PV SOLAR FARM COUNTY Board SPECIAL USE Permit.*

The Applicant hereby provides the following information:

Applicant:	N Duncan Road Solar, LLC P.O Box 1320 Portsmouth, NH 03802 Phone: 603-969-8492
Owner Operator:	ReWild Renewables, LLC P.O Box 1320 Portsmouth, NH 03802 Phone: 603-969-8492
Property Owner:	T&S Franey, LLC c/o Tom and Stephanie Franey 3702 Kearns Drive Champaign, IL 61822 Phone: 217-356-6800

§ *6.1.5 (U)(1)c: A site plan for the PV SOLAR FARM indicating the following: (a) The approximate planned location of al PV SOLAR FARM STRUCTURES, property lines (including identification of adjoining properties), required separations, public access roads and turnout locations, access driveways, solar devices, electrical inverter(s), electrical transformer(s), cabling, switching station, electrical cabling from the PV SOLAR FARM to the Substation(s), ancillary equipment, screening and fencing, third party transmission lines, meteorological station, maintenance and management facilities, and layout of all structures within the geographical boundaries of any applicable setback. (b) The site plan shall clearly indicate the area of the proposed PV SOLAR FARM COUNTY Board SPECIAL USE Permit as required by subparagraph 6.1.5A.(1). (c) The location of all below-ground wiring. (d) The location, height, and appearance of all above-ground wiring and wiring structures. (e) The separation of all PV SOLAR FARM structures from adjacent DWELLINGS and/or PRINCIPAL BUILDINGS or uses shall be dimensioned on the approved site plan and that dimension shall establish the effective minimum separation that shall be required for any Zoning Use Permit. Greater separation and somewhat different locations may be provided in the approved site plan for the Zoning Use Permit provided that the greater separation does not increase the noise impacts and/or glare that were approved in the PV SOLAR FARM COUNTY Board SPECIAL USE Permit. PV SOLAR FARM structures include substations, third party transmission lines, maintenance and management facilities, or other significant structures.*

The Applicant hereby confirms that all items typical for a Special Use Permit Plan set have been included in the set accompanying this package. The Applicant hereby confirms that the standards described above that are not indicated within the Special Use Permit Plan set shall be included in the construction plan set that will accompany building permit application.

§ *6.1.5 (U)(1)d: All other required studies, reports, certifications, and approvals demonstrating compliance with the provisions of this Ordinance.*

The Applicant hereby confirms that the Special Use Permit Application package contains all other required studies, reports, certifications, and approvals demonstrating compliance with the provisions of this Ordinance. See Table of Contents for listing of all studies, reports, certifications, and approvals demonstrating compliance with the provisions of this Ordinance.

§ *6.1.5 (U)(1)e: The PV SOLAR FARM SPECIAL USE Permit application shall include documentation that the applicant has provided a complete copy of the SPECIAL USE Permit application to any municipality within one-and-one-half miles of the proposed PV SOLAR FARM as required by Section 6.1.5B.(2)a.(b).*

The Applicant hereby confirms that a copy of this Special Use Permit Application package as well as a copy of the Special Use Permit Plan has been provided to the City of Champaign Planning and Development Department, specifically to the Planning Manager and Zoning Administrator via an email on the date the application was distributed to the County. A copy of which can be found in **Exhibit M – City of Champaign Notification**.

§ *6.1.5 (U)(1)f: A municipal resolution regarding the PV SOLAR FARM by any municipality located within one-and-one-half miles of the PV SOLAR FARM must be submitted to the Zoning Administrator prior to the consideration of the PV SOLAR FARM SPECIAL USE Permit by the Champaign COUNTY Board or, in the absence of such a resolution, the Zoning Administrator shall provide documentation to the COUNTY Board that any municipality within one-and-one-half miles of the PV SOLAR FARM was provided notice of the meeting dates for consideration of the proposed PV SOLAR FARM SPECIAL USE Permit for both the Environment and Land Use Committee and the COUNTY Board as required by Section 6.1.5B.(2)a.(c).*

No response to this provision is necessary, however Applicant acknowledges the above requirement.

§ *6.1.5 (U)(1)g: Documentation of an executed interconnection agreement with the appropriate electric utility shall be provided prior to issuance of a Zoning Compliance Certificate to authorize operation of the PV SOLAR FARM as required by Section 6.1.5B.(3)b.*

The Applicant directs the Board to view **Exhibit N – Executed Interconnection Agreement** as evidence of said interconnection agreement with the appropriate electric utility, Ameren.

§ *6.1.5 (U)(2): The Applicant shall notify the COUNTY of any changes to the information provided above that occurs while the COUNTY Board SPECIAL USE Permit application is pending.*

The Applicant acknowledges the above requirement.

§ *6.1.5 (U)(3): The Applicant shall include a copy of the signed Agricultural Impact Mitigation Agreement with the Illinois Department of Agriculture with the Zoning Use Permit Application to authorize construction.*

The Applicant directs the Board to view **Exhibit L – Fully Executed AIMA** as evidence of said AIMA with the Illinois Department of Agriculture.

5.0 CONCLUSION

The N Duncan Road Solar, LLC project adheres to all requirements of Champaign County, State of Illinois, and all federal agencies with jurisdiction. It is the Applicant's opinion that the Project qualifies for a Special Use Permit to construct a PV Solar Farm on the subject parcel identified as PIN 12-14-28-201-002.

5.1 SPECIAL USE HEARING CRITERIA (§9.1.11(B) OF CHAMPAIGN COUNTY ZONING ORDINANCE)

The County Board may approve a Special Use Permit application if it finds the public hearing record and written application demonstrate compliance with Special Use criteria described in §9.1.11 (B). It is understood that these criteria are often applied as a balancing test, and not explicitly as individual requirements to be met.

For the administrative record, excerpts from the §9.1.11(B) are reproduced below in italics and the Applicant's response follows in standard text.

A SPECIAL USE Permit shall not be granted by the BOARD unless the public hearing record and written application demonstrate:

1) *that it is necessary for the public convenience at that location;*

The Project **IS NECESSARY** for the public convenience because it will provide a stable, locally generated source of renewable electricity that supports regional energy reliability and statewide clean-energy goals. The site's rural, agricultural location is particularly suitable for this purpose. By siting the Project on farmland, the project preserves the land's long-term agricultural potential while diversifying the rural economy with lease payments to local landowners, increased tax revenues, and temporary and permanent jobs. The Project therefore enhances the public welfare by reducing dependence on fossil fuels, strengthening the local tax base, and providing environmental and economic benefits to the surrounding community in a location that minimizes conflicts with residential or commercial uses. *that it is so designed, located, and proposed as to be operated so that it will not be injurious to the DISTRICT in which it shall be located or otherwise detrimental to the public welfare;*

The Project has been designed, located, and proposed such that it **WILL NOT** be injurious or detrimental to the public welfare in that (i) the Project is expressly allowed in AG-2 districts, (ii) the Project meets or exceeds all requirements of the Zoning Ordinance, and (iii) has no noxious characteristics (sound, glare, pollution, traffic, etc.) that could negatively impact the public. The Project will utilize solar components that comply with the current edition of the National Electric Code, will be UL listed (or equivalent) and will be designed using anti-reflective coating. Applicant will maintain the property vegetation to keep it from overgrowing. The Project will also significantly increase the fair market value of the parcel for property taxes.

Additionally, the Project will provide a domestic, local source of energy that will be available to County residents who subscribe to the community solar project. The Project is a partnership with one landowner on a property that is currently used for agriculture. The transition of the parcel to a solar energy facility during the term of the lease supports restoration of the agricultural resources as the land beneath the solar modules will lie fallow, contributing to the restoration of soil nutrients. The Project will also comply with the Agricultural Impact Mitigation Agreement, into which it has entered.

Finally, the Project will include a security barrier, as required by the applicable solar energy systems ordinance to protect the solar energy from trespassers and vandals. The security barrier will comply with existing jurisdictional requirements. The Project will comply with all other local, state and federal regulations.

a. *The property is…BEST PRIME FARMLAND and the property with proposed improvements is WELL SUITED OVERALL.*
    i. *The site is one on which the proposed development can be safely and soundly accommodated using simple engineering and common, easily maintained construction methods with no unacceptable negative effects on neighbors or the general public.*
    ii. *The site is reasonably well-suited in all respects and has no major defects.*

The Project **CAN BE** safely and soundly accommodated at the property because its design and construction follow straightforward, low-impact engineering methods consistent with the AIMA. Project facility uses shallow, driven post foundations that do not require concrete footings or deep excavation, thereby minimizing soil compaction and disturbance to the natural soil profile. Consistent with AIMA standards, topsoil is preserved during construction, cabling is installed at appropriate depths to avoid interference with future agricultural use, and any drainage tiles are either avoided or repaired or replaced if disturbed. The Project's components can be easily removed at decommissioning, returning the land to full agricultural production. With vegetative ground cover to prevent erosion and manage stormwater, the Project operates quietly, emits no pollutants, and produces no glare or odor, ensuring there are no unacceptable negative effects on neighboring properties or the general public.

b. The site has no defects or concerns that make the site ill-suited for use for the Project, *The existing public services are available to support the proposed SPECIAL USE effectively and safely without undue public expense.*

The existing public services **ARE AVAILABLE** to effectively and safely support the Project in that (i) the design, construction, operation, and decommissioning standards discussed in this Special Use Permit Application package demonstrate such a finding and (ii) the Applicant has committed to entering into applicable use agreements to ensure that there is no undue public expense.

c. *The existing public infrastructure together with proposed improvements is adequate to support the proposed development effectively and safely without undue public expense.*

The existing public infrastructure **IS AVAILABLE** to effectively and safely support the Project in that (i) the design, construction, operation, and decommissioning standards discussed in this Special Use Permit Application package demonstrate such a finding and (ii) from an electrical standpoint the local electric utility, Ameren, has studied and approved of the Project with all interconnection related costs to be borne by the Applicant.

2) *that it conforms to the applicable regulations and standards of and preserves the essential character of the DISTRICT in which it shall be located, except where such regulations and standards are modified by Section 6;*

The Project **DOES CONFORM** to the applicable regulations and standards of the district and **DOES PRESERVE** the essential character of the district in that (i) the Applicant has asked for no material waivers to relevant regulations and standards and (ii) the Project is not only visually screened by existing and proposed vegetation, but is sited a considerable distance from non-participating residences and businesses and (iii) the Project introduces no noxious characteristics (sound, glare, pollution, traffic, etc.) that could negatively impact the district.

3) *that granting the SPECIAL USE is in harmony with the general purpose and intent of this ordinance;*

The Project **IS IN HARMONY** with the general purpose and intent of this ordinance in that the Applicant had designed the Project and performed extensive site discovery and diligence to confirm in this application package that the Project meets or exceeds the requirements outlined in the Zoning Ordinance.

4) *that, in the case of an existing NONCONFORMING USE, it will make such USE more compatible with its surroundings;*

Not applicable, there is no nonconforming use considered as part of this application.

5) *approval of a SPECIAL USE Permit shall authorize USE, CONSTRUCTION and operation only in a manner that is fully consistent with all testimony and evidence submitted by the petitioner or petitioner's agent(s);*

The Application **IS FULLY CONSISTENT** with the use it requests. To the extent Applicant's testimony contemplates additional conditions to the Project or proposed deviations from the Application, Applicant will be amenable to an issued permit reflecting those proposed additional conditions or proposed deviations.

5.2 GENERAL INFORMATION AND FREQUENTLY ASKED QUESTIONS

The purpose of this Section is to articulate responses to frequently asked questions the Applicant has encountered in its almost decade and a half of solar development across the country. These FAQ's focus intentionally on questions pertaining to the development of community solar in general, as site-specific review and discussion is taken up in the rest of this application package.

Below are a series of four short videos made available online by the Illinois Solar Energy Association and the University of Illinois which provide accurate context for and accurate example of the type of solar development being considered herein. Additionally, a general information document from American Clean Power has been provided in **Exhibit V – ACP Solar Fact Sheet** for the County's review.

- Intro to an Illinois Solar Farm: https://www.youtube.com/watch?v=hhYVWaajGNE
- What Does a Solar Farm Look and Sound Like: https://www.youtube.com/watch?v=Uigtbj5o34o
- How a Solar Farm Works: https://www.youtube.com/watch?v=hGgY0gkqOHs
- Do Solar Farms Affect Water Runoff or Wildlife: https://www.youtube.com/watch?v=HcZe_dhLjpY

Frequently Asked Questions:

1. *Question: A thirty to forty year operating period is a long time; what happens at the end of the project's useful life?*

Response: Simply put, the project is removed or decommissioned at the end of its operating term and the property may return to its agricultural use or pursue another development use. Per the State of Illinois' Renewable Energy Facilities Agricultural Impact Mitigation Act (505 ILCS 147/15) a solar developer must compose for each community solar project a decommissioning plan which describes the means, methods, and costs associated with the removal of the project at the end of its use. The cost is bonded during the operation period and available to the County to step in and oversee removal utilizing the bonded funds, should the Applicant default on its obligation to remove the project at the end of its useful life.

2. *Question: There are few, if any, community solar projects operating in Champaign County at this time; what standards are used for the design, construction, operation, and decommissioning of a project?*

Response: There have been approximately one thousand community solar projects developed and installed in IL since the 2016 Future Energy Jobs Act created Illinois' community solar program. In that time the state has developed a robust series of protections that are based on National Electric Code to govern electrical standards and the IL Department of Agriculture's Standard Agricultural Impact Mitigation Agreement to regulate the design, construction, operation, and decommissioning standards for community solar projects. At the county level, a project will need to comply with DeWitt County Zoning Code, Chapter 157. This application package outlines and describes how the proposed Project meets or exceeds all requirements.

3. *Question: What jurisdictional bodies are consulted, or what site diligence work is performed by the solar company to consider wildlife, historical, and other impacts?*

Response: A solar project developer consults a wide variety of subject matter experts and authorities with jurisdiction during the development process. Site specific findings are presented during the site-specific permitting phase, but the Applicant's diligence list for each individual property typically includes:

- ◊ Site Level: (i) wetlands location and delineation, (ii) geotechnical soils and subsurface analysis, (iii) phase one environmental site assessment, (iv) real estate impact assessment, (v) transportation plan, (vi) sound study, (vii) glare study, (viii) drain tile survey, (ix) vegetation management plan, (x) real estate title review, and (xi) boundary, topographical, and ALTA survey
- ◊ State Level: (i) IL Historic Preservation Agency review, (ii) IL Department of Natural Resources review, and (iii) IL Department of Agricultural AIMA contract execution
- ◊ Federal Level: (i) US Army Corps of Engineers wetland determination, (ii) Federal Emergency Management Agency flood plain review, (iii) Federal Aviation Administration hazard analysis, and (iv) US Fish and Wildlife Service species impact analysis.

The list shared above is intentionally exhaustive and is meant, not only to inform the development process such that the Applicant can create a project with the greatest net benefit to all stakeholders, but also to derisk the project from a financing standpoint. For the avoidance of doubt, almost all of these items are reviewed prior to submission of a siting permit application (documents are available upon request).

4. *Question: How does the solar project ensure that the surrounding properties are not materially impacted by the construction and operation of a project?*

Response: The Applicant focuses on two major areas of concern, the first being to ensure there are no negative impacts to existing conditions regarding water flow with respect to both stormwater drainage and agricultural irrigation. Stormwater protections are often regulated by local ordinances (in the same way a warehouse cannot be built or a parking lot paved without consideration to stormwater), and irrigation functionality and protection is governed by the AIMA.

The second focus is on visual screening of the community solar development. Landscaping and screening details are often discussed during the local siting hearings where the Applicant will take comments and incorporate them into the plan. It is the Applicant's process to come to the hearings with an opinion on the most likely screening method, but, because of how subjective visual screening can be and because of how many options there are (fences, plantings, cash payments, etc.), it is preferrable to get feedback before settling on the exact proposal.

5. *Question: Can you please summarize the benefits to the local municipality that can be attributed to the community solar project?*

Response: While there are many direct and indirect benefits to land annexation, the following are three major advantages that follow the development and construction of community solar.

- ◊ Increased Tax Revenue: Community solar projects in Illinois are taxed at a formulaic rate as determined by the IL Department of Revenue. In many cases the monies generated can be extremely impactful. As currently contemplated, the Applicant estimates that the installation of a community solar project on the subject parcel in consideration would result in a tax obligation of over $800K during the forty-year life that is typical of a community solar project. The IL Department of Revenue's Commercial Solar Energy Systems Valuation methodology white paper is available for review[1].
- ◊ Production of Clean, Domestic Energy: The community solar project contemplated will produce a material amount of clean, renewable, and domestic electricity that will reduce the local demand for energy sourced from fossil fuels often imported from overseas. The installation would result in enough renewable energy to offset approximately 6,383 metric tons of $CO2$ per year which is the equivalent of approximately 1,330 homes' electricity use or 1,489 gasoline-powered passenger vehicles driven for one year[2].
- ◊ Local and Domestic Job Creation: It is the Applicant's intent to procure materials (solar modules, racking, inverters, electrical equipment and wire, etc.) with the highest percentage of domestic content as is reasonably available and cost efficient. There is still a way to go to meet domestic demand, but since the Inflation Reduction Act of 2022 and continuing with support from the Executive Orders issued in the first days of President Trump's second term, the industry has seen a tremendous increase in the quality and availability of American made components for solar

[1] See IDOR methodology white paper here:
https://tax.illinois.gov/content/dam/soi/en/web/tax/localgovernments/property/documents/commercialsolarenergysystemsvaluation.pdf

[2] See calculations for 9,500 MWh annually at: https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

projects over the past two years. While we hope components are available for these projects, we can estimate confidently that project design and construction labor, which makes up approximately 45% of total project development and construction costs, will come from domestic and local engineers, civil contractors, and electricians and will be paid at prevailing wage.

6. *Question: Will living near a solar farm affect the value of my property?*

Response: Questions and concerns regarding the impact to property values of solar arrays are not uncommon. Noting that there is a vast quantity of information (both trustworthy and not) available online as well as a concept as property value is largely subjective, the Applicant is providing three articles for review in **Exhibit W – Property Value Impact Articles.** Article one was published in 2023 in Energy Policy Magazine entitled "Shedding Light on Large-scale Solar Impacts: An analysis of property values and proximity to photovoltaics across six U.S. states" and article two is a thesis published in 2022 titled "Impact of Utility-Scale Solar Farms on Property Values in North Carolina" and article three is a study published in 2020 by the Department of Environmental and Natural Resource Economics at the University of Rhode Island called "Property Value Impacts of Commercial-Scale Solar Energy in Massachusetts and Rhode Island." All three documents recognize the statistically significant mitigating factors as well as the subjective characteristic of property value, and conclude that there is very little impact, positive or negative, on nearby properties after the development and construction of solar projects.

In addition, the Applicant notes that property valuation experts from CohnReznick[3] have studied the value of properties that adjoin solar farms in Illinois and Indiana and concluded that the solar farms do not adversely affect the property values in either the short or long term. The study included solar farms in Lasalle and Winnebago Counties in Illinois; as well as Elkhart, Lake, Madison, Marion and Porter Counties in Indiana. Experts analyzed property sale prices and marketability of single-family homes and agricultural land that adjoins solar farms and compared this data to comparable properties in the same county. The study also included interviews with county assessors and local real estate professionals, all of whom concluded that solar farms in their area had not impacted property values. Similar research has been conducted in other states across the U.S. and none of these studies have found that solar farms adversely affect nearby property values. Similar research has been conducted in other states across the U.S. and none of these studies have found that solar farms materially affect nearby property values.

7. *Question: Do solar farms increase runoff, erosion or flooding?*

Response: Solar farms do not increase runoff and will improve soil and water quality. Stormwater management plans are a required part of the solar development process. These plans are prepared by professional engineers to ensure that projects don't contribute to erosion or flooding. The land on a solar farm is not paved and can be covered with native plants to promote infiltration and help recharge groundwater. Native grasses planted on solar farms create the added benefit of preventing erosion and improving soil quality.

[3] CohnReznick, LLP. 2018. Property Value Impact Study. A Study of Nine Existing Solar Farms: Champaign, LaSalle, and Winnebago Counties, Illinois; and, Lake, Porter, Madison, Marion, and Elkhart Counties, Indiana. March 2018.

8. *Question: Is the electric voltage at a solar project dangerous? Or do the projects create electromagnetic fields that are harmful to people or pets?*

Response: The electric current generated at solar panels is lower than the voltage in a home outlet. Electricity from a solar project travels through buried cables to a transformer, where voltage is increased so that it can feed into the electric grid. All the electric equipment on the site is secured and will not pose a risk to people or animals. Solar projects do not create electromagnetic fields that could be measured outside a project. Inverters used in solar facilities generate electromagnetic fields that are similar to household appliances, and many times weaker than those created by normal power lines. The weak electromagnetic fields from solar equipment can only be detected within around 150 feet of a solar farm's inverters.

9. *Question: Could chemicals associated with solar facilities affect land or water quality for families living nearby?*

Response: Solar panels are safe to touch, attach to your home or install in your neighborhood. Panels are primarily made of glass, aluminum, copper and other common materials . Solar farms also utilize steel racks to position panels, electrical cable and a small number of inverters and electric transformers to deliver power to the grid. All of this equipment is safe and contains the same materials that are found in household appliances. The panels are silicon-based and contain not hazardous chemicals, except for a small amount of lead that is used in the soldering. An article on such unfounded concerns is provided for review in **Exhibit X – Solar Module Toxicity Article**.

After their useful life, solar panels and equipment are easy to disassemble and recycle. Solar facilities are constantly monitored, and the owners have a business interest in keeping them well-maintained and operating properly. Solar plants are designed to withstand severe weather, and panels are built to last for up to 40 years. If solar panels are damaged, they can be quickly replaced with new ones.

10. *Question: Does it make sense to build solar projects on farm land? Shouldn't we be concerned about taking land out of production?*

Response: By hosting solar farms on their land, Illinois farmers can help feed the world and keep the lights on at the same time. Many agricultural producers are interested in diversifying their income by leasing some of their property to solar projects. It's also important to note that there are 27 million acres of farmland in Illinois — solar energy production will never displace agriculture's central role in Illinois' economy, landscape and culture. Solar projects are a temporary use of private land that can complement agriculture by helping farmers manage commodity price shifts and protect their way of life. Solar lease agreements include a binding commitment that project owners will return land to its prior use once a project is complete. Solar projects are typically planted with native grasses or wildflowers that improve soil and water quality and can be an important habitat for pollinators such as bees and butterflies, which make nearby farms more productive. There are currently about 900,000 acres of Illinois farmland that have been voluntarily taken out of production through the USDA's Conservation Reserve Program (CRP). The majority of this CRP land is used to grow native plants and grasses that prevent erosion and protect soil and water quality, solar farms can create those same benefits. An article which considers the impact of solar on native ecosystems is attached as **Exhibit Y – Vegetation Management at Solar Facilities Article** is provided for review.

11. *Question: Do solar farms create a fire hazard?*

Response: Community solar projects are safe and do not use heat to generate electricity. Millions of solar panels have been safely installed on homes and rooftops around the world for decades – including more than 53,000 MW of solar in the US. All solar installations in the US are fully permitted and inspected by applicable local authorities including fire departments, incidents of any kind are extremely rare, especially for ground mounted projects. The Applicant has successfully permitted projects on properties within many fire protection districts and has designed this project to the same standards.

EXHIBIT A: SPECIAL USE PERMIT APPLICATION

Champaign County
Department of

PLANNING & ZONING

Brookens Administrative Center
1776 E. Washington Street
Urbana, Illinois 61802

Telephone: (217) 384-3708
FAX: (217) 819-4021
Email: zoningdept@co.champaign.il.us
Online: www.co.champaign.il.us
Hours: 8:00 a.m. - 4:30 p.m.

FOR OFFICE USE ONLY
Township ______________ Section _______
Case No. ____________________________
Date _______________ Receipt # ________
Zoning District _______________________
PIN _________________________________

CHAMPAIGN COUNTY, ILLINOIS

APPLICATION FOR SPECIAL USE PERMIT

1. Applicant Name(s) | Phone | Address

Applicant Name(s)	Phone	Address
N Duncan Road Solar, LLC	603-969-8492	PO Box 1320, Portsmouth, NH 03802

Email of lead applicant: zak@rewildrenewables.com

2. Location of subject parcel(s) Southwest of the intersection of N Duncan Road and W Ford Harris Road

3. Property Identification Number (PIN): 12-14-28-201-002

4. Legal Description [*Note: This application cannot be processed unless accurate and complete legal description of subject parcel(s) is included with this form*]

   Please see "Exhibit A" attached to this form for a legal description of the subject property.

5. Area of subject property: +/- 113.7 acres or +/- 4,952,772 square feet

6. Existing use(s):

   Multiple: Residence, warehousing, cell tower, electrical utilities, agriculture

7. Number and type of **existing** principal buildings:

   1: Single family residence

8. Number and type of **existing** accessory buildings and structures:

   3: Warehouse building, cell tower, utility transmission lines

9. Number of **existing** dwelling units: 1

PLEASE COMPLETE BOTH PAGES

10. Proposed use(s): PV Solar Farm of +/- 5 MW AC

11. Attach an accurate site plan, no larger than 11x17, showing the boundaries of the subject property, adjacent streets, existing buildings, driveways and other structures. Provide dimensions, sufficient to accurately determine the size and location of all structures. [*Note: other drawings may also be required.*]

12. Reasons the proposed use is necessary for the public convenience at the above noted location:
Please see Section 5.1 of the Special Use Permit Application package for a discussion of hearing criteria.

13. List those reasons which will ensure to the County that the proposed land use is designed, located, and operated so that it will not be injurious to the District in which it shall be located or otherwise detrimental to the public welfare. Attach plans if necessary.
Please see Section 5.1 of the Special Use Permit Application package for a discussion of hearing criteria.

14. Does the proposed use conform to the applicable regulations and standards of, and preserve the essential character of, the District in which it shall be located except where such regulations and standards are modified by Section 6 of the County Zoning Ordinance?
Please see Section 5.1 of the Special Use Permit Application package for a discussion of hearing criteria.

15. If the property is an existing non-conforming use, will the Special Use make its use more compatible with its surroundings?
Please see Section 5.1 of the Special Use Permit Application package for a discussion of hearing criteria.

16. Time schedule for development (if applicable): Construction Commencement: Fall 2026
Construction Completion: Summer 2027

17. Additional exhibits submitted by applicant: Please see Special Use Permit Application package for a full project narrative, ordinance review, and extensive supporting exhibits.

18. Applicant Signature(s) | Date

DocuSigned by:
[signature]
A2FEC5F3390748F...

10/17/2025

NOTE: If signed by persons other than petitioner(s), state whether Agent or Attorney and give address and telephone number.

EXHIBIT "A"

Legal Description

For APN/Parcel ID(s): 12-14-28-201-002

THE NORTH HALF OF THE NORTHEAST QUARTER AND THE NORTHEAST QUARTER OF THE NORTHWEST QUARTER OF SECTION 28, TOWNSHIP 20, RANGE 8 EAST OF THE THIRD PRINCIPAL MERIDIAN, SITUATED IN CHAMPAIGN COUNTY, ILLINOIS, EXCEPT THAT PORTION TAKEN FOR ROAD PURPOSES; ALSO EXCEPT THE FOLLOWING DESCRIBED TRACT:

BEGINNING AT THE NORTHEAST CORNER OF SECTION 28, TOWNSHIP 20, RANGE 8 EAST OF THE THIRD PRINCIPAL MERIDIAN; PROCEED SOUTH 00°00'00" EAST, 299.89 FEET ALONG THE EAST LINE OF THE NORTHEAST QUARTER OF SAID SECTION 28; THENCE NORTH 90°00'00" WEST, 712.74 FEET TO THE TRUE POINT OF BEGINNING; THENCE CONTINUE NORTH 90°00'00" WEST, 559.62 FEET; THENCE SOUTH 00°00'00" WEST, 490.00 FEET; THENCE SOUTH 90°00'00" EAST, 559.62 FEET; THENCE NORTH 00°00'00" EAST, 490.00 FEET TO THE TRUE POINT OF BEGINNING, SITUATED IN CHAMPAIGN COUNTY, ILLINOIS.

EXHIBIT B: SPECIAL USE PERMIT PLANS

SPECIAL USE PERMIT PLANS

FOR

N DUNCAN ROAD SOLAR, LLC

LOCATED AT

INTERSECTION OF N DUNCAN ROAD & W FORD HARRIS ROAD, CHAMPAIGN, IL 61822

APPLICANT

N DUNCAN ROAD SOLAR, LLC C/O
REWILD RENEWABLES, LLC
PO BOX 1320
PORTSMOUTH, NH 03801
CONTACT: PROJECT DEVELOPMENT DEPARTMENT
PHONE: (603) 969-8492

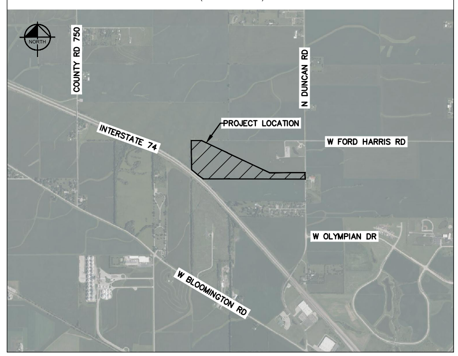
CIVIL ENGINEER

KIMLEY-HORN AND ASSOCIATES, INC.
111 W JACKSON BLVD, STE 1320
CHICAGO, IL 60604
CONTACT: DAN MARSHALL, P.E.
PHONE: (312) 445-8636

SURVEYOR

LANGAN
200 W MADISON ST, STE 1920
CHICAGO, IL 60606
CONTACT: ANTHONY MAIONE, P.L.S.
PHONE: (312) 547-7700

LOCATION MAP
(NOT TO SCALE)

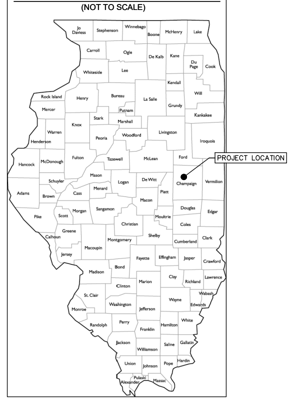


SHEET LIST TABLE	
SHEET NUMBER	SHEET TITLE
C-100	COVER SHEET
C-200	EXISTING CONDITIONS PLAN
C-300	PROPOSED CONDITIONS PLAN
C-400	CONSTRUCTION DETAILS
L-100	LANDSCAPE PLAN
L-101	LANDSCAPE BUFFER PLAN
L-200	LANDSCAPE NOTES

SURVEY NOTE

THE SURVEY PROVIDED BY LANGAN IS LOCATED USING ILLINOIS STATE PLAN COORDINATE SYSTEM, EAST ZONE, NAD 83.

STATE COUNTY MAP
(NOT TO SCALE)



SITE INFORMATION

PARCEL ZONING
AG-2: AGRICULTURAL DISTRICT (CHAMPAIGN COUNTY)

PROJECT DESCRIPTION
5 MW-AC SINGLE AXIS TRACKER SOLAR ARRAY PROJECT

Call Before You Dig
JULIE
1-800-892-0123

No.	REVISIONS	DATE
1	LANDSCAPE PLANS	10/16/2025
2	LANDSCAPE REVISION	11/11/2025

Rewild

Kimley-Horn

111 W JACKSON BLVD, STE 1320
CHICAGO, IL 60604
WWW.KIMLEY-HORN.COM

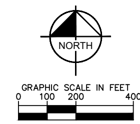
PRELIMINARY NOT FOR CONSTRUCTION

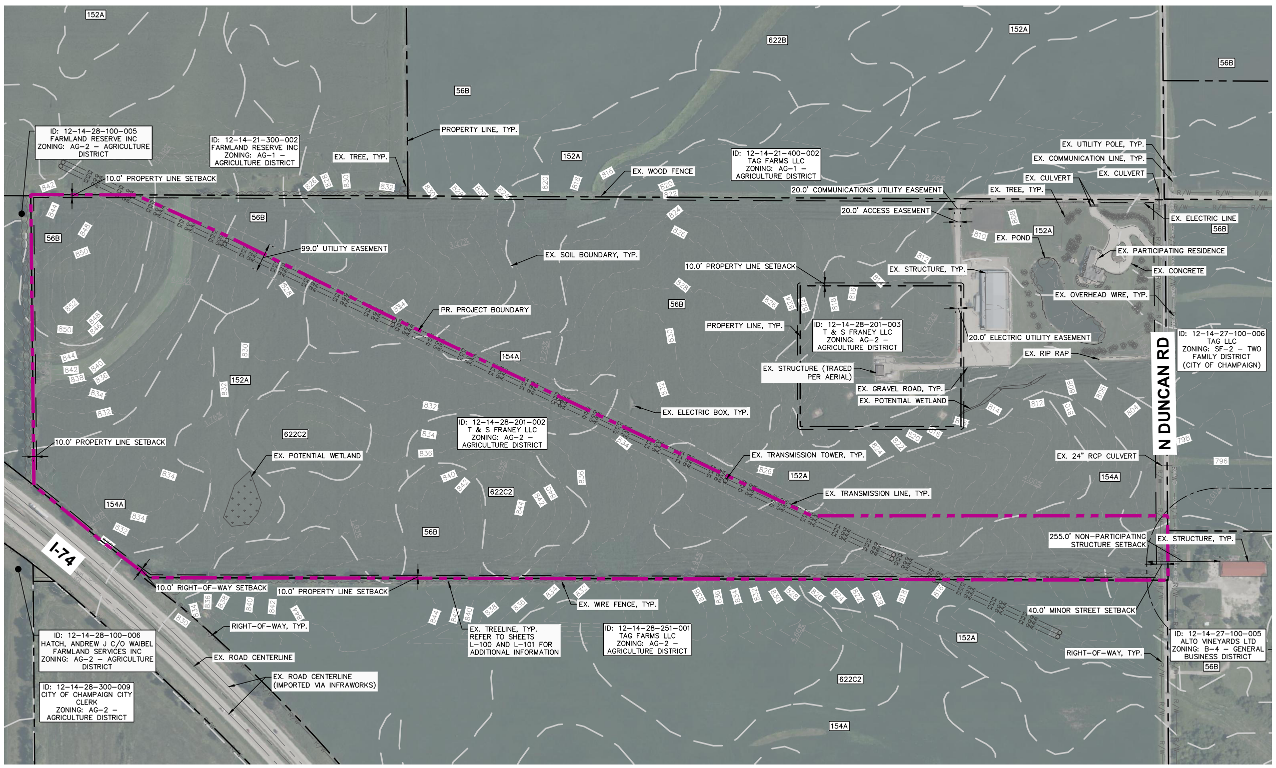
KHA PROJECT 268779005
DATE 10/16/2025
SCALE AS SHOWN
DESIGNED BY AT
DRAWN BY GG
CHECKED BY DM

COVER SHEET

N DUNCAN ROAD SOLAR, LLC
CHAMPAIGN COUNTY, IL

SHEET NUMBER
C-100





LEGEND

ROAD LABEL	**ROAD**
PROJECT BOUNDARY	
ROAD RIGHT OF WAY	R/W
PROPERTY LINES	
PROPERTY LINE/ROAD SETBACK	
STRUCTURE SETBACK	
EX. CONTOURS	XXX
EX. FLOW (DIRECTION AND SLOPE)	XX%
EX. OVERHEAD ELECTRIC	EX OHE
EX. TRANSMISSION LINE	EX OHE
EX. UTILITY POLE	
EX. TRANSMISSION TOWER	
EX. STRUCTURE	
EX. VEGETATION	
EX. TREELINE	
EX. COMMUNICATION LINE	COMM
EX. ROAD EDGE OF PAVEMENT	
EX. ROAD CENTERLINE	
EX. EASEMENT	
EX. POTENTIAL WETLAND	
EX. CULVERT	
EX. SOIL BOUNDARY	
EX. ELECTRIC BOX	E

SOILS DATA TABLE

MAP UNIT SYMBOL	MAP UNIT NAME	HYDROLOGIC SOIL GROUP
56B	DANA SILT LOAM, 2 TO 5 PERCENT SLOPES	C
152A	DRUMMER SILTY CLAY LOAM, 0 TO 2 PERCENT SLOPES	B/D
154A	FLANAGAN SILT LOAM, 0 TO 2 PERCENT SLOPES	C/D
171B	CATLIN SILT LOAM, 2 TO 5 PERCENT SLOPES	C
330A	PEOTONE SILTY CLAY LOAM, 0 TO 2 PERCENT SLOPES	C/D
481A	RAUB SILT LOAM, NON-DENSIC SUBSTRATUM, 0 TO 2 PERCENT SLOPES	B/D
622B	WYANET SILT LOAM, 2 TO 5 PERCENT SLOPES	C
622C2	WYANET SILT LOAM, 5 TO 10 PERCENT SLOPES, ERODED	C
802B	ORTHENTS, LOAMY, 1 TO 7 PERCENT SLOPES	C

NOTES

1. THE PURPOSE OF THESE PLANS ARE FOR SPECIAL USE PERMIT REVIEW AND APPROVAL BY CHAMPAIGN COUNTY TO CONSTRUCT A COMMERCIAL SOLAR FARM.
2. EXISTING CONDITIONS SURVEY AND TOPOGRAPHIC SURFACE PROVIDED BY LANGAN, DATED 03/06/2024. ALL ITEMS SHOWN WITHIN EXISTING CONDITIONS PLAN PER LANGAN ALTA AND TOPOGRAPHY SURVEYS UNLESS OTHERWISE STATED. ALL ADJACENT PARCEL LINEWORK IMPORTED VIA CHAMPAIGN COUNTY GIS, RECEIVED ON 02/28/2025.
3. EXISTING SOIL DATA AND BOUNDARY LOCATIONS PER NATURAL RESOURCES CONSERVATION SERVICE (NRCS) WEB SOIL SURVEY, ACCESSED ON 02/10/2025.
4. NO SETBACK UTILIZED ALONG PORTION OF NORTHERN PROJECT BOUNDARY, AS PARCEL CONTINUES TO THE NORTH OF PROPOSED PROJECT DEVELOPMENT.
5. SUBJECT PROPERTY DOES NOT LIE WITHIN A SPECIAL FLOOD HAZARD AS SHOWN ON THE FLOOD INSURANCE RATE MAP (COMMUNITY PANEL 17019C0291D) PUBLISHED BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA).
6. POTENTIAL WETLAND FEATURES ARE PRESENT WITHIN THE PROJECT AREA PER FIELD DELINEATION, CONDUCTED BY OLSON ECOLOGICAL SOLUTIONS, LLC DECEMBER 2023. WETLANDS ARE ANTICIPATED TO BE USACE NON-JURISDICTIONAL.
7. PROPERTY OWNER INFORMATION IS BASED OFF CHAMPAIGN COUNTY GIS DATA, ACCESSED ON 03/03/2025. ALL PARCELS ARE ZONED WITHIN CHAMPAIGN COUNTY, UNLESS OTHERWISE STATED.

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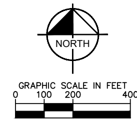
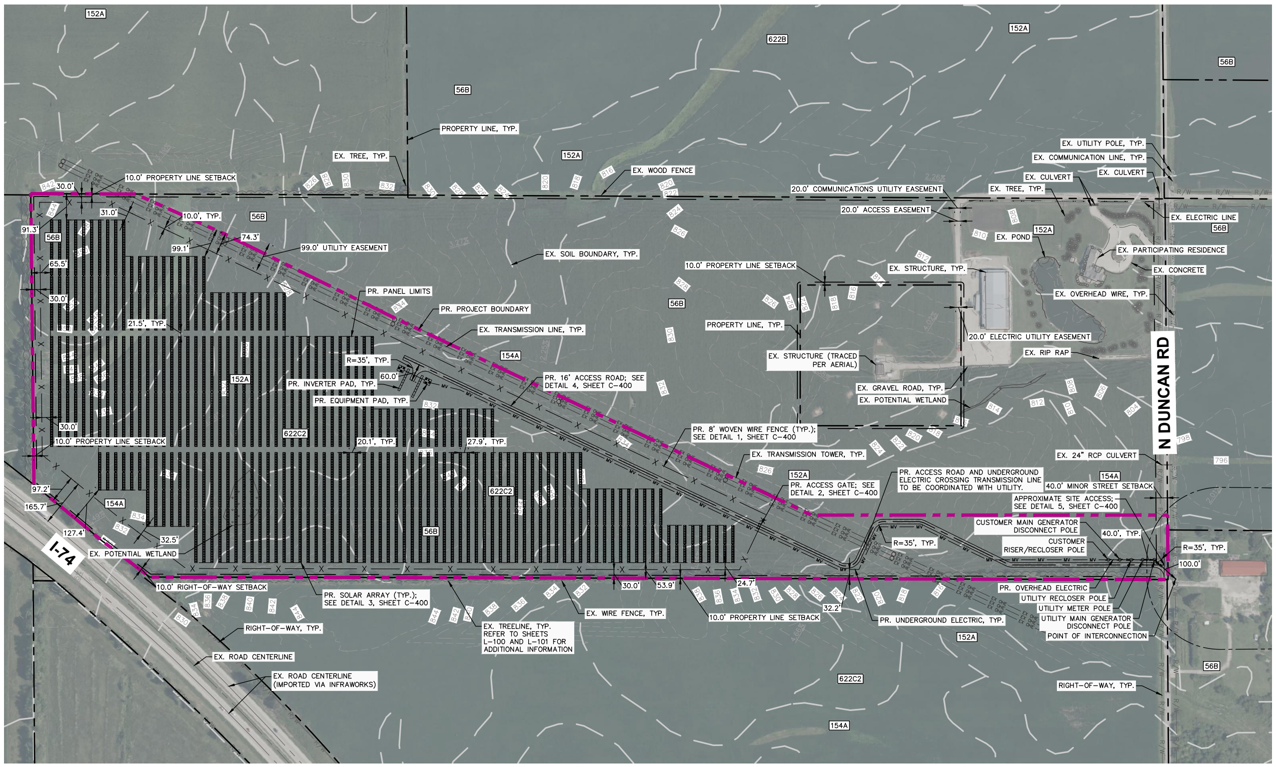
EXISTING CONDITIONS PLAN

N DUNCAN ROAD SOLAR, LLC

CHAMPAIGN COUNTY, IL

SHEET NUMBER
C-200





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ROAD LABEL	ROAD
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PROPERTY LINES	
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STRUCTURE SETBACK	
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EX. VEGETATION	
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EX. ROAD EDGE OF PAVEMENT	
EX. ROAD CENTERLINE	
EX. EASEMENT	
EX. POTENTIAL WETLAND	
EX. CULVERT	
EX. SOIL BOUNDARY	
EX. ELECTRIC BOX	
PR. FENCE	X
PR. ACCESS GATE	
PR. OVERHEAD ELECTRIC	OH
PR. UTILITY POLE	
PR. ACCESS ROAD	
PR. SOLAR ARRAY	
PR. PANEL LIMITS	
PR. UNDERGROUND ELECTRIC	MV
PR. EQUIPMENT PAD	
PR. INVERTER PAD	

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802B	ORTHENTS, LOAMY, 1 TO 7 PERCENT SLOPES	C

SITE DATA TABLE

APPLICANT	N DUNCAN ROAD SOLAR, LLC C/O REWILD RENEWABLES, LLC
PIN #	12-14-28-201-002
ZONING JURISDICTION	CHAMPAIGN COUNTY
EXISTING USE	AGRICULTURAL LAND WITH ROW CROPS
PROPOSED USE	PHOTOVOLTAIC SOLAR FARM
ANTICIPATED CAPACITY	5 MW AC
TOTAL PARCEL AREA	112.8 ± AC
PROJECT BOUNDARY AREA	57.9 ± AC
PRELIMINARY PROJECT AREA	45.7 ± AC
PRELIMINARY FENCED AREA	42.9 ± AC
PRELIMINARY SOLAR AREA	32.7 ± AC
PROPERTY SETBACK	10'
MINOR STREET (CENTERLINE) SETBACK	40'
DWELLING/PRINCIPLE BUILDING SETBACK	255'

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7. PHOTOVOLTAIC PANELS, INVERTERS, FENCING, ACCESS ROADS, AND INTERCONNECTION EQUIPMENT LOCATIONS SHOWN FOR REFERENCE ONLY. DESIGN AND FINAL LAYOUT TO BE DETERMINED DURING FINAL ENGINEERING.
8. ALL EXISTING ROADWAY SHOULDER AND DITCH SECTIONS SHALL REMAIN AS-IS AT A MINIMUM, OR BE UPGRADED AS DETERMINED NECESSARY AT THE ENTRANCE INSTALLATION LOCATION.
9. PROJECT AREA, INCLUDING CONSTRUCTION STAGING AREAS, WILL BE CLEARED AND GRUBBED AS NECESSARY, RETAINING PRE-DEVELOPMENT DRAINAGE PATTERNS TO THE BEST EXTENT POSSIBLE. CONSTRUCTION STAGING AND AREAS SUBJECT TO RUTTING DURING CONSTRUCTION WILL BE TEMPORARILY STABILIZED WITH GRAVEL OR APPROVED EQUAL. SOIL CONDITIONS AND EQUIPMENT LOADS WILL DETERMINE FINAL DESIGN.
10. CONTRACTOR SHALL CALL AT LEAST 72 HOURS PRIOR TO BEGINNING CONSTRUCTION OR EXCAVATION TO HAVE EXISTING UTILITIES LOCATED. ADDITIONALLY, CONTRACTOR SHALL CONTACT ANY LOCAL UTILITIES THAT PROVIDE THEIR OWN LOCATOR SERVICES.
11. STORMWATER MANAGEMENT FACILITIES TO BE PROVIDED AS REQUIRED BY THE COUNTY AND/OR NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMITTING. FINAL DESIGN WILL BE DETERMINED DURING FINAL ENGINEERING.
12. PV SOLAR FARM EQUIPMENT AND STRUCTURES TO BE FULLY ENCLOSED AND SECURED BY AN 8' PERIMETER FENCE, MEETING REQUIREMENT OF CHAMPAIGN COUNTY ZONING ORDINANCE.
13. SETBACKS SHOWN ON THIS PLAN ARE BASED ON THE CHAMPAIGN COUNTY CODE OF ORDINANCES, IN ACCORDANCE WITH SECTION 6.1.5. THE PROJECT LAYOUT IS ALSO IN COMPLIANCE WITH SETBACKS LISTED IN ILLINOIS HOUSE BILL 4412.
14. ALL NECESSARY PERMITS FOR SOIL EROSION CONTROL AND DRIVEWAY CONSTRUCTION WILL BE OBTAINED AS PART OF FINAL ENGINEERING AND PRIOR TO CONSTRUCTION.
15. TREES ALONG SOUTHERN BOUNDARY LINE ON SUBJECT PROPERTY TO BE REMOVED AS PART OF CONSTRUCTION ACTIVITIES.

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Rewild.

Kimley»Horn

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PRELIMINARY NOT FOR CONSTRUCTION

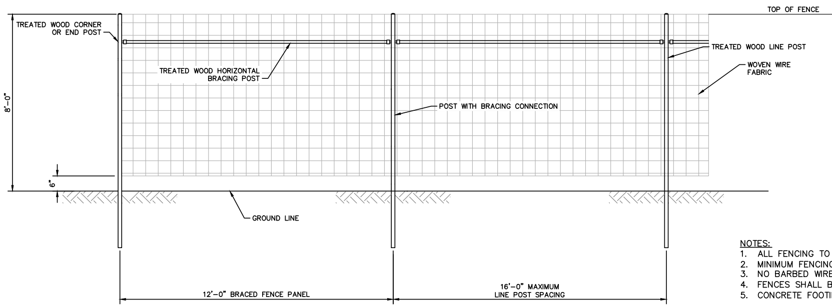
KHA PROJECT	268779005
DATE	10/16/2025
SCALE	AS SHOWN
DESIGNED BY	AT
DRAWN BY	GG
CHECKED BY	DM

PROPOSED CONDITIONS PLAN

N DUNCAN ROAD SOLAR, LLC

CHAMPAIGN COUNTY, IL

SHEET NUMBER
C-300

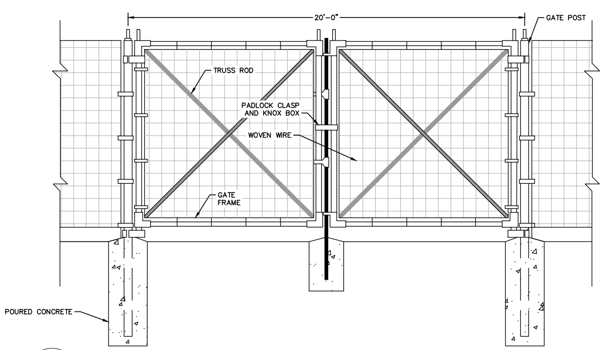


NOTES:
1. ALL FENCING TO BE INSTALLED PER MANUFACTURER'S DESIGN AND SPECIFICATIONS.
2. MINIMUM FENCING SHALL BE 7' TALL.
3. NO BARBED WIRE SHALL BE INSTALLED.
4. FENCES SHALL BE LOCATED A MINIMUM OF 15' FROM PANELS.
5. CONCRETE FOOTINGS MAY BE ADDED TO END AND CORNER POSTS AT CONTRACTOR'S DISCRETION.

1 — 8' WOVEN WIRE FENCE (C-400)

FOR REFERENCE ONLY – SUBJECT TO CHANGE DURING FINAL ENGINEERING

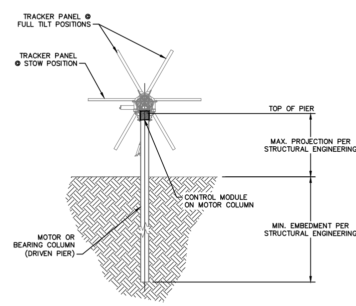
SCALE: NTS



2 — WOVEN WIRE FENCE – DOUBLE GATE (C-400)

FOR REFERENCE ONLY – SUBJECT TO CHANGE DURING FINAL ENGINEERING

SCALE: NTS

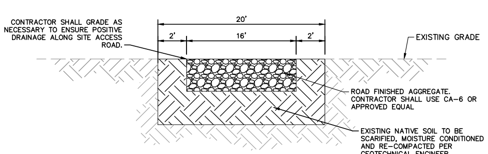


NOTES:
1. AREA UNDER PANELS WILL BE VEGETATED WITH ARRAY AREA POLLINATOR SEED MIX PER VEGETATIVE MANAGEMENT PLAN.

3 — TYPICAL TRACKER (VERTICAL SECTION) (C-400)

FOR REFERENCE ONLY – SUBJECT TO CHANGE DURING FINAL ENGINEERING

SCALE: NTS

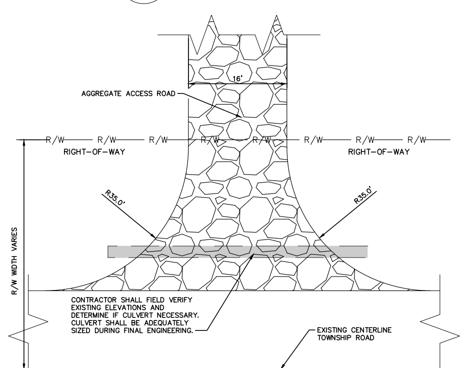


NOTES:
1. REMOVE ALL GRASSES AND ORGANICS WITHIN ACCESS ROAD AREA.
2. SCARIFY, MOISTURE CONDITION, AND RE-COMPACT EXISTING NATIVE SOILS PER GEOTECHNICAL ENGINEER RECOMMENDATIONS
3. COMPACTION SHALL BE VERIFIED BY TESTING BY THE GEOTECHNICAL ENGINEER. AGGREGATE THICKNESS, SUBGRADE PREP, ETC. DETERMINED BY A GEOTECHNICAL ENGINEER.

4 — TYPICAL SITE ACCESS ROAD (C-400)

FOR REFERENCE ONLY – SUBJECT TO CHANGE DURING FINAL ENGINEERING

SCALE: NTS



NOTES:
1. COVER OVER CULVERT PIPE TO BE DETERMINED DURING FINAL ENGINEERING, MINIMUM 12" RECOMMENDED.
2. CULVERT MATERIAL TO BE DETERMINED DURING FINAL ENGINEERING. RECOMMENDED CORRUGATED METAL PIPE (CMP) OR REINFORCED CONCRETE PIPE (RCP).
3. CONTRACTOR SHALL GRADE AS NECESSARY TO ENSURE MAXIMUM SLOPE OF 8% ALONG ENTRANCE AND ENSURE POSITIVE DRAINAGE.

5 — TYPICAL ROAD ENTRANCE (C-400)

FOR REFERENCE ONLY – SUBJECT TO CHANGE DURING FINAL ENGINEERING

SCALE: NTS

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CONSTRUCTION DETAILS

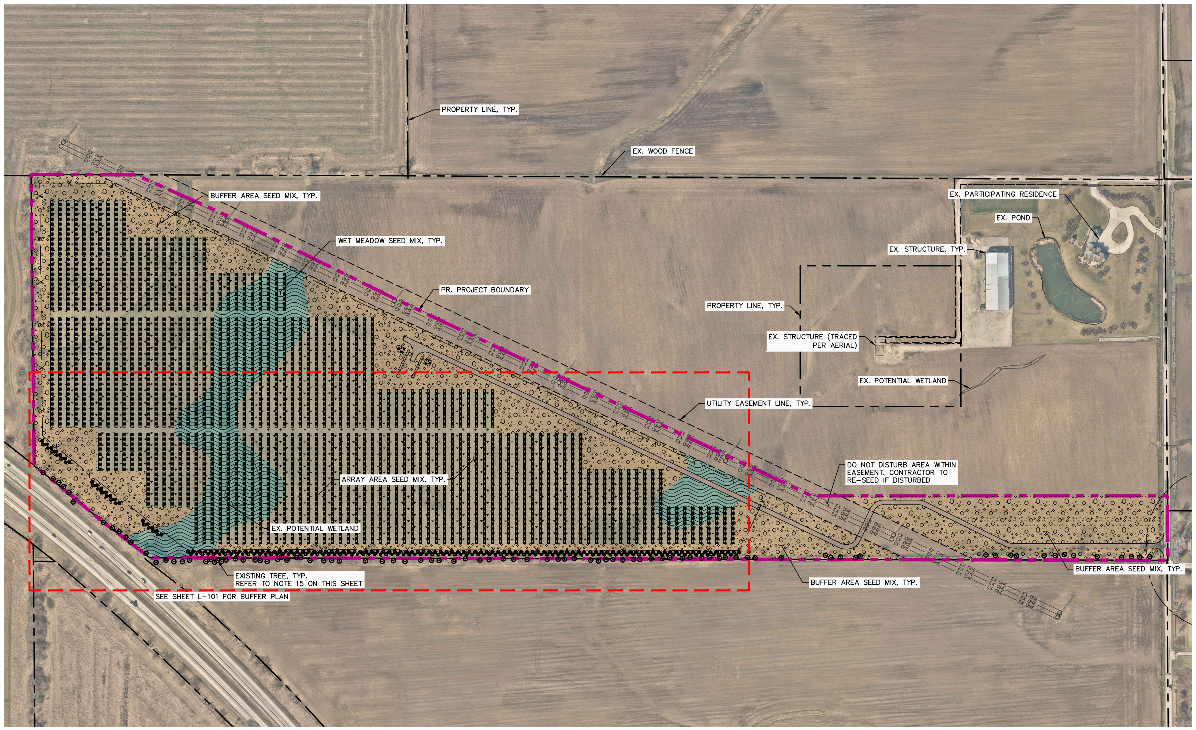
N DUNCAN ROAD SOLAR, LLC

CHAMPAIGN COUNTY, IL

SHEET NUMBER
C-400

NORTH

GRAPHIC SCALE IN FEET
0 100 200 400

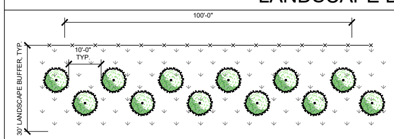


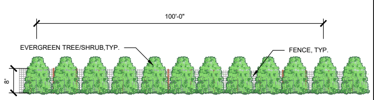
PLANT SCHEDULE

SYMBOL	CODE	QTY	BOTANICAL / COMMON NAME	CONT	SIZE
TREES					
	EX		EXISTING TREE	-	
	JC	56	JUNIPERUS CHINENSIS 'MOUNTBATTEN' / MOUNTBATTEN JUNIPER	B & B	5` HT. MIN.
	JE	60	JUNIPERUS VIRGINIANA / EASTERN REDCEDAR	B & B	5` HT. MIN.
	PF	56	PICEA PUNGENS GLAUCA 'FAT ALBERT' / FAT ALBERT COLORADO BLUE SPRUCE	B & B	5` HT. MIN.
	TI	56	THUJA X 'GREEN GIANT' / GREEN GIANT ARBORVITAE	B & B	5` HT. MIN.

SYMBOL	CODE	QTY	BOTANICAL / COMMON NAME
GROUND COVERS			
	A5		ARRAY AREA SEED MIX
	O7		BUFFER AREA SEED MIX
	XL		WET MEADOW SEED MIX

LANDSCAPE BUFFER EXHIBIT





SPECIES:	GROWTH RATE:	ESTIMATED 5 YEAR HEIGHT:
MOUNTBATTEN JUNIPER	MODERATE (1'+ PER SEASON)	10'
EASTERN RED CEDAR	MODERATE/FAST (1'-2'+ PER SEASON)	12'
GREEN GIANT ARBORVITAE	FAST (3'+ PER SEASON)	18'
COLORADO BLUE SPRUCE ('FAT ALBERT')	MODERATE/SLOW (1' PER SEASON)	10'

*NOTE: ACTUAL GROWTH RATES WILL VARY BASED ON CARE OF INSTALLATION, HEALTH OF NURSERY STOCK, TIME TO ESTABLISHMENT, WEATHER EVENTS, AND AVAILABLE SOIL NUTRIENTS. ALL NURSERY STOCK SHALL BE GUARANTEED BY THE CONTRACTOR, FOR ONE YEAR FROM DATE OF FINAL INSPECTION. SEE SHEET L-200 FOR FULL INSTALLATION AND ESTABLISHMENT. EXISTING VEGETATION BASED ON DESKTOP ANALYSIS AND IS FOR REFERENCE ONLY. CONTRACTOR TO VERIFY IN FIELD.

GENERAL LANDSCAPE NOTES

1. THE LANDSCAPE CONTRACTOR SHALL BE RESPONSIBLE FOR INSTALLING MATERIALS AND PLANTS SHOWN ON THE LANDSCAPE PLAN. THE CONTRACTOR IS RESPONSIBLE FOR THE COST TO REPAIR UTILITIES, ADJACENT LANDSCAPE, PUBLIC AND PRIVATE PROPERTY THAT IS DAMAGED BY THE CONTRACTOR OR THEIR SUBCONTRACTOR'S OPERATIONS DURING INSTALLATION OR DURING THE SPECIFIED MAINTENANCE PERIOD. CALL FOR UTILITY LOCATIONS PRIOR TO ANY EXCAVATION.
2. THE CONTRACTOR SHALL REPORT ANY DISCREPANCY IN PLAN VS. FIELD CONDITIONS IMMEDIATELY TO THE LANDSCAPE ARCHITECT, PRIOR TO CONTINUING WITH THAT PORTION OF WORK.
3. NO PLANTING WILL BE INSTALLED UNTIL ALL GRADING AND CONSTRUCTION HAS BEEN COMPLETED IN THE IMMEDIATE AREA.
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE REPAIR OF ANY OF THEIR TRENCHES OR EXCAVATIONS THAT SETTLE.
5. DO NOT DISTURB THE EXISTING PAVING, LIGHTING, OR LANDSCAPING THAT EXISTS ADJACENT TO THE SITE UNLESS OTHERWISE NOTED ON PLAN.
6. PLANT QUANTITIES SHOWN ARE FOR THE CONVENIENCE OF THE OWNER AND JURISDICTIONAL REVIEW AGENCIES. THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING ALL PLANT QUANTITIES AS DRAWN.
7. THE CONTINUED MAINTENANCE OF ALL REQUIRED LANDSCAPING SHALL BE THE RESPONSIBILITY OF THE OWNER OF THE PROPERTY ON WHICH SAID MATERIALS ARE REQUIRED. ALL PLANT MATERIALS REQUIRED BY THIS SECTION SHALL BE MAINTAINED AS LIVING VEGETATION AND SHALL BE PROMPTLY REPLACED IF THE PLANT MATERIAL HAS DIED PRIOR TO FINAL ACCEPTANCE.
8. 50% OF THE PROPOSED LANDSCAPE BUFFER SHALL BE ALIVE AND PRESENT AT THE END OF THE SECOND YEAR OF OPERATION. INDIVIDUAL BUFFER TREES THAT CONTAIN 50% OR MORE OF DEAD FOLIAGE/BRANCHING SHALL BE DEEMED AS DEAD. DEAD VEGETATION SHALL BE REPLACED IN KIND UNTIL THE OVERALL BUFFER REACHES MORE THAN 50% ON SITE.
9. NO GENERAL SPRAY OF HERBICIDES IS TO BE USED FOR ANY SEEDED AREAS.
10. ONLY HERBICIDES FORMULATED FOR ANIMAL SAFETY SHALL BE USED.
11. ALL WORK DEEMED NATURAL AREA TO BE SEEDED OR PLANTED SHALL BE PERFORMED BY A QUALIFIED LANDSCAPE CONTRACTOR.
12. SEED SHALL BE OBTAINED FROM SOURCE(S) SPECIALIZING IN NATIVE SPECIES, WHERE AVAILABLE OR AS APPROVED BY CLIENT OR CLIENT'S REPRESENTATIVE. SEE THE VEGETATION MANAGEMENT PLAN FOR SPECIFICATIONS AND INITIAL SEED MIX RECOMMENDATIONS.
13. ALL SEED MIXES SHALL BE INSTALLED WITH A COVER CROP DEPENDENT ON SEASON AND REQUIREMENTS SPECIFIED PER SEED MIX / SEED SUPPLIER.
14. EXISTING AND PROPOSED TREES SHOWN FOR REFERENCE ONLY AND SHALL BE FIELD VERIFIED. CONTRACTOR TO OBTAIN APPROVAL FROM AUTHORITY HAVING JURISDICTION FOR FINAL TREE LOCATIONS.
15. TREES ALONG SOUTHERN BOUNDARY LINE ON SUBJECT PROPERTY TO BE REMOVED AS PART OF CONSTRUCTION ACTIVITIES.

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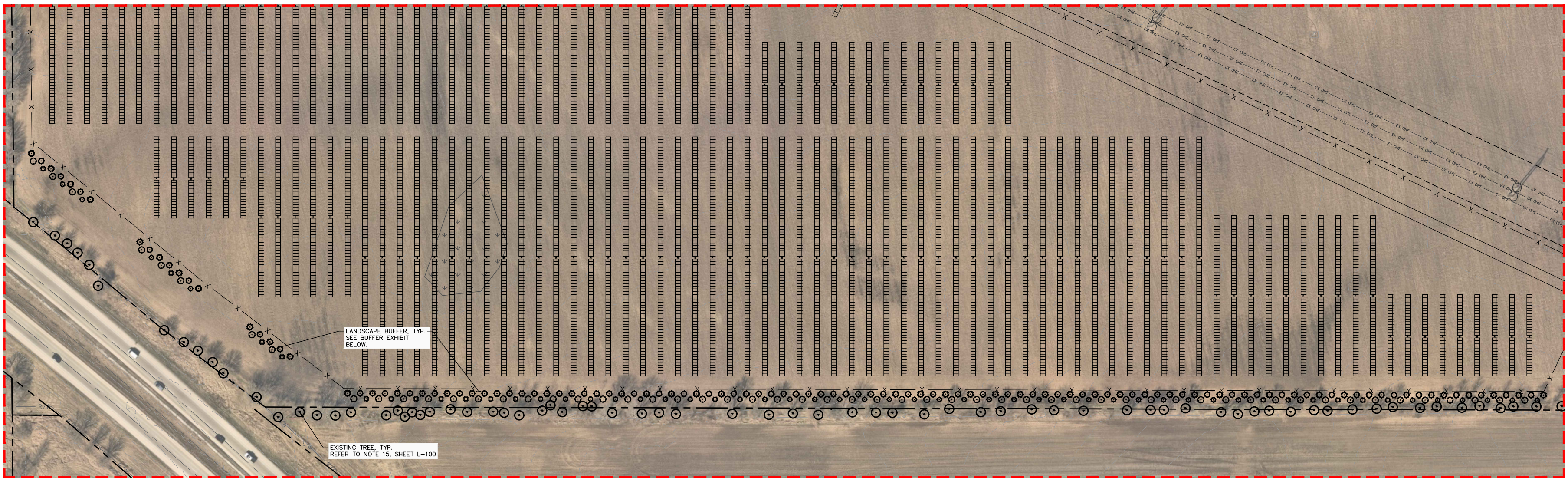
CHAMPAIGN COUNTY, IL

SHEET NUMBER
L-100

NORTH

GRAPHIC SCALE IN FEET
0 40 80 160



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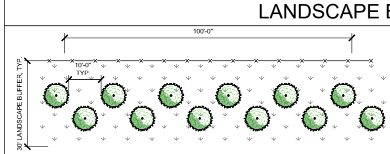
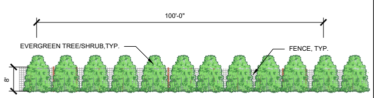
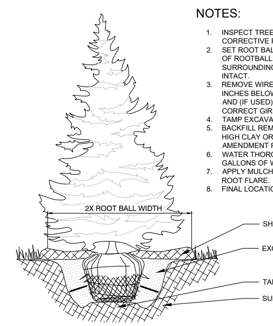
LANDSCAPE BUFFER EXHIBIT







NOTES:

1. INSPECT TREE FOR DAMAGED BRANCHES, APPLY CORRECTIVE PRUNING.
2. SET ROOT BALL ON UNEXCAVATED OR TAMPED SOIL. TOP OF ROOTBALL SHALL BE TWO INCHES ABOVE SURROUNDING GRADE WITH BURLAP AND WIRE BASKET INTACT.
3. REMOVE WIRE BASKET AND BURLAP DOWN FOUR TO SIX INCHES BELOW TOP OF ROOT BALL. REMOVE ALL TWINE AND (IF USED), SYNTHETIC MATERIAL. REMOVE OR CORRECT GIRDLING ROOTS.
4. TAMP EXCAVATED SOIL AROUND BASE OF ROOTBALL.
5. BACKFILL REMAINDER EXCAVATED SOIL TAMPED LIGHTLY. HIGH CLAY OR POOR SOIL SHALL RECEIVE SOIL AMENDMENT PER LANDSCAPE NOTES.
6. WATER THOROUGHLY WITHIN TWO HOURS USING 10 TO 15 GALLONS OF WATER.
7. APPLY MULCH IN EVEN LAYER, KEEPING AWAY FROM ROOT FLARE.
8. FINAL LOCATION OF TREE TO BE APPROVED BY OWNER.

1 EVERGREEN TREE PLANTING

NTS

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No.	REVISIONS	DATE
1	LANDSCAPE PLANS	10/16/2025
2	LANDSCAPE REVISION	11/11/2025

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CHICAGO, IL 60604
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KHA PROJECT 268779005
DATE 10/16/2025
SCALE AS SHOWN
DESIGNED BY AT
DRAWN BY GG
CHECKED BY DM

LANDSCAPE BUFFER PLAN

N DUNCAN ROAD SOLAR, LLC
CHAMPAIGN COUNTY, IL

SHEET NUMBER
L-101

GROUND COVER MAINTENANCE REQUIREMENTS

MAINTENANCE PROGRAMS SHALL BE SITE SPECIFIC AND COORDINATED WITH THE LANDSCAPE CONTRACTOR AND COUNTY FOR ADEQUATE MAINTENANCE PROCEDURES. A FIVE YEAR STEWARDSHIP PROGRAM IS NECESSARY TO ENSURE PROPER ESTABLISHMENT AND HEALTH OF GROUND COVER, TO CONTROL INVASIVE SPECIES, AND TO PREVENT OVERGROWTH AND SHADING OF EQUIPMENT. AFTER THE FIFTH GROWING SEASON, PROGRAM IS TO BE REDUCED TO TWO VISITS PER YEAR, DEPENDENT UPON SITE CONDITIONS AND REQUIRED STRATEGIES TO MAINTAIN GOOD HEALTH OF THE SITE SUCH AS DETHACHING, ADDITIONAL MOWING, OR HERBICIDE TREATMENTS.

FIRST YEAR

SPRING:
-EARLIEST POSSIBLE INSTALLATION MAY OCCUR IN THE SPRING OF THE FIRST YEAR. NO MAINTENANCE ACTIONS ARE REQUIRED TO BE PERFORMED DURING THE FIRST SEASON OF INSTALL. IF SEED APPLICATION TAKES PLACE IN SUMMER OR FALL OF THE FIRST YEAR, MAINTENANCE AND MONITORING SHOULD START THE FOLLOWING SEASON.

SUMMER:
-SITE VISITS ARE TO BE PERFORMED THREE TIMES THROUGHOUT THE SUMMER AT THE MIDDLE OR END OF EACH MONTH, WITH MONITORING AND EVALUATION OF VEGETATION HEIGHT AND PRESENCE OF INVASIVE SPECIES OCCURRING AT EACH VISIT.
-CONTROL INVASIVE WOODY AND HERBACEOUS FLORA THROUGH PHYSICAL REMOVAL OR SPOT *HERBICIDE TREATMENTS.
-CONDUCT MOWING UP TO THREE TIMES MAXIMUM DURING THE SUMMER IN AREAS OF THE SITE IDENTIFIED TO HAVE WEEDY OR INVASIVE VEGETATION. SEEDED AREAS SHOULD BE CUT BACK TO 12 INCHES IN HEIGHT, COLLECTED, REMOVED, AND PROPERLY DISPOSED OF.

FALL:
-SITE VISITS ARE TO BE PERFORMED THREE TIMES THROUGHOUT THE FALL AT THE MIDDLE OR END OF EACH MONTH, WITH MONITORING AND EVALUATION OF VEGETATION HEIGHT AND PRESENCE OF INVASIVE SPECIES OCCURRING AT EACH VISIT.
-CONTROL INVASIVE WOODY AND HERBACEOUS FLORA THROUGH PHYSICAL REMOVAL OR SPOT *HERBICIDE TREATMENTS.
-CONDUCT MOWING UP TO THREE TIMES MAXIMUM DURING THE FALL IN AREAS OF THE SITE IDENTIFIED TO HAVE WEEDY OR INVASIVE VEGETATION. SEEDED AREAS SHOULD BE CUT BACK TO 12 INCHES IN HEIGHT, COLLECTED, REMOVED, AND PROPERLY DISPOSED OF.

SECOND YEAR

SPRING:
-SITE VISITS ARE TO BE PERFORMED THREE TIMES THROUGHOUT THE SPRING AT THE MIDDLE OR END OF EACH MONTH, WITH MONITORING AND EVALUATION OF VEGETATION HEIGHT AND PRESENCE OF INVASIVE SPECIES OCCURRING AT EACH VISIT.
-DURING FIRST VISIT, MOWING SHOULD OCCUR TO CUT BACK ANY VEGETATION TO A HEIGHT OF 12 INCHES AND REMOVE DEAD STALKS AND SEED HEADS FROM THE PREVIOUS GROWING SEASON. ***SPRING MOWING SHALL BE PERFORMED BEFORE APRIL 15TH.***
-CONTROL INVASIVE WOODY AND HERBACEOUS FLORA THROUGH PHYSICAL REMOVAL OR SPOT *HERBICIDE TREATMENTS.
-CONDUCT MOWING UP TO THREE TIMES MAXIMUM DURING THE SPRING IN AREAS OF THE SITE IDENTIFIED TO HAVE WEEDY OR INVASIVE VEGETATION. AREAS IDENTIFIED AS WEEDY OR INVASIVE SHOULD BE CUT BACK WITH A MOWER BLADE 12 INCHES IN HEIGHT OR GREATER, COLLECTED, REMOVED, AND PROPERLY DISPOSED OF.
-PLANT SUPPLEMENTAL SEED AS NEEDED TO ADDRESS AREAS OF POOR COVERAGE AND TO INCREASE COMPETITION AND BIO-DIVERSITY.

SUMMER:
-SITE VISITS ARE TO BE PERFORMED THREE TIMES THROUGHOUT THE SUMMER AT THE MIDDLE OR END OF EACH MONTH, WITH MONITORING AND EVALUATION OF VEGETATION HEIGHT AND PRESENCE OF INVASIVE SPECIES OCCURRING AT EACH VISIT.
-MOWING SHOULD OCCUR TO CUT BACK ALL SEEDED AREAS TO A HEIGHT OF 12 INCHES, COLLECTED, REMOVED, AND PROPERLY DISPOSED OF.
-CONTROL INVASIVE WOODY AND HERBACEOUS FLORA THROUGH PHYSICAL REMOVAL OR SPOT *HERBICIDE TREATMENTS.
-CONDUCT MOWING UP TO THREE TIMES MAXIMUM DURING THE SUMMER IN AREAS OF THE SITE IDENTIFIED TO HAVE WEEDY OR INVASIVE VEGETATION. AREAS IDENTIFIED AS WEEDY OR INVASIVE SHOULD BE CUT BACK WITH A MOWER BLADE 12 INCHES IN HEIGHT OR GREATER, COLLECTED, REMOVED, AND PROPERLY DISPOSED OF.

FALL:
-SITE VISITS ARE TO BE PERFORMED THREE TIMES THROUGHOUT THE FALL AT THE MIDDLE OR END OF EACH MONTH, WITH MONITORING AND EVALUATION OF VEGETATION HEIGHT AND PRESENCE OF INVASIVE SPECIES OCCURRING AT EACH VISIT.
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-CONDUCT MOWING UP TO THREE TIMES MAXIMUM DURING THE FALL IN AREAS OF THE SITE IDENTIFIED TO HAVE WEEDY OR INVASIVE VEGETATION. AREAS IDENTIFIED AS WEEDY OR INVASIVE SHOULD BE CUT BACK WITH A MOWER BLADE 12 INCHES IN HEIGHT OR GREATER, COLLECTED, REMOVED, AND PROPERLY DISPOSED OF. SEEDED AREAS SHOULD BE CUT BACK TO 12 INCHES IN HEIGHT, COLLECTED, REMOVED, AND PROPERLY DISPOSED OF.

THIRD, FOURTH, AND FIFTH YEAR

SPRING:
-SITE VISIT IS TO BE PERFORMED ONE TIME DURING THE EARLY SPRING, WITH MONITORING AND EVALUATION OF VEGETATION HEIGHT AND PRESENCE OF INVASIVE SPECIES OCCURRING.
-MOWING SHOULD OCCUR TO CUT BACK ANY VEGETATION TO A HEIGHT OF 12 INCHES AND REMOVE DEAD STALKS AND SEED HEADS FROM THE PREVIOUS GROWING SEASON. ***SPRING MOWING SHALL BE PERFORMED BEFORE APRIL 15TH.***
-IF INVASIVE WOODY AND HERBACEOUS FLORA HAVE BEEN IDENTIFIED, PHYSICAL REMOVAL OR SPOT *HERBICIDE TREATMENTS ARE REQUIRED.

SUMMER:
-SITE VISIT IS TO BE PERFORMED ONE TIME DURING THE SUMMER, WITH MONITORING AND EVALUATION OF VEGETATION HEIGHT AND PRESENCE OF INVASIVE SPECIES OCCURRING.
-MOWING SHOULD OCCUR IN AREAS OF THE SITE IDENTIFIED TO HAVE WEEDY OR INVASIVE VEGETATION. AREAS IDENTIFIED AS WEEDY OR INVASIVE SHOULD BE CUT BACK WITH A MOWER BLADE 12 INCHES IN HEIGHT OR GREATER, COLLECTED, REMOVED, AND PROPERLY DISPOSED OF.
-IF INVASIVE WOODY AND HERBACEOUS FLORA HAVE BEEN IDENTIFIED, PHYSICAL REMOVAL OR SPOT *HERBICIDE TREATMENTS ARE REQUIRED.

FALL:
-SITE VISIT IS TO BE PERFORMED ONE TIME DURING THE FALL, WITH MONITORING AND EVALUATION OF VEGETATION HEIGHT AND PRESENCE OF INVASIVE SPECIES OCCURRING.
-MOWING SHOULD OCCUR IN AREAS OF THE SITE IDENTIFIED TO HAVE WEEDY OR INVASIVE VEGETATION. AREAS IDENTIFIED AS WEEDY OR INVASIVE SHOULD BE CUT BACK WITH A MOWER BLADE 12 INCHES IN HEIGHT OR GREATER, COLLECTED, REMOVED, AND PROPERLY DISPOSED OF.
-IF INVASIVE WOODY AND HERBACEOUS FLORA HAVE BEEN IDENTIFIED, PHYSICAL REMOVAL OR SPOT *HERBICIDE TREATMENTS ARE REQUIRED.

FOLLOWING THE FIFTH YEAR

-SITE VISITS ARE TO BE PERFORMED TWICE A YEAR, DURING THE EARLY SPRING AND LATE SUMMER, WITH MONITORING AND EVALUATION OF VEGETATION HEIGHT AND PRESENCE OF INVASIVE SPECIES OCCURRING AT EACH VISIT.
-DURING THE SPRING, MOWING SHOULD OCCUR TO CUT BACK ANY VEGETATION TO A HEIGHT OF 12 INCHES AND REMOVE DEAD STALKS AND SEED HEADS FROM THE PREVIOUS GROWING SEASON.
-DURING THE FALL, MOWING SHOULD OCCUR IN AREAS OF THE SITE IDENTIFIED TO HAVE WEEDY OR INVASIVE VEGETATION. AREAS IDENTIFIED AS WEEDY OR INVASIVE SHOULD BE CUT BACK TO 12 INCHES IN HEIGHT, COLLECTED, REMOVED, AND PROPERLY DISPOSED OF. ***SPRING MOWING SHALL BE PERFORMED BEFORE APRIL 15TH.***
-IF INVASIVE WOODY AND HERBACEOUS FLORA HAVE BEEN IDENTIFIED, PHYSICAL REMOVAL OR SPOT *HERBICIDE TREATMENTS ARE REQUIRED.

*ALL HERBICIDES ARE TO BE ANIMAL FRIENDLY AND APPLIED BY A TRAINED PERSONNEL.

PERFORMANCE STANDARDS

SATISFACTORY LANDSCAPE DEVELOPMENT ASSOCIATED WITH NATURALIZED VEGETATION WILL BE BASED ON THE FOLLOWING ITEMS.

1. **UPON COMPLETION OF CONSTRUCTION:** A TEMPORARY COVER CROP SHALL BE PLANTED TO AID IN THE ESTABLISHMENT OF THE NATIVE SPECIES AND PREVENT EROSION. COVER CROP MAY INCLUDE SPECIES SUCH AS OATS (AVENA SATIVA). NOTE: PERENNIAL RYE (LOLIUM PERENNE) AND BARNYARD GRASS (ECHINOCHLOA CRUSGALLI), WHICH ARE IDENTIFIED AS COVER CROP ON SOME REGIONAL SPECIES LISTS, SHALL NOT BE USED.
2. **WITHIN THREE (3) MONTHS OF SEEDING:** AT LEAST 70% O THE PROJECT SITE (EXCLUDING ACCESS ROAD(S) AND EQUIPMENT PAD(S)), AS MEASURED BY AERIAL COVERAGE, SHALL BE VEGETATED OR OTHERWISE STABILIZED AGAINST EROSION. THE COVER CROP MAY BE USED TO ACCOMPLISH THIS REQUIREMENT.
3. **YEAR 1:** BY THE END OF THE FIRST FULL GROWING SEASON, PLANTED AREAS SHALL HAVE 90% VEGETATION cover. THE COVER CROP MAY BE USED TO ACCOMPLISH THIS REQUIREMENT. ANY PLANTED TREES/SHRUBS THAT ARE DEAD OR TREES/SHRUBS WITH 50% OR MORE DEAD BRANCHES SHALL BE REPLACED.
4. **YEAR 2:** BY THE END OF THE SECOND GROWING SEASON, AT LEAST 50% OF THE VEGETATION PRESENT SHALL BE NATIVE, NON-INVASIVE SPECIES. NO AREA ON THE VEGETATED PORTION OF THE SITE GREATER THAN ONE (1) SQUARE METER SHALL BE DEVOID OF VEGETATION, AS MEASURED BY AERIAL COVERAGE. ANY PLANTED TREES/SHRUBS THAT ARE DEAD OR TREES/SHRUBS WITH 50% OR MORE DEAD BRANCHES SHALL BE REPLACED. NONE OF THE 3 MOST DOMINANT SPECIES WITHIN THE PLANTED COMMUNITIES SHALL BE NON-NATIVE OR INVASIVE SPECIES, INCLUDING, BUT NOT LIMITED TO: …
5. **YEAR 3:** BY THE END OF THE THIRD GROWING SEASON AT LEAST 60% OF THE VEGETATION PRESENT SHALL BE NATIVE, NON-INVASIVE SPECIES. NO NON-NATIVE OR INVASIVE SPECIES SHALL BE AMONG THE THREE (3) MOST DOMINANT SPECIES. NO AREA ON THE VEGETATED PORTION OF THE SITE GREATER THAN ONE (1) SQUARE METER SHALL BE DEVOID OF VEGETATION, AS MEASURED BY AERIAL COVERAGE. ANY PLANTED TREES/SHRUBS THAT ARE DEAD OR TREES/SHRUBS WITH 50% OR MORE DEAD BRANCHES SHALL BE REPLACED.
6. **YEAR 4:** BY THE END OF THE FOURTH GROWING SEASON AT LEAST 70% OF THE VEGETATION PRESENT SHALL BE NATIVE, NON-INVASIVE SPECIES. NO NON-NATIVE OR INVASIVE SPECIES SHALL BE AMONG THE THREE (3) MOST DOMINANT SPECIES. NO AREA ON THE VEGETATED PORTION OF THE SITE GREATER THAN ONE (1) SQUARE METER SHALL BE DEVOID OF VEGETATION, AS MEASURED BY AERIAL COVERAGE. ANY PLANTED TREES/SHRUBS THAT ARE DEAD OR TREES/SHRUBS WITH 50% OR MORE DEAD BRANCHES SHALL BE REPLACED.
7. **YEAR 5:** BY THE END OF THE FIFTH GROWING SEASON AT LEAST 75% OF THE VEGETATION PRESENT SHALL BE NATIVE, NON-INVASIVE SPECIES. NO NON-NATIVE OR INVASIVE SPECIES SHALL BE AMONG THE THREE (3) MOST DOMINANT SPECIES. NO AREA ON THE VEGETATED PORTION OF THE SITE GREATER THAN ONE (1) SQUARE METER SHALL BE DEVOID OF VEGETATION, AS MEASURED BY AERIAL COVERAGE. A MINIMUM OF 80% OF ALL TREES/SHRUBS IDENTIFIED IN THE APPROVED PLANS MUST BE ALIVE AND HEALTHY.
8. **COMPLIANCE APPROVAL:** AFTER YEAR 5 PERFORMANCE STANDARDS HAVE BEEN ACHIEVED, THE APPLICANT CAN SUBMIT A WRITTEN REQUEST FOR COMPLIANCE APPROVAL FROM SWCD. SWCD STAFF WILL VISIT THE SITE TO EVALUATE IF PERFORMANCE HAS BEEN MET. IF PERFORMANCE STANDARDS ARE CONFIRMED TO HAVE BEEN MET, SWCD WILL PROVIDE WRITTEN CONFIRMATION TO THE COMMUNITY DEVELOPMENT DIRECTOR. ONCE COMPLIANCE APPROVAL HAS BEEN OBTAINED, THE APPLICANT IS RESPONSIBLE FOR IMPLEMENTING THE LONG-TERM PORTION OF THE MAINTENANCE PLAN AND MAINTAINING THE YEAR 5 PERFORMANCE STANDARDS THROUGHOUT THE LIFE OF THE FACILITY.
9. **POST COMPLIANCE APPROVAL REPORTING:** AT EACH 5-YEAR INTERVAL AFTER COMPLIANCE APPROVAL, A BRIEF MONITORING REPORT SHALL BE SUBMITTED TO SWCD FOR REVIEW AND ACCEPTANCE. FAILURE TO SUBMIT THIS REPORT WILL BE A VIOLATION OF THE SPECIAL USE ORDINANCE. THE FORMAT OF THE REPORT SHALL FOLLOW THE FORMAT OF THE ANNUAL MONITORING AND MAINTENANCE REPORT. IF THE REPORT SHOWS THAT THE SITE DOES NOT MEET OR EXCEED THE YEAR 5 PERFORMANCE STANDARDS, ADDITIONAL MAINTENANCE SHALL BE PERFORMED DURING SUBSEQUENT YEARS TO ACHIEVE THE YEAR 5 STANDARDS. MONITORING REPORTS SHALL BE SUBMITTED ANNUALLY UNTIL SUCH STANDARD IS ACHIEVED, AT WHICH POINT THE 5-YEAR REPORTING PERIOD SHALL BE RESUMED.

ESTABLISHMENT NOTES AND STANDARDS

SEED AREA ESTABLISHMENT

PREPARATION

-SOIL IN AREAS OF EXISTING AGRICULTURAL USAGE IS RECOMMENDED TO BE TESTED FOR HIGH LEVELS OF HERBICIDES, AND AMENDED APPROPRIATELY TO BRING CONCENTRATION DOWN TO LEVELS APPROPRIATE FOR COMMON GRASSES. SOILS IDENTIFIED TO BE HIGH IN HERBICIDES OR CONTAMINATES SHOULD BE EVALUATED BY AN ENVIRONMENTAL SPECIALIST OR SOIL SCIENTIST TO DETERMINE REQUIRED METHODS OF REMEDIATION.
-SOILS SHALL BE UNIFORM, WITHOUT EXCESSIVE FURROWS, RUTS, OR RIDGES, AND LOW AREAS WHERE WATER MAY COLLECT.
-SOILS SHOULD BE CLEARED OF TRASH, DEBRIS, AND INVASIVE SPECIES PRIOR TO FINAL SEEDING APPLICATION.
-SOIL PREPARATION SHALL OCCUR WHEN WEATHER PERMITS AND TIMING ALLOWS FOR AT LEAST A FOLLOWING 48 HOURS WHERE SEEDING AND STABILIZATION METHODS MAY TAKE PLACE.

TIMING

-DORMANT SEASON SEEDING SHOULD BE PERFORMED BETWEEN NOVEMBER 1ST AND MARCH 15TH AND SHOULD UTILIZE WINTER-TOLERANT SEED FROM THE SPECIFIED SEED MIX, ALONG WITH 20-30 LBS PER ACRE OF A WINTER NURSE CROP SUCH AS SECALE CEREALE, PISUM SATIVUM, OR AVENA SATIVA.
-TO APPLY DORMANT SEED, SITE SHOULD BE CLEARED OF INVASIVE WEEDS, LIGHTLY TILLED OR DISKED, THEN DRILL APPLIED ACROSS THE ENTIRE AREA OF AGRICULTURAL SOIL.
-ACTIVE SEASON SEED APPLICATION SHOULD BE PERFORMED BETWEEN APRIL 1ST AND JUNE 15TH, AFTER RISK OF MAJOR FREEZING CONDITIONS IS MINIMIZED, FOR IDEAL ESTABLISHMENT AND MINIMIZING INVASIVE SPECIES COMPETITION.

APPLICATION

-SEED MIXTURES SHALL BE MECHANICALLY DRILLED.
-NO STRAW MULCH IS REQUIRED, UNLESS NEEDED FOR STEEP SLOPES, SOIL STABILIZATION, OR OTHER AREAS THAT ARE IDENTIFIED FOR EROSION PREVENTION.
-SEED SHALL BE APPLIED AT INDICATED RATES WITH COVER CROP OATS AT A RATE OF 32 LB PER ACRE, AS DIRECTED BY THE NRCS CONSERVATION PRACTICE STANDARD CONSERVATION COVER CODE 327.
-SEED SPECIES SHALL BE LOCALLY SOURCED WHEN FEASIBLE.
-FINAL SEED MIX MAY VARY DEPENDENT UPON SPECIFIC SPECIES AVAILABILITY AND TIME OF INSTALLATION.
-FINAL SEED MIX SHALL BE APPROVED BY OWNER, OWNER'S REPRESENTATIVE, OR LANDSCAPE ARCHITECT, AND THE AUTHORITY HAVING JURISDICTION.
-IF SEEDING IS PERFORMED PRIOR TO FINAL SITE INSTALLATION, ADDITIONAL SEED MAY BE APPLIED BY A LOW SPREADER IN AREAS THAT WERE DISTURBED.
-SITE SHOULD BE MONITORED FOLLOWING INSTALLATION FOR AREAS IDENTIFIED FOR ADDITIONAL RESEEDING UNTIL SEED MIX IS SUFFICIENTLY ESTABLISHED.

INVASIVE WEED CONTROL, MONITORING, AND MANAGEMENT

-A WORK PLAN SHOULD BE DEVELOPED TO AVOID THE SPREAD OF INVASIVE PLANTS FROM THESE AREAS.
-IF SUBSTANTIAL AREAS OF INVASIVE HERBACEOUS SPECIES ARE FOUND PRIOR TO OR AFTER PROJECT DEVELOPMENT, FOLIAR OR BROADCAST HERBICIDE APPLICATIONS MAY BE REQUIRED.
-FOR INVASIVE TREES, SHRUBS, AND VINES, MANAGEMENT MAY REQUIRE CUT-STEM HERBICIDE TREATMENTS.
-ALL INVASIVE SPECIES MANAGEMENT SHOULD BE CONDUCTED DURING THE SUMMER MONTHS WHILE THE TARGET PLANTS ARE ACTIVELY GROWING.
-TREATMENTS SHOULD BE CONDUCTED ACCORDING TO MAINTENANCE PLANS EACH YEAR AND SHOULD BE SEPARATED BY AT LEAST TWO WEEKS.
-HERBICIDE USE REPORTING WILL ADHERE TO ALL APPLICATOR LICENSING REQUIREMENTS.

TREE AND SHRUB INSTALLATION

-ALL PLANTS TO BE SPECIMEN GRADE, WELL BRANCHED, HEALTHY, FULL, PRE-INOCULATED, AND FERTILIZED. PLANTS SHALL BE FREE FROM DISEASE, PESTS, WOUNDS, AND SCARS. PLANTS SHALL BE FREE FROM NOTICEABLE GAPS, HOLES, OR DEFORMITIES. PLANTS SHALL BE FREE FROM BROKEN OR DEAD BRANCHES.
-TRUNKS WILL BE WRAPPED IF NECESSARY TO PREVENT SUN SCALD AND INSECT DAMAGE. THE LANDSCAPE CONTRACTOR SHALL REMOVE THE WRAP AT THE PROPER TIME AS PART OF THIS CONTRACT.
-THE OWNER'S REPRESENTATIVE MAY REJECT ANY PLANT MATERIALS THAT ARE DISEASED, DEFORMED, OR OTHERWISE NOT EXHIBITING SUPERIOR QUALITY.
-ALL NURSERY STOCK SHALL BE GUARANTEED, BY THE CONTRACTOR, FOR ONE YEAR FROM DATE OF FINAL INSPECTION. THE GUARANTEE BEGINS ON THE DATE OF THE LANDSCAPE ARCHITECT'S OR OWNER'S WRITTEN ACCEPTANCE OF THE INITIAL PLANTING. REPLACEMENT PLANT MATERIAL SHALL HAVE A ONE YEAR GUARANTEE COMMENCING UPON PLANTING.
-PLANTS ARE TO MEET AMERICAN STANDARD FOR NURSERY STOCK (ANSI Z60.1-2014 OR MOST CURRENT VERSION) REQUIREMENTS FOR SIZE AND TYPE SPECIFIED.
-PRUNE PLANTS AS NECESSARY PER STANDARD NURSERY PRACTICE AND TO CORRECT POOR BRANCHING OF EXISTING AND PROPOSED TREES.
-CONTRACTOR SHALL INSTALL SHREDDED HARDWOOD MULCH AT A 3" DEPTH TO ALL TREE AND SHRUB AREAS. TREES PLACED IN AREA COVERED BY TURF SHALL RECEIVE A 4' WIDE TREE RING WITH 3" DEPTH SHREDDED HARDWOOD MULCH.

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No.	REVISIONS	DATE
2	LANDSCAPE REVISION	11/11/2025
1	LANDSCAPE PLANS	10/16/2025

Rewild.

Kimley»Horn

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CHICAGO, IL 60604
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PRELIMINARY NOT FOR CONSTRUCTION

KHA PROJECT	268779005
DATE	10/16/2025
SCALE	AS SHOWN
DESIGNED BY	AT
DRAWN BY	GG
CHECKED BY	DM

LANDSCAPE NOTES

N DUNCAN ROAD SOLAR, LLC
CHAMPAIGN COUNTY, IL

SHEET NUMBER
L-200

EXHIBIT C: VEGETATION MANAGEMENT PLAN

VEGETATION MANAGEMENT PLAN

North Duncan Road Solar, LLC
Champaign County, IL

ReWild Renewables, LLC.

Prepared By:

Kimley-Horn & Associates, Inc.

November, 2025

Table of Contents

1.0 - INTRODUCTION

ReWild Renewables, LLC (the Developer) is developing North Duncan Road Solar, LLC (the Project), located in Champaign County, Illinois. The preliminary project development area is approximately 45.7 acres of a parcel in Champaign, IL, for the development of a solar energy facility. The Developer has established this Vegetation Management Plan (VMP) to guide groundcover and soils management practices for the Project from pre-construction through the life of the Project. This VMP will provide a preliminary review of site conditions and soils, recommendation of seed species, site preparation, timing of seed installation, seed application methods, and maintenance and monitoring guidelines.

1.1 - Project Goals

To develop a successful project, this VMP is to be used as a general guide, with flexibility to evolve with the Project as a benchmark to the on-going development and monitoring of the Project, and throughout the operational life of the Project. Such on-going monitoring may include on-site evaluation reports and coordination regarding any plan discrepancies, changes to the plans, or changes to the site program. Recommendations or modifications to the Project that vary from the VMP should be evaluated, coordinated, and authorized through the Project owner, the Developer, or an environmental consultant. Adaptive maintenance and monitoring, allowing for the change in pre-prescribed maintenance guidelines, are seen as a necessity in order to ensure success of the Project and to address changing conditions and unforeseen circumstances.

The primary goals of this VMP are to establish and maintain low-growing, hardy, and regionally appropriate groundcover vegetation and to minimize and control noxious and invasive plant species within the array and open areas of the Project limits throughout the Project lifetime. The proposed vegetation will include a variety of grasses and forbs with multiple benefits to soils, water, and wildlife. The primary composition of the groundcover will be low-growing grasses with a blend of cool-season and warm-season species to maintain a majority soils coverage, supplemented with perennial forbs with various blooming seasons.

1.2 - Existing Land Use

The Project is located East of Illinois-74 in Champaign, Illinois. The site primarily consists of one parcel lot, bordering a Right-of-Way to the West. The adjacent parcels to the North and South are zoned as agricultural (AG-1, AG-2) and to the East there is a SF-2 residential district. South of the SF-2 classified parcels includes a B-4 General Business zoning district. There is a cluster of residences that are located further south, past the abutting southern agricultural district. One of the larger features on site includes an overhead utility line that is alongside the majority of the western project boundary.

The proposed site plan limits consist of existing agricultural land to be developed for the use of solar energy production. The agricultural use includes primarily row-crop production with rotated crop species. For reference to the existing site location, land use, layout, existing vegetative conditions, and existing structures, please see the Preliminary Site Plan. [*separate document not included as part of this report*]

2.0 - SITE SOILS

A summary of the existing site soils was prepared from data and mapping provided by the United States Department of Agriculture, Natural Resources Conservation Service. In review of the existing site conditions, there are four major soils identified within the sites main area of solar production with more than 10% of overall land coverage. This evaluation looks at the aggregate conditions of soils across the major groups and any outlying areas.

SOILS SUMMARY OF NRCS WEB SOIL SURVEY								
SYMBOL	SOILS NAME	AREA	PERCENTAGE	DRAINAGE CLASS	FLOODING/PONDING	HYDRIC CLASS	RUNOFF CLASS	FARMLAND CLASS
56B	Dana silt loam, 2-5%	*15 ac*	31.9%	Moderately Well	None	No	Low	Prime Farmland
154A	Flanagan silt loam, 0-2%	*13.3 ac*	28.4%	Somewhat Poor	None	No	Low	Prime Farmland
622C2	Wyanet silt loam, 5-10%	*11.9 ac*	25.3%	Well Drained	None	No	Eroded	Farmland of Importance
152A	Drummer silty clay loam, 0-2%	*6.7 ac*	14.4%	Poor	Frequent Ponding	Yes	Negligible	Prime if Drained

The average soil properties include moderately well drained soils with a lower runoff classification. Depth to water table varies greatly between soil types but the majority of soils fall within 12-42" with extremes of 80+" and 0-12". This site does contain a few areas that may benefit from a different approach from the aggregate. Most notably, a small portion of the site contains a shallow water table with poor drainage and negligible runoff, leading to ponding, hydric soils, and standing water. This portion of soils should contain vegetation that is tolerant of wet conditions and can stand saturation for an extended period of time. Overall, with the majority of the site having a moderate drainage class, low runoff and no hydric classifications, vegetation should mainly be composed of typical hardy native vegetation that is lower growing underneath solar panels. Vegetation should also aim towards being deep rooted to allow for increased infiltration in certain areas where there may be shallow layers of clay contributing towards ponding and flooding on site. A Soils Map is provided as **Appendix A** as part of this report.

2.1 Moderate Soil Erosion

Soils on this site have been identified to contain steeper slopes (5-10%) and high levels of eroded topsoil. Soil erosion can cause a variety of problems for sites including reduced depth of topsoils, decrease in soil fertility and organic content, buildup of silt in swales and waterways, increased susceptibility to ponding and flooding, and damage to vegetation and structures on site. In order to address and prevent further erosion the site should be investigated prior to start of construction, to identify locations of existing and potential erosion. These locations should be immediately addressed with temporary or permanent erosion control measures such as seeding, erosion control blanket, silt fence checks, temporary sediment basins, fiber rolls, or other appropriate applications for the location and size of erosion area.

3.0 - EROSION AND SEDIMENT CONTROL / MITIGATION

Best Management Practices (BMP) shall conform to federal state, and local requirements of practice, as applicable to Erosion and Sediment Control/Mitigation, and defined in this Vegetative Management Plan. With the intention of reducing foot and vehicle traffic, the Project should define temporary parking and storage area to serve equipment maintenance and cleaning, employee parking, and locating site facilities, portable facilities, office trailers, and toilet facilities. Proper storage and disposal of project byproducts (wash water, oil, grease, rubbish, litter, etc.) is to be observed in order to mitigate the degradation of land and on-site resources.

Stabilization is defined as the improvement of soil stability though the addition of material to the soil. Stabilization practices should be initiated as soon as practical, completed at the end of each working day, but in no case more than 7 days where construction has temporarily ceased. Disturbed portions of the Project where construction activity has permanently stopped shall be stabilized with a temporary seed species or mix. If the action of vehicles traveling over the rocked construction entrances is not sufficient to remove the significant dirt or mud from falling onto paved roads, then the tires should be washed before the vehicles enter a public road. If washing is used, provisions must be made to intercept the wash water and trap the sediment before it is carried off site, as identified above. Slopes shall be left in a roughened condition during the grading phase to reduce runoff velocities and overall erosion.

All measures stated in this Vegetation Management Plan, and in any prepared Stormwater Pollution Prevention Plans (SWPPP), should be maintained in fully functional condition until no longer required for a completed phase of work or final stabilization of the site. All erosion and sedimentation control measures should be checked at least weekly during construction and within 24 hours of a 0.5" rainfall event or exceeds the governing requirements and cleaned/repaired.

3.1 - Soil Compaction Prevention

Compacted soils drastically reduce water infiltration, increase runoff, and promote additional sediment and topsoil erosion. Compacted soils also prevent or inhibit groundcover establishment over a long period of time, leading to additional erosional issues over the life of a project. To prevent soil compaction, construction equipment should be limited to designated access routes or areas identified for necessary construction only.

No equipment should be left outside of designated laydown yards between construction phases or during periods longer than 3 days. All equipment used outside of access routes and equipment laydown yards should be low ground pressure or equipped with wide-spread weight distribution tread/wheels. Personnel transport outside of designated access routes should be limited to small ATV vehicles or similar. No transport or construction equipment should enter or otherwise impact areas on site identified as wetland or surface water features.

Immediately following final construction of PV equipment, all disturbed and compacted areas should be tilled to a minimum depth of 3 inches prior to seed application. Deep tilling of soils is to be avoided in order to prevent bringing up dormant weedy or invasive seeds to the surface. If decompacted area is anticipated to remain bare longer than 2 weeks, straw mulch or similar cover should be applied to reduce risk of erosion or recompaction due to precipitation. Silt fence check dams may be utilized in areas of concentrated flow or slopes exceeding 5%.

No vegetation identified as noxious or invasive species shall be mulched or remain on site. Mulch may be brought in from off-site to use in temporary construction access locations or areas of erosion in order to prevent soil compaction and reduce surface erosion. Mulch brought from external sources should be untreated, uncolored, and free of contaminants of weedy species to prevent spread of noxious weed Mulch used for temporary purposes should remain on-site after construction, to aid in erosion control while groundcover vegetation establishes. Over time, wood mulch will decompose, providing additional nutrients and organic content to the soils. Mulch brought from external sources should be untreated, uncolored, and free of contaminants of weedy species to prevent spread of noxious weed species on site.

3.2 - Topsoil Management

Topsoil preservation is a key component to site erosion and stormwater mitigation, and establishment of permanent groundcover vegetation. Topsoils should be maintained in existing condition wherever feasible, and should be protected from construction disturbance through best management practices, identification of primary routes, erosion and sediment control barriers, and temporary stabilization. Topsoils in areas of high impact of site construction should be stockpiled in an area with minimally erodible topographic conditions, protected with stabilization measures such as temporary groundcover or other measures as identified as part of the Project's SWPPP [*separate document not included as part of this report*]. Topsoils should not be used for access road construction, backfill, or berming. No subsoils excavated during project construction should be placed on top of topsoils.

4.0 - PRELIMINARY SITE SEED RECOMMENDATION

4.1 - Temporary Seeding

In areas where construction is not on-going and has disturbed surface conditions, topsoils stockpiles, and areas identified as high concern of erosion, temporary seeding should be utilized for stabilization and protection of site soils. Temporary seeding should be performed in an as-needed basis, and at the earliest feasible timing to encourage quick stabilization. Temporary seeding should be applied either by broadcast with erosion control blanket or straw mulch, or by hydroseeding with straw mulch mix. Temporary seed species should be dependent on site conditions and season timing.

Temporary seeding should be planned for termination to reduce residual residue that can impede permanent seed establishment. The method for temporary seed species termination depends on the application, use, and location of the applied seed. Temporary seeding utilized for stabilization and steep slopes should not be fully removed to prevent erosion during transitional period. These areas should instead be treated with a glyphosate herbicide and mowed short, prior to immediate application of permanent seed mixture. Areas identified with high amounts of temporary vegetation and residue can be mowed and shallow disked to incorporate residue into the topsoil before application of permanent seed mixture. If temporary cover crop species were utilized with the permanent seed mix, no additional action is required as annual temporary species will be removed over time with general site maintenance, mowing, and dethatching.

TEMPORARY SEEDING TABLE			
SCIENTIFIC NAME	COMMON NAME	LBS/AC	TIMING
Avena sativa	Common Oat	*75*	Oct 1 - Feb 28
Echinochloa esculenta	Japanese Millet	*30*	April 1 - May 31
Glycine max	Soybean	*50*	April 1- Sept 30
Lolium multiflorum	Annual Ryegrass	*15*	April 1 - Sept 30
Pisum sativum	Common Pea	*40*	Oct 1 - Dec 15, April 1 - May 31
Secale cereale	Cereal Rye	*70*	Oct 1 - Dec 15, April 1 - May 31
Triticum aestivum	Winter Wheat	*100*	Oct 1 - Feb 28

4.2 - Permanent Seeding Recommendation

Permanent seeding is used to provide long-term vegetative groundcover during the lifetime of the Project. These mixes aid in the stabilization of soils, stormwater infiltration and slow runoff, and control noxious and invasive weedy species. The seed mixes presented in this VMP are initial recommendations and should be considered preliminary and typical. All plant species to be used on the site should be native or naturalized with additional benefits and designed to meet the Project's specific needs. A landscape plan set should be prepared to have the permanent and final seed species, composition percentages, and rates. [*separate document not included as part of this report*] Final selection of which array seed mix to procure and utilize is left to the decision of the Developer at the time of application.

ARRAY AREA SEED MIX					
% OF MIX BY WEIGHT	SCIENTIFIC NAME	COMMON NAME	HEIGHT	DROUGHT TOLERANCE	FLOOD TOLERANCE
38.85	Bouteloua curtipendula	Sideoats Grama	24–36"	High	Moderate
0.77	Bromus kalmil	Prairie Brome	20–40"	Moderate	Moderate
2.69	Carex brevior	Plains Oval Sedge	12–48"	High	High
1.54	Carex bicknellii	Bicknell's Sedge	18–36"	High	High
0.77	Carex vulpinoidea	Brown Fox Sedge	24–36"	Low–Moderate	High
31.92	Schizachyrium scoparium	Little Bluestem	24–48"	High	Low
0.38	Sporobolus heterolepis	Prairie Dropseed	24–36"	High	Low
0.35	Achillea millefolium	Western Yarrow	12–36"	High	Low
0.23	Allium cernuum	Nodding Onion	12–24"	Moderate–High	Low
1.33	Amorpha canescens	Lead Plant	24–36"	High	Low
0.04	Anemone canadensis	Canada Anemone	12–24"	Moderate	High
0.04	Aquilegia canadensis	Columbine	24–36"	Moderate	Moderate
0.17	Asclepias syriaca	Common Milkweed	24–48"	High	Moderate
0.46	Asclepias tuberosa	Butterfly Milkweed	18–24"	High	Low
0.15	Aster azureus	Sky Blue Aster	18–36"	Moderate	Moderate
1.04	Astragalus canadensis	Canada Milk Vetch	24–36"	Moderate	Moderate
0.04	Aster lateriflorus	Calico Aster	18–36"	Moderate	Moderate
3.07	Chamaecrista fasciculata	Partridge Pea	24–36"	High	Moderate
4.15	Dalea candida	White Prairie Clover	24–36"	High	Moderate
5.79	Dalea purpurea	Purple Prairie Clover	24–36"	High	Moderate
0.04	Gentiana flavida	Cream Gentian	12–24"	Moderate	Moderate
0.09	Pycnanthemum virginianum	Mountain Mint	24–36"	Moderate	Moderate
0.28	Rosa arkansana	Prairie Wild Rose	18–36"	Moderate	Moderate
1.85	Rudbeckia hirta	Black-eyed Susan	18–36"	High	Moderate
0.04	Solidago nemoralis	Gray Goldenrod	18–36"	High	Moderate
0.23	Tradescantia ohiensis	Ohio Spiderwort	18–36"	Moderate	Moderate
1.38	Verbena stricta	Hoary Vervain	18–36"	High	Moderate
2.31	Zizia aurea	Golden Alexanders	18–36"	Moderate	Moderate

Application of this mix should be at minimum rate of 13 lbs PLS per Acre. This mix should be supplemented with a nurse crop dependent on season.

BUFFER AREA SEED MIX					
% OF MIX BY WEIGHT	SCIENTIFIC NAME	COMMON NAME	HEIGHT	DROUGHT TOLERANCE	FLOOD TOLERANCE
18	*Schizachyrium scoparium*	Little Bluestem	24"-36"	High	Low
16	*Bouteloua curtipendula*	Sideoats Grama	24"-36"	High	Moderate
12	*Lolium perenne*	Perennial Ryegrass	1'	Moderate	Moderate
10	*Elymus virginicus*	Virginia Wild Rye	2-4'	High	High
6.5	*Elymus canadensis*	Canada Wildrye	3-4'	Moderate	Moderate
4.5	*Carex vulpinoidea*	Fox Sedge	2-3'	High	High
2.1	*Coreopsis lancelota*	Lanceleaf Coreopsis	1-3'	High	Low
4	*Chamaecrista fasciculata*	Partridge Pea	2'	High	Moderate
2.2	*Symphyotrichum laeve*	Smooth Blue Aster	2-4'	High	Moderate
4	*Allium cernuum*	Nodding Wild Onion	18"	High	High
3	*Dalea purpurea*	Purple Prairie Clover	1-3'	High	High
2.5	*Echinacea pallida*	Pale Purple Coneflower	2-4'	High	High
2	*Allium stellatum*	Prairie Onion	18"	High	Moderate
3.1	*Echinacea purpurea*	Purple Coneflower	2-4'	High	High
2	*Solidago nemoralis*	Gray Goldenrod	1-3'	High	Moderate
1.3	*Zizia aurea*	Golden Alexanders	1-2'	Moderate	Moderate
1.2	*Ratibida pinnata*	Yellow Prairie Coneflower	3-4'	High	High
0.8	*Symphyotrichum Ericoides*	Heath Aster	1-3'	High	Moderate
0.9	*Geranium Maculatum*	Wild Geranium	1-2'	High	Moderate
0.5	*Penstemon digitalis*	Foxglove Beardtongue	2-3'	High	High
1.4	*Solidago speciosa*	Showy Goldenrod	3'	High	Moderate
1	*Liatris aspera*	Rough Blazingstar	2-3'	High	Moderate
1	*Asclepias syriaca*	Common Milkweed	2-4'	High	Low

Application of this mix should be at minimum rate of 18 lbs PLS per Acre. This mix should be supplemented with a nurse crop dependent on season.

WET MEADOW AREA SEED MIX					
% OF MIX BY WEIGHT	SCIENTIFIC NAME	COMMON NAME	HEIGHT	DROUGHT TOLERANCE	FLOOD TOLERANCE
23.4	*Carex Vulpinoidea*	Fox Sedge	36"	High	High
14.1	*Bouteloua Curtipendula*	Sideoats Grama	24"	High	Moderate
10	*Elymus Virginicus*	Virginia Wild Rye	3-4'	High	High
7.4	*Tradescantia Ohiensis*	Ohio Spiderwort	36"	Moderate	High
6.3	*Juncus Dudleyi*	Dudley's Rush	24"	Moderate	High
6.2	*Carex Molesta*	Field Oval Sedge	36"	High	High
6.2	*Carex Brevior*	Plains Oval Sedge	24"	High	High
6.1	*Carex Stipata*	Common Fox Sedge	36"	High	High
5.3	*Allium Cernuum*	Nodding Wild Onion	8-18"	High	High
4.1	*Rudbeckia Hirta*	Black Eyed Susan	36"	High	High
3.2	*Echinacea Purpurea*	Purple Coneflower	36"	High	High
3.2	*Liatris Spicata*	Marsh Blazing Star	36"	Moderate	High
2.4	*Carex Bicknellii*	Copper-Shouldered Oval Sed	36"	High	High
2.1	*Juncus Effusus*	Soft Rush	3-4'	Moderate	High

Application of this mix should be at minimum rate of 15 lbs PLS per Acre. This mix should be supplemented with a nurse crop dependent on season.

5.0 - SITE PREPARATION

It is essential to prepare the site in order to give vegetation the highest chances of germinating and establishing. To do so it is important to clear the target area of existing weedy vegetation. This can be achieved through mowing and the targeted use of an animal-friendly Glyphosate herbicide. If a significant amount of weedy vegetation is present, it is not recommended to till the site as this can stir up dormant, buried weed seeds which can geminate quickly. If broad-application herbicide is required, seeding can take place one week after last herbicide application.

Soils should be uniform, without excessive furrows, ruts, or ridges, and low areas where water may collect. Areas identified to have rills or small gullies should be filled and blended with adjacent grade to mitigate and stop the continuation of soil erosion in these areas. Areas identified to have erosion should be noted and monitored during the first three years of seed establishment. Soils should be cleared of trash, debris, and invasive species prior to final seeding application. Soil preparation should occur when weather permits, and timing allows for at least a following 48 hours where seeding and stabilization methods may take place.

Since native pollinator species may be slow to establish, annual plant species, such as millet, rye, wheat, or oats may be used to temporarily stabilize the soil, depending on the soil and season, and at rates equal to 10-20 lbs per acre. These should not be allowed to seed and should be cut between 9 and 12 inches in height during the first season.

If excessive crop residue remains present on-site prior to seeding, residue should be disced or lightly tilled to a depth no more than 3 inches. Crop residue on the surface of soils can provide some soil stabilization and seed protection, however dense residue can hinder seed germination and establishment. If crop residue is identified to be dry and loose, care should be taken to minimize fire risk on site by applying water to the surface, removing residue, tilling residue into the topsoil, or a combination of these measures. No seeding should be performed during periods of excessive drought or where dry crop residue is identified.

6.0 - VEGETATION APPLICATION

6.1 - Seed Application Timing

To promote early and strong establishment the specified seed mix, dormant season seed application should be utilized if possible and as construction timeline permits. Dormant season seeding should occur between November 15th and February 28th utilizing winter-tolerant seed from the specified seed mix, along with a winter nurse crop such as annual rye, winter wheat, or annual oat. To apply dormant seed, the site should be cleared of invasive weeds, lightly tilled or disced, then drill seed applied across the entire area of agricultural soil. Active season seed application should be performed between April 1st and May 30th, after risk of major freezing conditions is minimized, for ideal establishment and minimizing invasive species competition.

6.2 - Seed Application on Slopes

Areas of highly erodible soils (per the soils report) or having evidence of existing erosion should be seeded with an erosion control blanket. The majority of soils on site are within the range of 0% and 10% slopes, contributing to varying degrees of erosion potential. Additional evaluation should occur on-site during site preparation and again during seeding application. During monitoring period, if additional areas of steep slope or erosion are identified, additional seeding and erosion control blanket should be applied.

6.3 - Seed Application Phasing

Seeding should occur in two phases. The first phase of seeding should occur at least 4 weeks prior to installation of array piles in order to reduce disturbance. During this time, laydown yards, temporary stormwater measures, or access road preparation may be performed only within designated areas. The first application should be mechanically drill seeded with the full nurse crop and at minimum 50% of the final and permanent seed mix. No straw mulch is required unless needed for soil stabilization in areas of concentrated surface flow. Straw mulch should be applied in these areas at a rate of 2 tons per acre during the first application of seed.

The second round of seeding should occur post-panel installation, after piles and array racking is built, and should include the full remainder seed mix by broadcast application and any additional that may be required in areas identified as heavily disturbed during the construction phase. Spot herbicide application should occur during this phase of seeding, focusing on areas where noxious weeds are aggressively outcompeting native vegetation.

7.0 - MAINTENANCE AND MONITORING DEVELOPMENT

Maintenance programs should be site specific and coordinated with the landscape contractor and county for adequate maintenance procedures. A five-year stewardship program is recommended to ensure proper establishment and health of ground cover, to control invasive species, and to prevent overgrowth and impact to solar energy production. After the fifth growing season, the program is to be reduced to a minimum of one visit per year, dependent upon site conditions and required strategies to maintain good health of the site such as dethatching, additional mowing, or herbicide treatments.

All assessments made during monitoring visits should identify any presence of invasive species as defined by the Illinois Exotic Weed Act (525 ILCS 10/ET SEQ.) and the Illinois Noxious Weed Law (505 ILCS 100/ET SEQ.), including additional species of invasive or weedy vegetation as defined by the Illinois Department of Natural Resources, University of Illinois, and the U.S. Department of Agriculture. Assessments should include planned action to manage and remove identified weedy species.

7.1 - Timeline of Implementation

First year:

The earliest possible seed application may occur in the Spring of the first year. No maintenance actions are required to be performed during the first season of application. If seed application takes place in summer or fall of the first year, maintenance and monitoring should start the following season.

Site visits are recommended to be performed one to three times throughout the Summer and an additional one to three times throughout the Fall at the beginning, middle, or end of each month, with monitoring and evaluation of vegetation height and presence of invasive species occurring at each visit. If weedy species are identified during an observation, measures to control invasive woody and herbaceous flora through physical removal or spot herbicide treatments is required. Mowing should be conducted during the first year in areas of the site identified to have vegetation over 16 inches in height. Areas with height under 16 inches may remain until the next scheduled monitoring visit. Newly seeded areas should be cut back to 9 inches in height, if possible, as the lower mowing height helps to reduce opportunistic weedy species.

Second year:

Site visits are recommended to be performed one to three times throughout the Spring, Summer, and Fall at the beginning, middle, or end of each month, with monitoring and evaluation of vegetation height and presence of invasive species occurring at each visit. During the first visit of the year, mowing should occur to cut back any vegetation to a height of 10 inches and remove dead stalks and seed heads from the previous growing season. If weedy species are identified during an observation, measures to control invasive woody and herbaceous flora through physical removal or spot herbicide treatments is required. Mowing should be conducted at each additional visit in areas of the site identified to have vegetation over 18 inches in height. Areas with height under 18 inches may remain until the next scheduled monitoring visit. Vegetative areas should be cut back to 9 inches in height.

Third, Fourth, and Fifth year:

Site visits are recommended to be performed one time during the early Spring, Summer, and Fall with monitoring and evaluation of vegetation height and presence of invasive species occurring at each visit. During the first visit of the year, mowing should occur to cut back any vegetation to a height between 9 and 12 inches to remove dead stalks and seed heads from the previous growing season. If weedy species are identified during an observation, measures to control invasive woody and herbaceous flora through physical removal or spot herbicide treatments is required. Mowing in open areas, along the fence line, and buffer areas should be conducted in areas of the site identified to have vegetation over 36 inches in height. Areas with height under 24 inches may remain until the next scheduled monitoring visit. Vegetative areas should be cut back to 9 inches in height.

Following the Fifth year:

Site visits are recommended to be performed at least once a year, during the early Spring, with monitoring and evaluation of vegetation height and presence of invasive species occurring during the visit. During the Spring, mowing should occur to cut back any vegetation to a height between 9 and 12 inches to remove dead stalks and seed heads from the previous growing season. If weedy species are identified during an observation, measures to control invasive woody and herbaceous flora through physical removal or spot herbicide treatments is required.

For the remainder of the year, vegetation should be mowed in open areas, along the fence line, and buffer areas to maintain a height under 48 inches through the growing season. Areas with height under 36 inches may remain until the next scheduled monitoring visit. Mowing within array areas should be conducted in areas identified to have vegetation over 24 inches in height. Vegetative areas should be cut back to 9 inches in height.

7.2 – Groundcover Maintenance Outside Project Fence Line

Groundcover outside solar production areas is intentionally more diverse and typically grows taller than vegetation beneath the panels. During initial establishment, monitoring and maintenance of vegetation beyond the project fence will generally follow the same approach as within the main solar production areas. Scheduled onsite inspections will include visual checks for weedy species, cover crop presence, and the health and productivity of native pollinator plants.

Weedy species will be controlled through physical removal and targeted herbicide applications. The established mowing schedule above will proactively prevent reseeding of weeds and cover crops.

8.0 – PERFORMANCE STANDARDS

Satisfactory groundcover development associated with naturalized vegetation should be evaluated at each monitoring period and based on the following criteria.

Upon completion of project construction:

All disturbed areas or areas identified as bare soils measuring one square meter with no vegetation should receive either temporary cover crop or permanent seed application. No areas of bare soils should remain after substantial completion of the Project.

Three months after seeding:

Within three months of seed application, or three months after the start of the growing season following dormant seeding, approximately 60 percent of the seeded area (excluding access roads, pads, or other hardscape areas), as measured by aerial cover, should be vegetated or otherwise stabilized against erosion. Temporary cover crop may be included in stabilization and seeded area percentage. Supplemental use of straw mulch or blanket should not be included in the seeded area percentage, unless new growth germination is identified within the straw or blanketed areas.

After the first year:

By the end of the first full growing season, all seeded areas should have 80 percent minimum vegetation (excluding access roads, pads, or other hardscape areas), as measured by aerial cover. Temporary cover crop may be included seeded area percentage.

After the second year:

By the end of the second growing season, all seeded areas should have a minimum of 90 percent vegetation ground cover, of which 50 percent should be native and naturalized species identified in final seed mix (excluding access roads, pads, or other hardscape areas). Native and naturalized species percentage should not include temporary cover crop, erosion control measures, or undesirable and invasive plant species.

After the third year:

By the end of the third growing season, all seeded areas should have a minimum of 60 percent ground cover by native and naturalized species identified in final seed mix (excluding access roads, pads, or other hardscape areas). This should not include temporary cover crop, erosion control measures, or undesirable and invasive plant species. No areas identified as bare soils of one square meter or larger should be present within seeded areas.

After the fourth year:

By the end of the third growing season, all seeded areas should have a minimum of 70 percent ground cover by native and naturalized species identified in final seed mix (excluding access roads, pads, or other hardscape areas). This should not include temporary cover crop, erosion control measures, or undesirable and invasive plant species. No areas identified as bare soils of one square meter or larger should be present within seeded areas.

After the fifth year, and subsequent years:

By the end of the third growing season, all seeded areas should have a minimum of 75 percent ground cover by native and naturalized species identified in final seed mix (excluding access roads, pads, or other hardscape areas). This should not include temporary cover crop, erosion control measures, or undesirable and invasive plant species. No areas identified as bare soils of one square meter or larger should be present within seeded areas.

If performance standards are not met at each observation period, the landscape contractor should notify the owner and Developer and propose corrective action in order to meet the performance standard by the next observation period. Corrective action may include overseeding, especially areas identified with bare soils, additional erosion control measures, or herbicide treatments.

APPENDIX A

SOILS MAP

(NOTE: BOUNDARIES DETERMINED BY MAIN AREAS OF SOLAR PRODUCTION)

Soil Map—Champaign County, Illinois
(Overall)

Map Scale: 1:4,740 if printed on A landscape (11" x 8.5") sheet.

Meters: 0, 50, 100, 200, 300

Feet: 0, 200, 400, 800, 1200

N

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

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

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

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

Soil Survey Area: Champaign County, Illinois
Survey Area Data: Version 19, Aug 21, 2024

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

Date(s) aerial images were photographed: Jul 7, 2023—Aug 31, 2023

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
56B	Dana silt loam, 2 to 5 percent slopes	15.0	31.9%
152A	Drummer silty clay loam, 0 to 2 percent slopes	6.7	14.4%
154A	Flanagan silt loam, 0 to 2 percent slopes	13.3	28.4%
622C2	Wyanet silt loam, 5 to 10 percent slopes, eroded	11.9	25.3%
Totals for Area of Interest		**46.8**	**100.0%**

Champaign County, Illinois

56B—Dana silt loam, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2smzw
Elevation: 610 to 850 feet
Mean annual precipitation: 37 to 43 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 165 to 190 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Dana and similar soils: 96 percent
Minor components: 4 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dana

Setting

Landform: Ground moraines, till plains
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loess over loamy till

Typical profile

Ap - 0 to 11 inches: silt loam
Bt1 - 11 to 32 inches: silty clay loam
2Bt2 - 32 to 58 inches: clay loam
2C - 58 to 79 inches: loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 24 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e

Hydrologic Soil Group: C
Ecological site: R108XA006IL - Loess Upland Prairie
Hydric soil rating: No

Minor Components

Drummer, drained

Percent of map unit: 4 percent
Landform: Swales on till plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: R108XA013IL - Wet Outwash Prairie, R110XY024IL - Ponded Depressional Sedge Meadow
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Champaign County, Illinois
Survey Area Data: Version 19, Aug 21, 2024

Champaign County, Illinois

154A—Flanagan silt loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2ssry
Elevation: 570 to 990 feet
Mean annual precipitation: 34 to 42 inches
Mean annual air temperature: 46 to 54 degrees F
Frost-free period: 160 to 190 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Flanagan and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Flanagan

Setting

Landform: Till plains, ground moraines
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess over loamy till

Typical profile

Ap - 0 to 8 inches: silt loam
A - 8 to 18 inches: silty clay loam
Bt1 - 18 to 32 inches: silty clay loam
Bt2 - 32 to 45 inches: silty clay loam
2Bt3 - 45 to 49 inches: silt loam
2C - 49 to 60 inches: loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 6.0
Available water supply, 0 to 60 inches: High (about 9.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: C/D
Ecological site: R108XA006IL - Loess Upland Prairie
Hydric soil rating: No

Minor Components

Elpaso, drained

Percent of map unit: 4 percent
Landform: Ground moraines, till plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: R108XA007IL - Wet Loess Upland Prairie, R108XA008IL - Ponded Loess Sedge Meadow, R110XY024IL - Ponded Depressional Sedge Meadow
Hydric soil rating: Yes

Urban land

Percent of map unit: 1 percent
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Data Source Information

Soil Survey Area: Champaign County, Illinois
Survey Area Data: Version 19, Aug 21, 2024

Champaign County, Illinois

622C2—Wyanet silt loam, 5 to 10 percent slopes, eroded

Map Unit Setting

National map unit symbol: 2zss1
Elevation: 490 to 1,130 feet
Mean annual precipitation: 35 to 42 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 150 to 185 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Wyanet, eroded, and similar soils: 93 percent
Minor components: 7 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wyanet, Eroded

Setting

Landform: Ground moraines, end moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Thin mantle of loess or other silty material over calcareous loamy till

Typical profile

Ap - 0 to 8 inches: silt loam
Bt1 - 8 to 28 inches: clay loam
Bt2 - 28 to 35 inches: loam
C - 35 to 60 inches: loam

Properties and qualities

Slope: 5 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 35 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 6.0
Available water supply, 0 to 60 inches: Moderate (about 7.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R108XA006IL - Loess Upland Prairie, R110XY006IL - Dry Glacial Drift Upland Prairie
Hydric soil rating: No

Minor Components

Drummer, drained

Percent of map unit: 5 percent
Landform: Outwash plains, till plains, stream terraces, swales
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Linear
Across-slope shape: Linear, concave
Ecological site: R108XA013IL - Wet Outwash Prairie, R110XY024IL - Ponded Depressional Sedge Meadow, R111XD020IN - Wet Outwash Mollisol
Hydric soil rating: Yes

Sable

Percent of map unit: 1 percent
Landform: Swales
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: R108XB009IL - Ponded Loess Sedge Meadow
Hydric soil rating: Yes

Raub

Percent of map unit: 1 percent
Landform: Ground moraines, end moraines
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R108XA006IL - Loess Upland Prairie, R110XY007IL - Moist Glacial Drift Upland Prairie
Hydric soil rating: No

Data Source Information

Soil Survey Area: Champaign County, Illinois
Survey Area Data: Version 19, Aug 21, 2024

Champaign County, Illinois

152A—Drummer silty clay loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2ssrz
Elevation: 490 to 1,020 feet
Mean annual precipitation: 33 to 43 inches
Mean annual air temperature: 46 to 54 degrees F
Frost-free period: 160 to 190 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Drummer, drained, and similar soils: 94 percent
Minor components: 6 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Drummer, Drained

Setting

Landform: Stream terraces on outwash plains, stream terraces on till plains, swales on outwash plains, swales on till plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, talf
Down-slope shape: Linear
Across-slope shape: Linear, concave
Parent material: Loess over stratified loamy outwash

Typical profile

Ap - 0 to 14 inches: silty clay loam
Btg - 14 to 41 inches: silty clay loam
2Btg - 41 to 47 inches: loam
2Cg - 47 to 60 inches: stratified sandy loam to clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Ecological site: R108XA013IL - Wet Outwash Prairie, R110XY024IL - Ponded Depressional Sedge Meadow, R111XD020IN - Wet Outwash Mollisol
Hydric soil rating: Yes

Minor Components

Peotone, drained

Percent of map unit: 3 percent
Landform: Depressions on outwash plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R110XY024IL - Ponded Depressional Sedge Meadow
Hydric soil rating: Yes

Harpster, drained

Percent of map unit: 3 percent
Landform: Depressions on outwash plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R110XY025IL - Ponded Calcareous Sedge Meadow
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Champaign County, Illinois
Survey Area Data: Version 19, Aug 21, 2024

EXHIBIT D: NOISE ASSESSMENT

Kimley»Horn

April 23, 2025

Zachary Farkes
ReWild Renewables

Subject: ***N Duncan Road Solar, LLC - Noise Assessment***
Champaign County, Illinois

Executive Summary

The purpose of this technical memorandum is to evaluate potential noise levels associated with the operational equipment located at the proposed N Duncan Road Solar, LLC Solar Site in Champaign County, IL. The proposed solar photovoltaic project site is located approximately half a mile northwest of Champaign, approximately 1.5 miles southeast of Mahomet, approximately 4.5 miles northeast of Bondville, and approximately 7 miles southwest of Thomasboro. The proposed N Duncan Road Solar, LLC Solar Site will be developed on nearly 43 acres of an approximately 58-acre parcel of agricultural land with County Road 900 East/North Duncan Road to the east, and Everett McKinley Dirksen Memorial Highway (I-74) to the west, and Meridian Drive to the south. Additionally, there is a Norfolk Southern (NS) rail line approximately 1.5 miles southwest of the site. The site will consist of solar arrays throughout the project area and sixteen (16) string inverters on two (2) equipment pads, with eight (8) string inverters on each equipment pad, near the northern portion of the site.

Noise Regulations

Section 6.1.5 (I) of the Champaign County, Illinois Zoning Ordinance states that "Noise levels from any PV SOLAR FARM shall be in compliance with the applicable Illinois Pollution Control Board (IPCB) regulations (35 Illinois Administrative Code, Subtitle H: Noise, Parts 900, 901, 910)." The IPCB noise regulations are based on allowable octave band sound pressure levels during daytime and nighttime hours. According to Title 35 (Environmental Protection), Subtitle H (Noise), Chapter I (Pollution Control Board), Part 901 (Sound Emission Standards and Limitations for Property Line-Noise Sources), a facility operating in an agricultural field (Class C Land) cannot cause an exceedance of sound levels at any point within a residential land use (Class A Land) during daytime hours as shown in **Table 1**.

Table 1: Maximum Allowable Sound Emitted to Class A Land During Daytime Hours

Octave Band Center Frequency (Hertz)	Allowable Octave Band Sound Pressure Levels (dB) of Sound Emitted to any Receiving Class A Land from		
	Class C Land	Class B Land	Class A Land
31.5	**75**	72	72
63	**74**	71	71
125	**69**	65	65
250	**64**	57	57
500	**58**	51	51
1000	**52**	45	45
2000	**47**	39	39
4000	**43**	34	34
8000	**40**	32	32

Since the solar array does not generate power at night, the equipment will not operate at night and will comply with the IPCB nighttime hour limits.

Noise Assessment

Noise levels from anticipated operational equipment likely to be installed at the proposed N Duncan Road Solar, LLC Solar site were evaluated to assist with determining a conservative distance that the equipment should be located from the edge of the project boundary.

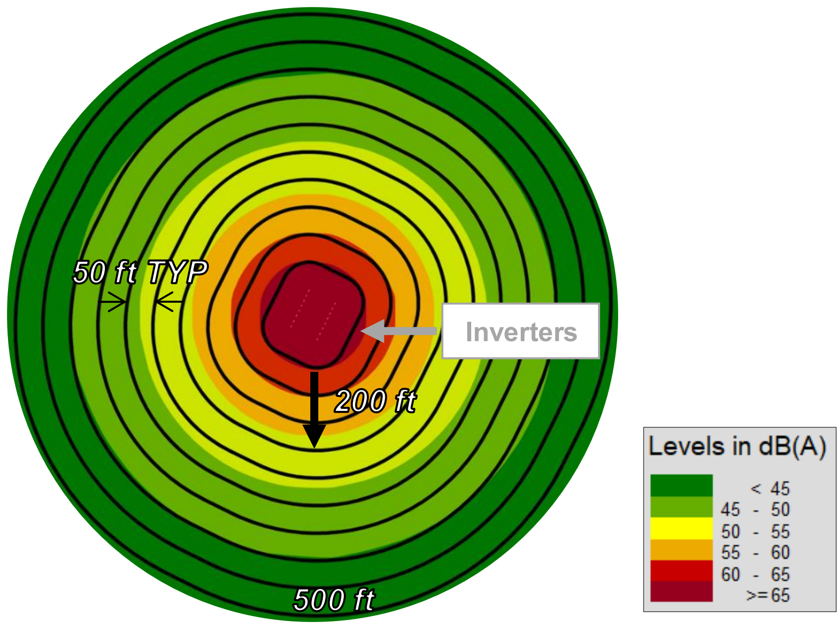
Inverters

Photovoltaic (PV) inverter equipment can generate steady, unvarying noise that may create issues when located near noise-sensitive uses. Based on provided noise emission levels for Solectria XGI 1500-250-DCG string inverter equipment, a maximum operational sound level of approximately 81 dB(A) at 1 meter (i.e., 3 feet) for each of the PV string inverters was used. **Table 2** shows the octave band emission levels for a single PV string inverter used for reference. The sound emissions from the operation of the Solectria XGI 1500-250-DCG string inverters were calculated using SoundPLAN. The anticipated noise level contours from the operation of string inverter equipment are shown in **Figure 1**.

Table 2: Sound Emissions for PV Inverter

Octave Band Center Frequency	**12.5 Hz**	**16 Hz**	**20 Hz**	**25 Hz**	**31.5 Hz**	**40 Hz**	**50 Hz**	**63 Hz**	**80 Hz**	**100 Hz**	**125 Hz**
Frequency Sound Level	2.8	7.8	11.5	15.0	17.3	21.4	26.2	27.5	28.2	39.7	51.1
Center Frequency	**160 Hz**	**200 Hz**	**250 Hz**	**315 Hz**	**400 Hz**	**500 Hz**	**630 Hz**	**800 Hz**	**1 kHz**	**1.25 kHz**	**1.6 kHz**
Sound Level	46.3	49.4	53.2	56.1	60.7	58.8	60.5	66.6	58.9	59.5	61.6
Center Frequency	**2 kHz**	**2.5 kHz**	**3.15 kHz**	**4 kHz**	**5 kHz**	**6.3 kHz**	**8 kHz**	**10 kHz**	**12.5 kHz**	**16 kHz**	**20 kHz**
Sound Level	58.8	59.4	62.5	64.9	68.0	79.5	59.1	65.2	62.7	45.5	47.0

Figure 1: Anticipated Noise Level Contours for String Inverter Operations



Recommendations and Conclusions

Based on the analysis of this memo, if the equipment pads are located greater than 200 feet from the project boundary, operational noise levels are anticipated to be in compliance with the IPCB noise regulations. See **Table 3** below for the SoundPLAN-predicted octave band noise levels at a distance of approximately 200 feet from the inverter equipment pads. See **Figure 2** below for the noise level contours in relation to the project site.

Table 3: Predicted Octave Band Sound Emissions for Inverter Operations

Octave Band Center Frequency	31 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Maximum Octave Band SPLs from Inverters	1.9	12.1	29.4	19.1	16.8	29.9	39.8	41.3	29.9

The inverter equipment at the N Duncan Road Solar, LLC Solar site is located approximately 150 feet from the closest project property boundary and approximately 1,645 feet from the closest residential land use; therefore, noise emission levels from the inverter equipment is anticipated to be in compliance with the applicable IPCB allowable octave band sound pressure level limits shown in **Table 1**. Therefore, noise mitigation measures do not need to be considered at this time.

Figure 2: Site Layout with Anticipated Noise Level Contours for String Inverter Operations

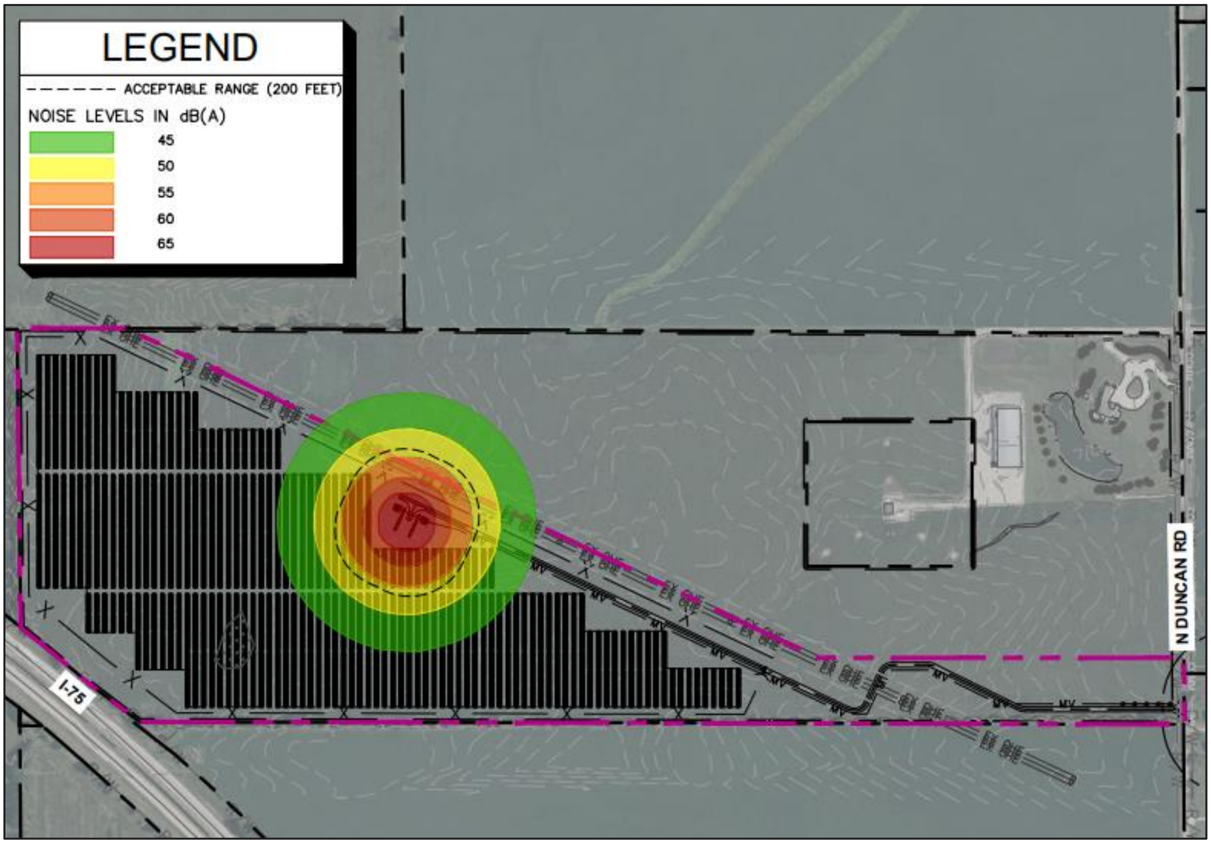


EXHIBIT E: FAA NO HAZARD DETERMINATION

Mail Processing Center
Federal Aviation Administration
Southwest Regional Office
Obstruction Evaluation Group
10101 Hillwood Parkway
Fort Worth, TX 76177

Aeronautical Study No.
2025-AGL-1675-OE

Issued Date: 02/19/2025

Rebecca Kwoka
N Duncan Road Solar, LLC
PO Box 1320
Portsmouth, NH 03802

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Solar Tower Highest Point
Location:	Hensley, IL
Latitude:	40-10-08.01N NAD 83
Longitude:	88-18-20.92W
Heights:	840 feet site elevation (SE)
	15 feet above ground level (AGL)
	855 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

Based on this evaluation, marking and lighting are not necessary for aviation safety. However, if marking/ lighting are accomplished on a voluntary basis, we recommend it be installed in accordance with FAA Advisory circular 70/7460-1 .

This determination expires on 08/19/2026 unless:

(a) the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.
(b) extended, revised, or terminated by the issuing office.
(c) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO

SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

This determination is based, in part, on the foregoing description which includes specific coordinates, heights, frequency(ies) and power. Any changes in coordinates, heights, and frequencies or use of greater power, except those frequencies specified in the Colo Void Clause Coalition; Antenna System Co-Location; Voluntary Best Practices, will void this determination. Any future construction or alteration, including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.This determination includes all previously filed frequencies and power for this structure.

If construction or alteration is dismantled or destroyed, you must submit notice to the FAA within 5 days after the construction or alteration is dismantled or destroyed.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

If we can be of further assistance, please contact our office at (817) 222-5954, or timothy.m.waychoff@faa.gov. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2025-AGL-1675-OE.

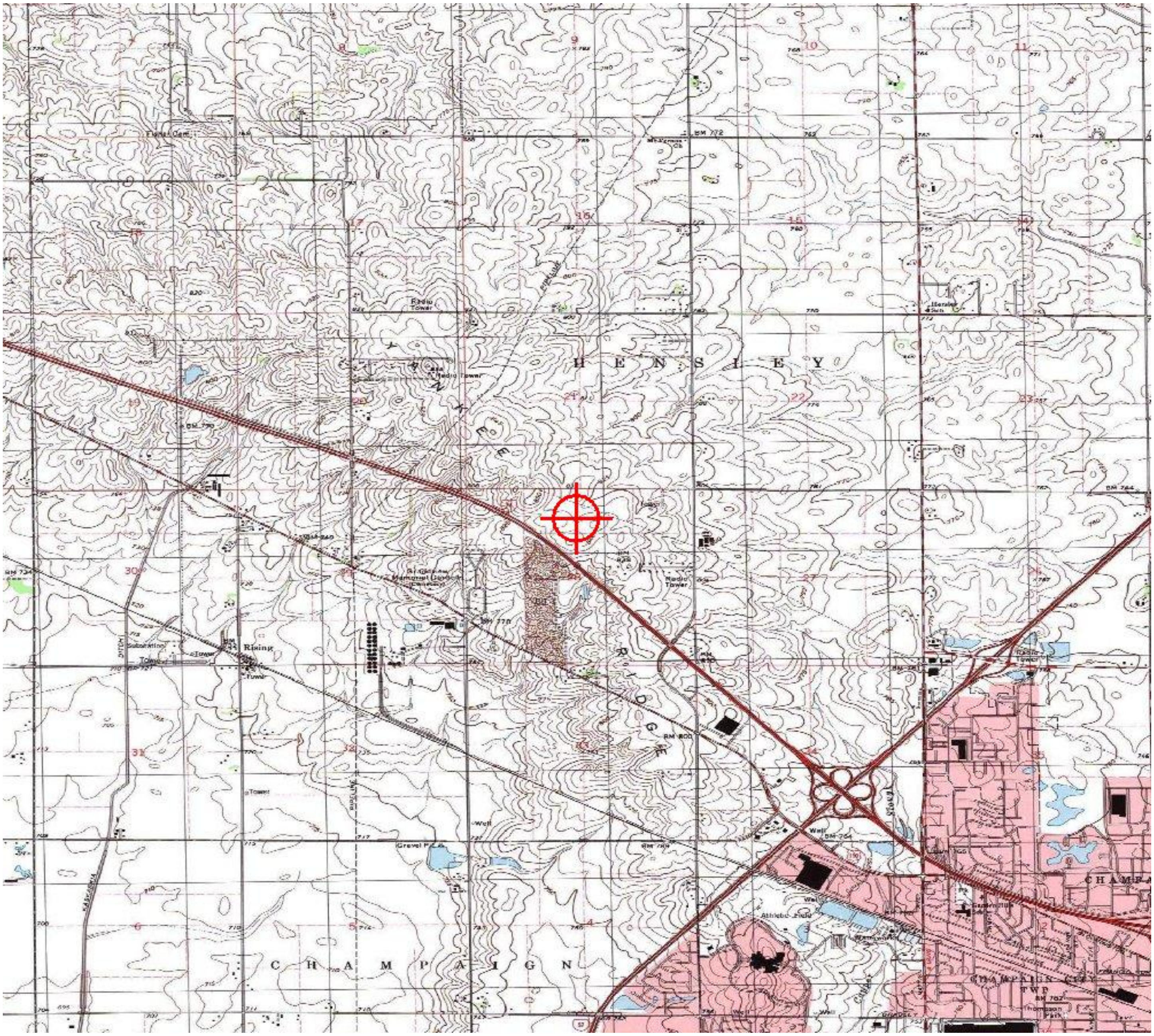
Signature Control No: 646505098-647904493 (DNE)

Timothy Waychoff
Specialist

Attachment(s)
Case Description
Map(s)

Solar facility in an open field.

TOPO Map for ASN 2025-AGL-1675-OE



Sectional Map for ASN 2025-AGL-1675-OE

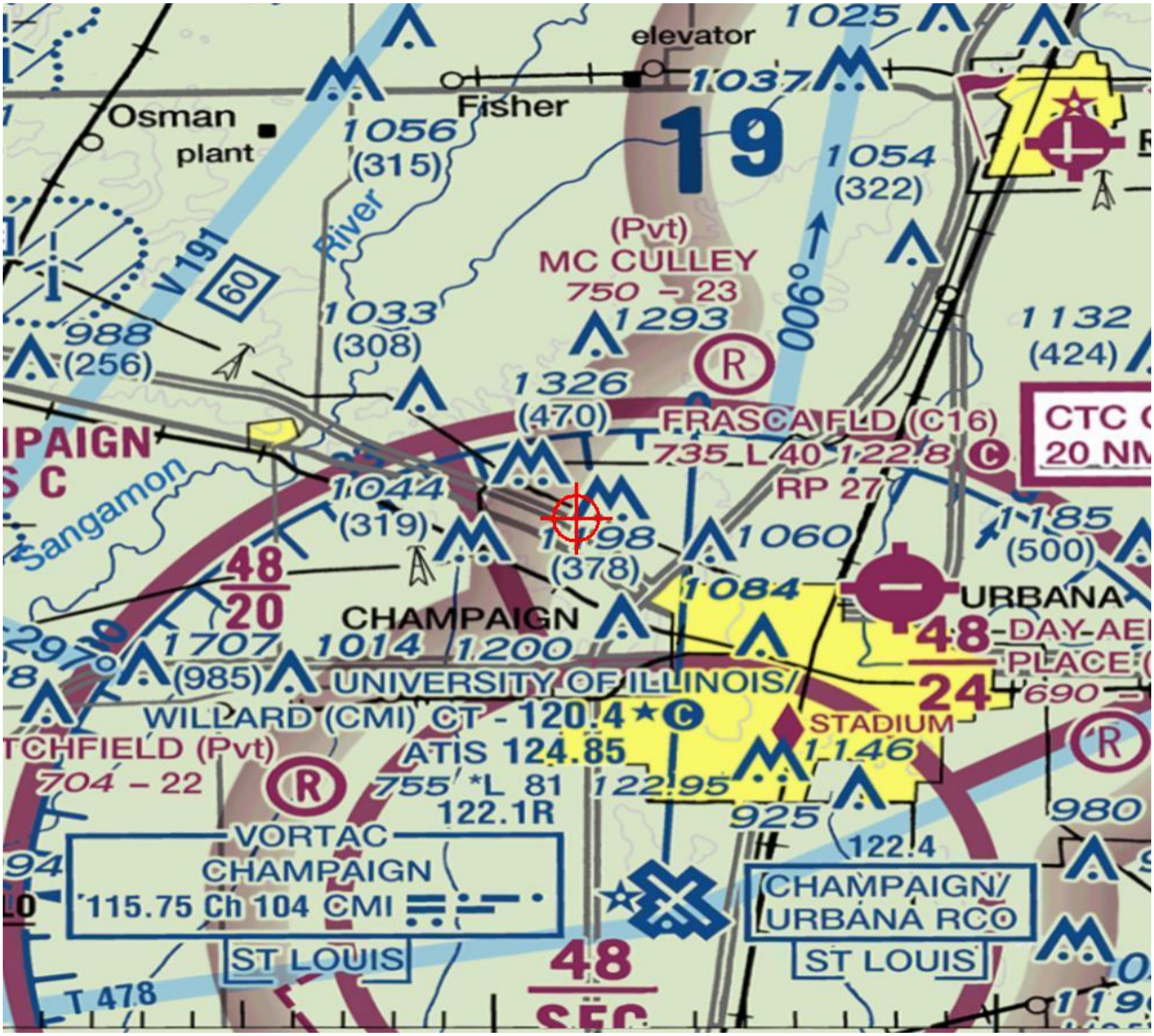


EXHIBIT F: FEMA FIRMETTE

National Flood Hazard Layer FIRMette

FEMA

88°18'30"W 40°10'24"N

88°17'53"W 40°9'57"N

Feet
0 250 500 1,000 1,500 2,000

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) *Zone A, V, A99*
		With BFE or Depth *Zone AE, AO, AH, VE, AR*
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
		Future Conditions 1% Annual Chance Flood Hazard *Zone X*
		Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
		Area with Flood Risk due to Levee *Zone D*
OTHER AREAS	NO SCREEN	Area of Minimal Flood Hazard *Zone X*
		Effective LOMRs
		Area of Undetermined Flood Hazard *Zone D*
GENERAL STRUCTURES		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES	B 20.2 / 17.5	Cross Sections with 1% Annual Chance Water Surface Elevation
	8	Coastal Transect
	513	Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
		Coastal Transect Baseline
		Profile Baseline
		Hydrographic Feature
MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 2/1/2025 at 1:14 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

EXHIBIT G: USFWS “NO EFFECT” DETERMINATION

September 24, 2025

United States Fish and Wildlife Service
Southern Illinois Sub-Office
8588 Route 148
Marion, IL 62959-5822

Subject: ***Section 9 and 10 Endangered Species Act – No Effect Determination***
ReWild Renewables, N Duncan Road Solar, LLC

On behalf of ReWild Renewables, Kimley-Horn and Associates, Inc. (Kimley-Horn) evaluated the N Duncan Road Solar, LLC Project ("Project") for compliance with the Endangered Species Act Section 9 and 10 provisions. The Project area consists of approximately 58 acres of the southwest section of the parcel and is located southwest of W Ford Harris Road, and west of N Duncan Road in Champaign, County, Illinois. The Project will include the installation of an alternating current (AC) ground-mounted solar system. The Project will primarily consist of ground mounted solar panels, racking, associated electrical components, with security fencing and interior access roads. The Project is a privately funded project which is not anticipated to have a federal nexus. An official U.S. Fish and Wildlife Service (USFWS) species list for Champaign County is included in Attachment A. An Ecological Compliance Assessment Tool (EcoCAT) Consultation Termination letter is included in Attachment B.

Kimley-Horn reviewed the USFWS Information for Planning and Consultation (IPaC) website for federally listed threatened and endangered species. According to the website, five species are listed and may be present in the project vicinity in Champaign County. The Indiana Bat is listed as endangered. The Whooping Crane is listed as experimental population, non-essential. The Salamander Mussel is listed as proposed endangered. The Monarch Butterfly is listed as proposed threatened. The Eastern Prairie Fringed Orchid is listed as threatened. The action area for the proposed project is made up primarily of agricultural row crops. A small group of trees exists in the northwestern corner of the study area, and a tree-lined row exists along the south and west boundaries. Minimal suitable habitat was identified within the Project area; therefore, no adverse effects are anticipated to the listed species. The EcoCAT showed no record of state threatened species present in the vicinity of the project. The EcoCAT showed no record of Illinois Natural Area Inventory sites, dedicated Illinois Nature Preserves, or registered Land and Water Reserves in the vicinity of the project location.

Based on the proposed project, we conclude that the Project will have "no effect" on federally listed species, their habitats, or designated critical habitat. No "incidental take" is anticipated; thus, no consultation with the USFWS is required based on the current Project.

If you have any questions or concerns, please feel free to contact me via phone (952.905.2910) or email (max.forsman@kimley-horn.com).

Sincerely,

Max Forsman, Kimley-Horn

Kimley»Horn

Attachment A

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Southern Illinois Sub-Office
Southern Illinois Sub-office
8588 Route 148
Marion, IL 62959-5822
Phone: (618) 998-5945
Email Address: Marion@fws.gov
https://www.fws.gov/office/illinois-iowa-ecological-services

In Reply Refer To: 09/24/2025 17:52:24 UTC
Project Code: 2025-0154055
Project Name: N Duncan Road Solar, LLC

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The attached species list identifies federally threatened, endangered, proposed and candidate species that may occur within the boundary of your proposed project or may be affected by your proposed project. The list also includes designated critical habitat, if present, within your proposed project area or affected by your project. This list is provided to you as the initial step of the consultation process required under section 7(c) of the Endangered Species Act, also referred to as Section 7 Consultation. If you determine that other federally protected species not listed in this Official Species List are present in your action area, you are still responsible to analyze your potential effects to those species and consult with the U.S. Fish and Wildlife Service if consultation is required.

Under 50 CFR 402.12(e) (the regulations that implement Section 7 of the Endangered Species Act) **the accuracy of this species list should be verified after 90 days**. This verification can be completed formally or informally. You may verify the list by visiting the Information for Planning and Consultation (IPaC) website https://ipac.ecosphere.fws.gov at regular intervals during project planning and implementation and completing the same process you used to receive the attached list.

Section 7 Consultation

Section 7 of the Endangered Species Act of 1973 requires that actions authorized, funded, or carried out by Federal agencies not jeopardize federally threatened or endangered species or adversely modify designated critical habitat. To fulfill this mandate, Federal agencies (or their designated non-federal representative) must consult with the U.S. Fish and Wildlife Service

(Service) if they determine their project “may affect” listed species or designated critical habitat. Under the ESA, it is the responsibility of the Federal action agency or its designated representative to determine if a proposed action may affect endangered, threatened, or proposed species, or designated critical habitat, and if so, to consult with the Service further. Similarly, it is the responsibility of the Federal action agency or project proponent, not the Service to make "no effect" determinations. If you determine that your proposed action will have no effect on threatened or endangered species or their respective designated critical habitat, you do not need to seek concurrence with the Service.

Note: For some species or projects, IPaC will present you with *Determination Keys*. You may be able to use one or more Determination Keys to conclude consultation on your action for species covered by those keys.

Technical Assistance for Listed Species

1. For assistance in determining if suitable habitat for listed, candidate, or proposed species occurs within your project area or if species may be affected by project activities, you can obtain information on the species life history, species status, current range, and other documents by selecting the species from the thumbnails or list view and visiting the species profile page.???????

No Effect Determinations for Listed Species

1. If there are *no* species or designated critical habitats on the Endangered Species portion of the species list: conclude "no species and no critical habitat present" and document your finding in your project records. No consultation under ESA section 7(a)(2) is required if the action would result in no effects to listed species or critical habitat. Maintain a copy of this letter and IPaC official species list for your records.
2. If any species or designated critical habitat are listed as potentially present in the **action area** of the proposed project the project proponents are responsible for determining if the proposed action will have “no effect” on any federally listed species or critical habitat. No effect, with respect to species, means that no individuals of a species will be exposed to any consequence of a federal action or that they will not respond to such exposure.
3. If the species habitat is not present within the action area or current data (surveys) for the species in the action area are negative: conclude “no species habitat or species present” and document your finding in your project records. For example, if the project area is located entirely within a “developed area” (an area that is already graveled/paved or supports structures and the only vegetation is limited to frequently mowed grass or conventional landscaping, is located within an existing maintained facility yard, or is in cultivated cropland conclude no species habitat present. Be careful when assessing actions that affect: 1) rights-of-ways that contains natural or semi-natural vegetation despite periodic mowing or other management; structures that have been known to support listed species (example: bridges), and 2) surface water or groundwater. Several species inhabit rights-of-ways, and you should carefully consider effects to surface water or groundwater, which often extend outside of a project’s immediate footprint.
4. Adequacy of Information & Surveys - Agencies may base their determinations on the best evidence that is available or can be developed during consultation. Agencies must give the benefit of any doubt to the species when there are any inadequacies in the information. Inadequacies may include uncertainty in any step of the analysis. To provide adequate information on which to base a determination, it may be appropriate to conduct surveys to determine whether listed species or their habitats are present in the action area. Please contact our office for more information or see the survey guidelines that the Service has made available in IPaC.

May Effect Determinations for Listed Species

1. If the species habitat is present within the action area and survey data is unavailable or inconclusive: assume the species is present or plan and implement surveys and interpret results in coordination with our office. If assuming species present or surveys for the species are positive continue with the may affect determination process. May affect, with respect to a species, is the appropriate conclusion when a species might be exposed to a consequence of a federal action and could respond to that exposure. For critical habitat, ‘may affect’ is the appropriate conclusion if the action area overlaps with mapped areas of critical habitat and an essential physical or biological feature may be exposed to a consequence of a federal action and could change in response to that exposure.
2. Identify stressors or effects to the species and to the essential physical and biological features of critical habitat that overlaps with the action area. Consider all consequences of the action and assess the potential for each life stage of the species that occurs in the action area to be exposed to the stressors. Deconstruct the action into its component parts to be sure that you do not miss any part of the action that could cause effects to the species or physical and biological features of critical habitat. Stressors that affect species’ resources may have consequences even if the species is not present when the project is implemented.
3. If no listed or proposed species will be exposed to stressors caused by the action, a ‘no effect’ determination may be appropriate – be sure to separately assess effects to critical habitat, if any overlaps with the action area. If you determined that the proposed action or other activities that are caused by the proposed action may affect a species or critical habitat, the next step is to describe the manner in which they will respond or be altered. Specifically, to assess whether the species/critical habitat is "not likely to be adversely affected" or "likely to be adversely affected."
4. Determine how the habitat or the resource will respond to the proposed action (for example, changes in habitat quality, quantity, availability, or distribution), and assess how the species is expected to respond to the effects to its habitat or other resources. Critical habitat analyses focus on how the proposed action will affect the physical and biological features of the critical habitat in the action area. If there will be only beneficial effects or the effects of the action are expected to be insignificant or discountable, conclude "may affect, not likely to adversely affect" and submit your finding and supporting rationale to our office and request concurrence.
5. If you cannot conclude that the effects of the action will be wholly beneficial, insignificant, or discountable, check IPaC for species-specific Section 7 guidance and conservation measures to determine whether there are any measures that may be implemented to avoid or minimize the negative effects. If you modify your proposed action to include conservation measures, assess how inclusion of those measures will likely change the effects of the action. If you cannot conclude that the effects of the action will be wholly beneficial, insignificant, or discountable, contact our office for assistance.
6. Letters with requests for consultation or correspondence about your project should include the Consultation Tracking Number in the header. Electronic submission is preferred.

For additional information on completing Section 7 Consultation including a Glossary of Terms used in the Section 7 Process, information requirements for completing Section 7, and example letters visit the Midwest Region Section 7 Consultations website at: https://www.fws.gov/library/collections/midwest-region-section-7-consultations.

https://www.fws.gov/office/midwest-region-headquarters/midwest-section-7-technical-assistance

You may find more specific information on completing Section 7 on communication towers and transmission lines on the following websites:

- Incidental Take Beneficial Practices: Power Lines - https://www.fws.gov/story/incidental-take-beneficial-practices-power-lines
- Recommended Best Practices for Communication Tower Design, Siting, Construction, Operation, Maintenance, and Decommissioning. - https://www.fws.gov/media/recommended-best-practices-communication-tower-design-siting-construction-operation

Tricolored Bat Update

On September 14, 2022, the Service published a proposal in the Federal Register to list the tricolored bat (Perimyotis subflavus) as endangered under the Endangered Species Act (ESA). The Service has up to 12-months from the date the proposal published to make a final determination, either to list the tricolored bat under the Act or to withdraw the proposal. The Service determined the bat faces extinction primarily due to the rangewide impacts of white-nose syndrome (WNS), a deadly fungal disease affecting cave-dwelling bats across North America. Because tricolored bat populations have been greatly reduced due to WNS, surviving bat populations are now more vulnerable to other stressors such as human disturbance and habitat loss. Species proposed for listing are not afforded protection under the ESA; however, as soon as a listing becomes effective (typically 30 days after publication of the final rule in the Federal Register), the prohibitions against jeopardizing its continued existence and “take” will apply. Therefore, if your future or existing project has the potential to adversely affect tricolored bats after the potential new listing goes into effect, we recommend that the effects of the project on tricolored bat and their habitat be analyzed to determine whether authorization under ESA section 7 or 10 is necessary. Projects with an existing section 7 biological opinion may require reinitiation of consultation, and projects with an existing section 10 incidental take permit may require an amendment to provide uninterrupted authorization for covered activities. Contact our office for assistance.

Bald and Golden Eagles

Although no longer protected under the Endangered Species Act, be aware that bald eagles are protected under the Bald and Golden Eagle Protection Act and Migratory Bird Treaty Act, as are golden eagles. Projects affecting these species may require measures to avoid harming eagles or may require a permit. If your project is near an eagle nest or winter roost area, please contact our office for further coordination. For more information on permits and other eagle information visit our website https://www.fws.gov/library/collections/bald-and-golden-eagle-management.

We appreciate your concern for threatened and endangered species. Please feel free to contact our office with questions or for additional information.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Southern Illinois Sub-Office
Southern Illinois Sub-office
8588 Route 148
Marion, IL 62959-5822
(618) 998-5945

PROJECT SUMMARY

Project Code:	2025-0154055
Project Name:	N Duncan Road Solar, LLC
Project Type:	Power Gen - Solar
Project Description:	The project is proposing the construction of a community-scale solar photovoltaic array consisting of solar panels, racking, and associated electrical components, with fencing and interior access roads.

Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@40.169484999999995,-88.30707016277566,14z

Counties: Champaign County, Illinois

ENDANGERED SPECIES ACT SPECIES

There is a total of 5 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

MAMMALS

NAME	STATUS
Indiana Bat *Myotis sodalis* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5949	Endangered

BIRDS

NAME	STATUS
Whooping Crane *Grus americana* Population: U.S.A. (AL, AR, CO, FL, GA, ID, IL, IN, IA, KY, LA, MI, MN, MS, MO, NC, NM, OH, SC, TN, UT, VA, WI, WV, western half of WY) No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/758	Experimental Population, Non-Essential

CLAMS

NAME	STATUS
Salamander Mussel *Simpsonaias ambigua* There is **proposed** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6208	Proposed Endangered

INSECTS

NAME	STATUS
Monarch Butterfly *Danaus plexippus* There is **proposed** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/9743	Proposed Threatened

FLOWERING PLANTS

NAME	STATUS
Eastern Prairie Fringed Orchid *Platanthera leucophaea* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/601	Threatened

CRITICAL HABITATS

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

YOU ARE STILL REQUIRED TO DETERMINE IF YOUR PROJECT(S) MAY HAVE EFFECTS ON ALL ABOVE LISTED SPECIES.

USFWS NATIONAL WILDLIFE REFUGE LANDS AND FISH HATCHERIES

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

IPAC USER CONTACT INFORMATION

Agency:	Kimley-Horn and Associates
Name:	Maxwell Forsman
Address:	14800 Galaxie Avenue
Address Line 2:	Suite 200
City:	Apple Valley
State:	MN
Zip:	55124
Email	max.forsman@kimley-horn.com
Phone:	9529052910

of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

Breeding Season ()
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort ()
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data ()
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

Migratory birds

The Migratory Bird Treaty Act (MBTA) [1] prohibits the take (including killing, capturing, selling, trading, and transport) of protected migratory bird species without prior authorization by the Department of Interior U.S. Fish and Wildlife Service (Service).

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1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide avoidance and minimization measures for birds
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

Measures for Proactively Minimizing Migratory Bird Impacts

Your IPaC Migratory Bird list showcases birds of concern, including Birds of Conservation Concern (BCC), in your project location. This is not a comprehensive list of all birds found in your project area. However, you can help proactively minimize significant impacts to all birds at your project location by implementing the measures in the Nationwide avoidance and minimization measures for birds document, and any other project-specific avoidance and minimization measures suggested at the link Measures for avoiding and minimizing impacts to birds for the birds of concern on your list below.

Ensure Your Migratory Bird List is Accurate and Complete

If your project area is in a poorly surveyed area, your list may not be complete and you may need to rely on other resources to determine what species may be present (e.g. your local FWS field office, state surveys, your own surveys). Please review the Supplemental Information on Migratory Birds and Eagles document, to help you properly interpret the report for your specified location, including determining if there is sufficient data to ensure your list is accurate.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the "Probability of Presence Summary" below to see when these birds are most likely to be present and breeding in your project area.

Review the FAQs

The FAQs below provide important additional information and resources.

NAME	BREEDING SEASON
American Golden-plover Pluvialis dominica This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Oct 15 to Aug 31
Chimney Swift Chaetura pelagica This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 15 to Aug 25
Eastern Whip-poor-will Antrostomus vociferus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Aug 20
Kentucky Warbler Geothlypis formosa This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 20 to Aug 20

Lesser Yellowlegs Tringa flavipes — Breeds elsewhere

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9679

Pectoral Sandpiper Calidris melanotos — Breeds elsewhere

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Red-headed Woodpecker Melanerpes erythrocephalus — Breeds May 10 to Sep 10

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Wood Thrush Hylocichla mustelina — Breeds May 10 to Aug 31

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence ( )

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the

maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season ( )

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

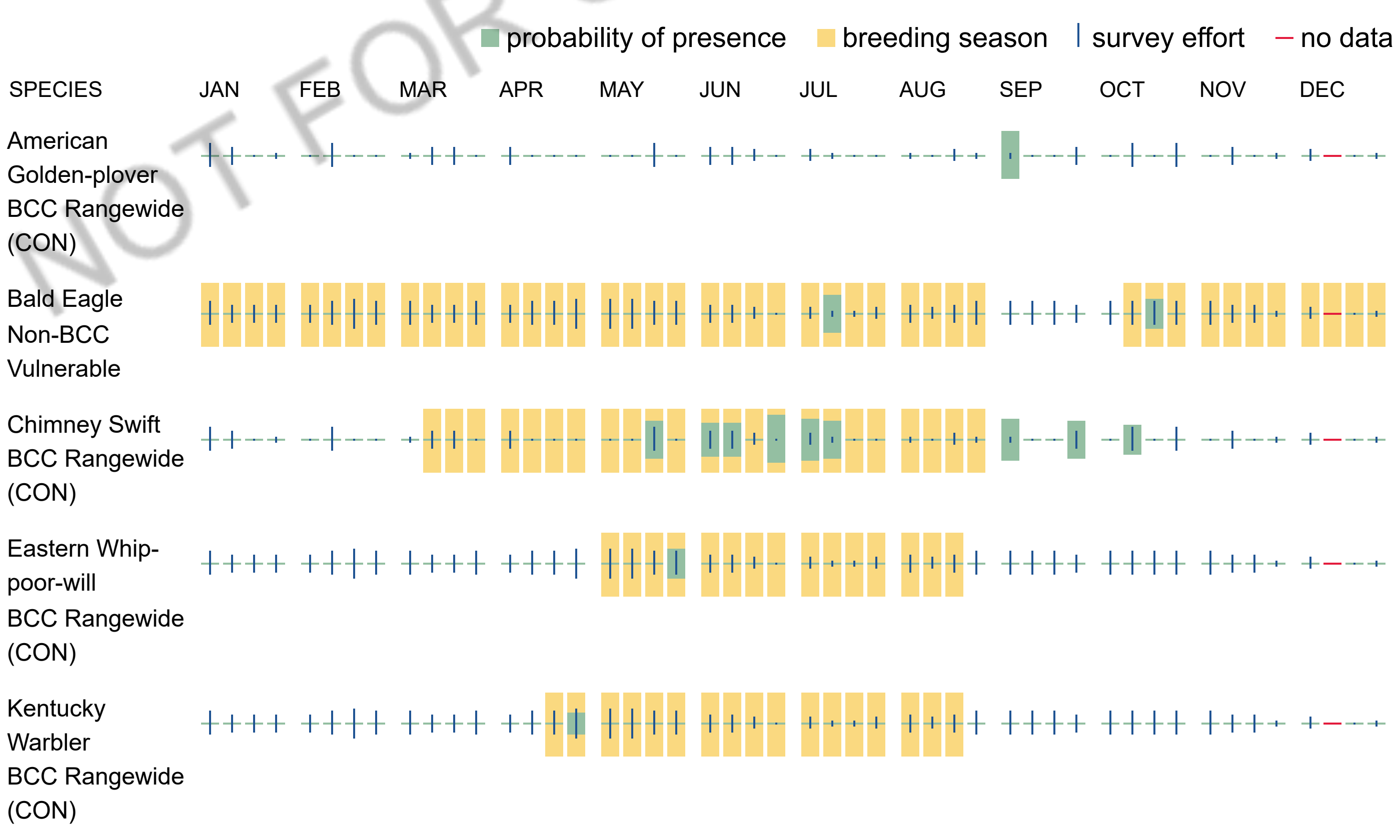
To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)

A week is marked as having no data if there were no survey events for that week.

Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

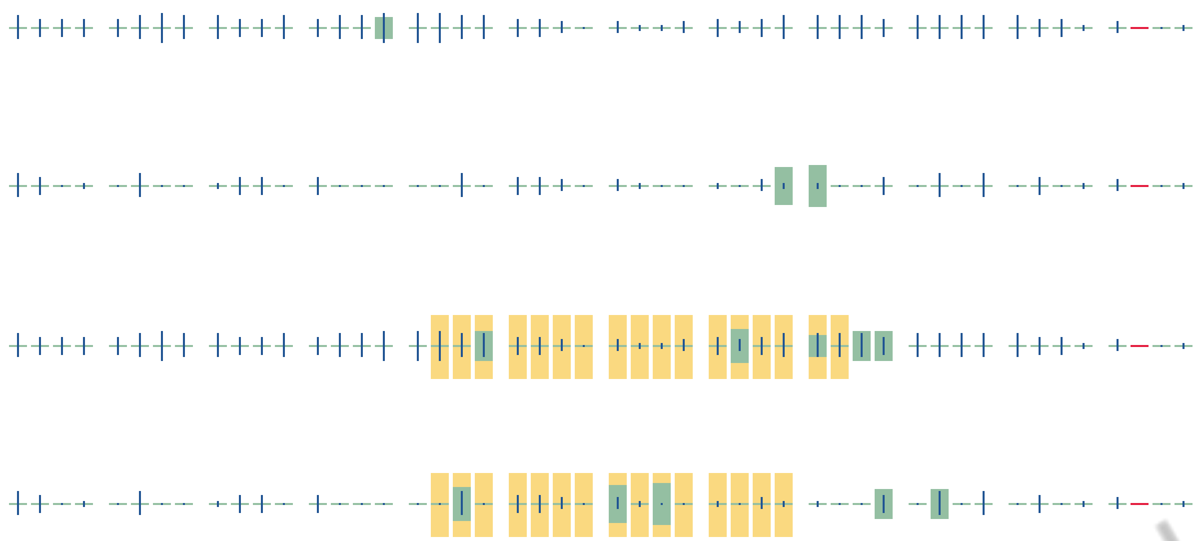


Lesser Yellowlegs
BCC Rangewide (CON)

Pectoral Sandpiper
BCC Rangewide (CON)

Red-headed Woodpecker
BCC Rangewide (CON)

Wood Thrush
BCC Rangewide (CON)



Migratory Bird FAQs

Tell me more about avoidance and minimization measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Avoidance & Minimization Measures for Birds describes measures that can help avoid and minimize impacts to all birds at any location year-round. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is one of the most effective ways to minimize impacts. To see when birds are most likely to occur and breed in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location, such as those listed under the Endangered Species Act or the Bald and Golden Eagle Protection Act and those species marked as “Vulnerable”. See the FAQ “What are the levels of concern for migratory birds?” for more information on the levels of concern covered in the IPaC migratory bird species list.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) with which your project intersects. These species have been identified as warranting special attention because they are BCC species in that area, an eagle (Bald and Golden Eagle Protection Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, and to verify survey effort when no results present, please visit the Rapid Avian Information Locator (RAIL) Tool.

Why are subspecies showing up on my list?

Subspecies profiles are included on the list of species present in your project area because observations in the AKN for **the species** are being detected. If the species are present, that means that the subspecies may also be present. If a subspecies shows up on your list, you may need to rely on other resources to determine if that subspecies may be present (e.g. your local FWS field office, state surveys, your own surveys).

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go to the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating, or resident), you may query your location using the RAIL Tool and view the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your IPaC migratory bird species list has a breeding season associated with it (indicated by yellow vertical bars on the phenology graph in your "IPaC PROBABILITY OF PRESENCE SUMMARY" at the top of your results list), there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Bald and Golden Eagle Protection Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially BCC species. For more information on avoidance and minimization measures you can implement to help avoid and minimize migratory bird impacts, please see the FAQ "Tell me more about avoidance and minimization measures I can implement to avoid or minimize impacts to migratory birds".

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Proper interpretation and use of your migratory bird report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please look carefully at the survey effort (indicated by the black vertical line) and for the existence of the "no data" indicator (a red horizontal line). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list does not represent all birds present in your project area. It is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list and associated information help you know what to look for to confirm presence and helps guide implementation of avoidance and minimization measures to eliminate or reduce potential impacts from your project activities, should presence be confirmed. To learn more about avoidance and minimization measures, visit the FAQ "Tell me about avoidance and minimization measures I can implement to avoid or minimize impacts to migratory birds".

Interpreting the Probability of Presence Graphs

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. A taller bar indicates a higher probability of species presence. The survey effort can be used to establish a level of confidence in the presence score.

How is the probability of presence score calculated? The calculation is done in three steps:

The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.

To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

Breeding Season ()

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort ()

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data ()

A week is marked as having no data if there were no survey events for that week.

Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

This location did not intersect any wetlands mapped by NWI.

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

Kimley»Horn

Attachment B

EcoCAT
Ecological Compliance Assessment Tool

ILLINOIS DEPARTMENT OF NATURAL RESOURCES

Applicant:	Zachary Farkes	*IDNR Project Number:*	2509742
Contact:	Keller Lee-Otley	*Date:*	02/19/2025
Address:	111 W Jackson Blvd STE 1320 Chicago, IL 60604		

Project: N Duncan Road Solar LLC
Address: West of County Rd 900E, champaign

Description: Construction of solar farm with associated access roads and utilities.

Natural Resource Review Results

Consultation for Endangered Species Protection and Natural Areas Preservation (Part 1075)

The Illinois Natural Heritage Database contains no record of State-listed threatened or endangered species, Illinois Natural Area Inventory sites, dedicated Illinois Nature Preserves, or registered Land and Water Reserves in the vicinity of the project location.

Consultation is terminated. This consultation is valid for two years unless new information becomes available that was not previously considered; the proposed action is modified; or additional species, essential habitat, or Natural Areas are identified in the vicinity. If the project has not been implemented within two years of the date of this letter, or any of the above listed conditions develop, a new consultation is necessary. Termination does not imply IDNR's authorization or endorsement.

Location

The applicant is responsible for the accuracy of the location submitted for the project.

County: Champaign

Township, Range, Section:
20N, 8E, 21
20N, 8E, 28

IL Department of Natural Resources Contact
Adam Rawe
217-785-5500
Division of Ecosystems & Environment

Government Jurisdiction
IL Environmental Protection Agency
Terri LeMasters
1020 North Grand Avenue East
Springfield, Illinois 62794 -9276

Disclaimer

The Illinois Natural Heritage Database cannot provide a conclusive statement on the presence, absence, or condition of natural resources in Illinois. This review reflects the information existing in the Database at the time of this inquiry, and should not be regarded as a final statement on the site being considered, nor should it be a substitute for detailed site surveys or field surveys required for environmental assessments. If additional protected resources are encountered during the project's implementation, compliance with applicable statutes and regulations is required.

Terms of Use

By using this website, you acknowledge that you have read and agree to these terms. These terms may be revised by IDNR as necessary. If you continue to use the EcoCAT application after we post changes to these terms, it will mean that you accept such changes. If at any time you do not accept the Terms of Use, you may not continue to use the website.

1. The IDNR EcoCAT website was developed so that units of local government, state agencies and the public could request information or begin natural resource consultations on-line for the Illinois Endangered Species Protection Act, Illinois Natural Areas Preservation Act, and Illinois Interagency Wetland Policy Act. EcoCAT uses databases, Geographic Information System mapping, and a set of programmed decision rules to determine if proposed actions are in the vicinity of protected natural resources. By indicating your agreement to the Terms of Use for this application, you warrant that you will not use this web site for any other purpose.

2. Unauthorized attempts to upload, download, or change information on this website are strictly prohibited and may be punishable under the Computer Fraud and Abuse Act of 1986 and/or the National Information Infrastructure Protection Act.

3. IDNR reserves the right to enhance, modify, alter, or suspend the website at any time without notice, or to terminate or restrict access.

Security

EcoCAT operates on a state of Illinois computer system. We may use software to monitor traffic and to identify unauthorized attempts to upload, download, or change information, to cause harm or otherwise to damage this site. Unauthorized attempts to upload, download, or change information on this server is strictly prohibited by law.

Unauthorized use, tampering with or modification of this system, including supporting hardware or software, may subject the violator to criminal and civil penalties. In the event of unauthorized intrusion, all relevant information regarding possible violation of law may be provided to law enforcement officials.

Privacy

EcoCAT generates a public record subject to disclosure under the Freedom of Information Act. Otherwise, IDNR uses the information submitted to EcoCAT solely for internal tracking purposes.

EXHIBIT H: USACE DETERMINATION AND WETLAND DELINEATION REPORT

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, LOUISVILLE DISTRICT
INDIANAPOLIS REGULATORY OFFICE
8902 OTIS AVENUE, SUITE 105B
INDIANAPOLIS, IN 46216

April 22, 2025

Regulatory Division
North Branch
ID No. LRL-2025-00221-DDC

Mr. Zachary Farkes
ReWild Renewables
111 Jackson Blvd, Ste 1320
Chicago, IL 60604

Dear Mr. Farkes:

This is regarding your letter received March 7, 2025, concerning the proposal to initiate the N Duncan Road Solar, LLC Project, with the installation of a 5-megawatt (MW) alternating current (AC) ground-mounted solar system. The solar system will consist of ground mounted solar panels, racking, associated electrical components, with security fencing and interior access roads. The project is located at Latitude: 40.1697°, Longitude: -88.3017°, near Champaign, Champaign County, Illinois. We have reviewed the submitted data relative to Section 404 of the Clean Water Act (CWA).

Based on the information submitted, it does not appear that a Department of the Army permit will be needed since the project referenced above would not involve a discharge of dredged and/or fill material below the Ordinary High-Water elevation of any "waters of the United States (U.S.)" or any wetlands. "Waters of the U.S." include all waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce. This jurisdictional determination is valid for a period of 5 years from the date of this letter unless new information warrants revision of the determination before the expiration date.

The provided information indicates that the proposed project will not result in a placement of dredged or fill material, permanently or temporarily, into any “waters of the United States”. Therefore, a Department of the Army permit under Section 404 CWA is not required. If the project would necessitate the discharge of dredged or fill material into "waters of the U.S.," including wetlands, plans should be submitted for our review.

If you have any questions concerning this matter, please contact us by email at David.D.Carr@usace.army.mil, by writing to the above address or by calling 463-317-9923. Any correspondence should reference our assigned Identification Number LRL-2025-00222-DDC.

Sincerely,

Sarah J. Keller
Team Leader
Indianapolis Regulatory Office

Copy Furnished: Kimley-Horn and Associates, Inc. (Leet-Otley)

AQUATIC RESOURCE PRELIMINARY DELINEATION

DUNCAN

Location:
Unincorporated Champaign County, Illinois

DECEMBER 18, 2023

ACKNOWLEDGEMENTS

Report Prepared For:

Patrick Jackson, Rewild Renewables
47 Bow Street, Portsmouth, New Hampshire, 03801
pat@rewildrenewables.com
603-969-8492

Aquatic Resource Delineation by:

Report and Field Assessment:
Alden O'Connor, Olson Ecological Solutions, LLC
2221 Hammond Dr., Schaumburg, IL 60173

Project Management and Field Assessment:
Colleen Stull, A3 Environmental Consultants
3030 Warrenville Road, Suite 418, Lisle, IL 60532

Mapping:
Kristin Adams, Tallgrass Restoration, LLC
2221 Hammond Dr., Schaumburg, IL 60173

Technical Assistance
Rebecca Olson, A3E Olson Ecological Joint Venture, LLC.

Contact:

Rebecca Olson
815-985-2689
rebecca@olsonecosolutions.com

QUALIFICATIONS OF STAFF

Rebecca Olson, owner of A3E Olson Ecological Joint Venture (A3E+OES) and Olson Ecological Solutions (OES) provided quality assurance and technical support. She is a Certified Wetland Specialist with Lake and McHenry counties and a Qualified Wetland Specialist in Kane County, Illinois. She holds a Master of Science degree in wildlife biology from Colorado State University. Her experience extends from wetland and stream delineation, restoration, and mitigation to ecological consulting and land conservation. She completed the Wetland Training Institute's Wetland Delineation course in 2010. Most of her time is balanced between wetland and stream mitigation and banking, writing and implementing Environmental Protection Agency-sponsored watershed based plans, and designing green infrastructure projects related to stormwater runoff. She also assists land transactions for conservation purposes.

Kristin Adams prepared both preliminary review and post-delineation mapping. Kristin completed her Bachelor's degree of Science in Biology at Illinois State University in 2010, obtained a GIS certification from Elmhurst College in 2015, and attended the Wisconsin DNR's Wetland Delineation course in 2016. Kristin works for Tallgrass Restoration as their GIS Specialist and Plant Ecologist. Kristin has worked with OES for many years on numerous mapping and ecological design projects related to wetland and watershed planning and conducting aquatic resource delineations.

Colleen L. Stull, a Project Manager for A3 Environmental, LLC, provided project management and field assessment. She has 4 years of experience in environmental consulting, encompassing field work and office work for a wide variety of projects for local and state governments as well as private industries. Her experience includes project management, reporting, soil and groundwater sample collection, data management, and site remediation oversight. She completed the Wetland Training Institute's Basic Wetland Delineation course in 2021.

Alden O'Connor provided field asessment and wrote the report. He is an Ecological Consultant and Crew Leader at OES, who completed his Bachelor's of Arts degree in Environmental Studies at Lake Forest College in 2021. He also completed the Wetland Training Institute's Basic Wetland Delineation Course in August of 2022. His restoration experience has included prescribed burning and various invasive species removal methods. His consulting experience has included wetland permitting, green stormwater infrastructure design, aquatic resource delineations, and writing for watershed plans and grant applications.

For more information, visit the websites for A3E+OES, OES, and Tallgrass at the following links:

https://a3e.com/wetland-delineation-wetland-permitting-project-profile/

www.olsonecosolutions.com www.tallgrassrestoration.com

INTRODUCTION

In November of 2023, consultants conducted an aquatic resource delineation for an approximately 112.61-acre project area planned for solar panel development by the applicant in Section 28, Township 20 North, Range 8 East, located just northwest of Champaign, Illinois in Champaign County. At the time of investigation, the land use at the site was entirely corn farmland.

Patrick Jackson, with Rewild Renewables, requested an aquatic resource delineation of the site approximately bounded on the all sides by farmland. Additionally, two homes border the eastern side of the project area and I-74 runs through the southwestern corner of the project area. The location of the site is summarized in the Property Location Map (Figure 1). The purpose of the aquatic resource delineation was to determine the location and size of wetlands associated with the solar panel project. While we found no wetlands in the project area, it is possible that the USACE may reasonably question our findings due to a lack of vegetation within the farmland to inform our conclusion, which is why we have marked "potential wetlands" on the Figure 8: OES Delineated Aquatic Resources Map.

As reviewed in the Conclusion section below, all regulatory decisions and final determinations rest with the U.S. Army Corps of Engineers (USACE). This report summarizes the process of our investigations and submits our findings. Marking the potential wetland boundaries with flagging and recording GPS points allows us to communicate a complex boundary to the USACE. Due to the variance in the GPS unit's accuracy, recorded GPS data is considered secondary to the flags placed in the field, which may be revised by the USACE.

METHODS

Consultants conducted the aquatic resource delineation in November 2023 using the technical guidelines as described in the *Army Corps of Engineers Wetland Delineation Manual* (Environmental Laboratory, 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Midwest Region* (U.S. Army Corps of Engineers, 2010). This process included desktop analysis and a field investigation.

The off-site review of the study area included an analysis of the following maps and aerial photography, determination of normal precipitation, and a review of wetness signatures on recent aerial photography:

Figure 1:	Property Location Map (ESRI, 2009)
Figure 2:	Topographic Map (ESRI, 2013)
Figure 3:	Hillshade Elevation Map (ESRI, 2014)
Figure 4:	National Wetlands Inventory Map (USFWS, 2010)
Figure 5:	Floodzone Map (FEMA, 2016)
Figure 6:	Hydric Soils Map (NRCS, 2006)
Figure 7:	Historical Aerial Photography from 1940 (ISGS, 2008)
Figure 9:	Drain Tile Map
Figure 10:	Aerial Imagery from April 2023
Figure 11:	Aerial Imagery from October 2020
Figure 12:	Aerial Imagery from July 2020
Figure 13:	Aerial Imagery from April 2019
Figure 14:	Aerial Imagery from October 2016
Figure 15:	Aerial Imagery from September 2011
Appendix A:	Rainfall Documentation for Field Assessment

We determined if the delineation time frame was drier than normal, normal, or wetter than normal using recent precipitation recorded at the local Champaign 3S, IL Weather Station for the months of October, September, and August compared to historic precipitation norms as determined by a W.E.T.S. Table created through AgACIS for years 1991 through 2020 (NOAA, 2023b). We also considered antecedent precipitation from the week before the field study through AgACIS using the same weather station (NOAA, 2023a). We learned that agricultural drain tiles had been installed on the property and the date of installation, and we considered aerial imagery taken during periods before and after the installation.

Field investigation took place on November 15 and November 16 of 2023. After confirming the project boundary, we examined the site for the presence of natural or human induced changes affecting vegetation, soils, and hydrology, and we traversed the site in several places. We explored suspected wetland areas with mapped hydric soils, saturation, or inundation visible on aerial imagery, areas indicated as wetlands by the National Wetlands Inventory, and areas appearing as wetlands on historic imagery. We looked for drainage patterns and depressions in the landscape, and we conducted a final walk-through of the entire site.

We recorded data and marked a data point with a pink “Wetland Delineation” flag and recorded a GPS point in all suspected areas. For areas with mapped hydric soils, we looked for coinciding wetland vegetation and hydrology. In areas found to have the hydrology indicator of saturation or inundation visible on aerial imagery or if an area was a floodplain, drainage area, or indicated as wetland on the NWI map or historic aerial, we first looked for wetland vegetation and if found, we explored for additional hydrology indicators and then hydric soils.

We labeled all data points with letters (e.g., A, B, C, etc.) and all reference vegetation points with the letter of the related data point followed by the number two (e.x., A.2) noting the labels on GPS points and marking each point with a flag in the field. We marked potential wetlands with GPS points but not pink flags.

RESULTS

Desktop Analysis

As part of the desktop analysis, prior to the field assessment, we observed features in the project boundary to determine areas suspected to have wetlands by considering historical aerial imagery from Google Earth, wetness signatures, topographical features, hillshade elevation, wetland features identified by the USFWS National Wetland Inventory, flood hazard areas from FEMA, and hydric soils from Web Soil Survey.

Historic aerial imagery from Google Earth shows the project area has been farmland since 1940, as shown in Figure 7 (ISGS, 2008). In present day, the project area's land use is still farmland bordered by a residential development, farmland, North Duncan Road, and I-74. The topography map, shown in Figure 2 (ESRI, 2013), provides a visual of the site location in Champaign Illinois. The hillshade elevation map in Figure 3 (ESRI, 2014) highlights the site's gradual topography, as well as the hill in the northwestern corner and a couple of small swales.

We evaluated existing wetlands present on the site using the National Wetlands Inventory. No features were located within or in the near vicinity of the project boundary, as shown in Figure 4 (USFWS, 2010). The entire project area contained no FEMA-designated floodways, flood hazards, or other special flood areas. This is depicted in Figure 5 (FEMA, 2016).

We observed hydric soils, shown in Figure 6 (NRCS, 2006) from data provided by the Natural Resources Conservation Service's Web Soil Survey. There were four soil types of present:

- Flanagan silt loam, 0-2%% slopes (154A);
- Drummer silty clay loam, 0-2% slopes (152A);
- Dana silt loam, 2-5% slopes (56B);
- and Wyanet silt loam, 5-10% slopes (622C2).

Overall, approximately 18.7% of the site contained soil areas mapped as 100% hydric (152A) and 81.3% of the site contained soil areas mapped as 4-6% hydric.

We examined aerial imagery from Google Earth between April 2023 and September 2011 for wetness signatures to understand which areas of the farm exhibited such signatures and which areas exhibited such signatures more consistently. Each of the images were taken during three-month periods of normal precipitation, except for the 2019 and 2011 images, which were taken during wetter and drier years, respectively. This aerial imagery can be viewed in Figures 10 through 15. Additionally, we obtained an aerial image marked up by the landowner that shows where drain tiles have been installed. We added text to the image to label the separate drain tile installation dates, as shared by the landowner. Drain Tile A was installed in 2022 and Drain Tile B was installed in 2017. Aerial This aerial map is shown in Figure 9. Aerial images prior to the addition of these drain tiles do not represent current conditions but are included in this report for historical reference.

Climate in the three-month window before the investigation was wetter than normal. According to precipitation summaries from AgACIS for Champaign County at the Champaign 3S, IL Weather Station, it rained 0.02 inches over the seven days prior to both field assessment days. (NOAA, 2023a and b).

The hydric soils map and wetness signatures from aerial imagery before and after the installation of agricultural drain tiles helped the most in identifying suspected wetland areas. These areas were almost entirely within the 152A (100% hydric) soil area where saturation or inundation visible on aerial imagery was also most prominent. Areas with less convincing or no saturation on aerial imagery and lower hydric soils (less than 6%) were generally suspected to be uplands.

Potential Wetland Descriptions

We visited the site during the late growing season, after the corn harvest, when few weedy species were present to inform our delineation. Some of our data points had wetland hydrology and hydric soils but lacked hydrophytic vegetation due to the presence of small percentages of facultative-upland or upland species. Moreover, such data points did not stick out as clear wetlands and we concluded that they were indeed uplands. We realize that we may see a greater diversity and vigor of weedy species if we visit the site again in the spring of 2024, possibly changing our conclusions for such areas. Below, we describe such areas that could potentially be deemed wetlands upon further assessment at a different time of the year.

Potential Wetland A

Potential Wetland A was located near the southwestern corner of the project area within the 152A (100% hydric) soil area. We took Data Point D at this location, which had concave local relief (albeit gradual) and lay at a toeslope. Data Point D qualified for hydric soils according to the Redox Dark Surface (F6) indicator. It also qualified for wetland hydrology due to Saturation Visible on Aerial Imagery (C9) and Geomorphic Position (D2) indicators. It lacked hydrophytic vegetation due to the presence of *Lamium amplexicaule* and *Capsella bursa-pastoris*, which had three percent cover and one percent cover, respectively. This resulted in a 0.0% on the Dominance Test and a 4.75 on the Prevalence Index.

Notably, drain tiles were installed upslope of this area in the spring of 2022, which is visible on the map in Figure 9 and on aerial imagery in Figure 10. Functioning drain tiles in this areas could explain why this area contained wetland hydrology indicators and hydric soils, but also contained conditions suitable for drier plant species due to the recent alteration in hydrology of the area.

Potential Wetland B

Potential Wetland B was located in the eastern quarter of the project area within the 152A (100% hydric) soil area. We took Data Point H at this location, which lay in a slight swale that had linear local relief. Data Point H qualified for hydric soils according to the Redox Dark Surface (F6) indicator and wetland hydrology due to the Saturation Visible on Aerial Imagery

(C9) and Stunted or Stressed Plants (D1) indicators. It lacked hydrophytic vegetation due to the presence of *Lamium amplexicaule*, which had three percent cover. This resulted in a 0.0% percent on the Dominance Test and a 5.00 on the Prevalence Index.

If any area at the site may be deemed a wetland upon further assessment, we believe this area has the strongest case. It's possible that the installation of drain tile upslope and to the west of this area in the spring of 2017 altered the hydrology of this area, similarly to Potential Wetland A, but likely not as significantly considering the drain tiles nearer to this area don't appear to drain as large of an area upslope of Potential Wetland B as observed on-site.

Upland Descriptions

Other than Data Points D and H, only Data Point I also had wetland hydrology and hydric soils but lacked hydrophytic vegetation. Overall, the site featured gradual slopes and drain tiles that likely altered areas to be more accommodating of upland conditions. We also took two reference vegetation points for Data Points B and F called Data Point B.2 and Data Point F.2, respectively, which are important to understand in addition to Data Point I.

Data Point B was located within the western third of the project area, near the northern boundary and within the 152A (100% hydric) soil area. It lay at a toeslope that had gradual concave local relief. Land east, south, and west of this point sloped toward this point and then further north toward reference Data Point B.2. Data Point B had hydric soils according to the Redox Dark Surface (F6) indicator and wetland hydrology due to the Saturation Visible on Aerial Imagery (C9), Stunted or Stressed Plants (D1), and Geomorphic Position (D2) indicators. We found no vegetation with any stratum at Data Point B, hence the need for a reference point.

We took Data Point B.2 approximately 48' directly to the north of Data Point B, which lay just barely within a separate mapped hydric soil area, which was 56B (4% hydric). This Data Point lay at a toeslope that also had concave local relief. We only observed vegetation at this point but believed that this point reasonably represented vegetation that would grow at Data Point B if the land use was natural. We believe it was representative hydrologically because this reference point lay slightly downslope or roughly at the same elevation, as the land sloped from the east, south, and west toward this point. We assumed this point had similar enough soils due to its close approximation to Data Point B. Beyond Data Point B.2 to the north, the land sloped further downward and formed a depression. Vegetation at such lower elevations, including *Morus alba*, was not included within the vegetation sampling. The vegetation was not hydrophytic at Data Point B.2 and was dominated by *Celtis occidentalis*, *Dactylis glomerata*, and *Taraxacum officinale*. This steep dropoff down the slope from Data Point B.2 might help explain the upland conditions at Data Points B and B.2.

Data Point F was taken further east of Data Point B, also within the 152A (100% hydric) soil area. It lay at a toeslope that had no local relief. Data Point F had hydric soils according to the Redox Dark Surface (F6) indicator and but lacked wetland hydrology, with only the secondary indicator Saturation Visible on Aerial Imagery (C9) present. With no vegetation present with any stratum at this point, we elected to take reference Data Point F.2.

Data Point F.2 lay within the same soil area approximately 41’ to the north. It also lay at a toeslope with no local relief. We only observed vegetation at this point but believed that this point reasonably represented vegetation that would grow at Data Point F if the land use was natural. We believe it was representative hydrologically because this reference point lay at roughly the same elevation. We assumed this point had similar enough soils due to its close approximation to Data Point B and location with the same mapped hydric soil area. Vegetation was not hydrophytic at this location and was dominated by *Morus alba* and *Bromus inermis*.

Lastly, Data Point I was taken within the roadside swale off North Duncan Road, next to the culvert, and within the 152A (100% hydric) soil area. It had concave local relief and lay at the toeslope of this swale. It had hydric soils according to the Thick Dark Surface (A12) and Redox Dark Surface (F6) indicators. It had wetland hydrology according to the presence of Geomorphic Position (D2) and Surface Water (A1) located roughly one foot away from the pit. It lacked hydrophytic vegetation and was dominated by *Lamium amplexicaule* and *Schedonorus arundinaceus*. This data point likely lacked hydrophytic vegetation, likely due to the adjacent culvert preventing water from settling in this low spot for long enough to support enough wetland species.

CONCLUSION

The project area contained many areas with wetness signatures visible on aerial imagery and 18.7% of the area contained mapped soil areas rated as 100% hydric. As expected, several of our data points contained both hydric soils and wetland hydrology but, surprisingly, were disqualified from determination as wetlands due to the presence of a handful of weedy facultative-upland and upland species. While surprising, we believe our conclusions to be accurate based on the evidence present at the time of desktop analysis and field assessment. Moreover, while the field assessment took place during the annual dry season for Illinois, the climate in the prior three months was wetter than normal, which may indicate that we at least wouldn't have been observing species suited to drier soil conditions than what typically grows in the field at that time of year. Drain tile locations and installation dates detailed under the Results section and in Figure 9 provided additional support that some areas were drier than aerial imagery from the last decade indicated. Therefore, we present this conclusion of no wetlands located in the project area but realize that the USACE may reasonably question our findings and ask that we revisit the project area during the spring in hopes of observing more species that could inform our delineation. We included the boundaries of areas that were disqualified as wetland based on less than five percent coverage of upland and facultative upland weeds and have referred to them as Potential Wetlands.

The boundaries of each Potential Wetland are reflected in the OES Delineated Aquatic Resource Map (Figure 8). Table 1 below shows the acreages of each potential wetland.

Table 1: Potential Wetland Areas

Potential Wetland Areas	
Potential Wetland	Area (acres)
A	0.360
B	0.062
Total	**0.422**

OES notes that final authority regarding regulatory jurisdiction rests with the US Army Corps of Engineers (USACE) and that the delineation is not final until so designated by the USACE. Notification of a final Jurisdictional Determination should be received from the USACE prior to any construction on the property. If any construction is planned for areas within a WETLAND, it may require the filing of a joint permit to the USACE, Illinois Environmental Protection Agency, and Illinois Department of Natural Resources. Local regulations may also apply.

ATTACHMENTS

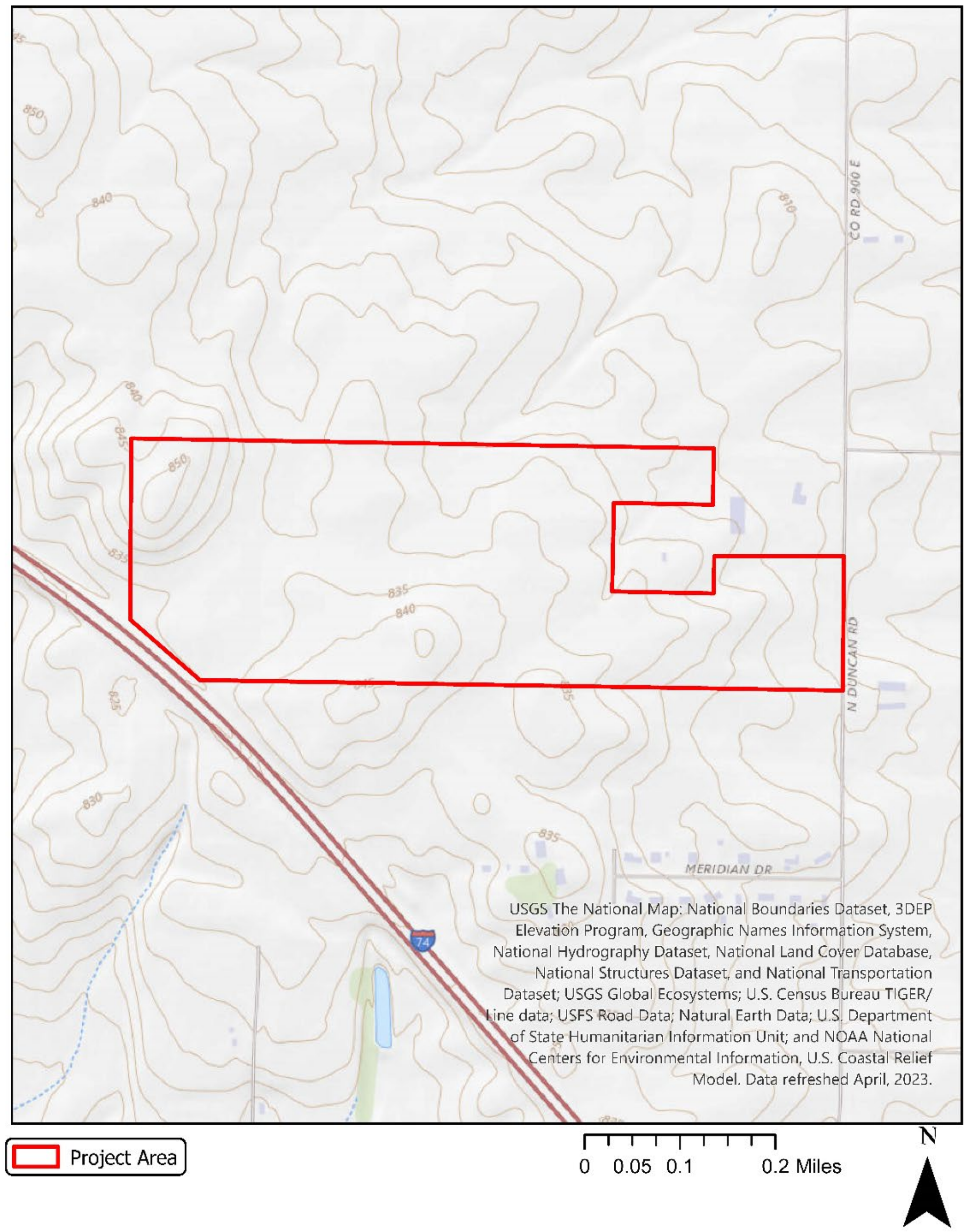
FIGURE 1: PROJECT LOCATION MAP

Duncan Aquatic Resource Delineation Location

Map created by Kristin Adams with Tallgrass Restoration, LLC
Data Sources: ESRI
Edited December 12, 2023

FIGURE 2: TOPOGRAPHIC MAP

Duncan Aquatic Resource Delineation Topographic



Map created by Kristin Adams with Tallgrass Restoration, LLC
Data Sources: ESRI
Edited December 12, 2023

FIGURE 3: HILLSHADE ELEVATION MAP

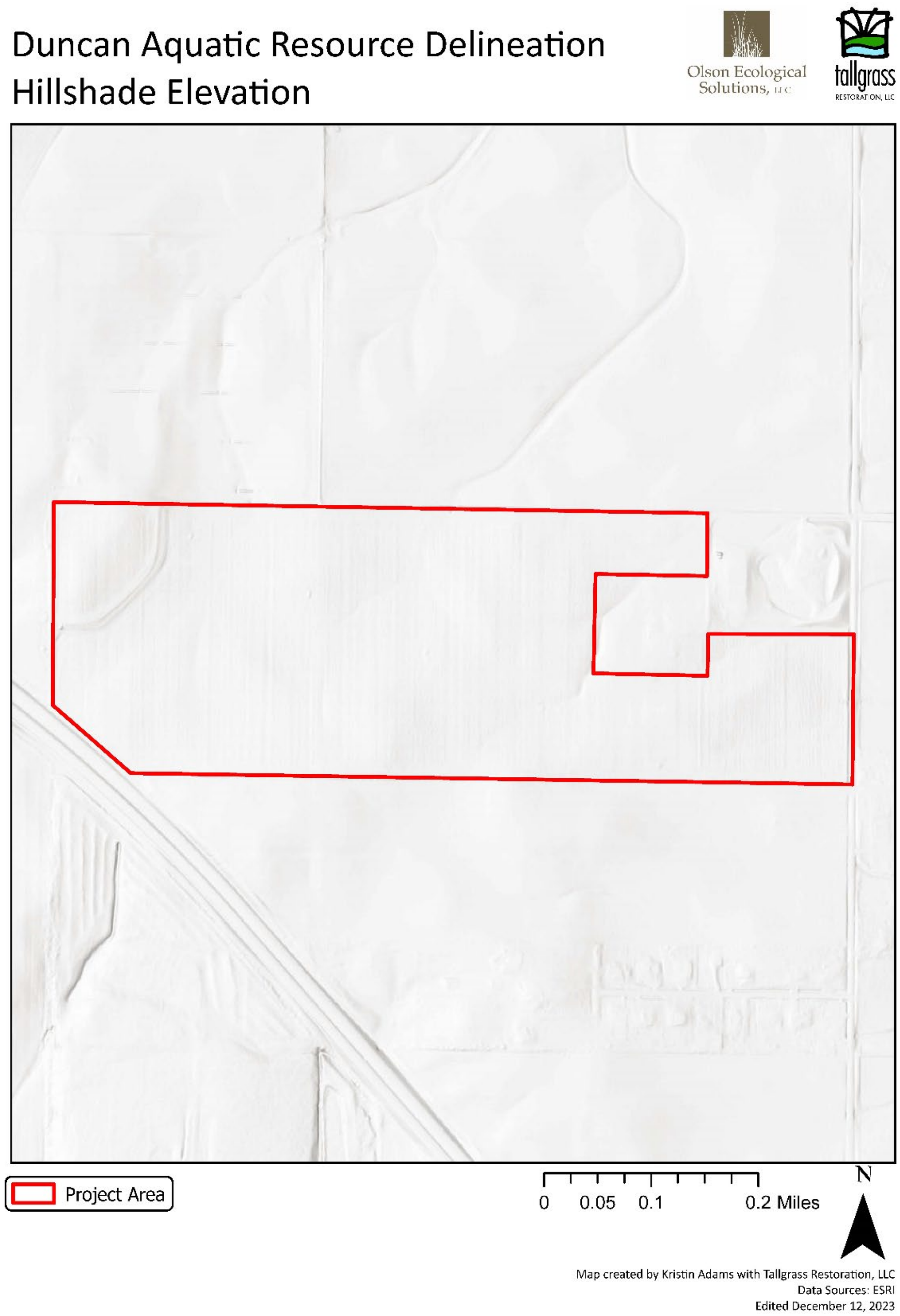


FIGURE 4: NATIONAL WETLANDS INVENTORY MAP

FIGURE 5: FLOOD HAZARD MAP

FIGURE 6: HYDRIC SOILS MAP

FIGURE 7: HISTORICAL AERIAL PHOTOGRAPHY FROM 1939

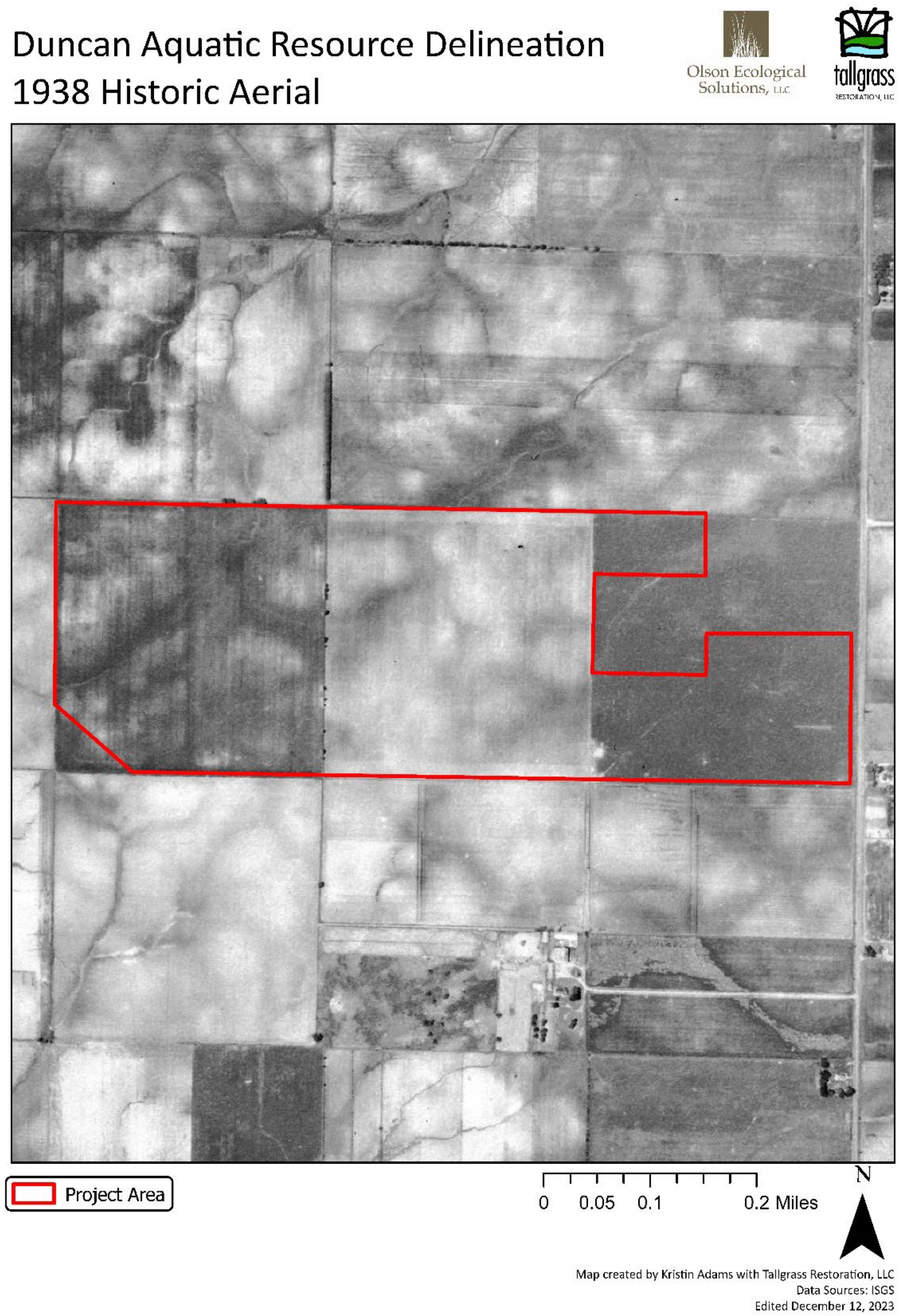


FIGURE 8: OES DELINEATED AQUATIC RESOURCES MAP

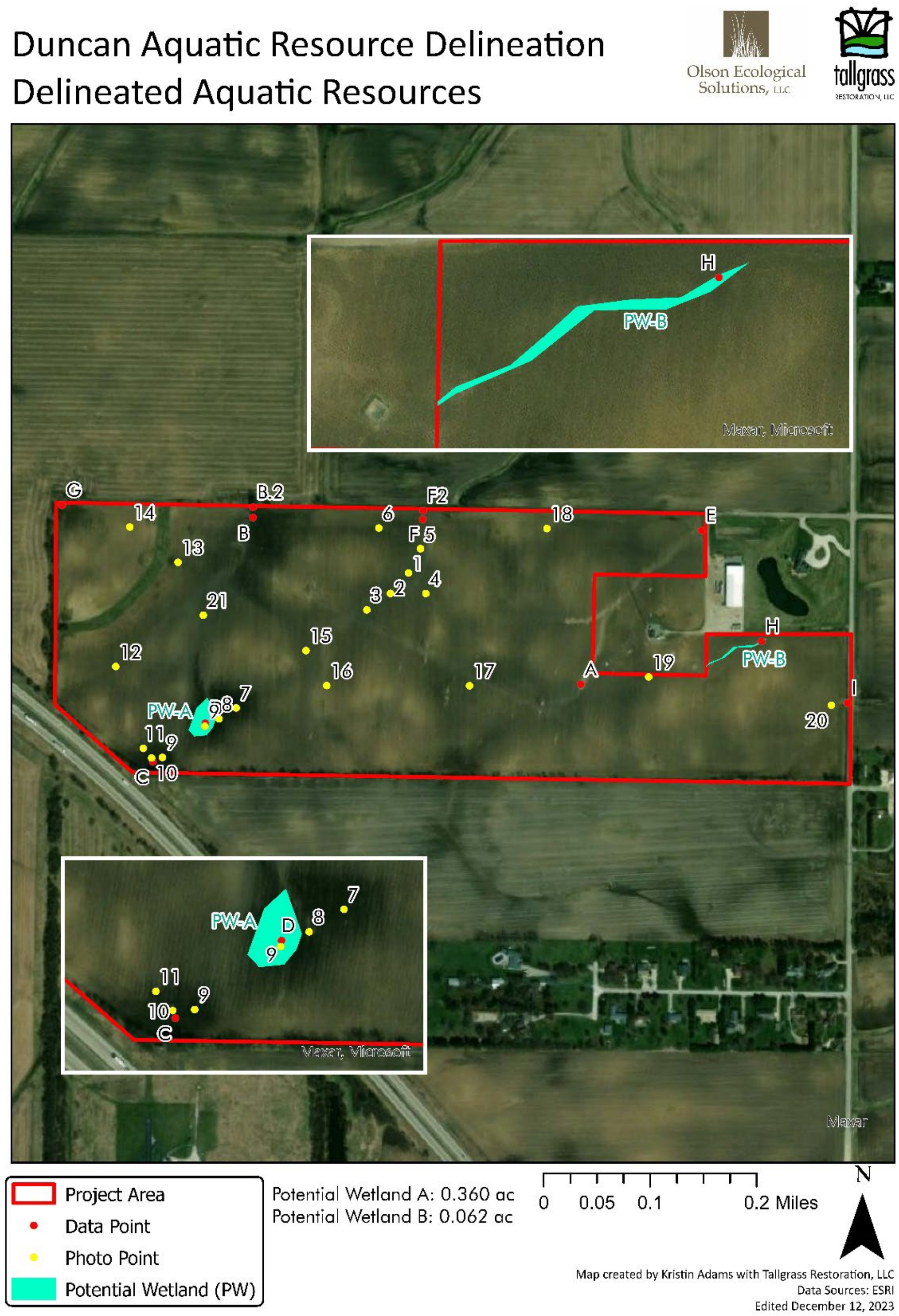
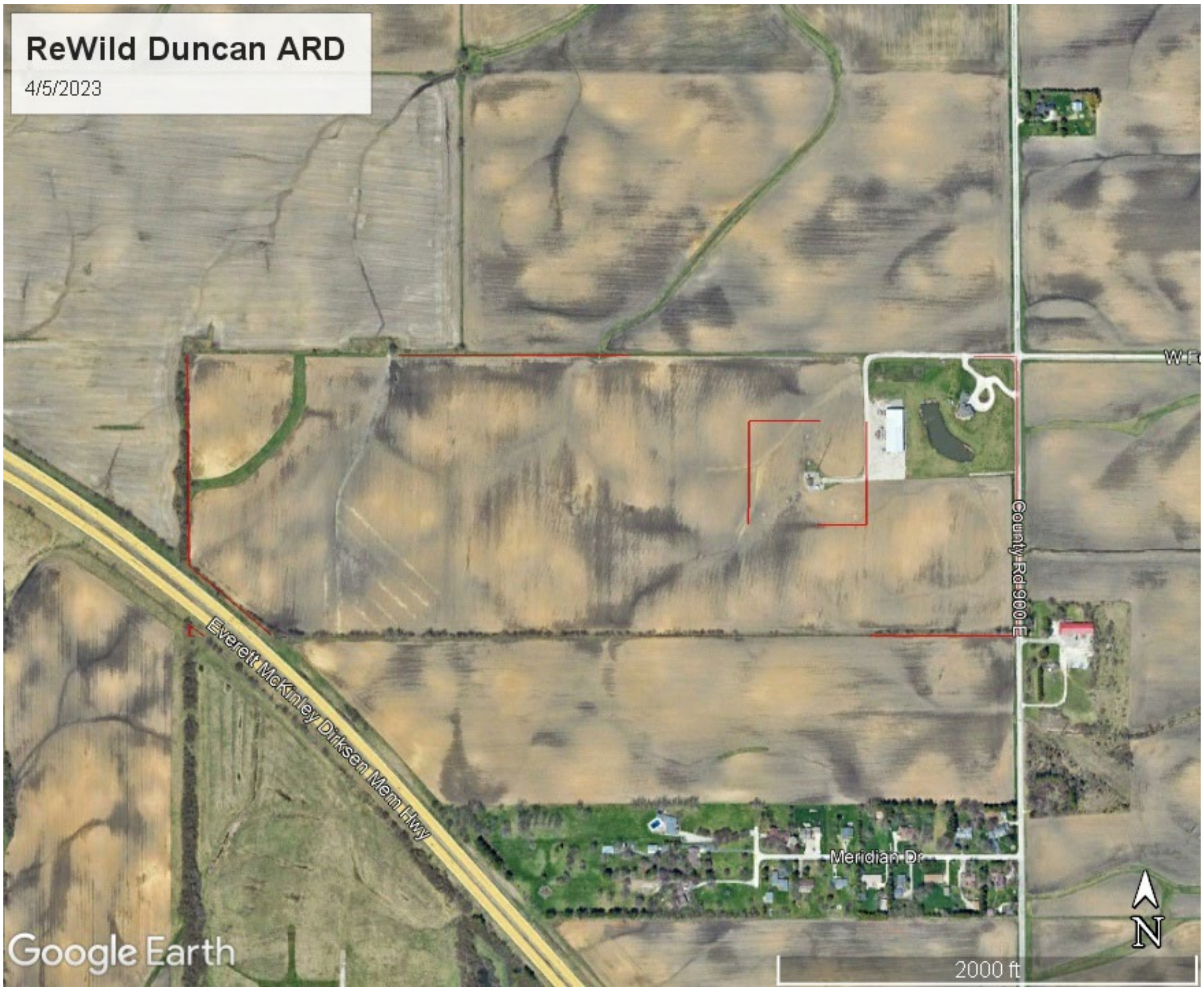


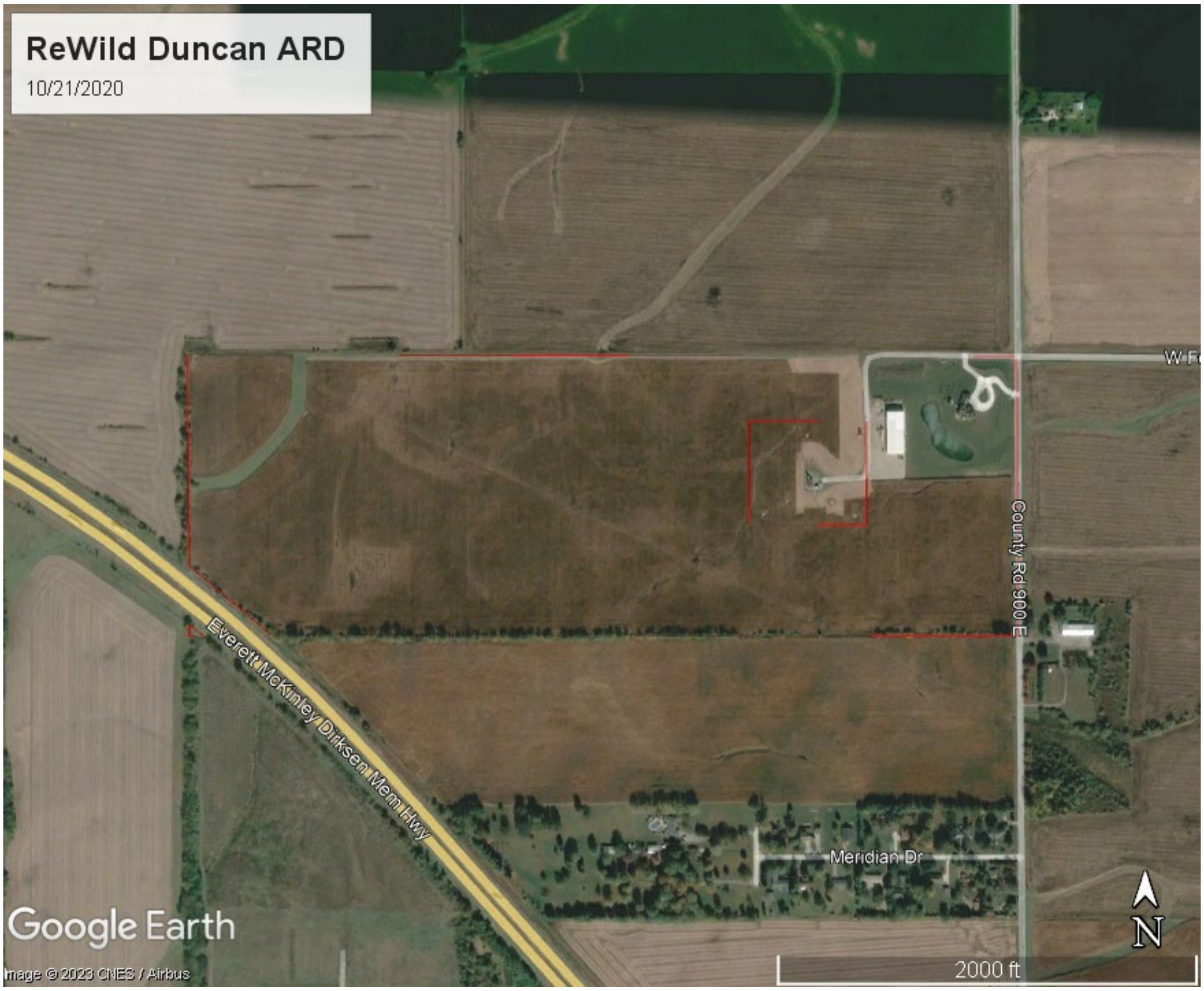
FIGURE 9: DRAIN TILE MAP

FIGURE 10: AERIAL IMAGERY FROM APRIL 2023



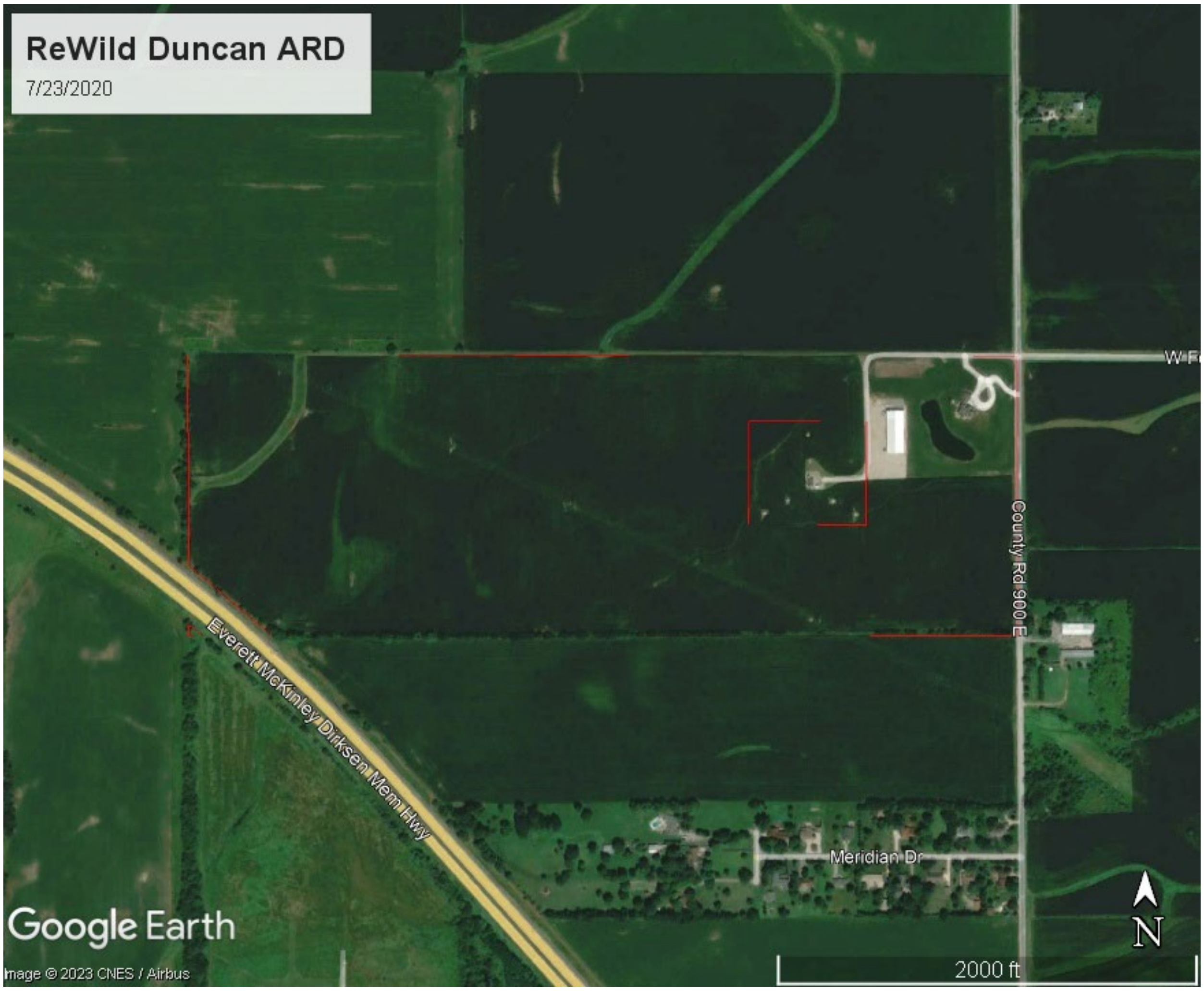
Drain Tile A, Drain Tile B, and Pond Outlet were all installed before this image was taken.

FIGURE 11: AERIAL IMAGERY FROM OCTOBER 2020



Drain Tile B was installed before this image was taken.

FIGURE 12: AERIAL IMAGERY FROM JULY 2020



Drain Tile B was installed before this image was taken.

FIGURE 13: AERIAL IMAGERY FROM APRIL 2019

Drain Tile B was installed before this image was taken.

FIGURE 14: AERIAL IMAGERY FROM OCTOBER 2016

No drain tiles or similar drainage features are known to have been installed before this image was taken.

FIGURE 15: AERIAL IMAGERY FROM SEPTEMBER 2011

No drain tiles or similar drainage features are known to have been installed before this image was taken.

GIS CITATIONS

All datum is North American 1983

Type: Aerial Images from Google Earth.
Date: As marked, 2011-2023
Description: Each aerial was from Google's Timeline feature.

Type: Flood Hazard
Source/Agency: ESRI, Federal Emergency Management Agency (FEMA)
Date: June 20, 2018, updated April 27, 2021
Description: FEMA National Flood Hazard Map
https://www.arcgis.com/home
Data accessed: 11/15/2023

Type: Hillshade Elevation
Source/Agency: Airbus, USGS, NGA, NASA, CGIAR, NLS, OS, NMA, Geodatastyrelsen, GSA, GSI and the GIS User Community
Date: June 24, 2014 (frequently updated)
Description: This map provides a hillshaded surface generated dynamically using a multi-directional hillshade server-side custom function on the World Elevation Terrain layer.
https://www.arcgis.com/home
Data accessed: 11/15/2023

Type: Historical Aerial
Source/Agency: Illinois State Geological Survey (ISGS)
Date: Version 4, 2008
Description: Aerial imagery from 1938
https://clearinghouse.isgs.illinois.edu/data/imagery/1937-1947-illinois-historical-aerialphotography
Data accessed: 11/15/2023

Type: USA Soil Map Units
Source/Agency: United State Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) Web Soil Survey, and ESRI
Date: April 4, 2019 (Updated June 29, 2023)
Description: This feature layer displays the soils of the United States and associated territories derived from the SSURGO dataset.
https://www.arcgis.com/home
Data accessed: 11/15/2023

Type: USA Wetlands
Source/Agency: U.S. Fish and Wildlife Service
Date: October 7, 2022

Description: This feature layer displays wetlands of the United States from the National Wetlands Inventory produced by the US Fish and Wildlife Service.
https://www.arcgis.com/home
Data accessed: 11/15/2023

Type: DuPage Assessment Parcel Viewer
Source: DuPage County GIS
Date: November 18, 2015 (Updated Nov 13, 2023)
Description: Parcel Data for DuPage Co., IL. This parcel layer makes up the county working parcel feature layer for 2015. This is not the end of tax year parcel layer. Some new parcel polygons in this layer may have not been finalized by the County Clerks Office at this time.
https://www.arcgis.com/home
Data accessed: 11/15/2023

Type: World Imagery
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
Date: October 15, 2013 (Updated Nov 2, 2023)
Description: This layer presents satellite imagery for the world and high-resolution imagery for many locations worldwide. This layer is designed to support export of basemap tiles for offline use.
https://www.arcgis.com/home
Data accessed: 11/15/2023

Type: USGS TNM Topo Base Map
Source/Agency: Florida Department of Environmental Protection
Date: December 4, 2018 (Updated Dec 2, 2019)
Description: USGS Topo is a tile cache base map service that combines the most current data in The National Map (TNM), and other public-domain data, into a multi-scale topographic reference map. Data themes included are Boundaries, Geographic Names, Transportation, Contours, Hydrography, Land Cover, Shaded Relief, and Bathymetry. This service is designed to provide a seamless view of TNM data in a geographic information system (GIS) accessible format.
https://basemap.nationalmap.gov/arcgis/rest/services/USGSTopo/MapServer
Data accessed: 11/15/2023

Type: Open Street Map (Streets)
Source/Agency: ESRI
Date: May 3, 2019 (Updated Oct 18, 2023)
Description: OpenStreetMap (OSM) is a collaborative project to create a free editable map of the world. This vector basemap is based on the Daylight map distribution of OSM data and is hosted by Esri. The cartographic presentation is an Esri World Street Map style of the OSM data.
https://www.arcgis.com/home
Data accessed: 11/15/2023

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APPENDIX A

Rainfall Documentation Worksheets

NRCS method - Rainfall Documentation Worksheet Hydrology Tools for Wetland Determination
NRCS Engineering Field Handbook Chapter 19

Date	12/7/2023	**Landowner/Project**	Duncan
Weather Station	Champaigm 3S	**State**	Illinois
County	Champaign	**Growing Season**	Yes
Photo/obs Date		**Soil Name**	

shaded cells are locked or calculated

	Month	**30% chance <**	**30% chance >**	**Precip**	Condition **D**ry, **W**et, **N**ormal	Condition Value	Month Weight Value	Product of Previous 2 Columns
	Long-term rainfall statistics (from WETS table or State Climatology Office)							
1st Prior Month*	October	2.30	3.99	4.35	W	3	3	9
2nd Prior Month*	September	2.06	4.08	3.28	N	2	2	4
3rd Prior Month*	August	2.11	4.29	3.99	N	2	1	2
	*compared to photo/observation date						**Sum**	**15**

Note: If sum is	
6 - 9	prior period has been drier than normal
10 - 14	prior period has been normal
15 - 18	prior period has been wetter than normal

Condition value:
Dry =1
Normal =2
Wet =3

Conclusions: **prior period has been wetter than normal**

WETS Table

WETS Station: CHAMPAIGN 3S, IL								
Requested years: 1991 - 2020								
Month	Avg Max Temp	Avg Min Temp	Avg Mean Temp	Avg Precip	30% chance precip less than	30% chance precip more than	Avg number days precip 0.10 or more	Avg Snowfall
Jan	33.5	17.9	25.7	2.31	1.51	2.79	5	6.5
Feb	38.4	21.2	29.8	2.18	1.20	2.59	5	5.8
Mar	50.4	31.2	40.8	2.77	1.93	3.28	6	2.5
Apr	63.1	41.6	52.4	3.94	2.80	4.71	8	0.3
May	73.8	52.7	63.3	4.78	3.43	5.64	9	0.0
Jun	82.7	62.1	72.4	4.58	3.06	5.61	7	0.0
Jul	85.2	65.2	75.2	4.49	2.88	5.41	7	0.0
Aug	84.0	63.6	73.8	3.54	2.11	4.29	6	0.0
Sep	78.8	55.6	67.2	3.37	2.06	4.08	5	0.0
Oct	65.8	43.9	54.9	3.35	2.30	3.99	6	0.0
Nov	50.7	32.2	41.5	3.21	2.21	3.82	6	0.9
Dec	38.5	23.6	31.1	2.40	1.65	2.85	5	4.8
Annual:					37.74	43.85		
Average	62.1	42.6	52.3	-	-	-	-	-
Total	-	-	-	40.92			74	20.8

GROWING SEASON DATES			
Years with missing data:	24 deg = 0	28 deg = 0	32 deg = 0
Years with no occurrence:	24 deg = 0	28 deg = 0	32 deg = 0
Data years used:	24 deg = 30	28 deg = 30	32 deg = 30
Probability	24 F or higher	28 F or higher	32 F or higher
50 percent *	3/24 to 11/12: 233 days	4/2 to 11/2: 214 days	4/14 to 10/17: 186 days
70 percent *	3/20 to 11/17: 242 days	3/29 to 11/6: 222 days	4/10 to 10/21: 194 days
* Percent chance of the growing season occurring between the Beginning and Ending dates.			

STATS TABLE - total precipitation (inches)													
Yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annl
1888								M0.10	1.32	3.40	M2.81	2.41	10.04
1889	1.48	2.08	1.61	0.61	5.52	7.49	5.81	0.60	1.58	1.42	4.28	1.82	34.30
1890	5.26	1.87	2.70	4.11	3.56	3.80	2.82	1.93	1.19	2.35	1.63	0.05	31.27
1891	0.99	2.60	3.55	3.54	0.89	2.08	1.41	2.86	0.41	1.29	3.91	1.53	25.06
1892	0.79	2.64	2.59	6.45	7.86	5.36	2.50	2.43	0.93	0.93	4.95	1.62	39.05
1893	1.05	4.48	3.20	7.68	4.83	1.55	0.59	0.06	3.62	1.14	2.98	1.09	32.27
1894	1.95	1.33	2.41	1.89	3.34	1.78	1.08	2.06	4.21	0.51	1.95	1.44	23.95
1895	1.36	0.52	0.97	2.42	2.20	2.24	3.61	1.81	5.27	0.21	3.07	5.71	29.39
1896	1.12	1.95	1.22	1.89	5.62	2.98	7.87	3.74	5.	0.	2.87	0.39	35.

									84	42			91
1897	3.91	1.09	4.10	4.22	1.80	5.14	4.68	0.63	0.31	0.44	4.90	2.67	33.89
1898	4.77	1.43	7.76	2.69	5.65	6.08	1.89	3.61	5.19	4.53	3.01	1.86	48.47
1899	1.97	2.33	1.74	0.50	6.09	2.29	2.65	2.29	1.07	5.10	1.49	2.14	29.66
1900	0.17	3.61	1.79	0.84	4.60	4.11	3.81	6.23	2.23	2.39	3.42	0.98	34.18
1901	1.55	1.41	3.14	0.80	1.93	5.80	2.48	1.68	M1.38	M4.10	1.31	3.06	28.64
1902	0.62	1.48	1.70	2.11	2.60	11.58	4.02	9.79	4.90	2.10	2.43	2.94	46.27
1903	1.04	2.40	1.43	5.71	3.95	2.56	5.13	2.33	0.99	2.70	2.06	2.18	32.48
1904	3.09	1.86	7.66	3.97	1.60	1.17	2.72	3.55	2.53	0.81	T	0.83	29.79
1905	1.80	2.27	0.75	2.95	4.24	1.30	5.40	2.14	2.88	3.11	1.45	1.31	29.60
1906	1.65	1.11	4.61	2.23	3.31	3.08	2.16	4.57	2.45	1.36	4.59	3.13	34.25
1907	6.09	0.24	3.34	2.34	5.04	5.56	5.41	4.42	0.94	1.51	1.99	3.32	40.20
1908	1.21	4.09	3.20	5.00	7.83	1.99	2.31	2.05	1.95	0.21	1.99	1.44	33.27
1909	2.17	M5.70	1.76	7.44	5.58	3.75	7.57	2.37	2.36	M2.25	3.45	2.55	46.95
1910	2.23	1.79	0.38	1.57	5.35	2.99	2.76	2.62	4.14	1.34	1.20	1.59	27.96
1911	2.27	1.19	1.85	3.59	2.44	0.82	0.62	3.35	8.90	3.10	2.83	1.35	32.31
1912	1.36	2.28	3.42	5.60	4.16	1.89	3.68	2.06	1.76	2.95	1.77	0.57	31.50
1913	5.38	1.10	5.99	2.19	0.56	1.73	1.52	1.44	2.50	4.03	4.49	M0.77	31.70
1914	1.97	2.50	0.89	2.87	1.94	2.40	1.44	2.66	2.11	2.85	0.80	2.25	24.68
1915	1.81	2.33	1.12	1.59	5.11	2.98	7.30	4.90	2.58	0.64	1.02	2.85	34.23
1916	6.02	0.63	1.14	1.28	5.70	3.88	0.47	1.72	2.69	2.26	1.93	1.99	29.71
1917	1.07	0.45	4.43	3.26	4.91	6.45	2.73	3.80	2.01	2.34	0.18	0.60	32.23
1918	1.74	1.86	1.57	6.78	4.70	5.43	2.51	5.15	4.91	2.82	1.73	3.99	43.19
1919	0.21	1.92	4.12	0.75	3.29	6.90	2.04	4.47	2.47	5.59	3.37	0.12	35.25
1920	0.83	0.45	3.40	5.69	3.80	0.94	3.08	M3.18	1.79	2.02	1.29	2.81	29.28
1921	1.60	0.49	5.82	5.25	5.26	1.68	2.54	4.26	5.64	2.23	4.91	1.98	41.66
1922	1.23	1.60	8.35	7.64	3.70	1.03	2.51	2.82	0.57	3.17	2.30	1.81	36.73
1923	1.57	1.34	5.25	2.96	5.26	3.20	3.26	4.08	2.99	3.78	1.68	5.01	40.38
1924	1.70	1.93	2.74	3.61	2.69	8.68	0.86	7.65	2.22	1.36	0.83	6.13	40.40
1925	0.73	1.28	4.62	1.85	0.22	2.28	1.12	3.44	5.24	4.60	2.81	1.19	29.38
1926	1.86	2.98	2.75	4.01	1.54	4.40	2.60	5.79	9.76	4.45	2.46	0.93	43.53
1927	1.67	1.22	3.84	6.48	5.01	5.87	6.02	4.79	6.27	4.15	6.77	3.55	55.64
1928	2.18	2.28	1.45	3.16	2.48	4.65	3.59	2.77	3.65	2.34	1.88	2.53	32.96
1929	3.56	0.53	2.92	6.40	7.80	2.71	6.46	4.77	0.94	3.72	1.36	2.96	44.13
1930	4.81	1.77	1.87	4.07	1.53	2.23	0.47	2.02	2.	1.	1.49	0.22	25.

									98	62			08
1931	0.47	1.26	2.62	4.43	3.97	4.33	4.26	2.90	5.41	2.28	2.54	2.00	36.47
1932	2.60	1.69	1.83	1.31	1.28	3.57	2.41	2.63	3.63	3.84	2.37	3.93	31.09
1933	1.96	1.40	5.38	3.35	5.84	1.19	0.61	4.40	5.14	3.41	0.67	1.12	34.47
1934	1.42	0.76	3.60	1.03	0.53	5.33	2.09	4.87	6.99	0.87	5.44	2.22	35.15
1935	2.17	1.27	2.69	2.87	6.93	3.64	4.12	2.36	3.94	1.65	4.25	1.32	37.21
1936	1.28	2.81	1.55	3.00	3.94	0.47	1.35	3.54	5.83	3.49	4.16	3.67	35.09
1937	5.97	1.49	0.76	5.38	2.59	5.43	2.43	0.80	5.34	3.92	1.49	2.05	37.65
1938	1.58	2.28	7.20	3.42	4.97	5.67	6.45	4.28	0.88	2.50	1.57	1.97	42.77
1939	3.72	3.72	4.83	5.39	1.19	6.17	1.73	6.38	0.32	2.54	1.13	0.93	38.05
1940	1.43	1.10	2.07	3.96	4.53	5.04	0.95	2.80	0.48	1.93	3.83	2.48	30.60
1941	1.34	0.64	1.46	4.21	3.94	6.19	3.27	3.61	4.91	9.01	3.33	0.96	42.87
1942	1.93	3.84	4.12	3.32	3.57	3.92	4.94	2.58	3.89	2.36	5.40	2.51	42.38
1943	0.62	1.09	3.80	3.47	11.20	2.43	1.42	3.94	2.12	2.00	2.17	1.28	35.54
1944	0.37	3.70	4.65	7.43	7.70	2.61	3.82	3.85	2.82	1.29	1.34	1.15	40.73
1945	0.36	1.49	6.18	4.37	5.09	7.33	3.27	5.09	7.27	2.45	2.62	2.49	48.01
1946	1.55	2.46	3.29	1.45	6.85	5.77	2.74	2.11	1.15	2.65	3.90	1.54	35.46
1947	2.01	0.15	2.23	4.77	4.51	9.38	2.05	2.05	2.16	3.69	1.99	1.91	36.90
1948	1.26	3.62	4.53	1.97	4.18	6.41	6.30	1.99	3.81	1.68	2.46	3.15	41.36
1949	6.21	2.96	2.40	2.26	4.43	4.57	4.93	2.37	1.67	7.73	1.00	5.00	45.53
1950	7.62	3.71	1.77	4.53	1.80	4.32	5.09	1.65	4.36	2.29	3.67	2.18	42.99
1951	2.07	3.91	3.69	3.07	2.49	4.98	3.66	4.71	2.13	2.76	2.41	2.51	38.39
1952	1.94	1.79	3.66	3.82	5.02	5.70	2.09	2.76	M1.66	1.34	2.62	1.46	33.86
1953	2.34	1.49	7.13	1.57	1.94	2.92	3.83	0.68	0.59	1.71	0.72	1.17	26.09
1954	1.81	1.56	1.94	4.15	3.05	2.73	2.92	4.69	0.25	4.46	0.53	1.61	29.70
1955	2.82	2.18	2.29	3.25	2.94	3.01	5.47	1.83	3.15	7.42	2.51	0.30	37.17
1956	0.63	2.43	1.07	2.35	2.92	1.89	5.82	3.79	1.25	0.39	2.11	2.65	27.30
1957	1.61	1.84	1.41	7.49	4.08	6.46	5.09	1.53	0.98	3.26	3.00	4.89	41.64
1958	1.53	0.44	1.37	2.36	4.29	7.50	7.17	3.27	2.84	0.42	4.85	0.59	36.63
1959	2.78	2.79	3.53	3.04	M6.54	1.09	1.54	2.44	3.36	4.53	2.61	2.33	36.58
1960	1.54	2.82	1.97	3.28	4.14	6.23	2.77	1.32	2.82	2.30	2.05	1.62	32.86
1961	0.51	2.17	4.59	5.71	5.46	6.47	2.80	1.27	3.92	3.47	3.37	2.36	42.10
1962	4.21	2.74	2.74	2.47	5.27	2.23	9.57	2.81	1.59	2.41	1.53	0.41	37.98
1963	0.95	0.96	6.84	2.22	0.90	2.26	4.32	3.55	0.30	1.69	2.02	0.88	26.89
1964	1.89	1.74	3.97	9.55	0.58	5.20	2.41	2.59	2.	0.	3.42	1.79	35.

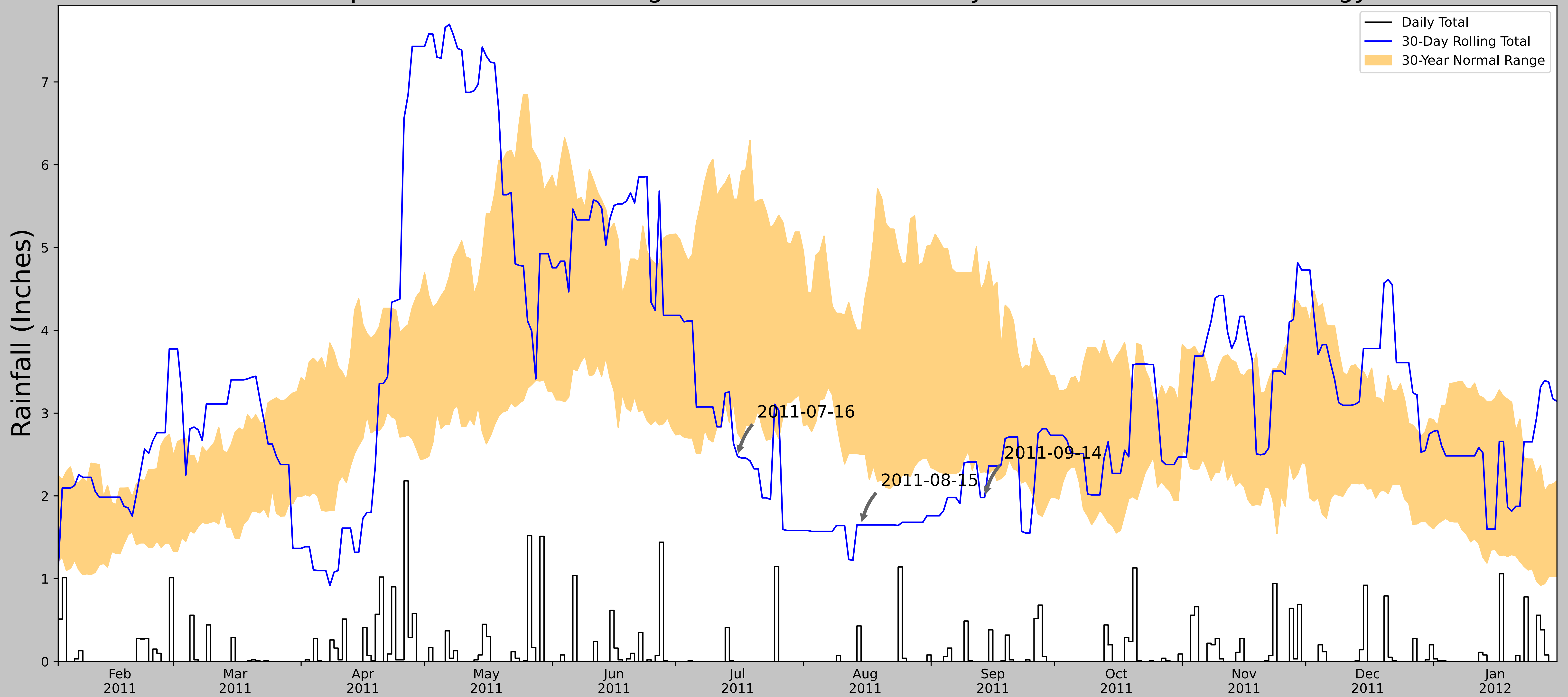
									18	16			48
1965	4.13	1.46	2.50	5.64	3.66	3.05	5.12	6.89	5.91	1.96	1.24	2.88	44.44
1966	0.40	2.07	1.91	4.64	2.99	3.02	1.34	2.97	6.29	1.03	3.52	5.66	35.84
1967	3.05	1.39	2.51	2.39	4.66	1.55	2.66	1.46	1.54	4.47	2.49	6.63	34.80
1968	2.31	1.41	1.69	3.31	6.92	6.97	2.83	4.80	1.78	0.64	4.68	2.38	39.72
1969	3.60	1.02	2.23	6.00	1.71	1.82	2.98	3.30	5.74	5.39	1.88	1.38	37.05
1970	0.52	0.86	2.30	7.71	1.72	3.26	4.58	3.12	6.99	3.07	1.34	1.01	36.48
1971	1.03	3.27	1.46	0.70	3.84	1.22	10.96	1.43	4.77	0.72	1.59	6.16	37.15
1972	0.98	0.83	3.28	4.81	1.40	3.44	2.58	5.71	8.69	2.13	4.17	4.93	42.95
1973	1.11	0.67	6.55	5.14	3.23	7.05	9.21	3.04	3.01	2.91	2.47	4.81	49.20
1974	3.08	3.33	3.86	4.74	6.31	5.71	1.47	5.94	1.52	1.30	3.78	2.54	43.58
1975	4.64	2.85	2.59	3.08	3.85	6.21	4.90	6.43	2.97	2.20	3.32	2.85	45.89
1976	1.31	2.90	3.82	0.59	4.56	5.65	4.17	2.23	3.80	2.90	0.57	0.27	32.77
1977	1.31	1.36	5.83	0.75	3.58	2.30	3.03	10.01	4.83	4.75	2.52	2.63	42.90
1978	1.34	1.18	3.68	2.62	4.38	1.96	5.53	5.77	1.83	1.75	2.62	3.39	36.05
1979	2.86	1.27	4.87	6.47	1.47	1.01	8.44	5.10	0.54	1.57	2.71	1.45	37.76
1980	0.78	1.70	4.29	2.39	3.76	4.62	1.36	4.26	3.34	2.24	1.63	1.36	31.73
1981	0.64	2.21	0.76	6.03	5.83	4.72	6.81	8.64	3.82	2.82	1.27	2.32	45.87
1982	5.79	1.33	3.18	2.45	6.49	3.57	4.96	2.77	1.48	3.01	4.34	4.38	43.75
1983	0.74	1.15	3.55	6.43	5.56	9.15	1.40	4.63	0.83	7.24	M4.61	4.99	50.28
1984	0.72	2.87	4.85	4.68	5.65	1.22	4.66	2.61	3.00	M2.78	3.64	3.87	40.55
1985	0.67	4.52	5.08	2.40	3.45	5.50	4.26	5.10	0.71	1.60	10.08	2.33	45.70
1986	0.06	2.65	1.02	2.67	2.72	4.28	4.70	1.42	7.90	3.31	2.94	1.71	35.38
1987	1.90	0.60	1.18	3.38	3.16	4.99	7.84	5.01	2.01	1.10	4.80	5.42	41.39
1988	2.16	1.28	2.51	1.50	1.55	0.32	3.64	1.28	3.33	3.18	5.93	2.93	29.61
1989	1.23	1.29	1.98	5.73	5.80	5.02	1.78	4.14	4.55	1.21	1.42	0.69	34.84
1990	1.01	6.05	3.46	2.14	8.64	8.33	3.63	2.48	1.49	6.90	3.00	6.18	53.31
1991	1.65	0.33	4.29	2.63	9.32	0.67	2.59	2.27	2.11	4.43	2.82	1.76	34.87
1992	1.03	1.35	2.00	3.30	3.09	2.47	13.82	2.39	3.14	2.08	8.03	2.45	45.15
1993	4.39	2.30	3.04	5.06	1.83	5.47	8.42	10.02	7.97	4.10	4.24	1.70	58.54
1994	1.84	0.98	1.10	9.27	4.01	M1.99	1.28	3.65	3.21	3.11	5.15	1.90	37.49
1995	2.12	0.45	2.91	3.59	10.11	1.93	1.99	5.36	0.50	3.88	2.03	1.62	36.49
1996	2.04	1.41	2.19	3.58	8.26	5.65	3.36	1.42	3.40	1.55	4.14	1.39	38.39
1997	2.50	3.51	2.93	1.09	4.69	2.37	2.90	7.02	3.40	1.96	2.56	1.97	36.90
1998	2.23	1.80	6.35	4.61	7.82	8.72	4.19	1.94	2.	2.	2.43	0.89	46.

									19	94			11
1999	4.88	2.48	1.90	4.77	3.52	6.14	3.82	5.34	1.91	1.92	0.81	2.05	39.54
2000	1.54	2.40	1.77	2.78	6.18	4.52	2.45	3.59	4.24	2.76	3.84	1.73	37.80
2001	1.32	3.84	0.85	1.09	3.83	2.83	3.64	4.79	3.55	6.45	1.91	2.21	36.31
2002	2.81	2.95	3.10	4.21	6.29	2.78	2.73	7.27	1.77	3.17	0.86	1.54	39.48
2003	0.79	1.60	2.08	2.20	3.59	3.04	6.98	6.27	4.07	1.31	4.94	3.11	39.98
2004	2.18	0.56	7.74	1.88	4.38	3.77	5.73	3.59	2.19	3.71	5.16	2.02	42.91
2005	6.20	2.00	1.73	3.98	0.97	2.42	4.30	2.26	5.66	1.28	3.72	1.86	36.38
2006	1.78	0.52	3.46	4.41	3.06	1.65	7.85	3.00	1.34	3.78	2.35	4.68	37.88
2007	3.03	2.07	2.23	2.43	1.63	5.68	3.44	1.48	2.06	3.29	3.65	2.95	33.94
2008	2.31	5.96	2.84	3.01	6.07	6.40	7.89	0.79	8.15	2.96	1.31	4.89	52.58
2009	0.68	1.68	2.62	6.94	5.71	4.42	6.30	5.62	0.80	8.79	3.92	3.77	51.25
2010	1.24	M0.88	2.91	2.08	3.41	8.33	3.75	1.64	3.20	1.10	3.85	2.55	34.94
2011	0.66	3.77	1.36	7.42	4.93	4.18	1.58	1.76	2.73	2.46	4.72	2.74	38.31
2012	M3.15	1.13	1.63	2.32	3.11	2.28	0.61	5.56	5.71	5.46	1.07	2.07	34.10
2013	2.57	3.21	1.33	7.05	3.74	6.27	3.53	0.36	0.68	3.59	1.54	M2.16	36.03
2014	1.60	3.02	1.39	3.94	4.38	8.21	8.70	1.52	3.44	4.96	2.42	1.81	45.39
2015	1.43	1.23	1.70	3.62	6.07	9.16	4.22	3.16	6.44	1.24	4.41	7.47	50.15
2016	0.91	1.22	3.51	3.26	3.79	7.12	4.44	4.15	5.39	1.88	3.32	1.35	40.34
2017	2.53	0.41	2.38	5.81	5.91	2.05	2.80	2.22	0.84	6.31	3.06	0.46	34.78
2018	1.10	6.12	3.18	2.32	3.45	8.26	3.32	4.15	4.72	2.29	3.71	3.37	45.99
2019	3.85	1.90	5.09	4.89	6.08	2.82	3.38	2.19	3.36	5.00	1.91	1.82	42.29
2020	5.23	2.67	3.30	M5.59	4.09	5.88	4.73	1.36	2.91	2.59	2.29	1.43	42.07
2021	M1.52	2.19	4.11	2.11	3.51	7.24	4.65	4.54	3.11	7.40	1.30	2.96	44.64
2022	0.63	3.02	4.69	2.52	4.12	0.81	2.42	4.94	4.82	2.33	1.83	2.82	34.95
2023	2.05	2.39	3.78	1.81	1.98	1.75	3.03	3.99	3.28	4.35	0.64	M1.62	30.67
Notes: Data missing in any month have an "M" flag. A "T" indicates a trace of precipitation.													
Data missing for all days in a month or year is blank.													
Creation date: 2023-12-07													

Climatological Data for CHAMPAIGN 3S, IL - November 2023

Date	Max Temperature	Min Temperature	Avg Temperature	GDD Base 40	GDD Base 50	Precipitation	Snowfall	Snow Depth
2023-11-01	39	27	33.0	0	0	T	T	0
2023-11-02	45	26	35.5	0	0	0.00	0.0	0
2023-11-03	57	27	42.0	2	0	0.00	0.0	0
2023-11-04	62	38	50.0	10	0	0.00	0.0	0
2023-11-05	62	33	47.5	8	0	0.00	0.0	0
2023-11-06	64	37	50.5	11	1	T	0.0	0
2023-11-07	72	50	61.0	21	11	0.00	0.0	0
2023-11-08	66	48	57.0	17	7	0.00	0.0	0
2023-11-09	79	42	60.5	21	11	0.02	0.0	0
2023-11-10	57	37	47.0	7	0	0.00	0.0	0
2023-11-11	54	28	41.0	1	0	0.00	0.0	0
2023-11-12	52	34	43.0	3	0	0.00	0.0	0
2023-11-13	61	38	49.5	10	0	0.00	0.0	0
2023-11-14	65	30	47.5	8	0	0.00	0.0	0
2023-11-15	65	30	47.5	8	0	0.00	0.0	0
2023-11-16	70	36	53.0	13	3	0.00	0.0	0
2023-11-17	66	43	54.5	15	5	0.01	0.0	0
2023-11-18	57	27	42.0	2	0	0.00	0.0	0
2023-11-19	55	29	42.0	2	0	0.00	0.0	0
2023-11-20	61	37	49.0	9	0	0.00	0.0	0
2023-11-21	50	40	45.0	5	0	0.41	0.0	0
2023-11-22	43	31	37.0	0	0	0.00	0.0	0
2023-11-23	43	31	37.0	0	0	0.00	0.0	0
2023-11-24	50	30	40.0	0	0	0.00	0.0	0
2023-11-25	38	28	33.0	0	0	0.00	0.0	0
2023-11-26	40	28	34.0	0	0	0.06	0.6	0
2023-11-27	34	23	28.5	0	0	0.14	0.3	T
2023-11-28	31	13	22.0	0	0	0.00	0.0	T
2023-11-29	26	15	20.5	0	0	0.00	0.0	T
2023-11-30	50	26	38.0	0	0	0.00	0.0	0
Average|Sum	53.8	32.1	42.9	173	38	0.64	0.9	0.0

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



Coordinates	40.169478, -88.303291
Observation Date	2011-09-14
Elevation (ft)	831.382
Drought Index (PDSI)	Mild drought
WebWIMP H_2O Balance	Dry Season

30 Days Ending	30^{th} %ile (in)	70^{th} %ile (in)	Observed (in)	Wetness Condition	Condition Value	Month Weight	Product
2011-09-14	2.290945	4.57874	1.980315	Dry	1	3	3
2011-08-15	2.50315	4.001969	1.649606	Dry	1	2	2
2011-07-16	2.764173	5.584252	2.476378	Dry	1	1	1
Result							Drier than Normal - 6

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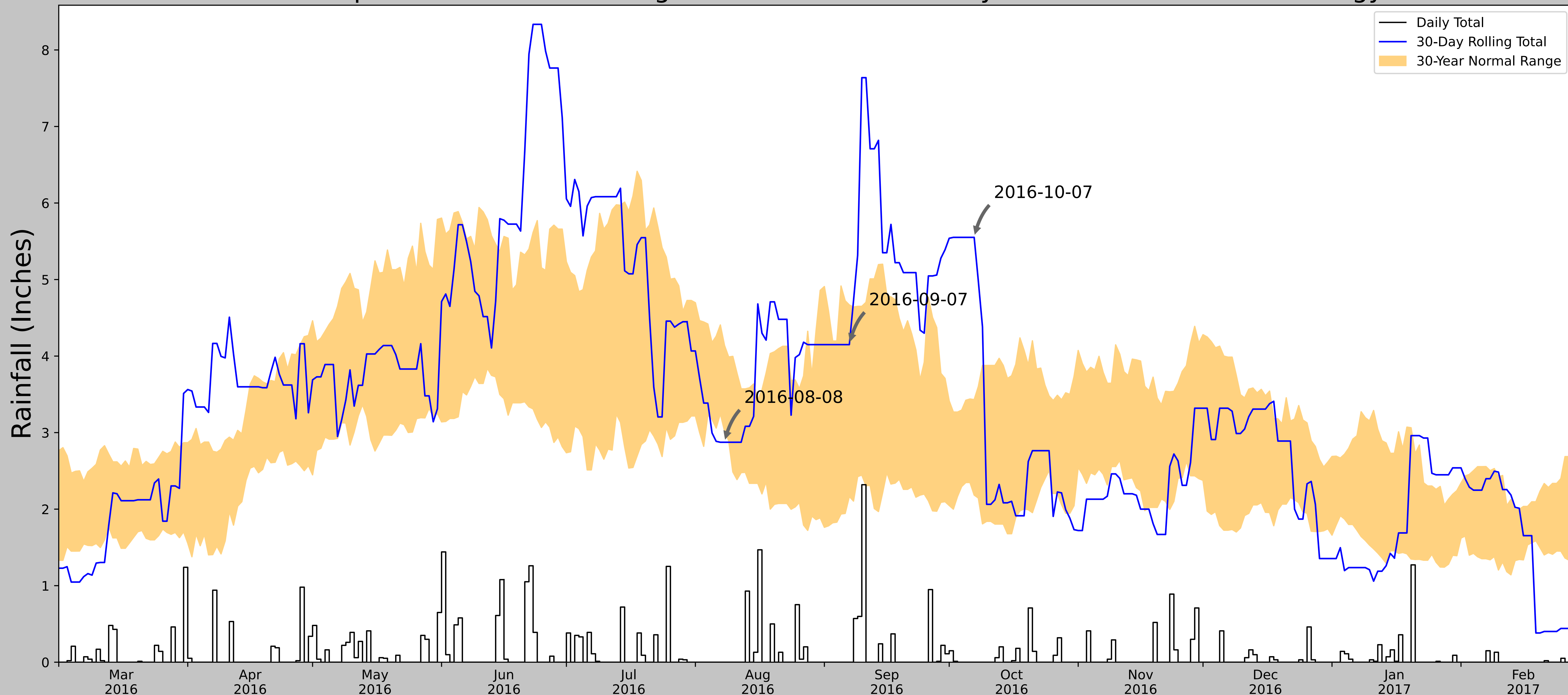
Figures and tables made by the Antecedent Precipitation Tool Version 2.0

Developed by: U.S. Army Corps of Engineers and U.S. Army Engineer Research and Development Center

Weather Station Name	Coordinates	Elevation (ft)	Distance (mi)	Elevation Δ	Weighted Δ	Days Normal	Days Antecedent
CHAMPAIGN 3S	40.0842, -88.2403	722.113	6.767	109.269	3.785	11327	90
CHAMPAIGN 2.7 S	40.0742, -88.2591	737.861	1.21	15.748	0.564	2	0
RANTOUL	40.3131, -88.1594	740.158	16.382	18.045	7.668	24	0

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



Coordinates	40.169478, -88.303291
Observation Date	2016-10-07
Elevation (ft)	831.382
Drought Index (PDSI)	Severe wetness
WebWIMP H_2O Balance	Wet Season

30 Days Ending	30^{th} %ile (in)	70^{th} %ile (in)	Observed (in)	Wetness Condition	Condition Value	Month Weight	Product
2016-10-07	2.183858	3.431102	5.551181	Wet	3	3	9
2016-09-07	2.165354	4.667717	4.149606	Normal	2	2	4
2016-08-08	3.022441	4.13937	2.874016	Dry	1	1	1
Result							Normal Conditions - 14

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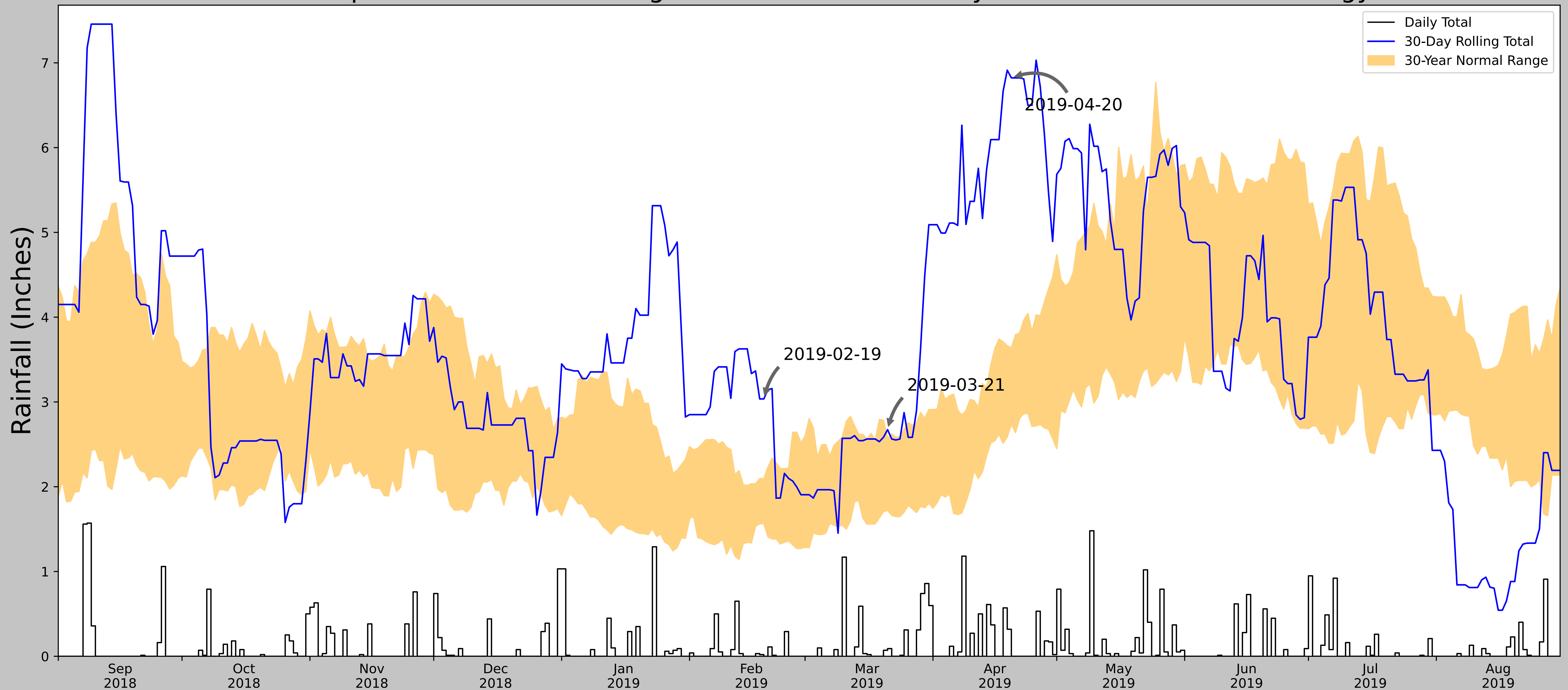
Weather Station Name	Coordinates	Elevation (ft)	Distance (mi)	Elevation Δ	Weighted Δ	Days Normal	Days Antecedent
CHAMPAIGN 3S	40.0842, -88.2403	722.113	6.767	109.269	3.785	11333	90
SAVOY 0.9 N	40.0781, -88.2537	735.892	0.824	13.779	0.382	3	0
CHAMPAIGN 2.7 S	40.0742, -88.2591	737.861	1.21	15.748	0.564	2	0
RANTOUL	40.3131, -88.1594	740.158	16.382	18.045	7.668	15	0

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



Coordinates	40.169478, -88.303291
Observation Date	2019-04-20
Elevation (ft)	831.382
Drought Index (PDSI)	Moderate wetness
WebWIMP H_2O Balance	Wet Season

30 Days Ending	30^{th} %ile (in)	70^{th} %ile (in)	Observed (in)	Wetness Condition	Condition Value	Month Weight	Product
2019-04-20	2.735433	3.637402	6.822835	Wet	3	3	9
2019-03-21	1.720866	2.568504	2.673228	Wet	3	2	6
2019-02-19	1.566142	2.096063	3.035433	Wet	3	1	3
Result							Wetter than Normal - 18

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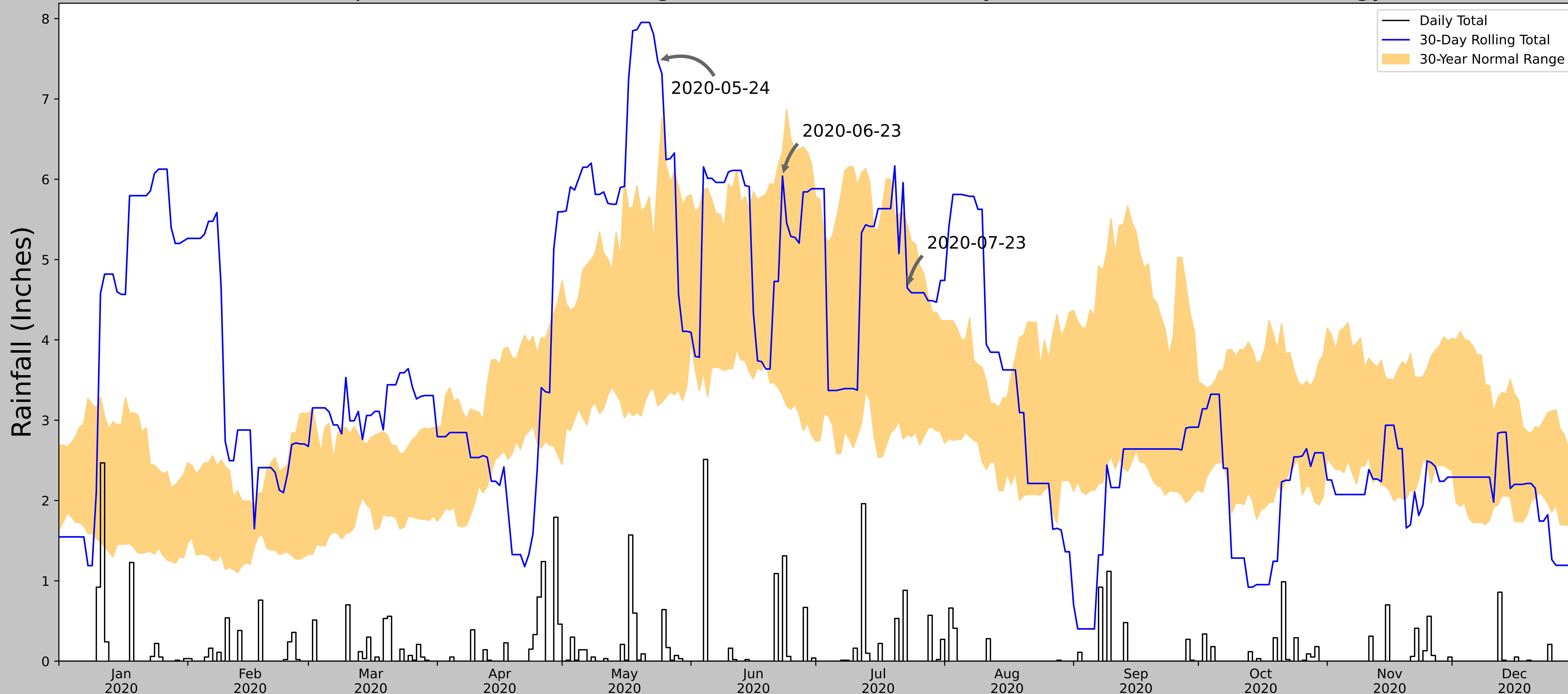
Weather Station Name	Coordinates	Elevation (ft)	Distance (mi)	Elevation Δ	Weighted Δ	Days Normal	Days Antecedent
CHAMPAIGN 3S	40.0842, -88.2403	722.113	6.767	109.269	3.785	11333	90
SAVOY 0.9 N	40.0781, -88.2537	735.892	0.824	13.779	0.382	3	0
CHAMPAIGN 2.7 S	40.0742, -88.2591	737.861	1.21	15.748	0.564	2	0
RANTOUL	40.3131, -88.1594	740.158	16.382	18.045	7.668	15	0

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



Coordinates	40.169478, -88.303291
Observation Date	2020-07-23
Elevation (ft)	831.382
Drought Index (PDSI)	Severe wetness
WebWIMP H_2O Balance	Dry Season

30 Days Ending	30^{th} %ile (in)	70^{th} %ile (in)	Observed (in)	Wetness Condition	Condition Value	Month Weight	Product
2020-07-23	2.820866	5.433858	4.645669	Normal	2	3	6
2020-06-23	3.309843	6.33937	6.03937	Normal	2	2	4
2020-05-24	3.183071	6.021654	7.472441	Wet	3	1	3
Result							Normal Conditions - 13

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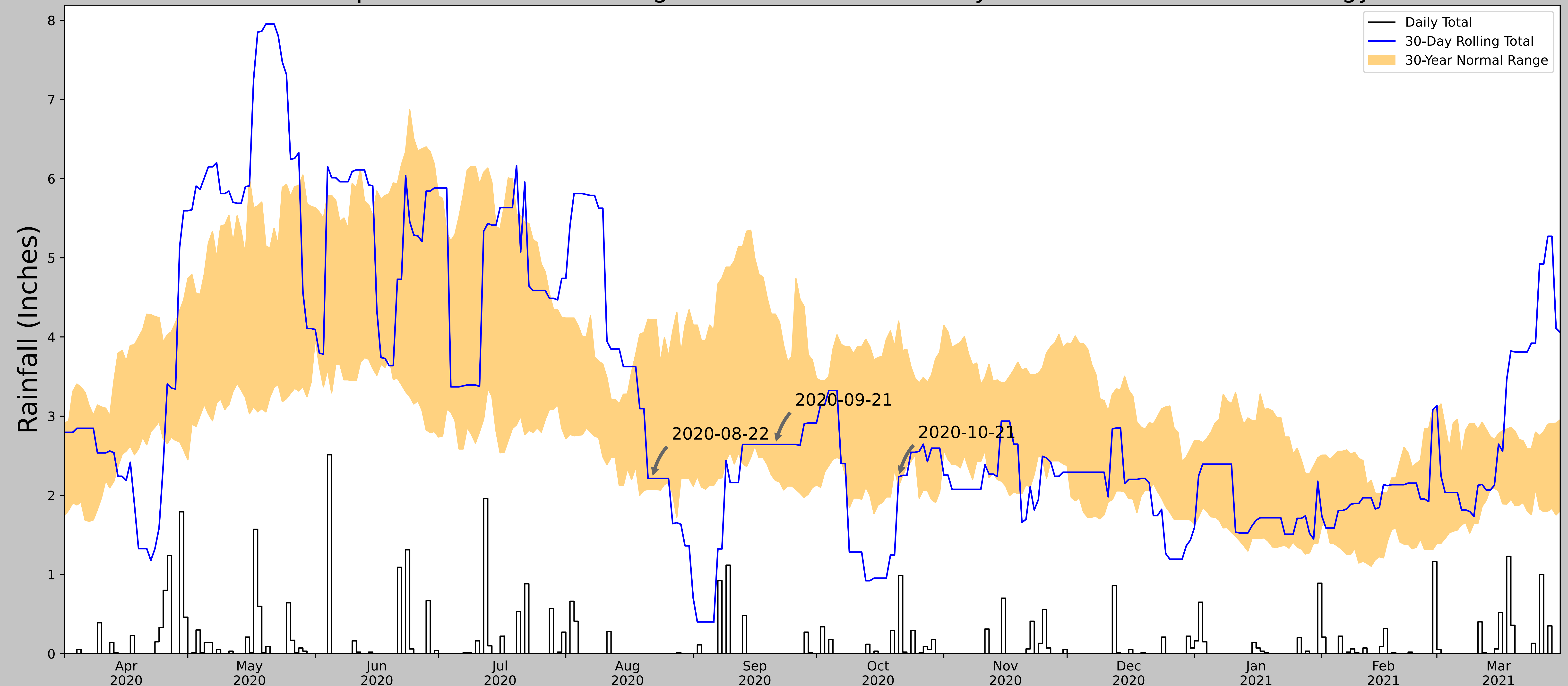
Weather Station Name	Coordinates	Elevation (ft)	Distance (mi)	Elevation Δ	Weighted Δ	Days Normal	Days Antecedent
CHAMPAIGN 3S	40.0842, -88.2403	722.113	6.767	109.269	3.785	11332	90
SAVOY 0.9 N	40.0781, -88.2537	735.892	0.824	13.779	0.382	3	0
CHAMPAIGN 2.7 S	40.0742, -88.2591	737.861	1.21	15.748	0.564	2	0
RANTOUL	40.3131, -88.1594	740.158	16.382	18.045	7.668	15	0

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



Coordinates	40.169478, -88.303291
Observation Date	2020-10-21
Elevation (ft)	831.382
Drought Index (PDSI)	Incipient drought
WebWIMP H_2O Balance	Wet Season

30 Days Ending	30^{th} %ile (in)	70^{th} %ile (in)	Observed (in)	Wetness Condition	Condition Value	Month Weight	Product
2020-10-21	2.114173	4.2	2.232284	Normal	2	3	6
2020-09-21	2.188189	4.288189	2.641732	Normal	2	2	4
2020-08-22	2.074016	4.219291	2.212598	Normal	2	1	2
Result							Normal Conditions - 12

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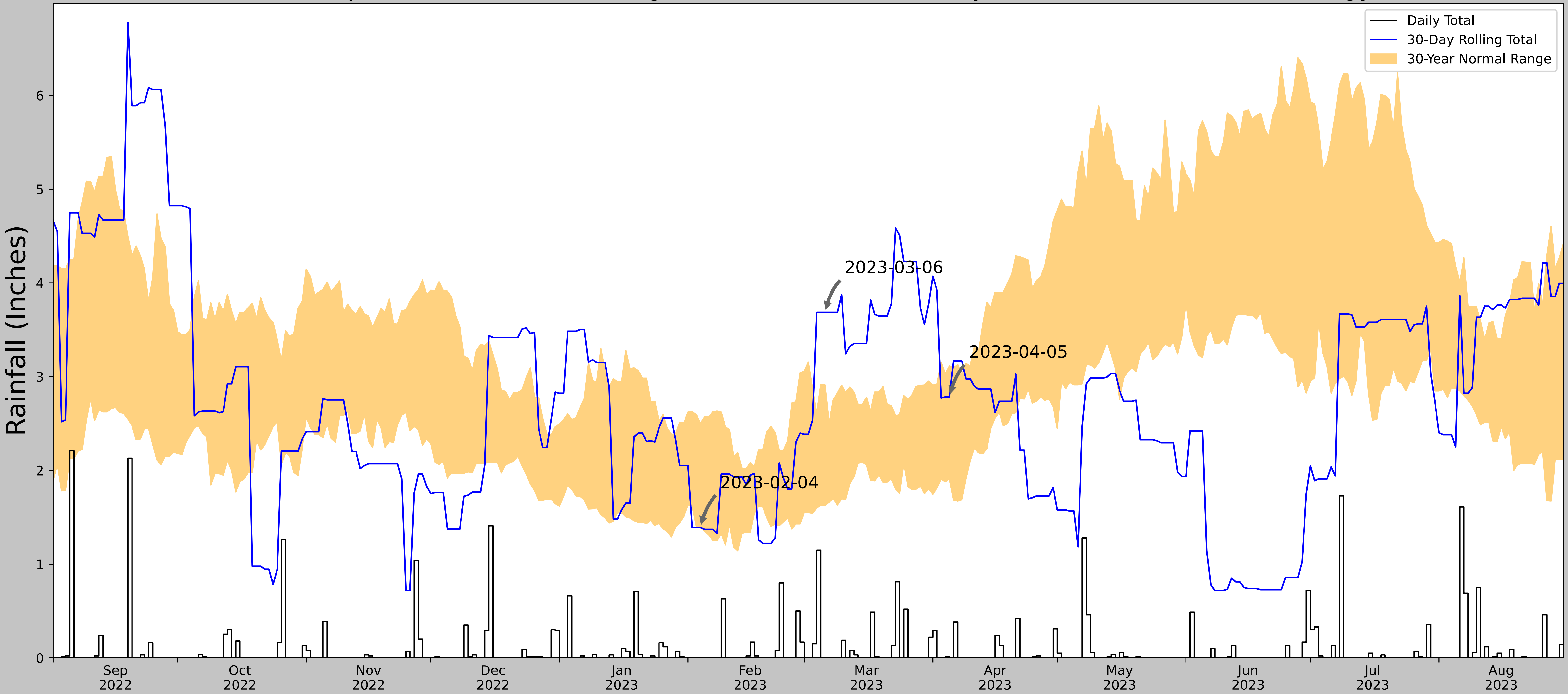
Weather Station Name	Coordinates	Elevation (ft)	Distance (mi)	Elevation Δ	Weighted Δ	Days Normal	Days Antecedent
CHAMPAIGN 3S	40.0842, -88.2403	722.113	6.767	109.269	3.785	11332	90
SAVOY 0.9 N	40.0781, -88.2537	735.892	0.824	13.779	0.382	4	0
CHAMPAIGN 2.7 S	40.0742, -88.2591	737.861	1.21	15.748	0.564	2	0
RANTOUL	40.3131, -88.1594	740.158	16.382	18.045	7.668	15	0

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



Coordinates	40.169478, -88.303291
Observation Date	2023-04-05
Elevation (ft)	831.382
Drought Index (PDSI)	Incipient drought
WebWIMP H_2O Balance	Wet Season

30 Days Ending	30^{th} %ile (in)	70^{th} %ile (in)	Observed (in)	Wetness Condition	Condition Value	Month Weight	Product
2023-04-05	1.914173	3.114173	2.783465	Normal	2	3	6
2023-03-06	1.626772	2.912205	3.685039	Wet	3	2	6
2023-02-04	1.388189	2.502756	1.389764	Normal	2	1	2
Result							Normal Conditions - 14

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Weather Station Name	Coordinates	Elevation (ft)	Distance (mi)	Elevation Δ	Weighted Δ	Days Normal	Days Antecedent
CHAMPAIGN 3S	40.0842, -88.2403	722.113	6.767	109.269	3.785	11332	90
SAVOY 0.9 N	40.0781, -88.2537	735.892	0.824	13.779	0.382	4	0
CHAMPAIGN 2.7 S	40.0742, -88.2591	737.861	1.21	15.748	0.564	2	0
RANTOUL	40.3131, -88.1594	740.158	16.382	18.045	7.668	15	0

APPENDIX B

DATA FORMS

U.S. Army Corps of Engineers WETLAND DETERMINATION DATA SHEET – Midwest Region See ERDC/EL TR-10-16; the proponent agency is CECW-CO-R	*OMB Control #: 0710-0024, Exp:11/30/2024* *Requirement Control Symbol EXEMPT:* *(Authority: AR 335-15, paragraph 5-2a)*

Project/Site: Duncan City/County: Unincorporated/Champaign Sampling Date: 11/15/2023

Applicant/Owner: Rewild Renewables, LLC. State: IL Sampling Point: A

Investigator(s): Colleen Stull Section, Township, Range: Sec 28, T 20N, R 8E

Landform (hillside, terrace, etc.): Hillslope Local relief (concave, convex, none): Linear

Slope (%): 3-5 Lat: 40.168945 Long: -88.300898 Datum: NAD 83

Soil Map Unit Name: 152A - Drummer silty clay loam, 0 to 2 percent slopes NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)

Are Vegetation X , Soil ___ , or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___ , Soil ___ , or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		
Hydric Soil Present?	X	
Wetland Hydrology Present?		X

Is the Sampled Area within a Wetland? Yes ___ No X

Remarks:
Climate was wetter than normal in the three months prior, it rained 0.02 inches in the seven days prior, and the field assessment was conducted during the typical Illinois dry season.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30' r)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
=Total Cover			
Sapling/Shrub Stratum (Plot size: 15' r)			
1.			
2.			
3.			
4.			
5.			
=Total Cover			
Herb Stratum (Plot size: 5' r)			
1. *Lamium amplexicaule*	1	Yes	UPL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
=Total Cover	1		
Woody Vine Stratum (Plot size: 30' r)			
1.			
2.			
=Total Cover			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	0	(A)
Total Number of Dominant Species Across All Strata:	1	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	0.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	1	x 5 =	5
Column Totals:	1 (A)		5 (B)

Prevalence Index = B/A = 5.00

Hydrophytic Vegetation Indicators:

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

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

Hydrophytic Vegetation Present? Yes ___ No ___

Remarks: (Include photo numbers here or on a separate sheet.)
Veg was significantly disturbed as this point was taken within the farmfield.

SOIL

Sampling Point: A

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-11	10YR 2/1	80	10YR 5/6	3	C	M	Loamy/Clayey	Prominent redox concentrations
	10YR 3/2	17					Loamy/Clayey	
11-24	10YR 5/6	50					Loamy/Clayey	
	10YR 5/1	45					Loamy/Clayey	
	10YR 2/1	5					Loamy/Clayey	

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

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ Iron-Manganese Masses (F12)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

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

Remarks:

Growing season verified by soil temperature reading of 53 degrees Fahrenheit at 12" below the surface.

HYDROLOGY

Wetland Hydrology Indicators:

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

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Gauge or Well Data (D9)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- X Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? **Yes** ___ **No** X

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

Remarks:

FAC-Neutral Test failed 0:1 considering dominant species. Pit dug to 24".

U.S. Army Corps of Engineers **WETLAND DETERMINATION DATA SHEET – Midwest Region** See ERDC/EL TR-10-16; the proponent agency is CECW-CO-R	*OMB Control #: 0710-0024, Exp:11/30/2024* *Requirement Control Symbol EXEMPT:* *(Authority: AR 335-15, paragraph 5-2a)*

Project/Site: Duncan City/County: Unincorporated/Champaign Sampling Date: 11/15/2023

Applicant/Owner: Rewild Renewables, LLC. State: IL Sampling Point: B

Investigator(s): Alden O'Connor Section, Township, Range: Sec 28, T 20N, R 8E

Landform (hillside, terrace, etc.): Toeslope Local relief (concave, convex, none): Concave

Slope (%): 0-2 Lat: 40.171146 Long: -88.306759 Datum: NAD 83

Soil Map Unit Name: 152A - Drummer silty clay loam, 0 to 2 percent slopes NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)

Are Vegetation X , Soil ___ , or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___ , Soil ___ , or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___	No ___	**Is the Sampled Area within a Wetland?** **Yes** ___ **No** X
Hydric Soil Present?	Yes X	No ___	
Wetland Hydrology Present?	Yes X	No ___	

Remarks:
Climate was wetter than normal in the three months prior, it rained 0.02 inches in the seven days prior, and the field assessment was conducted during the typical Illinois dry season.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30' r)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 15' r)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5' r)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	=Total Cover		
Woody Vine Stratum (Plot size: 30' r)			
1.			
2.			
	=Total Cover		

Dominance Test worksheet:

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

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

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

Prevalence Index worksheet:

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

Prevalence Index = B/A = ___

Hydrophytic Vegetation Indicators:

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

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

Hydrophytic Vegetation Present? **Yes** ___ **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)
Please see reference point B.2 for vegetation sampled in an area with representative soil and hydrologic conditions. Veg was disturbed as this point was taken with the farmfield.

SOIL

Sampling Point: B

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 2/1	100					Loamy/Clayey	
8-16	10YR 2/1	98	10YR 6/8	1	C	M	Loamy/Clayey	Prominent redox concentrations
8-16			7.5YR 4/6	1	C	M		Prominent redox concentrations
16-27	10YR 2/1	96	7.5YR 5/8	3	C	M	Loamy/Clayey	Prominent redox concentrations
16-27			10YR 5/8	1	C	M		Prominent redox concentrations

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

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ 2 cm Muck (A10)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ 5 cm Mucky Peat or Peat (S3)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Loamy Mucky Mineral (F1)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
X Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ Iron-Manganese Masses (F12)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

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

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ True Aquatic Plants (B14)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Gauge or Well Data (D9)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
X Saturation Visible on Aerial Imagery (C9)
X Stunted or Stressed Plants (D1)
X Geomorphic Position (D2)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? **Yes** X **No** ___

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

Remarks:
FAC-Neutral Test not applicable due to absence of vegetation at this point. Pit dug to 27".

U.S. Army Corps of Engineers **WETLAND DETERMINATION DATA SHEET – Midwest Region** See ERDC/EL TR-10-16; the proponent agency is CECW-CO-R	*OMB Control #: 0710-0024, Exp:11/30/2024* *Requirement Control Symbol EXEMPT:* *(Authority: AR 335-15, paragraph 5-2a)*

Project/Site: Duncan City/County: Unincorporated/Champaign Sampling Date: 11/15/2023

Applicant/Owner: Rewild Renewables, LLC. State: IL Sampling Point: B.2

Investigator(s): Alden O'Connor and Colleen Stull Section, Township, Range: Sec 28, T 20N, R 8E

Landform (hillside, terrace, etc.): Toeslope Local relief (concave, convex, none): Concave

Slope (%): 0-2 Lat: 40.171287 Long: -88.30676 Datum: NAD 83

Soil Map Unit Name: 56B - Dana silt loam, 2 to 5 percent slopes NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)

Are Vegetation X , Soil ___ , or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___ , Soil ___ , or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No	
Hydrophytic Vegetation Present?			**Is the Sampled Area within a Wetland?** Yes ___ No X
Hydric Soil Present?		X	
Wetland Hydrology Present?		X	

Remarks:
Climate was wetter than normal in the three months prior, it rained 0.02 inches in the seven days prior, and the field assessment was conducted during the typical Illinois dry season. This is a vegetation reference point for Data Point B.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30' r)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Celtis occidentalis*	25	Yes	FAC
2.			
3.			
4.			
5.			
	25	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15' r)			
1. *Celtis occidentalis*	10	Yes	FAC
2.			
3.			
4.			
5.			
	10	=Total Cover	
Herb Stratum (Plot size: 5' r)			
1. *Dactylis glomerata*	40	Yes	FACU
2. *Taraxacum officinale*	30	Yes	FACU
3. *Oxalis dillenii*	3	No	FACU
4. *Capsella bursa-pastoris*	1	No	FACU
5. *Lamium amplexicaule*	1	No	UPL
6. *Trifolium repens*	1	No	FACU
7.			
8.			
9.			
10.			
	76	=Total Cover	
Woody Vine Stratum (Plot size: 30' r)			
1.			
2.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	2	(A)
Total Number of Dominant Species Across All Strata:	4	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	50.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	0	x 2 = 0
FAC species	35	x 3 = 105
FACU species	75	x 4 = 300
UPL species	1	x 5 = 5
Column Totals:	111 (A)	410 (B)
Prevalence Index = B/A =	3.69	

Hydrophytic Vegetation Indicators:

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

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

Hydrophytic Vegetation Present? Yes ___ No ___

Remarks: (Include photo numbers here or on a separate sheet.)
See report for detail regarding suitability as a veg reference point. Veg marked as disturbed due to point location on border of farmfield and natrualized area.

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Midwest Region
See ERDC/EL TR-10-16; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp:11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Duncan | City/County: Unincorporated/Champaign | Sampling Date: 11/15/2023

Applicant/Owner: Rewild Renewables, LLC. | State: IL | Sampling Point: C

Investigator(s): Colleen Stull | Section, Township, Range: Sec 28, T 20N, R 8E

Landform (hillside, terrace, etc.): Toeslope | Local relief (concave, convex, none): None

Slope (%): 0-2 | Lat: 40.167808 | Long: -88.308472 | Datum: NAD 83

Soil Map Unit Name: 152A - Drummer silty clay loam, 0 to 2 percent slopes | NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)

Are Vegetation X , Soil ___ , or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___ , Soil ___ , or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		
Hydric Soil Present?		X
Wetland Hydrology Present?		X

Is the Sampled Area within a Wetland? **Yes** ___ **No** X

Remarks:
Climate was wetter than normal in the three months prior, it rained 0.02 inches in the seven days prior, and the field assessment was conducted during the typical Illinois dry season.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30' r)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
		=Total Cover	
Sapling/Shrub Stratum (Plot size: 15' r)			
1.			
2.			
3.			
4.			
5.			
		=Total Cover	
Herb Stratum (Plot size: 5' r)			
1. *Lamium amplexicaule*	3	Yes	UPL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	3	=Total Cover	
Woody Vine Stratum (Plot size: 30' r)			
1.			
2.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	0	(A)
Total Number of Dominant Species Across All Strata:	1	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	0.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	3	x 5 =	15
Column Totals:	3 (A)		15 (B)

Prevalence Index = B/A = 5.00

Hydrophytic Vegetation Indicators:

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

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

Hydrophytic Vegetation Present? **Yes** ___ **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)
Veg was significantly disturbed as point was taken within farmfield.

SOIL

Sampling Point: C

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-10	10YR 2/1	99	2.5YR 3/6	1	C	M	Loamy/Clayey	Prominent redox concentrations
10-26	10YR 2/1	58	2.5YR 4/6	2	C	M	Loamy/Clayey	Prominent redox concentrations
10-26	10YR 6/6	40					Loamy/Clayey	

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

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ 2 cm Muck (A10)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ 5 cm Mucky Peat or Peat (S3)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Loamy Mucky Mineral (F1)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ Iron-Manganese Masses (F12)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: ________

Depth (inches): ________

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

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ True Aquatic Plants (B14)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Gauge or Well Data (D9)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
X Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? **Yes** ___ **No** X

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

Remarks:

FAC-Neutral Test failed 0:1 considering dominants species. Pit dug to 26".

U.S. Army Corps of Engineers **WETLAND DETERMINATION DATA SHEET – Midwest Region** See ERDC/EL TR-10-16; the proponent agency is CECW-CO-R	*OMB Control #: 0710-0024, Exp:11/30/2024* *Requirement Control Symbol EXEMPT:* *(Authority: AR 335-15, paragraph 5-2a)*

Project/Site: Duncan City/County: Unincorporated/Champaign Sampling Date: 11/15/2023

Applicant/Owner: Rewild Renewables, LLC. State: IL Sampling Point: D

Investigator(s): Alden O'Connor Section, Township, Range: Sec 28, T 20N, R 8E

Landform (hillside, terrace, etc.): Toeslope Local relief (concave, convex, none): Concave

Slope (%): 0-2 Lat: 40.16834 Long: -88.30755 Datum: NAD 83

Soil Map Unit Name: 152A - Drummer silty clay loam, 0 to 2 percent slopes NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)

Are Vegetation X , Soil ___ , or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___ , Soil ___ , or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___	No ___	**Is the Sampled Area within a Wetland?** **Yes** ___ **No** X
Hydric Soil Present?	Yes X	No ___	
Wetland Hydrology Present?	Yes X	No ___	

Remarks:
Climate was wetter than normal in the three months prior, it rained 0.02 inches in the seven days prior, and the field assessment was conducted during the typical Illinois dry season.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30' r)			
1.			
2.			
3.			
4.			
5.			
		=Total Cover	
Sapling/Shrub Stratum (Plot size: 15' r)			
1.			
2.			
3.			
4.			
5.			
		=Total Cover	
Herb Stratum (Plot size: 5' r)			
1. *Lamium amplexicaule*	3	Yes	UPL
2. *Capsella bursa-pastoris*	1	Yes	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	4	=Total Cover	
Woody Vine Stratum (Plot size: 30' r)			
1.			
2.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	0	(A)
Total Number of Dominant Species Across All Strata:	2	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	0.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	1	x 4 =	4
UPL species	3	x 5 =	15
Column Totals:	4 (A)		19 (B)

Prevalence Index = B/A = 4.75

Hydrophytic Vegetation Indicators:

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

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

Hydrophytic Vegetation Present? **Yes** ___ **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)
Veg was significantly disturbed as point was taken within farmfield.

SOIL

Sampling Point: D

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

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 2/1	98	7.5YR 5/8	2	C	M	Loamy/Clayey	Prominent redox concentrations
12-24	10YR 2/1	96	7.5YR 5/8	3	C	M	Loamy/Clayey	Prominent redox concentrations
			2.5Y 7/6	1	C	M		Prominent redox concentrations
24-30	10YR 2/1	60	7.5YR 5/8	8	C	M	Loamy/Clayey	Prominent redox concentrations
	2.5Y 4/3	30	2.5Y 5/6	2	C	M	Loamy/Clayey	Distinct redox concentrations

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

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ 2 cm Muck (A10)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ 5 cm Mucky Peat or Peat (S3)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Loamy Mucky Mineral (F1)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
X Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ Iron-Manganese Masses (F12)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):
Type: ___
Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ True Aquatic Plants (B14)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Gauge or Well Data (D9)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
X Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
X Geomorphic Position (D2)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___
Water Table Present? Yes ___ No X Depth (inches): ___
Saturation Present? Yes ___ No X Depth (inches): ___
(includes capillary fringe)

Wetland Hydrology Present? Yes X No ___

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

Remarks:
FAC-Neutral Test failed 0:2 considering dominants. Pit dug to 30".

U.S. Army Corps of Engineers **WETLAND DETERMINATION DATA SHEET – Midwest Region** See ERDC/EL TR-10-16; the proponent agency is CECW-CO-R	*OMB Control #: 0710-0024, Exp:11/30/2024* *Requirement Control Symbol EXEMPT:* *(Authority: AR 335-15, paragraph 5-2a)*

Project/Site: Duncan City/County: Unincorporated/Champaign Sampling Date: 11/15/2023

Applicant/Owner: Rewild Renewables, LLC. State: IL Sampling Point: E

Investigator(s): Alden O'Connor and Colleen Stull Section, Township, Range: Sec 28, T 20N, R 8E

Landform (hillside, terrace, etc.): Footslope Local relief (concave, convex, none): Concave

Slope (%): 1-3 Lat: 40.17106 Long: -88.298793 Datum: NAD 83

Soil Map Unit Name: 152A - Drummer silty clay loam, 0 to 2 percent slopes NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)

Are Vegetation X , Soil ___ , or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___ , Soil ___ , or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___	No ___	**Is the Sampled Area within a Wetland?** **Yes** ___ **No** X
Hydric Soil Present?	Yes ___	No X	
Wetland Hydrology Present?	Yes ___	No X	

Remarks:
Climate was wetter than normal in the three months prior, it rained 0.02 inches in the seven days prior, and the field assessment was conducted during the typical Illinois dry season.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30' r)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
		=Total Cover	
Sapling/Shrub Stratum (Plot size: 15' r)			
1.			
2.			
3.			
4.			
5.			
		=Total Cover	
Herb Stratum (Plot size: 5' r)			
1. *Lamium amplexicaule*	15	Yes	UPL
2. *Stellaria media*	6	Yes	FACU
3. *Taraxacum officinale*	5	No	FACU
4. *Capsella bursa-pastoris*	2	No	FACU
5.			
6.			
7.			
8.			
9.			
10.			
	28	=Total Cover	
Woody Vine Stratum (Plot size: 30' r)			
1.			
2.			
		=Total Cover	

Dominance Test worksheet:

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

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	13	x 4 =	52
UPL species	15	x 5 =	75
Column Totals:	28 (A)		127 (B)

Prevalence Index = B/A = 4.54

Hydrophytic Vegetation Indicators:

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

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

Hydrophytic Vegetation Present? **Yes** ___ **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)
Veg was significantly disturbed as point was taken on the border of farmfield and naturalize buffer area.

SOIL

Sampling Point: E

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-7	10YR 3/2	80					Loamy/Clayey	
	10YR 3/1	20					Loamy/Clayey	
7-18	10YR 2/1	100					Loamy/Clayey	
18-27	10YR 2/1	85	10YR 5/8	10	C	M	Loamy/Clayey	Prominent redox concentrations
	10YR 5/4	5					Loamy/Clayey	

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

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ 2 cm Muck (A10)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ 5 cm Mucky Peat or Peat (S3)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Loamy Mucky Mineral (F1)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ Iron-Manganese Masses (F12)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

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

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ True Aquatic Plants (B14)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Gauge or Well Data (D9)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? **Yes** ___ **No** X

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

Remarks:
FAC-Neutral Test failed 0:2 considering dominants. Pit dug to 27".

U.S. Army Corps of Engineers **WETLAND DETERMINATION DATA SHEET – Midwest Region** See ERDC/EL TR-10-16; the proponent agency is CECW-CO-R	*OMB Control #: 0710-0024, Exp:11/30/2024* *Requirement Control Symbol EXEMPT:* *(Authority: AR 335-15, paragraph 5-2a)*

Project/Site: Duncan City/County: Unincorporated/Champaign Sampling Date: 11/15/2023

Applicant/Owner: Rewild Renewables, LLC. State: IL Sampling Point: F

Investigator(s): Alden O'Connor and Colleen Stull Section, Township, Range: Sec 28, T 20N, R 8E

Landform (hillside, terrace, etc.): Toeslope Local relief (concave, convex, none): None

Slope (%): 0-2 Lat: 40.171156 Long: -88.303745 Datum: NAD 83

Soil Map Unit Name: 152A - Drummer silty clay loam, 0 to 2 percent slopes NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)

Are Vegetation X , Soil ___ , or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___ , Soil ___ , or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___	No ___	**Is the Sampled Area within a Wetland?** **Yes** ___ **No** X
Hydric Soil Present?	Yes X	No ___	
Wetland Hydrology Present?	Yes ___	No X	

Remarks:
Climate was wetter than normal in the three months prior, it rained 0.02 inches in the seven days prior, and the field assessment was conducted during the typical Illinois dry season.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30' r)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 15' r)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5' r)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	=Total Cover		
Woody Vine Stratum (Plot size: 30' r)			
1.			
2.			
	=Total Cover		

Dominance Test worksheet:

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

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

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

Prevalence Index worksheet:

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

Prevalence Index = B/A = ___

Hydrophytic Vegetation Indicators:

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

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

Hydrophytic Vegetation Present? **Yes** ___ **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)
Veg was significantly disturbed as point was taken within farmfield.

SOIL

Sampling Point: F

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

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 3/1	96	10YR 6/2	2	D	M	Loamy/Clayey	
			10YR 6/8	2	C	M		Prominent redox concentrations
8-13	10YR 3/1	97	10YR 6/8	3	C	M	Loamy/Clayey	Prominent redox concentrations
13-28	10YR 2/1	98	10YR 6/6	2	C	M	Loamy/Clayey	Prominent redox concentrations

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

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 5 cm Mucky Peat or Peat (S3)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ Iron-Manganese Masses (F12)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

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

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Gauge or Well Data (D9)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- X Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? **Yes** ___ **No** X

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

Remarks:

No veg present to consider for the FAC-Neutral Test. Pit dug to 28".

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Midwest Region
See ERDC/EL TR-10-16; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp:11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Duncan City/County: Unincorporated/Champaign Sampling Date: 11/15/2023
Applicant/Owner: Rewild Renewables, LLC. State: IL Sampling Point: F.2
Investigator(s): Alden O'Connor and Colleen Stull Section, Township, Range: Sec 28, T 20N, R 8E
Landform (hillside, terrace, etc.): Toeslope Local relief (concave, convex, none): None
Slope (%): 0-2 Lat: 40.171274 Long: -88.303739 Datum: NAD 83
Soil Map Unit Name: 152A - Drummer silty clay loam, 0 to 2 percent slopes NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)
Are Vegetation X , Soil ___ , or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation ___ , Soil ___ , or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		
Hydric Soil Present?		X
Wetland Hydrology Present?		X

Is the Sampled Area within a Wetland? Yes ___ No X

Remarks:
Climate was wetter than normal in the three months prior, it rained 0.02 inches in the seven days prior, and the field assessment was conducted during the typical Illinois dry season. This is a vegetation reference point for Data Point F.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30' r)			
1.			
2.			
3.			
4.			
5.			
		=Total Cover	
Sapling/Shrub Stratum (Plot size: 15' r)			
1. *Morus alba*	5	Yes	FAC
2.			
3.			
4.			
5.			
	5	=Total Cover	
Herb Stratum (Plot size: 5' r)			
1. *Bromus inermis*	45	Yes	FACU
2. *Taraxacum officinale*	6	No	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	51	=Total Cover	
Woody Vine Stratum (Plot size: 30' r)			
1.			
2.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)
Total Number of Dominant Species Across All Strata: 2 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	5	x 3 =	15
FACU species	51	x 4 =	204
UPL species	0	x 5 =	0
Column Totals:	56 (A)		219 (B)

Prevalence Index = B/A = 3.91

Hydrophytic Vegetation Indicators:

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

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

Hydrophytic Vegetation Present? Yes ___ No ___

Remarks: (Include photo numbers here or on a separate sheet.)
See report for detail about suitability as a veg reference point. Veg was significantly disturbed as point was taken on border of farmfield and naturalized buffer.

U.S. Army Corps of Engineers **WETLAND DETERMINATION DATA SHEET – Midwest Region** See ERDC/EL TR-10-16; the proponent agency is CECW-CO-R	*OMB Control #: 0710-0024, Exp:11/30/2024* *Requirement Control Symbol EXEMPT:* *(Authority: AR 335-15, paragraph 5-2a)*

Project/Site: Duncan City/County: Unincorporated/Champaign Sampling Date: 11/15/2023

Applicant/Owner: Rewild Renewables, LLC. State: IL Sampling Point: G

Investigator(s): Alden O'Connor and Colleen Stull Section, Township, Range: Sec 28, T 20N, R 8E

Landform (hillside, terrace, etc.): Footslope Local relief (concave, convex, none): Linear

Slope (%): 1-3 Lat: 40.171277 Long: -88.31015 Datum: NAD 83

Soil Map Unit Name: 56B - Dana silt loam, 2 to 5 percent slopes NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)

Are Vegetation X , Soil ___ , or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___ , Soil ___ , or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No	**Is the Sampled Area**	
Hydric Soil Present?	Yes X	No	**within a Wetland?**	**Yes** ___ **No** X
Wetland Hydrology Present?	Yes	No X		

Remarks:
Climate was wetter than normal in the three months prior, it rained 0.02 inches in the seven days prior, and the field assessment was conducted during the typical Illinois dry season.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30' r)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Prunus serotina*	5	Yes	FACU
2.			
3.			
4.			
5.			
	5	=Total Cover	
Sapling/Shrub Stratum (Plot size: 15' r)			
1.			
2.			
3.			
4.			
5.			
		=Total Cover	
Herb Stratum (Plot size: 5' r)			
1. *Setaria faberi*	80	Yes	FACU
2. *Xanthium strumarium*	2	No	FAC
3. *Abutilon theophrasti*	1	No	FACU
4. *Cirsium arvense*	1	No	FACU
5.			
6.			
7.			
8.			
9.			
10.			
	84	=Total Cover	
Woody Vine Stratum (Plot size: 30' r)			
1.			
2.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	0	(A)
Total Number of Dominant Species Across All Strata:	2	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	0.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	2	x 3 =	6
FACU species	87	x 4 =	348
UPL species	0	x 5 =	0
Column Totals:	89 (A)		354 (B)

Prevalence Index = B/A = 3.98

Hydrophytic Vegetation Indicators:

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

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

Hydrophytic Vegetation Present? **Yes** ___ **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)
Veg was significantly disturbed as point was taken within farmfield. Part of the tree stratum includes naturalized cropfield buffer of the same hydrology and soils.

SOIL

Sampling Point: G

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

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-10	10YR 3/2	93	10YR 6/6	2	C	M	Loamy/Clayey	Prominent redox concentrations
			7.5YR 4/6	5	C	M		Prominent redox concentrations
10-19	10YR 3/1	99	7.5YR 5/8	1	C	M	Loamy/Clayey	Prominent redox concentrations
19-28	7.5YR 2.5/1	97	10YR 4/2	3	D	M	Loamy/Clayey	

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

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ 2 cm Muck (A10)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ 5 cm Mucky Peat or Peat (S3)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Loamy Mucky Mineral (F1)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
X Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ Iron-Manganese Masses (F12)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):
Type: ___
Depth (inches): ___

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

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ True Aquatic Plants (B14)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Gauge or Well Data (D9)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
X Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? **Yes** ___ **No** X

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

Remarks:
FAC-Neutral Test failed 0:3 considering dominants. Pit dug to 28".

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Midwest Region
See ERDC/EL TR-10-16; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp:11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Duncan City/County: Unincorporated/Champaign Sampling Date: 11/15/2023
Applicant/Owner: Rewild Renewables, LLC. State: IL Sampling Point: H
Investigator(s): Alden O'Connor Section, Township, Range: Sec 28, T 20N, R 8E
Landform (hillside, terrace, etc.): Swale Local relief (concave, convex, none): Linear
Slope (%): 2-4 Lat: 40.171277 Long: -88.297703 Datum: NAD 83
Soil Map Unit Name: 152A - Drummer silty clay loam, 0 to 2 percent slopes NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)
Are Vegetation X , Soil ___ , or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation ___ , Soil ___ , or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		
Hydric Soil Present?	X	
Wetland Hydrology Present?	X	

Is the Sampled Area within a Wetland? Yes ___ No X

Remarks:
Climate was wetter than normal in the three months prior, it rained 0.02 inches in the seven days prior, and the field assessment was conducted during the typical Illinois dry season.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30' r)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
=Total Cover			
Sapling/Shrub Stratum (Plot size: 15' r)			
1.			
2.			
3.			
4.			
5.			
=Total Cover			
Herb Stratum (Plot size: 5' r)			
1. *Lamium amplexicaule*	3	Yes	UPL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
=Total Cover	3		
Woody Vine Stratum (Plot size: 30' r)			
1.			
2.			
=Total Cover			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)
Total Number of Dominant Species Across All Strata: 1 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	3	x 5 =	15
Column Totals:	3 (A)		15 (B)

Prevalence Index = B/A = 5.00

Hydrophytic Vegetation Indicators:

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

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

Hydrophytic Vegetation Present? Yes ___ No ___

Remarks: (Include photo numbers here or on a separate sheet.)
Veg was significantly disturbed as point was taken within farmfield.

SOIL

Sampling Point: H

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-10	10YR 2/2	86	10YR 6/8	4	C	M	Loamy/Clayey	Prominent redox concentrations
	10YR 3/3	8	7.5YR 4/6	2	C	M	Loamy/Clayey	Prominent redox concentrations
10-18	10YR 2/1	76	2.5Y 6/6	10	C	M	Loamy/Clayey	Prominent redox concentrations
	10YR 3/3	10	7.5YR 5/8	4	C	M	Loamy/Clayey	Prominent redox concentrations
18-27	10YR 2/1	65	7.5YR 5/8	12	C	M	Loamy/Clayey	Prominent redox concentrations
	2.5Y 4/3	15	10YR 6/8	8	C	M	Loamy/Clayey	Prominent redox concentrations

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

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ 2 cm Muck (A10)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ 5 cm Mucky Peat or Peat (S3)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Loamy Mucky Mineral (F1)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
_X_ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ Iron-Manganese Masses (F12)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):
Type: ______
Depth (inches): ______

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

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ True Aquatic Plants (B14)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Gauge or Well Data (D9)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
_X_ Saturation Visible on Aerial Imagery (C9)
_X_ Stunted or Stressed Plants (D1)
___ Geomorphic Position (D2)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No _X_ Depth (inches): ___
Water Table Present? Yes ___ No _X_ Depth (inches): ___
Saturation Present? Yes ___ No _X_ Depth (inches): ___
(includes capillary fringe)

Wetland Hydrology Present? **Yes** _X_ **No** ___

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

Remarks:
FAC-Neutral Test failed 0:1 considering dominants. Pit dug to 27".

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Midwest Region
See ERDC/EL TR-10-16; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp:11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Duncan   City/County: Unincorporated/Champaign   Sampling Date: 11/15/2023
Applicant/Owner: Rewild Renewables, LLC.   State: IL   Sampling Point: I
Investigator(s): Alden O'Conno   Section, Township, Range: Sec 28, T 20N, R 8E
Landform (hillside, terrace, etc.): Toeslope   Local relief (concave, convex, none): Concave
Slope (%): 0-2   Lat: 40.168744   Long: -88.296162   Datum: NAD 83
Soil Map Unit Name: 152A - Drummer silty clay loam, 0 to 2 percent slopes   NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)
Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		X
Hydric Soil Present?	X	
Wetland Hydrology Present?	X	

Is the Sampled Area within a Wetland? **Yes** ___ **No** X

Remarks:
Climate was wetter than normal in the three months prior, it rained 0.02 inches in the seven days prior, and the field assessment was conducted during the typical Illinois dry season.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30' r)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
		=Total Cover	
Sapling/Shrub Stratum (Plot size: 15' r)			
1.			
2.			
3.			
4.			
5.			
		=Total Cover	
Herb Stratum (Plot size: 5' r)			
1. *Lamium amplexicaule*	10	Yes	UPL
2. *Schedonorus arundinaceus*	4	Yes	FACU
3. *Rumex crispus*	3	No	FAC
4. *Capsella bursa-pastoris*	1	No	FACU
5.			
6.			
7.			
8.			
9.			
10.			
	18	=Total Cover	
Woody Vine Stratum (Plot size: 30' r)			
1.			
2.			
		=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	0	(A)
Total Number of Dominant Species Across All Strata:	2	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	0.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	3	x 3 =	9
FACU species	5	x 4 =	20
UPL species	10	x 5 =	50
Column Totals:	18 (A)		79 (B)

Prevalence Index = B/A = 4.39

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

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

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: I

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

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 2/1	94	10YR 6/8	4	C	M	Loamy/Clayey	Prominent redox concentrations
			7.5YR 4/6	2	C	M		Prominent redox concentrations
12-19	10YR 2/1	90	7.5YR 5/8	7	C	M	Loamy/Clayey	Prominent redox concentrations
			2.5YR 5/6	3	C	M		Prominent redox concentrations
19-27	2.5Y 5/2	60	10YR 5/6	14	C	M	Loamy/Clayey	Prominent redox concentrations
	10YR 2/1	23	7.5YR 5/8	3	C	M	Loamy/Clayey	Prominent redox concentrations

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

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ 2 cm Muck (A10)
___ Depleted Below Dark Surface (A11)
_X_ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ 5 cm Mucky Peat or Peat (S3)
___ Sandy Gleyed Matrix (S4)
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___ Loamy Mucky Mineral (F1)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
_X_ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ Coast Prairie Redox (A16)
___ Iron-Manganese Masses (F12)
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

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

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

_X_ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ True Aquatic Plants (B14)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Gauge or Well Data (D9)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Stunted or Stressed Plants (D1)
_X_ Geomorphic Position (D2)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _X_ No ___ Depth (inches): 0
Water Table Present? Yes ___ No _X_ Depth (inches): ___
Saturation Present? Yes ___ No _X_ Depth (inches): ___
(includes capillary fringe)

Wetland Hydrology Present? **Yes** _X_ **No** ___

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

Remarks:
FAC-Neutral Test failed 0:2 considering dominants. Surface water locared ~1' from pit. Pit dug to 27".

APPENDIX C

SITE PHOTOS

DATA POINT A




DATA POINT B




DATA POINT B.2

DATA POINT C

DATA POINT D





DATA POINT E

DATA POINT F






DATA POINT F.2

DATA POINT G




DATA POINT H

DATA POINT I

PHOTO POINT 1

PHOTO POINT 2

PHOTO POINT 3

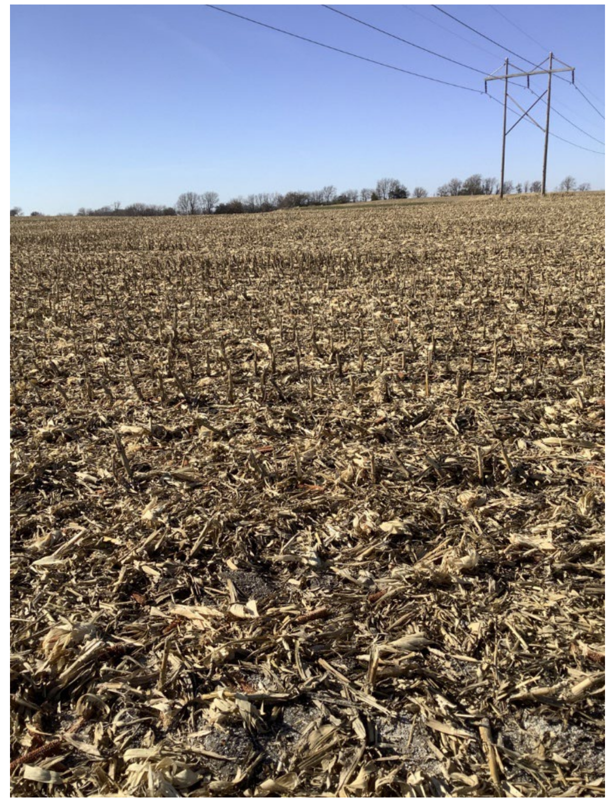


PHOTO POINT 4



PHOTO POINT 5

PHOTO POINT 6

PHOTO POINT 7

PHOTO POINT 8

PHOTO POINT 9

PHOTO POINT 10

PHOTO POINT 11

PHOTO POINT 12





PHOTO POINT 13

PHOTO POINT 14

PHOTO POINT 15

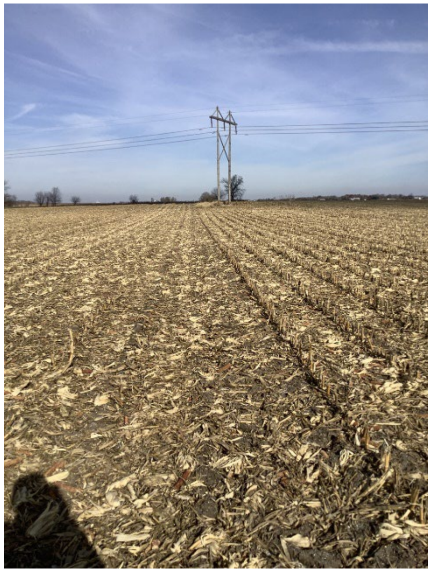



PHOTO POINT 16





PHOTO POINT 17

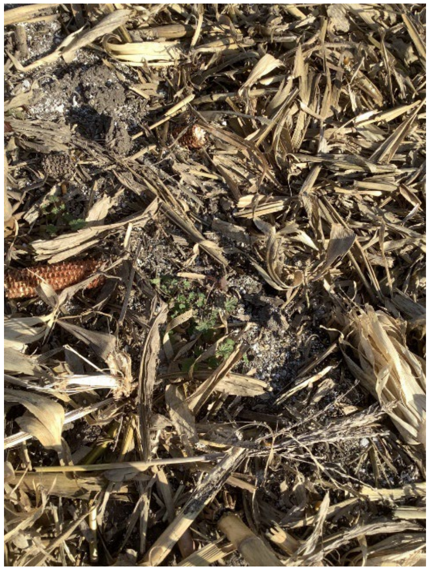




PHOTO POINT 18

PHOTO POINT 19





PHOTO POINT 20

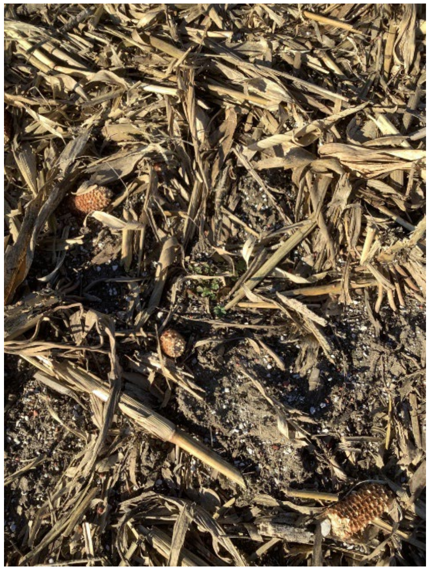
   

PHOTO POINT 21





EXHIBIT I: IDNR CLEARANCE LETTER

EcoCAT
Ecological Compliance Assessment Tool

Applicant:	Zachary Farkes	*IDNR Project Number:*	2509742
Contact:	Keller Lee-Otley	*Date:*	02/19/2025
Address:	111 W Jackson Blvd STE 1320 Chicago, IL 60604		

Project: N Duncan Road Solar LLC
Address: West of County Rd 900E, champaign

Description: Construction of solar farm with associated access roads and utilities.

Natural Resource Review Results

Consultation for Endangered Species Protection and Natural Areas Preservation (Part 1075)

The Illinois Natural Heritage Database contains no record of State-listed threatened or endangered species, Illinois Natural Area Inventory sites, dedicated Illinois Nature Preserves, or registered Land and Water Reserves in the vicinity of the project location.

Consultation is terminated. This consultation is valid for two years unless new information becomes available that was not previously considered; the proposed action is modified; or additional species, essential habitat, or Natural Areas are identified in the vicinity. If the project has not been implemented within two years of the date of this letter, or any of the above listed conditions develop, a new consultation is necessary. Termination does not imply IDNR's authorization or endorsement.

Location

The applicant is responsible for the accuracy of the location submitted for the project.

County: Champaign

Township, Range, Section:
20N, 8E, 21
20N, 8E, 28

IL Department of Natural Resources Contact
Adam Rawe
217-785-5500
Division of Ecosystems & Environment

Government Jurisdiction
IL Environmental Protection Agency
Terri LeMasters
1020 North Grand Avenue East
Springfield, Illinois 62794 -9276

Disclaimer

The Illinois Natural Heritage Database cannot provide a conclusive statement on the presence, absence, or condition of natural resources in Illinois. This review reflects the information existing in the Database at the time of this inquiry, and should not be regarded as a final statement on the site being considered, nor should it be a substitute for detailed site surveys or field surveys required for environmental assessments. If additional protected resources are encountered during the project’s implementation, compliance with applicable statutes and regulations is required.

Terms of Use

By using this website, you acknowledge that you have read and agree to these terms. These terms may be revised by IDNR as necessary. If you continue to use the EcoCAT application after we post changes to these terms, it will mean that you accept such changes. If at any time you do not accept the Terms of Use, you may not continue to use the website.

1. The IDNR EcoCAT website was developed so that units of local government, state agencies and the public could request information or begin natural resource consultations on-line for the Illinois Endangered Species Protection Act, Illinois Natural Areas Preservation Act, and Illinois Interagency Wetland Policy Act. EcoCAT uses databases, Geographic Information System mapping, and a set of programmed decision rules to determine if proposed actions are in the vicinity of protected natural resources. By indicating your agreement to the Terms of Use for this application, you warrant that you will not use this web site for any other purpose.

2. Unauthorized attempts to upload, download, or change information on this website are strictly prohibited and may be punishable under the Computer Fraud and Abuse Act of 1986 and/or the National Information Infrastructure Protection Act.

3. IDNR reserves the right to enhance, modify, alter, or suspend the website at any time without notice, or to terminate or restrict access.

Security

EcoCAT operates on a state of Illinois computer system. We may use software to monitor traffic and to identify unauthorized attempts to upload, download, or change information, to cause harm or otherwise to damage this site. Unauthorized attempts to upload, download, or change information on this server is strictly prohibited by law.

Unauthorized use, tampering with or modification of this system, including supporting hardware or software, may subject the violator to criminal and civil penalties. In the event of unauthorized intrusion, all relevant information regarding possible violation of law may be provided to law enforcement officials.

Privacy

EcoCAT generates a public record subject to disclosure under the Freedom of Information Act. Otherwise, IDNR uses the information submitted to EcoCAT solely for internal tracking purposes.

EXHIBIT J: SHPO SURVEY REQUEST

Illinois Department of Natural Resources

JB Pritzker, Governor • Natalie Phelps Finnie, Director
One Natural Resources Way • Springfield, Illinois 62702-1271
www.dnr.illinois.gov

Champaign County
Champaign
SW of N Duncan Rd & W Ford Harris Rd
Section:28-Township:20N-Range:8E
IEPA, KHA-268779005
New Construction, N Duncan Road Solar LLC

PLEASE REFER TO: SHPO LOG #011030725

SURVEY REQUEST

April 30, 2025

Keller Leet-Otley
Kimley-Horn and Associates, Inc.
570 Lake Cook Road, Suite 200
Deerfield, IL 60015

The Illinois State Historic Preservation Office is required by the Illinois State Agency Historic Resources Preservation Act (20 ILCS 3420, as amended, 17 IAC 4180) (Act) to review all state funded, permitted, or licensed undertakings for their effect on cultural resources. We have received information indicating that the referenced project will, pursuant to that law, require comments from our office and our comments follow. Should you have any contrary information, please contact our office at the number below.

According to the information provided there is no federal involvement in your project. Be aware that the state law is less restrictive than the federal cultural resource laws concerning archaeology. Therefore, if your project will use federal loans or grants, need federal agency permits, or is on federal property then your project must be reviewed by us pursuant to the National Historic Preservation Act of 1966, as amended. Please notify us immediately if such is the case, as additional archaeological survey coverage beyond what is described below may be necessary.

The project area has a high probability of containing significant archaeological resources. **A structure is annotated within the project area on a plat map published in 1893**. Accordingly, a Phase I archaeological **survey** to locate, identify, and record this archaeological resource, at a legal minimum pursuant to Section 6 of the Act, a will be **required**. Survey beyond this known site location is *not required*, but we are always open to reviewing the results of any additional due diligence survey coverage that may help prevent unanticipated discoveries during construction and potential construction delays. This decision is based upon our understanding that there has not been any large-scale disturbance of the ground surface (excluding agricultural activities) or major construction activity within the project area which would have destroyed existing cultural resources prior to your project. If the area has been disturbed, please contact our office with the appropriate written and/or photographic evidence. If you have questions, please contact Jeff Kruchten, Principal Archaeologist, at 217/785-1279 or jeff.kruchten@illinois.gov.

We have found that no historic architectural properties will be affected within the one-quarter (0.25) mile visual area of potential effects. If you have questions about this, please contact Steve Dasovich, Cultural Resources Manager, at 217/782-7441 or steve.dasovich@illinois.gov.

Sincerely,

Carey L. Mayer

Carey L. Mayer, AIA
Deputy State Historic Preservation Officer

EXHIBIT K: PRELIMINARY STORMWATER REPORT

STORMWATER REPORT

Rewild Renewables

N Duncan Road Solar, LLC

Intersection of N Duncan Road and W Ford Harris Road
Hensley Township (Champaign County), IL

Prepared by:
Kimley-Horn and Associates, Inc.
111 W Jackson Blvd, Suite 1320
Chicago, IL 60604
Contact: Dan Marshall, P.E.
Phone: (312) 445-8636

Prepared on: August 29th, 2025

Kimley»Horn

Kimley»Horn

TABLE OF CONTENTS

EXHIBITS

1. PROJECT DESCRIPTION

The development is a proposed 5-MW photovoltaic (PV) solar farm located in Champaign County, IL. The proposed development will include solar panels, a gravel access drive, and associated electrical equipment foundations. The project will be surrounded by a perimeter fence.

This report evaluates the pre and post development runoff characteristics of the development and addresses the stormwater requirements of Champaign County. The analysis compares peak runoff rates in pre and post development conditions during large storm events. The analysis was completed with the assistance of HydroCAD Version 10.20-5c.

1.1. PRE-DEVELOPMENT CONDITIONS

The Project area occupies approximately 46 acres of the approximate 113 acre parcel. The Project area consists of agricultural land and an existing transmission line. The drainage areas can be broken down as follows:

- EX-01, EX-03, and EX-04 flow north toward agricultural land.
- EX-02 flows south toward U.S. Interstate 74.
- EX-05 flows southeast towards a tree line bordering the project parcel.
- EX-06 flows east toward agricultural land and eventually to N Duncan Road.

Refer to **Exhibit 5** for the Pre-Development Drainage Area Map.

Per the Wetland Delineation Report, dated December 18, 2023, one potential wetland was identified within the Project area. Refer to **Exhibit 1** for the Wetland Delineation Report. A No Permit Required (NPR) has been obtained from the United States Army Corps of Engineers (USACE), which determined that USACE features are not present onsite. Refer to **Exhibit 9** for the USACE NPR Letter dated 04/22/2025.

Per FEMA Map Panel 17019C0291D effective 10/02/2013, the developed area is within Zone X – Area of Minimal Flood Hazard. Refer to **Exhibit 2** for FEMA Firm Map.

The Natural Resources Conservation Service (NRCS) soil report concludes onsite soils as dana silt loam, drummer silty clay loam, flanagan silt loam, and wyanet silt loam. For calculations detailed in this report, the soil types in both pre- and post- development conditions are assumed to be Type C, as a majority of the site soils are Type C. Refer to **Exhibit 4** for NRCS Soils Report.

1.2. POST-DEVELOPMENT CONDITIONS

The proposed project is a PV solar farm. The PV solar farm will consist of rows of photovoltaic solar modules, a gravel access driveway, associated electrical equipment foundations, and underground utilities. Solar modules will be mounted on piles and elevated above the ground as to preserve the existing underlying soil and allow for revegetation and infiltration. The project will be surrounded by a perimeter fence. Ground area within the fence perimeter that is not occupied by gravel roads or foundations will be seeded, including the area under the panels. The existing drainage patterns and drainage tributary areas will be maintained in the proposed condition. Refer to **Exhibit 6** for the Post-Development Drainage Area Map and Section 2 – Stormwater Summary of this report for additional information on the stormwater management design.

2. STORMWATER SUMMARY

2.1. ALLOWABLE DISCHARGE SUMMARY

The peak discharge rates for the 2-year, 10-year, and 100-year storms were calculated using HydroCAD Version 10.20-5c. Calculations have been provided in **Exhibits 7 and 8,** detailing the findings of the HydroCAD model for both pre- and post- development conditions. A summary showing peak discharge rates to 6 points of analysis (POA) in a 2-year, 10-year, and 100-year storm event is shown below in Table 1.

Table 1: Summary Pre vs. Post Development Runoff Rates

Storm Event	*Outfall Area*	*Area (AC)*	*Pre (cfs)*	*Post (cfs)*
2-Year	POA-01	1.57	0.33	0.23
	POA-02	7.46	1.55	1.13
	POA-03	21.08	4.38	3.44
	POA-04	6.75	1.40	1.06
	POA-05	1.99	0.41	0.31
	POA-06	6.89	1.43	1.12
10-Year	POA-01	1.57	0.56	0.44
	POA-02	7.46	2.68	2.17
	POA-03	21.08	7.55	6.44
	POA-04	6.75	2.42	2.01
	POA-05	1.99	0.71	0.59
	POA-06	6.89	2.47	2.11
100-Year	POA-01	1.57	0.97	0.84
	POA-02	7.46	4.60	4.08
	POA-03	21.08	12.97	11.85
	POA-04	6.75	4.16	3.75
	POA-05	1.99	1.23	1.11
	POA-06	6.89	4.24	3.88

2.2. SCHEDULE FOR SITE STORMWATER MANAGEMENT PLAN IMPLEMENTATION

The following sequence of construction, or approved similar sequence, will be utilized for stormwater management implementation:

- Install stabilized construction entrance
- Prepare temporary parking and storage areas, upon implementation and installation for the following areas: trailers, parking, laydown, porta-potty, wheel wash, concrete, washout, fuel and material storage containers, solid waste containers, etc. Denote the locations on the site maps immediately and note any changes in the locations as they occur throughout the construction process
- Install access road and immediately stabilize

- Install silt fence, silt fence rock outlets, filter sock or approved equivalent erosion control BMP's outside of array area
- Clear/grub the site as necessary. Temporary seed disturbed areas, throughout construction, that will be inactive for seven (7) days or more or as required by the general permit
- Stabilization of all exposed soil areas must be initiated immediately to limit soil erosion but in no case completed later than seven (7) days after the construction activity in that portion of the site has temporarily or permanently ceased
- Begin grading, pile drive, racking installations, solar module placement, fencing, utility pole and overhead wires, and utility trenching
- Provide permanent seeding/stabilization per the landscape plan. Install filter sock within array area once grading and seeding is complete
- All stockpiles are to be removed as part of the permanent stabilization of the site. No topsoil should leave the site during construction
- Remove all temporary erosion and sediment control devices (only after site is fully stabilized and approved by the county and state)

Note: the sequence on construction shown above is a general overview and is intended to convey the general concepts of the erosion control design and should not be relied upon for construction purposed. The contractor is solely responsible for detailed phasing and construction sequencing necessary to construct the proposed improvements included in these plans. The contractor shall notify the engineer in writing immediately, prior to and/or during construction if any additional information on the construction sequence is necessary. Contractor is solely responsible for complying with the requirements of the authority having jurisdiction and all other applicable laws.

3. CONCLUSION

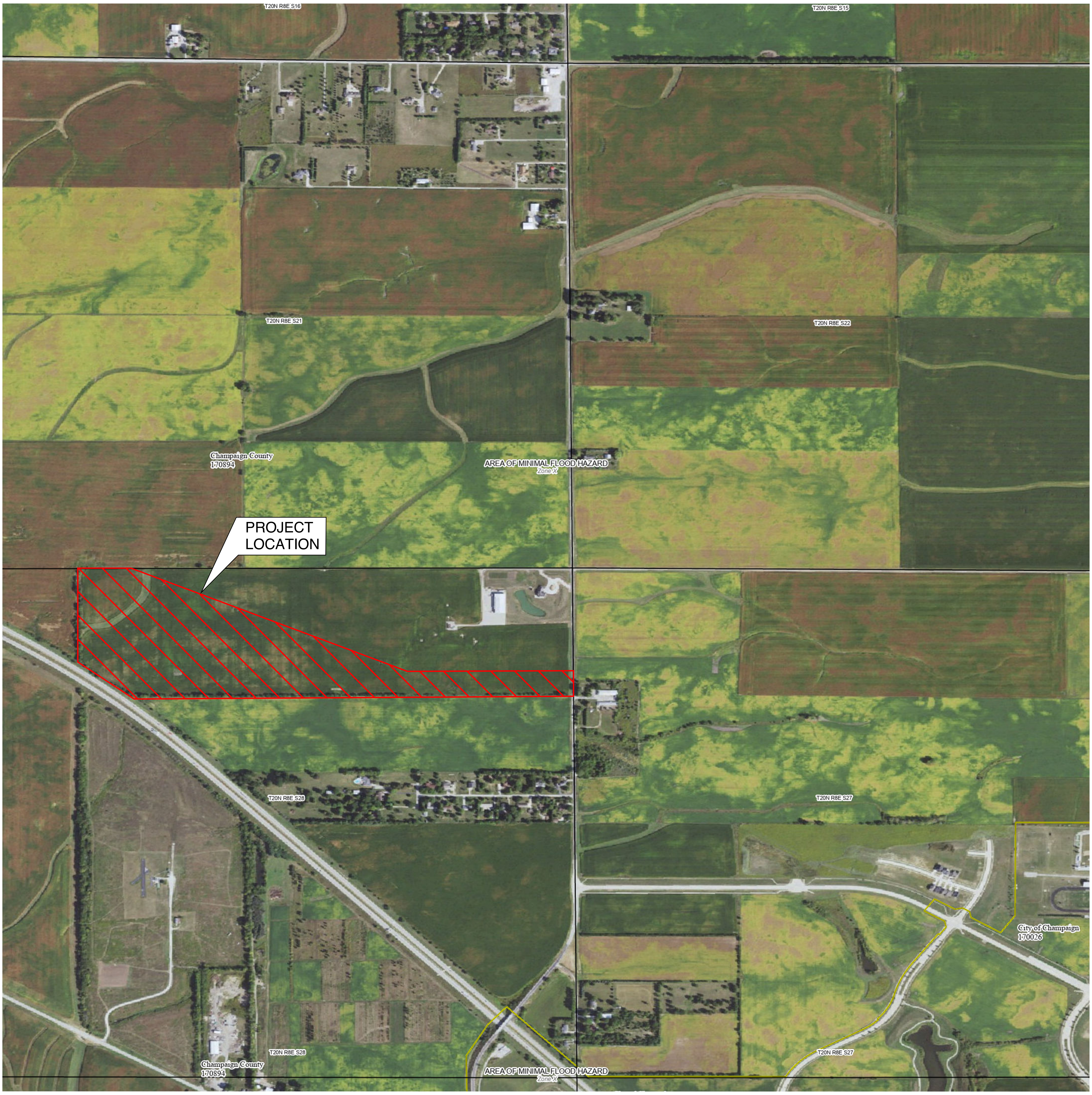
A study published in the Journal of Hydrologic Engineering researched the hydrologic impacts of utility scale solar farms. The study utilized a model to simulate runoff from pre and post solar panel conditions. The study concluded that the solar panels themselves have little to no impact on runoff volumes or rates. Rainfall losses, most notably infiltration, are not impacted by the solar panels. Rainfall that falls directly on a solar panel runs to the pervious areas around and under the surrounding panels. Based on the proposed improvements on the project site, the findings of the above referenced study, and the calculations included within this report, increases in runoff volume or rate are not anticipated.

Exhibit 1 –Wetland Delineation Report

[see exhibit H above]

Exhibit 2 – FEMA Firm Map

88°18'45.45"W 40°11'21.67"N



88°16'52.09"W 40°9'15.99"N

FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP
FOR DRAFT FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) *Zone A, V, A99* With BFE or Depth *Zone AE, AO, AH, VE, AR* Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X* Future Conditions 1% Annual Chance Flood Hazard *Zone X* Area with Reduced Flood Risk due to Levee See Notes *Zone X* Area with Flood Risk due to Levee *Zone D*
OTHER AREAS	NO SCREEN Area of Minimal Flood Hazard *Zone X* Effective LOMRs Area of Undetermined Flood Hazard *Zone D*
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer Levee, Dike, or Floodwall
OTHER FEATURES	20.2 Cross Sections with 1% Annual Chance 17.5 Water Surface Elevation 8 Coastal Transect Coastal Transect Baseline Profile Baseline Hydrographic Feature 513 Base Flood Elevation Line (BFE) Limit of Study Jurisdiction Boundary

LINK> </CLR>for official maps and additional

NOTES TO USERS

For information and questions about this Flood Insurance Rate Map (FIRM), available products associated with this FIRM, including historic versions, the current map date for each FIRM panel, how to order products, or the National Flood Insurance Program (NFIP) in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Flood Map Service Center website at https://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Flood Map Service Center at the number listed above.

For community and countywide map dates, refer to the Flood Insurance Study Report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Basemap information shown on this FIRM was provided in digital format by USDA, Farm Service Agency (FSA). This information was derived from NAIP, dated April 11, 2018.

This map was exported from FEMA's National Flood Hazard Layer (NFHL) on **8/20/2025 1:17 PM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time. For additional information, please see the Flood Hazard Mapping Updates Overview Fact Sheet at https://www.fema.gov/media-library/assets/documents/118418

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards. This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date.

SCALE

Map Projection:
GCS, Geodetic Reference System 1980;
Vertical Datum: No elevation features on this FIRM
For information about the specific vertical datum for elevation features, datum conversions, or vertical monuments used to create this map, please see the Flood Insurance Study (FIS) Report for your community at https://msc.fema.gov

1 inch = 500 feet 1:6,000

N

0 250 500 1,000 1,500 2,000 Feet

Meters 0 50 100 200 300 400

FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

PANEL **291** OF **625**

Panel Contains:

COMMUNITY	NUMBER	PANEL
CHAMPAIGN COUNTY	170894	0291
CITY OF CHAMPAIGN	170026	0291

MAP NUMBER
17019C0291D
EFFECTIVE DATE
October 02, 2013

Exhibit 3 – USGS Map

USGS
science for a changing world

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map
US Topo

RISING QUADRANGLE
ILLINOIS - CHAMPAIGN COUNTY
7.5-MINUTE SERIES

Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and
1 000-meter grid:Universal Transverse Mercator, Zone 16T

This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery....................NAIP, September 2019 - September 2019
Roads.................... U.S. Census Bureau, 2017
Names....................GNIS, 1980 - 2023
Hydrography....................National Hydrography Dataset, 2004 - 2022
Contours....................National Elevation Dataset, 2022
Boundaries..........Multiple sources; see metadata file 2021 - 2022
Public Land Survey System....................BLM, 2020
Wetlands..........FWS National Wetlands Inventory Not Available

MN
GN
3°23´
60 MILS
0°51´
15 MILS

UTM GRID AND 2023 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

U.S. National Grid
100,000 - m Square ID
CK
Grid Zone Designation 16T

SCALE 1:24 000

KILOMETERS: 1 0.5 0 1 2
METERS: 1000 500 0 1000 2000
MILES: 1 0.5 0 1
FEET: 1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000

CONTOUR INTERVAL 5 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Program US Topo Product Standard.

ILLINOIS
QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

ADJOINING QUADRANGLES

1 Foosland
2 Fisher
3 Rantoul
4 Mahomet
5 Thomasboro
6 Seymour
7 Bondville
8 Urbana

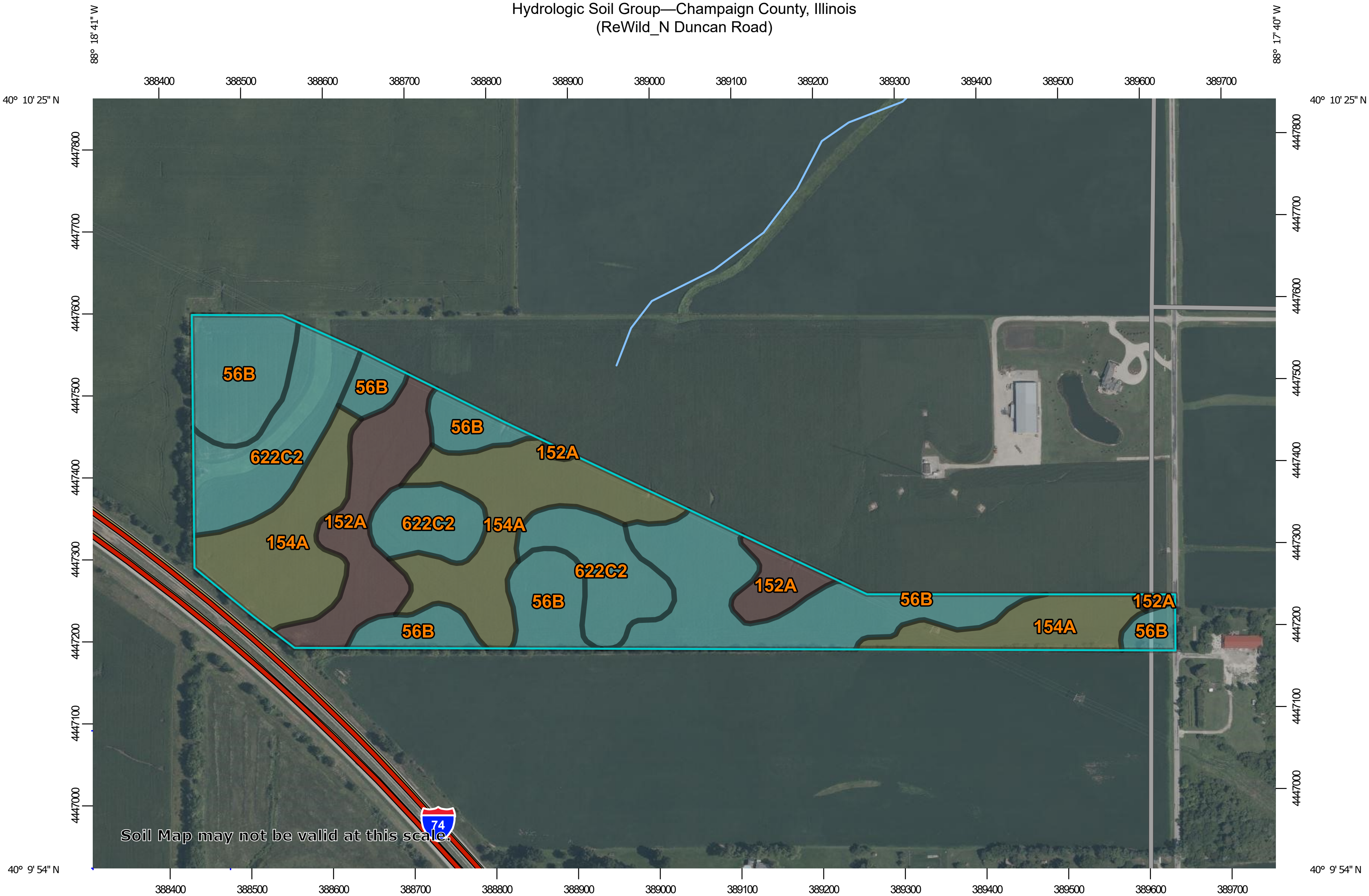
ROAD CLASSIFICATION
Expressway
Secondary Hwy
Ramp
Local Connector
Local Road
4WD
Interstate Route
US Route
State Route

RISING, IL
2024

NSN. 7643016365719
NGA REF NO. USGSX24K38005

Exhibit 4 – NRCS Report

Hydrologic Soil Group—Champaign County, Illinois
(ReWild_N Duncan Road)



Map Scale: 1:6,620 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 300 600 1200 1800

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

MAP LEGEND

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

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

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

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

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

Soil Survey Area: Champaign County, Illinois
Survey Area Data: Version 19, Aug 21, 2024

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

Date(s) aerial images were photographed: Jul 7, 2023—Aug 31, 2023

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
56B	Dana silt loam, 2 to 5 percent slopes	C	20.1	34.7%
152A	Drummer silty clay loam, 0 to 2 percent slopes	B/D	7.7	13.2%
154A	Flanagan silt loam, 0 to 2 percent slopes	C/D	17.8	30.8%
622C2	Wyanet silt loam, 5 to 10 percent slopes, eroded	C	12.3	21.3%
Totals for Area of Interest			**57.9**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

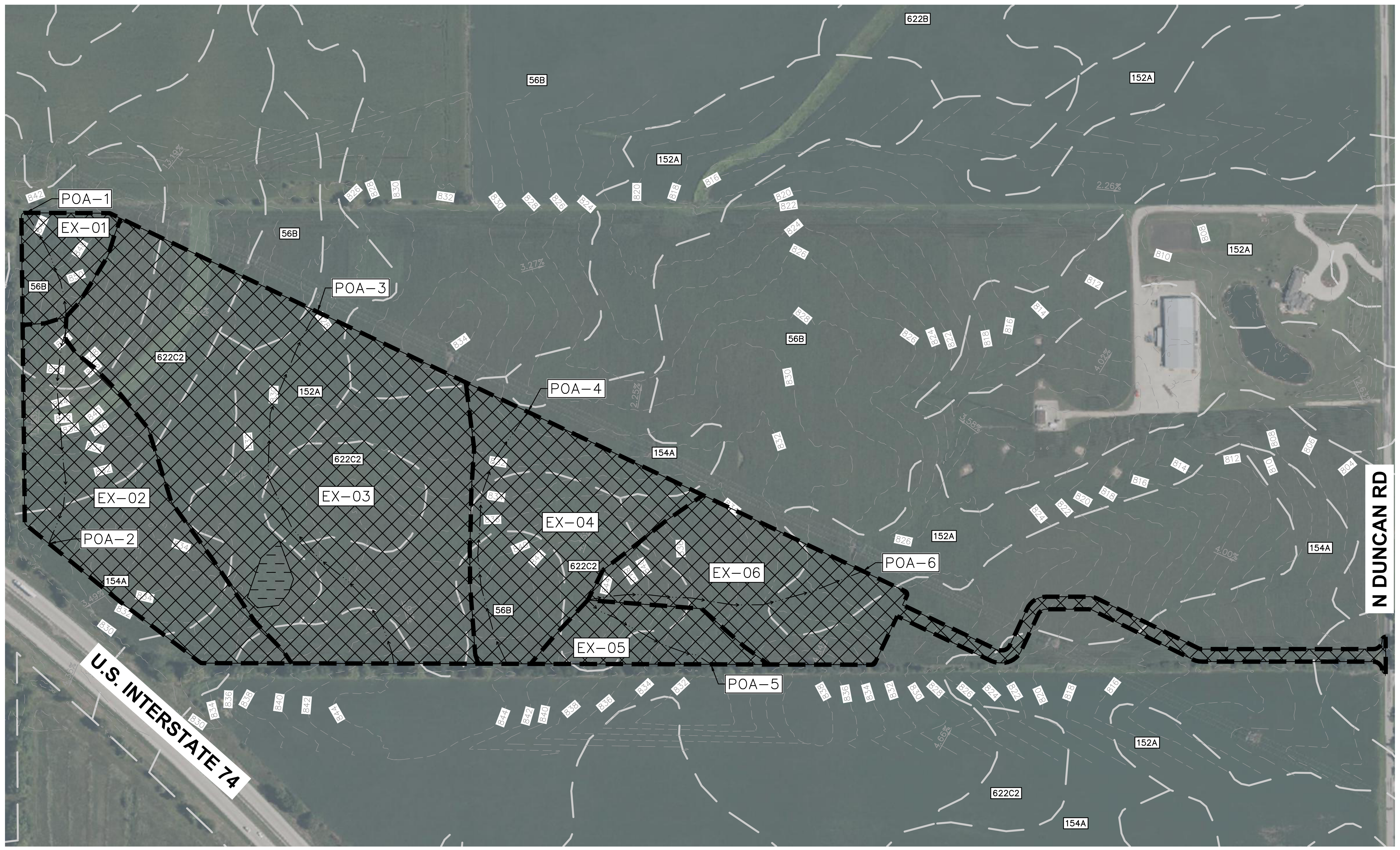
Tie-break Rule: Higher

Exhibit 5 – Pre-Development Drainage Area Map

NORTH

GRAPHIC SCALE IN FEET
0 100 200 400

PRE-DEVELOPMENT DRAINAGE AREAS						
DRAINAGE AREA	ROW CROP (SR) TYPE C (CN=85)	WETLAND TYPE C (CN=98)	IMPERVIOUS TYPE C (CN=98)	MEADOW TYPE C (CN=71)	TOTAL (AC)	CUMULATIVE CN
EX-01	1.57	0	0	0	1.57	85
EX-02	7.46	0	0	0	7.46	85
EX-03	20.72	0.36	0	0	21.08	85
EX-04	6.75	0	0	0	6.75	85
EX-05	1.99	0	0	0	1.99	85
EX-06	6.89	0	0	0	6.89	85
TOTAL	45.38	0.36	0	0	45.74	85



SOILS DATA TABLE

MAP UNIT SYMBOL	MAP UNIT NAME
56B	DANA SILT LOAM, 2 TO 5 PERCENT SLOPES
152A	DRUMMER SILTY CLAY LOAM, 0 TO 2 PERCENT SLOPES
154A	FLANAGAN SILT LOAM, 0 TO 2 PERCENT SLOPES
622B	WYANET SILT LOAM, 2 TO 5 PERCENT SLOPES
622C2	WYANET SILT LOAM, 5 TO 10 PERCENT SLOPES, ERODED

SOILS NOTE: NRCS SOIL DATA WAS PULLED FROM USGS. THE NRCS DATA CONCLUDES THAT ONSITE SOILS CONSIST OF SILT LOAM AND SILTY CLAY LOAM, MOST CLOSELY CORRESPONDING WITH HSG TYPE C. THEREFORE, THE SITE WAS MODELED USING TYPE C SOILS.

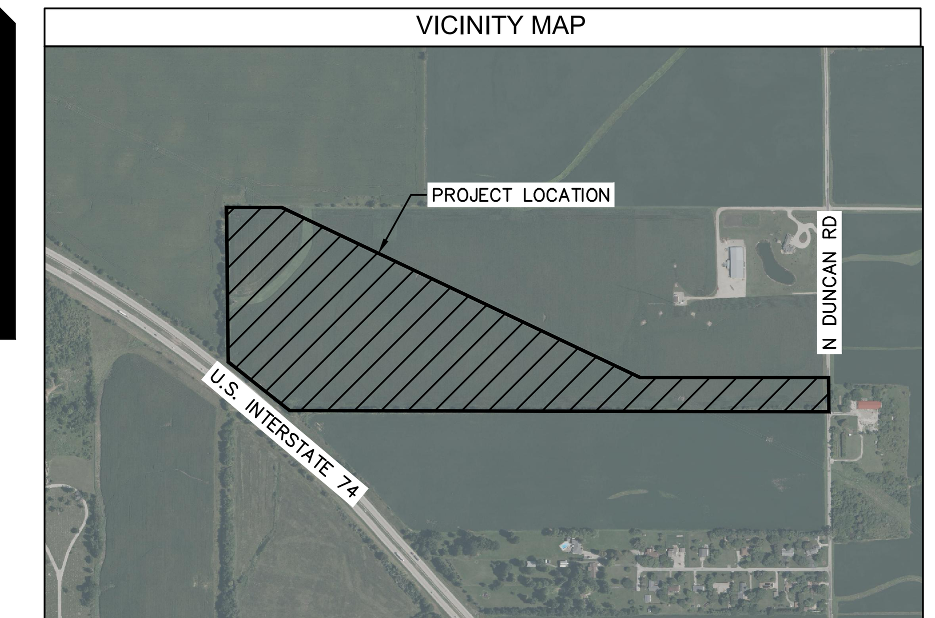
LEGEND

- DRAINAGE BOUNDARY/ LIMITS OF ANALYSIS
- TIME OF CONCENTRATION FLOW PATH
- LIMIT OF SOIL TYPE
- EX. CONTOURS
- EX. SLOPE LABELS
- STRAIGHT ROW CROPS
- WETLAND

Table 2-2c Runoff curve numbers for other agricultural lands 1/

Cover description: Cover type	Hydrologic condition	Curve numbers for hydrologic soil group: A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. 2/	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. 3/	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 4/	48	65	73
Woods—grass combination (orchard or tree farm). 5/	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. 6/	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 4/	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

VICINITY MAP



SCALE 1" = 1000'

Table 2-2a Runoff curve numbers for urban areas 1/

Cover type and hydrologic condition	Average percent impervious area 2/	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) 3/:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) 4/		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) 5/		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

Table 2-2b Runoff curve numbers for cultivated agricultural lands 1/

Cover type	Treatment 2/	Hydrologic condition 3/	A	B	C	D
Fallow	Bare soil	—	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
	C&T+ CR	Poor	65	73	79	81
		Good	61	70	77	80
Small grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C&T	Poor	61	72	79	82
		Good	59	70	78	81
	C&T+ CR	Poor	60	71	78	81
		Good	58	69	77	80
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

Call Before You Dig
JULIE
1-800-892-0123

No.	REVISIONS	DATE

Rewild

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111 JACKSON BLVD STE. 1320
CHICAGO, IL 60604
WWW.KIMLEY-HORN.COM

PRELIMINARY NOT FOR CONSTRUCTION

KHA PROJECT	DATE	SCALE	DESIGNED BY	DRAWN BY	CHECKED BY
268779005	08/29/2025	AS SHOWN	AT	GG	DM

PRE-DEVELOPMENT DRAINAGE AREA MAP

N DUNCAN ROAD SOLAR, LLC
CHAMPAIGN COUNTY, IL

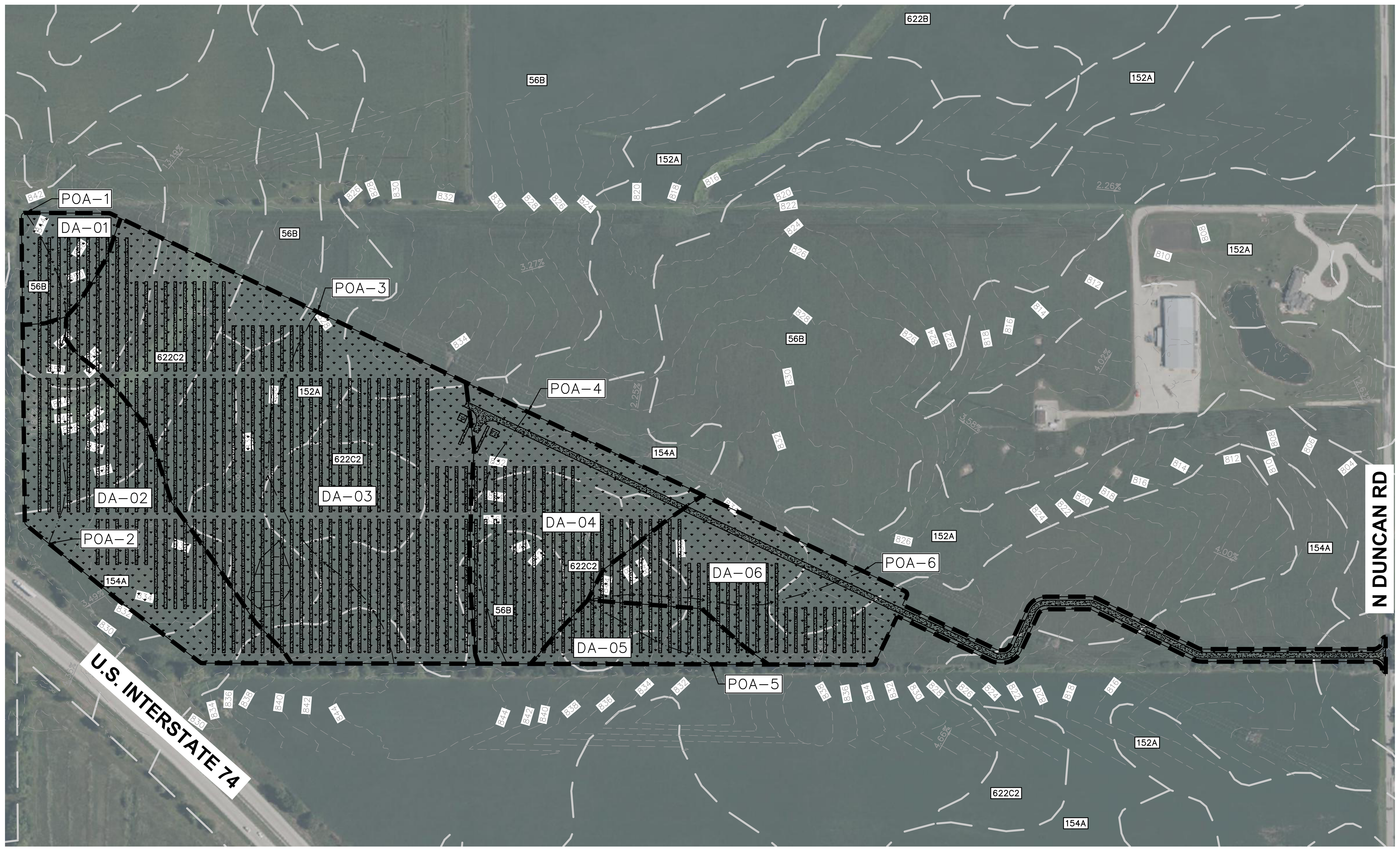
SHEET NUMBER
EX-5

Exhibit 6 – Post-Development Drainage Area Map

NORTH

GRAPHIC SCALE IN FEET
0 100 200 400

POST-DEVELOPMENT DRAINAGE AREAS						
DRAINAGE AREA	ROW CROP (SR) TYPE C (CN=85)	WETLAND TYPE C (CN=98)	IMPERVIOUS TYPE C (CN=98)	MEADOW TYPE C (CN=71)	TOTAL (AC)	CUMULATIVE CN
DA-01	0	0	0.26	1.31	1.57	75
DA-02	0	0	1.49	5.97	7.46	76
DA-03	0	0.26	4.86	15.96	21.08	78
DA-04	0	0	1.47	5.28	6.75	77
DA-05	0	0	0.42	1.57	1.99	77
DA-06	0	0	1.70	5.19	6.89	78
TOTAL	0	0.26	10.20	35.28	45.74	77



SOILS DATA TABLE

MAP UNIT SYMBOL	MAP UNIT NAME
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152A	DRUMMER SILTY CLAY LOAM, 0 TO 2 PERCENT SLOPES
154A	FLANAGAN SILT LOAM, 0 TO 2 PERCENT SLOPES
622B	WYANET SILT LOAM, 2 TO 5 PERCENT SLOPES
622C2	WYANET SILT LOAM, 5 TO 10 PERCENT SLOPES, ERODED

SOILS NOTE: NRCS SOIL DATA WAS PULLED FROM USGS. THE NRCS DATA CONCLUDES THAT ONSITE SOILS CONSIST OF SILT LOAM AND SILTY CLAY LOAM, MOST CLOSELY CORRESPONDING WITH HSG TYPE C. THEREFORE, THE SITE WAS MODELED USING TYPE C SOILS.

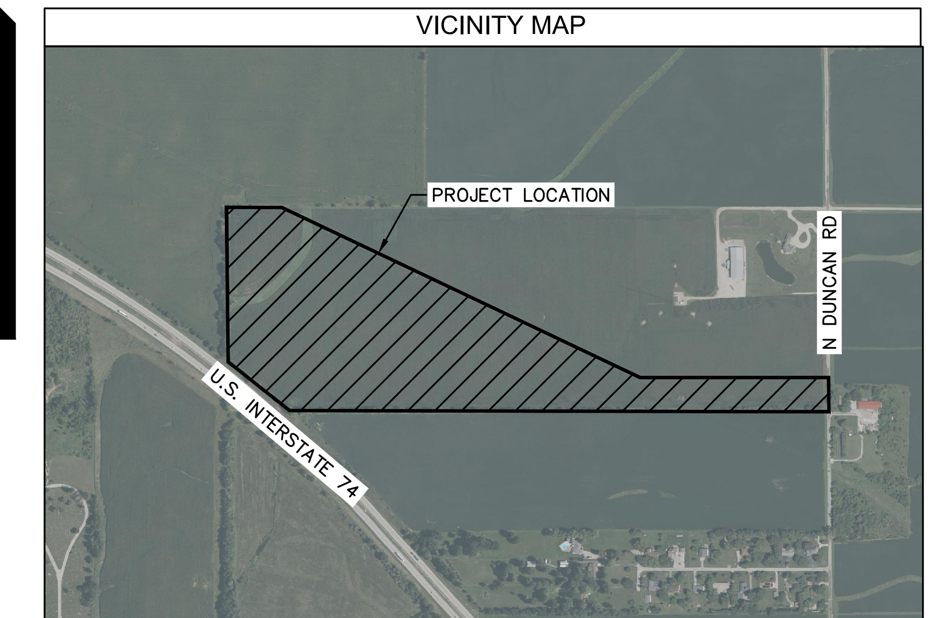
LEGEND

- DRAINAGE BOUNDARY/ LIMITS OF ANALYSIS
- TIME OF CONCENTRATION FLOW PATH
- LIMIT OF SOIL TYPE
- EX. CONTOURS
- EX. SLOPE LABELS
- MEADOW
- WETLAND
- IMPERVIOUS

Table 2-2c Runoff curve numbers for other agricultural lands 1/

Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. 2/	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. 3/	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 4/	48	65	73
Woods—grass combination (orchard or tree farm). 5/	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. 6/	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 4/	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

VICINITY MAP



SCALE 1" = 1000'

Table 2-2a Runoff curve numbers for urban areas 1/

Cover type and hydrologic condition	Average percent impervious area 2/	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) 3/:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) 4/		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) 5/		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

Table 2-2b Runoff curve numbers for cultivated agricultural lands 1/

Cover type	Treatment 2/	Hydrologic condition 3/	A	B	C	D
Fallow	Bare soil	—	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
	C&T+ CR	Poor	65	73	79	81
		Good	61	70	77	80
Small grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C&T	Poor	61	72	79	82
		Good	59	70	78	81
	C&T+ CR	Poor	60	71	78	81
		Good	58	69	77	80
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

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No.	REVISIONS	DATE

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DATE 08/29/2025
SCALE AS SHOWN
DESIGNED BY AT
DRAWN BY GG
CHECKED BY DM

POST-DEVELOPMENT DRAINAGE AREA MAP

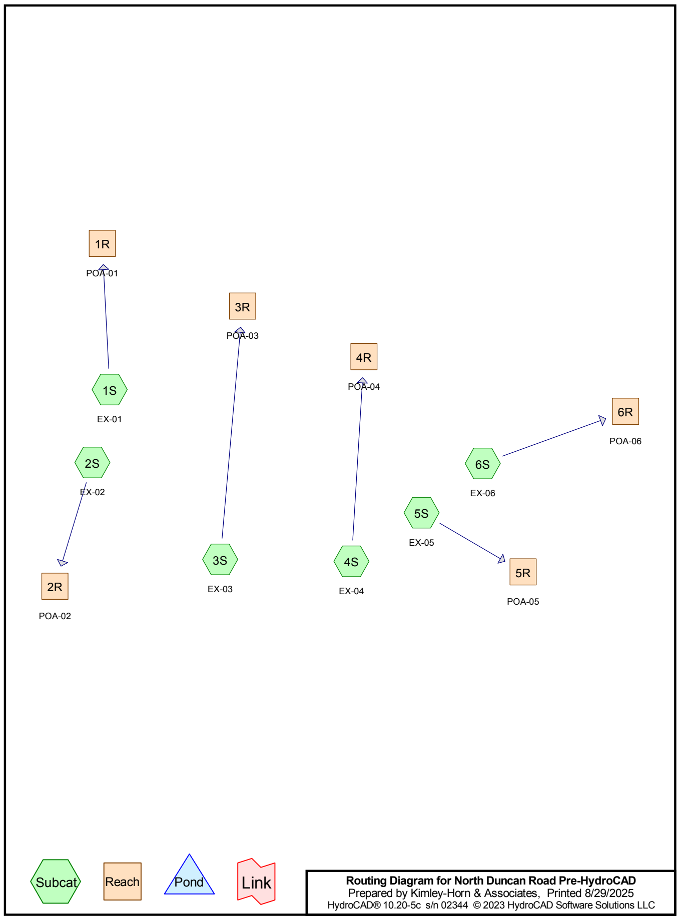
N DUNCAN ROAD SOLAR, LLC

CHAMPAIGN COUNTY, IL

SHEET NUMBER
EX-6

Drawing name: K:\CHI_LDEV\268779005_ReWild_North Duncan Road_IL\2 Design\CAD\Exhibits\Stormwater\North Duncan Road_Post-Development Drainage Area Map.dwg Layout1 Aug 29, 2025 9:53am by: Grant.Gattoni

Exhibit 7 – Pre-Development HydroCAD Model



Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Yr HUFF	Huff B75 0-10sm	3Q	Scale	24.00	1	3.12	2
2	10-Yr HUFF	Huff B75 0-10sm	3Q	Scale	24.00	1	4.71	2
3	100-Yr HUFF	Huff B75 0-10sm	3Q	Scale	24.00	1	7.43	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
45.380	85	ROW CROP TYPE C (1S, 2S, 3S, 4S, 5S, 6S)
0.360	98	WETLAND TYPE C (3S)
45.740	**85**	**TOTAL AREA**

Time span=1.00-72.00 hrs, dt=0.05 hrs, 1421 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: EX-01 Runoff Area=1.570 ac 0.00% Impervious Runoff Depth=1.69"
Flow Length=325' Tc=7.3 min CN=85 Runoff=0.33 cfs 0.221 af

Subcatchment 2S: EX-02 Runoff Area=7.460 ac 0.00% Impervious Runoff Depth=1.69"
Flow Length=622' Tc=10.0 min CN=85 Runoff=1.55 cfs 1.050 af

Subcatchment 3S: EX-03 Runoff Area=21.080 ac 1.71% Impervious Runoff Depth=1.69"
Flow Length=1,168' Tc=22.6 min CN=85 Runoff=4.38 cfs 2.968 af

Subcatchment 4S: EX-04 Runoff Area=6.750 ac 0.00% Impervious Runoff Depth=1.69"
Flow Length=776' Tc=14.0 min CN=85 Runoff=1.40 cfs 0.950 af

Subcatchment 5S: EX-05 Runoff Area=1.990 ac 0.00% Impervious Runoff Depth=1.69"
Flow Length=404' Tc=7.8 min CN=85 Runoff=0.41 cfs 0.280 af

Subcatchment 6S: EX-06 Runoff Area=6.890 ac 0.00% Impervious Runoff Depth=1.69"
Flow Length=811' Tc=14.5 min CN=85 Runoff=1.43 cfs 0.970 af

Reach 1R: POA-01 Inflow=0.33 cfs 0.221 af
Outflow=0.33 cfs 0.221 af

Reach 2R: POA-02 Inflow=1.55 cfs 1.050 af
Outflow=1.55 cfs 1.050 af

Reach 3R: POA-03 Inflow=4.38 cfs 2.968 af
Outflow=4.38 cfs 2.968 af

Reach 4R: POA-04 Inflow=1.40 cfs 0.950 af
Outflow=1.40 cfs 0.950 af

Reach 5R: POA-05 Inflow=0.41 cfs 0.280 af
Outflow=0.41 cfs 0.280 af

Reach 6R: POA-06 Inflow=1.43 cfs 0.970 af
Outflow=1.43 cfs 0.970 af

Total Runoff Area = 45.740 ac Runoff Volume = 6.440 af Average Runoff Depth = 1.69"
99.21% Pervious = 45.380 ac 0.79% Impervious = 0.360 ac

Summary for Subcatchment 1S: EX-01

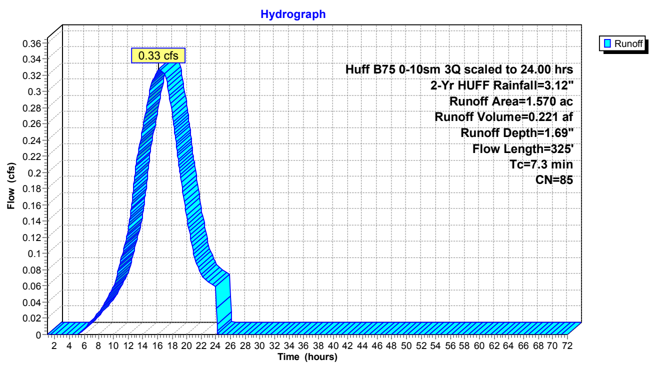
Runoff = 0.33 cfs @ 16.17 hrs, Volume= 0.221 af, Depth= 1.69"
Routed to Reach 1R : POA-01

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 2-Yr HUFF Rainfall=3.12"

	Area (ac)	CN	Description
*	1.570	85	ROW CROP TYPE C
	1.570		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	100	0.0198	0.35		**Sheet Flow, CROPLAND** Cultivated: Residue<=20% n= 0.060 P2= 3.12"
2.5	225	0.0269	1.48		**Shallow Concentrated Flow, CROPLAND** Cultivated Straight Rows Kv= 9.0 fps
7.3	325	Total			

Subcatchment 1S: EX-01



Summary for Subcatchment 2S: EX-02

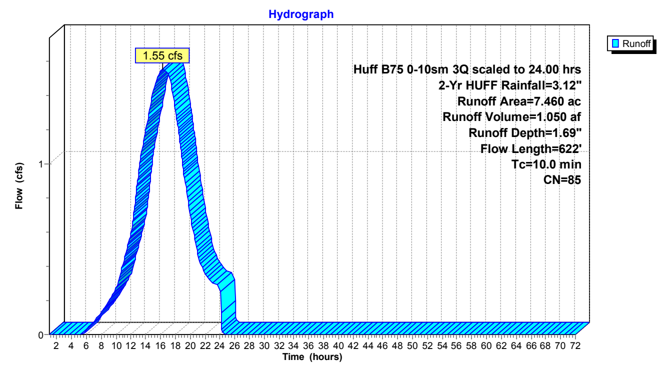
Runoff = 1.55 cfs @ 16.23 hrs, Volume= 1.050 af, Depth= 1.69"
Routed to Reach 2R : POA-02

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 2-Yr HUFF Rainfall=3.12"

	Area (ac)	CN	Description
*	7.460	85	ROW CROP TYPE C
	7.460		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	100	0.0157	0.32		**Sheet Flow, CROPLAND** Cultivated: Residue<=20% n= 0.060 P2= 3.12"
4.7	522	0.0424	1.85		**Shallow Concentrated Flow, CROPLAND** Cultivated Straight Rows Kv= 9.0 fps
10.0	622	Total			

Subcatchment 2S: EX-02



Summary for Subcatchment 3S: EX-03

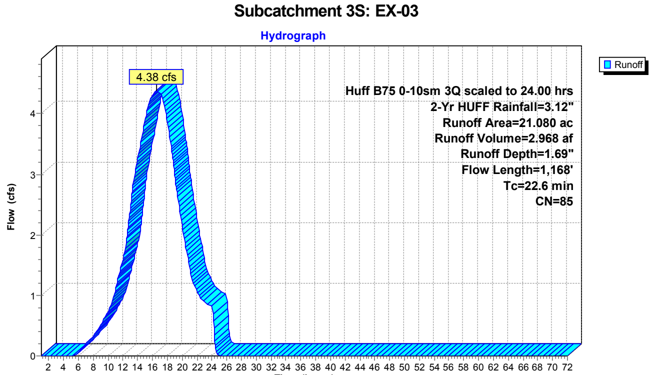
Runoff = 4.38 cfs @ 16.47 hrs, Volume= 2.968 af, Depth= 1.69"
Routed to Reach 3R : POA-03

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 2-Yr HUFF Rainfall=3.12"

	Area (ac)	CN	Description
*	20.720	85	ROW CROP TYPE C
*	0.360	98	WETLAND TYPE C
	21.080	85	Weighted Average
	20.720		98.29% Pervious Area
	0.360		1.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	100	0.0274	0.40		**Sheet Flow, CROPLAND** Cultivated: Residue<=20% n= 0.060 P2= 3.12"
18.4	1,068	0.0115	0.97		**Shallow Concentrated Flow, CROPLAND** Cultivated Straight Rows Kv= 9.0 fps
22.6	1,168	Total			

Subcatchment 3S: EX-03



Summary for Subcatchment 4S: EX-04

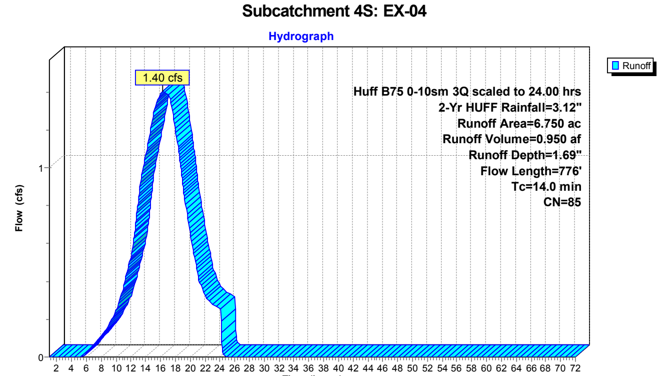
Runoff = 1.40 cfs @ 16.30 hrs, Volume= 0.950 af, Depth= 1.69"
Routed to Reach 4R : POA-04

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 2-Yr HUFF Rainfall=3.12"

	Area (ac)	CN	Description
*	6.750	85	ROW CROP TYPE C
	6.750		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	100	0.0199	0.35		**Sheet Flow, CROPLAND** Cultivated: Residue<=20% n= 0.060 P2= 3.12"
9.2	676	0.0185	1.22		**Shallow Concentrated Flow, CROPLAND** Cultivated Straight Rows Kv= 9.0 fps
14.0	776	Total			

Subcatchment 4S: EX-04



Summary for Subcatchment 5S: EX-05

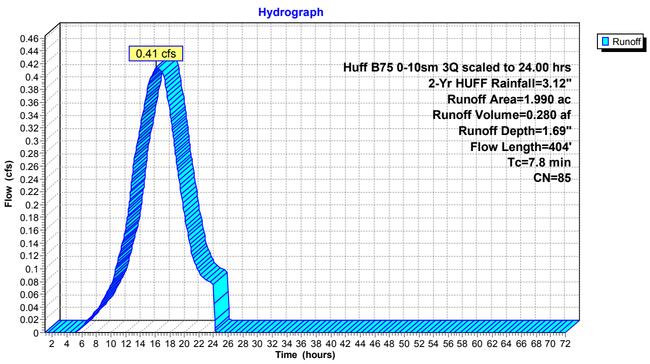
Runoff = 0.41 cfs @ 16.18 hrs, Volume= 0.280 af, Depth= 1.69"
Routed to Reach 5R : POA-05

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 2-Yr HUFF Rainfall=3.12"

	Area (ac)	CN	Description
*	1.990	85	ROW CROP TYPE C
	1.990		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	100	0.0243	0.38		**Sheet Flow, CROPLAND** Cultivated: Residue<=20% n= 0.060 P2= 3.12"
3.4	304	0.0269	1.48		**Shallow Concentrated Flow, CROPLAND** Cultivated Straight Rows Kv= 9.0 fps
7.8	404	Total			

Subcatchment 5S: EX-05



Summary for Subcatchment 6S: EX-06

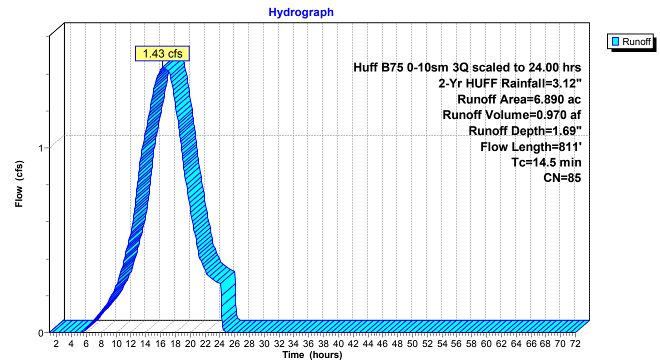
Runoff = 1.43 cfs @ 16.31 hrs, Volume= 0.970 af, Depth= 1.69"
Routed to Reach 6R : POA-06

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 2-Yr HUFF Rainfall=3.12"

	Area (ac)	CN	Description
*	6.890	85	ROW CROP TYPE C
	6.890		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	100	0.0150	0.31		**Sheet Flow, CROPLAND** Cultivated: Residue<=20% n= 0.060 P2= 3.12"
9.2	711	0.0205	1.29		**Shallow Concentrated Flow, CROPLAND** Cultivated Straight Rows Kv= 9.0 fps
14.5	811	Total			

Subcatchment 6S: EX-06



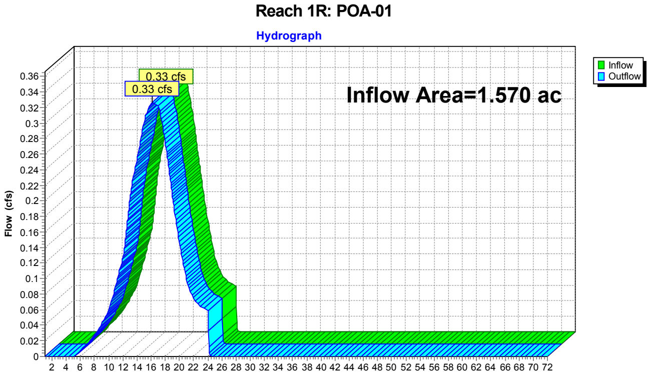
Summary for Reach 1R: POA-01

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.570 ac, 0.00% Impervious, Inflow Depth = 1.69" for 2-Yr HUFF event
Inflow = 0.33 cfs @ 16.17 hrs, Volume= 0.221 af
Outflow = 0.33 cfs @ 16.17 hrs, Volume= 0.221 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 1R: POA-01



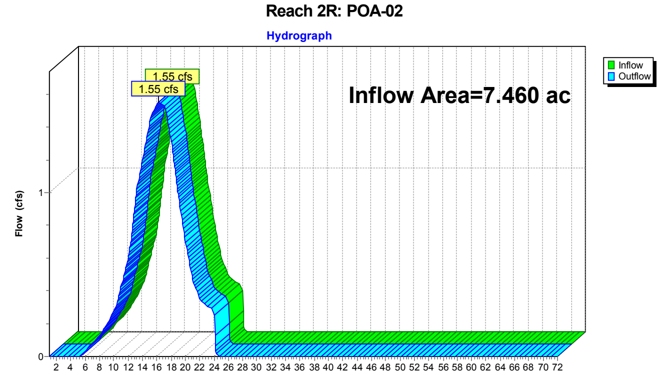
Summary for Reach 2R: POA-02

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 7.460 ac, 0.00% Impervious, Inflow Depth = 1.69" for 2-Yr HUFF event
Inflow = 1.55 cfs @ 16.23 hrs, Volume= 1.050 af
Outflow = 1.55 cfs @ 16.23 hrs, Volume= 1.050 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 2R: POA-02



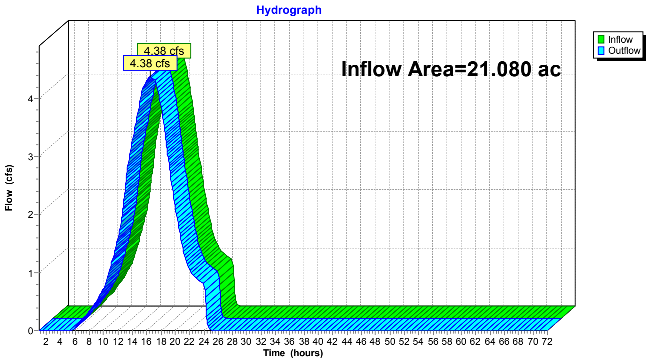
Summary for Reach 3R: POA-03

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 21.080 ac, 1.71% Impervious, Inflow Depth = 1.69" for 2-Yr HUFF event
Inflow = 4.38 cfs @ 16.47 hrs, Volume= 2.968 af
Outflow = 4.38 cfs @ 16.47 hrs, Volume= 2.968 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 3R: POA-03



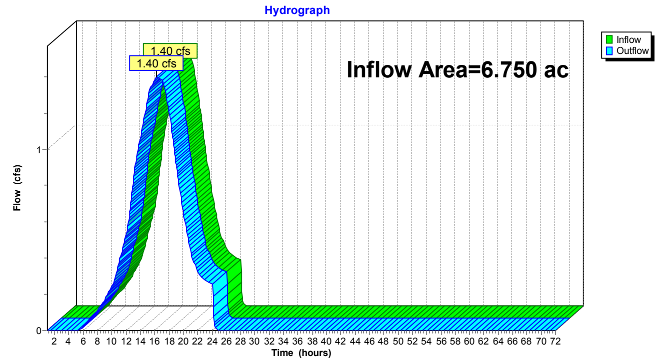
Summary for Reach 4R: POA-04

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.750 ac, 0.00% Impervious, Inflow Depth = 1.69" for 2-Yr HUFF event
Inflow = 1.40 cfs @ 16.30 hrs, Volume= 0.950 af
Outflow = 1.40 cfs @ 16.30 hrs, Volume= 0.950 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 4R: POA-04



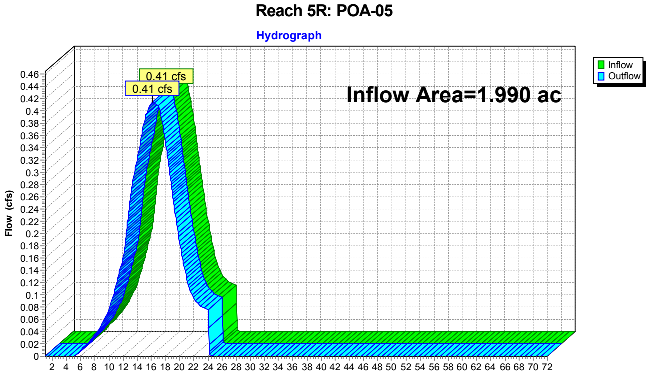
Summary for Reach 5R: POA-05

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.990 ac, 0.00% Impervious, Inflow Depth = 1.69" for 2-Yr HUFF event
Inflow = 0.41 cfs @ 16.18 hrs, Volume= 0.280 af
Outflow = 0.41 cfs @ 16.18 hrs, Volume= 0.280 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 5R: POA-05



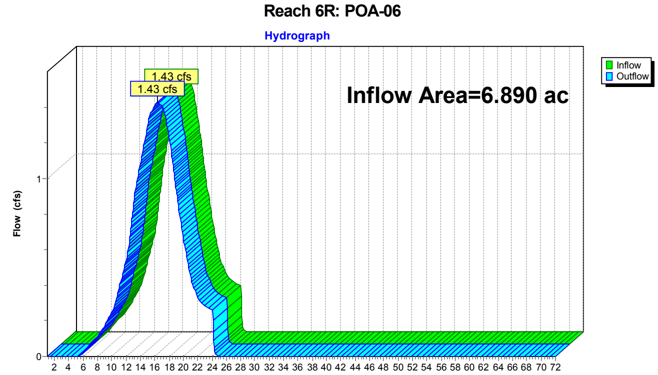
Summary for Reach 6R: POA-06

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.890 ac, 0.00% Impervious, Inflow Depth = 1.69" for 2-Yr HUFF event
Inflow = 1.43 cfs @ 16.31 hrs, Volume= 0.970 af
Outflow = 1.43 cfs @ 16.31 hrs, Volume= 0.970 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 6R: POA-06



Time span=1.00-72.00 hrs, dt=0.05 hrs, 1421 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: EX-01	Runoff Area=1.570 ac 0.00% Impervious Runoff Depth=3.10" Flow Length=325' Tc=7.3 min CN=85 Runoff=0.56 cfs 0.406 af
Subcatchment 2S: EX-02	Runoff Area=7.460 ac 0.00% Impervious Runoff Depth=3.10" Flow Length=622' Tc=10.0 min CN=85 Runoff=2.68 cfs 1.928 af
Subcatchment 3S: EX-03	Runoff Area=21.080 ac 1.71% Impervious Runoff Depth=3.10" Flow Length=1,168' Tc=22.6 min CN=85 Runoff=7.55 cfs 5.448 af
Subcatchment 4S: EX-04	Runoff Area=6.750 ac 0.00% Impervious Runoff Depth=3.10" Flow Length=776' Tc=14.0 min CN=85 Runoff=2.42 cfs 1.744 af
Subcatchment 5S: EX-05	Runoff Area=1.990 ac 0.00% Impervious Runoff Depth=3.10" Flow Length=404' Tc=7.8 min CN=85 Runoff=0.71 cfs 0.514 af
Subcatchment 6S: EX-06	Runoff Area=6.890 ac 0.00% Impervious Runoff Depth=3.10" Flow Length=811' Tc=14.5 min CN=85 Runoff=2.47 cfs 1.781 af
Reach 1R: POA-01	Inflow=0.56 cfs 0.406 af Outflow=0.56 cfs 0.406 af
Reach 2R: POA-02	Inflow=2.68 cfs 1.928 af Outflow=2.68 cfs 1.928 af
Reach 3R: POA-03	Inflow=7.55 cfs 5.448 af Outflow=7.55 cfs 5.448 af
Reach 4R: POA-04	Inflow=2.42 cfs 1.744 af Outflow=2.42 cfs 1.744 af
Reach 5R: POA-05	Inflow=0.71 cfs 0.514 af Outflow=0.71 cfs 0.514 af
Reach 6R: POA-06	Inflow=2.47 cfs 1.781 af Outflow=2.47 cfs 1.781 af

Total Runoff Area = 45.740 ac Runoff Volume = 11.820 af Average Runoff Depth = 3.10"
99.21% Pervious = 45.380 ac 0.79% Impervious = 0.360 ac

Summary for Subcatchment 1S: EX-01

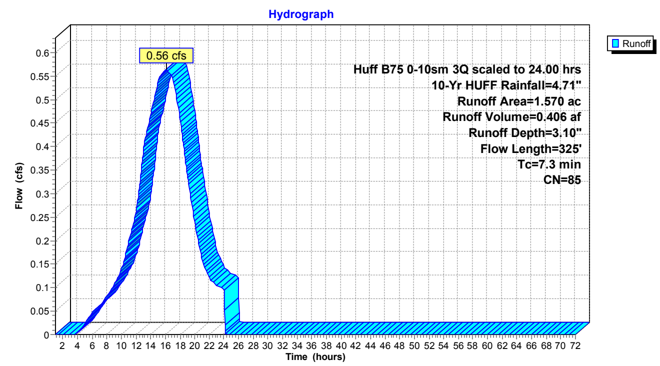
Runoff = 0.56 cfs @ 16.10 hrs, Volume= 0.406 af, Depth= 3.10"
Routed to Reach 1R : POA-01

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 10-Yr HUFF Rainfall=4.71"

	Area (ac)	CN	Description
*	1.570	85	ROW CROP TYPE C
	1.570		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	100	0.0198	0.35		**Sheet Flow, CROPLAND** Cultivated: Residue<=20% n= 0.060 P2= 3.12"
2.5	225	0.0269	1.48		**Shallow Concentrated Flow, CROPLAND** Cultivated Straight Rows Kv= 9.0 fps
7.3	325	Total			

Subcatchment 1S: EX-01



Summary for Subcatchment 2S: EX-02

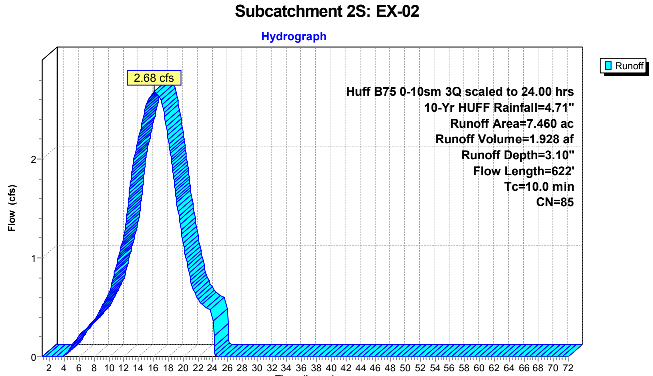
Runoff = 2.68 cfs @ 16.14 hrs, Volume= 1.928 af, Depth= 3.10"
Routed to Reach 2R : POA-02

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 10-Yr HUFF Rainfall=4.71"

	Area (ac)	CN	Description
*	7.460	85	ROW CROP TYPE C
	7.460		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	100	0.0157	0.32		**Sheet Flow, CROPLAND** Cultivated: Residue<=20% n= 0.060 P2= 3.12"
4.7	522	0.0424	1.85		**Shallow Concentrated Flow, CROPLAND** Cultivated Straight Rows Kv= 9.0 fps
10.0	622	Total			

Subcatchment 2S: EX-02



Summary for Subcatchment 3S: EX-03

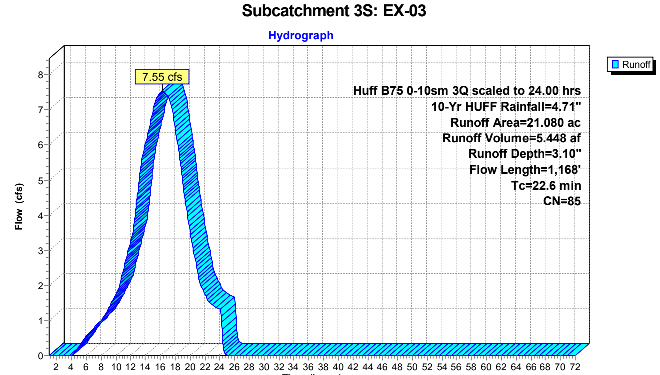
Runoff = 7.55 cfs @ 16.32 hrs, Volume= 5.448 af, Depth= 3.10"
Routed to Reach 3R : POA-03

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 10-Yr HUFF Rainfall=4.71"

	Area (ac)	CN	Description
*	20.720	85	ROW CROP TYPE C
*	0.360	98	WETLAND TYPE C
	21.080	85	Weighted Average
	20.720		98.29% Pervious Area
	0.360		1.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	100	0.0274	0.40		**Sheet Flow, CROPLAND** Cultivated: Residue<=20% n= 0.060 P2= 3.12"
18.4	1,068	0.0115	0.97		**Shallow Concentrated Flow, CROPLAND** Cultivated Straight Rows Kv= 9.0 fps
22.6	1,168	Total			

Subcatchment 3S: EX-03



Summary for Subcatchment 4S: EX-04

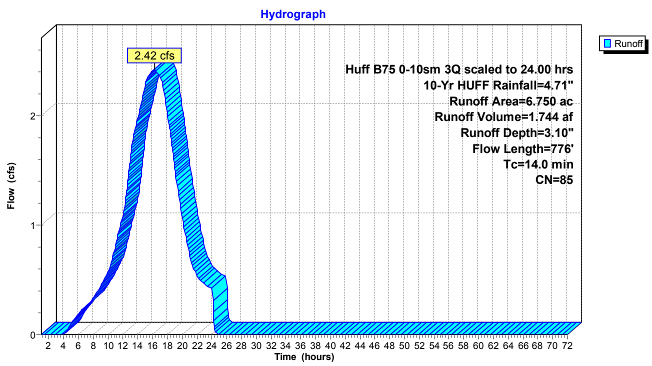
Runoff = 2.42 cfs @ 16.19 hrs, Volume= 1.744 af, Depth= 3.10"
Routed to Reach 4R : POA-04

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 10-Yr HUFF Rainfall=4.71"

	Area (ac)	CN	Description
*	6.750	85	ROW CROP TYPE C
	6.750		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	100	0.0199	0.35		**Sheet Flow, CROPLAND** Cultivated: Residue<=20% n= 0.060 P2= 3.12"
9.2	676	0.0185	1.22		**Shallow Concentrated Flow, CROPLAND** Cultivated Straight Rows Kv= 9.0 fps
14.0	776	Total			

Subcatchment 4S: EX-04



Summary for Subcatchment 5S: EX-05

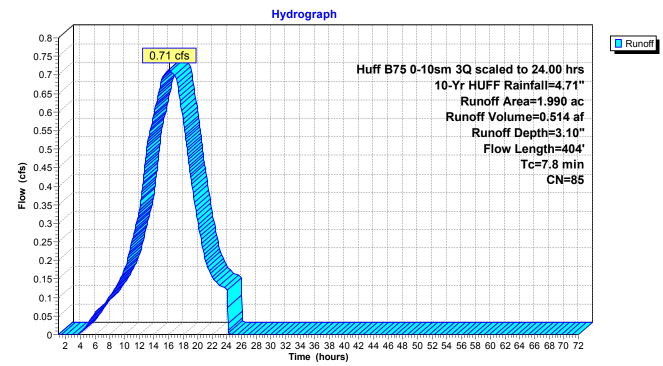
Runoff = 0.71 cfs @ 16.11 hrs, Volume= 0.514 af, Depth= 3.10"
Routed to Reach 5R : POA-05

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 10-Yr HUFF Rainfall=4.71"

	Area (ac)	CN	Description
*	1.990	85	ROW CROP TYPE C
	1.990		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	100	0.0243	0.38		**Sheet Flow, CROPLAND** Cultivated: Residue<=20% n= 0.060 P2= 3.12"
3.4	304	0.0269	1.48		**Shallow Concentrated Flow, CROPLAND** Cultivated Straight Rows Kv= 9.0 fps
7.8	404	Total			

Subcatchment 5S: EX-05



Summary for Subcatchment 6S: EX-06

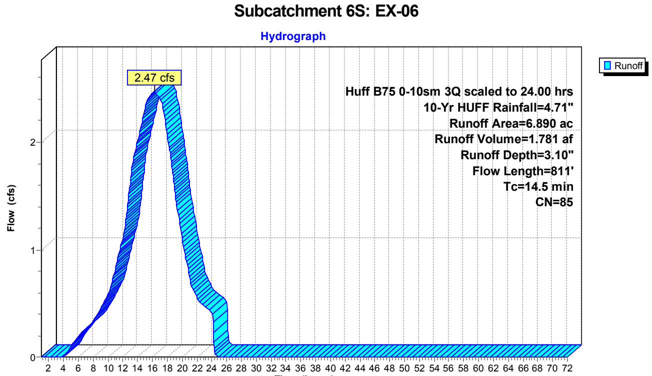
Runoff = 2.47 cfs @ 16.20 hrs, Volume= 1.781 af, Depth= 3.10"
Routed to Reach 6R : POA-06

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 10-Yr HUFF Rainfall=4.71"

	Area (ac)	CN	Description
*	6.890	85	ROW CROP TYPE C
	6.890		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	100	0.0150	0.31		**Sheet Flow, CROPLAND** Cultivated: Residue<=20% n= 0.060 P2= 3.12"
9.2	711	0.0205	1.29		**Shallow Concentrated Flow, CROPLAND** Cultivated Straight Rows Kv= 9.0 fps
14.5	811	Total			

Subcatchment 6S: EX-06



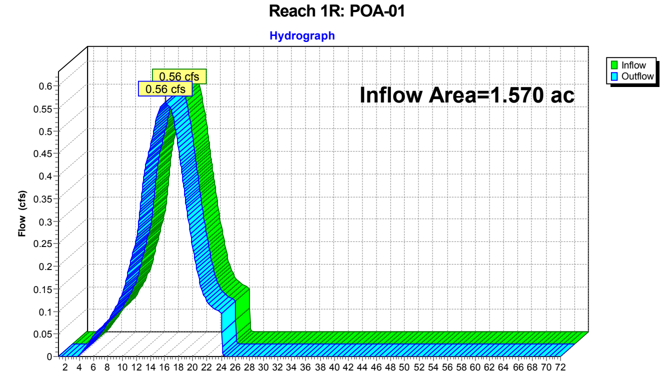
Summary for Reach 1R: POA-01

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.570 ac, 0.00% Impervious, Inflow Depth = 3.10" for 10-Yr HUFF event
Inflow = 0.56 cfs @ 16.10 hrs, Volume= 0.406 af
Outflow = 0.56 cfs @ 16.10 hrs, Volume= 0.406 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 1R: POA-01



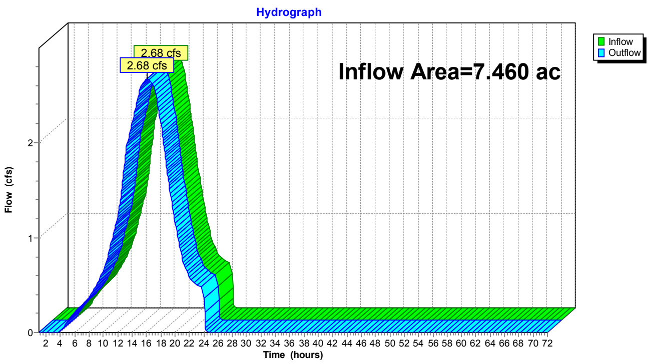
Summary for Reach 2R: POA-02

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 7.460 ac, 0.00% Impervious, Inflow Depth = 3.10" for 10-Yr HUFF event
Inflow = 2.68 cfs @ 16.14 hrs, Volume= 1.928 af
Outflow = 2.68 cfs @ 16.14 hrs, Volume= 1.928 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 2R: POA-02



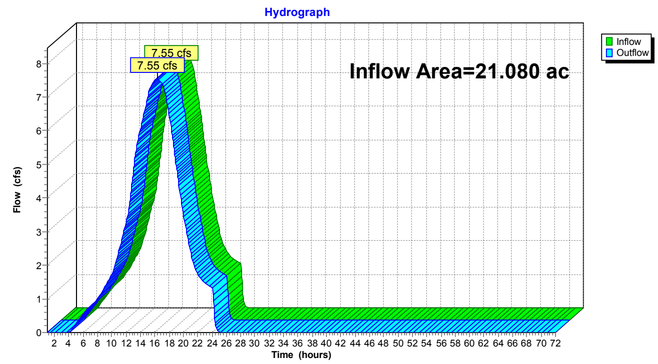
Summary for Reach 3R: POA-03

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 21.080 ac, 1.71% Impervious, Inflow Depth = 3.10" for 10-Yr HUFF event
Inflow = 7.55 cfs @ 16.32 hrs, Volume= 5.448 af
Outflow = 7.55 cfs @ 16.32 hrs, Volume= 5.448 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 3R: POA-03



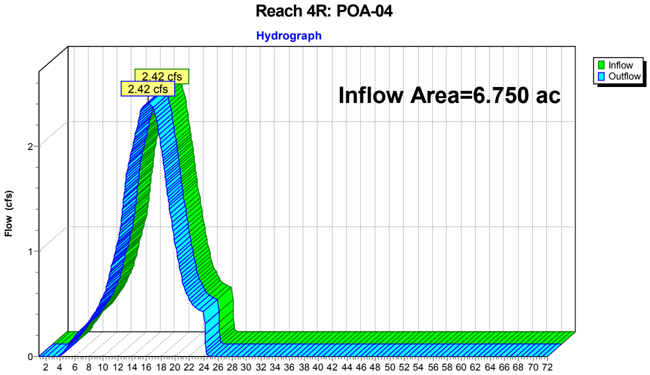
Summary for Reach 4R: POA-04

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.750 ac, 0.00% Impervious, Inflow Depth = 3.10" for 10-Yr HUFF event
Inflow = 2.42 cfs @ 16.19 hrs, Volume= 1.744 af
Outflow = 2.42 cfs @ 16.19 hrs, Volume= 1.744 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 4R: POA-04



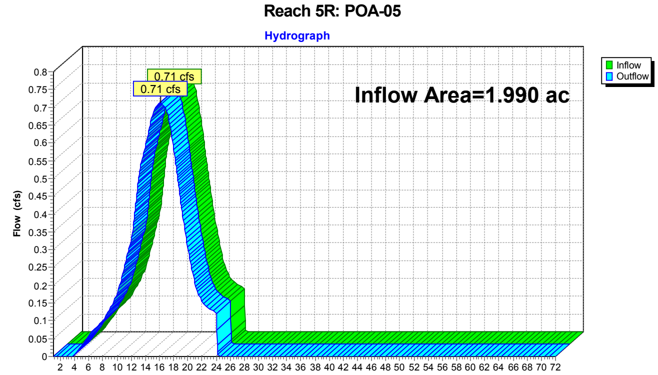
Summary for Reach 5R: POA-05

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.990 ac, 0.00% Impervious, Inflow Depth = 3.10" for 10-Yr HUFF event
Inflow = 0.71 cfs @ 16.11 hrs, Volume= 0.514 af
Outflow = 0.71 cfs @ 16.11 hrs, Volume= 0.514 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 5R: POA-05



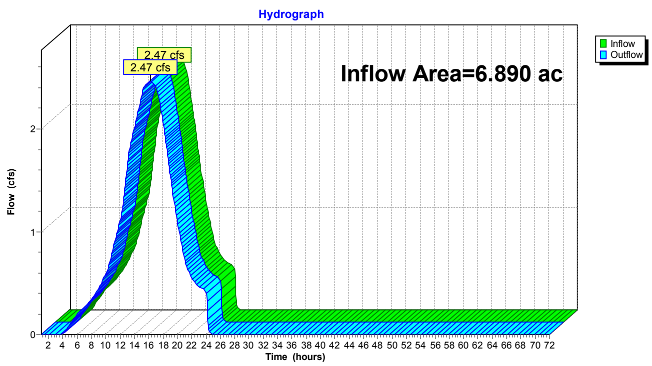
Summary for Reach 6R: POA-06

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.890 ac, 0.00% Impervious, Inflow Depth = 3.10" for 10-Yr HUFF event
Inflow = 2.47 cfs @ 16.20 hrs, Volume= 1.781 af
Outflow = 2.47 cfs @ 16.20 hrs, Volume= 1.781 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 6R: POA-06



Time span=1.00-72.00 hrs, dt=0.05 hrs, 1421 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: EX-01	Runoff Area=1.570 ac 0.00% Impervious Runoff Depth=5.66" Flow Length=325' Tc=7.3 min CN=85 Runoff=0.97 cfs 0.741 af
Subcatchment 2S: EX-02	Runoff Area=7.460 ac 0.00% Impervious Runoff Depth=5.66" Flow Length=622' Tc=10.0 min CN=85 Runoff=4.60 cfs 3.521 af
Subcatchment 3S: EX-03	Runoff Area=21.080 ac 1.71% Impervious Runoff Depth=5.66" Flow Length=1,168' Tc=22.6 min CN=85 Runoff=12.97 cfs 9.951 af
Subcatchment 4S: EX-04	Runoff Area=6.750 ac 0.00% Impervious Runoff Depth=5.66" Flow Length=776' Tc=14.0 min CN=85 Runoff=4.16 cfs 3.186 af
Subcatchment 5S: EX-05	Runoff Area=1.990 ac 0.00% Impervious Runoff Depth=5.66" Flow Length=404' Tc=7.8 min CN=85 Runoff=1.23 cfs 0.939 af
Subcatchment 6S: EX-06	Runoff Area=6.890 ac 0.00% Impervious Runoff Depth=5.66" Flow Length=811' Tc=14.5 min CN=85 Runoff=4.24 cfs 3.252 af
Reach 1R: POA-01	Inflow=0.97 cfs 0.741 af Outflow=0.97 cfs 0.741 af
Reach 2R: POA-02	Inflow=4.60 cfs 3.521 af Outflow=4.60 cfs 3.521 af
Reach 3R: POA-03	Inflow=12.97 cfs 9.951 af Outflow=12.97 cfs 9.951 af
Reach 4R: POA-04	Inflow=4.16 cfs 3.186 af Outflow=4.16 cfs 3.186 af
Reach 5R: POA-05	Inflow=1.23 cfs 0.939 af Outflow=1.23 cfs 0.939 af
Reach 6R: POA-06	Inflow=4.24 cfs 3.252 af Outflow=4.24 cfs 3.252 af

Total Runoff Area = 45.740 ac Runoff Volume = 21.591 af Average Runoff Depth = 5.66"
99.21% Pervious = 45.380 ac 0.79% Impervious = 0.360 ac

Summary for Subcatchment 1S: EX-01

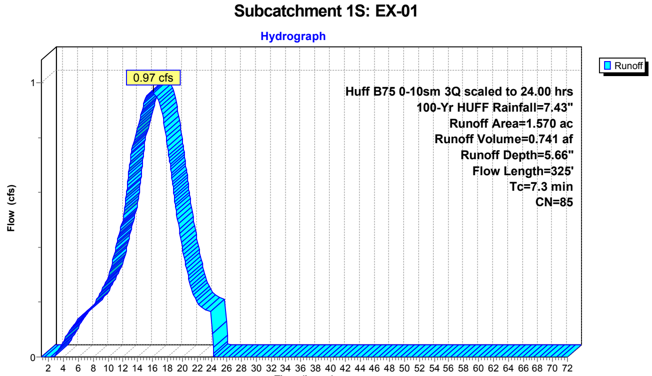
Runoff = 0.97 cfs @ 16.07 hrs, Volume= 0.741 af, Depth= 5.66"
Routed to Reach 1R : POA-01

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 100-Yr HUFF Rainfall=7.43"

	Area (ac)	CN	Description
*	1.570	85	ROW CROP TYPE C
	1.570		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	100	0.0198	0.35		**Sheet Flow, CROPLAND** Cultivated: Residue<=20% n= 0.060 P2= 3.12"
2.5	225	0.0269	1.48		**Shallow Concentrated Flow, CROPLAND** Cultivated Straight Rows Kv= 9.0 fps
7.3	325	Total			

Subcatchment 1S: EX-01



Summary for Subcatchment 2S: EX-02

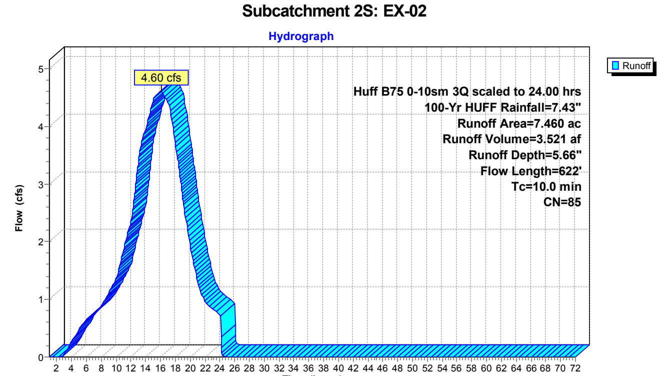
Runoff = 4.60 cfs @ 16.10 hrs, Volume= 3.521 af, Depth= 5.66"
Routed to Reach 2R : POA-02

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 100-Yr HUFF Rainfall=7.43"

	Area (ac)	CN	Description
*	7.460	85	ROW CROP TYPE C
	7.460		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	100	0.0157	0.32		**Sheet Flow, CROPLAND** Cultivated: Residue<=20% n= 0.060 P2= 3.12"
4.7	522	0.0424	1.85		**Shallow Concentrated Flow, CROPLAND** Cultivated Straight Rows Kv= 9.0 fps
10.0	622	Total			

Subcatchment 2S: EX-02



Summary for Subcatchment 3S: EX-03

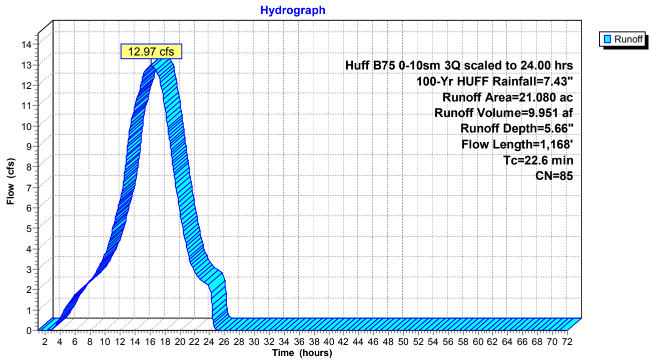
Runoff = 12.97 cfs @ 16.23 hrs, Volume= 9.951 af, Depth= 5.66"
Routed to Reach 3R : POA-03

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 100-Yr HUFF Rainfall=7.43"

	Area (ac)	CN	Description
*	20.720	85	ROW CROP TYPE C
*	0.360	98	WETLAND TYPE C
	21.080	85	Weighted Average
	20.720		98.29% Pervious Area
	0.360		1.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.2	100	0.0274	0.40		**Sheet Flow, CROPLAND** Cultivated: Residue<=20% n= 0.060 P2= 3.12"
18.4	1,068	0.0115	0.97		**Shallow Concentrated Flow, CROPLAND** Cultivated Straight Rows Kv= 9.0 fps
22.6	1,168	Total			

Subcatchment 3S: EX-03



Summary for Subcatchment 4S: EX-04

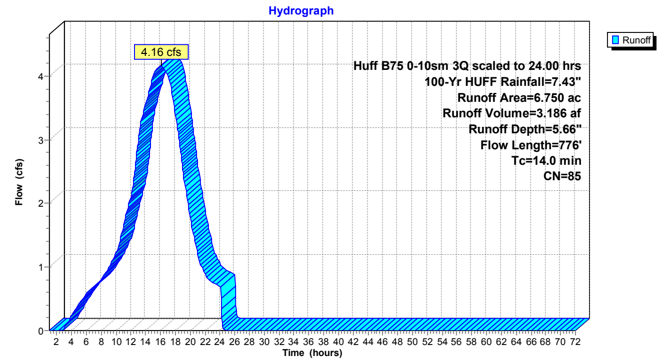
Runoff = 4.16 cfs @ 16.14 hrs, Volume= 3.186 af, Depth= 5.66"
Routed to Reach 4R : POA-04

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 100-Yr HUFF Rainfall=7.43"

	Area (ac)	CN	Description
*	6.750	85	ROW CROP TYPE C
	6.750		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	100	0.0199	0.35		**Sheet Flow, CROPLAND** Cultivated: Residue<=20% n= 0.060 P2= 3.12"
9.2	676	0.0185	1.22		**Shallow Concentrated Flow, CROPLAND** Cultivated Straight Rows Kv= 9.0 fps
14.0	776	Total			

Subcatchment 4S: EX-04



Summary for Subcatchment 5S: EX-05

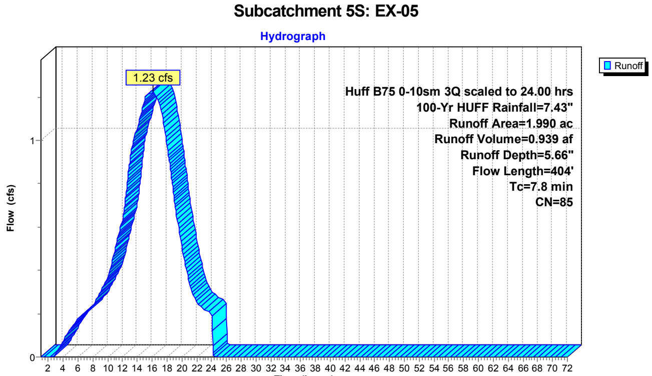
Runoff = 1.23 cfs @ 16.08 hrs, Volume= 0.939 af, Depth= 5.66"
Routed to Reach 5R : POA-05

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 100-Yr HUFF Rainfall=7.43"

	Area (ac)	CN	Description
*	1.990	85	ROW CROP TYPE C
	1.990		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	100	0.0243	0.38		**Sheet Flow, CROPLAND** Cultivated: Residue<=20% n= 0.060 P2= 3.12"
3.4	304	0.0269	1.48		**Shallow Concentrated Flow, CROPLAND** Cultivated Straight Rows Kv= 9.0 fps
7.8	404	Total			

Subcatchment 5S: EX-05



Summary for Subcatchment 6S: EX-06

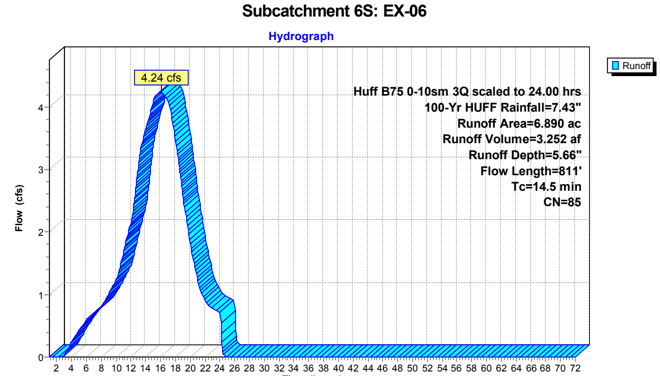
Runoff = 4.24 cfs @ 16.15 hrs, Volume= 3.252 af, Depth= 5.66"
Routed to Reach 6R : POA-06

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 100-Yr HUFF Rainfall=7.43"

	Area (ac)	CN	Description
*	6.890	85	ROW CROP TYPE C
	6.890		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	100	0.0150	0.31		**Sheet Flow, CROPLAND** Cultivated: Residue<=20% n= 0.060 P2= 3.12"
9.2	711	0.0205	1.29		**Shallow Concentrated Flow, CROPLAND** Cultivated Straight Rows Kv= 9.0 fps
14.5	811	Total			

Subcatchment 6S: EX-06



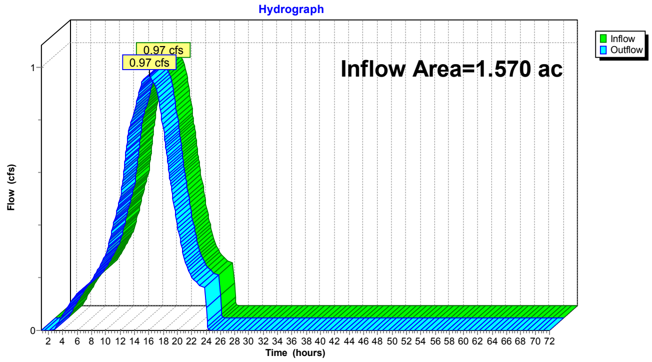
Summary for Reach 1R: POA-01

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.570 ac, 0.00% Impervious, Inflow Depth = 5.66" for 100-Yr HUFF event
Inflow = 0.97 cfs @ 16.07 hrs, Volume= 0.741 af
Outflow = 0.97 cfs @ 16.07 hrs, Volume= 0.741 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 1R: POA-01



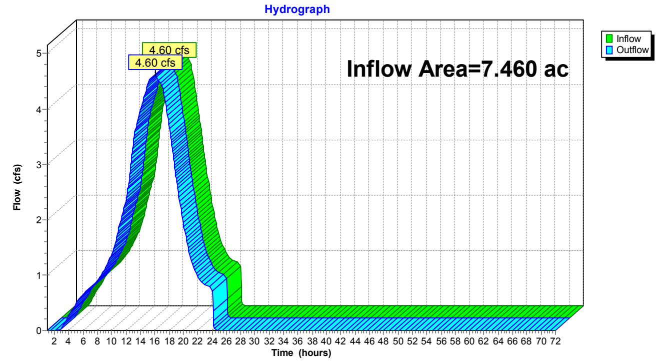
Summary for Reach 2R: POA-02

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 7.460 ac, 0.00% Impervious, Inflow Depth = 5.66" for 100-Yr HUFF event
Inflow = 4.60 cfs @ 16.10 hrs, Volume= 3.521 af
Outflow = 4.60 cfs @ 16.10 hrs, Volume= 3.521 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 2R: POA-02



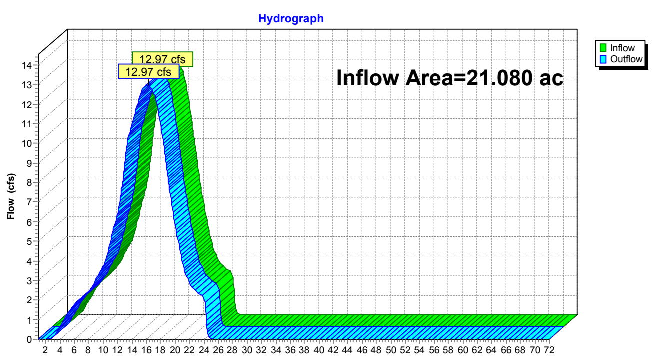
Summary for Reach 3R: POA-03

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 21.080 ac, 1.71% Impervious, Inflow Depth = 5.66" for 100-Yr HUFF event
Inflow = 12.97 cfs @ 16.23 hrs, Volume= 9.951 af
Outflow = 12.97 cfs @ 16.23 hrs, Volume= 9.951 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 3R: POA-03



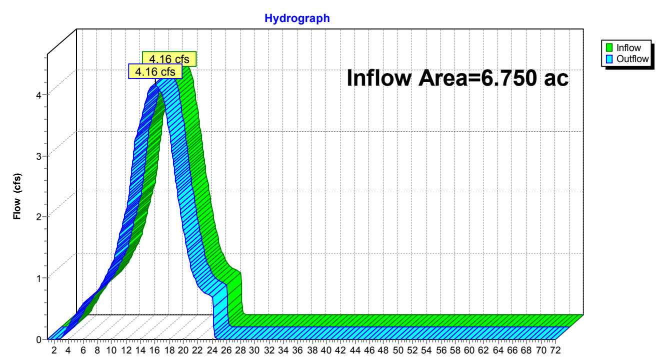
Summary for Reach 4R: POA-04

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.750 ac, 0.00% Impervious, Inflow Depth = 5.66" for 100-Yr HUFF event
Inflow = 4.16 cfs @ 16.14 hrs, Volume= 3.186 af
Outflow = 4.16 cfs @ 16.14 hrs, Volume= 3.186 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 4R: POA-04



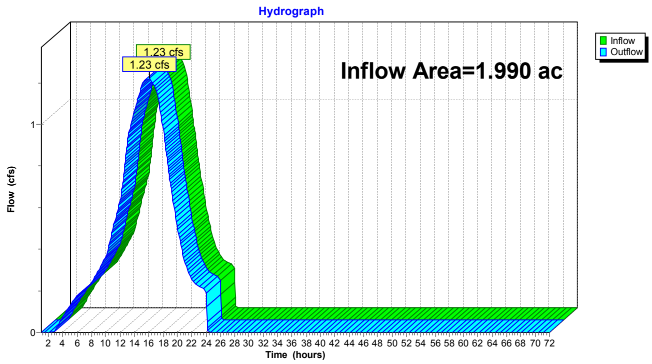
Summary for Reach 5R: POA-05

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.990 ac, 0.00% Impervious, Inflow Depth = 5.66" for 100-Yr HUFF event
Inflow = 1.23 cfs @ 16.08 hrs, Volume= 0.939 af
Outflow = 1.23 cfs @ 16.08 hrs, Volume= 0.939 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 5R: POA-05



Summary for Reach 6R: POA-06

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.890 ac, 0.00% Impervious, Inflow Depth = 5.66" for 100-Yr HUFF event
Inflow = 4.24 cfs @ 16.15 hrs, Volume= 3.252 af
Outflow = 4.24 cfs @ 16.15 hrs, Volume= 3.252 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 6R: POA-06

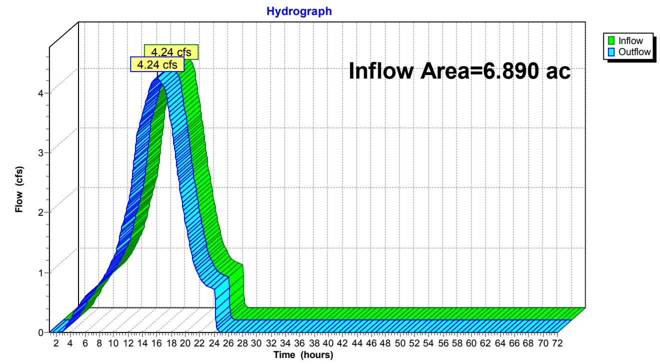
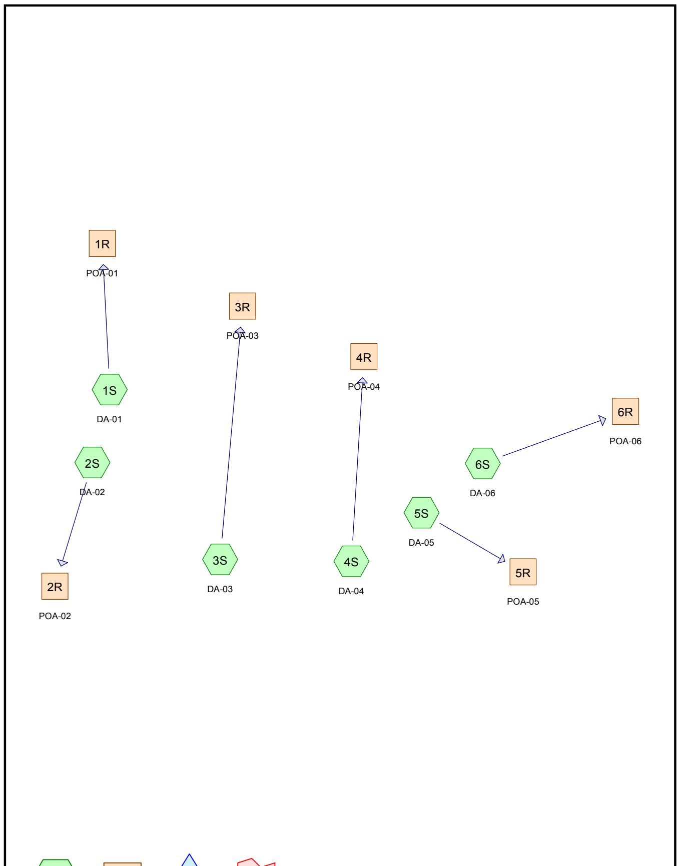


Exhibit 8 – Post-Development HydroCAD Model



Routing Diagram for North Duncan Road Post-HydroCAD
Prepared by Kimley-Horn & Associates, Printed 8/29/2025
HydroCAD® 10.20-5c s/n 02344 © 2023 HydroCAD Software Solutions LLC

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Yr HUFF	Huff B75 0-10sm	3Q	Scale	24.00	1	3.12	2
2	10-Yr HUFF	Huff B75 0-10sm	3Q	Scale	24.00	1	4.71	2
3	100-Yr HUFF	Huff B75 0-10sm	3Q	Scale	24.00	1	7.43	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
10.200	98	IMPERVIOUS TYPE C (1S, 2S, 3S, 4S, 5S, 6S)
35.280	71	MEADOW TYPE C (1S, 2S, 3S, 4S, 5S, 6S)
0.260	98	WETLAND TYPE C (3S)
45.740	**77**	**TOTAL AREA**

Time span=1.00-72.00 hrs, dt=0.05 hrs, 1421 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: DA-01 Runoff Area=1.570 ac 16.56% Impervious Runoff Depth=1.04"
Flow Length=325' Tc=13.3 min CN=75 Runoff=0.23 cfs 0.136 af

Subcatchment 2S: DA-02 Runoff Area=7.460 ac 19.97% Impervious Runoff Depth=1.10"
Flow Length=622' Tc=16.9 min CN=76 Runoff=1.13 cfs 0.682 af

Subcatchment 3S: DA-03 Runoff Area=21.080 ac 24.29% Impervious Runoff Depth=1.22"
Flow Length=1,168' Tc=32.4 min CN=78 Runoff=3.44 cfs 2.134 af

Subcatchment 4S: DA-04 Runoff Area=6.750 ac 21.78% Impervious Runoff Depth=1.15"
Flow Length=776' Tc=21.5 min CN=77 Runoff=1.06 cfs 0.650 af

Subcatchment 5S: DA-05 Runoff Area=1.990 ac 21.11% Impervious Runoff Depth=1.15"
Flow Length=404' Tc=13.6 min CN=77 Runoff=0.31 cfs 0.192 af

Subcatchment 6S: DA-06 Runoff Area=6.890 ac 24.67% Impervious Runoff Depth=1.22"
Flow Length=811' Tc=22.7 min CN=78 Runoff=1.12 cfs 0.698 af

Reach 1R: POA-01 Inflow=0.23 cfs 0.136 af
Outflow=0.23 cfs 0.136 af

Reach 2R: POA-02 Inflow=1.13 cfs 0.682 af
Outflow=1.13 cfs 0.682 af

Reach 3R: POA-03 Inflow=3.44 cfs 2.134 af
Outflow=3.44 cfs 2.134 af

Reach 4R: POA-04 Inflow=1.06 cfs 0.650 af
Outflow=1.06 cfs 0.650 af

Reach 5R: POA-05 Inflow=0.31 cfs 0.192 af
Outflow=0.31 cfs 0.192 af

Reach 6R: POA-06 Inflow=1.12 cfs 0.698 af
Outflow=1.12 cfs 0.698 af

Total Runoff Area = 45.740 ac Runoff Volume = 4.491 af Average Runoff Depth = 1.18"
77.13% Pervious = 35.280 ac 22.87% Impervious = 10.460 ac

Summary for Subcatchment 1S: DA-01

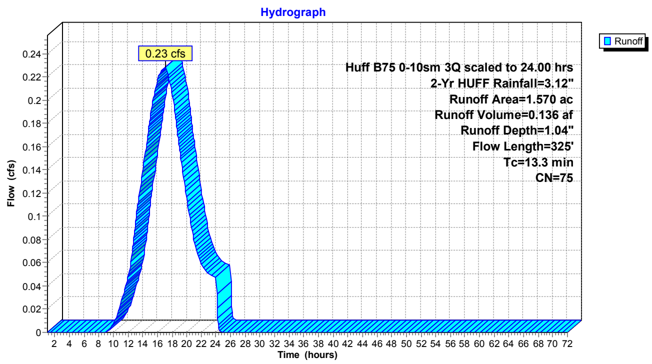
Runoff = 0.23 cfs @ 17.11 hrs, Volume= 0.136 af, Depth= 1.04"
Routed to Reach 1R : POA-01

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 2-Yr HUFF Rainfall=3.12"

	Area (ac)	CN	Description
*	1.310	71	MEADOW TYPE C
*	0.260	98	IMPERVIOUS TYPE C
	1.570	75	Weighted Average
	1.310		83.44% Pervious Area
	0.260		16.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	100	0.0198	0.17		**Sheet Flow, MEADOW** Grass: Short n= 0.150 P2= 3.12"
3.3	225	0.0269	1.15		**Shallow Concentrated Flow, MEADOW** Short Grass Pasture Kv= 7.0 fps
13.3	325	Total			

Subcatchment 1S: DA-01



Summary for Subcatchment 2S: DA-02

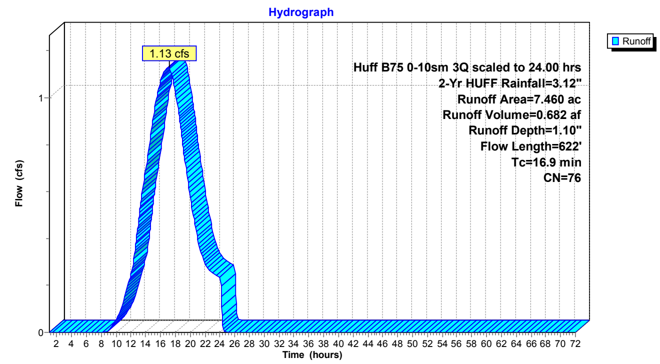
Runoff = 1.13 cfs @ 17.13 hrs, Volume= 0.682 af, Depth= 1.10"
Routed to Reach 2R : POA-02

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 2-Yr HUFF Rainfall=3.12"

	Area (ac)	CN	Description
*	5.970	71	MEADOW TYPE C
*	1.490	98	IMPERVIOUS TYPE C
	7.460	76	Weighted Average
	5.970		80.03% Pervious Area
	1.490		19.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	100	0.0157	0.15		**Sheet Flow, MEADOW** Grass: Short n= 0.150 P2= 3.12"
6.0	522	0.0424	1.44		**Shallow Concentrated Flow, MEADOW** Short Grass Pasture Kv= 7.0 fps
16.9	622	Total			

Subcatchment 2S: DA-02



Summary for Subcatchment 3S: DA-03

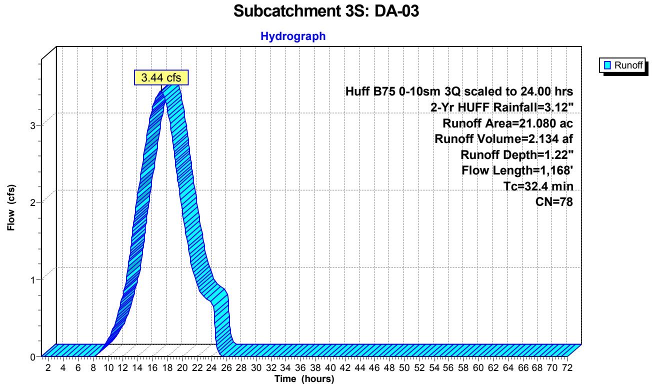
Runoff = 3.44 cfs @ 17.24 hrs, Volume= 2.134 af, Depth= 1.22"
Routed to Reach 3R : POA-03

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 2-Yr HUFF Rainfall=3.12"

	Area (ac)	CN	Description
*	15.960	71	MEADOW TYPE C
*	0.260	98	WETLAND TYPE C
*	4.860	98	IMPERVIOUS TYPE C
	21.080	78	Weighted Average
	15.960		75.71% Pervious Area
	5.120		24.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	100	0.0274	0.19		**Sheet Flow, MEADOW** Grass: Short n= 0.150 P2= 3.12"
23.7	1,068	0.0115	0.75		**Shallow Concentrated Flow, MEADOW** Short Grass Pasture Kv= 7.0 fps
32.4	1,168	Total			

Subcatchment 3S: DA-03



Summary for Subcatchment 4S: DA-04

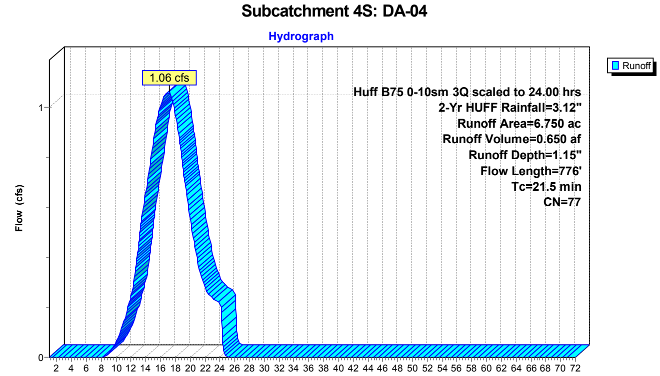
Runoff = 1.06 cfs @ 17.15 hrs, Volume= 0.650 af, Depth= 1.15"
Routed to Reach 4R : POA-04

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 2-Yr HUFF Rainfall=3.12"

	Area (ac)	CN	Description
*	5.280	71	MEADOW TYPE C
*	1.470	98	IMPERVIOUS TYPE C
	6.750	77	Weighted Average
	5.280		78.22% Pervious Area
	1.470		21.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.9	100	0.0199	0.17		**Sheet Flow, MEADOW** Grass: Short n= 0.150 P2= 3.12"
10.6	610	0.0188	0.96		**Shallow Concentrated Flow, MEADOW** Short Grass Pasture Kv= 7.0 fps
0.1	16	0.0154	2.52		**Shallow Concentrated Flow, IMPERVIOUS** Paved Kv= 20.3 fps
0.9	50	0.0166	0.90		**Shallow Concentrated Flow, MEADOW** Short Grass Pasture Kv= 7.0 fps
21.5	776	Total			

Subcatchment 4S: DA-04



Summary for Subcatchment 5S: DA-05

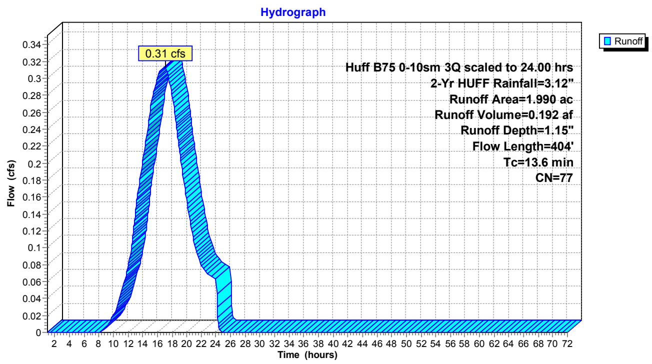
Runoff = 0.31 cfs @ 17.08 hrs, Volume= 0.192 af, Depth= 1.15"
Routed to Reach 5R : POA-05

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 2-Yr HUFF Rainfall=3.12"

	Area (ac)	CN	Description
*	1.570	71	MEADOW TYPE C
*	0.420	98	IMPERVIOUS TYPE C
	1.990	77	Weighted Average
	1.570		78.89% Pervious Area
	0.420		21.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	100	0.0243	0.18		**Sheet Flow, MEADOW** Grass: Short n= 0.150 P2= 3.12"
4.4	304	0.0269	1.15		**Shallow Concentrated Flow, MEADOW** Short Grass Pasture Kv= 7.0 fps
13.6	404	Total			

Subcatchment 5S: DA-05



Summary for Subcatchment 6S: DA-06

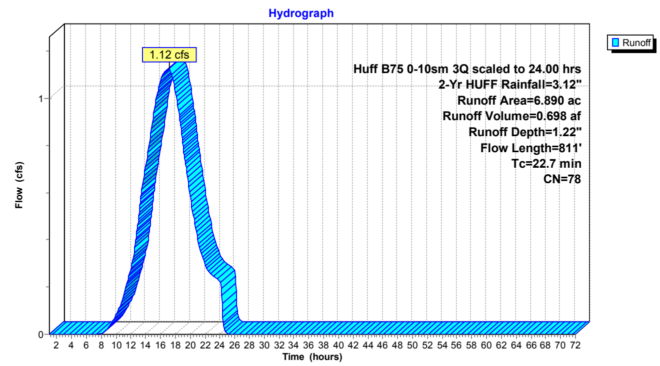
Runoff = 1.12 cfs @ 17.14 hrs, Volume= 0.698 af, Depth= 1.22"
Routed to Reach 6R : POA-06

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 2-Yr HUFF Rainfall=3.12"

	Area (ac)	CN	Description
*	5.190	71	MEADOW TYPE C
*	1.700	98	IMPERVIOUS TYPE C
	6.890	78	Weighted Average
	5.190		75.33% Pervious Area
	1.700		24.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	100	0.0150	0.15		**Sheet Flow, MEADOW** Grass: Short n= 0.150 P2= 3.12"
10.2	623	0.0212	1.02		**Shallow Concentrated Flow, MEADOW** Short Grass Pasture Kv= 7.0 fps
0.1	22	0.0170	2.65		**Shallow Concentrated Flow, IMPERVIOUS** Paved Kv= 20.3 fps
1.3	66	0.0151	0.86		**Shallow Concentrated Flow, MEADOW** Short Grass Pasture Kv= 7.0 fps
22.7	811	Total			

Subcatchment 6S: DA-06



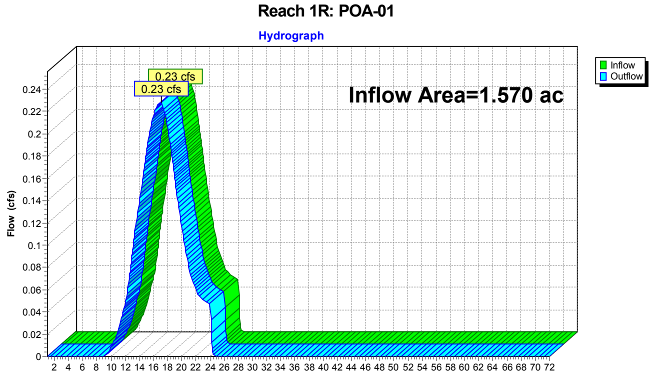
Summary for Reach 1R: POA-01

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.570 ac, 16.56% Impervious, Inflow Depth = 1.04" for 2-Yr HUFF event
Inflow = 0.23 cfs @ 17.11 hrs, Volume= 0.136 af
Outflow = 0.23 cfs @ 17.11 hrs, Volume= 0.136 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 1R: POA-01



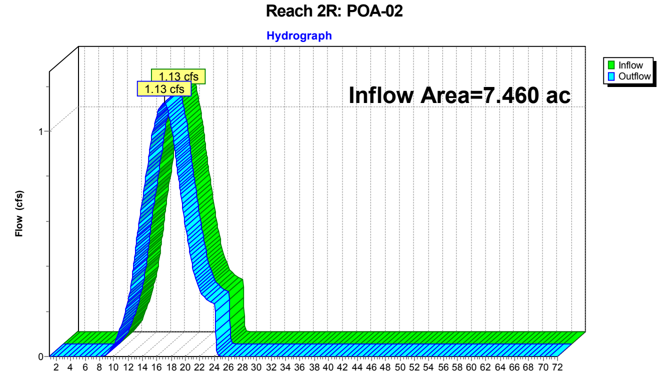
Summary for Reach 2R: POA-02

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 7.460 ac, 19.97% Impervious, Inflow Depth = 1.10" for 2-Yr HUFF event
Inflow = 1.13 cfs @ 17.13 hrs, Volume= 0.682 af
Outflow = 1.13 cfs @ 17.13 hrs, Volume= 0.682 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 2R: POA-02



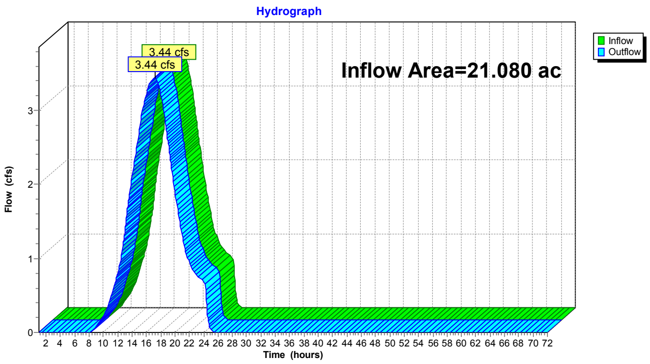
Summary for Reach 3R: POA-03

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 21.080 ac, 24.29% Impervious, Inflow Depth = 1.22" for 2-Yr HUFF event
Inflow = 3.44 cfs @ 17.24 hrs, Volume= 2.134 af
Outflow = 3.44 cfs @ 17.24 hrs, Volume= 2.134 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 3R: POA-03



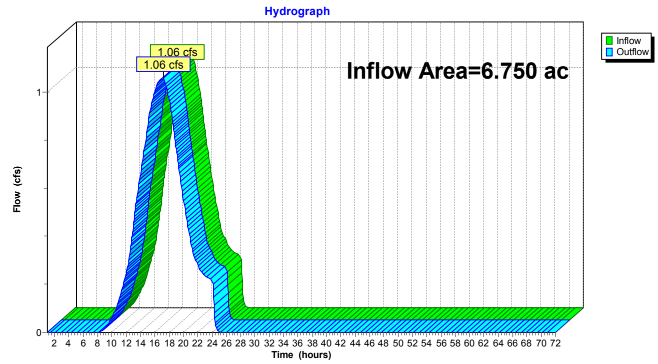
Summary for Reach 4R: POA-04

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.750 ac, 21.78% Impervious, Inflow Depth = 1.15" for 2-Yr HUFF event
Inflow = 1.06 cfs @ 17.15 hrs, Volume= 0.650 af
Outflow = 1.06 cfs @ 17.15 hrs, Volume= 0.650 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 4R: POA-04



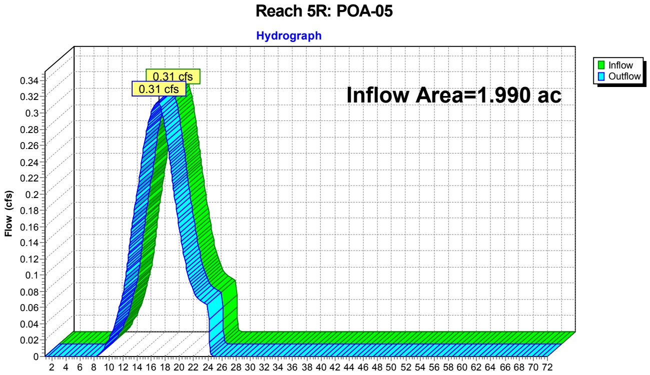
Summary for Reach 5R: POA-05

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.990 ac, 21.11% Impervious, Inflow Depth = 1.15" for 2-Yr HUFF event
Inflow = 0.31 cfs @ 17.08 hrs, Volume= 0.192 af
Outflow = 0.31 cfs @ 17.08 hrs, Volume= 0.192 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 5R: POA-05



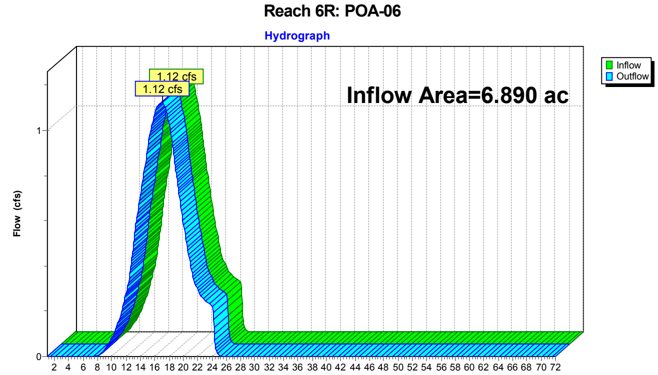
Summary for Reach 6R: POA-06

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.890 ac, 24.67% Impervious, Inflow Depth = 1.22" for 2-Yr HUFF event
Inflow = 1.12 cfs @ 17.14 hrs, Volume= 0.698 af
Outflow = 1.12 cfs @ 17.14 hrs, Volume= 0.698 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 6R: POA-06



Time span=1.00-72.00 hrs, dt=0.05 hrs, 1421 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: DA-01	Runoff Area=1.570 ac 16.56% Impervious Runoff Depth=2.22" Flow Length=325' Tc=13.3 min CN=75 Runoff=0.44 cfs 0.290 af
Subcatchment 2S: DA-02	Runoff Area=7.460 ac 19.97% Impervious Runoff Depth=2.30" Flow Length=622' Tc=16.9 min CN=76 Runoff=2.17 cfs 1.429 af
Subcatchment 3S: DA-03	Runoff Area=21.080 ac 24.29% Impervious Runoff Depth=2.47" Flow Length=1,168' Tc=32.4 min CN=78 Runoff=6.44 cfs 4.334 af
Subcatchment 4S: DA-04	Runoff Area=6.750 ac 21.78% Impervious Runoff Depth=2.38" Flow Length=776' Tc=21.5 min CN=77 Runoff=2.01 cfs 1.340 af
Subcatchment 5S: DA-05	Runoff Area=1.990 ac 21.11% Impervious Runoff Depth=2.38" Flow Length=404' Tc=13.6 min CN=77 Runoff=0.59 cfs 0.395 af
Subcatchment 6S: DA-06	Runoff Area=6.890 ac 24.67% Impervious Runoff Depth=2.47" Flow Length=811' Tc=22.7 min CN=78 Runoff=2.11 cfs 1.417 af
Reach 1R: POA-01	Inflow=0.44 cfs 0.290 af Outflow=0.44 cfs 0.290 af
Reach 2R: POA-02	Inflow=2.17 cfs 1.429 af Outflow=2.17 cfs 1.429 af
Reach 3R: POA-03	Inflow=6.44 cfs 4.334 af Outflow=6.44 cfs 4.334 af
Reach 4R: POA-04	Inflow=2.01 cfs 1.340 af Outflow=2.01 cfs 1.340 af
Reach 5R: POA-05	Inflow=0.59 cfs 0.395 af Outflow=0.59 cfs 0.395 af
Reach 6R: POA-06	Inflow=2.11 cfs 1.417 af Outflow=2.11 cfs 1.417 af

Total Runoff Area = 45.740 ac Runoff Volume = 9.205 af Average Runoff Depth = 2.41"
77.13% Pervious = 35.280 ac 22.87% Impervious = 10.460 ac

Summary for Subcatchment 1S: DA-01

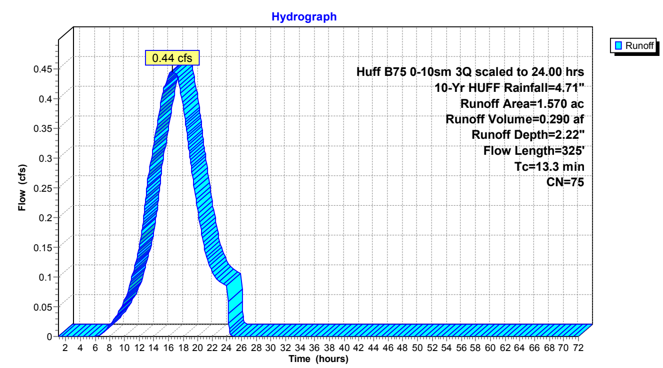
Runoff = 0.44 cfs @ 16.54 hrs, Volume= 0.290 af, Depth= 2.22"
Routed to Reach 1R : POA-01

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 10-Yr HUFF Rainfall=4.71"

	Area (ac)	CN	Description
*	1.310	71	MEADOW TYPE C
*	0.260	98	IMPERVIOUS TYPE C
	1.570	75	Weighted Average
	1.310		83.44% Pervious Area
	0.260		16.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	100	0.0198	0.17		**Sheet Flow, MEADOW** Grass: Short n= 0.150 P2= 3.12"
3.3	225	0.0269	1.15		**Shallow Concentrated Flow, MEADOW** Short Grass Pasture Kv= 7.0 fps
13.3	325	Total			

Subcatchment 1S: DA-01



Summary for Subcatchment 2S: DA-02

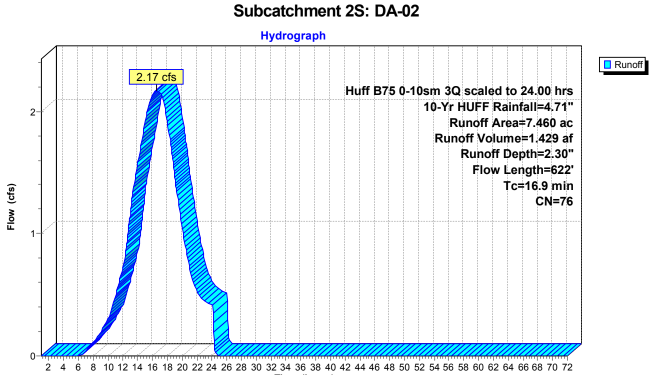
Runoff = 2.17 cfs @ 16.47 hrs, Volume= 1.429 af, Depth= 2.30"
Routed to Reach 2R : POA-02

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 10-Yr HUFF Rainfall=4.71"

	Area (ac)	CN	Description
*	5.970	71	MEADOW TYPE C
*	1.490	98	IMPERVIOUS TYPE C
	7.460	76	Weighted Average
	5.970		80.03% Pervious Area
	1.490		19.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	100	0.0157	0.15		**Sheet Flow, MEADOW** Grass: Short n= 0.150 P2= 3.12"
6.0	522	0.0424	1.44		**Shallow Concentrated Flow, MEADOW** Short Grass Pasture Kv= 7.0 fps
16.9	622	Total			

Subcatchment 2S: DA-02



Summary for Subcatchment 3S: DA-03

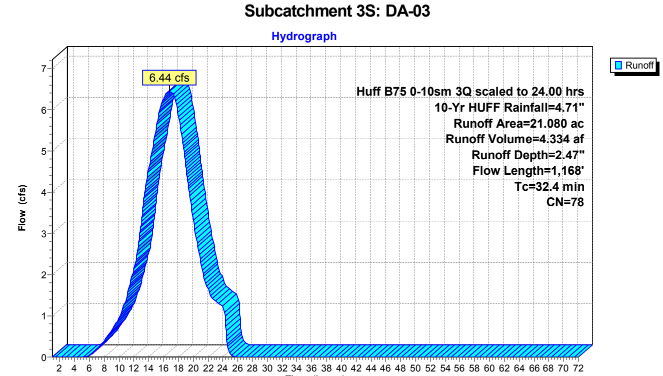
Runoff = 6.44 cfs @ 16.76 hrs, Volume= 4.334 af, Depth= 2.47"
Routed to Reach 3R : POA-03

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 10-Yr HUFF Rainfall=4.71"

	Area (ac)	CN	Description
*	15.960	71	MEADOW TYPE C
*	0.260	98	WETLAND TYPE C
*	4.860	98	IMPERVIOUS TYPE C
	21.080	78	Weighted Average
	15.960		75.71% Pervious Area
	5.120		24.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	100	0.0274	0.19		**Sheet Flow, MEADOW** Grass: Short n= 0.150 P2= 3.12"
23.7	1,068	0.0115	0.75		**Shallow Concentrated Flow, MEADOW** Short Grass Pasture Kv= 7.0 fps
32.4	1,168	Total			

Subcatchment 3S: DA-03



Summary for Subcatchment 4S: DA-04

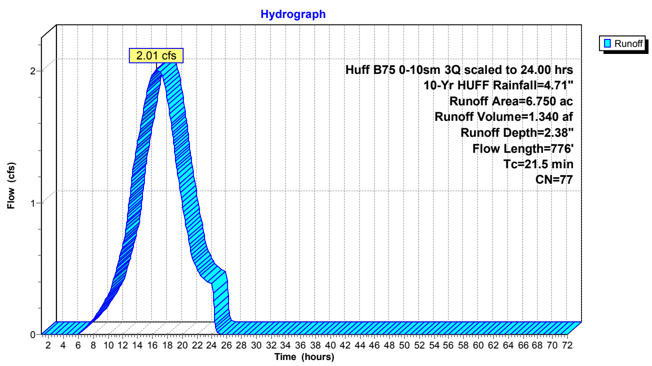
Runoff = 2.01 cfs @ 16.55 hrs, Volume= 1.340 af, Depth= 2.38"
Routed to Reach 4R : POA-04

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 10-Yr HUFF Rainfall=4.71"

	Area (ac)	CN	Description
*	5.280	71	MEADOW TYPE C
*	1.470	98	IMPERVIOUS TYPE C
	6.750	77	Weighted Average
	5.280		78.22% Pervious Area
	1.470		21.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.9	100	0.0199	0.17		**Sheet Flow, MEADOW** Grass: Short n= 0.150 P2= 3.12"
10.6	610	0.0188	0.96		**Shallow Concentrated Flow, MEADOW** Short Grass Pasture Kv= 7.0 fps
0.1	16	0.0154	2.52		**Shallow Concentrated Flow, IMPERVIOUS** Paved Kv= 20.3 fps
0.9	50	0.0166	0.90		**Shallow Concentrated Flow, MEADOW** Short Grass Pasture Kv= 7.0 fps
21.5	776	Total			

Subcatchment 4S: DA-04



Summary for Subcatchment 5S: DA-05

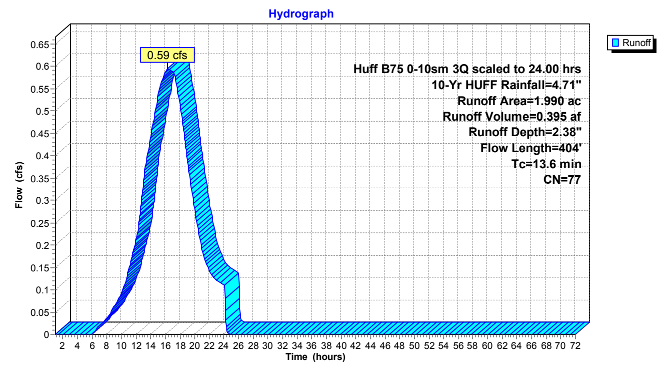
Runoff = 0.59 cfs @ 16.36 hrs, Volume= 0.395 af, Depth= 2.38"
Routed to Reach 5R : POA-05

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 10-Yr HUFF Rainfall=4.71"

	Area (ac)	CN	Description
*	1.570	71	MEADOW TYPE C
*	0.420	98	IMPERVIOUS TYPE C
	1.990	77	Weighted Average
	1.570		78.89% Pervious Area
	0.420		21.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	100	0.0243	0.18		**Sheet Flow, MEADOW** Grass: Short n= 0.150 P2= 3.12"
4.4	304	0.0269	1.15		**Shallow Concentrated Flow, MEADOW** Short Grass Pasture Kv= 7.0 fps
13.6	404	Total			

Subcatchment 5S: DA-05



Summary for Subcatchment 6S: DA-06

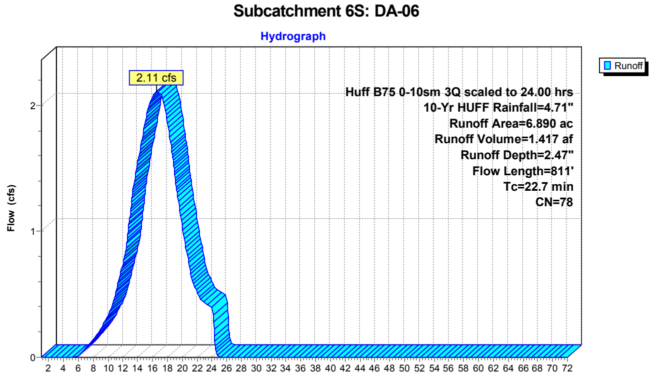
Runoff = 2.11 cfs @ 16.52 hrs, Volume= 1.417 af, Depth= 2.47"
Routed to Reach 6R : POA-06

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 10-Yr HUFF Rainfall=4.71"

	Area (ac)	CN	Description
*	5.190	71	MEADOW TYPE C
*	1.700	98	IMPERVIOUS TYPE C
	6.890	78	Weighted Average
	5.190		75.33% Pervious Area
	1.700		24.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	100	0.0150	0.15		**Sheet Flow, MEADOW** Grass: Short n= 0.150 P2= 3.12"
10.2	623	0.0212	1.02		**Shallow Concentrated Flow, MEADOW** Short Grass Pasture Kv= 7.0 fps
0.1	22	0.0170	2.65		**Shallow Concentrated Flow, IMPERVIOUS** Paved Kv= 20.3 fps
1.3	66	0.0151	0.86		**Shallow Concentrated Flow, MEADOW** Short Grass Pasture Kv= 7.0 fps
22.7	811	Total			

Subcatchment 6S: DA-06



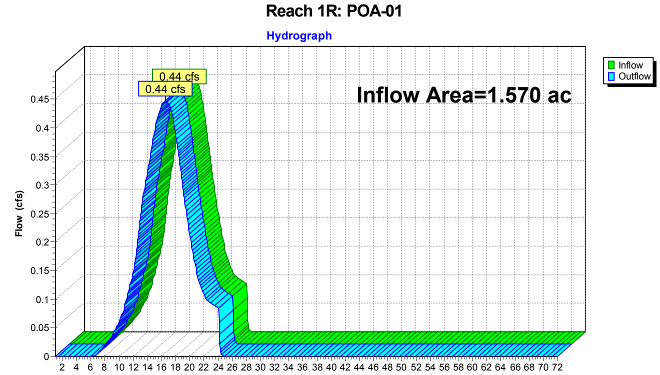
Summary for Reach 1R: POA-01

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.570 ac, 16.56% Impervious, Inflow Depth = 2.22" for 10-Yr HUFF event
Inflow = 0.44 cfs @ 16.54 hrs, Volume= 0.290 af
Outflow = 0.44 cfs @ 16.54 hrs, Volume= 0.290 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 1R: POA-01



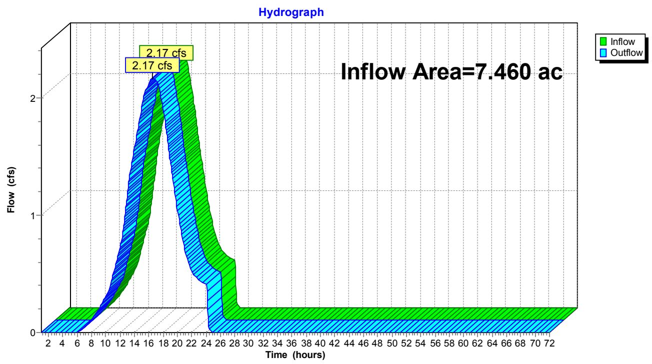
Summary for Reach 2R: POA-02

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 7.460 ac, 19.97% Impervious, Inflow Depth = 2.30" for 10-Yr HUFF event
Inflow = 2.17 cfs @ 16.47 hrs, Volume= 1.429 af
Outflow = 2.17 cfs @ 16.47 hrs, Volume= 1.429 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 2R: POA-02



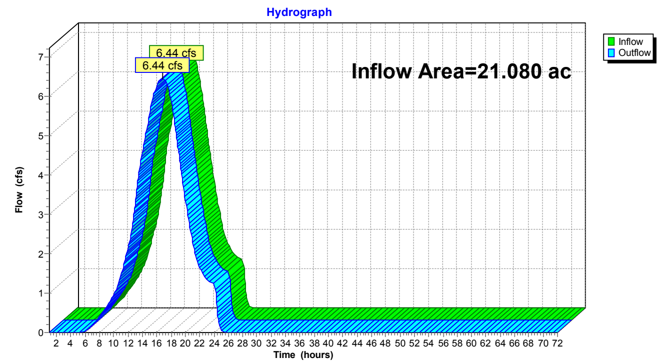
Summary for Reach 3R: POA-03

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 21.080 ac, 24.29% Impervious, Inflow Depth = 2.47" for 10-Yr HUFF event
Inflow = 6.44 cfs @ 16.76 hrs, Volume= 4.334 af
Outflow = 6.44 cfs @ 16.76 hrs, Volume= 4.334 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 3R: POA-03



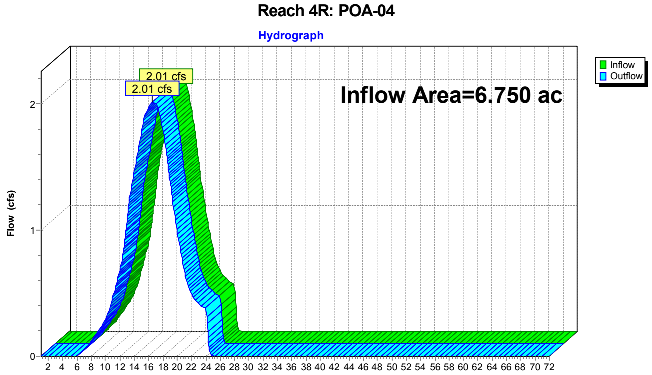
Summary for Reach 4R: POA-04

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.750 ac, 21.78% Impervious, Inflow Depth = 2.38" for 10-Yr HUFF event
Inflow = 2.01 cfs @ 16.55 hrs, Volume= 1.340 af
Outflow = 2.01 cfs @ 16.55 hrs, Volume= 1.340 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 4R: POA-04



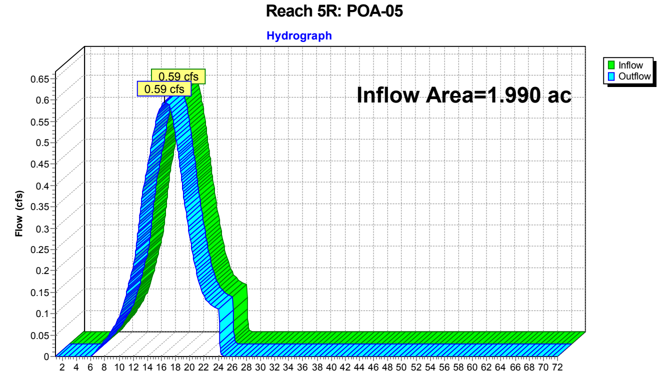
Summary for Reach 5R: POA-05

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.990 ac, 21.11% Impervious, Inflow Depth = 2.38" for 10-Yr HUFF event
Inflow = 0.59 cfs @ 16.36 hrs, Volume= 0.395 af
Outflow = 0.59 cfs @ 16.36 hrs, Volume= 0.395 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 5R: POA-05



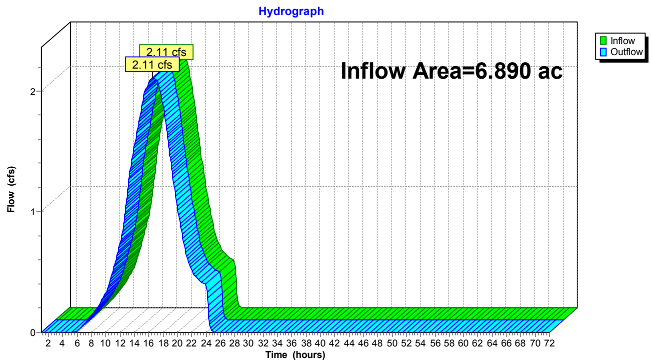
Summary for Reach 6R: POA-06

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.890 ac, 24.67% Impervious, Inflow Depth = 2.47" for 10-Yr HUFF event
Inflow = 2.11 cfs @ 16.52 hrs, Volume= 1.417 af
Outflow = 2.11 cfs @ 16.52 hrs, Volume= 1.417 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 6R: POA-06



Time span=1.00-72.00 hrs, dt=0.05 hrs, 1421 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: DA-01	Runoff Area=1.570 ac 16.56% Impervious Runoff Depth=4.53" Flow Length=325' Tc=13.3 min CN=75 Runoff=0.84 cfs 0.593 af
Subcatchment 2S: DA-02	Runoff Area=7.460 ac 19.97% Impervious Runoff Depth=4.64" Flow Length=622' Tc=16.9 min CN=76 Runoff=4.08 cfs 2.886 af
Subcatchment 3S: DA-03	Runoff Area=21.080 ac 24.29% Impervious Runoff Depth=4.87" Flow Length=1,168' Tc=32.4 min CN=78 Runoff=11.85 cfs 8.549 af
Subcatchment 4S: DA-04	Runoff Area=6.750 ac 21.78% Impervious Runoff Depth=4.75" Flow Length=776' Tc=21.5 min CN=77 Runoff=3.75 cfs 2.674 af
Subcatchment 5S: DA-05	Runoff Area=1.990 ac 21.11% Impervious Runoff Depth=4.75" Flow Length=404' Tc=13.6 min CN=77 Runoff=1.11 cfs 0.788 af
Subcatchment 6S: DA-06	Runoff Area=6.890 ac 24.67% Impervious Runoff Depth=4.87" Flow Length=811' Tc=22.7 min CN=78 Runoff=3.88 cfs 2.794 af
Reach 1R: POA-01	Inflow=0.84 cfs 0.593 af Outflow=0.84 cfs 0.593 af
Reach 2R: POA-02	Inflow=4.08 cfs 2.886 af Outflow=4.08 cfs 2.886 af
Reach 3R: POA-03	Inflow=11.85 cfs 8.549 af Outflow=11.85 cfs 8.549 af
Reach 4R: POA-04	Inflow=3.75 cfs 2.674 af Outflow=3.75 cfs 2.674 af
Reach 5R: POA-05	Inflow=1.11 cfs 0.788 af Outflow=1.11 cfs 0.788 af
Reach 6R: POA-06	Inflow=3.88 cfs 2.794 af Outflow=3.88 cfs 2.794 af

Total Runoff Area = 45.740 ac Runoff Volume = 18.285 af Average Runoff Depth = 4.80"
77.13% Pervious = 35.280 ac 22.87% Impervious = 10.460 ac

Summary for Subcatchment 1S: DA-01

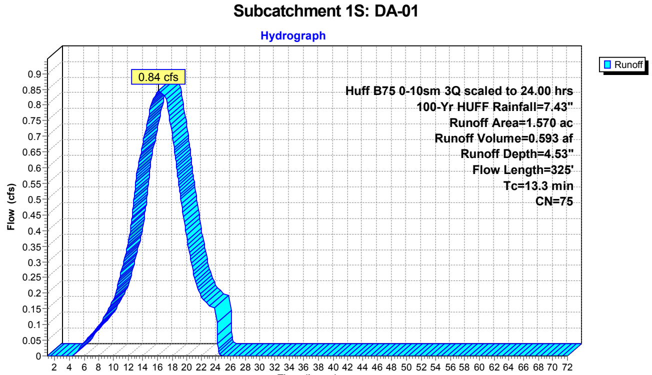
Runoff = 0.84 cfs @ 16.22 hrs, Volume= 0.593 af, Depth= 4.53"
Routed to Reach 1R : POA-01

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 100-Yr HUFF Rainfall=7.43"

	Area (ac)	CN	Description
*	1.310	71	MEADOW TYPE C
*	0.260	98	IMPERVIOUS TYPE C
	1.570	75	Weighted Average
	1.310		83.44% Pervious Area
	0.260		16.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	100	0.0198	0.17		**Sheet Flow, MEADOW** Grass: Short n= 0.150 P2= 3.12"
3.3	225	0.0269	1.15		**Shallow Concentrated Flow, MEADOW** Short Grass Pasture Kv= 7.0 fps
13.3	325	Total			

Subcatchment 1S: DA-01



Summary for Subcatchment 2S: DA-02

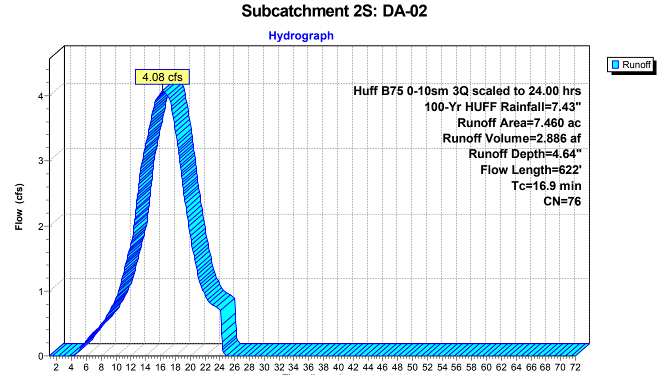
Runoff = 4.08 cfs @ 16.28 hrs, Volume= 2.886 af, Depth= 4.64"
Routed to Reach 2R : POA-02

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 100-Yr HUFF Rainfall=7.43"

	Area (ac)	CN	Description
*	5.970	71	MEADOW TYPE C
*	1.490	98	IMPERVIOUS TYPE C
	7.460	76	Weighted Average
	5.970		80.03% Pervious Area
	1.490		19.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	100	0.0157	0.15		**Sheet Flow, MEADOW** Grass: Short n= 0.150 P2= 3.12"
6.0	522	0.0424	1.44		**Shallow Concentrated Flow, MEADOW** Short Grass Pasture Kv= 7.0 fps
16.9	622	Total			

Subcatchment 2S: DA-02



Summary for Subcatchment 3S: DA-03

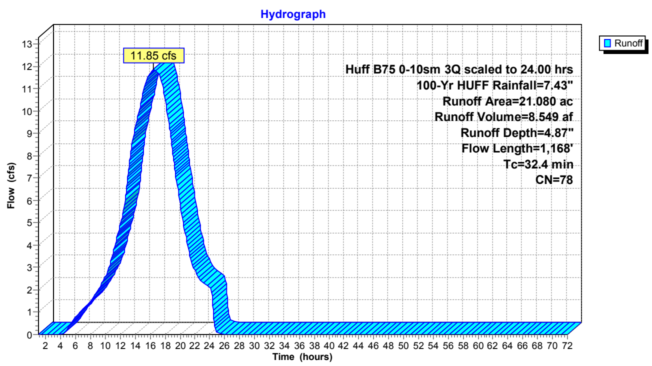
Runoff = 11.85 cfs @ 16.45 hrs, Volume= 8.549 af, Depth= 4.87"
Routed to Reach 3R : POA-03

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 100-Yr HUFF Rainfall=7.43"

	Area (ac)	CN	Description
*	15.960	71	MEADOW TYPE C
*	0.260	98	WETLAND TYPE C
*	4.860	98	IMPERVIOUS TYPE C
	21.080	78	Weighted Average
	15.960		75.71% Pervious Area
	5.120		24.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	100	0.0274	0.19		**Sheet Flow, MEADOW** Grass: Short n= 0.150 P2= 3.12"
23.7	1,068	0.0115	0.75		**Shallow Concentrated Flow, MEADOW** Short Grass Pasture Kv= 7.0 fps
32.4	1,168	Total			

Subcatchment 3S: DA-03



Summary for Subcatchment 4S: DA-04

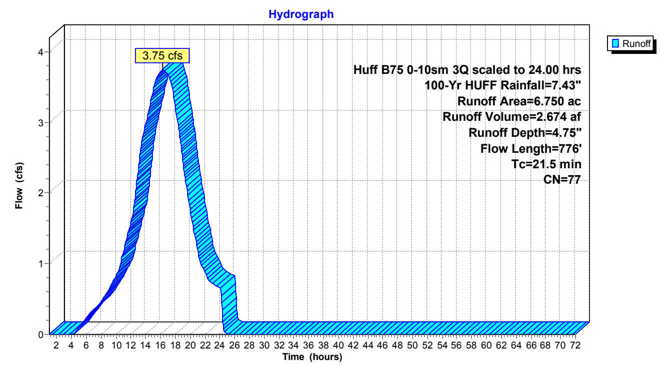
Runoff = 3.75 cfs @ 16.32 hrs, Volume= 2.674 af, Depth= 4.75"
Routed to Reach 4R : POA-04

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 100-Yr HUFF Rainfall=7.43"

	Area (ac)	CN	Description
*	5.280	71	MEADOW TYPE C
*	1.470	98	IMPERVIOUS TYPE C
	6.750	77	Weighted Average
	5.280		78.22% Pervious Area
	1.470		21.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.9	100	0.0199	0.17		**Sheet Flow, MEADOW** Grass: Short n= 0.150 P2= 3.12"
10.6	610	0.0188	0.96		**Shallow Concentrated Flow, MEADOW** Short Grass Pasture Kv= 7.0 fps
0.1	16	0.0154	2.52		**Shallow Concentrated Flow, IMPERVIOUS** Paved Kv= 20.3 fps
0.9	50	0.0166	0.90		**Shallow Concentrated Flow, MEADOW** Short Grass Pasture Kv= 7.0 fps
21.5	776	Total			

Subcatchment 4S: DA-04



Summary for Subcatchment 5S: DA-05

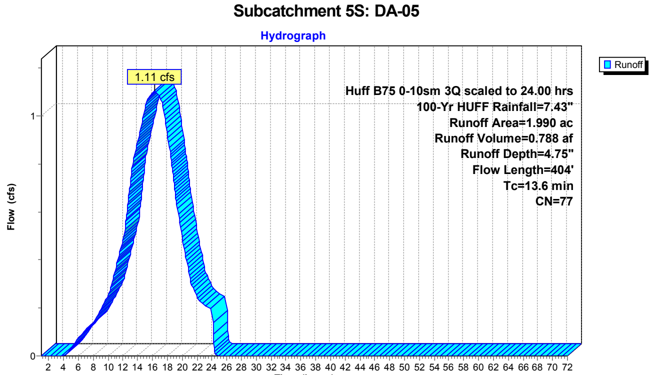
Runoff = 1.11 cfs @ 16.20 hrs, Volume= 0.788 af, Depth= 4.75"
Routed to Reach 5R : POA-05

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 100-Yr HUFF Rainfall=7.43"

	Area (ac)	CN	Description
*	1.570	71	MEADOW TYPE C
*	0.420	98	IMPERVIOUS TYPE C
	1.990	77	Weighted Average
	1.570		78.89% Pervious Area
	0.420		21.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	100	0.0243	0.18		**Sheet Flow, MEADOW** Grass: Short n= 0.150 P2= 3.12"
4.4	304	0.0269	1.15		**Shallow Concentrated Flow, MEADOW** Short Grass Pasture Kv= 7.0 fps
13.6	404	Total			

Subcatchment 5S: DA-05



Summary for Subcatchment 6S: DA-06

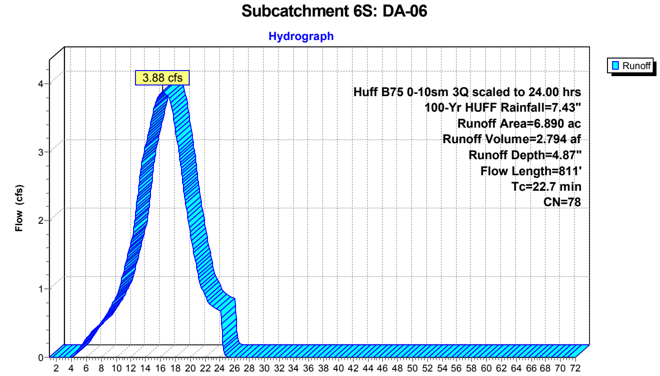
Runoff = 3.88 cfs @ 16.32 hrs, Volume= 2.794 af, Depth= 4.87"
Routed to Reach 6R : POA-06

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs
Huff B75 0-10sm 3Q scaled to 24.00 hrs 100-Yr HUFF Rainfall=7.43"

	Area (ac)	CN	Description
*	5.190	71	MEADOW TYPE C
*	1.700	98	IMPERVIOUS TYPE C
	6.890	78	Weighted Average
	5.190		75.33% Pervious Area
	1.700		24.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	100	0.0150	0.15		**Sheet Flow, MEADOW** Grass: Short n= 0.150 P2= 3.12"
10.2	623	0.0212	1.02		**Shallow Concentrated Flow, MEADOW** Short Grass Pasture Kv= 7.0 fps
0.1	22	0.0170	2.65		**Shallow Concentrated Flow, IMPERVIOUS** Paved Kv= 20.3 fps
1.3	66	0.0151	0.86		**Shallow Concentrated Flow, MEADOW** Short Grass Pasture Kv= 7.0 fps
22.7	811	Total			

Subcatchment 6S: DA-06



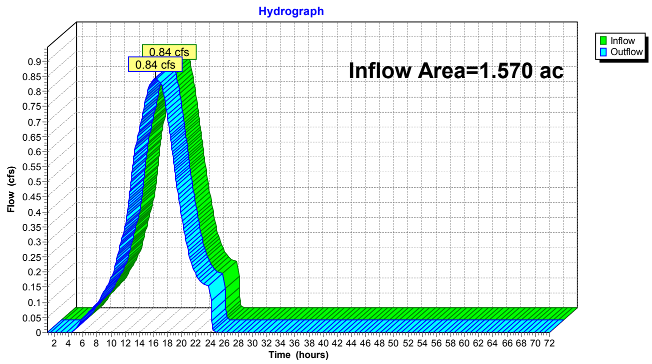
Summary for Reach 1R: POA-01

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.570 ac, 16.56% Impervious, Inflow Depth = 4.53" for 100-Yr HUFF event
Inflow = 0.84 cfs @ 16.22 hrs, Volume= 0.593 af
Outflow = 0.84 cfs @ 16.22 hrs, Volume= 0.593 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 1R: POA-01



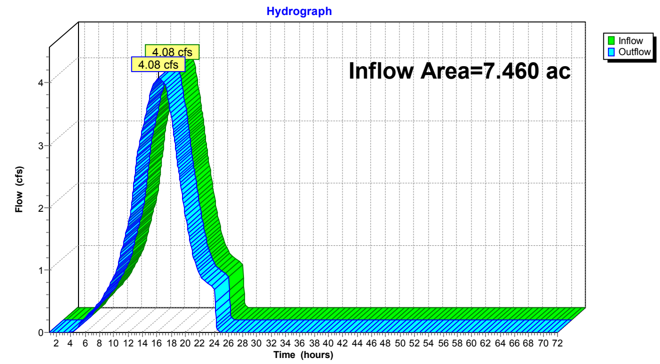
Summary for Reach 2R: POA-02

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 7.460 ac, 19.97% Impervious, Inflow Depth = 4.64" for 100-Yr HUFF event
Inflow = 4.08 cfs @ 16.28 hrs, Volume= 2.886 af
Outflow = 4.08 cfs @ 16.28 hrs, Volume= 2.886 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 2R: POA-02



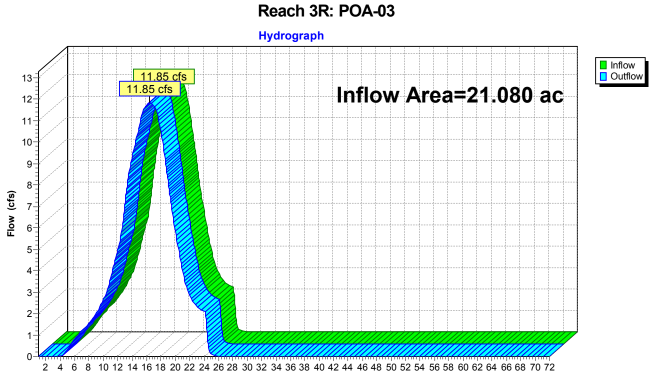
Summary for Reach 3R: POA-03

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 21.080 ac, 24.29% Impervious, Inflow Depth = 4.87" for 100-Yr HUFF event
Inflow = 11.85 cfs @ 16.45 hrs, Volume= 8.549 af
Outflow = 11.85 cfs @ 16.45 hrs, Volume= 8.549 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 3R: POA-03



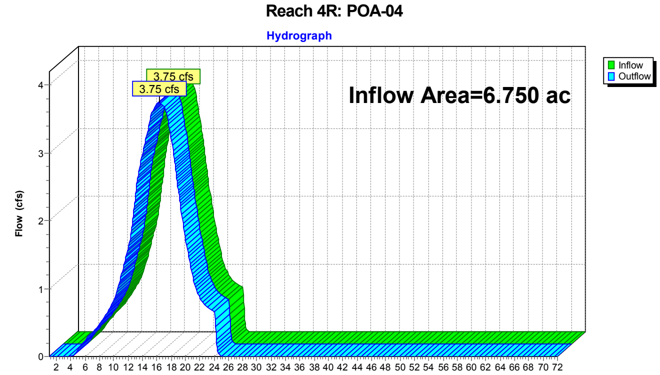
Summary for Reach 4R: POA-04

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.750 ac, 21.78% Impervious, Inflow Depth = 4.75" for 100-Yr HUFF event
Inflow = 3.75 cfs @ 16.32 hrs, Volume= 2.674 af
Outflow = 3.75 cfs @ 16.32 hrs, Volume= 2.674 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 4R: POA-04



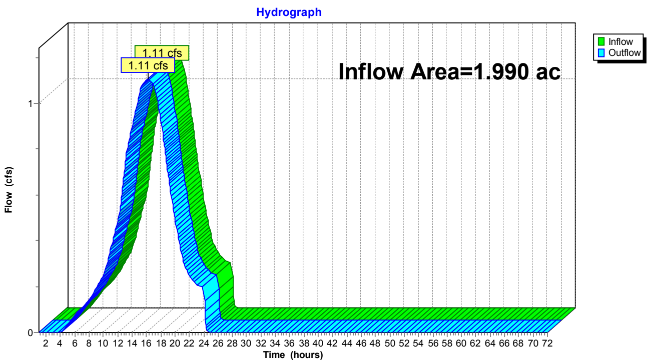
Summary for Reach 5R: POA-05

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	1.990 ac, 21.11% Impervious, Inflow Depth = 4.75"	for 100-Yr HUFF event
Inflow =	1.11 cfs @ 16.20 hrs, Volume=	0.788 af
Outflow =	1.11 cfs @ 16.20 hrs, Volume=	0.788 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 5R: POA-05



Summary for Reach 6R: POA-06

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	6.890 ac, 24.67% Impervious, Inflow Depth = 4.87"	for 100-Yr HUFF event
Inflow =	3.88 cfs @ 16.32 hrs, Volume=	2.794 af
Outflow =	3.88 cfs @ 16.32 hrs, Volume=	2.794 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.05 hrs

Reach 6R: POA-06

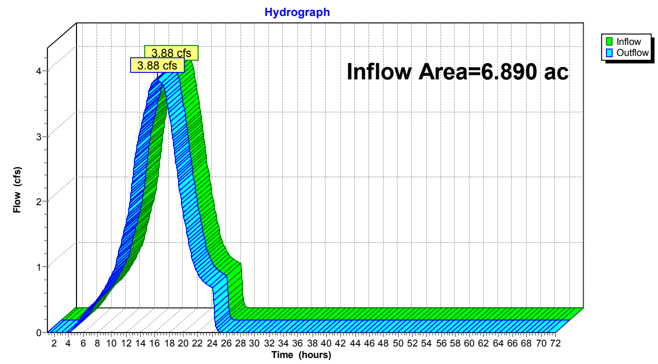


Exhibit 9 – USACE NPR Letter

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, LOUISVILLE DISTRICT
INDIANAPOLIS REGULATORY OFFICE
8902 OTIS AVENUE, SUITE 105B
INDIANAPOLIS, IN 46216

April 22, 2025

Regulatory Division
North Branch
ID No. LRL-2025-00221-DDC

Mr. Zachary Farkes
ReWild Renewables
111 Jackson Blvd, Ste 1320
Chicago, IL 60604

Dear Mr. Farkes:

This is regarding your letter received March 7, 2025, concerning the proposal to initiate the N Duncan Road Solar, LLC Project, with the installation of a 5-megawatt (MW) alternating current (AC) ground-mounted solar system. The solar system will consist of ground mounted solar panels, racking, associated electrical components, with security fencing and interior access roads. The project is located at Latitude: 40.1697°, Longitude: -88.3017°, near Champaign, Champaign County, Illinois. We have reviewed the submitted data relative to Section 404 of the Clean Water Act (CWA).

Based on the information submitted, it does not appear that a Department of the Army permit will be needed since the project referenced above would not involve a discharge of dredged and/or fill material below the Ordinary High-Water elevation of any "waters of the United States (U.S.)" or any wetlands. "Waters of the U.S." include all waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce. This jurisdictional determination is valid for a period of 5 years from the date of this letter unless new information warrants revision of the determination before the expiration date.

The provided information indicates that the proposed project will not result in a placement of dredged or fill material, permanently or temporarily, into any "waters of the United States". Therefore, a Department of the Army permit under Section 404 CWA is not required. If the project would necessitate the discharge of dredged or fill material into "waters of the U.S.," including wetlands, plans should be submitted for our review.

If you have any questions concerning this matter, please contact us by email at David.D.Carr@usace.army.mil, by writing to the above address or by calling 463-317-9923. Any correspondence should reference our assigned Identification Number LRL-2025-00222-DDC.

Sincerely,

Date: 2025.04.22
15:09:38 -04'00'

Sarah J. Keller
Team Leader
Indianapolis Regulatory Office

Copy Furnished: Kimley-Horn and Associates, Inc. (Leet-Otley)

Exhibit 10 - Hydrologic Response of Solar Farms (By Others)

Hydrologic Response of Solar Farms

Lauren M. Cook, S.M.ASCE[1]; and Richard H. McCuen, M.ASCE[2]

Abstract: Because of the benefits of solar energy, the number of solar farms is increasing; however, their hydrologic impacts have not been studied. The goal of this study was to determine the hydrologic effects of solar farms and examine whether or not storm-water management is needed to control runoff volumes and rates. A model of a solar farm was used to simulate runoff for two conditions: the pre- and postpaneled conditions. Using sensitivity analyses, modeling showed that the solar panels themselves did not have a significant effect on the runoff volumes, peaks, or times to peak. However, if the ground cover under the panels is gravel or bare ground, owing to design decisions or lack of maintenance, the peak discharge may increase significantly with storm-water management needed. In addition, the kinetic energy of the flow that drains from the panels was found to be greater than that of the rainfall, which could cause erosion at the base of the panels. Thus, it is recommended that the grass beneath the panels be well maintained or that a buffer strip be placed after the most downgradient row of panels. This study, along with design recommendations, can be used as a guide for the future design of solar farms. **DOI:** 10.1061/(ASCE)HE.1943-5584.0000530. © *2013 American Society of Civil Engineers.*

CE Database subject headings: Hydrology; Land use; Solar power; Floods; Surface water; Runoff; Stormwater management.

Author keywords: Hydrology; Land use change; Solar energy; Flooding; Surface water runoff; Storm-water management.

Introduction

Storm-water management practices are generally implemented to reverse the effects of land-cover changes that cause increases in volumes and rates of runoff. This is a concern posed for new types of land-cover change such as the solar farm. Solar energy is a renewable energy source that is expected to increase in importance in the near future. Because solar farms require considerable land, it is necessary to understand the design of solar farms and their potential effect on erosion rates and storm runoff, especially the impact on offsite properties and receiving streams. These farms can vary in size from 8 ha (20 acres) in residential areas to 250 ha (600 acres) in areas where land is abundant.

The solar panels are impervious to rain water; however, they are mounted on metal rods and placed over pervious land. In some cases, the area below the panel is paved or covered with gravel. Service roads are generally located between rows of panels. Altlhough some panels are stationary, others are designed to move so that the angle of the panel varies with the angle of the sun. The angle can range, depending on the latitude, from 22° during the summer months to 74° during the winter months. In addition, the angle and direction can also change throughout the day. The issue posed is whether or not these rows of impervious panels will change the runoff characteristics of the site, specifically increase runoff volumes or peak discharge rates. If the increases are hydrologically significant, storm-water management facilities may be needed. Additionally, it is possible that the velocity of water draining from the edge of the panels is sufficient to cause erosion of the soil below the panels, especially where the maintenance roadways are bare ground.

The outcome of this study provides guidance for assessing the hydrologic effects of solar farms, which is important to those who plan, design, and install arrays of solar panels. Those who design solar farms may need to provide for storm-water management. This study investigated the hydrologic effects of solar farms, assessed whether or not storm-water management might be needed, and if the velocity of the runoff from the panels could be sufficient to cause erosion of the soil below the panels.

Model Development

Solar farms are generally designed to maximize the amount of energy produced per unit of land area, while still allowing space for maintenance. The hydrologic response of solar farms is not usually considered in design. Typically, the panels will be arrayed in long rows with separations between the rows to allow for maintenance vehicles. To model a typical layout, a unit width of one panel was assumed, with the length of the downgradient strip depending on the size of the farm. For example, a solar farm with 30 rows of 200 panels each could be modeled as a strip of 30 panels with space between the panels for maintenance vehicles. Rainwater that drains from the upper panel onto the ground will flow over the land under the 29 panels on the downgradient strip. Depending on the land cover, infiltration losses would be expected as the runoff flows to the bottom of the slope.

To determine the effects that the solar panels have on runoff characteristics, a model of a solar farm was developed. Runoff in the form of sheet flow without the addition of the solar panels served as the prepaneled condition. The paneled condition assumed a downgradient series of cells with one solar panel per ground cell. Each cell was separated into three sections: wet, dry, and spacer.

The dry section is that portion directly underneath the solar panel, unexposed directly to the rainfall. As the angle of the panel from the horizontal increases, more of the rain will fall directly onto

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Note. This manuscript was submitted on August 12, 2010; approved on October 20, 2011; published online on October 24, 2011. Discussion period open until October 1, 2013; separate discussions must be submitted for individual papers. This paper is part of the ***Journal of Hydrologic Engineering***, Vol. 18, No. 5, May 1, 2013. © ASCE, ISSN 1084-0699/2013/5-536-541/$25.00.

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the ground; this section of the cell is referred to as the wet section. The spacer section is the area between the rows of panels used by maintenance vehicles. Fig. 1 is an image of two solar panels and the spacer section allotted for maintenance vehicles. Fig. 2 is a schematic of the wet, dry, and spacer sections with their respective dimensions. In Fig. 1, tracks from the vehicles are visible on what is modeled within as the spacer section. When the solar panel is horizontal, then the length longitudinal to the direction that runoff will occur is the length of the dry and wet sections combined. Runoff from a dry section drains onto the downgradient spacer section. Runoff from the spacer section flows to the wet section of the next downgradient cell. Water that drains from a solar panel falls directly onto the spacer section of that cell.

The length of the spacer section is constant. During a storm event, the loss rate was assumed constant for the 24-h storm because a wet antecedent condition was assumed. The lengths of the wet and dry sections changed depending on the angle of the solar panel. The total length of the wet and dry sections was set equal to the length of one horizontal solar panel, which was assumed to be 3.5 m. When a solar panel is horizontal, the dry section length would equal 3.5 m and the wet section length would be zero. In the paneled condition, the dry section does not receive direct rainfall because the rain first falls onto the solar panel then drains onto the spacer section. However, the dry section does infiltrate some of the runoff that comes from the upgradient wet section. The wet section was modeled similar to the spacer section with rain falling directly onto the section and assuming a constant loss rate.

For the presolar panel condition, the spacer and wet sections are modeled the same as in the paneled condition; however, the cell does not include a dry section. In the prepaneled condition, rain falls directly onto the entire cell. When modeling the prepaneled condition, all cells receive rainfall at the same rate and are subject to losses. All other conditions were assumed to remain the same such that the prepaneled and paneled conditions can be compared.

Rainfall was modeled after an natural resources conservation service (NRCS) Type II Storm (McCuen 2005) because it is an accurate representation of actual storms of varying characteristics that are imbedded in intensity-duration-frequency (IDF) curves. For each duration of interest, a dimensionless hyetograph was developed using a time increment of 12 s over the duration of the storm (see Fig. 3). The depth of rainfall that corresponds to each storm magnitude was then multiplied by the dimensionless hyetograph. For a 2-h storm duration, depths of 40.6, 76.2, and 101.6 mm were used for the 2-, 25-, and 100-year events. The 2- and 6-h duration hyetographs were developed using the center portion of the 24-h storm, with the rainfall depths established with the Baltimore IDF curve. The corresponding depths for a 6-h duration were 53.3, 106.7, and 132.1 mm, respectively. These magnitudes were chosen to give a range of storm conditions.

During each time increment, the depth of rain is multiplied by the cell area to determine the volume of rain added to each section of each cell. This volume becomes the storage in each cell. Depending on the soil group, a constant volume of losses was subtracted from the storage. The runoff velocity from a solar panel was calculated using Manning's equation, with the hydraulic radius for sheet flow assumed to equal the depth of the storage on the panel (Bedient and Huber 2002). Similar assumptions were made to compute the velocities in each section of the surface sections.

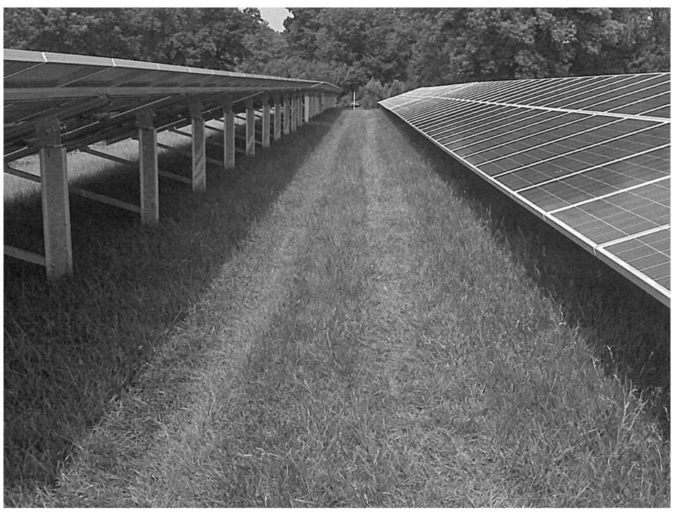

Fig. 1. Maintenance or "spacer" section between two rows of solar panels (photo by John E. Showler, reprinted with permission)

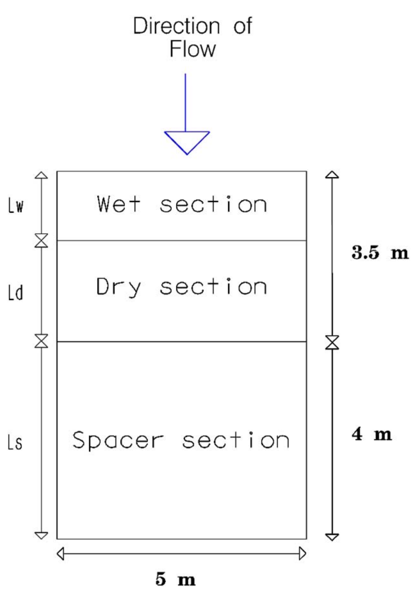

Fig. 2. Wet, dry, and spacer sections of a single cell with lengths *Lw*, *Ls*, and *Ld* with the solar panel covering the dry section

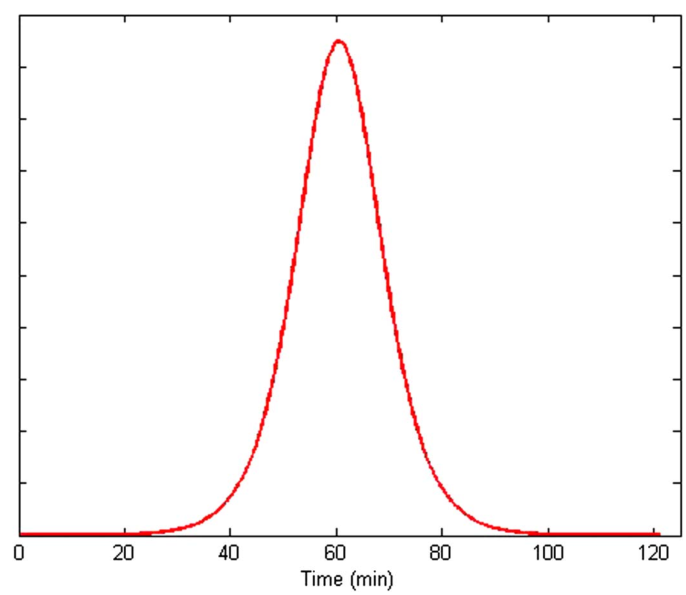

Fig. 3. Dimensionless hyetograph of 2-h Type II storm

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Runoff from one section to the next and then to the next downgradient cell was routed using the continuity of mass. The routing coefficient depended on the depth of flow in storage and the velocity of runoff. Flow was routed from the wet section to the dry section to the spacer section, with flow from the spacer section draining to the wet section of the next cell. Flow from the most downgradient cell was assumed to be the outflow. Discharge rates and volumes from the most downgradient cell were used for comparisons between the prepaneled and paneled conditions.

Alternative Model Scenarios

To assess the effects of the different variables, a section of 30 cells, each with a solar panel, was assumed for the base model. Each cell was separated individually into wet, dry, and spacer sections. The area had a total ground length of 225 m with a ground slope of 1% and width of 5 m, which was the width of an average solar panel. The roughness coefficient (Engman 1986) for the silicon solar panel was assumed to be that of glass, 0.01. Roughness coefficients of 0.15 for grass and 0.02 for bare ground were also assumed. Loss rates of 0.5715 cm/h (0.225 in./h) and 0.254 cm/h (0.1 in./h) for B and C soils, respectively, were assumed.

The prepaneled condition using the 2-h, 25-year rainfall was assumed for the base condition, with each cell assumed to have a good grass cover condition. All other analyses were made assuming a paneled condition. For most scenarios, the runoff volumes and peak discharge rates from the paneled model were not significantly greater than those for the prepaneled condition. Over a total length of 225 m with 30 solar panels, the runoff increased by 0.26 m^3, which was a difference of only 0.35%. The slight increase in runoff volume reflects the slightly higher velocities for the paneled condition. The peak discharge increased by 0.0013 m^3, a change of only 0.31%. The time to peak was delayed by one time increment, i.e., 12 s. Inclusion of the panels did not have a significant hydrologic impact.

Storm Magnitude

The effect of storm magnitude was investigated by changing the magnitude from a 25-year storm to a 2-year storm. For the 2-year storm, the rainfall and runoff volumes decreased by approximately 50%. However, the runoff from the paneled watershed condition increased compared to the prepaneled condition by approximately the same volume as for the 25-year analysis, 0.26 m^3. This increase represents only a 0.78% increase in volume. The peak discharge and the time to peak did not change significantly. These results reflect runoff from a good grass cover condition and indicated that the general conclusion of very minimal impacts was the same for different storm magnitudes.

Ground Slope

The effect of the downgradient ground slope of the solar farm was also examined. The angle of the solar panels would influence the velocity of flows from the panels. As the ground slope was increased, the velocity of flow over the ground surface would be closer to that on the panels. This could cause an overall increase in discharge rates. The ground slope was changed from 1 to 5%, with all other conditions remaining the same as the base conditions.

With the steeper incline, the volume of losses decreased from that for the 1% slope, which is to be expected because the faster velocity of the runoff would provide less opportunity for infiltration. However, between the prepaneled and paneled conditions, the increase in runoff volume was less than 1%. The peak discharge and the time to peak did not change. Therefore, the greater ground slope did not significantly influence the response of the solar farm.

Soil Type

The effect of soil type on the runoff was also examined. The soil group was changed from B soil to C soil by varying the loss rate. As expected, owing to the higher loss rate for the C soil, the depths of runoff increased by approximately 7.5% with the C soil when compared with the volume for B soils. However, the runoff volume for the C soil condition only increased by 0.17% from the prepaneled condition to the paneled condition. In comparison with the B soil, a difference of 0.35% in volume resulted between the two conditions. Therefore, the soil group influenced the actual volumes and rates, but not the relative effect of the paneled condition when compared to the prepaneled condition.

Panel Angle

Because runoff velocities increase with slope, the effect of the angle of the solar panel on the hydrologic response was examined. Analyses were made for angles of 30° and 70° to test an average range from winter to summer. The hydrologic response for these angles was compared to that of the base condition angle of 45°. The other site conditions remained the same. The analyses showed that the angle of the panel had only a slight effect on runoff volumes and discharge rates. The lower angle of 30° was associated with an increased runoff volume, whereas the runoff volume decreased for the steeper angle of 70° when compared with the base condition of 45°. However, the differences (~0.5%) were very slight. Nevertheless, these results indicate that, when the solar panel was closer to horizontal, i.e., at a lower angle, a larger difference in runoff volume occurred between the prepaneled and paneled conditions. These differences in the response result are from differences in loss rates.

The peak discharge was also lower at the lower angle. At an angle of 30°, the peak discharge was slightly lower than at the higher angle of 70°. For the 2-h storm duration, the time to peak of the 30° angle was 2 min delayed from the time to peak of when the panel was positioned at a 70° angle, which reflects the longer travel times across the solar panels.

Storm Duration

To assess the effect of storm duration, analyses were made for 6-h storms, testing magnitudes for 2-, 25-, and 100-year return periods, with the results compared with those for the 2-h rainfall events. The longer storm duration was tested to determine whether a longer duration storm would produce a different ratio of increase in runoff between the prepaneled and paneled conditions. When compared to runoff volumes from the 2-h storm, those for the 6-h storm were 34% greater in both the paneled and prepaneled cases. However, when comparing the prepaneled to the paneled condition, the increase in the runoff volume with the 6-h storm was less than 1% regardless of the return period. The peak discharge and the time-to-peak did not differ significantly between the two conditions. The trends in the hydrologic response of the solar farm did not vary with storm duration.

Ground Cover

The ground cover under the panels was assumed to be a native grass that received little maintenance. For some solar farms, the area beneath the panel is covered in gravel or partially paved because the panels prevent the grass from receiving sunlight. Depending on the

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volume of traffic, the spacer cell could be grass, patches of grass, or bare ground. Thus, it was necessary to determine whether or not these alternative ground-cover conditions would affect the runoff characteristics. This was accomplished by changing the Manning's n for the ground beneath the panels. The value of n under the panels, i.e., the dry section, was set to 0.015 for gravel, with the value for the spacer or maintenance section set to 0.02, i.e., bare ground. These can be compared to the base condition of a native grass ($n = 0.15$). A good cover should promote losses and delay the runoff.

For the smoother surfaces, the velocity of the runoff increased and the losses decreased, which resulted in increasing runoff volumes. This occurred both when the ground cover under the panels was changed to gravel and when the cover in the spacer section was changed to bare ground. Owing to the higher velocities of the flow, runoff rates from the cells increased significantly such that it was necessary to reduce the computational time increment. Fig. 4(a) shows the hydrograph from a 30-panel area with a time increment of 12 s. With a time increment of 12 s, the water in each cell is discharged at the end of every time increment, which results in no attenuation of the flow; thus, the undulations shown in Fig. 4(a) result. The time increment was reduced to 3 s for the 2-h storm, which resulted in watershed smoothing and a rational hydrograph shape [Fig. 4(b)]. The results showed that the storm runoff increased by 7% from the grass-covered scenario to the scenario with gravel under the panel. The peak discharge increased by 73% for the gravel ground cover when compared with the grass cover without the panels. The time to peak was 10 min less with the gravel than with the grass, which reflects the effect of differences in surface roughness and the resulting velocities.

If maintenance vehicles used the spacer section regularly and the grass cover was not adequately maintained, the soil in the spacer section would be compacted and potentially the runoff volumes and rates would increase. Grass that is not maintained has the potential to become patchy and turn to bare ground. The grass under the panel may not get enough sunlight and die. Fig. 1 shows the result of the maintenance trucks frequently driving in the spacer section, which diminished the grass cover.

The effect of the lack of solar farm maintenance on runoff characteristics was modeled by changing the Manning's n to a value of 0.02 for bare ground. In this scenario, the roughness coefficient for the ground under the panels, i.e., the dry section, as well as in the spacer cell was changed from grass covered to bare ground ($n = 0.02$).The effects were nearly identical to that of the gravel. The runoff volume increased by 7% from the grass-covered to the bare-ground condition. The peak discharge increased by 72% when compared with the grass-covered condition. The runoff for the bare-ground condition also resulted in an earlier time to peak by approximately 10 min. Two other conditions were also modeled, showing similar results. In the first scenario, gravel was placed directly under the panel, and healthy grass was placed in the spacer section, which mimics a possible design decision. Under these conditions, the peak discharge increased by 42%, and the volume of runoff increased by 4%, which suggests that storm-water management would be necessary if gravel is placed anywhere.

Fig. 5 shows two solar panels from a solar farm in New Jersey. The bare ground between the panels can cause increased runoff rates and reductions in time of concentration, both of which could necessitate storm-water management. The final condition modeled involved the assumption of healthy grass beneath the panels and bare ground in the spacer section, which would simulate the condition of unmaintained grass resulting from vehicles that drive over the spacer section. Because the spacer section is 53% of the cell, the change in land cover to bare ground would reduce losses and decrease runoff travel times, which would cause runoff to amass as it

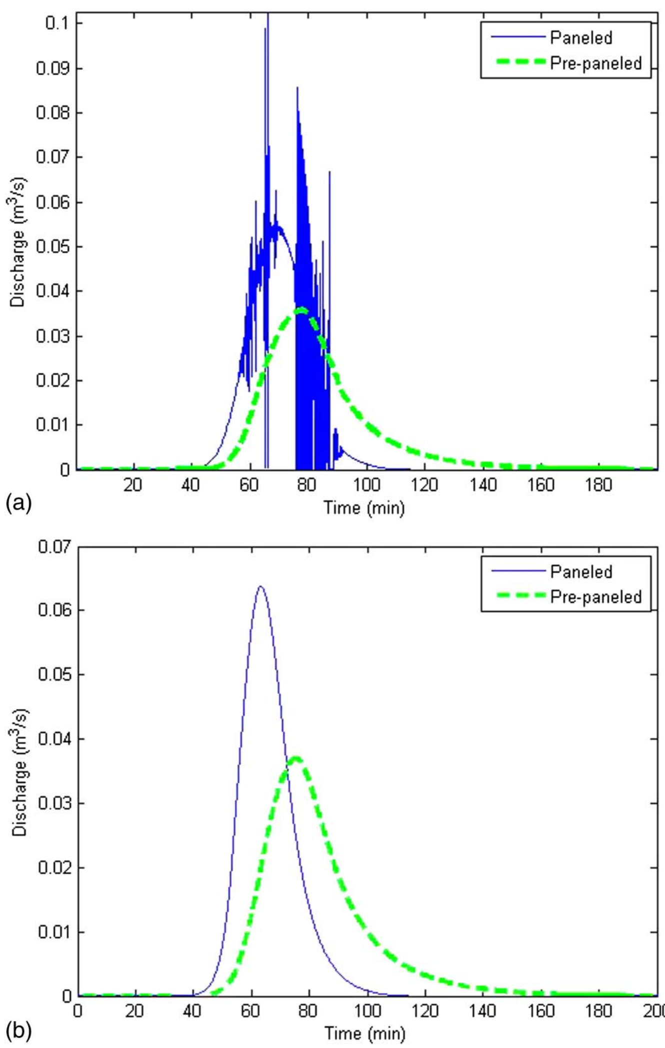

Fig. 4. Hydrograph with time increment of (a) 12 s; (b) 3 s with Manning's n for bare ground

Fig. 5. Site showing the initiation of bare ground below the panels, which increases the potential for erosion (photo by John Showler, reprinted with permission)

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moves downgradient. With the spacer section as bare ground, the peak discharge increased by 100%, which reflected the increases in volume and decrease in timing. These results illustrate the need for maintenance of the grass below and between the panels.

Design Suggestions

With well-maintained grass underneath the panels, the solar panels themselves do not have much effect on total volumes of the runoff or peak discharge rates. Although the panels are impervious, the rainwater that drains from the panels appears as runoff over the downgradient cells. Some of the runoff infiltrates. If the grass cover of a solar farm is not maintained, it can deteriorate either because of a lack of sunlight or maintenance vehicle traffic. In this case, the runoff characteristics can change significantly with both runoff rates and volumes increasing by significant amounts. In addition, if gravel or pavement is placed underneath the panels, this can also contribute to a significant increase in the hydrologic response.

If bare ground is foreseen to be a problem or gravel is to be placed under the panels to prevent erosion, it is necessary to counteract the excess runoff using some form of storm-water management. A simple practice that can be implemented is a buffer strip (Dabney et al. 2006) at the downgradient end of the solar farm. The buffer strip length must be sufficient to return the runoff characteristics with the panels to those of runoff experienced before the gravel and panels were installed. Alternatively, a detention basin can be installed.

A buffer strip was modeled along with the panels. For approximately every 200 m of panels, or 29 cells, the buffer must be 5 cells long (or 35 m) to reduce the runoff volume to that which occurred before the panels were added. Even if a gravel base is not placed under the panels, the inclusion of a buffer strip may be a good practice when grass maintenance is not a top funding priority. Fig. 6 shows the peak discharge from the graveled surface versus the length of the buffer needed to keep the discharge to prepaneled peak rate.

Water draining from a solar panel can increase the potential for erosion of the spacer section. If the spacer section is bare ground, the high kinetic energy of water draining from the panel can cause soil detachment and transport (Garde and Raju 1977; Beuselinck et al. 2002). The amount and risk of erosion was modeled using the velocity of water coming off a solar panel compared with the velocity and intensity of the rainwater. The velocity of panel

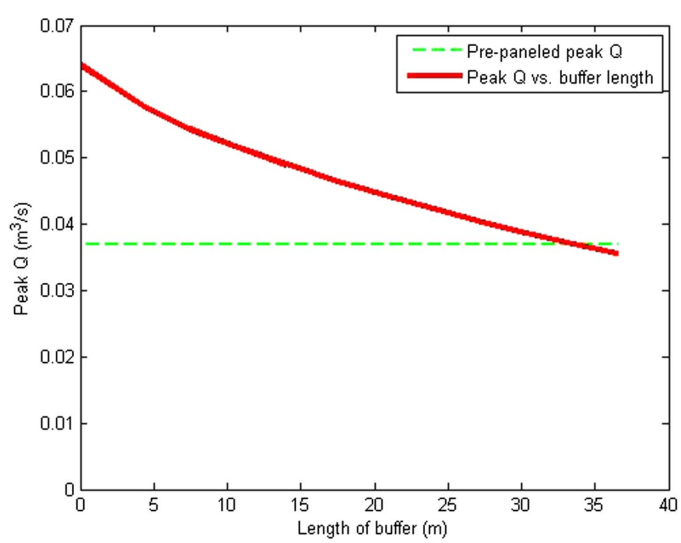

Fig. 6. Peak discharge over gravel compared with buffer length

runoff was calculated using Manning's equation, and the velocity of falling rainwater was calculated using the following:

$$V_t = 120\, d_r^{0.35} \tag{1}$$

where d_r = diameter of a raindrop, assumed to be 1 mm. The relationship between kinetic energy and rainfall intensity is

$$K_e = 916 + 330 \log_{10} i \tag{2}$$

where i = rainfall intensity (in./h) and K_e = kinetic energy (ft-tons per ac-in. of rain) of rain falling onto the wet section and the panel, as well as the water flowing off of the end of the panel (Wischmeier and Smith 1978). The kinetic energy (Salles et al. 2002) of the rainfall was greater than that coming off the panel, but the area under the panel (i.e., the product of the length, width, and cosine of the panel angle) is greater than the area under the edge of the panel where the water drains from the panel onto the ground. Thus, dividing the kinetic energy by the respective areas gives a more accurate representation of the kinetic energy experienced by the soil. The energy of the water draining from the panel onto the ground can be nearly 10 times greater than the rain itself falling onto the ground area. If the solar panel runoff falls onto an unsealed soil, considerable detachment can result (Motha et al. 2004). Thus, because of the increased kinetic energy, it is possible that the soil is much more prone to erosion with the panels than without. Where panels are installed, methods of erosion control should be included in the design.

Conclusions

Solar farms are the energy generators of the future; thus, it is important to determine the environmental and hydrologic effects of these farms, both existing and proposed. A model was created to simulate storm-water runoff over a land surface without panels and then with solar panels added. Various sensitivity analyses were conducted including changing the storm duration and volume, soil type, ground slope, panel angle, and ground cover to determine the effect that each of these factors would have on the volumes and peak discharge rates of the runoff.

The addition of solar panels over a grassy field does not have much of an effect on the volume of runoff, the peak discharge, nor the time to peak. With each analysis, the runoff volume increased slightly but not enough to require storm-water management facilities. However, when the land-cover type was changed under the panels, the hydrologic response changed significantly. When gravel or pavement was placed under the panels, with the spacer section left as patchy grass or bare ground, the volume of the runoff increased significantly and the peak discharge increased by approximately 100%. This was also the result when the entire cell was assumed to be bare ground.

The potential for erosion of the soil at the base of the solar panels was also studied. It was determined that the kinetic energy of the water draining from the solar panel could be as much as 10 times greater than that of rainfall. Thus, because the energy of the water draining from the panels is much higher, it is very possible that soil below the base of the solar panel could erode owing to the concentrated flow of water off the panel, especially if there is bare ground in the spacer section of the cell. If necessary, erosion control methods should be used.

Bare ground beneath the panels and in the spacer section is a realistic possibility (see Figs. 1 and 5). Thus, a good, well-maintained grass cover beneath the panels and in the spacer section is highly recommended. If gravel, pavement, or bare ground is

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deemed unavoidable below the panels or in the spacer section, it may necessary to add a buffer section to control the excess runoff volume and ensure adequate losses. If these simple measures are taken, solar farms will not have an adverse hydrologic impact from excess runoff or contribute eroded soil particles to receiving streams and waterways.

Acknowledgments

The authors appreciate the photographs (Figs. 1 and 5) of Ortho Clinical Diagnostics, 1001 Route 202, North Raritan, New Jersey, 08869, provided by John E. Showler, Environmental Scientist, New Jersey Department of Agriculture. The extensive comments of reviewers resulted in an improved paper.

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EXHIBIT L: FULLY EXECUTED AIMA

STANDARD AGRICULTURAL IMPACT MITIGATION AGREEMENT
between
N DUNCAN ROAD SOLAR, LLC

and the
ILLINOIS DEPARTMENT OF AGRICULTURE
Pertaining to the Construction of a Commercial Solar Energy Facility
in
Champaign County, Illinois

Pursuant to the Renewable Energy Facilities Agricultural Impact Mitigation Act (505 ILCS 147), the following standards and policies are required by the Illinois Department of Agriculture (IDOA) to help preserve the integrity of any Agricultural Land that is impacted by the Construction and Deconstruction of a Commercial Solar Energy Facility. They were developed with the cooperation of agricultural agencies, organizations, Landowners, Tenants, drainage contractors, and solar energy companies to comprise this Agricultural Impact Mitigation Agreement (AIMA).

N DUNCAN ROAD SOLAR, LLC, hereafter referred to as Commercial Solar Energy Facility Owner, or simply as Facility Owner, plans to develop and/or operate a 5.0 MW AC Commercial Solar Energy Facility in Champaign County [GPS Coordinates: 40°10'08.0"N 88°18'22.8"W], which will consist of up to 40 acres that will be covered by solar facility related components, such as solar panel arrays, racking systems, access roads, an onsite underground collection system, inverters and transformers and any affiliated electric transmission lines. This AIMA is made and entered between the Facility Owner and the IDOA.

If Construction does not commence within four years after this AIMA has been fully executed, this AIMA shall be revised, with the Facility Owner's input, to reflect the IDOA's most current Solar Farm Construction and Deconstruction Standards and Policies. This AIMA, and any updated AIMA, shall be filed with the County Board by the Facility Owner prior to the commencement of Construction.

The below prescribed standards and policies are applicable to Construction and Deconstruction activities occurring partially or wholly on privately owned agricultural land.

Conditions of the AIMA

The mitigative actions specified in this AIMA shall be subject to the following conditions:

A. All Construction or Deconstruction activities may be subject to County or other local requirements. However, the specifications outlined in this AIMA shall be the minimum standards applied to all Construction or Deconstruction activities. IDOA may utilize any legal means to enforce this AIMA.

B. Except for Section 17. B. through F., all actions set forth in this AIMA are subject to modification through negotiation by Landowners and the Facility Owner, provided such changes are negotiated in advance of the respective Construction or Deconstruction activities.

C. The Facility Owner may negotiate with Landowners to carry out the actions that Landowners wish to perform themselves. In such instances, the Facility Owner shall offer Landowners the area commercial rate for their machinery and labor costs.

D. All provisions of this AIMA shall apply to associated future Construction, maintenance, repairs, and Deconstruction of the Facility referenced by this AIMA.

E. The Facility Owner shall keep the Landowners and Tenants informed of the Facility's Construction and Deconstruction status, and other factors that may have an impact upon their farming operations.

F. The Facility Owner shall include a statement of its adherence to this AIMA in any environmental assessment and/or environmental impact statement.

G. Execution of this AIMA shall be made a condition of any Conditional/Special Use Permit. Not less than 30 days prior to the commencement of Construction, a copy of this AIMA shall be provided by the Facility Owner to each Landowner that is party to an Underlying Agreement. In addition, this AIMA shall be incorporated into each Underlying Agreement.

H. The Facility Owner shall implement all actions to the extent that they do not conflict with the requirements of any applicable federal, state and local rules and regulations and other permits and approvals that are obtained by the Facility Owner for the Facility.

I. No later than 45 days prior to the Construction and/or Deconstruction of a Facility, the Facility Owner shall provide the Landowner(s) with a telephone number the Landowner can call to alert the Facility Owner should the Landowner(s) have questions or concerns with the work which is being done or has been carried out on his/her property.

J. If there is a change in ownership of the Facility, the Facility Owner assuming ownership of the Facility shall provide written notice within 90 days of ownership transfer, to the Department, the County, and to Landowners of such change. The Financial Assurance requirements and the other terms of this AIMA shall apply to the new Facility Owner.

K. The Facility Owner shall comply with all local, state and federal laws and regulations, specifically including the worker protection standards to protect workers from pesticide exposure.

L. Within 30 days of execution of this AIMA, the Facility Owner shall use Best Efforts to provide the IDOA with a list of all Landowners that are party to an Underlying Agreement and known Tenants of said Landowner who may be affected by the Facility. As the list of Landowners and Tenants is updated, the Facility Owner shall notify the IDOA of any additions or deletions.

M. If any provision of this AIMA is held to be unenforceable, no other provision shall be affected by that holding, and the remainder of the AIMA shall be interpreted as if it did not contain the unenforceable provision.

Definitions

Abandonment	When Deconstruction has not been completed within 12 months after the Commercial Solar Energy Facility reaches the end of its useful life. For purposes of this definition, a Commercial Solar Energy Facility shall be presumed to have reached the end of its useful life if the Commercial Solar Energy Facility Owner fails, for a period of 6 consecutive months, to pay the Landowner amounts owed in accordance with an Underlying Agreement.

Aboveground Cable	Electrical power lines installed above ground surface to be utilized for conveyance of power from the solar panels to the solar facility inverter and/or point of interconnection to utility grid or customer electric meter.
Agricultural Impact Mitigation Agreement (AIMA)	The Agreement between the Facility Owner and the Illinois Department of Agriculture (IDOA) described herein.
Agricultural Land	Land used for Cropland, hayland, pastureland, managed woodlands, truck gardens, farmsteads, commercial ag-related facilities, feedlots, livestock confinement systems, land on which farm buildings are located, and land in government conservation programs used for purposes as set forth above.
Best Efforts	Diligent, good faith, and commercially reasonable efforts to achieve a given objective or obligation.
Commercial Operation Date	The calendar date of which the Facility Owner notifies the Landowner, County, and IDOA in writing that commercial operation of the facility has commenced. If the Facility Owner fails to provide such notifications, the Commercial Operation Date shall be the execution date of this AIMA plus 6 months.
Commercial Solar Energy Facility (Facility)	A solar energy conversion facility equal to or greater than 500 kilowatts in total nameplate capacity, including a solar energy conversion facility seeking an extension of a permit to construct granted by a county or municipality before June 29, 2018. "Commercial solar energy facility" does not include a solar energy conversion facility: (1) for which a permit to construct has been issued before June 29, 2018; (2) that is located on land owned by the commercial solar energy facility owner; (3) that was constructed before June 29, 2018; or (4) that is located on the customer side of the customer's electric meter and is primarily used to offset that customer's electricity load and is limited in nameplate capacity to less than or equal to 2,000 kilowatts.
Commercial Solar Energy Facility Owner deemed (Facility Owner)	A person or entity that owns a commercial solar energy facility. A Commercial Solar Energy Facility Owner is not nor shall it be to be a public utility as defined in the Public Utilities Act.
County	The County or Counties where the Commercial Solar Energy Facility is located.
Construction	The installation, preparation for installation and/or repair of a Facility.
Cropland	Land used for growing row crops, small grains or hay; includes land which was formerly used as cropland, but is currently enrolled in a government conservation program; also includes pastureland that is classified as Prime Farmland.

Deconstruction	The removal of a Facility from the property of a Landowner and the restoration of that property as provided in the AIMA.
Deconstruction Plan	A plan prepared by a Professional Engineer, at the Facility's expense, that includes: (1) the estimated Deconstruction cost, in current dollars at the time of filing, for the Facility, considering among other things: i. the number of solar panels, racking, and related facilities involved; ii. the original Construction costs of the Facility; iii. the size and capacity, in megawatts of the Facility; iv. the salvage value of the facilities (if all interests in salvage value are subordinate to that of the Financial Assurance holder if abandonment occurs); v. the Construction method and techniques for the Facility and for other similar facilities; and (2) a comprehensive detailed description of how the Facility Owner plans to pay for the Deconstruction of the Facility.
Department	The Illinois Department of Agriculture (IDOA).
Financial Assurance	A reclamation or surety bond or other commercially available financial assurance that is acceptable to the County, with the County or Landowner as beneficiary.
Landowner	Any person with an ownership interest in property that is used for agricultural purposes and that is party to an Underlying Agreement.
Prime Farmland	Agricultural Land comprised of soils that are defined by the USDA Natural Resources Conservation Service (NRCS) as "Prime Farmland" (generally considered to be the most productive soils with the least input of nutrients and management).
Professional Engineer	An engineer licensed to practice engineering in the State of Illinois.
Soil and Water Conservation District (SWCD)	A unit of local government that provides technical and financial assistance to eligible Landowners for the conservation of soil and water resources.
Tenant	Any person, apart from the Facility Owner, lawfully residing or leasing/renting land that is subject to an Underlying Agreement.
Topsoil	The uppermost layer of the soil that has the darkest color or the highest content of organic matter; more specifically, it is defined as the "A" horizon.
Underlying Agreement	The written agreement between the Facility Owner and the Landowner(s) including, but not limited to, an easement, option, lease, or license under the terms of which another person has constructed, constructs, or intends to construct a Facility on the property of the Landowner.

Underground Cable	Electrical power lines installed below the ground surface to be utilized for conveyance of power within a Facility or from a Commercial Solar Energy Facility to the electric grid.
USDA Natural Resources Conservation Service (NRCS)	An agency of the United States Department of Agriculture that provides America's farmers with financial and technical assistance to aid with natural resources conservation.

Construction and Deconstruction Standards and Policies

1. Support Structures

A. Only single pole support structures shall be used for the Construction and operation of the Facility on Agricultural Land. Other types of support structures, such as lattice towers or H-frames, may be used on nonagricultural land.

B. Where a Facility's Aboveground Cable will be adjacent and parallel to highway and/or railroad right-of-way, but on privately owned property, the support structures shall be placed as close as reasonably practicable and allowable by the applicable County Engineer or other applicable authorities to the highway or railroad right-of-way. The only exceptions may be at jogs or weaves on the highway alignment or along highways or railroads where transmission and distribution lines are already present.

C. When it is not possible to locate Aboveground Cable next to highway or railroad right-of-way, Best Efforts shall be expended to place all support poles in such a manner to minimize their placement on Cropland (i.e., longer than normal above ground spans shall be utilized when traversing Cropland).

2. Aboveground Facilities

Locations for facilities shall be selected in a manner that is as unobtrusive as reasonably possible to ongoing agricultural activities occurring on the land that contains or is adjacent to the Facility.

3. Guy Wires and Anchors

Best Efforts shall be made to place guy wires and their anchors, if used, out of Cropland, pastureland and hayland, placing them instead along existing utilization lines and on land other than Cropland. Where this is not feasible, Best Efforts shall be made to minimize guy wire impact on Cropland. All guy wires shall be shielded with highly visible guards.

4. Underground Cabling Depth

A. Underground electrical cables located outside the perimeter of the (fence) of the solar panels shall be buried with:

1. a minimum of 5 feet of top cover where they cross Cropland.
2. a minimum of 5 feet of top cover where they cross pastureland or other non-Cropland classified as Prime Farmland.
3. a minimum of 3 feet of top cover where they cross pastureland and other Agricultural Land not classified as Prime Farmland.

4. a minimum of 3 feet of top cover where they cross wooded/brushy land.

B. Provided that the Facility Owner removes the cables during Deconstruction, underground electric cables may be installed to a minimum depth of 18 inches:

1. Within the fenced perimeter of the Facility; or

2. When buried under an access road associated with the Facility provided that the location and depth of cabling is clearly marked at the surface.

C. If Underground Cables within the fenced perimeter of the solar panels are installed to a minimum depth of 5 feet, they may remain in place after Deconstruction.

5. Topsoil Removal and Replacement

A. Any excavation shall be performed in a manner to preserve topsoil. Best Efforts shall be made to store the topsoil near the excavation site in such a manner that it will not become intermixed with subsoil materials.

B. Best Efforts shall be made to store all disturbed subsoil material near the excavation site and separate from the topsoil.

C. When backfilling an excavation site, Best Efforts shall be used to ensure the stockpiled subsoil material will be placed back into the excavation site before replacing the topsoil.

D. Refer to Section 7 for procedures pertaining to rock removal from the subsoil and topsoil.

E. Refer to Section 8 for procedures pertaining to the repair of compaction and rutting of the topsoil.

F. Best Efforts shall be performed to place the topsoil in a manner so that after settling occurs, the topsoil's original depth and contour will be restored as close as reasonably practicable. The same shall apply where excavations are made for road, stream, drainage ditch, or other crossings. In no instance shall the topsoil materials be used for any other purpose unless agreed to explicitly and in writing by the Landowner.

G. Based on the mutual agreement of the landowner and Facility Owner, excess soil material resulting from solar facility excavation shall either be removed or stored on the Landowner's property and reseeded per the applicable National Pollution Discharge Elimination System (NPDES) permit/Stormwater Pollution Prevention Plan (SWPPP). After the Facility reaches the end of its Useful Life, the excess subsoil material shall be returned to an excavation site or removed from the Landowner's property, unless otherwise agreed to by Landowner.

6. Rerouting and Permanent Repair of Agricultural Drainage Tiles

The following standards and policies shall apply to underground drainage tile line(s) directly or indirectly affected by Construction and/or Deconstruction:

A. Prior to Construction, the Facility Owner shall work with the Landowner to identify drainage tile lines traversing the property subject to the Underlying Agreement to the extent reasonably practicable. All drainage tile lines identified in this manner shall be shown on the Construction and Deconstruction Plans.

B. The location of all drainage tile lines located adjacent to or within the footprint of the Facility shall be recorded using Global Positioning Systems (GPS) technology. Within 60 days after Construction is complete, the Facility Owner shall provide the Landowner, the IDOA, and the respective County Soil and Water Conservation District (SWCD) with "as built" drawings (strip maps) showing the location of all drainage tile lines by survey station encountered in the Construction of the Facility, including any tile line repair location(s), and any underground cable installed as part of the Facility.

C. **Maintaining Surrounding Area Subsurface Drainage**

If drainage tile lines are damaged by the Facility, the Facility Owner shall repair the lines or install new drainage tile line(s) of comparable quality and cost to the original(s), and of sufficient size and appropriate slope in locations that limit direct impact from the Facility. If the damaged tile lines cause an unreasonable disruption to the drainage system, as determined by the Landowner, then such repairs shall be made promptly to ensure appropriate drainage. Any new line(s) may be located outside of, but adjacent to the perimeter of the Facility. Disrupted adjacent drainage tile lines shall be attached thereto to provide an adequate outlet for the disrupted adjacent tile lines.

D. **Re-establishing Subsurface Drainage Within Facility Footprint**

Following Deconstruction and using Best Efforts, if underground drainage tile lines were present within the footprint of the facility and were severed or otherwise damaged during original Construction, facility operation, and/or facility Deconstruction, the Facility Owner shall repair existing drainage tiles or install new drainage tile lines of comparable quality and cost to the original, within the footprint of the Facility with sufficient capacity to restore the underground drainage capacity that existed within the footprint of the Facility prior to Construction. Such installation shall be completed within 12 months after the end of the useful life of the Facility and shall be compliant with Figures 1 and 2 to this Agreement or based on prudent industry standards if agreed to by Landowner.

E. If there is any dispute between the Landowner and the Facility Owner on the method of permanent drainage tile line repair, the appropriate County SWCD's opinion shall be considered by the Facility Owner and the Landowner.

F. During Deconstruction, all additional permanent drainage tile line repairs beyond those included above in Section 6.D. must be made within 30 days of identification or notification of the damage, weather and soil conditions permitting. At other times, such repairs must be made at a time mutually agreed upon by the Facility Owner and the Landowner. If the Facility Owner and Landowner cannot agree upon a reasonable method to complete this restoration, the Facility Owner may implement the recommendations of the appropriate County SWCD and such implementation constitutes compliance with this provision.

G. Following completion of the work required pursuant to this Section, the Facility Owner shall be responsible for correcting all drainage tile line repairs that fail due to Construction and/or Deconstruction for one year following the completion of Construction or Deconstruction, provided those repairs were made by the Facility Owner. The Facility Owner shall not be responsible for drainage tile repairs that the Facility Owner pays the Landowner to perform.

7. Rock Removal

With any excavations, the following rock removal procedures pertain only to rocks found in the uppermost 42 inches of soil, the common freeze zone in Illinois, which emerged or were brought to the site as a result of Construction and/or Deconstruction.

A. Before replacing any topsoil, Best Efforts shall be taken to remove all rocks greater than 3 inches in any dimension from the surface of exposed subsoil which emerged or were brought to the site as a result of Construction and/or Deconstruction.

B. If trenching, blasting, or boring operations are required through rocky terrain, precautions shall be taken to minimize the potential for oversized rocks to become interspersed in adjacent soil material.

C. Rocks and soil containing rocks removed from the subsoil areas, topsoil, or from any excavations, shall be removed from the Landowner's premises or disposed of on the Landowner's premises at a location that is mutually acceptable to the Landowner and the Facility Owner.

8. Repair of Compaction and Rutting

A. Unless the Landowner opts to do the restoration work on compaction and rutting, after the topsoil has been replaced post-Deconstruction, all areas within the boundaries of the Facility that were traversed by vehicles and Construction and/or Deconstruction equipment that exhibit compaction and rutting shall be restored by the Facility Owner. All prior Cropland shall be ripped at least 18 inches deep or to the extent practicable, and all pasture and woodland shall be ripped at least 12 inches deep or to the extent practicable. The existence of drainage tile lines or underground utilities may necessitate less ripping depth. The disturbed area shall then be disked.

B. All ripping and disking shall be done at a time when the soil is dry enough for normal tillage operations to occur on Cropland adjacent to the Facility.

C. The Facility Owner shall restore all rutted land to a condition as close as possible to its original condition upon Deconstruction, unless necessary earlier as determined by the Landowner.

D. If there is any dispute between the Landowner and the Facility Owner as to what areas need to be ripped/disked or the depth at which compacted areas should be ripped/disked, the appropriate County SWCD's opinion shall be considered by the Facility Owner and the Landowner.

9. Construction During Wet Weather

Except as provided below, construction activities are not allowed on agricultural land during times when normal farming operations, such as plowing, disking, planting or harvesting, cannot take place due to excessively wet soils. With input from the landowner, wet weather conditions may be determined on a field by field basis.

A. Construction activities on prepared surfaces, surfaces where topsoil and subsoil have been removed, heavily compacted in preparation, or otherwise stabilized (e.g. through cement mixing) may occur at the discretion of the Facility Owner in wet weather conditions.

B. Construction activities on unprepared surfaces will be done only when work will not result in rutting which may mix subsoil and topsoil. Determination as to the potential of subsoil and topsoil mixing will be made in consultation with the underlying Landowner, or, if approved by the Landowner, his/her designated tenant or designee.

10. Prevention of Soil Erosion

A. The Facility Owner shall work with Landowners and create and follow a SWPPP to prevent excessive erosion on land that has been disturbed by Construction or Deconstruction of a Facility.

B. If the Landowner and Facility Owner cannot agree upon a reasonable method to control erosion on the Landowner's property, the Facility Owner shall consider the recommendations of the appropriate County SWCD to resolve the disagreement.

C. The Facility Owner may, per the requirements of the project SWPPP and in consultation with the Landowner, seed appropriate vegetation around all panels and other facility components to prevent erosion. The Facility Owner must utilize Best Efforts to ensure that all seed mixes will be as free of any noxious weed seeds as possible. The Facility Owner shall consult with the Landowner regarding appropriate varieties to seed.

11. Repair of Damaged Soil Conservation Practices

Consultation with the appropriate County SWCD by the Facility Owner shall be carried out to determine if there are soil conservation practices (such as terraces, grassed waterways, etc.) that will be damaged by the Construction and/or Deconstruction of the Facility. Those conservation practices shall be restored to their preconstruction condition as close as reasonably practicable following Deconstruction in accordance with USDA NRCS technical standards. All repair costs shall be the responsibility of the Facility Owner.

12. Compensation for Damages to Private Property

The Facility Owner shall reasonably compensate Landowners for damages caused by the Facility Owner. Damage to Agricultural Land shall be reimbursed to the Landowner as prescribed in the applicable Underlying Agreement.

13. Clearing of Trees and Brush

A. If trees are to be removed for the Construction or Deconstruction of a Facility, the Facility Owner shall consult with the Landowner to determine if there are trees of commercial or other value to the Landowner.

B. If there are trees of commercial or other value to the Landowner, the Facility Owner shall allow the Landowner the right to retain ownership of the trees to be removed and the disposition of the removed trees shall be negotiated prior to the commencement of land clearing.

14. Access Roads

A. To the extent practicable, access roads shall be designed to not impede surface drainage and shall be built to minimize soil erosion on or near the access roads.

B. Access roads may be left intact during Construction, operation or Deconstruction through mutual agreement of the Landowner and the Facility Owner unless otherwise restricted by federal, state, or local regulations.

C. If the access roads are removed, Best Efforts shall be expended to assure that the land shall be restored to equivalent condition(s) as existed prior to their construction, or as otherwise agreed to by the Facility Owner and the Landowner. All access roads that are removed shall be ripped to a depth of 18 inches. All ripping shall be performed consistent with Section 8.

15. Weed/Vegetation Control

A. The Facility Owner shall provide for weed control in a manner that prevents the spread of weeds. Chemical control, if used, shall be done by an appropriately licensed pesticide applicator.

B. The Facility Owner shall be responsible for the reimbursement of all reasonable costs incurred by owners of agricultural land where it has been determined by the appropriate state or county entity that weeds have spread from the Facility to their property. Reimbursement is contingent upon written notice to the Facility Owner. Facility Owner shall reimburse the property owner within 45 days after notice is received.

C. The Facility Owner shall ensure that all vegetation growing within the perimeter of the Facility is properly and appropriately maintained. Maintenance may include, but not be limited to, mowing, trimming, chemical control, or the use of livestock as agreed to by the Landowner.

D. The Deconstruction plans must include provisions for the removal of all weed control equipment used in the Facility, including weed-control fabrics or other ground covers.

16. Indemnification of Landowners

The Facility Owner shall indemnify all Landowners, their heirs, successors, legal representatives, and assigns from and against all claims, injuries, suits, damages, costs, losses, and reasonable expenses resulting from or arising out of the Commercial Solar Energy Facility, including Construction and Deconstruction thereof, and also including damage to such Facility or any of its appurtenances, except where claims, injuries, suits, damages, costs, losses, and expenses are caused by the negligence or intentional acts, or willful omissions of such Landowners, and/or the Landowners heirs, successors, legal representatives, and assigns.

17. Deconstruction Plans and Financial Assurance of Commercial Solar Energy Facilities

A. Deconstruction of a Facility shall include the removal/disposition of all solar related equipment/facilities, including the following utilized for operation of the Facility and located on Landowner property:

1. Solar panels, cells and modules;
2. Solar panel mounts and racking, including any helical piles, ground screws, ballasts, or other anchoring systems;
3. Solar panel foundations, if used (to depth of 5 feet);

4. Transformers, inverters, energy storage facilities, or substations, including all components and foundations; however, Underground Cables at a depth of 5 feet or greater may be left in place;
5. Overhead collection system components;
6. Operations/maintenance buildings, spare parts buildings and substation/switching gear buildings unless otherwise agreed to by the Landowner;
7. Access Road(s) unless Landowner requests in writing that the access road is to remain;
8. Operation/maintenance yard/staging area unless otherwise agreed to by the Landowner; and
9. Debris and litter generated by Deconstruction and Deconstruction crews.

B. The Facility Owner shall, at its expense, complete Deconstruction of a Facility within twelve (12) months after the end of the useful life of the Facility.

C. During the County permit process, or if none, then prior to the commencement of construction, the Facility Owner shall file with the County a Deconstruction Plan. The Facility Owner shall file an updated Deconstruction Plan with the County on or before the end of the tenth year of commercial operation.

D. The Facility Owner shall provide the County with Financial Assurance to cover the estimated costs of Deconstruction of the Facility. Provision of this Financial Assurance shall be phased in over the first 11 years of the Project's operation as follows:

1. On or before the first anniversary of the Commercial Operation Date, the Facility Owner shall provide the County with Financial Assurance to cover ten (10) percent of the estimated costs of Deconstruction of the Facility as determined in the Deconstruction Plan.
2. On or before the sixth anniversary of the Commercial Operation Date, the Facility Owner shall provide the County with Financial Assurance to cover fifty (50) percent of the estimated costs of Deconstruction of the Facility as determined in the Deconstruction Plan.
3. On or before the eleventh anniversary of the Commercial Operation Date, the Facility Owner shall provide the County with Financial Assurance to cover one hundred (100) percent of the estimated costs of Deconstruction of the Facility as determined in the updated Deconstruction Plan provided during the tenth year of commercial operation.

The Financial Assurance shall not release the surety from liability until the Financial Assurance is replaced. The salvage value of the Facility may only be used to reduce the estimated costs of Deconstruction if the County agrees that all interests in the salvage value are subordinate or have been subordinated to that of the County if Abandonment occurs.

E. The County may, but is not required to, reevaluate the estimated costs of Deconstruction of any Facility after the tenth anniversary, and every five years thereafter, of the Commercial Operation Date. Based on any reevaluation, the County may require changes in the level of Financial Assurance used to calculate the phased Financial Assurance levels described in Section 17.D. required from the Facility Owner. If the County is unable to its satisfaction to perform the investigations necessary to approve the Deconstruction Plan filed by the Facility Owner, then the County and Facility may mutually agree on the selection of a Professional Engineer independent of the Facility Owner to conduct any necessary investigations. The Facility Owner shall be responsible for the cost of any such investigations.

F. Upon Abandonment, the County may take all appropriate actions for Deconstruction including drawing upon the Financial Assurance.

Concurrence of the Parties to this AIMA

The Illinois Department of Agriculture and N DUNCAN ROAD SOLAR, LLC concur that this AIMA is the complete AIMA governing the mitigation of agricultural impacts that may result from the Construction and Deconstruction of the solar farm project in Champaign County within the State of Illinois.

The effective date of this AIMA commences on the date of execution.

STATE OF ILLINOIS
DEPARTMENT OF AGRICULTURE

Jerry Costello II

By: Jerry Costello II, Director

Clay Nordsiek

By Clay Nordsiek, Deputy General Counsel

801 E. Sangamon Avenue,
State Fairgrounds, POB 19281
Springfield, IL 62794-9281

3/4, 2025

N DUNCAN ROAD SOLAR, LLC

DocuSigned by:
Patrick Jackson
3E0BA90709094B9...

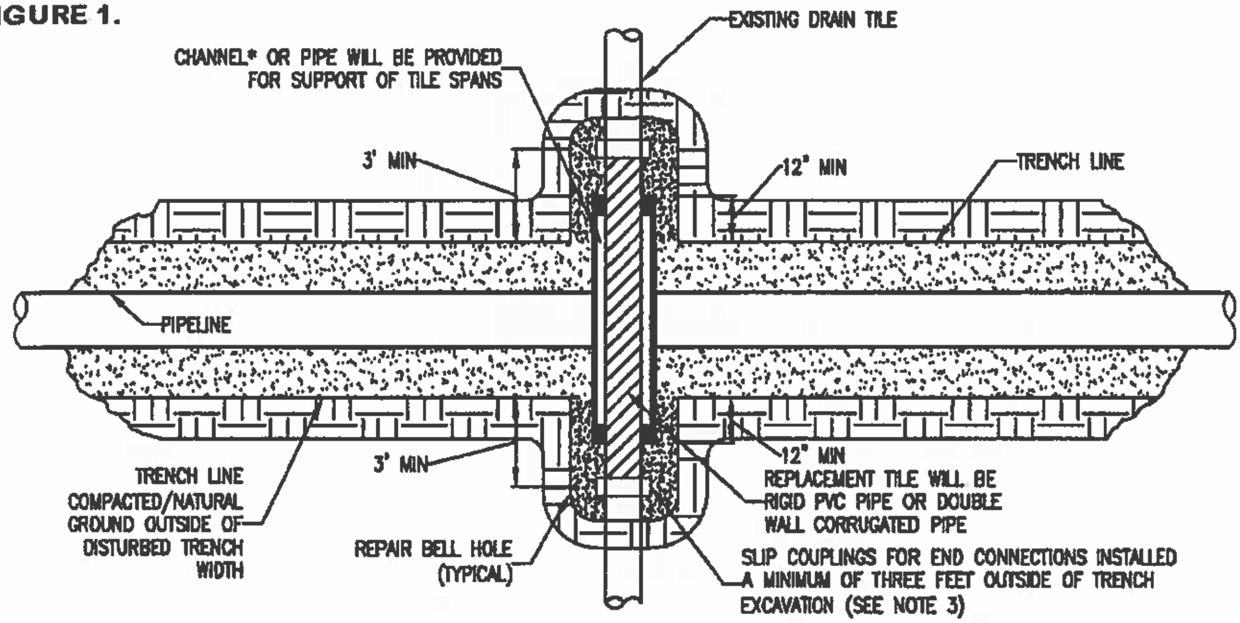
By Patrick Jackson, SVP

P.O. Box 1320
Portsmouth, NH 03802

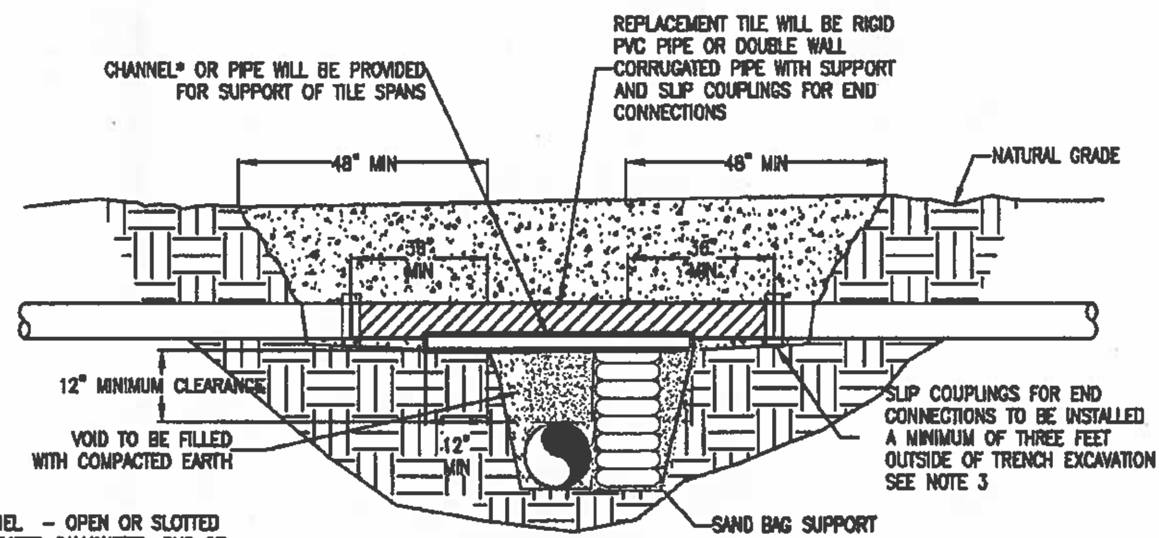
Address

February 5, 2025

FIGURE 1.



PLAN
N.T.S.



*CHANNEL – OPEN OR SLOTTED CORRUGATED GALVANIZED, PVC OR ALUMINUM CRADLE TO SUPPORT DRAIN TILE.

CROSS SECTION
N.T.S.

NOTE:

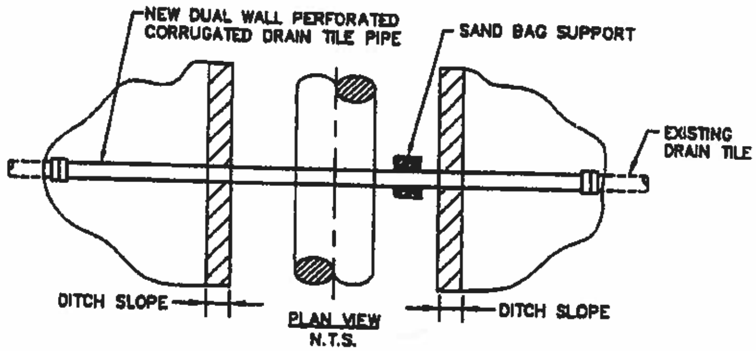
1. IMMEDIATELY REPAIR TILE IF WATER IS FLOWING THROUGH TILE AT TIME OF TRENCHING. IF NO WATER IS FLOWING AND TEMPORARY REPAIR IS DELAYED, OR NOT MADE BY THE END OF THE WORK DAY, A SCREEN OR APPROPRIATE 'NIGHT CAP' SHALL BE PLACED ON OPEN ENDS OF TILE TO PREVENT ENTRAPMENT OF ANIMALS ETC.

2. CHANNEL OR PIPE (OPEN OR SLOTTED) MADE OF CORRUGATED GALVANIZED PIPE, PVC OR ALUMINUM WILL BE USED FOR SUPPORT OF DRAIN TILE SPANS.

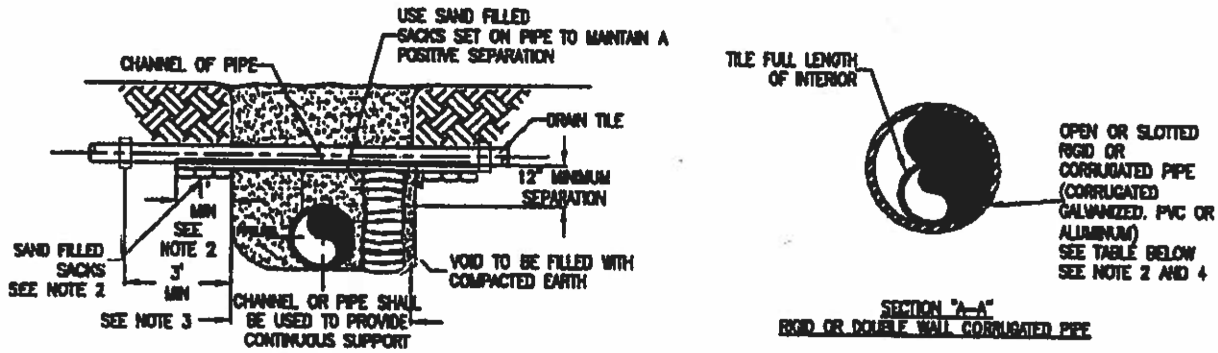
3. INDUSTRY STANDARDS SHALL BE FOLLOWED TO ENSURE PROPER SEAL OF REPAIRED DRAIN TILES.

TEMPORARY DRAIN TILE REPAIR

FIGURE 2.



PLAN VIEW



END VIEWS

MINIMUM SUPPORT TABLE				
TILE SIZE	CHANNEL SIZE		PIPE SIZE	
3"	4" @ 5.4	#/ft	4"	STD. WT.
4"-5"	5" @ 6.7	#/ft	6"	STD. WT.
6"-9"	7" @ 9.8	#/ft	9"-10"	STD. WT.
10"	10" @ 15.3	#/ft	12"	STD. WT.

NOTE:

1. TILE REPAIR AND REPLACEMENT SHALL MAINTAIN ORIGINAL ALIGNMENT GRADIENT AND WATER FLOW TO THE GREATEST EXTENT POSSIBLE. IF THE TILE NEEDS TO BE RELOCATED, THE INSTALLATION ANGLE MAY VARY DUE TO SITE SPECIFIC CONDITIONS AND LANDOWNER RECOMMENDATIONS.

2. 1'-0" MINIMUM LENGTH OF CHANNEL OR RIGID PIPE (OPEN OR SLOTTED CORRUGATED GALVANIZED, PVC OR ALUMINUM CRADLE) SHALL BE SUPPORTED BY UNDISTURBED SOIL, OR IF CROSSING IS NOT AT RIGHT ANGLES TO PIPELINE, EQUIVALENT LENGTH PERPENDICULAR TO TRENCH. SHIM WITH SAND BAGS TO UNDISTURBED SOIL FOR SUPPORT AND DRAINAGE GRADIENT MAINTENANCE (TYPICAL BOTH SIDES).

3. DRAIN TILES WILL BE PERMANENTLY CONNECTED TO EXISTING DRAIN TILES A MINIMUM OF THREE FEET OUTSIDE OF EXCAVATED TRENCH LINE USING INDUSTRY STANDARDS TO ENSURE PROPER SEAL OF REPAIRED DRAIN TILES INCLUDING SLIP COUPLINGS.

4. DIAMETER OF RIGID PIPE SHALL BE OF ADEQUATE SIZE TO ALLOW FOR THE INSTALLATION OF THE TILE FOR THE FULL LENGTH OF THE RIGID PIPE.

5. OTHER METHODS OF SUPPORTING DRAIN TILE MAY BE USED IF ALTERNATE PROPOSED IS EQUIVALENT IN STRENGTH TO THE CHANNEL/PIPE SECTIONS SHOWN AND IF APPROVED BY COMPANY REPRESENTATIVES AND LANDOWNER IN ADVANCE. SITE SPECIFIC ALTERNATE SUPPORT SYSTEM TO BE DEVELOPED BY COMPANY REPRESENTATIVES AND FURNISHED TO CONTRACTOR FOR SPANS IN EXCESS OF 20', TILE GREATER THEN 10" DIAMETER, AND FOR "HEADER" SYSTEMS.

6. ALL MATERIAL TO BE FURNISHED BY CONTRACTOR.

7. PRIOR TO REPAIRING TILE, CONTRACTOR SHALL PROBE LATERALLY INTO THE EXISTING TILE TO FULL WIDTH OF THE RIGHTS OF WAY TO DETERMINE IF ADDITIONAL DAMAGE HAS OCCURRED. ALL DAMAGED/DISTURBED TILE SHALL BE REPAIRED AS NEAR AS PRACTICABLE TO ITS ORIGINAL OR BETTER CONDITION.

PERMANENT DRAIN TILE REPAIR

EXHIBIT M: CITY OF CHAMPAIGN COMMUNICATION

N Duncan Road Solar Special Use Permit Application

1 message

Zachary Farkes <zak@rewildrenewables.com> Wed, Nov 12, 2025 at 12:49 PM
To: Jeff Marino <Jeff.Marino@champaignil.gov>, Katherine Trotter <Katherine.trotter@champaignil.gov>

Good Morning Jeff and Kat,

Per our conversations, please take this email as notice pursuant to Section 6.1.5(B)(2)(c) of the Champaign County Zoning Ordinance, that the Applicant has provided its Special Use Permit Application to the City of Champaign contemporaneously with its submittal to the County.

The electronic application package, which is within the sharefile link below, includes the following:

[link to download application materials]

- Special Use Permit Application Package dated 11/12/2025
- Civil Plan-Set dated 11/12/2025

I am very happy to discuss any aspects of this project with the City of Champaign. Please let me know if you have any questions.

Best,

Zak

--

Zachary Farkes
617-851-2893
Senior VP of Project Finance
Senior VP of Project Development
Rewild Renewables

EXHIBIT N: EXECUTED INTERCONNECTION AGREEMENT

STANDARD AGREEMENT FOR INTERCONNECTION OF DISTRIBUTED ENERGY RESOURCES FACILITIES WITH A CAPACITY LESS THAN OR EQUAL TO 10 MVA

This agreement (together with all attachments, the "Agreement") is made and entered into this 10 day of April 2025, by and between N Duncan Road Solar, LLC ("interconnection customer"), as a Limited Liability Company organized and existing under the laws of the State of Delaware and Ameren Illinois Company, ("Electric Distribution Company" or "EDC"), a corporation existing under the laws of the State of Illinois. Interconnection customer and EDC each may be referred to as a "Party", or collectively as the "Parties".

Recitals:

Whereas, interconnection customer is proposing to install or direct the installation of a distributed energy resources (DER) facility, or is proposing a generating capacity addition to an existing distributed energy resources (DER) facility, consistent with the interconnection request application form completed by interconnection customer on 9/8/23; and

Whereas, the interconnection customer will operate and maintain, or cause the operation and maintenance of, the DER facility; and

Whereas, interconnection customer desires to interconnect the DER facility with EDC's electric distribution system.

Now, therefore, in consideration of the premises and mutual covenants set forth in this Agreement, and other good and valuable consideration, the receipt, sufficiency and adequacy of which are hereby acknowledged, the Parties covenant and agree as follows:

Article 1. Scope and Limitations of Agreement

1.1 This Agreement shall be used for all approved interconnection requests for DER facilities that fall under Levels 2, 3 and 4 according to the procedures set forth in Part 466 of the Commission's rules (83 Ill. Adm. Code 466) (referred to as the Illinois Distributed Energy Resources Interconnection Standard).

1.2 This Agreement governs the terms and conditions under which the DER facility will interconnect to, and operate in parallel with, the EDC's electric distribution system.

1.3 This Agreement does not constitute an agreement to purchase or deliver the interconnection customer's power.

1.4 Nothing in this Agreement is intended to affect any other agreement between the EDC and the interconnection customer.

1.5 Terms used in this agreement are defined as in Section 466.20 of the Illinois Distributed Energy Resources Interconnection Standard unless otherwise noted.

1.6 Responsibilities of the Parties

1.6.1 The Parties shall perform all obligations of this Agreement in accordance with all applicable laws and regulations.

1.6.2 The EDC shall construct, own, operate, and maintain its interconnection facilities in accordance with this Agreement.

1.6.3 The interconnection customer shall construct, own, operate, and maintain its distributed energy resources (DER) facility and interconnection facilities in accordance with this Agreement.

1.6.4 Each Party shall operate, maintain, repair, and inspect, and shall be fully responsible for, the facilities that it now or subsequently may own unless otherwise specified in the attachments to this Agreement. Each Party shall be responsible for the safe installation, maintenance, repair and condition of its respective lines and appurtenances on its respective sides of the point of interconnection.

1.6.5 The interconnection customer agrees to design, install, maintain and operate its DER facility so as to minimize the likelihood of causing an adverse system impact on the electric distribution system or any other electric system that is not owned or operated by the EDC.

1.7 Parallel Operation Obligations
Once the DER facility has been authorized to commence parallel operation, the interconnection customer shall abide by all operating procedures established in IEEE Standard 1547 and any other applicable laws, statutes or guidelines, including those specified in Attachment 4 of this Agreement.

1.8 Metering
The interconnection customer shall be responsible for the cost to purchase, install, operate, maintain, test, repair, and replace metering and data acquisition equipment specified in Attachments 5 and 6 of this Agreement.

1.9 Reactive Power

1.9.1 Interconnection customers with a DER facility larger than or equal to 1 MVA shall design their DER facilities to maintain a power factor at the point of interconnection between .95 lagging and .95 leading at all times. Interconnection customers with a DER facility smaller than 1 MVA shall design their DER facility to maintain a power factor at the point of interconnection between .90 lagging and .90 leading at all times.

1.9.2 Any EDC requirements for meeting a specific voltage or specific reactive power schedule as a condition for interconnection shall be clearly specified in Attachment 4. Under no circumstance shall the EDC's additional requirements for voltage or reactive power schedules exceed the normal operating capabilities of the DER facility.

1.9.3 If the interconnection customer does not operate the distributed energy resources (DER) facility within the power factor range specified in Attachment 4, or does not operate the distribute generation facility in accordance with a voltage or reactive power schedule specified in Attachment 4, the interconnection customer is in default, and the terms of Article 6.5 apply.

1.10 Standards of Operations

The interconnection customer must obtain all certifications, permits, licenses and approvals necessary to construct, operate and maintain the facility and to perform its obligations under this Agreement. The interconnection customer is responsible for coordinating and synchronizing the DER facility with the EDC's system. The interconnection customer is responsible for any damage that is caused by the interconnection customer's failure to coordinate or synchronize the DER facility with the electric distribution system. The interconnection customer agrees to be primarily liable for any damages resulting from the continued operation of the DER facility after the EDC ceases to energize the line section to which the DER facility is connected. In Attachment 4, the EDC shall specify the shortest reclose time setting for its protection equipment that could affect the DER facility. The EDC shall notify the interconnection customer at least 10 business days prior to adopting a faster reclose time on any automatic protective equipment, such as a circuit breaker or line recloser, that might affect the DER facility.

<u>Article 2.</u> Inspection, Testing, Authorization, and Right of Access

2.1 Equipment Testing and Inspection

The interconnection customer shall test and inspect its DER facility including the interconnection equipment prior to interconnection in accordance with IEEE Standard 1547 (2003) and IEEE Standard 1547.1 (2005). The interconnection customer shall not operate its DER facility in parallel with the EDC's electric distribution system without prior written authorization by the EDC as provided for in Articles 2.1.1-2.1.3.

2.1.1 The EDC shall perform a witness test after construction of the DER facility is completed, but before parallel operation, unless the EDC specifically waives the witness test. The interconnection customer shall provide the EDC at least 15 business days' notice of the planned commissioning test for the DER facility. If the EDC performs a witness test at a time that is not concurrent with the commissioning test, it shall contact the interconnection customer to schedule the witness test at a mutually agreeable time within 10 business days after the scheduled commissioning test designated on the application. If the EDC does not perform the witness test within 10 business days after the commissioning test, the witness test is deemed waived unless the Parties mutually agree to extend the date for scheduling the witness test, or unless the EDC cannot do so for good cause, in which case, the Parties shall agree to another date for scheduling the test within 10 business days after the original scheduled date. If the witness test is not acceptable to the EDC, the EDC shall deliver in writing a detailed technical description of all deficiencies of the DER facility identified by the EDC during the witness test. The interconnection customer has 30 business days after receipt of the written description to address and resolve any deficiencies. This time period may be extended upon agreement between the EDC and the interconnection customer. If the interconnection customer fails to address and resolve the deficiencies to the satisfaction of the EDC, the applicable cure provisions of Article 6.5 shall apply. The interconnection customer shall, if requested by the EDC, provide a copy of all documentation in its possession regarding testing conducted pursuant to IEEE Standard 1547.1.

2.1.2 If the interconnection customer conducts interim testing of the DER facility prior to the witness test, the interconnection customer shall obtain permission from the EDC before each occurrence of operating the DER facility in parallel with the electric distribution system. The EDC may, at its own expense, send qualified personnel to the DER facility to observe such interim testing, but it cannot mandate that these tests be considered in the final witness test. The EDC is not required to observe the interim testing or precluded from requiring the tests be repeated at the final witness test. During and leading up to the witness test, the EDC shall not limit the interconnection customer's ability to test the DER facility during normal working hours except for safety and reliability reasons.

2.1.3 After the DER facility passes the witness test, the EDC shall affix an authorized signature to the certificate of completion and return it to the interconnection customer approving the interconnection and authorizing parallel operation. The authorization shall not be conditioned or delayed and the EDC shall return the signed certificate of completion to the interconnection customer no more than 10 business days after the date that the DER facility passes the witness test.

2.2 Commercial Operation
The interconnection customer shall not operate the DER facility, except for interim testing as provided in Article 2.1, until such time as the certificate of completion is signed by all Parties.

2.3 Right of Access
The EDC must have access to the disconnect switch and metering equipment of the DER facility at all times. When practical, the EDC shall provide notice to the customer prior to using its right of access.

Article 3. Effective Date, Term, Termination, and Disconnection

3.1 Effective Date
This Agreement shall become effective upon execution by all Parties.

3.2 Term of Agreement
This Agreement shall become effective on the effective date and shall remain in effect unless terminated in accordance with Article 3.3 of this Agreement.

3.3 Termination

3.3.1 The interconnection customer may terminate this Agreement at any time by giving the EDC 30 calendar days prior written notice.

3.3.2 Either Party may terminate this Agreement after default pursuant to Article 6.5.

3.3.3 The EDC may terminate, upon 60 calendar days' prior written notice, for failure of the interconnection customer to complete construction of the DER facility within 12 months after the in-service date as specified by the Parties in Attachment 2, which may be extended by agreement between the Parties.

3.3.4 The EDC may terminate this Agreement, upon 60 calendar days' prior written notice, if the interconnection customer has abandoned, cancelled, permanently disconnected or stopped development, construction, or operation of the DER facility, or if the interconnection customer fails to operate the DER facility in parallel with the EDC's electric system for three consecutive years.

3.3.5 Upon termination of this Agreement, the DER facility will be disconnected from the EDC's electric distribution system. Terminating this Agreement does not relieve either Party of its liabilities and obligations that are owed or continuing when the Agreement is terminated.

3.3.6 If the Agreement is terminated, the interconnection customer loses its position in the interconnection queue.

3.4 Temporary Disconnection

A Party may temporarily disconnect the DER facility from the electric distribution system in the event one or more of the following conditions or events occurs:

3.4.1 Emergency conditions – shall mean any condition or situation: (1) that in the judgment of the Party making the claim is likely to endanger life or property; or (2) that the EDC determines is likely to cause an adverse system impact, or is likely to have a material adverse effect on the EDC's electric distribution system, interconnection facilities or other facilities, or is likely to interrupt or materially interfere with the provision of electric utility service to other customers; or (3) that is likely to cause a material adverse effect on the DER facility or the interconnection equipment. Under emergency conditions, the EDC or the interconnection customer may suspend interconnection service and temporarily disconnect the DER facility from the electric distribution system. The EDC must notify the interconnection customer when it becomes aware of any conditions that might affect the interconnection customer's operation of the DER facility. The interconnection customer shall notify the EDC when it becomes aware of any condition that might affect the EDC's electric distribution system. To the extent information is known, the notification shall describe the condition, the extent of the damage or deficiency, the expected effect on the operation of both Parties' facilities and operations, its anticipated duration, and the necessary corrective action.

3.4.2 Scheduled maintenance, construction, or repair – the EDC may interrupt interconnection service or curtail the output of the DER facility and temporarily disconnect the DER facility from the EDC's electric distribution system when necessary for scheduled maintenance, construction, or repairs on EDC's electric distribution system. The EDC shall provide the interconnection customer with notice no less than 5 business days before an interruption due to scheduled maintenance, construction, or repair, or the EDC shall provide notice immediately if the scheduled maintenance, construction, or repair is scheduled less than 5 business days in advance. The EDC shall coordinate the reduction or temporary disconnection with the interconnection customer; however, the interconnection customer is responsible for out-of-pocket costs incurred by the EDC for deferring or rescheduling maintenance, construction or repair at the interconnection customer's request.

3.4.3 Forced outages – The EDC may suspend interconnection service to repair the EDC's electric distribution system. The EDC shall provide the interconnection customer with prior notice, if possible. If prior notice is not possible, the EDC shall, upon written request, provide the interconnection customer with written documentation, after the fact, explaining the circumstances of the disconnection.

3.4.4 Adverse system impact – the EDC must provide the interconnection customer with written notice of its intention to disconnect the DER facility, if the EDC determines that operation of the DER facility creates an adverse system impact. The documentation that supports the EDC's decision to disconnect must be provided to the interconnection customer. The EDC may disconnect the DER facility if, after receipt of the notice, the interconnection customer fails to remedy the adverse system impact, unless emergency conditions exist, in which case, the provisions of Article 3.4.1 apply. The EDC may continue to leave the generating facility disconnected until the adverse system impact is corrected.

3.4.5 Modification of the DER facility – The interconnection customer must receive written authorization from the EDC prior to making any change to the DER facility, other than a minor equipment modification. If the interconnection customer modifies its facility without the EDC's prior written authorization, the EDC has the right to disconnect the DER facility until such time as the EDC concludes the modification poses no threat to the safety or reliability of its electric distribution system.

3.4.6 The EDC's compliance with Article 3 shall preclude any claim for damages for any lost opportunity or other costs incurred by the interconnection customer as a result of an interruption of service under Article 3. Any dispute over whether the EDC complied with Article 3 shall be resolved in accordance with the dispute resolution mechanism set forth in Article 8.

<u>Article 4.</u> Cost Responsibility for Interconnection Facilities and Distribution Upgrades

4.1 Interconnection Facilities

4.1.1 The interconnection customer shall pay, or reimburse the EDC, as applicable, for the cost of the interconnection facilities itemized in Attachment 3. The EDC shall identify the additional interconnection facilities necessary to interconnect the DER facility with the EDC's electric distribution system, the cost of those facilities, and the time required to build and install those facilities, as well as an estimated date of completion of the building or installation of those facilities.

4.1.2 The interconnection customer is responsible for its expenses, including overheads, associated with owning, operating, maintaining, repairing, and replacing its interconnection equipment.

4.2 Distribution Upgrades
The EDC shall design, procure, construct, install, and own any distribution upgrades. The actual cost of the distribution upgrades, including overheads, shall be directly assigned to the interconnection customer whose distributed energy resources (DER) facility caused the need for the distribution upgrades.

<u>Article 5.</u> Billing, Payment, Milestones, and Financial Security

5.1 Billing and Payment Procedures and Final Accounting (Applies to supplemental reviews conducted under Level 2 or 3 review with EDC construction necessary for accommodating the DER facility, and Level 4 reviews)

5.1.1 The EDC shall bill the interconnection customer for the design, engineering, construction, and procurement costs of EDC-provided interconnection facilities and distribution upgrades contemplated by this Agreement as set forth in Attachment 3. The billing shall occur on a monthly basis, or as otherwise agreed to between the Parties. The interconnection customer shall pay each bill within 30 calendar days after receipt, or as otherwise agreed to between the Parties.

5.1.2 Unless waived by the interconnection customer, within 90 calendar days after completing the construction and installation of the EDC's interconnection facilities and distribution upgrades described in Attachments 2 and 3 to this Agreement, the EDC shall provide the interconnection customer with a final accounting report of any difference between (1) the actual cost incurred to complete the construction and installation of the EDC's interconnection facilities and distribution upgrades; and (2) the interconnection customer's previous deposit and aggregate payments to the EDC for the interconnection facilities and distribution upgrades. If the interconnection customer's cost responsibility exceeds its previous deposit and aggregate payments, the EDC shall invoice the interconnection customer for the amount due and the interconnection customer shall pay the EDC within 30 calendar days. If the interconnection customer's previous deposit and aggregate payments exceed its cost responsibility under this Agreement, the EDC shall refund to the interconnection customer an amount equal to the difference within 30 calendar days after the final accounting report. Upon request from the interconnection customer, if the difference between the budget estimate and the actual cost exceeds 20%, the EDC will provide a written explanation for the difference.

5.1.3 If a Party disputes any portion of its payment obligation pursuant to this Article 5, the Party shall pay in a timely manner all non-disputed portions of its invoice, and the disputed amount shall be resolved pursuant to the dispute resolution provisions contained in Article 8. A Party disputing a portion of an Article 5 payment shall not be considered to be in default of its obligations under this Article.

5.2 Interconnection Customer Deposit

Within 15 business days after signing and returning the interconnection agreement to the EDC, the interconnection customer shall provide the EDC with a deposit equal to 100% of the estimated, non-binding cost to procure, install, or construct any such facilities. However, when the estimated date of completion of the building or installation of facilities exceeds three months from the date of notification, pursuant to Article 4.1.1 of this Agreement, this deposit may be held in escrow by a mutually agreed-upon third-party, with any interest to inure to the benefit of the interconnection customer. To the extent that this interconnection agreement is terminated for any reason, the EDC shall return all deposits provided by the interconnection customer, less any actual costs incurred by the EDC.

Article 6. Assignment, Limitation on Damages, Indemnity, Force Majeure, and Default

6.1 Assignment

This Agreement may be assigned by either Party. If the interconnection customer attempts to assign this Agreement, the assignee must agree to the terms of this Agreement in writing and such writing must be provided to the EDC. Any attempted assignment that violates this Article is void and ineffective. Assignment shall not relieve a Party of its obligations, nor shall a Party's obligations be enlarged, in whole or in part, by reason of the assignment. An assignee is responsible for meeting the same obligations as the assignor.

6.1.1 Either Party may assign this Agreement without the consent of the other Party to any affiliate (including mergers, consolidations or transfers, or a sale of a substantial portion of the Party's assets, between the Party and another entity), of the assigning Party that has an equal or greater credit rating and the legal authority and operational ability to satisfy the obligations of the assigning Party under this Agreement.

6.1.2 The interconnection customer can assign this Agreement, without the consent of the EDC, for collateral security purposes to aid in providing financing for the DER facility.

6.2 Limitation on Damages

Except for cases of gross negligence or willful misconduct, the liability of any Party to this Agreement shall be limited to direct actual damages and reasonable attorney's fees, and all other damages at law are waived. Under no circumstances, except for cases of gross negligence or willful misconduct, shall any Party or its directors, officers, employees and agents, or any of them, be liable to another Party, whether in tort, contract or other basis in law or equity for any special, indirect, punitive, exemplary or consequential damages, including lost profits, lost revenues, replacement power, cost of capital or replacement equipment. This limitation on damages shall not affect any Party's rights to obtain equitable relief, including specific performance, as otherwise provided in this Agreement. The provisions of this Article 6.2 shall survive the termination or expiration of the Agreement.

6.3 Indemnity

6.3.1 This provision protects each Party from liability incurred to third parties as a result of carrying out the provisions of this Agreement. Liability under this provision is exempt from the general limitations on liability found in Article 6.2.

6.3.2 The interconnection customer shall indemnify and defend the EDC and the EDC's directors, officers, employees, and agents, from all damages and expenses resulting from a third party claim arising out of or based upon the interconnection customer's (a) negligence or willful misconduct or (b) breach of this Agreement.

6.3.3 The EDC shall indemnify and defend the interconnection customer and the interconnection customer's directors, officers, employees, and agents from all damages and expenses resulting from a third party claim arising out of or based upon the EDC's (a) negligence or willful misconduct or (b) breach of this Agreement.

6.3.4 Within 5 business days after receipt by an indemnified Party of any claim or notice that an action or administrative or legal proceeding or investigation as to which the indemnity provided for in this Article may apply has commenced, the indemnified Party shall notify the indemnifying Party of such fact. The failure to notify, or a delay in notification, shall not affect a Party's indemnification obligation unless that failure or delay is materially prejudicial to the indemnifying Party.

6.3.5 If an indemnified Party is entitled to indemnification under this Article as a result of a claim by a third party, and the indemnifying Party fails, after notice and reasonable opportunity to proceed under this Article, to assume the defense of such claim, that indemnified Party may, at the expense of the indemnifying Party, contest, settle or consent to the entry of any judgment with respect to, or pay in full, the claim.

6.3.6 If an indemnifying Party is obligated to indemnify and hold any indemnified Party harmless under this Article, the amount owing to the indemnified person shall be the amount of the indemnified Party's actual loss, net of any insurance or other recovery.

6.4 Force Majeure

6.4.1 As used in this Article, a force majeure event shall mean any act of God, labor disturbance, act of the public enemy, war, acts of terrorism, insurrection, riot, fire, storm or flood, explosion, breakage or accident to machinery or equipment through no direct, indirect, or contributory act of a Party, any order, regulation or restriction imposed by governmental, military or lawfully established civilian authorities, or any other cause beyond a Party's control. A force majeure event does not include an act of gross negligence or intentional wrongdoing by the Party claiming force majeure.

6.4.2 If a force majeure event prevents a Party from fulfilling any obligations under this Agreement, the Party affected by the force majeure event ("Affected Party") shall notify the other Party of the existence of the force majeure event within one business day. The notification must specify the circumstances of the force majeure event, its expected duration, and the steps that the Affected Party is taking and will take to mitigate the effects of the event on its performance. If the initial notification is verbal, it must be followed up with a written notification within one business day. The Affected Party shall keep the other Party informed on a continuing basis of developments relating to the force majeure event until the event ends. The Affected Party may suspend or modify its obligations under this Agreement (other than the obligation to make payments) only to the extent that the effect of the force majeure event cannot be otherwise mitigated.

6.5 Default

6.5.1 No default shall exist when the failure to discharge an obligation (other than the payment of money) results from a force majeure event as defined in this Agreement, or the result of an act or omission of the other Party.

6.5.2 A Party shall be in default ("Default") of this Agreement if it fails in any material respect to comply with, observe or perform, or defaults in the performance of, any covenant or obligation under this Agreement and fails to cure the failure within 60 calendar days after receiving written notice from the other Party. Upon a default of this Agreement, the non-defaulting Party shall give written notice of the default to the defaulting Party. Except as provided in Article 6.5.3, the defaulting Party has 60 calendar days after receipt of the default notice to cure the default; provided, however, if the default cannot be cured within 60 calendar days, the defaulting Party shall commence the cure within 20 calendar days after original notice and complete the cure within six months from receipt of the default notice; and, if cured within that time, the default specified in the notice shall cease to exist.

6.5.3 If a Party has assigned this Agreement in a manner that is not specifically authorized by Article 6.1, fails to provide reasonable access pursuant to Article 2.3, and is in default of its obligations pursuant to Article 7, or if a Party is in default of its payment obligations pursuant to Article 5 of this Agreement, the defaulting Party has 30 days from receipt of the default notice to cure the default.

6.5.4 If a default is not cured as provided for in this Article, or if a default is not capable of being cured within the period provided for in this Article, the non-defaulting Party shall have the right to terminate this Agreement by written notice, and be relieved of any further obligation under this Agreement and, whether or not that Party terminates this Agreement, to recover from the defaulting Party all amounts due under this Agreement, plus all other damages and remedies to which it is entitled at law or in equity. The provisions of this Article shall survive termination of this Agreement.

Article 7. Insurance

For DER facilities with a nameplate capacity of 1 MVA or above, the interconnection customer shall carry sufficient insurance coverage so that the maximum comprehensive/general liability coverage that is continuously maintained by the interconnection customer during the term shall be not less than $2,000,000 for each occurrence, and an aggregate, if any, of at least $4,000,000. The EDC, its officers, employees and agents shall be added as an additional insured on this policy. The interconnection customer agrees to provide the EDC with at least 30 calendar days advance written notice of cancellation, reduction in limits, or non-renewal of any insurance policy required by this Article.

Article 8. Dispute Resolution

8.1 Parties shall attempt to resolve all disputes regarding interconnection as provided in this Article in a good faith manner.

8.2 If there is a dispute between the Parties about implementation or an interpretation of the Agreement, the aggrieved Party shall issue a written notice to the other Party to the Agreement that specifies the dispute and the Agreement articles that are disputed.

8.3 A meeting between the Parties shall be held within 10 days after receipt of the written notice. Persons with decision-making authority from each Party shall attend the meeting. If the dispute involves technical issues, persons with sufficient technical expertise and familiarity with the issue in dispute from each Party shall also attend the meeting. The meeting may be conducted by teleconference. The informal process between the parties shall extend 30 days after the receipt of written notice, after which the dispute is deemed resolved and the timeframes for decisions within the interconnection process resume, unless one of the parties seeks resolution through non-binding arbitration procedures described in Article 8.4 or files a formal complaint at the Commission prior to the end of the 30-day period.

8.4 If the parties are unable to resolve the dispute through the process outlined in Article 8.3, either party may submit the interconnection dispute to an Ombudsman for non-binding arbitration. The party electing non-binding arbitration shall notify the other party of the request in writing. The non-binding arbitration process is limited to 60 days, absent mutual agreement of the parties and the Ombudsman to a longer period.

8.5 Each party shall bear its own fees, costs and expenses and an equal share of the expenses of the non-binding arbitration.

8.6 Within 10 days after the conclusion of the procedures in Article 8.4, either party may initiate a formal complaint with the Commission and ask for an expedited resolution of the dispute. If the complaint seeks expedited resolution, any written recommendation of the Ombudsman shall be appended to the complaint. The formal complaint shall proceed as a contested hearing pursuant to the Commission's Rules of Practice.

8.7 A party may, after good faith negotiations have failed, decline to pursue non-binding arbitration and instead initiate a formal complaint with the Commission. The formal complaint shall proceed as a contested hearing pursuant to the Commission's Rules of Practice.

8.8 Pursuit of dispute resolution may not affect an interconnection request or an interconnection applicant's position in the EDC's interconnection queue.

8.9 If the Parties fail to resolve their dispute under the dispute resolution provisions of this Article, nothing in this Article shall affect any Party's rights to obtain equitable relief, including specific performance, as otherwise provided in this Agreement.

Article 9. Miscellaneous

9.1 Governing Law, Regulatory Authority, and Rules

The validity, interpretation and enforcement of this Agreement and each of its provisions shall be governed by the laws of the State of Illinois, without regard to its conflicts of law principles. This Agreement is subject to all applicable laws and regulations. Each Party expressly reserves the right to seek change in, appeal, or otherwise contest any laws, orders or regulations of a governmental authority. The language in all parts of this Agreement shall in all cases be construed as a whole, according to its fair meaning, and not strictly for or against the EDC or interconnection customer, regardless of the involvement of either Party in drafting this Agreement.

9.2 Amendment

Modification of this Agreement shall be only by a written instrument duly executed by both Parties.

9.3 No Third-Party Beneficiaries

This Agreement is not intended to and does not create rights, remedies, or benefits of any character whatsoever in favor of any persons, corporations, associations, or entities other than the Parties, and the obligations in this Agreement assumed are solely for the use and benefit of the Parties, their successors in interest and, where permitted, their assigns.

9.4 Waiver

9.4.1 Except as otherwise provided in this Agreement, a Party's compliance with any obligation, covenant, agreement, or condition in this Agreement may be waived by the Party entitled to the benefits thereof only by a written instrument signed by the Party granting the waiver, but the waiver or failure to insist upon strict compliance with the obligation, covenant, agreement, or condition shall not operate as a waiver of, or estoppel with respect to, any subsequent or other failure.

9.4.2. Failure of any Party to enforce or insist upon compliance with any of the terms or conditions of this Agreement, or to give notice or declare this Agreement or the rights under this Agreement terminated, shall not constitute a waiver or relinquishment of any rights set out in this Agreement, but the same shall be and remain at all times in full force and effect, unless and only to the extent expressly set forth in a written document signed by that Party granting the waiver or relinquishing any such rights. Any waiver granted, or relinquishment of any right, by a Party shall not operate as a relinquishment of any other rights or a waiver of any other failure of the Party granted the waiver to comply with any obligation, covenant, agreement, or condition of this Agreement.

9.5 Entire Agreement

Except as provided in Article 9.1, this Agreement, including all attachments, constitutes the entire Agreement between the Parties with reference to the subject matter of this Agreement, and supersedes all prior and contemporaneous understandings or agreements, oral or written, between the Parties with respect to the subject matter of this Agreement. There are no other agreements, representations, warranties, or covenants that constitute any part of the consideration for, or any condition to, either Party's compliance with its obligations under this Agreement.

9.6 Multiple Counterparts

This Agreement may be executed in two or more counterparts, each of which is deemed an original, but all constitute one and the same instrument.

9.7 No Partnership

This Agreement shall not be interpreted or construed to create an association, joint venture, agency relationship, or partnership between the Parties, or to impose any partnership obligation or partnership liability upon either Party. Neither Party shall have any right, power or authority to enter into any agreement or undertaking for, or act on behalf of, or to act as or be an agent or representative of, or to otherwise bind, the other Party.

9.8 Severability

If any provision or portion of this Agreement shall for any reason be held or adjudged to be invalid or illegal or unenforceable by any court of competent jurisdiction or other governmental authority, (1) that portion or provision shall be deemed separate and independent, (2) the Parties shall negotiate in good faith to restore insofar as practicable the benefits to each Party that were affected by the ruling, and (3) the remainder of this Agreement shall remain in full force and effect.

9.9 Environmental Releases

Each Party shall notify the other Party of the release of any hazardous substances, any asbestos or lead abatement activities, or any type of remediation activities related to the DER facility or the interconnection facilities, each of which may reasonably be expected to affect the other Party. The notifying Party shall (1) provide the notice as soon as practicable, provided that Party makes a good faith effort to provide the notice no later than 24 hours after that Party becomes aware of the occurrence, and (2) promptly furnish to the other Party copies of any publicly available reports filed with any governmental authorities addressing such events.

9.10 Subcontractors

Nothing in this Agreement shall prevent a Party from using the services of any subcontractor it deems appropriate to perform its obligations under this Agreement; provided, however, that each Party shall require its subcontractors to comply with all applicable terms and conditions of this Agreement in providing services and each Party shall remain primarily liable to the other Party for the performance of the subcontractor.

9.10.1 A subcontract relationship does not relieve any Party of any of its obligations under this Agreement. The hiring Party remains responsible to the other Party for the acts or omissions of its subcontractor. Any applicable obligation imposed by this Agreement upon the hiring Party shall be equally binding upon, and shall be construed as having application to, any subcontractor of the hiring Party.

9.10.2 The obligations under this Article cannot be limited in any way by any limitation of subcontractor's insurance.

Article 10. **Notices**

10.1 General

Unless otherwise provided in this Agreement, any written notice, demand, or request required or authorized in connection with this Agreement ("Notice") shall be deemed properly given if delivered in person, delivered by recognized national courier service, or sent by first class mail, postage prepaid, to the person specified below:

If to Interconnection Customer:

Interconnection Customer: N Duncan Road Solar, LLC

Attention: Matt Doubleday

Address: 47 Bow St

City: Portsmouth State: NH Zip: 03801

Phone: 603-852-2318 Fax: ______ E-Mail: matt@rewildrenewables.com

If to EDC:

EDC: Ameren Illinois Company

Attention: Ameren Illinois Net Metering Coordinator

Address: 10 Richard Mark Way – Mail Code 910

City: Collinsville State: IL Zip: 62234

Phone: ______ Fax: ______ E-Mail: RenewablesIllinois@ameren.com

Alternative Forms of Notice

Any notice or request required or permitted to be given by either Party to the other Party and not required by this Agreement to be in writing may be given by telephone, facsimile or e-mail to the telephone numbers and e-mail addresses set out above.

10.2 Billing and Payment

Billings and payments shall be sent to the addresses set out below:

If to Interconnection Customer:

Interconnection Customer: N Duncan Road Solar, LLC

Attention: Patrick Jackson

Address: PO Box 1320

City: Portsmouth State: NH Zip: 03801

If to EDC:

EDC: Ameren Illinois

Attention: Ameren Net Metering Coordinator

Address: 10 Richard Mark Way – Mail Code 910

City: Collinsville State: IL Zip: 62234

10.3 Designated Operating Representative
The Parties may also designate operating representatives to conduct the communications that may be necessary or convenient for the administration of this Agreement. This person will also serve as the point of contact with respect to operations and maintenance of the Party's facilities.

Interconnection Customer's Operating Representative: N Duncan Road Solar, LLC

Attention: Matt Doubleday

Address: 47 Bow St

City: Portsmouth State: NH Zip: 03801

EDC's Operating Representative: Ameren Illinois

Attention: Ameren Illinois Net Metering Coordinator

Address: 10 Richard Mark Way – Mail Code 910

City: Collinsville State: IL Zip: 62234

10.4 Changes to the Notice Information
Either Party may change this notice information by giving five business days written notice before the effective date of the change.

<u>Article 11.</u> Signatures

IN WITNESS WHEREOF, the Parties have caused this Agreement to be executed by their respective duly authorized representatives.

<u>For the Interconnection Customer: -</u>

Name: Patrick Jackson

Title: Managing Member

Date: 5/23/25

<u>For EDC:</u>

Name: Patrick E. Smith

Title: SVP, Operations and Technical Services

Date: 6/6/2025

Attachment 1

Definitions

Adverse system impact – A negative effect that compromises the safety or reliability of the electric distribution system or materially affects the quality of electric service provided by the electric distribution company (EDC) to other customers.

Applicable laws and regulations – All duly promulgated applicable federal, State and local laws, regulations, rules, ordinances, codes, decrees, judgments, directives, or judicial or administrative orders, permits and other duly authorized actions of any governmental authority, having jurisdiction over the Parties.

Commissioning test – Tests applied to a distributed energy resources (DER) facility by the applicant after construction is completed to verify that the facility does not create adverse system impacts. At a minimum, the scope of the commissioning tests performed shall include the commissioning test specified IEEE Standard 1547 Section 5.4 "Commissioning tests."

Distributed Energy Resources (DER) facility – The equipment used by an interconnection customer to generate or store electricity that operates in parallel with the electric distribution system. A distributed generation facility typically includes an electric generator, prime mover, and the interconnection equipment required to safely interconnect with the electric distribution system or a local electric power system.

Distribution upgrades – A required addition or modification to the EDC's electric distribution system at or beyond the point of interconnection to accommodate the interconnection of a distributed energy resources (DER) facility. Distribution upgrades do not include interconnection facilities.

Electric distribution company or EDC – Any electric utility entity subject to the jurisdiction of the Illinois Commerce Commission.

Electric distribution system – The facilities and equipment used to transmit electricity to ultimate usage points such as homes and industries from interchanges with higher voltage transmission networks that transport bulk power over longer distances. The voltage levels at which electric distribution systems operate differ among areas but generally carry less than 100 kilovolts of electricity. Electric distribution system has the same meaning as the term Area EPS, as defined in 3.1.6.1 of IEEE Standard 1547.

Facilities study – An engineering study conducted by the EDC to determine the required modifications to the EDC's electric distribution system, including the cost and the time required to build and install the modifications, as necessary to accommodate an interconnection request.

Force majeure event – Any act of God, labor disturbance, act of the public enemy, war, acts of terrorism, insurrection, riot, fire, storm or flood, explosion, breakage or accident to machinery or equipment through no direct, indirect, or contributory act of a Party, any order, regulation or restriction imposed by governmental, military or lawfully established civilian authorities, or any other cause beyond a Party's control. A force majeure event does not include an act of gross negligence or intentional wrongdoing.

Governmental authority – Any federal, State, local or other governmental regulatory or administrative agency, court, commission, department, board, other governmental subdivision, legislature, rulemaking board, tribunal, or other governmental authority having jurisdiction over the Parties, their respective facilities, or the respective services they provide, and exercising or entitled to exercise any administrative, executive, police, or taxing authority or power; provided, however, that this term does not include the interconnection customer, EDC or any affiliate of either.

IEEE Standard 1547 – The Institute of Electrical and Electronics Engineers, Inc. (IEEE), 3 Park Avenue, New York NY 10016-5997, Standard 1547 (2003), "Standard for Interconnecting Distributed Resources with Electric Power Systems."

IEEE Standard 1547.1 – The IEEE Standard 1547.1 (2005), "Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems."

Interconnection agreement or Agreement – The agreement between the interconnection customer and the EDC. The interconnection agreement governs the connection of the distributed energy resources (DER) facility to the EDC's electric distribution system and the ongoing operation of the distributed generation facility after it is connected to the EDC's electric distribution system.

Interconnection customer – The entity entering into this Agreement for the purpose of interconnecting a distributed energy resources (DER) facility to the EDC's electric distribution system.

Interconnection equipment – A group of components or an integrated system connecting an electric generator with a local electric power system or an electric distribution system that includes all interface equipment, including switchgear, protective devices, inverters or other interface devices. Interconnection equipment may be installed as part of an integrated equipment package that includes a generator or other electric source.

Interconnection facilities – Facilities and equipment required by the EDC to accommodate the interconnection of a distributed energy resources (DER) facility. Collectively, interconnection facilities include all facilities, and equipment between the distributed energy resources (DER) facility and the point of interconnection, including modification, additions, or upgrades that are necessary to physically and electrically interconnect the distributed energy resources (DER) facility to the electric distribution system. Interconnection facilities are sole use facilities and do not include distribution upgrades.

Interconnection request – An interconnection customer's request, on the required form, for the interconnection of a new distributed energy resources (DER) facility, or to increase the capacity or change the operating characteristics of an existing distributed energy resources (DER) facility that is interconnected with the EDC's electric distribution system.

Interconnection study – Any of the following studies, as determined to be appropriate by the EDC: the interconnection feasibility study, the interconnection system impact study, and the interconnection facilities study.

Illinois standard distributed energy resources interconnection rules – The most current version of the procedures for interconnecting distributed energy resources (DER) facilities adopted by the Illinois Commerce Commission. See 83 Ill. Adm. Code 466.

Parallel operation or Parallel – The state of operation that occurs when a distributed energy resources (DER) facility is connected electrically to the electric distribution system.

Point of interconnection – The point where the distributed energy resources (DER) facility is electrically connected to the electric distribution system. Point of interconnection has the same meaning as the term "point of common coupling" defined in 3.1.13 of IEEE Standard 1547.

Witness test – For lab-certified equipment, verification (either by an on-site observation or review of documents) by the EDC that the interconnection installation evaluation required by IEEE Standard 1547 Section 5.3 and the commissioning test required by IEEE Standard 1547 Section 5.4 have been adequately performed. For interconnection equipment that has not been lab-certified, the witness test shall also include verification by the EDC of the on-site design tests required by IEEE Standard 1547 Section 5.1 and verification by the EDC of production tests required by IEEE Standard 1547 Section 5.2. All tests verified by the EDC are to be performed in accordance with the test procedures specified by IEEE Standard 1547.1.

Attachment 2

Construction Schedule, Proposed Equipment & Settings

This attachment is to be completed by the interconnection customer and shall include the following:

1. The construction schedule for the distributed energy resources (DER) facility.

2. A one-line diagram indicating the distributed energy resources (DER) facility, interconnection equipment, interconnection facilities, metering equipment, and distribution upgrades.

3. Component specifications for equipment identified in the one-line diagram.

4. Component settings.

5. Proposed sequence of operations.

6. A three line diagram showing current potential circuits for protective relays.

7. Relay tripping and control schematic diagram.

Attachment 3

Description, Costs and Time Required to Build and Install the EDC's Interconnection Facilities

This attachment is to be completed by the EDC and shall include the following:

1. Required interconnection facilities, including any required metering.

   Per the prior studies - EDC shall build the substation facilities as required to support the interconnection of the interconnection customer proposed facility up to the point of disconnect. The interconnection would consist of 3Ø, 3-wire, 69 kV meter (pole, instrument transformers, cabinet, etc.) , Ameren-owned, 69 kV Viper at the POI, main line disconnect switches at POI ,Line tap pole , and 1.22 mile tap extension to POI. The interconnection customer would be responsible for construction to the point of disconnect. All costs shall be paid for and/or reimbursed by the interconnection customer pursuant to Article 5 of this agreement. The interconnection customer is required to construct all facilities which connect to EDC’s facilities or otherwise interface with EDC’s facilities, all as determined by EDC’s final, detailed engineering, in accordance with EDC’s published standards.

   Additional required interconnection facilities and system upgrades may be identified while completing Detailed Engineering.

2. An estimate of itemized costs charged by the EDC for interconnection, including overheads, based on results from prior studies.

   North Duncan Road Hensley PH2: North Duncan Road Hensley Township, IL- **5000 KW** (PowerClerk DER-26254)

   Queue Position:2

   NOTE: *THE COST ESTIMATE PROVIDED FOR YOUR PROJECT IN THE NEXT SECTION IS CONTINGENT UPON CONSTRUCTION COMPLETION OF ALL SYSTEM UPGRADES REQUIRED OF PROJECT(S) AHEAD OF YOUR PROJECT IN THE QUEUE THAT HAVE AN IMPACT ON THE CONNECTION OF YOUR PROJECT. SHOULD ANY ONE OR MORE OF SUCH PROJECTS WITHDRAW FOR ANY REASON, THE COSTS ASSOCIATED WITH YOUR PROJECT MAY CHANGE TO REFLECT THE COST IMPACT OF SYSTEM UPGRADES THAT NOW MAY BE*

REQUIRED TO CONNECT YOUR PROJECT AS A RESULT OF THE WITHDRAWAL OF SUCH HIGHER QUEUED PROJECTS.

An estimate of itemized costs charged by the EDC for interconnection, including overheads.

[redacted]

Ameren Illinois reserves the right to revise this estimate prior to and during construction based on the requirements of Good Utility practices not foreseen at the time of the original estimate. The revisions to the estimate may include, but are not limited to, changes in the cost of materials and required labor.

Notwithstanding Section 5.2 of this Agreement, the Parties may agree to other forms of security in lieu of a cash deposit provided such other form of security is acceptable to the EDC.

3. An estimate for the time required to build and install the EDC's interconnection facilities based on results from prior studies and an estimate of the date upon which the facilities will be completed.

The final construction timeline will be developed during the scoping meeting which will be held with the applicant after the deposit is paid in full and will continue to be updated as the developer and Ameren Illinois work thru the construction process. That notwithstanding, it is anticipated that Ameren Illinois will initiate procurement activities immediately following the scoping meeting. Any revisions to the current scope of construction activities and their timeline will be provided immediately after that discussion. The requested in-service date is dependent on the availability of any long lead time equipment and weather impacts on construction activities.

Attachment 4

Operating Requirements for Distributed Energy Resources Facilities Operating in Parallel

The EDC shall list specific operating practices that apply to this distributed energy resources (DER) interconnection and the conditions under which each listed specific operating practice applies.

1. Customer shall meet requirements specified in Level 2 or 4 study.

Attachment 5

Monitoring and Control Requirements

This attachment is to be completed by the EDC and shall include the following:

1. The EDC's monitoring and control requirements must be specified, along with a reference to the EDC's written requirements documents from which these requirements are derived.

2. An internet link to the requirements documents.

https://www.ameren.com/service-manual

http://standards.ieee.org

Attachment 6

Metering Requirements

This attachment is to be completed by the EDC and shall include the following:

1. The metering requirements for the distributed generation facility.

   The specific metering requirements and equipment will be specified as part of the Detailed Engineering.

2. Identification of the appropriate tariffs that establish these requirements.

3. An internet link to these tariffs.

https://www.ameren.com/illinois/business/rates/

https://www.ameren.com/illinois/electric-choice/renewables

Attachment 7

As Built Documents

This attachment is to be completed by the interconnection customer and shall include the following:

When it returns the certificate of completion to the EDC, the interconnection customer shall provide the EDC with documents detailing the as-built status of the following:

1. A one-line diagram indicating the distributed generation facility, interconnection equipment, interconnection facilities, and metering equipment.

2. Component specifications for equipment identified in the one-line diagram.

3. Component settings.

4. Proposed sequence of operations.

5. A three-line diagram showing current potential circuits for protective relays.

6. Relay tripping and control schematic diagram.

EXHIBIT O: CRITICAL COMPONENT DATA SHEETS

CanadianSolar

HiKu7 Mono PERC

645 W ~ 675 W

CS7N-645 | 650 | 655 | 660 | 665 | 670 | 675MS

MORE POWER

675 W — Module power up to 675 W
Module efficiency up to 21.7 %

Up to 3.5 % lower LCOE
Up to 5.7 % lower system cost

Comprehensive LID / LeTID mitigation technology, up to 50% lower degradation

Better shading tolerance

MORE RELIABLE

40 °C lower hot spot temperature, greatly reduce module failure rate

Minimizes micro-crack impacts

Heavy snow load up to 5400 Pa, wind load up to 2400 Pa*

12 Years Enhanced Product Warranty on Materials and Workmanship*

25 Years Linear Power Performance Warranty*

1st year power degradation no more than 2%
Subsequent annual power degradation no more than 0.55%

*According to the applicable Canadian Solar Limited Warranty Statement.

MANAGEMENT SYSTEM CERTIFICATES*

ISO 9001 : 2015 / Quality management system
ISO 14001 : 2015 / Standards for environmental management system
ISO 45001 : 2018 / International standards for occupational health & safety
IEC62941 : 2019 / Photovoltaic module manufacturing quality system

PRODUCT CERTIFICATES*

IEC 61215 / IEC 61730 / CE / INMETRO / MCS / UKCA
UL 61730 / IEC 61701 / IEC 62716 / IEC 63126 Level1 / IEC 60068-2-68
UNI 9177 Reaction to Fire: Class 1 / Take-e-way

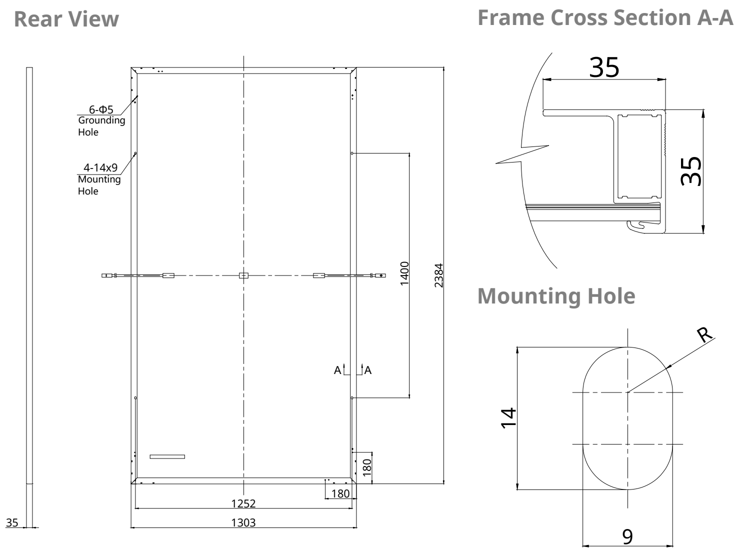
* The specific certificates applicable to different module types and markets will vary, and therefore not all of the certifications listed herein will simultaneously apply to the products you order or use. Please contact your local Canadian Solar sales representative to confirm the specific certificates available for your Product and applicable in the regions in which the products will be used.

CSI Solar Co., Ltd. is committed to providing high quality solar photovoltaic modules, solar energy and battery storage solutions to customers. The company was recognized as the No. 1 module supplier for quality and performance/price ratio in the IHS Module Customer Insight Survey. Over the past 23 years, it has successfully delivered over 125 GW of premium-quality solar modules across the world.

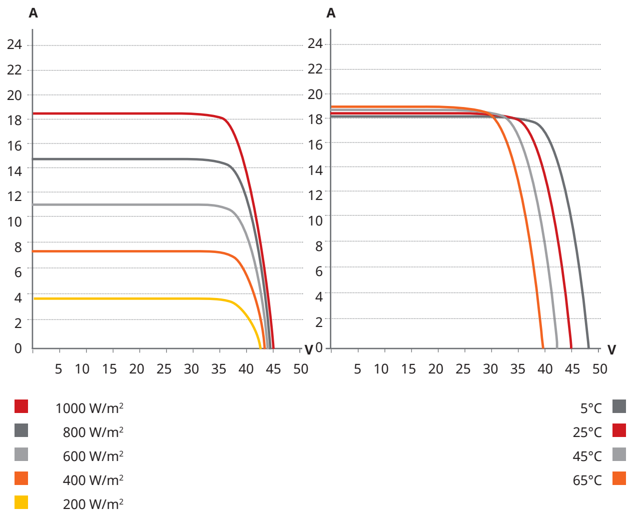
* For detailed information, please refer to the Installation Manual.

CSI Solar Co., Ltd.
199 Lushan Road, SND, Suzhou, Jiangsu, China, 215129, www.csisolar.com, support@csisolar.com

ENGINEERING DRAWING (mm)



CS7N-650MS / I-V CURVES



ELECTRICAL DATA | STC*

CS7N	645MS	650MS	655MS	660MS	665MS	670MS	675MS
Nominal Max. Power (Pmax)	645 W	650 W	655 W	660 W	665 W	670 W	675 W
Opt. Operating Voltage (Vmp)	37.7 V	37.9 V	38.1 V	38.3 V	38.5 V	38.7 V	38.9 V
Opt. Operating Current (Imp)	17.11 A	17.16 A	17.20 A	17.24 A	17.28 A	17.32 A	17.36 A
Open Circuit Voltage (Voc)	44.8 V	45.0 V	45.2 V	45.4 V	45.6 V	45.8 V	46.0 V
Short Circuit Current (Isc)	18.35 A	18.39 A	18.43 A	18.47 A	18.51 A	18.55 A	18.59 A
Module Efficiency	20.8%	20.9%	21.1%	21.2%	21.4%	21.6%	21.7%
Operating Temperature	-40°C ~ +85°C						
Max. System Voltage	1500V (IEC/UL)) or 1000V (IEC/UL))						
Module Fire Performance	TYPE 1 (UL 61730 1500V) or TYPE 2 (UL 61730 1000V) or CLASS C (IEC 61730)						
Max. Series Fuse Rating	30 A						
Protection Class	Class II						
Power Tolerance	0 ~ + 10 W						

* Under Standard Test Conditions (STC) of irradiance of 1000 W/m², spectrum AM 1.5 and cell temperature of 25°C.

ELECTRICAL DATA | NMOT*

CS7N	645MS	650MS	655MS	660MS	665MS	670MS	675MS
Nominal Max. Power (Pmax)	484 W	487 W	491 W	495 W	499 W	502 W	506 W
Opt. Operating Voltage (Vmp)	35.3 V	35.5 V	35.7 V	35.9 V	36.1 V	36.3 V	36.5 V
Opt. Operating Current (Imp)	13.72 A	13.74 A	13.76 A	13.79 A	13.83 A	13.85 A	13.88 A
Open Circuit Voltage (Voc)	42.3 V	42.5 V	42.7 V	42.9 V	43.1 V	43.3 V	43.5 V
Short Circuit Current (Isc)	14.80 A	14.83 A	14.86 A	14.89 A	14.93 A	14.96 A	14.99 A

* Under Nominal Module Operating Temperature (NMOT), irradiance of 800 W/m², spectrum AM 1.5, ambient temperature 20°C, wind speed 1 m/s.

MECHANICAL DATA

Specification	Data
Cell Type	Mono-crystalline
Cell Arrangement	132 [2 x (11 x 6)]
Dimensions	2384 × 1303 × 35 mm (93.9 × 51.3 × 1.38 in)
Weight	33.9 kg (74.7 lbs)
Front Cover	3.2 mm tempered glass with anti-reflective coating
Frame	Anodized aluminium alloy, crossbar enhanced
J-Box	IP68, 3 bypass diodes
Cable	4 mm² (IEC), 12 AWG (UL)
Cable Length (Including Connector)	360 mm (14.2 in) (+) / 200 mm (7.9 in) (-) or customized length*
Connector	T6 or T4 or MC4-EVO2 or MC4-EVO2A
Per Pallet	31 pieces
Per Container (40' HQ)	558 pieces

* For detailed information, please contact your local Canadian Solar sales and technical representatives.

TEMPERATURE CHARACTERISTICS

Specification	Data
Temperature Coefficient (Pmax)	-0.34 % / °C
Temperature Coefficient (Voc)	-0.26 % / °C
Temperature Coefficient (Isc)	0.05 % / °C
Nominal Module Operating Temperature	41 ± 3°C

PARTNER SECTION

* The specifications and key features contained in this datasheet may deviate slightly from our actual products due to the on-going innovation and product enhancement. CSI Solar Co., Ltd. reserves the right to make necessary adjustment to the information described herein at any time without further notice.
Please be kindly advised that PV modules should be handled and installed by qualified people who have professional skills and please carefully read the safety and installation instructions before using our PV modules.

CSI Solar Co., Ltd.
199 Lushan Road, SND, Suzhou, Jiangsu, China, 215129, www.csisolar.com, support@csisolar.com

ARRAY

FASTER COMMISSIONING

SkyLink motors receive power from the PV field. This allows trackers to be commissioned without the need for AC power. Once the equipment around one inverter block is installed, the block can be commissioned and is ready to generate power. No need to wait for 100% site completion or AC backfeed.

CYBERSECURITY

Zigbee wireless communication follows a "Defense-in-Depth" approach recommended by US Department of Homeland Security guidelines. This adds multiple layers of protection against security breaches through wireless communication.

ARRAY TECHNOLOGIES

3901 Midway Place NE
Albuquerque, NM 87109 USA

sales@arraytechinc.com
arraytechinc.com

UP TO 8 LINKED ROWS PER DRIVE MOTOR

STRING POWERED

STRUCTURAL & MECHANICAL FEATURES/SPECIFICATIONS

Tracker Type	Horizontal single axis (1 module in portrait)
Ground Cover Ratio (GCR)	Site configurable. Typical: 28-45%
Linked Rows per Drive Motor	Up to 8
Drive Type	Rotating gear drive connected by drivelines (no driveline or bearing lubrication required)
ARRAY Height	Torque Tube Elevation: 54" standard, adjustable (48" min height above grade)
Tracking Range of Motion	+/- 52°
Terrain Flexibility (N-S)	Up to 8.5° standard (up to 15° optional) and up to 1° slope change in torque tube
Terrain Flexibility (E-W)	Up to 30° combined angle
Wind Protection	Autonomous passive mechanical system No sensors or grid power required to activate
Max Wind Speed	140mph (225 km/h) per ASCE 7-10 (3-second gust), higher wind speeds possible depending on project conditions
Operating Temp Range	-40°F to 140°F (-40°C to 60°C)
Materials	Pre-galv steel, HDG steel and aluminum structural members, as required.
Codes and Standards	Certified to UL 3703

MODULE COMPATIBLITY

c-Si Modules per Row (1500V DC)	Typical: 84-112 Maximum: 120
First Solar Modules per Row (1500V DC)	Series 6 Plus: 84-108 Series 7: 96-114
Modules Supported	Most commercially available, including framed or frameless crystalline, thin film, bifacial, and back rails.
Module Attachment	Single fastener, high-speed mounting clamps with integrated grounding. Traditional rails for crystalline in landscape, custom racking for thin film and frameless crystalline and bifacial per manufacturer specs.

*Power Consumption for "Motor + Controller" and "Repeater" do not account for power curtailment by inverter. Consumption will be reduced if this curtailment is considered.

CONTROL SYSTEM DETAILS

Baseline Solar Tracking Method	SANDIA's Ephemeris Model
Control Electronics	SmarTrack™ Controller SkyLink tracker controller SkyLink gateway
Communications	Internal: wireless Zigbee External: MODBUS TCP
Backtracking	Yes (Optional terrain adaptive backtracking with SmarTrack)
Diffuse Light Response	Yes (Optional with SmarTrack)
Hail Alert Response	Yes (Optional with SmarTrack)
Automated Snow Re-sponse	Yes (Optional with SmarTrack)
Night-time Stow	Yes (configurable)
Tracking Accuracy	+/- 2°
Motor Type	150W 24V brushless DC

INSTALLATION, OPERATION, AND MAINTENANCE

Daily Power Consumption* (per 5 MWdc)	Motor + Controller = 8kWh Repeater = 0.5kWh Gateway = 0.7kWh
PE Stamped Structural Calculations & Drawings	Yes
On-site Training and System Commissioning	Yes
Connection	100% bolted connections. No drilling, cutting or welding on-site or in-field fabrication
Scheduled Maintenance	None required
Module Cleaning Compatibility	Robotic, Tractor, Manual
Warranty	10 years structural; 5 years drive and controls components

EXHIBIT P: DRAIN TILE MEMO

Kimley»Horn

MEMORANDUM

To:	Zachary Farkes *ReWild Renewables*
From:	Ashley Payne Keller Leet-Otley *Kimley-Horn and Associates, Inc.*
Date:	March 7, 2025
Subject:	*Hensley Township, Champaign County, Illinois – N Duncan Road Solar, LLC Desktop Drain Tile Memorandum*

INTRODUCTION

Kimley-Horn was contracted by ReWild Renewables to review the N Duncan Road Solar, LLC project array study area for potential drain tile locations. The study area is located in Hensley Township, Champaign County, Illinois. The array study area is approximately 58 acres in size and is located in Section 28 of Township 20N, Range 8E. Kimley-Horn reviewed available background data to assist in determining if there are any potential drain tile locations in the study area.

DATA REVIEWED:

- USGS Topography (See **Figure 1**)
- National Hydrography Dataset (See **Figure 2**)
- National Wetlands Inventory (See **Figure 2**)
- LiDAR (See **Figure 2**)
- Champaign County Soil Survey (See **Figure 3**)
- Available historic aerials from Google Earth (See **Appendix A**)

CONCLUSIONS AND RECOMMENDATIONS:

Based on hydric soil areas, existing topography, and historic aerials from Google Earth, three main drain tile lines with multiple branches are visible throughout the array study area. See **Figure 4** for potential drain tile locations. Based on the desktop review, drain tile is anticipated within the array study area and a drain tile survey is recommended prior to construction.

If you have any questions or concerns, please feel free to contact us via phone (507.216.0763) or email (ashley.payne@kimley-horn.com) or Keller Leet-Otley via phone (507.216.0288) or email (keller.leet-otley@kimley-horn.com).

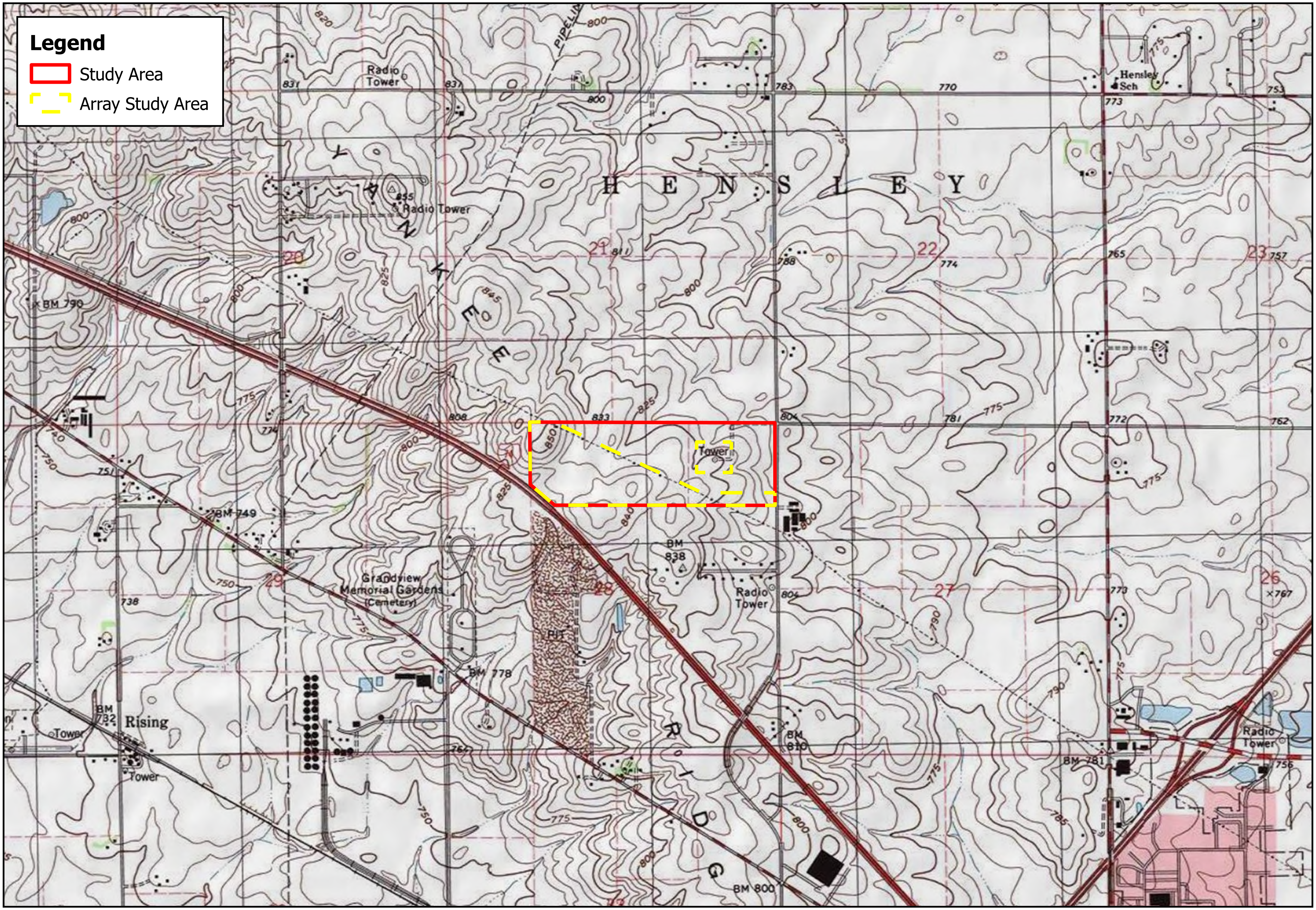
Sincerely,

Ashley Payne, Kimley-Horn

Keller Leet-Otley, Kimley-Horn

Kimley»Horn

Figures

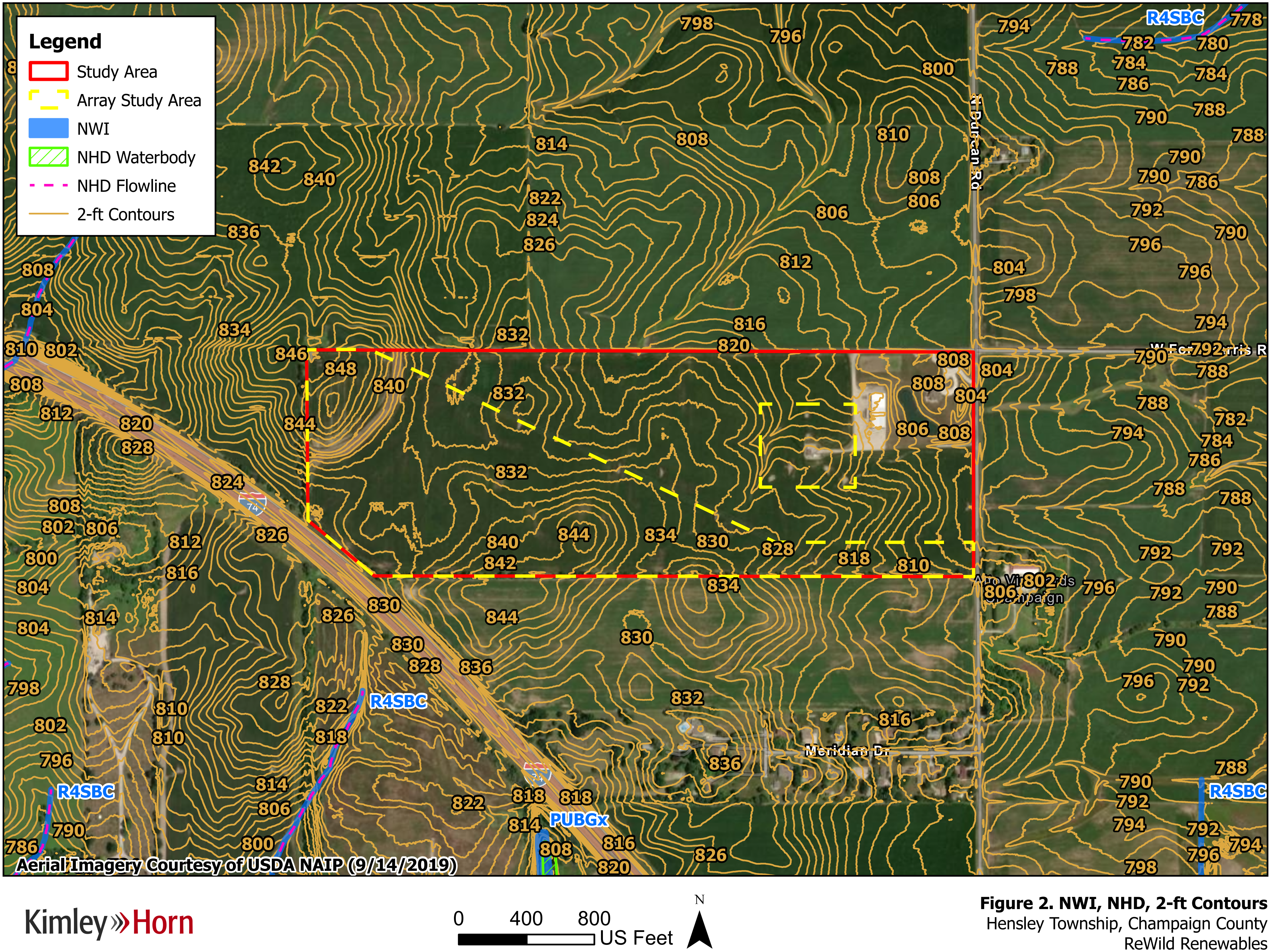


Kimley»Horn

0 1,000 2,000 US Feet

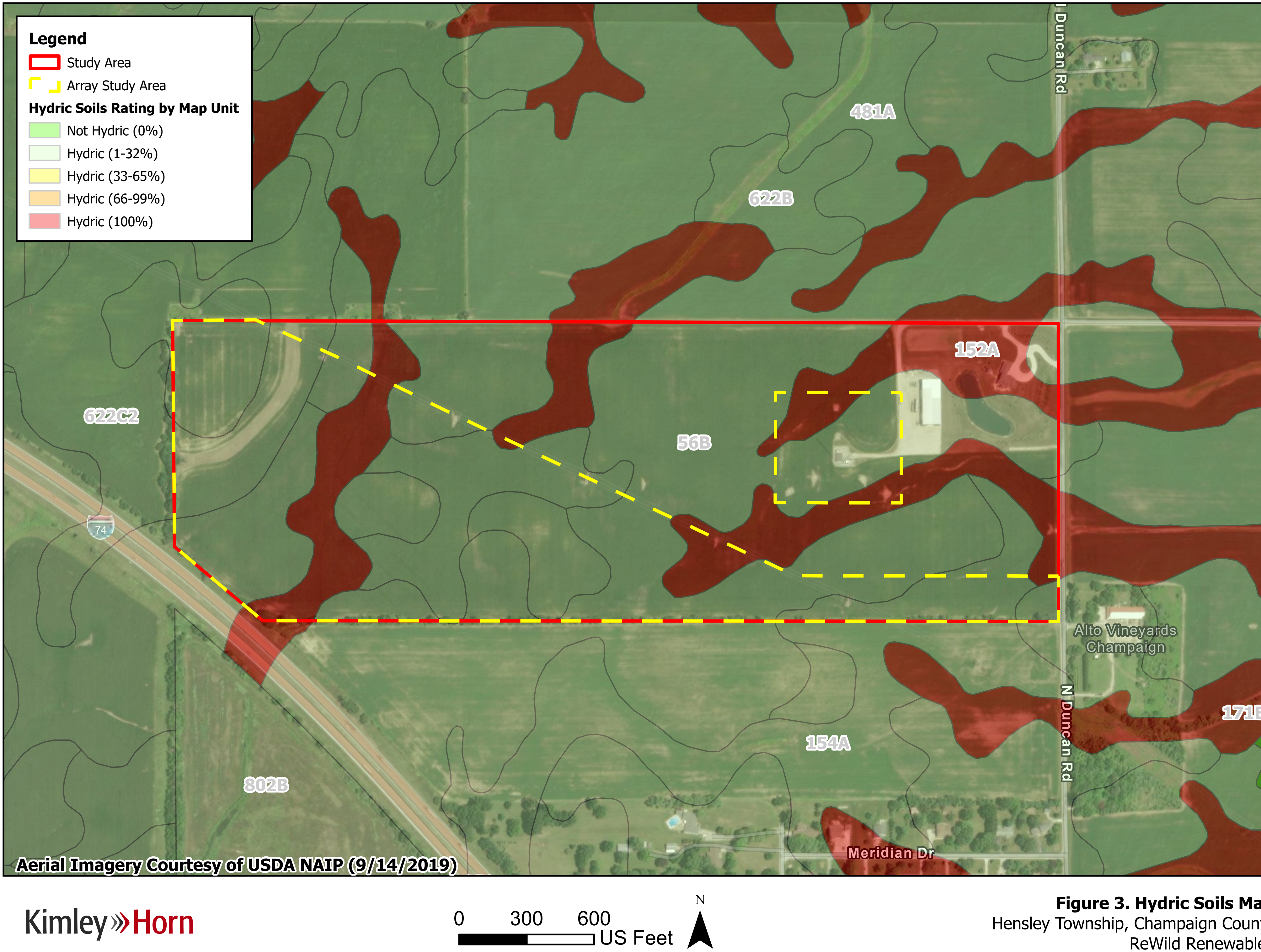
N

Figure 1. USGS Topographic Map
Hensley Township, Champaign County
ReWild Renewables



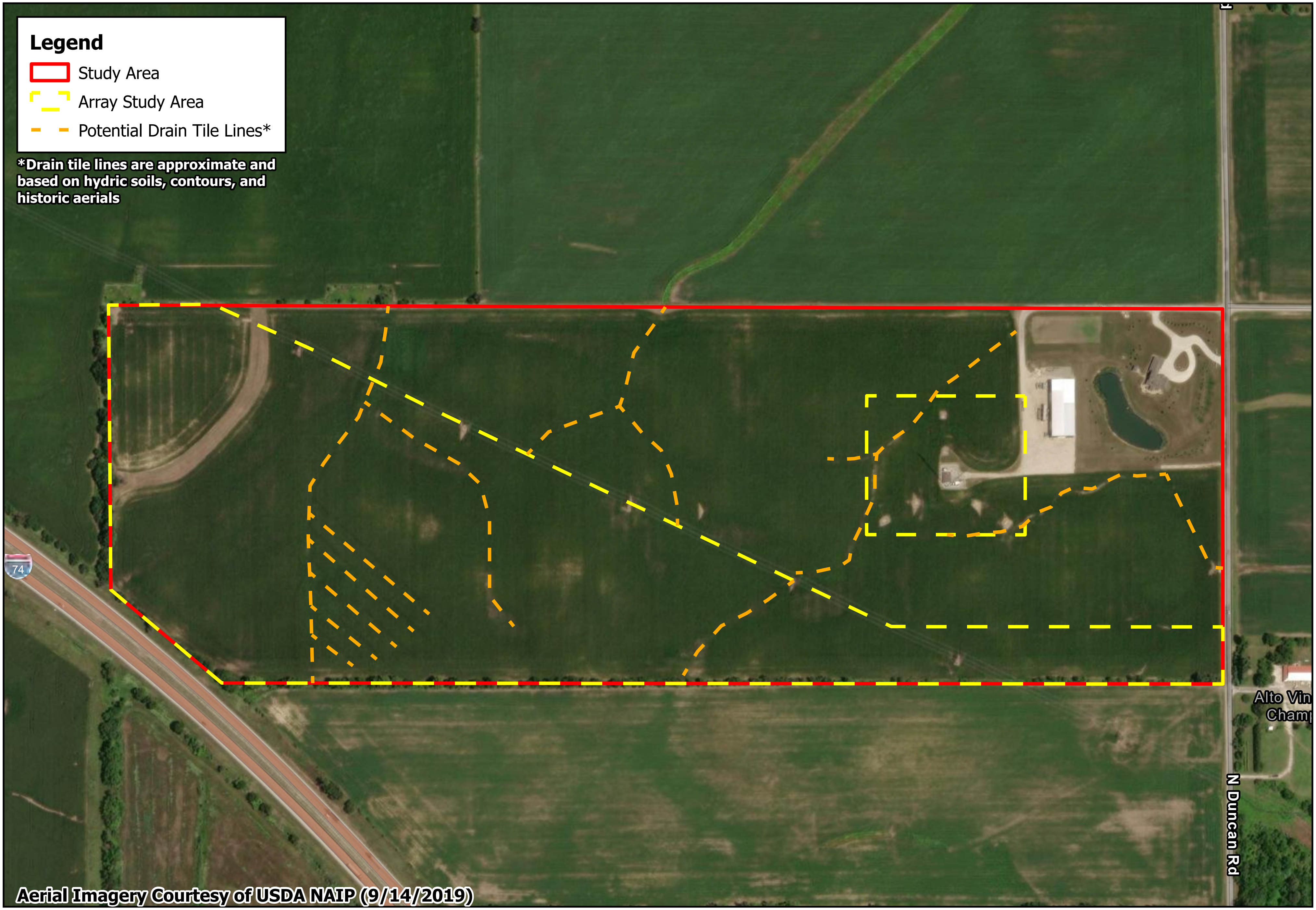
Kimley»Horn

Figure 2. NWI, NHD, 2-ft Contours
Hensley Township, Champaign County
ReWild Renewables



Kimley»Horn

Figure 3. Hydric Soils Map
Hensley Township, Champaign County
ReWild Renewables



Kimley»Horn

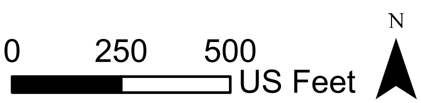
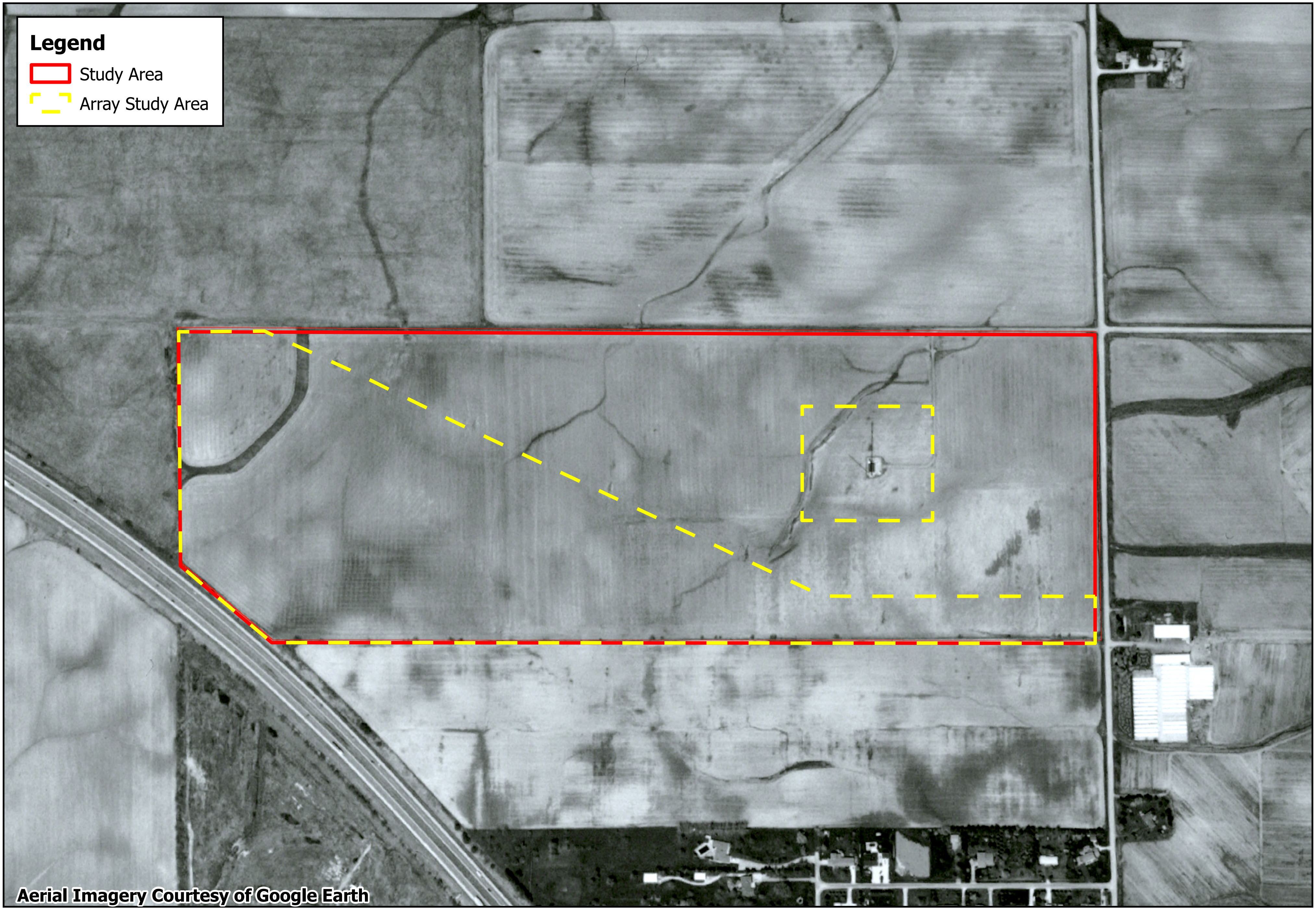


Figure 4. Potential Drain Tile Locations
Hensley Township, Champaign County
ReWild Renewables

Kimley»Horn

ATTACHMENT A

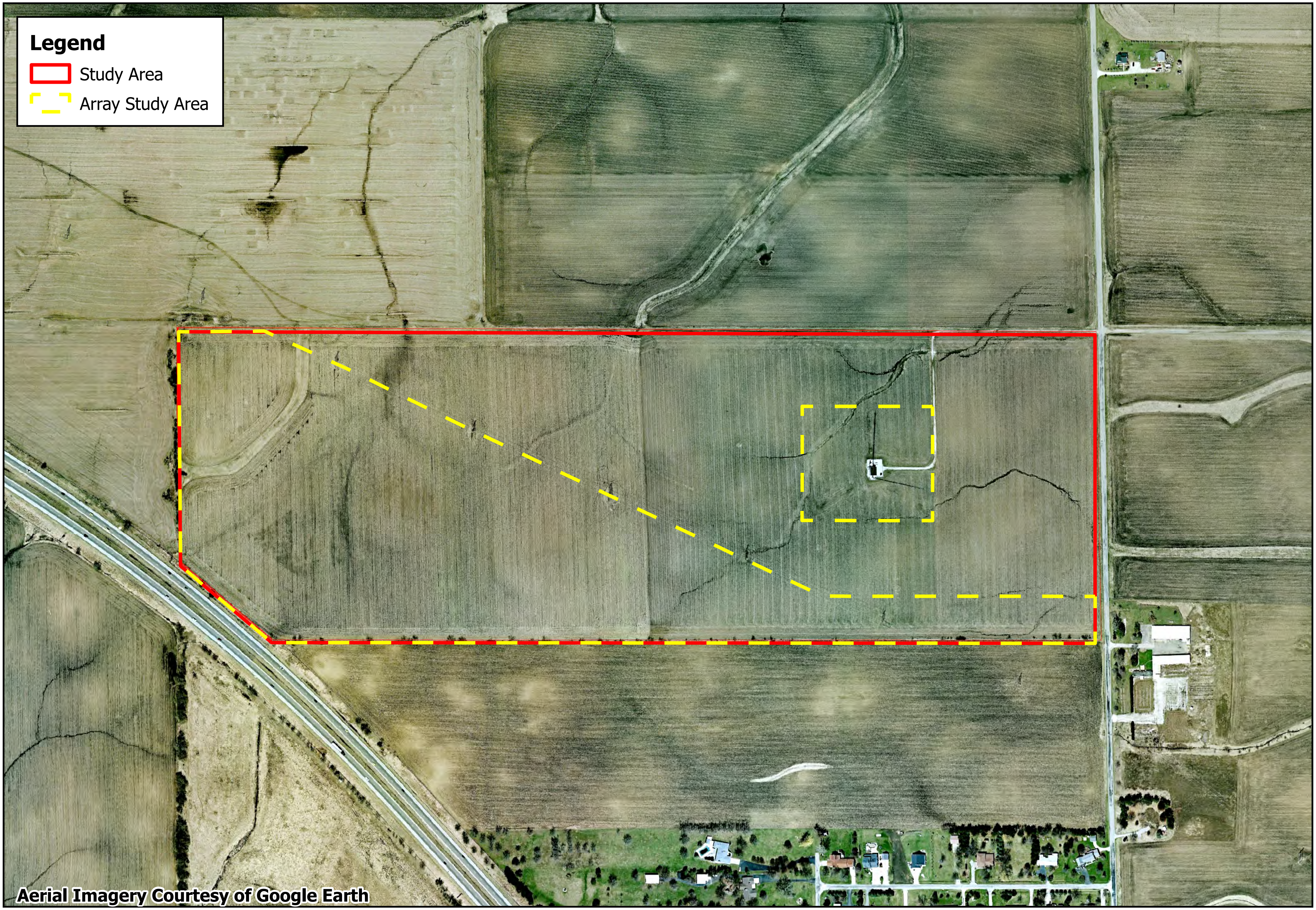
Historic Aerials



Kimley»Horn

0 250 500
US Feet
N

Historic Aerial (April 1998)
Hensley Township, Champaign County
ReWild Renewables

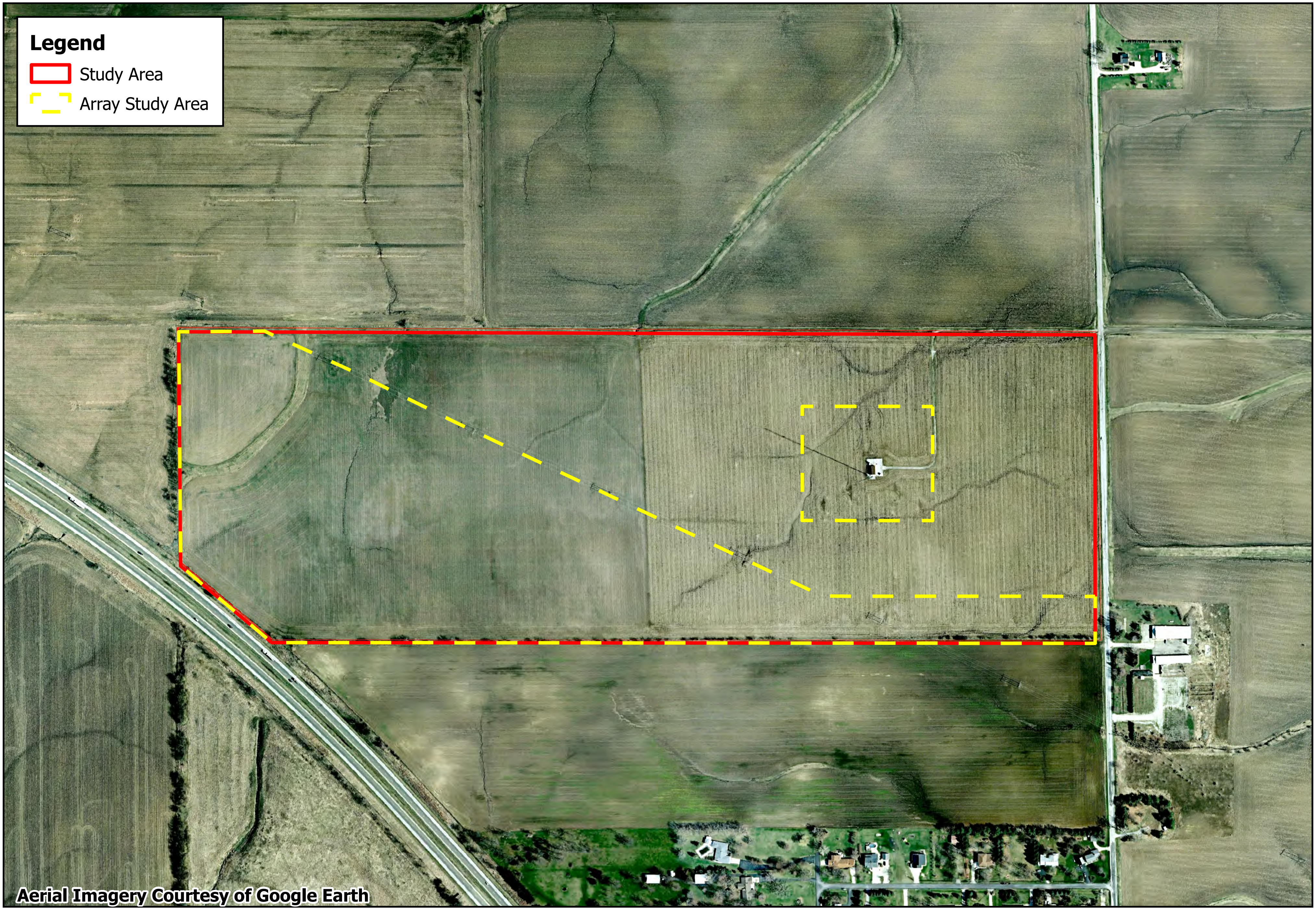


Kimley»Horn

0 250 500 US Feet

N

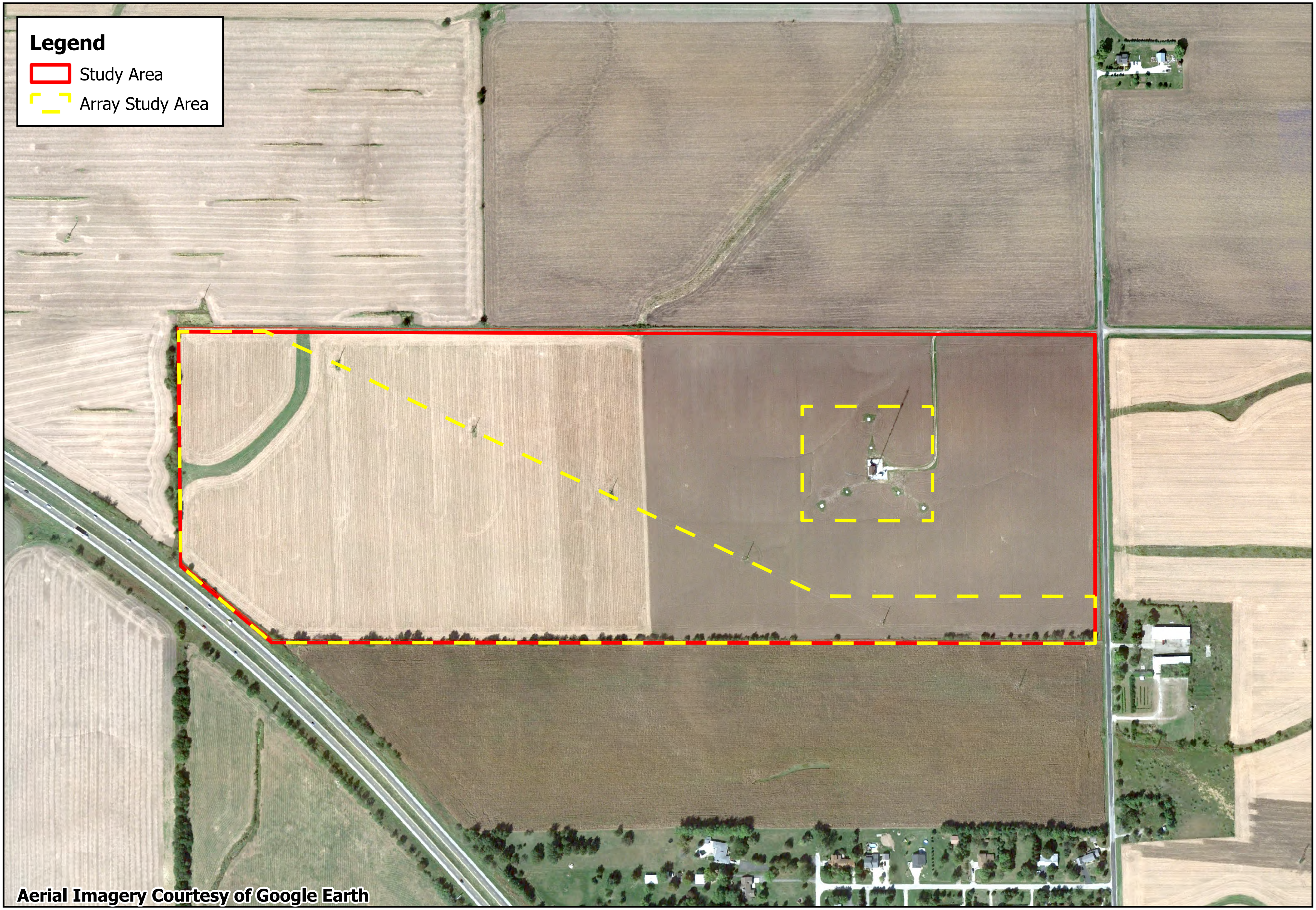
Historic Aerial (March 2005)
Hensley Township, Champaign County
ReWild Renewables



Kimley»Horn

0 250 500
US Feet
N

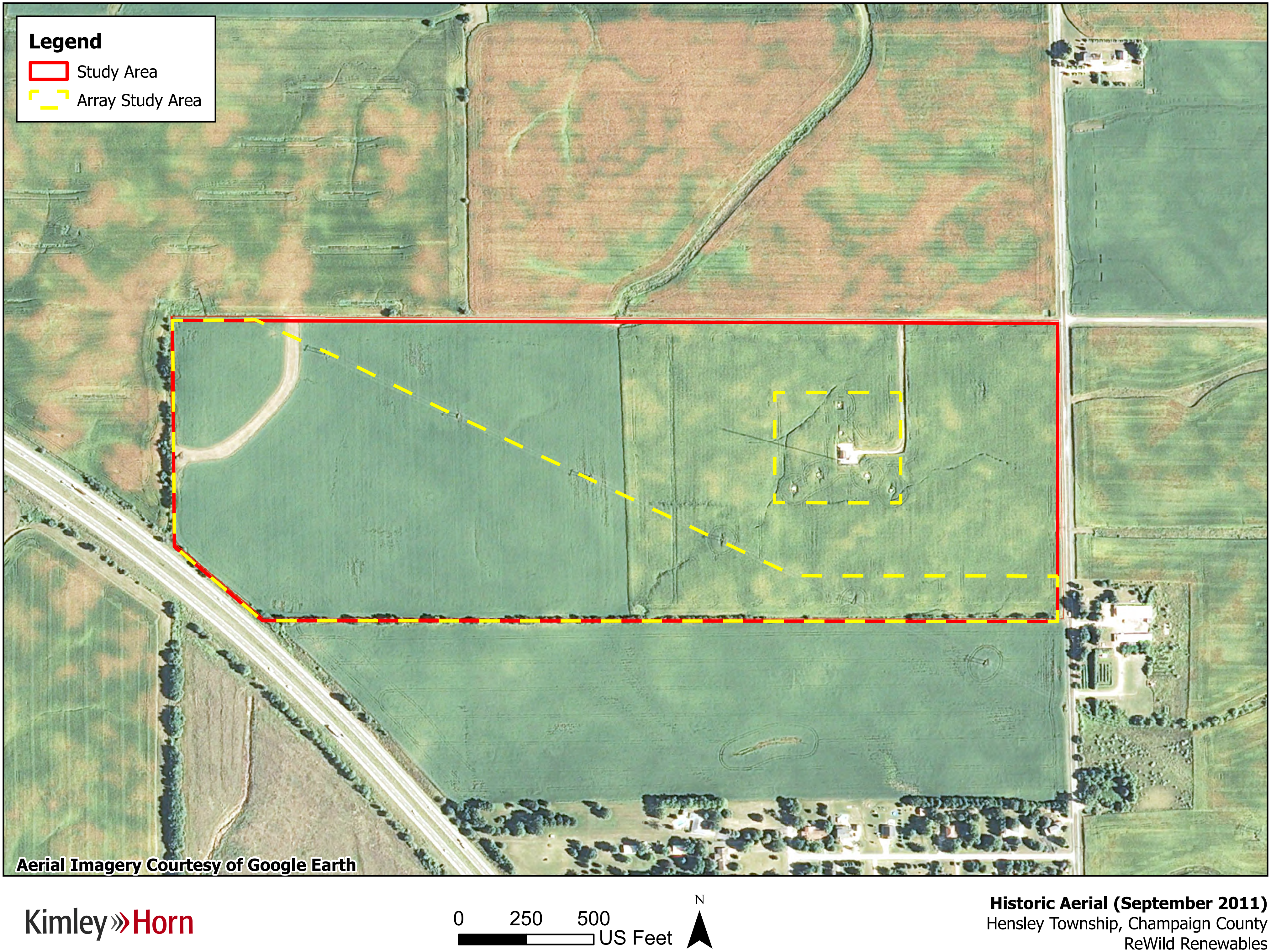
Historic Aerial (April 2008)
Hensley Township, Champaign County
ReWild Renewables



Kimley»Horn

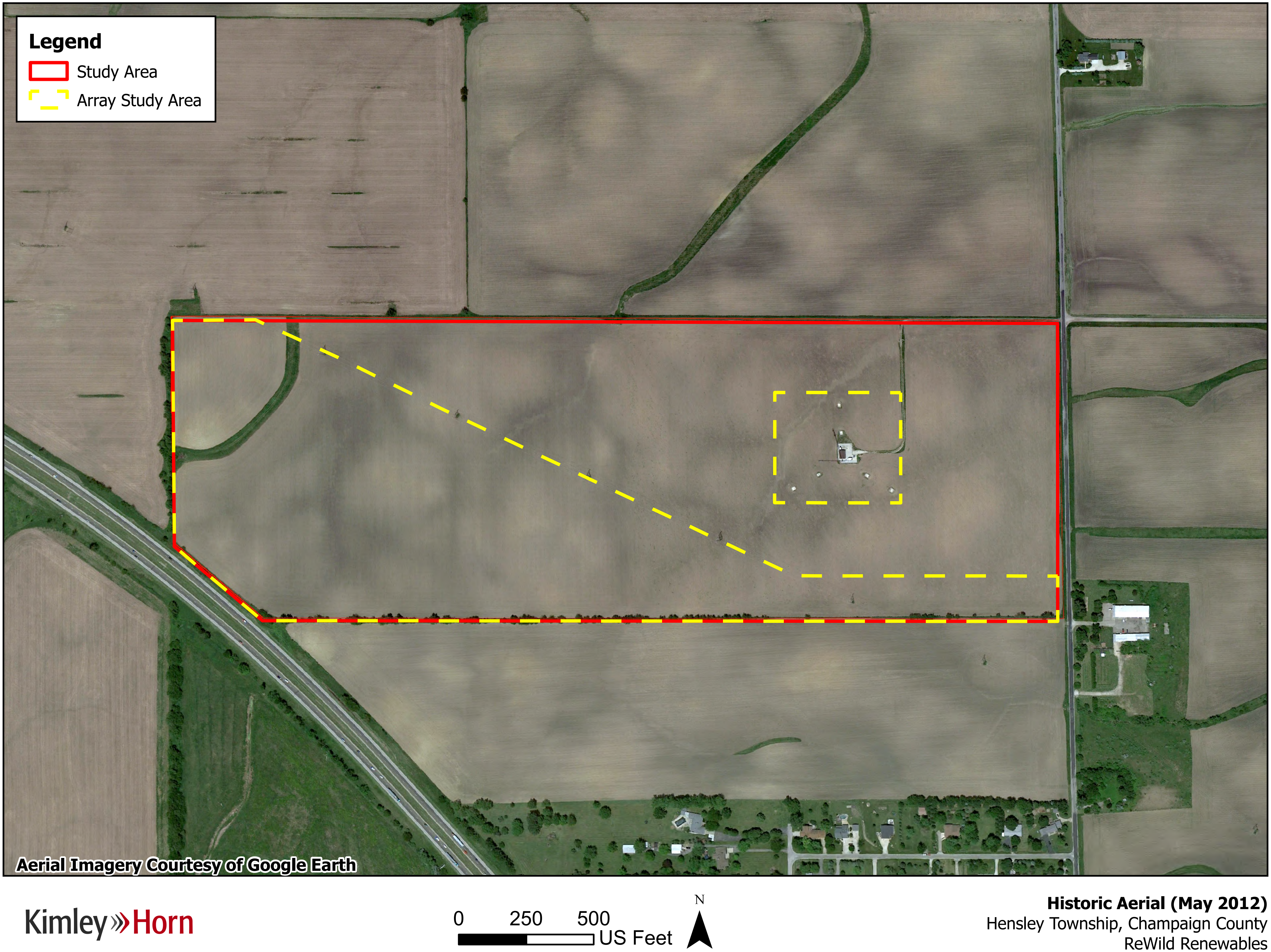
0 250 500
US Feet
N

Historic Aerial (October 2010)
Hensley Township, Champaign County
ReWild Renewables



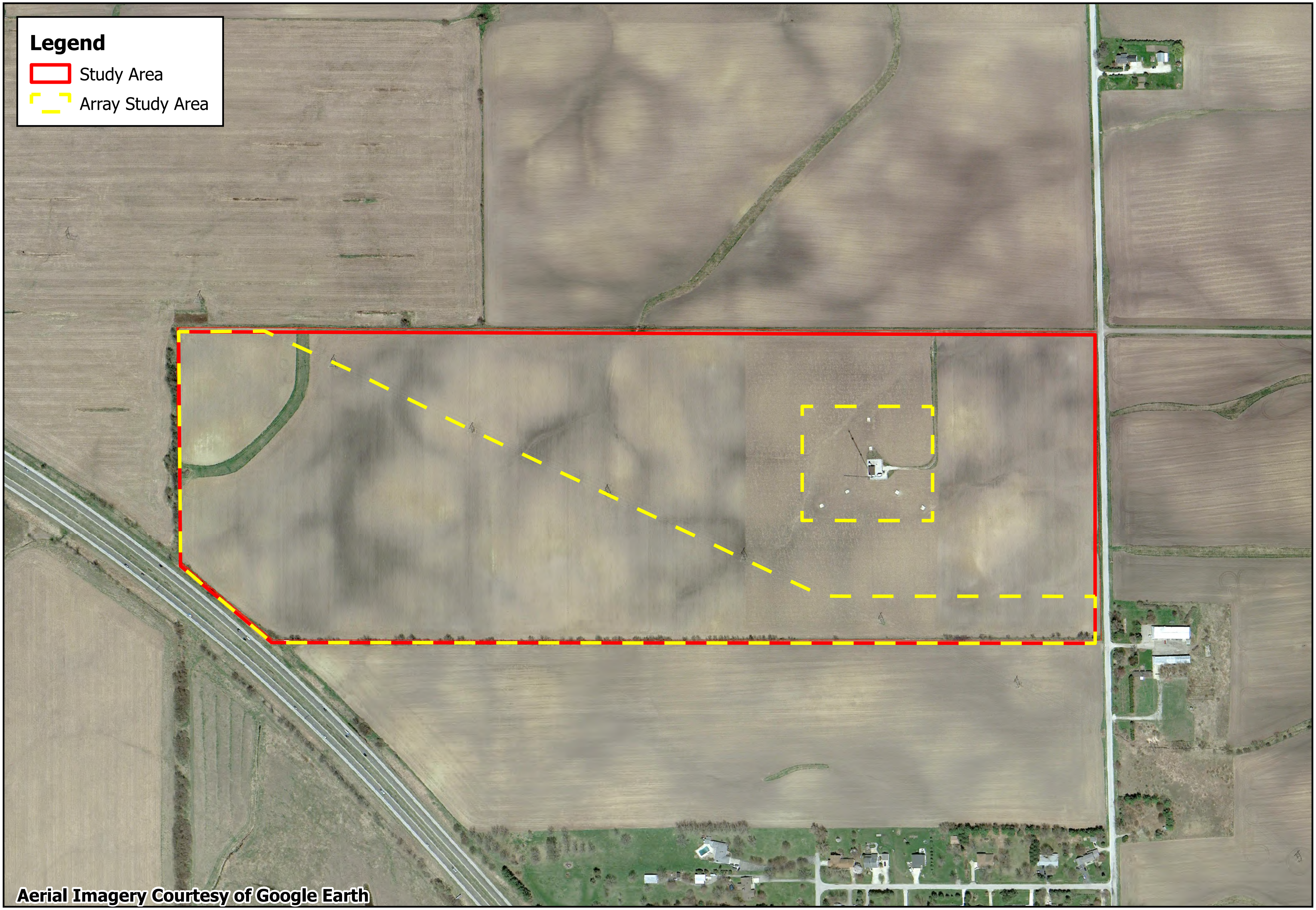
Kimley»Horn

Historic Aerial (September 2011)
Hensley Township, Champaign County
ReWild Renewables



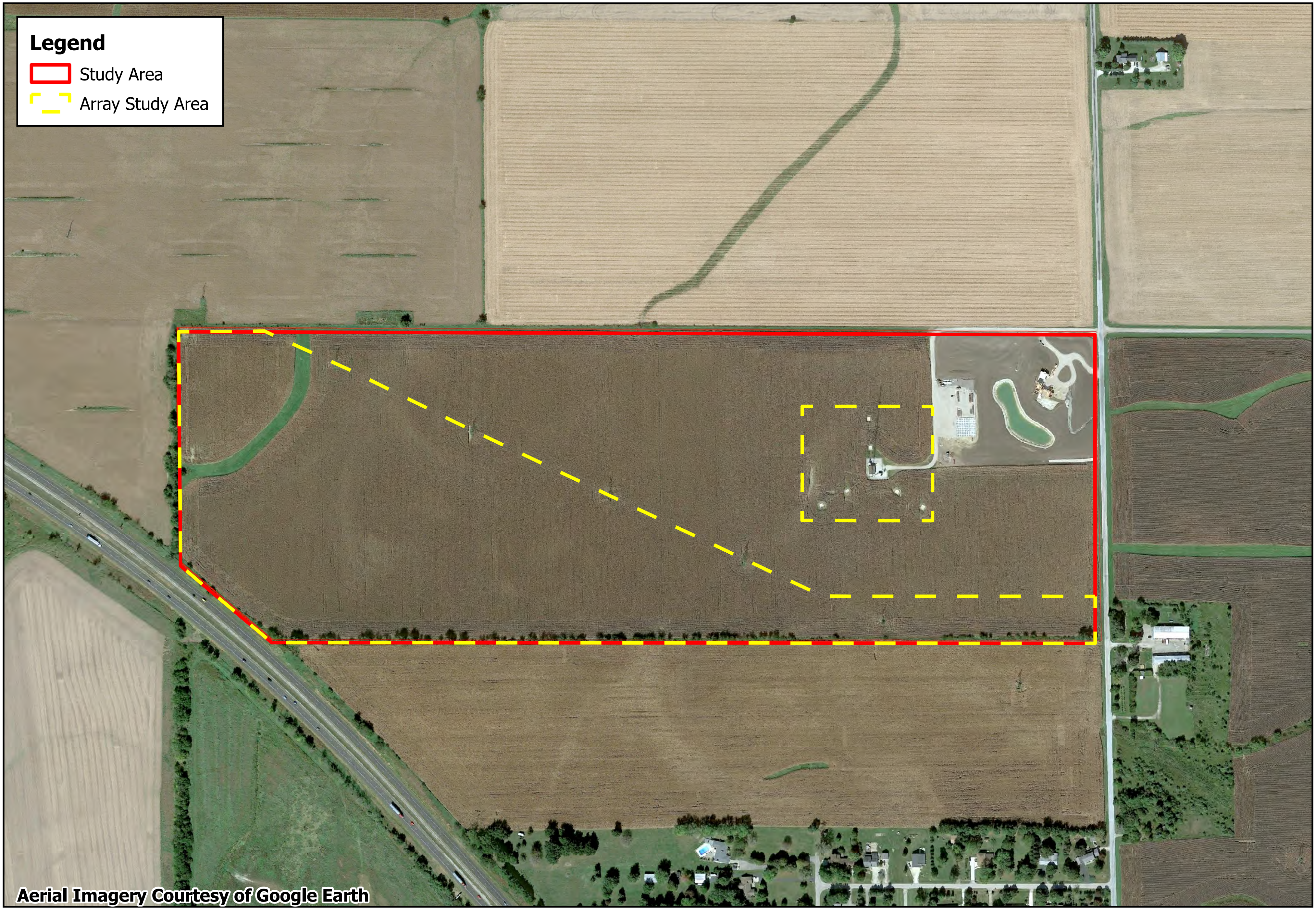
Kimley»Horn

Historic Aerial (May 2012)
Hensley Township, Champaign County
ReWild Renewables



Kimley»Horn

Historic Aerial (April 2014)
Hensley Township, Champaign County
ReWild Renewables



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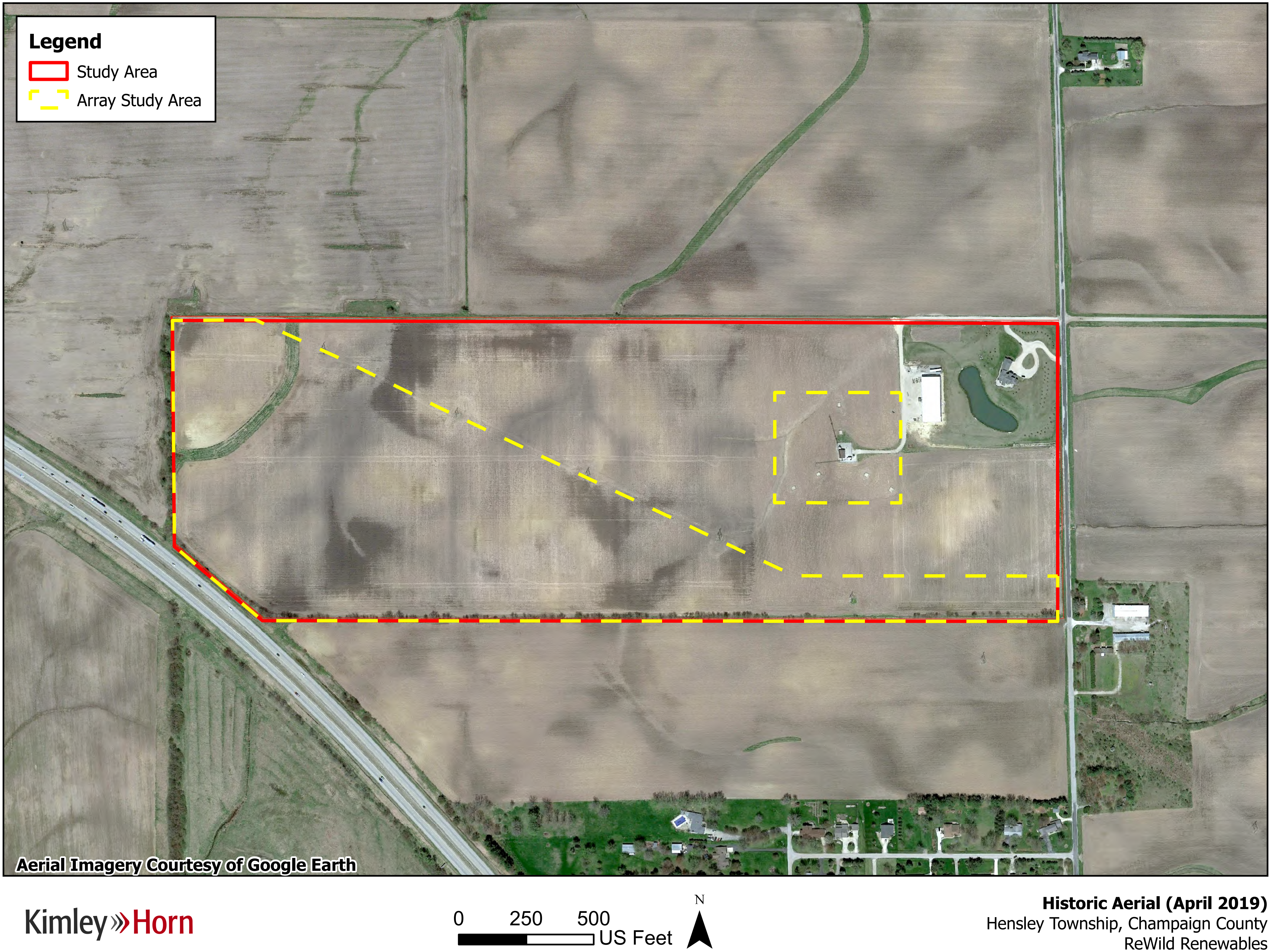
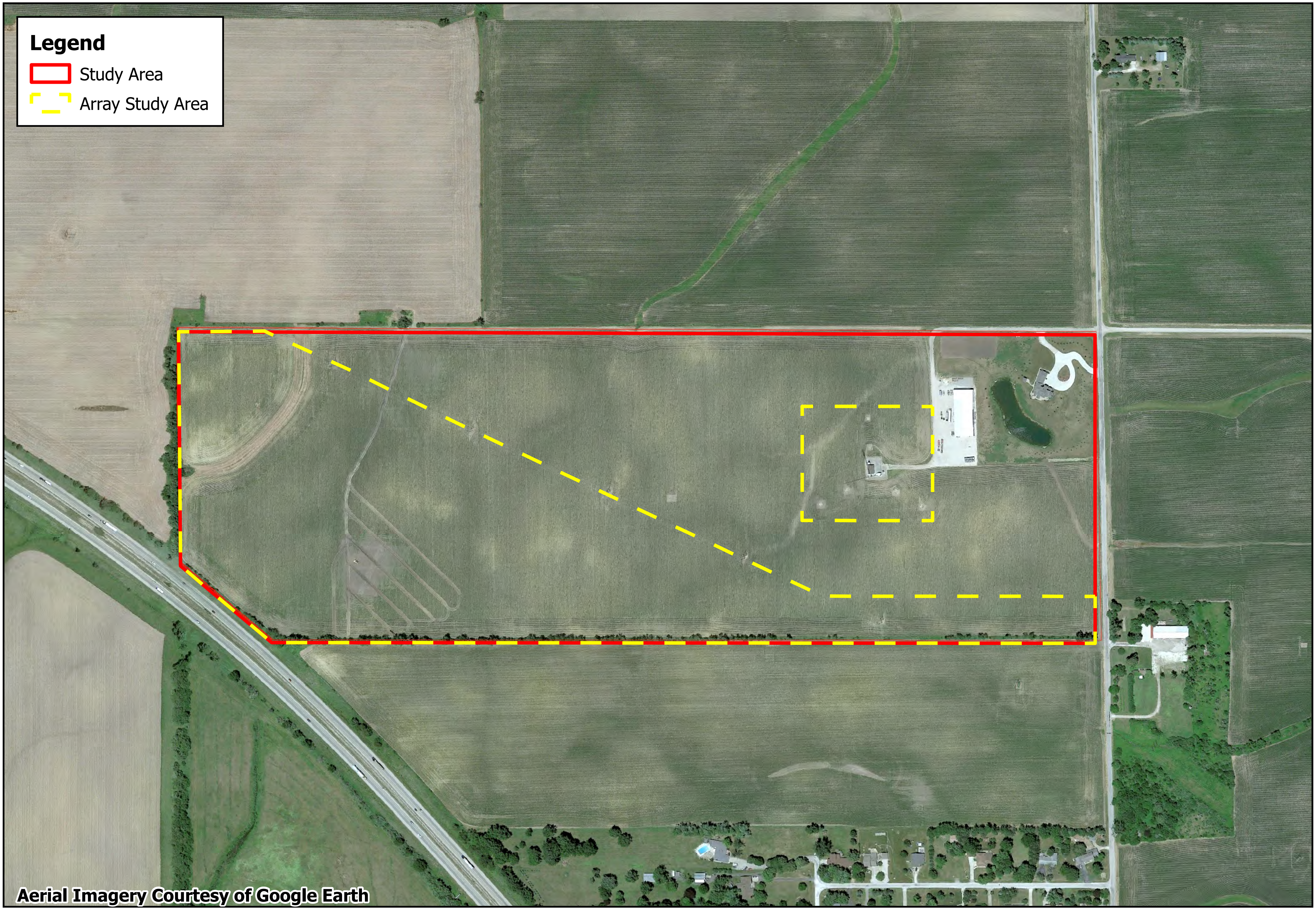
Historic Aerial (October 2016)
Hensley Township, Champaign County
ReWild Renewables



Kimley»Horn

Historic Aerial (April 2019)
Hensley Township, Champaign County
ReWild Renewables



Kimley»Horn

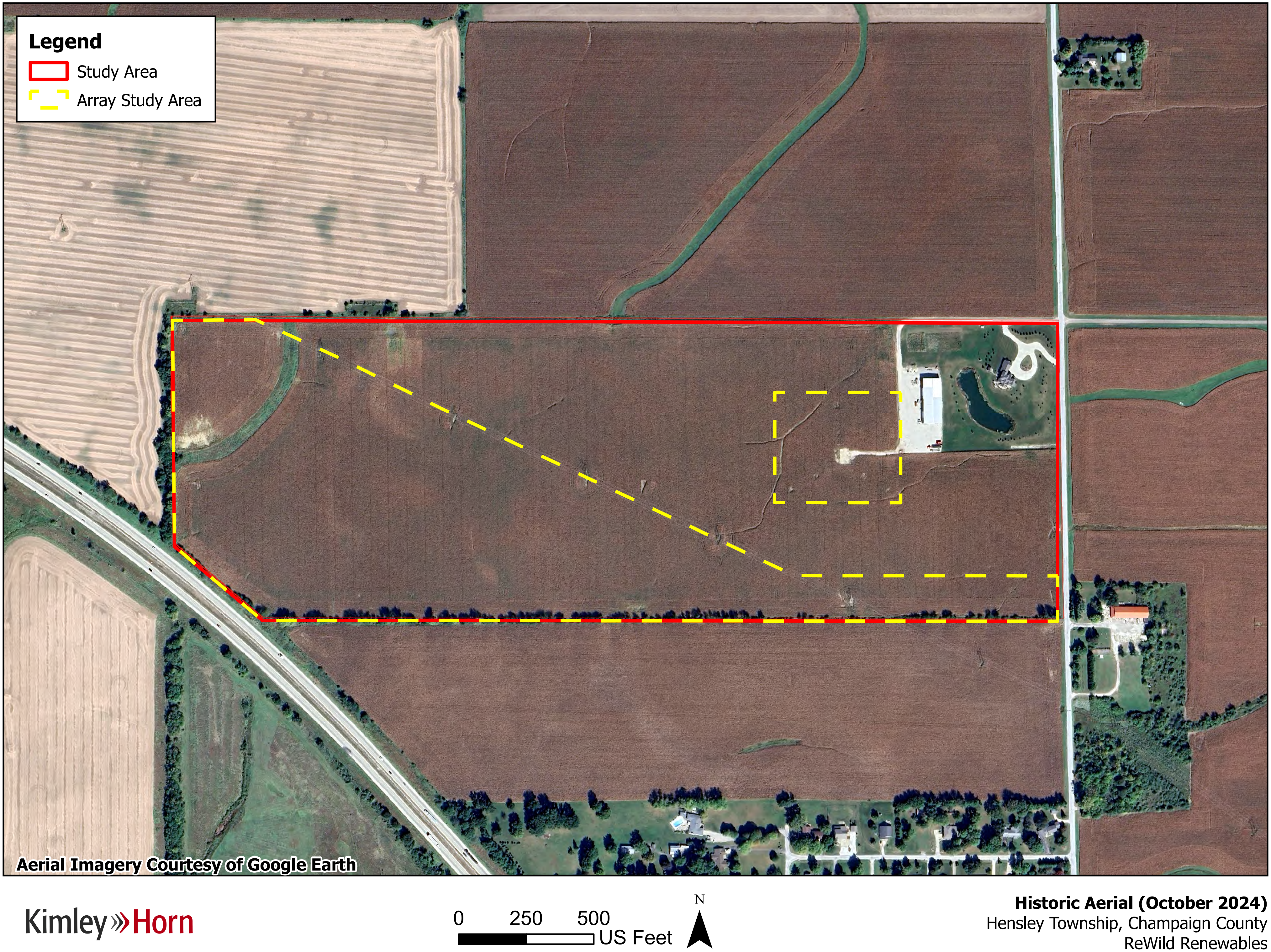
0 250 500 US Feet

N

Historic Aerial (June 2022)
Hensley Township, Champaign County
ReWild Renewables

Kimley»Horn

Historic Aerial (June 2023)
Hensley Township, Champaign County
ReWild Renewables



Kimley»Horn

Historic Aerial (October 2024)
Hensley Township, Champaign County
ReWild Renewables

EXISTING AGRICULTURAL DRAIN TILE INVESTIGATION PLAN

N. DUNCAN RD SOLAR

Prepared for: ReWild Renewables,LLC

Section no. 28, Hensley Twp., Campaign Co., IL

EXISTING SUBSURFACE AGRICULTURAL DRAIN TILE INVESTIGATION REPORT

N. DUNCAN RD SOLAR

ReWild Renewables,LLC

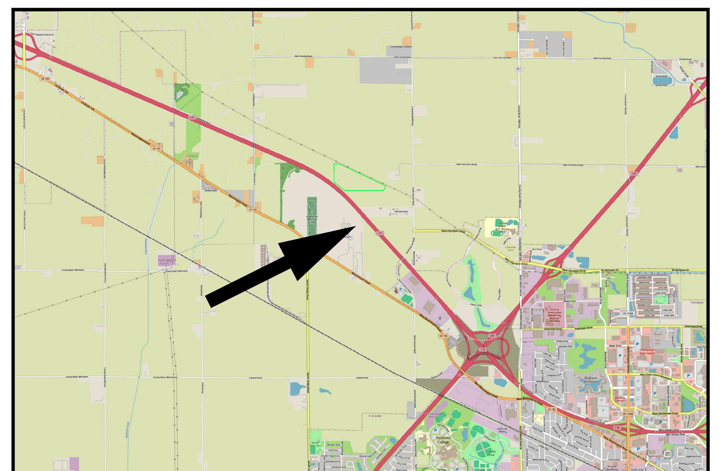
N. DUNCAN RD SOLAR / ReWild Renewables,LLC , FIELD FILE NO. 18-11-28 , DATE: 10/9/25 .
IN ACCORDANCE W/ LOCAL COUNTY and A.I.M.A EXISTING DRAIN TILE INVESTIGATION & LOCATION STANDARDS

DESCRIPTION CHART NO. 1A : INVESTIGATION SLIT TRENCH LOCATIONS

ID NO.	SZ.	TYPE / QUALITY	FLOW %	SILT %	DEPTH GRD/INV	FIELD NOTES:
A1	4"	CLAY / GOOD	SLIGHT	CLEAN	46"	ACTIVE FLOW RATE AND CAPACITY
B	---	NO DRAIN TILES	---	---	---	NO DRAIN TILE LOCATED
C1	5"	CLAY / GOOD	SLIGHT	CLEAN	60"	ACTIVE FLOW RATE AND CAPACITY
C2	6"	POLY./GOOD	SLIGHT	CLEAN	32"	ACTIVE FLOW RATE AND CAPACITY
D	---	NO DRAIN TILES	---	---	---	NO DRAIN TILE LOCATED
E1	3"	CLAY / GOOD	SLIGHT	CLEAN	39"	ACTIVE FLOW RATE AND CAPACITY
F	---	NO DRAIN TILES	---	---	---	NO DRAIN TILE LOCATED
G	---	NO DRAIN TILES	---	---	---	NO DRAIN TILE LOCATED
H	---	NO DRAIN TILES	---	---	---	NO DRAIN TILE LOCATED
I1	5"	POLY./GOOD	SLIGHT	SLIGHT	37"	ACTIVE FLOW RATE AND CAPACITY
J1	4"	POLY./GOOD	SLIGHT	CLEAN	50"	ACTIVE FLOW RATE AND CAPACITY
K1	4"	POLY./GOOD	SLIGHT	CLEAN	55"	ACTIVE FLOW RATE AND CAPACITY
L1	4"	POLY./GOOD	SLIGHT	CLEAN	54"	ACTIVE FLOW RATE AND CAPACITY
M1	4"	POLY./GOOD	SLIGHT	CLEAN	61"	ACTIVE FLOW RATE AND CAPACITY
N1	4"	POLY./GOOD	SLIGHT	CLEAN	56"	ACTIVE FLOW RATE AND CAPACITY
O1	6"	POLY./GOOD	SLIGHT	CLEAN	65"	ACTIVE FLOW RATE AND CAPACITY
P	---	NO DRAIN TILES	---	---	---	NO DRAIN TILE LOCATED

DESCRIPTION CHART NO. 1B : SURVEY DATA POINT LOCATIONS

DATA POINT	SZ.	TYPE / QUALITY	FLOW %	SILT %	DEPTH HUB/INV	FIELD NOTES:
1	4"	CLAY / GOOD	NONE	CLEAN	42"	MAINLINE AT PROPERTY EGRESS
2	5"	CLAY / GOOD	NONE	SLIGHT	60"	LATERAL AT PROPERTY EGRESS
3	6"	POLY./POOR	NONE	SLIGHT	33"	LATERAL AT PROPERTY EGRESS
4	3"	CLAY / GOOD	NONE	CLEAN	37"	MAINLINE AT PROPERTY EGRESS



SITE LOCATION

Section no. 28, Hensley Twp., Campaign Co., IL

MAP LEGEND :

- EXIST. DRAIN TILE COVER MEASUREMENT, TOP OF TILE TO SURFACE
- EX. POLYETHYLENE MAINLINE OR SYSTEM PART
- EX. CLAY DRAIN TILE MAINLINE OR SYSTEM PARTS
- EX. CONCRETE DRAIN TILE MAINLINE OR SYSTEM PART
- EXISTING DRAIN TILE CONTINUES TO UPLAND WATERSHED
- EXISTING DRAIN TILE OUTLETS TO SURFACE
- 1- 2- EXIST. DRAIN TILE (1) INSPECTION STRUCTURE / (2) CATCH BASIN
- 1- 2- END EXIST. DRAIN TILE (1) LOCATED END / (2) ASSUMED END
- EXISTING DRAIN TILE CONTINUES TO OFF-SITE OUTLET SYSTEM
- EXISTING DRAIN TILE FAILURE /FLOW SURCHARGE TO SURFACE
- EXISTING DRAIN TILE MAPPED BY SPECULATION AND ASSUMPTION
- EXISTING DRAIN TILE ABANDONED (NOT FUNCTIONAL)
- EXISTING DRAIN TILE "BLOWOUT" OR FAILURE
- HAND PROBE OR ELECTRONIC SCAN FOR DRAIN TILE LOCATION
- INVESTIGATION SLIT TRENCH FOR INVESTIGATION
- SPECIFIC PIT EXCAVATION FOR INVESTIGATION
- SURVEY DATA POINTS
- M1 REPORT IDENTIFICATION NUMBER

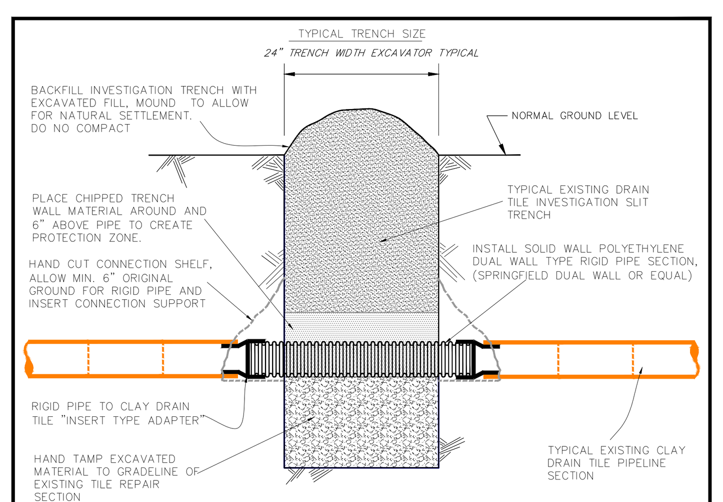
REPORT LEGEND :

ID NO. .... POINT OF EXCAVATION FOR SPECIFIC DRAIN TILE INVESTIGATION.
SZ. (SIZE)............ DRAIN TILE INTERNAL DIAMETER IN INCHES.
MATERIAL / QUALITY...... TYPE OF TILE MATERIALS, PIPE QUALITY - GOOD, FAIR & POOR.
FLOW % .... PERCENTAGE OF TILE DIAMETER OCCUPIED BY ACTIVE FLOW.
Ⓡ .... RESTRICTED OR BACKED UP FLOW, SURCHARGED CONDITION
SILT % .... PERCENTAGE OF TILE DIAMETER OCCUPIED BY RESTRICTIVE SILT.
Ⓐ .... ABANDONED, FILLED WITH SILT BLOCKAGE, NO FLOW POTENTIAL
DEPTH .... MEASUREMENT FROM EXISTING GROUND LEVEL TO PIPE INVERT.

(GENERAL NOTES)
MAINLINE TILE .... TRUNK LINE OR MUTUAL DRAIN, COLLECTOR OF SUB-SYSTEMS.
SUB-MAIN TILE........... SECONDARY TRUNK LINE OR RANDOM SYSTEM COLLECTOR.
LATERAL TILE .... FEEDER LINE, SERVICE TILE OR SYSTEM SPUR.
"BLOWOUT" .... EXISTING SYSTEM PIPE FAILURE OR RESTRICTION.
DRAIN TILE ENDS ...... MAINLINE, SUB-MAIN OR LATERAL PLANNED TERMINATION.
SLIT TRENCH .... INVESTIGATION TRENCH, TYPICAL 2'- 0" WIDE x 6'- 0" DEPTH.

SPECIAL NOTES :

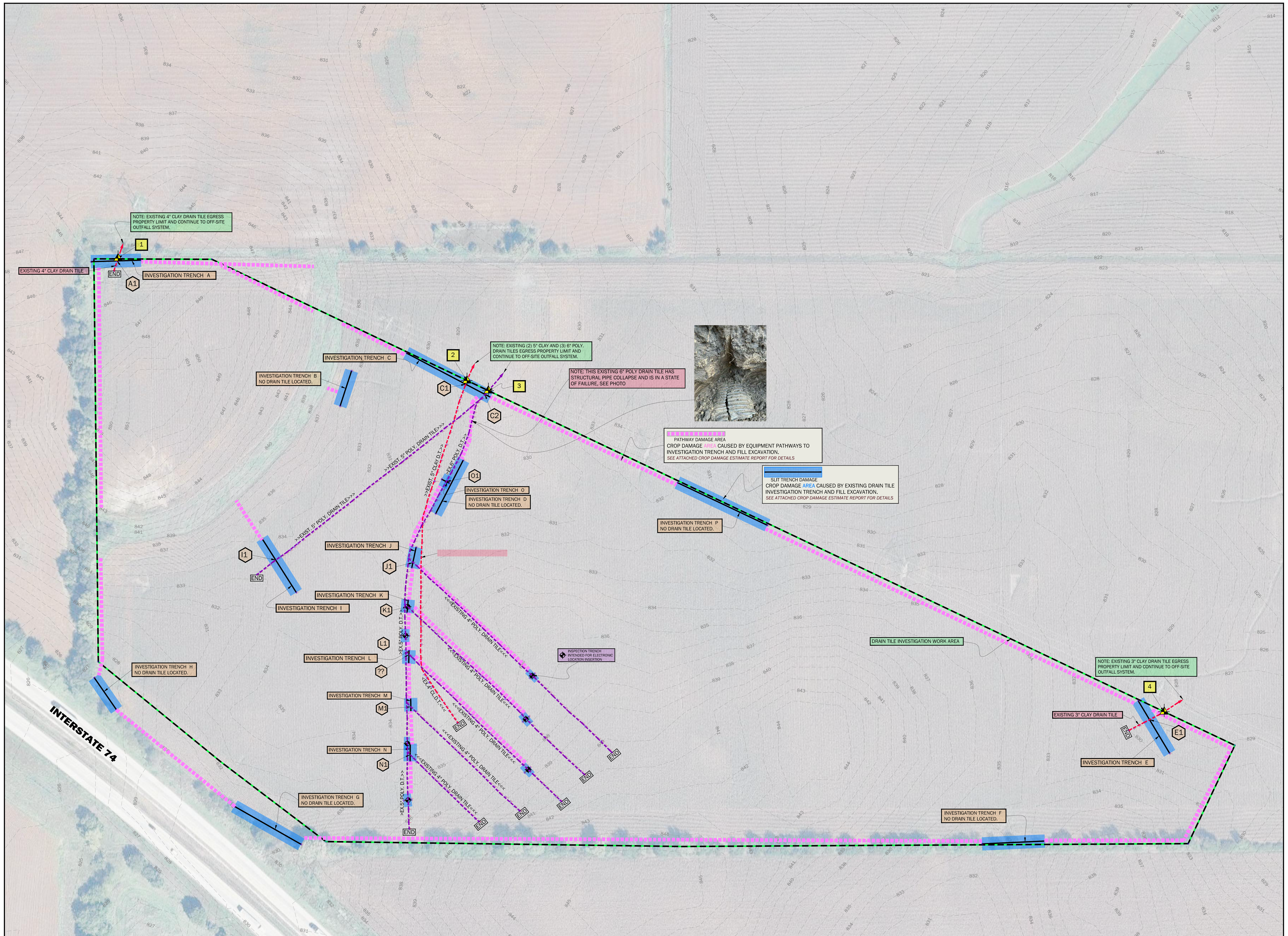
- *All existing agricultural drain tiles located during this investigation survey have been identified on this plan and field staked at < 50' intervals, in some occasions certain existing local drain tile sections may be speculated and considered as an assumed route which shall be delineated on this plan.*
- *Any existing drain tile not encountered during slit trenching or probe transect procedures will remain unknown.*
- *All existing drain tiles damaged during the investigation process shall be repaired to their original state in accordance with Natural Resource Conservation Service standards for drain tile installation and repair. All existing drain tile not encountered during slit trenching procedure will remain unknown.*
  (Huddleston McBride (62a) typical standard "A")
- *All existing drain tile location dimensions have been mapped in state plane coordinates by gps survey systems and include sub meter accuracy, all locations pertinent to final design shall be verified by the project surveyor.*
- *This drain tile investigation report is intended to identify existing drain tile mainline systems only with additional priority on drain tiles which may service the upland property of others or with mutual drainage status.*
- *This drain tile investigation report shall be filed with Huddleston McBride Drainage Co., and will be reproduced and disbursed only by permission of the contract principals.*
  Solar Field Development - It is our recommendation that all existing drain tile systems within the proposed solar field development should be replaced by "like kind" construction which will assure the location and replacement of unknown drain tile systems that were not located by this Existing Drain Tile Investigation.



EXISTING CLAY DRAIN TILE REPAIR SECTION
FOR DRAINAGE INVESTIGATION PROJECTS
EXISTING CLAY AGRICULTURAL DRAIN TILE INVESTIGATION TRENCH STRIKE
TYPICAL REPAIR SECTION FOR DRAIN TILES DAMAGED BY SLIT TRENCHING
HUDDLESTON DRAINAGE TYPICAL SECTION NO. 62A

TYPICAL CONSTRUCTION SECTION [A].

00 THESE SYMBOLS REPRESENT SURVEY DATA POINTS WHICH HAVE BEEN STAKED IN THE FIELD FOR THE SPECIFIC PURPOSE OF ELECTRONIC LOCATION AND ELEVATION DETERMINATION BY THE PROJECT SURVEYOR.
THESE DATA POINTS CONSIST OF A 2" X 2" GROUND HUB AND A 3'-0" ON-LINE LOCATION STAKE WHICH INCLUDES DATA POINT IDENTIFICATION NUMBER, SEPARATION MEASUREMENT FROM HUB TO PIPE INVERT, AND PIPE SIZE.
ALL EXISTING DRAIN TILE ROUTES HAVE BEEN FIELD STAKED WITH "EXISTING DRAIN TILE" PIN FLAGS AT 50' INTERVALS AND DOUBLE FLAGS AT INTERSECTIONS.



CROP DAMAGE ESTIMATE REPORT

REGARDING EXISTING DRAIN TILE SURVEY DAMAGE

ALL EXISTING INVESTIGATION TRENCHES ARE ESTIMATED AT A WIDTH OF 30ft, WHICH INCLUDES TRENCH EXCAVATION AND BACKFILLING.
ALL FIELD TRAVEL PATHWAYS FROM PUBLIC ACCESS OR NON-CROP AREA TO EACH INVESTIGATION TRENCH ARE ESTIMATED AT A WIDTH OF 8ft. WHICH INCLUDES ONE WAY TRAFFIC,

N. DUNCAN RD SOLAR, FILE NO. 18-11-28
CALCULATION ESTIMATE FOR CROP DAMAGE

INVESTIGATION TRENCHES, TOTAL 1765 lin ft. x 30 width ft. EQUALS 52950sq ft. or 1.21 acres — SLIT TRENCH DAMAGE

INVESTIGATION PATHWAYS, TOTAL 7401 lin ft. x 8 width ft. EQUALS 59208 sq ft. or 1.35 acres — PATHWAY DAMAGE

FIELD TRAVEL PATHWAYS IN NON CROP AREAS (NOT CALCULATED AS PART OF HUDDMAC DAMAGE) — PATHWAYS IN NON CROP AREAS

TOTAL CROP DAMAGE AREA ESTIMATE 2.56 ACRES.

PROJECT CLIENT: **ReWild Renewables,LLC** Zachary Farkes , Project Manager, 47 Bow Street, Portsmouth, NH 03801	APPROVED BY AND DATE: RUDY P. DIXON, P.E., 10/9/25	PROJECT DATE: 10/9/25	REVISIONS — DATE: BY: DESCRIPTION:
	ACKNOWLEDGMENTS: HUDDLESTON DRAINAGE MAP and ARCHIVE SYSTEMS	FIELD FILE NO.: 18-11-28	
	DRAWN BY AND DATE: TOM HUDDLESTON 10/9/25	DRAWING NO.: 18-11-28_X1	WEATHER CONDITIONS: SUNNY/ COOL - 80o; DRAWING SCALE: 1" TO 120'; SHEET NO.: ONE OF ONE

LICENSED PROFESSIONAL ENGINEER RUDY P. DIXON 062.065333 OF ILLINOIS

HUDDLESTON-MCBRIDE CO. 1976 49th Anniversary 2025 AGRICULTURAL DRAINAGE CONTRACTOR

ILLINOIS FARM BUREAU MEMBER

811 Know what's below. Call before you dig. +8 DIG NUMBER

NORTH

N. DUNCAN RD SOLAR

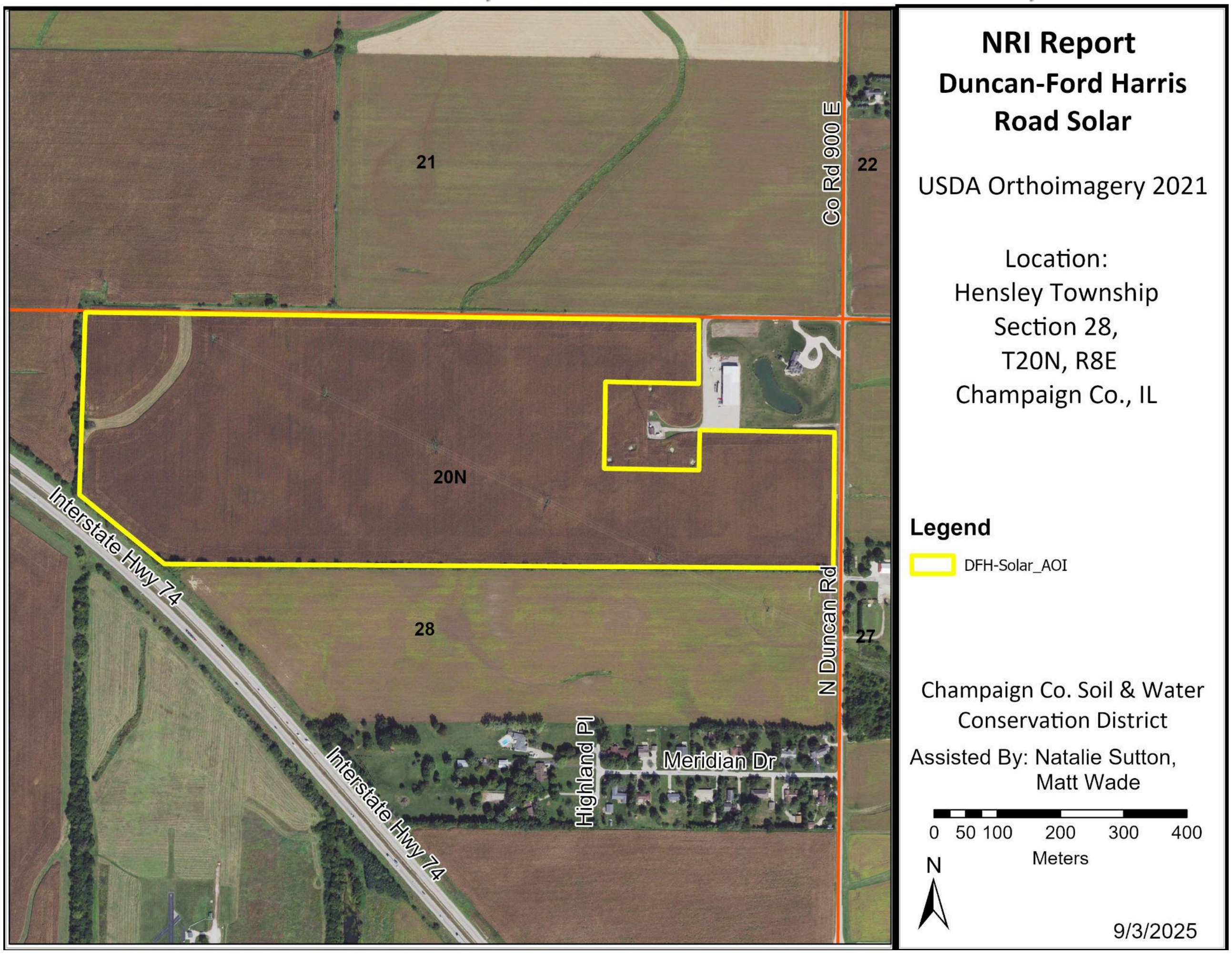
HUDDLESTON McBRIDE
PROFESSIONAL LAND DRAINAGE SERVICES
Women-Owned Small Business (WOSB)
9504 FOWLER RD., ROCHELLE, ILLINOIS PHONE 815-562-6007

COORDINATE SYSTEM: ILLINOIS STATE PLANE EAST NAD 83

EXHIBIT Q: NATURAL RESOURCES INFORMATION REPORT

NATURAL RESOURCE INFORMATION (NRI) REPORT 2025.10.01

Petitioner: N Duncan Solar, LLC. and W Ford Harris Solar, LLC.



Date District Board Reviewed Application	October 10, 2025
Applicant's Name	N Duncan Rd Solar, LLC. W Ford Harris Rd Solar, LLC.
Contact Person	Dan Marshall
Size of Subject Property	120 Acres
Present Zoning	AG-1
Proposed Zoning	I-1
Present Land Use	Agriculture
Proposed Land Use	PV Solar Farm

PREPARED BY: CHAMPAIGN COUNTY SOIL & WATER CONSERVATION DISTRICT
2110 W PARK CT, STE C, CHAMPAIGN, IL 61821
(217) 352-3536 EXT 3 | WWW.CCSWCD.COM

Champaign County Soil and Water Conservation District Natural Resource Information Report (NRI)		
Copies of this report or notification of the proposed land-use change were provided to:	***Yes***	***No***
The Applicant	x	
The Contact Person	x	
The Local/Township Planning Commission	n/a	n/a
The Village/City/County Planning & Zoning Department	x	
The Champaign County Soil & Water Conservation District Files	x	

Report Prepared By: Natalie Sutton, Resource Conservationist

Table of Contents

Forward

Soil and Water Conservation Districts are required to prepare Natural Resource Information (NRI) Reports under the Illinois Soil and Water Conservation Act of 1977, Illinois Revised Statutes, Chapter Five.

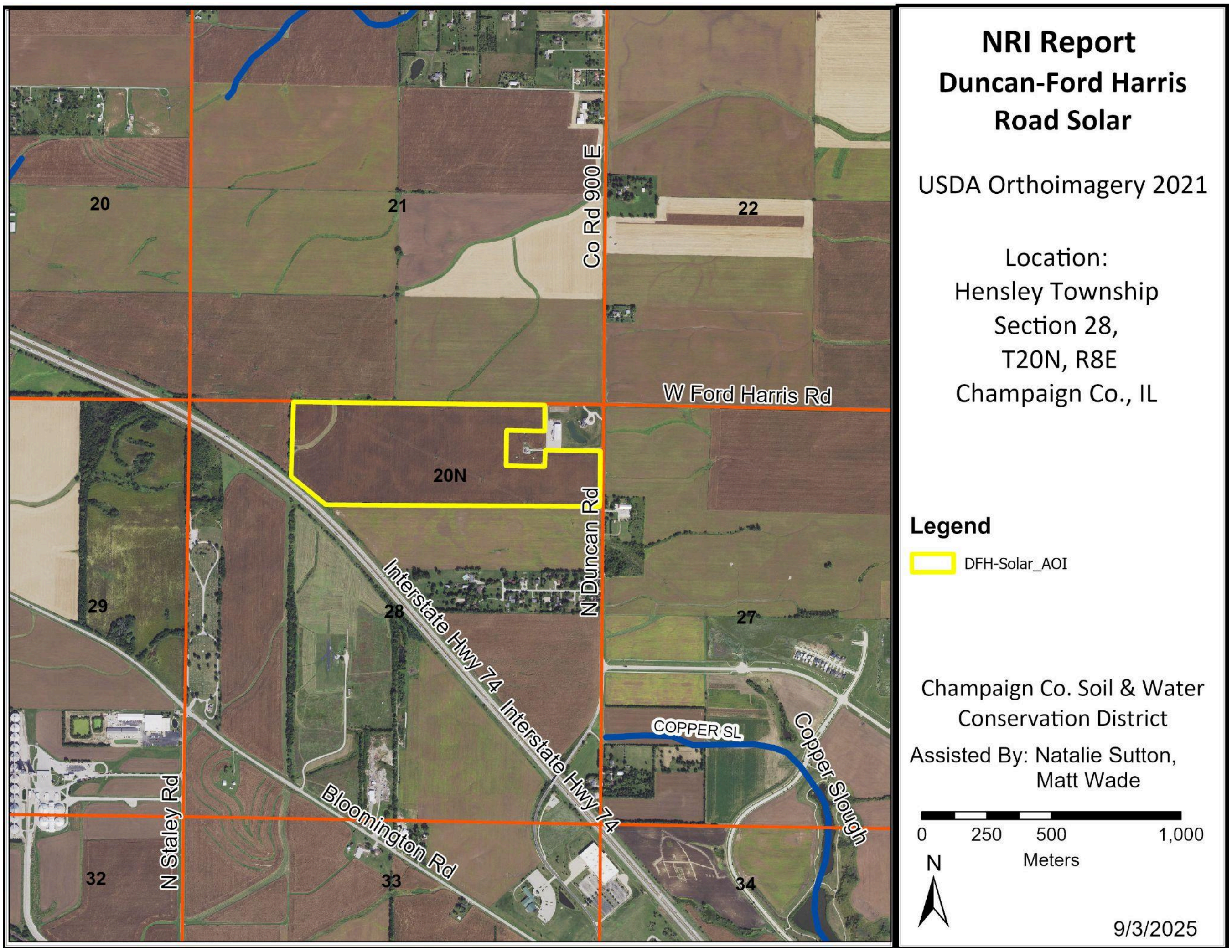
Section 22.02a The Soil and Water Conservation District shall make all natural resource information available to the appropriate county agency or municipality in the promulgation of zoning, ordinances or variances. Any person who petitions any municipality or county agency in the district for variation, amendment, or other relief from municipality's or county's zoning ordinance or who proposes to sub-divide vacant or agricultural lands therein shall furnish a copy of such petition or proposal to the Soil and Water Conservation District. The Soil and Water Conservation District shall be given not more than thirty days from the time of receipt of the petition or proposal to issue its written opinion concerning the petition or proposal and submit the same to the appropriate county agency or municipality for further action. Added by Act approved December 3, 1971.

This report provides technical data necessary to evaluate the natural resources of a specific area and the impacts or limitations associated with the proposed land use change. The report is limited to information researched by the Champaign County Soil and Water Conservation District staff. (Technical information is obtained from several different sources and may be subject to modification based on detailed site investigations or new technical information.) The information gathered in this report comes from several key reference materials and are cited throughout this report and listed in the Reference section. Any questions on the information contained in this report can be directed to:

Champaign County Soil and Water Conservation District
2110 W. Park Court, Suite C
Champaign, IL 61821
Phone 217-352-3536 ext. 3

Subject Property Location

Location Map for Natural Resources Information Report for N Duncan Road Solar, LLC. and W Ford Harris. The property is located in the northwest quarter of Section 28, Township 20N, Range 8E in Champaign County, Illinois.



Summary and Concerns of the Board

The Champaign County Soil and Water Conservation District has reviewed the proposed land use change and has the following concerns relevant to the impact on the area's natural resources.

1. Some soils on the subject property are not suitable for solar array ballast anchor or soil-based anchor systems. See pages 8-10.
2. A portion of the soils on the subject property are not suitable for dwellings or small commercial buildings. It is advised to consult with a professional to determine safety and quality of current and future construction projects. See page 10.
3. The project area is 89.1% prime farmland. See page 14.
4. The average Land Evaluation (LE) score for this site is: 93. See pages 14-15.
5. Wetlands and streams are not present near the subject property. See pages 17-18.

Soil Information

The soil information comes from the United States Department of Agriculture Natural Resources Conservation Service (USDA-NRCS) Soil Survey of Champaign County. This information is important to all parties involved in determining the suitability of the proposed land use change. Each polygon is given a number with letters, which represents its soil type, slope, flooding, etc., and is then called a map unit. Each soil map unit has limitations for a variety of land uses, which are explained using interpretations.

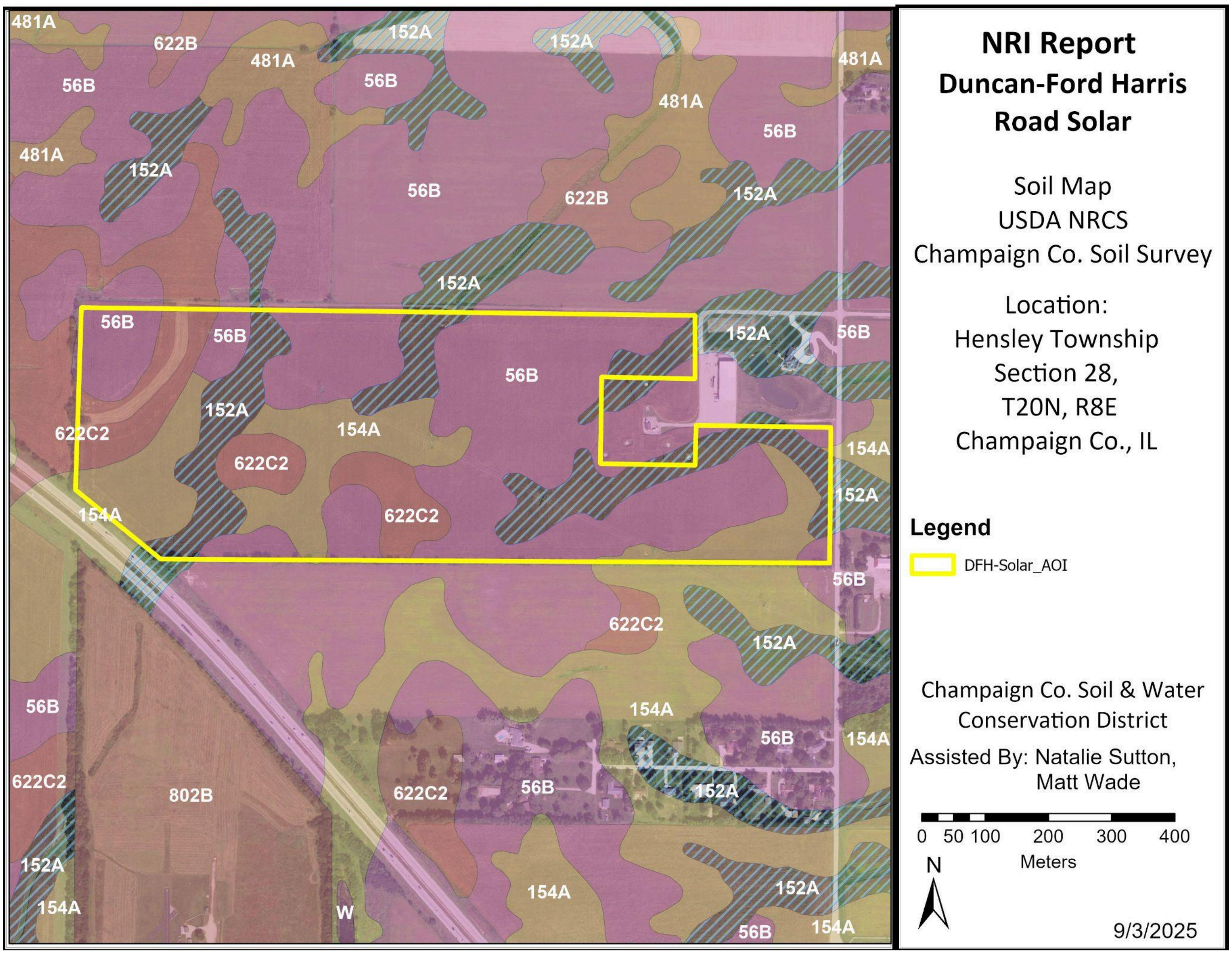


Table 1. Soil map unit descriptions.

Map Unit Symbol	Description	Acres	Percent of Area
56B	Dana silt loam, 2 to 5 percent slopes	60.8	50.7%
152A	Drummer silty clay loam, 0 to 2 percent slopes	25.6	21.3%
154A	Flanagan silt loam, 0 to 2 percent slopes	20.5	17.1%

622C2	Wyanet silt loam, 5 to 10 percent slopes, eroded	13.1	10.9%
Totals for Area of Interest		**120.0**	**100.0%**

Introduction to Soil Interpretations

Non-agricultural soil interpretations are ratings that help engineers, planners, and others understand how soil properties influence behavior when used for nonagricultural uses such as building site development or construction materials. This report gives ratings for proposed uses in terms of limitations and restrictive features. The tables list only the most restrictive features. Other features may need treatment to overcome soil limitations for a specific purpose.

Ratings come from the soil's "natural" state, that is, no unusual modification occurs other than that which is considered normal practice for the rated use. Even though soils may have limitations, an engineer may alter soil features or adjust building plans for a structure to compensate for most degrees of limitations. However, most of these practices are costly. The final decision in selecting a site for a land use generally involves weighing the costs for site preparation and maintenance.

Soil properties influence the development of building sites, including the selection of the site, the design of the structure, construction, performance after construction, and maintenance. Soil limitation ratings of slight, moderate, and severe are given for the types of proposed improvements that are listed or inferred by the petitioner as entered on the report application and/or zoning petition. The most common type of building limitation this report gives limitations ratings for is septic systems. It is understood that engineering practices can overcome most limitations for buildings with and without basements, and small commercial buildings. Organic soils, when present on the subject property, are referenced in the hydric soils section of the report.

The area of development will be susceptible to erosion both during and after construction. Any areas left bare for more than 7 days should be temporarily seeded or mulched and permanent vegetation needs to be established as soon as possible.

Limitation Ratings

1. *Not limited*- This soil has favorable properties for the intended use. The degree of limitation is minor and easy to overcome. Those involved can expect good performance and low maintenance.
2. *Somewhat limited*- This soil has moderately favorable properties for the intended use. Special planning, design, or maintenance can overcome this degree of limitation. During some parts of the year, the expected performance is less desirable than for soils rated “*not limited*.”
3. *Very limited*- This soil has one or more properties that are unfavorable for the rated use. These may include the following: steep slopes, bedrock near the surface, flooding, high shrink-swell potential, a seasonally high water table, or low strength. This degree of limitation generally requires major soil reclamation, special design, or intensive maintenance, which in most situations is difficult and costly.

Soil Interpretations

Ground Based Solar Arrays

Ground-based solar arrays are solar panel systems installed directly on the ground rather than on buildings or poles. These systems rely on a racking structure to hold the panels in an optimal orientation, which must be securely anchored to the ground for stability and long-term performance. There are two primary anchoring methods used, and the choice between them depends heavily on site-specific conditions and costs.

Soil-Based Anchor Systems

This method uses components such as driven piles, screw augers, or concrete piers that are inserted into the ground to provide a strong foundation. These systems are most suitable when the soil is deep, stable, and free of large rocks or other obstructions. However, the effectiveness and ease of installation depend on soil characteristics such as: Soil depth and strength, Rock content, Corrosivity, Drainage capacity, and Shrink-swell behavior

Ballast Anchor Systems

In contrast, ballast systems use precast concrete blocks or trays placed on the surface of the ground to hold the racking system in place by sheer weight, without penetrating the soil. These are often used in areas where soil-penetrating anchors are not feasible, such as: Shallow soils, Rocky or stony soils, and Contaminated sites where digging could release hazardous materials

While they avoid soil disturbance, ballast systems come with their own requirements—primarily, the ground must be strong enough to support the heavy equipment and vehicles used to transport and install the ballast.

Site suitability for both anchoring systems is also affected by broader environmental conditions such as: Slope and aspect (direction the slope faces), Wind speed and exposure, Risk of flooding or water ponding, Shading from nearby trees, buildings, or terrain, and Average daily sunlight hours

Additionally, soils are evaluated based on whether they are restrictive to solar installations, using an interpretive system. If any soil property within 150 cm (60 inches) of the surface poses a limitation, it is flagged, and the most significant issue determines the site's overall rating. Minor limitations are also noted, which may still influence design decisions even if they don't affect the final rating.

Table 2. Ballast Anchor Systems and Soil-Based Anchor Systems

Map Unit Symbol	**Ballast Anchor System Rating**	**Soil-based Anchor System Rating**	**Acres**	**Percent of Area**
56B	Very Limited: frost action, low strength, hillslope position, slope shape across, depth to saturated zone, ponding	Very Limited: frost action, steel corrosion, low strength, hillslope position, slope shape across	60.8	50.7
152A	Very limited: ponding, depth to saturated zones, frost action, low strength, slope shape across	Very limited: ponding, depth to saturated zone, frost action, low strength, steel corrosion, shrink-swell	25.6	21.3
154A	Somewhat limited: low strength, depth to saturated zone, frost action	Somewhat limited: low strength, shrink-swell, steel corrosion, depth to saturated zone, frost action	20.5	17.1

622C2	Somewhat limited: frost action, hillslope position, low strength, slope direction and gradient	Somewhat limited: frost action, hillslope position, low strength, slope direction and gradient	13.1	10.9

For the subject property: Some of the soils on the property are very limited for the use of ballast anchor systems or soil-based anchor systems.

Building Site Development
The table below shows the degree and the kind of soil limitations that affect dwellings with or without basements and small commercial buildings.

Dwellings and Small Commercial Buildings: Structures built on a shallow foundation on undisturbed soil that are three stories or less. The ratings are based on soil properties, site features, and observed performance of the soils. High water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding effect the ease of excavation, construction, and maintenance.

Table 3. Dwellings and small commercial buildings limitations.

Map Unit Symbol	Dwellings with Basements	Dwellings without Basements	Small Commercial Buildings	Acres	Percent of Area
56B	Very limited: ponding, depth to saturated zone, shrink-swell	Somewhat limited: depth to saturated zone, shrink-swell	Somewhat limited: Depth to saturated zone, shrink-swell	60.8	50.7%
152A	Very limited: ponding, depth to saturated zone, shrink-swell	Very limited: ponding, depth to saturated zone, shrink-swell	Very limited: ponding, depth to saturated zone, shrink-swell	25.6	21.3%
154A	Very limited: depth to saturated zone, ponding, shrink-swell	Somewhat limited: depth to saturated zone, shrink-swell	Somewhat limited: depth to saturated zone, shrink-swell	20.5	17.1%
622C2	Not Limited	Not Limited	Somewhat limited: slope, depth to saturated zone, shrink-swell	13.1	10.9%

Soil Water (Wetness) Features

This section gives estimates of various soil water (wetness) features that should be taken into consideration when reviewing engineering for a land use project.

Hydrologic Soil Groups (HSGs): The groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

- Group A: Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.
- Group B: Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.
- Group C: Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

- Group D: Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Note: if a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D) the first letter is for drained areas and the second is for undrained areas.

Surface Runoff: Refers to the loss of water from an area by flow over the land surface. Surface runoff classes are based upon slope, climate, and vegetative cover and indicates relative runoff for very specific conditions (it is assumed that the surface of the soil is bare and that the retention of surface water resulting from the irregularities in the ground surface is minimal). The classes are negligible, very low, low, medium, high, and very high.

Water Table: Refers to a saturated zone in the soil and the data indicates, by month, depth to the top (upper limit) and base (lower limit) of the saturated zone in most years. These estimates are based upon observations of the water table at selected sites and on evidence of a saturated zone (grayish colors or mottles, called redoximorphic features) in the soil. Note: a saturated zone that lasts for less than a month is not considered a water table.

Ponding: Refers to standing water in a closed depression and the data indicates duration and frequency of ponding.

- Duration: expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days and *very long* if more than 30 days.
- Frequency: expressed as *none* (ponding is not possible), *rare* (unlikely but possible under unusual weather conditions), *occasional* (occurs, on average, once or less in 2 years), *frequent* (occurs, on average, more than once in 2 years).

Flooding: The temporary inundation of an area caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, and water standing in swamps and marshes is considered ponding rather than flooding.

- Duration: Expressed as *extremely brief* if 0.1 hour to 4 hours; *very brief* if 4 hours to 2 days; *brief* if 2 to 7 days; *long* if 7 to 30 days; and *very long* if more than 30 days.
- Frequency: Expressed as *none* (flooding is not probable), *very rare* (very unlikely but possible under extremely unusual weather conditions (chance of flooding is less than 1% in any year)), *rare* (unlikely but possible under unusual weather conditions (chance of flooding is 1 to 5% in any year)), *occasional* (occurs infrequently under normal weather conditions (chance of flooding is 5 to 50% in any year but is less than 50% in all months in any year)), and *very frequent* (likely to occur very often under normal weather conditions (chance of flooding is more than 50% in all months of any year)).

Note: The information is based on evidence in the soil profile. In addition, consideration is also given to local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

Table 4. Soil water (wetness) features.

Map Unit Symbol	HSG	Surface Runoff	Depth to Water Table (ft)			Ponding		Flooding	
			Upper Limit	Lower Limit	Kind	Duration	Frequency	Duration	Frequency
56B	C	Low	2.0-3.5	3.3-5.0	Perched	-	None	-	None
152A	B/D	Neg	0.0-1.0	6.0	Apparent	Brief (2-7 days)	Frequent	-	None
154A	C/D	Low	1.0-2.0	3.7-5.9	Perched	-	None	-	None
622C2	C	Low	-	-	-	-	None	-	None

Hydric Soils

Hydric soils by definition have seasonal high water at or near the soil surface and/or have potential flooding or ponding problems. All hydric soils range from poorly suited to unsuitable for building. Soil maps may not be small enough to show inclusions of hydric soils, so it is important to consult a soil scientist if building residential areas on hydric soils or soils with hydric inclusions.

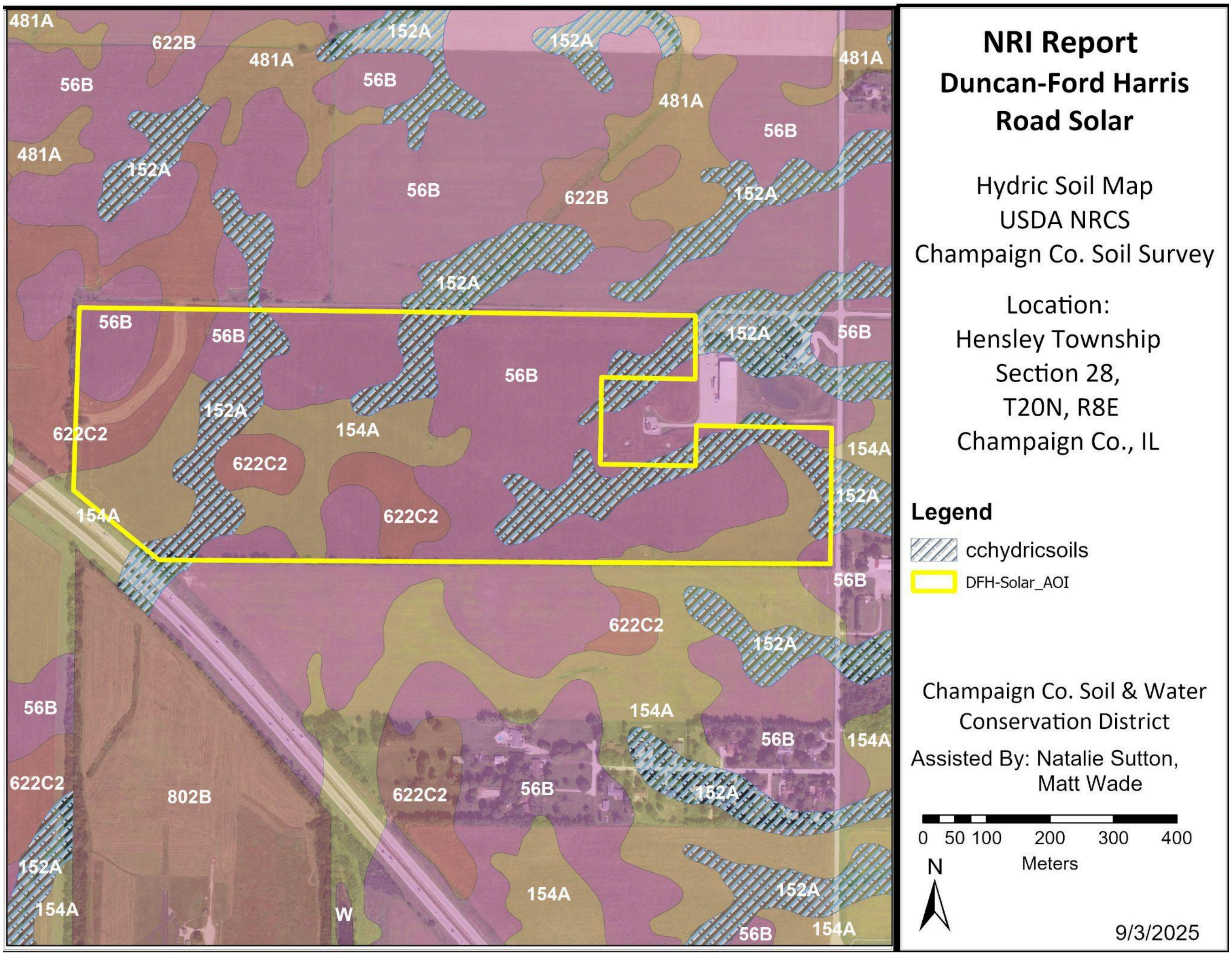
On most agricultural soils in the county that are poorly or somewhat poorly drained, subsurface agriculture drainage tile occurs. This expedites drainage but must be maintained and undisturbed so the soil does not return to its original hydrologic condition.

The Champaign County SWCD recommends the following for an intense land use, such as a subdivision:

1. A topographical survey with 1-foot contour intervals to define the flood area.
2. An intensive soil survey to define locations of hydric inclusions.
3. A drainage tile survey to locate tiles that must be preserved.

Table 5. Hydric soils.

Map Unit Symbol	Drainage Class	Hydric Designation	Acres	Percent of Area
56B	Moderately well drained	Non Hydric	60.8	50.7%
152A	Poorly drained	Hydric	25.6	21.3%
154A	Somewhat poorly drained	Non Hydric	20.5	17.1%
622C2	Well drained	Non Hydric	13.1	10.9%
			Percent Hydric	**21.3%**



Soil Erosion and Sediment Control

Erosion is the wearing away of the soil by water, wind, and other forces and a soil's erodibility is mainly determined by the following properties: soil texture, slope, soil structure, soil organic matter content. Soil erosion threatens the nation's soil productivity and contributes to pollutants in waterways. Sediment entering creeks, rivers, and lakes degrade water quality and reduce capacity, which increases the risk of flooding and disrupts ecosystems. Sediment also carries other possible pollutants, such as chemicals and metals, by adhering to the sediment's surface.

Erosion Control at Construction Sites

Construction sites can experience 20 to 200 tons/acre/year of soil loss, which is greater than other land uses, like agriculture, averaging 4-5 tons/acre/year. It is extremely important that the developer employ Best Management Practices, like the ones listed below, to help reduce soil erosion and protect water quality during and after construction.

- **Silt Fencing:** A woven geotextile fabric stretched across and attached to supporting posts used to intercept sediment-laden runoff from small drainage areas of disturbed soil. The purpose is to filter out sediment from runoff before it enters a water body.
- **Construction Road Stabilization:** The stabilization of temporary construction access routes, subdivision roads, on-site vehicle transportation routes, and construction parking areas with stone immediately after grading the area to reduce erosion.

- **Vegetative Cover:** One of the most important means to control runoff is to plant temporary vegetation around the perimeter of the construction site. This provides a natural buffer to filter sediment and chemicals. The CCSWCD recommends that temporary grass be planted (i.e. smooth bromegrass, oats, cereal rye) to help protect soil from erosion during construction.

EPA Stormwater Pollution Prevention Plan (SWPPP) Reference Tool

EPA requires a plan to control storm water pollution for all construction sites over 1 acre in size. *A Guide for Construction Sites* is a reference tool for construction site operators who must prepare a SWPPP to obtain NPDES permit coverage for their storm water discharges. More information at the following website: http://www.epa.gov/npdes/stormwater-discharges-construction-activities#resources.

Table 6. Soil erosion potential.

Map Unit Symbol	Slope	Rating	Acres	Percent of Area
56B	3.0%	Moderate	60.8	50.7%
152A	0.5%	Slight	25.6	21.3%
154A	0.9%	Slight	20.5	17.1%
622C2	7.0%	Severe	13.1	10.9%

Prime Farmland Soils

Prime farmland soils are an important resource to Champaign County. Some of the most productive soils in the world occur locally. Each soil map unit in the United States is assigned a prime or non-prime rating. Urban or built-up land on prime farmland soils is not prime farmland.

Table 7. Prime farmland designation.

Map Unit Symbol	Prime Designation	Acres	Percent of Area
56B	All Areas prime farmland	60.8	50.7%
152A	Prime farmland if drained	25.6	21.3%
154A	All areas are prime farmland	20.5	17.1%
622C2	Farmland of statewide importance	13.1	10.9%
		Percent Prime Farmland	89.1%

The Land Evaluation and Site Assessment System

Decision-makers in Champaign County use the Land Evaluation and Site Assessment (LESA) system to determine the suitability of a land use change and/or a zoning request as it relates to agricultural land. The LESA system was developed by the USDA-NRCS and takes into consideration local conditions, such as physical characteristics of the land, compatibility of surrounding land uses, and urban growth factors. The LESA system is a two-step procedure:

- Land Evaluation (LE) – the soils of a given area are rated and placed in groups ranging from the best to worst suited for a stated agricultural use. The best group is assigned a value of 100 and is based on data from the Champaign County Soil Survey. The Champaign County LE designates soils with a score of 91 to 100 as best prime farmland, as reported in Bulletin 811 Optimum Crop Productivity Ratings for Illinois Soils. Best Prime Farmland consists of:
  a) Soils identified as agricultural value groups 1, 2, 3, and/or 4
  b) Soils that, in combination on a subject site, have an average LE of 91 or higher
  c) Any site that includes a significant amount (10% or more of the area proposed to be developed) of agriculture value groups 1, 2, 3, and/or 4
- Site Assessment (SA) – the site is numerically evaluated according to important factors that contribute to the quality of the site. Each factor selected is assigned values in accordance with the local needs and objectives.

The Champaign County LESA system is designed to provide officials with a systematic objective means to numerically rate a site in terms of its agricultural importance.

- To assist officials in evaluating the proposed conversion of farmland on a parcel or site in zoning cases that include farmland conversion to a non-agricultural land use.
- To assist in the review of state and federal projects for compliance with the Illinois Farmland Preservation Act and the Federal Farmland Protection Policy Act in terms of their impact on important farmland.

Note: A land evaluation (LE) score will be compiled for every project property, but a site assessment score is not applicable in most cases, making the full LESA score unavailable.

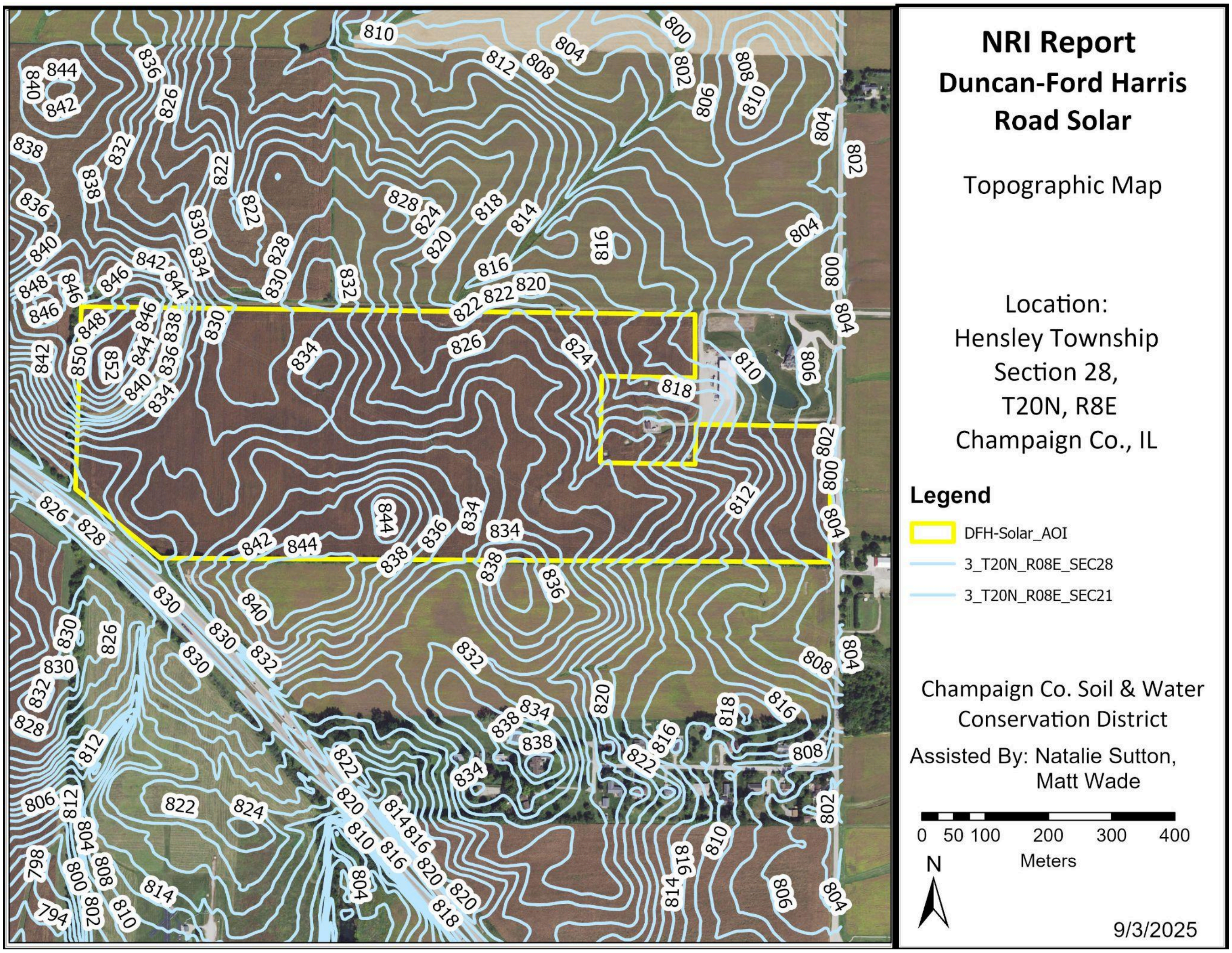
Table 8. Land Evaluation and Site Assessment System score.

Map Unit Symbol	**Value Group**	**Relative Value**	**Acres**	**Product (Relative Value*Acres)**
56B	4	91	60.8	5532.8
152A	2	100	25.6	2560.0
154A	1	100	20.5	2050.0
622C2	11	78	13.1	1021.8
LE Score		LE = 11164.60/120	120	**LE = 93.0**

For the subject property: the overall Land Evaluation (LE) score is 93.

Topographic Information

United States Geologic Survey (USGA) topographic maps give information on elevation, which are important mostly to determine slope, drainage direction, and watershed information. Elevation determines the area of impact of floods. Slope information determines steepness and erosion potential. Drainage directions determine where water leaves the subject property, possibly impacting surrounding natural resources.



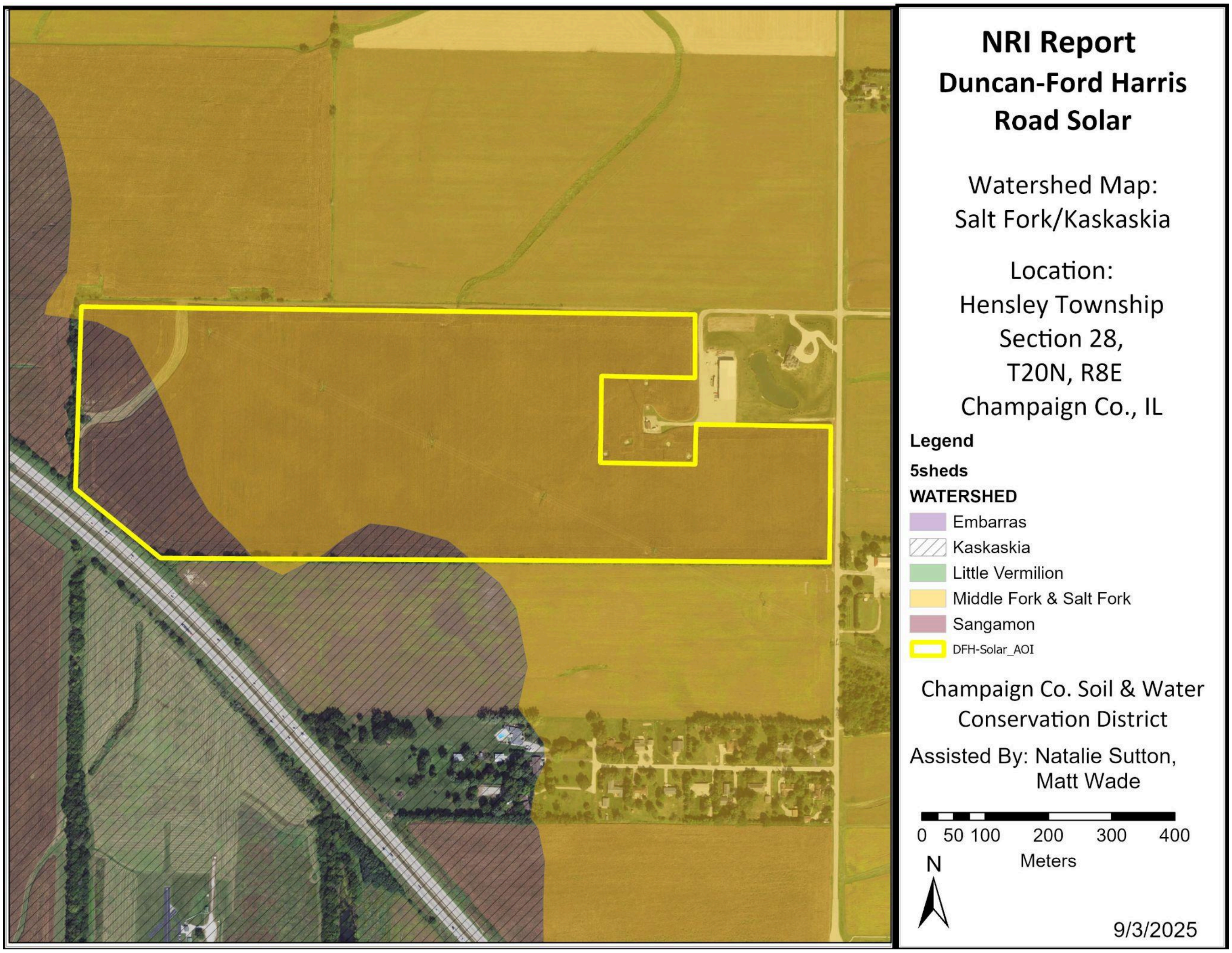
Watershed Information

Watershed information is given when land use is changed to a subdivision type of development on parcels greater than 10 acres. A watershed is an area of land that drains to an associated water resource, such as a wetland, river, or lake. Rainwater carries pollutants through watersheds, impacting natural resources and people living downstream. Residents can minimize this impact by being aware of their environment and implications of their activities.

The following are recommendations to developers for protection of watersheds:

- Preserve open space
- Maintain wetlands as part of development
- Use natural water management
- Prevent soil from leaving construction sites
- Protect subsurface drainage
- Use native vegetation
- Retain natural features
- Mix housing and style types
- Decrease impervious surfaces
- Reduce area disturbed by mass grading
- Treat water where it falls

<u>For the subject property</u>: the property is located in the Salt Fork/Kaskaskia watershed.



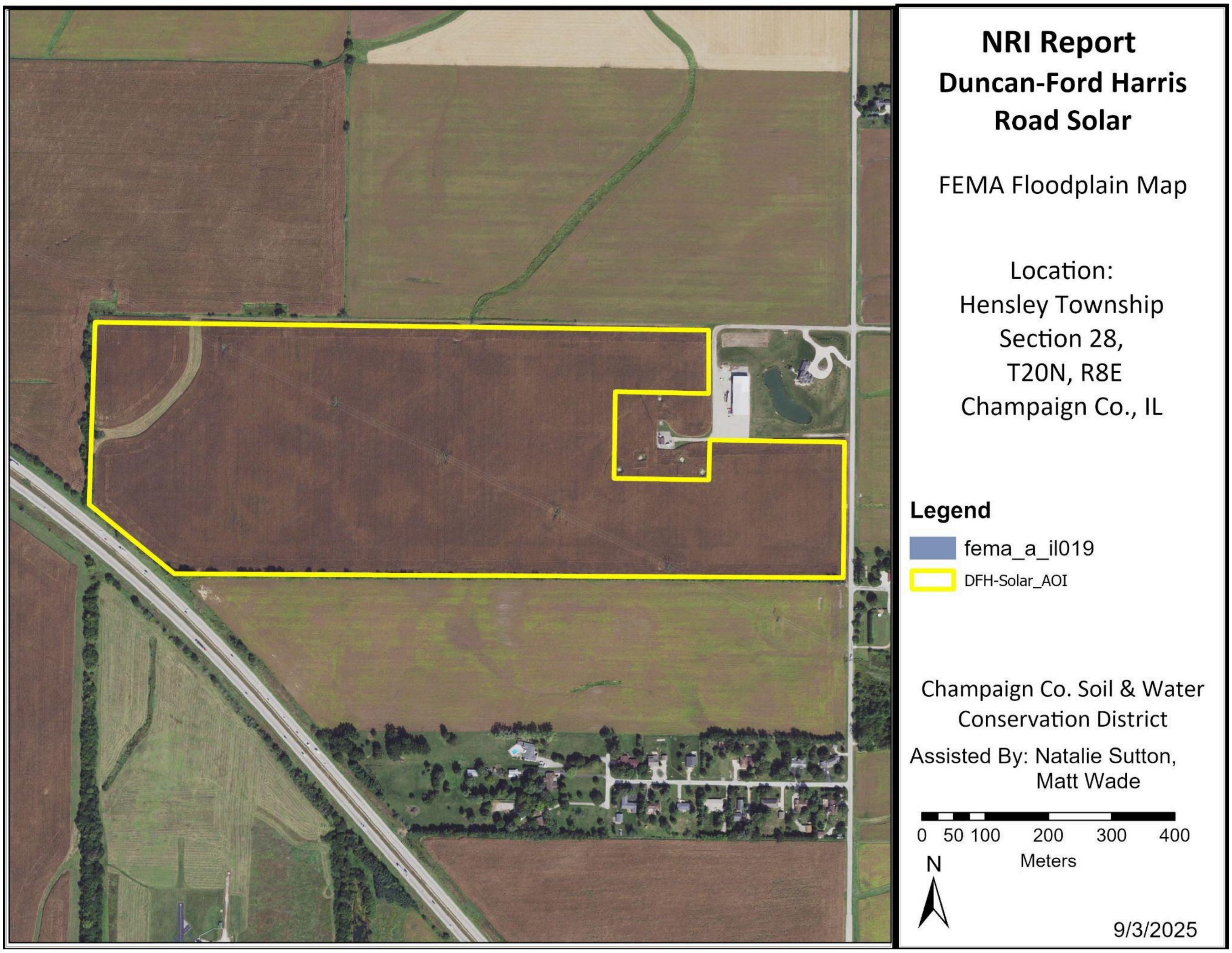
Floodplain and Wetland Information

Floodplain Information

A floodplain is defined as land adjoining a watercourse (riverine) or an inland depression (non-riverine) that is subject to periodic inundation by high water. Floodplains are important areas that demand protection since they have water storage and conveyance functions that affect upstream and downstream flows, water quality and quantity, and suitability of the land for human activity. Since floodplains play distinct and vital roles in the hydrologic cycle, development that interferes with their hydrologic and biologic functions should be carefully considered.

Flooding is dangerous to people and destructive to their properties. The following map can help developers and future homeowners to "sidestep" potential flooding or ponding problems. The Flood Insurance Rate Map (FIRM) was produced by the Federal Emergency Management Agency (FEMA) to define flood elevation adjacent to tributaries and major bodies of water that are superimposed onto a simplified USGS topographic map.

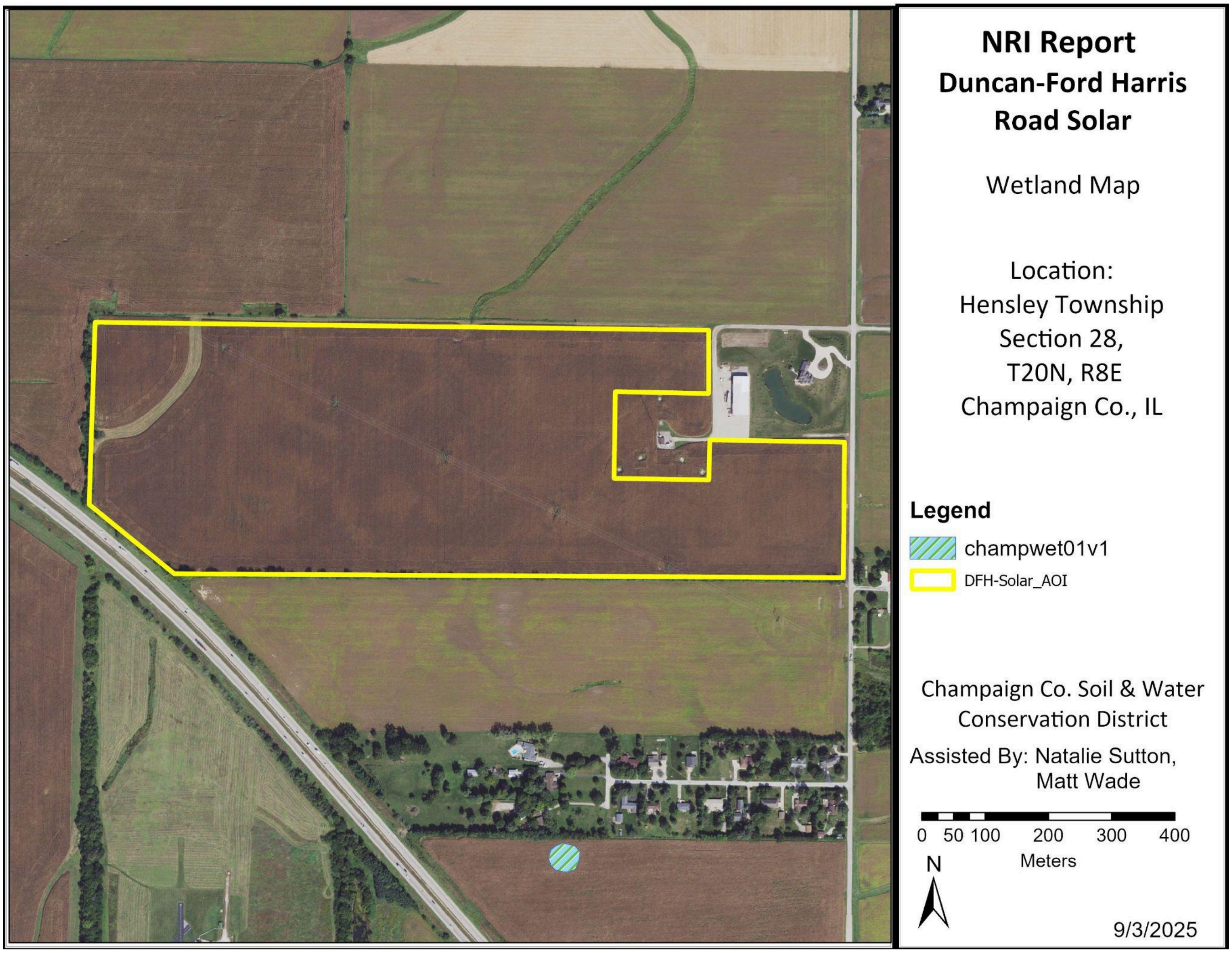
For the subject property: No portion of the property is in the floodplain.



Wetland Information

Wetlands function in many ways to provide numerous benefits to society and the environment, including flood control, cleanse water, recharge groundwater, and provide a wildlife habitat. However, approximately 95% of the wetlands that were historically present in Illinois have been destroyed. It is crucial that we take steps to conserve current wetlands and reestablish new wetlands where once destroyed. Wetland determinations are made by a certified NRCS staff.

<u>For the subject property</u>: No wetlands are present near the subject property.



Wetland and Floodplain Regulations

Please read the following if you are planning to do any work near a stream, lake, wetland, or floodway, including: dredge, fill, rip rap, or otherwise alter the banks or beds of, or construct, operate, or maintain any dock, pier, wharf, sluice, dam, piling, wall, fence, utility, flood plain, or floodway subject to State or Federal regulatory jurisdiction.

The laws of the United States and the State of Illinois assign certain agencies specific and different regulatory roles to protect the waters within the State's boundaries. These roles, when considered together, include protection of navigation channels and harbors, protection against flood way encroachments, maintenance and enhancement of water quality, protection of fish and wildlife habitat and recreational resources, and, in general, the protection of total public interest. Unregulated used of the waters within the State of Illinois could permanently destroy and adversely impact the public. Therefore, please contact the proper authorities when planning any work associated with Illinois waters so that proper consideration and approval can be obtained.

Regulatory Agencies:

- Wetlands or U.S. Waters: U.S. Army Corps of Engineers
- Floodplains: Illinois Department of Natural Resources/Office of Water Resources, Natural Resources Way, Springfield, IL
- Water Quality/Erosion Control: Illinois Environmental Protection Agency

Coordination: we recommend early coordination with the agencies BEFORE finalizing work plans. This allows the agencies to recommend measures to mitigate or compensate for adverse impacts. This could reduce time required to process necessary approvals and reduce expense.

Cultural and Animal Resources

Cultural Resources

The most common cultural resources found during changes in land use are historical properties or non-structural archaeological sites. These sites often extend below the soil surface and must be protected against disruption by development or other earth moving activity if possible. Cultural resources are non-renewable because there is no way to grow a site to replace a disrupted site. Landowners with historical properties on their land have ownership of that historical property. However, the State of Illinois owns all of the following: human remains, grave markers, burial mounds, and artifacts associated with graves and human remains. Non-grave artifacts from archaeological sites and historical buildings are the property of the landowner. The landowner may choose to disturb a historical property but may not receive federal or state assistance to do so. If an earth-moving activity disturbs human remains, the landowner must contact the county coroner within 48 hours.

The Illinois Historic Preservation Agency may require a Phase 1 Archaeological review to identify any cultural resources that may be on the site. The IHPA has not been contacted by the Champaign County SWCD. The applicant may need to contact the IHPA according to current Illinois law.

Animal Resources

According to the Illinois Endangered Species Protection Act & Illinois Natural Areas Preservation Act, state agencies or local units of government must consult Illinois Department of Natural Resources (IDNR) about proposed actions that they will authorize, fund, or perform. Private parties do not have to consult, but they are liable for prohibited taking of state-listed plants and animals or for adversely modifying a Nature Preserve or a Land and Water Preserve. Home rule governments may delegate this responsibility through duly enacted ordinances to the parties seeking authorization or funding of the action.

Ecologically Sensitive Areas

Biodiversity is the sum of total of all the plants, animals, fungi, and microorganisms in the world, or in a particular area that make up the fabric of the Earth and allow it to function. Biodiversity must be protected, as it is diminishing, which weakens entire natural systems. It is intrinsically valuable for an ecosystem to be biologically diverse to sustain ecosystem health and support life.

As part of the Natural Resources Information Report, staff checks if any nature preserves are in the general vicinity of the subject property. If there is a nature preserve in the area, then that resource will be identified as part of the report. The SWCD recommends that every effort be made to protect that resource. Such efforts should include but are not limited to erosion control, sediment control, stormwater management, and groundwater monitoring.

For the subject property: As shown on the below EcoCAT, there is no record of sensitive areas or endangered species in or near the subject property.

EcoCAT
Ecological Compliance Assessment Tool

ILLINOIS DEPARTMENT OF NATURAL RESOURCES

Applicant:	Champaign County NRCS	*IDNR Project Number:*	2605399
Contact:	Natalie Sutton	*Date:*	09/15/2025
Address:	2110 W Park Ct. Suite C Champaign, IL 61821		
Project:	Duncan Ford Harris Solar		
Address:	Champaign , Champaign		

Description: Solar Field

Natural Resource Review Results

This project was submitted for information only. It is not a consultation under Part 1075.

The Illinois Natural Heritage Database contains no record of State-listed threatened or endangered species, Illinois Natural Area Inventory sites, dedicated Illinois Nature Preserves, or registered Land and Water Reserves in the vicinity of the project location.

Location

The applicant is responsible for the accuracy of the location submitted for the project.

County: Champaign

Township, Range, Section:
20N, 8E, 28

IL Department of Natural Resources Contact
Impact Assessment Section
217-785-5500
Division of Ecosystems & Environment

Government Jurisdiction
U.S. Department of Agriculture

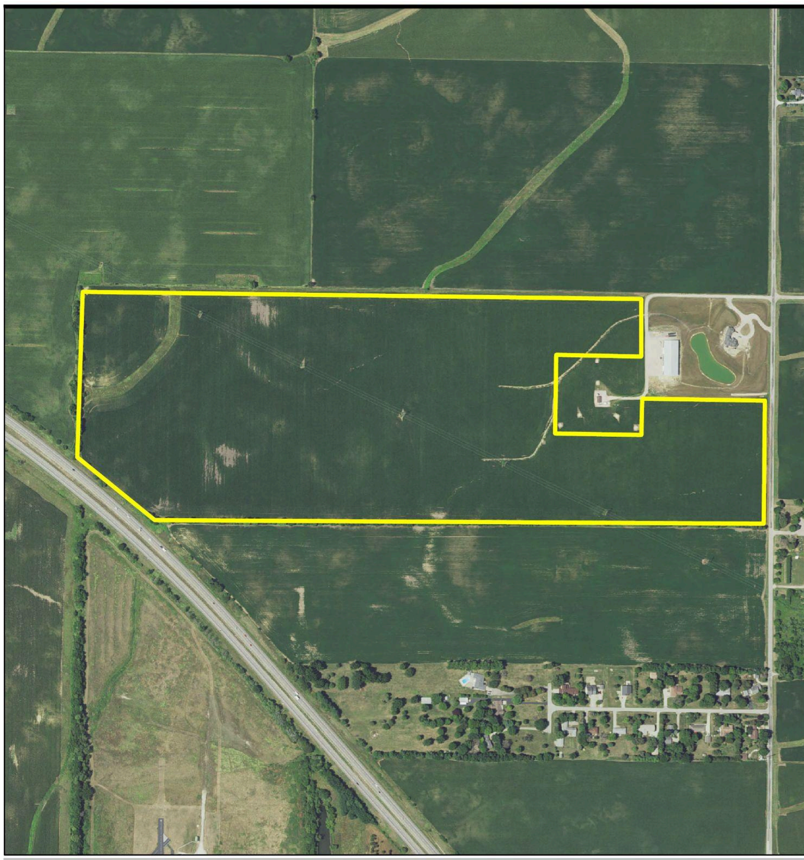
Disclaimer

The Illinois Natural Heritage Database cannot provide a conclusive statement on the presence, absence, or condition of natural resources in Illinois. This review reflects the information existing in the Database at the time of this inquiry, and should not be regarded as a final statement on the site being considered, nor should it be a substitute for detailed site surveys or field surveys required for environmental assessments. If additional protected resources are encountered during the project's implementation, compliance with applicable statutes and regulations is required.

Terms of Use

By using this website, you acknowledge that you have read and agree to these terms. These terms may be revised by IDNR as necessary. If you continue to use the EcoCAT application after we post changes to these terms, it will mean that you accept such changes. If at any time you do not accept the Terms of Use, you may not continue to use the website.

Historic Aerial Photos



NRI Report
Duncan-Ford Harris Road Solar

USDA Orthoimagery 2017

Location:
Hensley Township
Section 28,
T20N, R8E
Champaign Co., IL

Legend

DFH-Solar_AOI

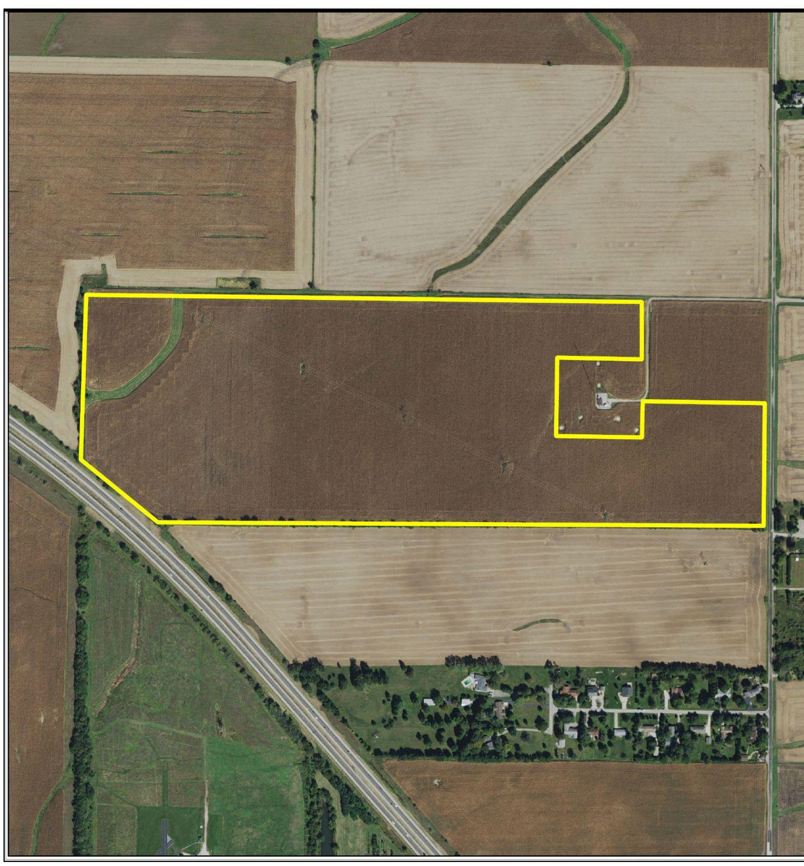
Champaign Co. Soil & Water Conservation District

Assisted By: Natalie Sutton, Matt Wade

0 50 100 200 300 400
Meters

N

9/3/2025



NRI Report
Duncan-Ford Harris Road Solar

USDA Orthoimagery 2015

Location:
Hensley Township
Section 28,
T20N, R8E
Champaign Co., IL

Legend

DFH-Solar_AOI

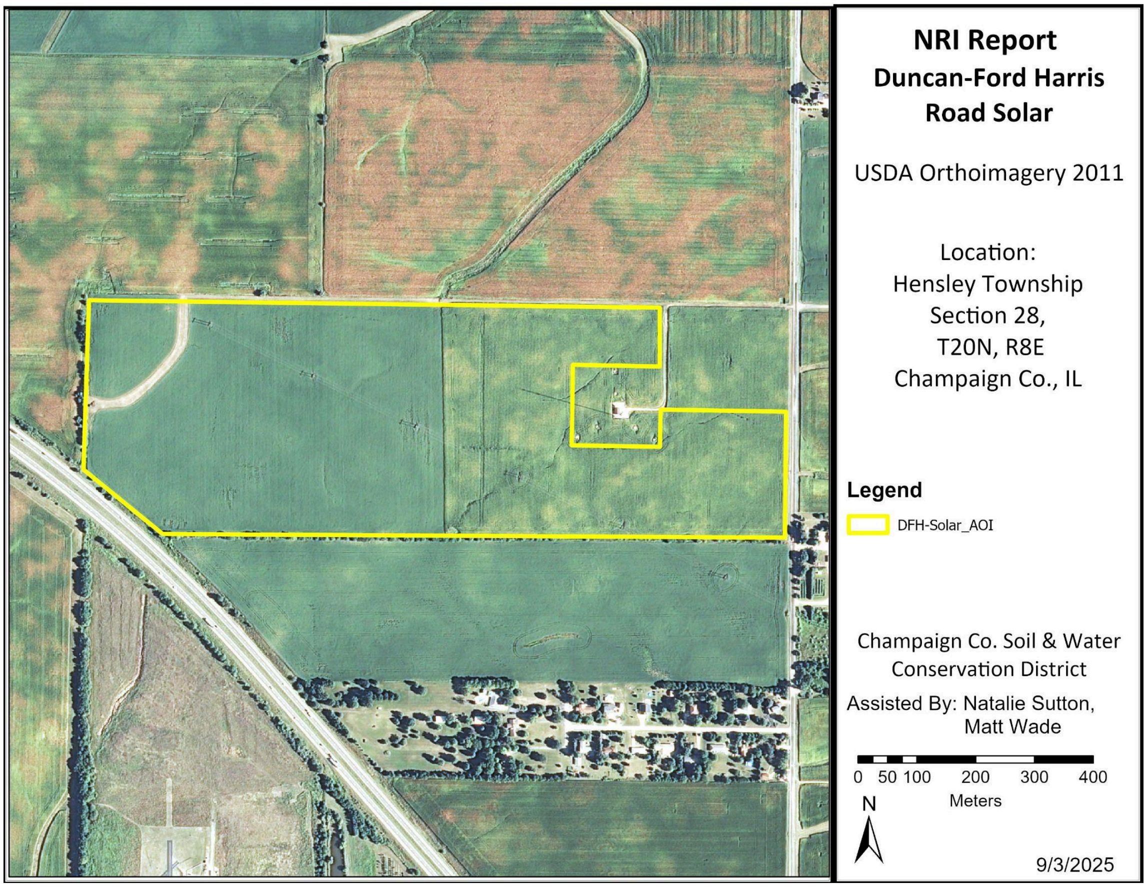
Champaign Co. Soil & Water Conservation District

Assisted By: Natalie Sutton, Matt Wade

0 50 100 200 300 400
Meters

N

9/3/2025


NRI Report
Duncan-Ford Harris
Road Solar
USDA Orthoimagery 2011
Location:
Hensley Township
Section 28,
T20N, R8E
Champaign Co., IL
Legend
DFH-Solar_AOI
Champaign Co. Soil & Water
Conservation District
Assisted By: Natalie Sutton,
Matt Wade
0 50 100 200 300 400
Meters
N
9/3/2025

Glossary and Acronyms

Agriculture – The growing, harvesting, and storing of crops, including legumes, hay, grain, fruit; and truck or vegetables, including dairy, poultry, swine, sheep, beef cattle, pony and horse, fur, and fish and wildlife; farm buildings used for growing, harvesting, and preparing crop products for market, or for use on the farm; roadside stands, farm buildings for storing and protecting farm machinery and equipment from the elements, or for housing livestock or poultry and for preparing livestock or poultry products for market; farm dwellings occupied by farm owners, operators, tenants, or seasonal or year around hired farm workers.

ADT – average daily traffic that a local road normally receives, based upon records by the County Superintendent of Highways.

B.G. – below grade. Under the surface of the Earth.

Bedrock – indicates depth at which bedrock occurs. Also lists hardness as rippable or hard.

Flooding – indicates frequency, duration, and period during year when floods are likely to occur.

High Level Management – the application of effective practices adapted to different crops, soils, and climatic conditions. Such practices include providing for adequate soil drainage, protection from flooding, erosion and runoff control, near optimum tillage, and planting the correct kind and amount of high-quality seed. Weeds, diseases, and harmful insects are controlled. Favorable soil reaction and near-optimum levels of available nitrogen, phosphorus, and potassium for individual crops are maintained. Efficient sue is made of available crop residues, barnyard manure, and/or green manure crops. All operations, when combined efficiently and timely, can create favorable growing conditions and reduce harvesting losses (within limits imposed by weather).

High Water Table – a seasonal highwater table is a zone of saturation at the highest average depth during the wettest part of the year. May be apparent, perched, or artesian.

Water Table, Apparent – a thick zone of free water in the soil indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water Table, Artesian – a water table under hydrostatic head, generally beneath an impermeable layer. When a layer is penetrated, the water level rises in the uncased borehole.

Water Table, Perched – a water table standing above an unsaturated zone, often separated from a lower wet zone by a dry zone.

Delineation – (for wetlands) a series of orange flags placed on the ground by a certified professional that outlines the wetland boundary on a parcel.

Determination – (for wetlands) a polygon drawn on a map using map information that gives an outline of a wetland.

Hydric Soil – soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part (USDA Natural Resources Conservation Service, 1987).

Intensive Soil Mapping – mapping done on a small, intensive scale than a modern soil survey to determine soil properties of a specific site, i.e. mapping for septic suitability.

Land Evaluation Site Assessment (L.E.S.A.) – LESA is a systematic approach for evaluating a parcel of land and to determine a numerical value for the parcel for farmland preservation purposes.

Modern Soil Survey – a soil survey is a field investigation of the soils of a specific area, supported by information from other sources. The kinds of soil in the survey area are identified and their extent is shown on a map. An accompanying report describes, defines, classifies, and interprets the soils. Interpretations predict the behavior of soils under different uses and the soils' response to management. Predictions are made for areas of soil at specific places. Soil information collected in a soil survey are useful in developing land use plans and alternatives.

Palustrine – name given to inland fresh water wetlands.

Permeability – values listed estimate the range of time it takes for downward movement of water in the major soil layers when saturated but allowed to drain freely. The estimates are based on soil texture, soil structure, available data on permeability and infiltration tests, and observation of water movement through soils or other geologic materials.

PIQ – parcel in question

Potential Frost Action – damage that may occur to structures and roads due to ice lens formation, causing upward and lateral soil movement. Based primarily on soil texture and wetness.

Prime Farmland – lands that are best suited for food, feed, forage, fiber, and oilseed crops. It may be cropland, pasture, woodland, or other land, but it is not urban, built up land, or water areas. When well-managed, the soil qualities and moisture supply provide a sustained high yield of crops with minimum inputs of energy and economic resources in the least damage to the environment. Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooding during the growing season. The slope ranges from 0 to 5 percent. (USDA Natural Resources Conservation Service)

Productivity Indexes – express the estimated yields of the major grain crops in Illinois as a single percentage of the average yields obtained under basic management from several of the more productive soils in the state (Muscatine, Ipava, Sable, Lisbon, Drummer, Flanagan, Littleton, Elburn, Joy soil series). See Circular 1156 from the Illinois Cooperative Extension Service.

Seasonal – when used in reference to wetlands, indicates the area flooded only during a portion of the year.

Shrink-Swell Potential – indicates volume changes to be expected for the specific soil material with changes in moisture content.

Soil Mapping Unit – collection of soil and miscellaneous areas delineated in mapping. Generally, an aggregate of the delineations of many different bodies of a kind of soil or miscellaneous area but may consist of only one delineated body. Taxonomic class names and accompanying terms are used to name soil map units. They are described in terms of ranges of soil properties within the limits defined for tax and in terms of ranges of tax adjuncts and inclusions.

Soil Series – a group of soils formed from a type of parent material, having horizons that, except for texture of the surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, mineralogy, and chemical composition.

Subsidence – applies mainly to organic soils after drainage. Soil material subsides due to shrinkage and oxidation.

Terrain – the area or surface over which a particular rock or group of rocks is prevalent.

Topsoil – portion of the soil profile where higher concentrations or organic material, fertility, bacterial activity, and plant growth take place. Depths of topsoil vary between soil types.

Watershed – an area of land that drains to an associated water resource, such as a wetland, river, or lake. Depending on the size and topography, watersheds can contain numerous tributaries, such as streams, ditches, and ponding areas, such as detention structures, natural ponds, or wetlands.

Wetland – an area that has a predominance of hydric soils that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support a prevalence of hydrophilic vegetation typically adapted for life in saturated soil conditions.

References

Field Office Technical Guide. USDA Natural Resources Conservation Service.

Flood Insurance Rate Map. National Flood Insurance Program, Federal Emergency Management Agency.

Illinois Urban Manual. 2016. Association of Illinois Soil & Water Conservation Districts.

Soil Survey of Champaign County. USDA Natural Resources Conservation Service.

Wetlands Inventory Maps. Department of the Interior.

Potential for Contamination of Shallow Aquifers in Illinois. Illinois Department of Energy and Natural Resources, State Geological Survey Division.

Land Evaluation and Site Assessment System. The Kendall County Department of Planning, Building, and Zoning, and the Champaign County Soil and Water Conservation District. In cooperation with USDA Natural Resources Conservation Service.

EXHIBIT R: PRELIMINARY OPERATIONS AND MAINTENANCE PLAN

Operations & Maintenance

Statement of Work

Table of Contents

1 GENERAL SCOPE OF SERVICES

This Statement of Work under the **Operations and Maintenance Agreement ("Agreement")** between [PROJECT OWNER] ("Owner") and [OPERATOR COMPANY] ("Operator") is effective as of ________, 2025 (the "Commencement Date"). Capitalized terms used in this Statement of Work but not defined in this Exhibit T will have the meanings given in the Agreement.

The terms and conditions of the Agreement shall be deemed incorporated into and made part of this Statement of Work, provided that in the event of a conflict between the Agreement and the express terms of this Statement of Work applicable to the System(s) set forth in Section 1 below, the express terms and conditions of this Scope of Services shall govern. Operator shall perform the System Services set forth in Scope of Services to this Statement of Work with respect to the System(s) described below:

1.1 TERM

The initial term of this Statement of Work will be XX years (the "Initial Term"), commencing on the Commencement Date, and shall be automatically extended for consecutive one (1)-year periods after the expiration of the Initial Term (each XX year extension period being hereinafter referred to as an "Extension Term") (the Initial Term and all Extension Terms being collectively referred to herein as the "Term"), unless terminated by either Party pursuant to Sections XX of the Agreement.

1.2 FEES

The Basic Service Fee and Additional Service Fees outlined in **Error! Reference source not found.**, shall escalate XX percent (XX%) per year in accordance with the terms set forth in the Agreement.

2 DESCRIPTION OF SERVICES

Operator shall perform the Services as designated in this Agreement and shall follow all procedures outlined.

2.1 SCOPE OF OPERATIONAL SERVICES

The Scope of Operational Services shall include providing the following services (to be performed in accordance with the standards set forth in Section 1 of this Exhibit):

a) Environmental, Health, and Safety (HSE)
b) System Monitoring, Alarm Response, and System Analysis
c) Operation Reporting
d) Inspection and Service of equipment and Facility
e) Warranty administration and adherence
f) Corrective maintenance
g) Inventory and Spare Parts management and replacement
h) Site Maintenance

2.2 COVERED FACILITIES

a) PV Modules

b) Mounting/Racking System
c) DC combiners
d) DC raceways
e) PV output connectors
f) DC disconnects
g) Inverters
h) AC raceways
i) AC disconnects
j) Data Acquisitions System Service and monitoring
k) Medium-Voltage Customer Facilities (per As-built drawings)
    - Transformers
    - Goab
    - Recloser
    - Grounding transformers

2.3 GENERAL REQUIREMENTS

2.3.1 Operator shall perform all Services in a safe and professional manner and comply with all applicable federal and state safety regulations, including any jurisdiction having such authority guidelines.

2.3.2 All of Operator's service personnel shall be properly trained, qualified, and certified by the Operator or any jurisdiction having authority over such certification.

2.3.3 Operator's employees shall, at all times, be under the direct control of a supervisor whose responsibility it is to ensure that their employees perform all duties in accordance with the standards set forth in this Agreement.

2.3.4 Operator shall maintain all applicable licenses, permits, and/or other federal, state, and local approvals for providing Services, including any additional permits as required by any jurisdiction having authority. Any and all fees for any of the above shall be the sole responsibility of the Operator.

2.3.5 Services that will be sub-contracted to third-party Operators shall meet same level of assurance and auditing requirements as the Operator.

2.3.6 When equipment installations and/or repairs require inspections by authorities having jurisdiction over such installations and/or repairs, Operator shall coordinate and ensure inspections have been performed.

2.3.7 Operator shall perform all the Services in such a manner so as to not unreasonably interfere with Customer's facility business operations at the Facility(s).

2.3.8 Operator service vehicles shall not block drive lanes, truck docks, fire lanes, or entrances or exits.

2.3.9 Operator shall be responsible for determining the specific techniques for providing the Services, including any storage, transportation, and disposal of wastes.

2.3.10 It is the responsibility of the Operator to ensure that all debris and materials generated in connection with this Agreement are collected, transported, and disposed of in accordance with all applicable federal, state, and local laws.

2.3.11 Operator shall not store extra parts or tools at the Facility.

2.3.12 Operator shall provide full warranty coverage for all work performed. The warranty shall include all parts, labor, and return travel. This warranty shall extend for one (1) year from the date such work was performed. It will be the Operator's financial responsibility to cover any costs related to rectifying the original Service. The costs can include Operator performed labor, trip charge and any parts provided to complete the work. If the Facility Owner determines that a warranty claim is necessary, Facility Owner shall send written notice to Operator regarding such warranty claim and describing the defective work, equipment or materials that are the subject of such claim. Facility Owner shall send written notice to Operator within fifteen (15) days of Facility Owner's discovery of the condition giving rise to such claim; provided, however, failure to provide such written notice during such period shall not prevent Owner from making any warranty claim during the warranty period described in this paragraph.

2.3.13 Operator will provide all service-related documentation to Facility Owner upon request. Documentation will include labor reports, parts, part pricing, service tickets/logs, and photographs, as applicable, that Facility Owner deems as necessary for management of the service contract.

2.3.14 Operator will maintain all service records for a minimum of one (1) year after termination of this Agreement, or longer as may be required by applicable federal, state, and local laws or regulations.

2.3.15 Operator shall provide on a monthly basis (but only during a month in which any work is actually performed) an accurate description of all work performed, including location, time and date, equipment serviced, warranty claims, and service description.

2.4 HOURS OF SERVICE AND SCHEDULING

2.4.1 Preventive maintenance services shall be performed at a time and date mutually agreeable to Facility Owner and Operator.

2.4.2 In the event that the Operator is engaged by Facility Owner to perform any corrective maintenance work or emergency maintenance work, which is considered work outside of the Services, Operator shall be able to perform these services three hundred sixty-five (365) days a year and be able to perform before and after-hours service, if this is requested by Facility Owner. This includes evenings, weekends and holidays for corrective maintenance work and emergency maintenance work.

2.5 SCHEDULING

2.5.1 For preventative maintenance work, Operator shall contact the Facility Owner, by phone or e-mail, a minimum of five (5) Business Days prior to the start of such Services. If contact was made prior to five (5) Business Days, Operator shall confirm the schedule with Facility Owner a minimum of two (2) days prior to the start of such Services.

2.5.2 In the event that Operator is engaged by Facility Owner to perform any corrective maintenance work or emergency maintenance work, which is considered work outside of the Services, Operator and Facility Owner will mutually agree on a time and date to perform such work outside of the Services.

3 RESPONSE TIME REQUIREMENTS

The Operator shall guarantee response times to each event level as specified below with respect to any Facility that includes a solar photovoltaic generating system.

Event Level	Event Description

"Level 1"	Any event that causes the loss of less than or equal to 250 kWp AC generating capacity at the affected System. The on-site response time is three (3) calendar days. Written approval from Owner is required for any Additional Service(s). Operator shall not incur any overtime or weekend work unless prior written approval from Owner is received. Notice of a "Level 1" breakdown will be provided to Owner within 4 hours of occurrence of event. Written approval may be in the form of an email.
"Level 2"	Any event causes the loss of greater than 250 kWp AC but less than or equal to 500 kWp AC generating capacity at the affected Facility. The on-site response time is two (2) calendar days. If repair is necessary (excluding spare parts from inventory), written approval from Owner is required. Operator shall not incur any overtime work unless prior written approval from Owner is received. Notice of a "Level 2" breakdown will be provided to Owner within 2 hours of event. Written approval may be in the form of an email; or
"Level 3"	Any event which (i) causes the loss of greater than 500 kWp AC generating capacity at the affected Facility (ii) results in any material act of theft at the affected System. The on-site response time is twenty-four (24) hours or same day if the event is prior to **1:00 PM (local time).** If repair is necessary (excluding spare parts from inventory), written approval from Owner is required. Notice of a "Level 3" breakdown will be provided to Owner within 1 hour of occurrence of event. Operator shall not incur any overtime or weekend work unless prior written approval from Owner is received. Written approval may be in the form of an email; or
"Level 4"	Any issue which: results in a fire or other significant threat of death, personal injury or **material** property damage at the Facility of the affected System, or (2) If not remedied immediately, would cause a default under any Facility agreement, or (3) A full Facility outage at the affected System; provided that such Facility has a nameplate AC capacity greater than 500 kWp AC. As soon as Operator becomes aware of any such issue, Operator shall notify Owner immediately, address the issue remotely via the SCADA for such System, if applicable, and cause an on-site response within four (4) hours. In the case that a Level 4 event occurs after 5PM (local time) at the affected Facility, the actual Operator response time shall be measured starting at 6 AM (local time) of the next calendar day. Any steps necessary to make the affected Facility safe and secure shall not require prior approval from Owner. If the affected Facility can be immediately restarted with no safety or security risk, Operator shall immediately proceed. Otherwise, prior written approval from the Owner shall be required to repair or restore the affected Facility to operation, but in no event within 30 minutes of the occurrence of such "Level4" breakdown, Operator shall notify Owner

4 MONITORING REQUIREMENTS

Operator shall perform monitoring Services for the PV Facility as set forth in Scope of Services to this Statement of Work, including:

4.1.1 **Energy Yield and PR (Performance Ratio):** Operator shall monitor energy yield, availability, and system performance ratio daily to identify discrepancies between expected and actual performance. Any underperformance shall be reported in the Monthly Report and flagged for troubleshooting.

4.1.2 **Monitoring System:** Operator shall monitor parameters including but not limited to voltage, current, irradiation, temperature, and energy output daily to identify discrepancies between expected and actual performance. Any underperformance shall be reported in the Monthly Report and flagged for troubleshooting.

4.1.3 **Alerts:** Operator shall continuously monitor the PV Facility for system alerts, communication errors, and outages. Operator shall utilize active alert notifications when any of the following events are observed:

a) A loss of capacity equivalent to one (1) inverter.
b) A loss of telemetry and/or communications.
c) Site or PV Facility Outage.

APPENDIX A. FACILITY DRAWINGS (AS-BUILT)

[Reserved for As-Built Drawing References]

APPENDIX B. SCOPE OF SERVICES

Below are O&M inspections and Services that should be incorporated into an O&M agreement. Manufacturer specific O&M services should be adhered to, and appropriate documentation shall be taken to uphold any Facility warranties.

Table 1 1 - Applicable to the Solar Facility and Balance of System (BOS)

#	Service Area/Item Description	Basic Frequency	Additional Services
1.0	**Environmental Health and Safety (EHS)**		
1.1	Ensure that all regulatory required policies/procedures/plans are written, certified when applicable, and maintained for the Facility as required.	Ongoing	
1.2	Operator will submit all health and safety reports to Customer, or its Affiliates governmental authorities required from the Operator as it pertains to the asset(s) for which Operator provides Services.	Ongoing	
1.3	Inspect and replace as necessary signs and labels in accordance with regulatory requirements.	Ongoing	Replace signage
1.4	Allow Customer or Customer's representative to access Facility and Facility personnel to perform EHS auditing on a periodic basis. Customer and/or its representative shall follow the System's safety procedures, including use of appropriate PPE.	Ongoing	
1.5	All safety, environmental and emergency response equipment must be maintained by Operator throughout the Term. This includes but is not limited to fire extinguishers, spill kits, PPE, eyewash & shower stations, etc. Response equipment not on-site at handover to Operator may be provided as an Additional Service. Re- charging or re-stocking of emergency response equipment used in response to an emergency event will be billed as an Additional Service.	Ongoing	
2.0	**System Monitoring, Alarm Response & System Analysis**		
2.1	Owner to supply Operator with administrative rights to Owner's Data Acquisition System. Included in pricing is an allowance of four hours per project for onboarding and set-up of Owner's DAS. Additional hours, if required, shall be billed at the Project Management Rate.	Ongoing	As noted
2.2	Active monitoring 24 hours per day, 365 days per year	Ongoing	
2.3	Alarm Notification	Ongoing	
2.4	Remote Corrective Diagnostics	Ongoing	
2.5	Remote Power Plant Operation when available	Ongoing	

2.6	Dispatch to technicians for Corrective Actions. Dispatch times and details as per Contract Documents	Ongoing	
2.7	Communications with Utility or Customer	Ongoing	
2.8	Remote system analysis	Ongoing	
3.0	**Operation Reporting**		
3.1	Owner will be provided with remote web access to Operator's CMMS to view all testing, inspection and preventative maintenance performed, all Facility equipment details, all service reports, and performance data	Ongoing	
3.2	Work Order Reports – A detailed report that includes time, date, technician, work performed and photos.	Ongoing	
3.3	**Monthly Reporting** Executive summary, Environmental issues, Safety Issues, Work Order Summary, and a Production Table that includes YTD Actual to Forecast and Actual to Weather Adjusted.	Monthly	
3.4	**Quarterly Reporting** Environmental issues, Safety Issues, Work Order Summary, and a Production Table that includes YTD Actual to Forecast and Actual to Weather-Adjusted. Detail all System Services performed, and all services and claims under any warranties (including replacement of any Equipment associated therewith), conducted during the prior calendar months of such quarter, including without limitation all major maintenance (whether planned or unplanned), material interactions with any landowner or Governmental Authority. Outlines all significant issues (including any environmental or safety issues) about which Operator is aware and which relate to the operation or maintenance of the System, including, without limitation, prospective claims under any of the warranties, information issues regarding safety issues, environmental and permit issues (including any notices of violation), and any material operating problems, in each case to be accompanied by action plans to address such issues.	Quarterly	
3.5	**Annual Reporting** Environmental issues, Safety Issues, Work Order Summary, and a Production Table that includes Actual to Forecast and Actual to Weather-Adjusted. Digital checklist of all items detailed in the Scope of Work below, including photos, pass/fail, when fail, a	Annually	

	description of the issue and if it was, or was not, repaired while on site and a summary of corrective actions required after the inspection with detailed pricing to make recommended repairs.		
3.6	**Record Keeping** Perform comprehensive record keeping of all relevant System documentation provided by customer and generated by Operator including, but not limited to, as- built drawings, equipment specifications, safety manuals, detailed maintenance and repair logs, preventative maintenance logs, Owner Inventory, and equipment operating manuals.	Ongoing	
4.0	**PV Modules**		
4.1	**Aerial Thermal Imaging:** Perform, or cause to be performed, aerial infrared (“IR”) thermal imaging of the System to identify sub-module, module, and string-level performance deficiencies. Operator shall evaluate the IR imaging results and provide a detailed report with its findings including, but not limited to, a site plan displaying faults/issues and a summary of the faults/issues found, their location, and loss impact of non-compliant equipment. Corrective action to remediate deficiencies found during the imaging audit will be subject to Customer’s approval and performed by Operator as Additional Services. For systems less than 300 KWP DC, Operator will perform Open Circuit String Level Voltage testing in lieu of Aerial Thermal Imaging.	Annually	Corrective Actions
4.2	**Module Inspection, Front** Front Inspect front of modules for broken glass, delamination, yellowing or browning, burnt or oxidized cell, or cracks in cells.	Annually	
4.3	**Module Inspection, Frame** Frame Inspect module frames for damage or misalignment	Annually	
4.4	**Module Inspection, Back** Module Inspection, Back Inspect back of modules for delamination or burnt marks. For roof-top systems, underside of module inspection will occur on modules that are readily accessible, such as the end of each row, or where it is apparent there is or very well could be an issue. If disassembly is required to perform back module inspection then this	Annually	

	section is excluded or will be an Additional System Service.		
4.5	**Module Inspection, J-Box** Module Inspection, J-Box Inspect junction boxes for loose attachment, evidence of overheating and corrosion	Annually	
4.6	**Module Inspection, Connector** Connector Inspect wire connectors for detachment, evidence of overheating and exposed electrical parts.	Annually	
4.7	**Module, Cleaning** Perform, or cause to be performed, cleaning of 100% of the PV modules following manufacturer's recommendations as needed and approved by Owner as an additional system service.	Additional System Service	As needed and approved by Owner
5.0	**Mounting System**		
5.1	**Mounting System, Support Structure** Visually inspect support posts and structural components for evidence of rust, corrosion, settling and tilt	Annually	
5.2	**Mounting System, Hardware** Visually inspect hardware for tightness and evidence of rust and corrosion	Annually	
5.3	**Grounding** Inspect and test rack grounding, check for torque levels, re-torque as necessary. Measure and record earth to ground resistance between rack and ground rod with low-resistance ohmmeter.	Annually	
5.4	**Tracking Systems** Perform manufacturer-recommended maintenance on single-axis trackers including, but not limited to: • Inspection for evidence of wear, moisture intrusion, loss of lubrication, or distortion/damage in all motor drive/gearbox assemblies, bushings/bearings, linkage and torque tubes, • Calibration of sensors/tracker (calibration to be paid by Customer as Additional Service), • Inspection of electronic enclosure seals for integrity, • Perform inspection and lubrication of gearboxes/slew drives	Per Manufacturer requirements and recommendations	
5.5	**Tracking Systems** Inspect tracker systems following the manufacturer's recommendations including,	Per Manufacturer requirements and recommendations	

	but not limited to, inspecting for evidence of wear, moisture intrusion, loss of lubrication, or damage in all motor drive/gearbox assemblies, bushings/bearings, linkage and torque tubes		
6.0	**DC Combiner**		
6.1	**DC Combiner, Enclosure** Inspect enclosure and devices for corrosion, moisture entry, insect and rodent infestation, and exterior damage. Confirm that all signage and labeling are in place.	Annually	
6.2	**DC Combiner, SPD** Inspect Surge Protection Devices for indication of failure. If any single SPD indicates failure mode, replace all SPD modules.	Annually	Replacement of SPDs
6.3	**DC Combiner, IR** Perform thermographic survey of all terminations and over current protection devices.	Annually	
6.4	**Open Circuit Voltage Testing of All Connected Strings** Verify balance of expected voltage inputs of all strings in combiner box or string inverter wiring.	Annually	
7.0	**DC Raceway**		
7.1	**DC Raceway** Inspect all DC raceways for loose connections, missing sealant, corrosion and above-grade intrusions.	Annually	
8.0	**PV Output Connector**		
8.1	**PV Output Connector, Insulation** Inspect exposed insulation jacket for physical damage and evidence of overheating.	Annually	
8.2	**PV Output Connector, Compression Connector** Inspect compression-applied connectors for correct cable match and indentation.	Annually	
8.3	**PV Output Conductor, IR** Perform thermographic survey of all terminations and overcurrent protective devices not covered elsewhere in scope.	Annually	
9.0	**DC Disconnect**		
9.1	**DC Disconnect, Enclosure** Inspect enclosure and devices for corrosion, heat distortion, moisture entry, insect and rodent infestation and exterior damage. Confirm that all signage and labeling are in place.	Annually	
9.2	**DC Disconnect, IR** Annual Perform thermographic survey of all terminations and overcurrent devices.	Annually	

10.0	**Inverter**		
10.1	Perform annual inverter preventative maintenance work for all inverters per manufacturer's recommendations and manufacturer's warranty requirements. *Note: Warranty maintenance requirements that must occur more frequently than annually are invoiced as Additional Services. *Note: Warranty maintenance requirements that include a material amount of repair work beyond inspection & cleaning, such as software updates, re-torquing factory components, replacement of inverter components, or in-depth electrical testing are invoiced as Additional Services.	Annually	
10.2	**Open Circuit Voltage Testing of All Connected Strings** Verify balance of expected voltage inputs of all strings in combiner box or string inverter wiring.	Annually	
10.3	**Inverter, Enclosure** Inspect enclosure, door seals, latches and door stops for signs of corrosion, heat distortion, moisture entry, insect and rodent infestation, and exterior damage. Confirm that all sings and labeling are in place.	Annually	
10.4	**Inverter, Cleaning** Clean all ventilation plates, air ducts, screens, devices and seals in accordance with manufacturer's recommendations. Replace filters as necessary.	Annually	Filters
10.5	**Inverter, SPD** Inspect Sure Protection Devices for indication of failure. If any single SPD indicates failure mode, replace all SPD modules.	Annually	Replacement of SPDs
10.6	**Inverter, IR** Perform thermographic survey of all readily available terminations and overcurrent protection devices.	Annually	
11.0	**AC Raceways**		
11.1	**AC Raceways, Visual** Inspect all AC raceways for loose connections, missing sealant. Corrosion and above-grad moisture intrusion.	Annually	
12.0	**AC DISCONNECT**		
12.1	**AC Disconnect, Enclosure** Inspect enclosure and devices for corrosion, heat distortion, moisture entry, insect and	Annually	

	rodent infestation, and exterior damage. Confirm that all signage and labeling are in place.		
12.2	**AC Disconnect, IR** Perform thermographic survey of all terminations and overcurrent protection devices.	Annually	
13.0	**DATA ACQUISITION SERVICE**		
13.1	**Metering Device** Inspect meter and case for physical damage	Annually	
13.2	**Metering Device** Clean front panel	Annually	
13.3	**Metering Device** Check tightness of electrical connections	Annually	
13.4	**Metering Device** Record model number, serial number, firmware revision, software revision and rated control voltage	Annually	
13.5	**Metering Device** Verify operation of display and indicating devices	Annually	
13.6	**Metering Device** Record Passwords	Annually	
13.7	**Metering Device** Verify unit is grounded in accordance with manufacturer's instructions	Annually	
13.8	**Metering Device** Verify accuracy of meters	Annually	
13.9	**Meteorological Station, Alignment** Inspect weather station and all sensors for proper alignment. Realign sensors as required.	Annually	
13.10	**Meteorological Station, Housing** Inspect instrument housings and base supports for evidence of corrosion or damage	Annually	
13.11	**Meteorological Station, Cleaning** Clean pyranometers and irradiance sensors with isopropyl alcohol and lint-free cloth	Annually	
13.12	**Meteorological Station, Desiccant** Check desiccant of pyranometer drying cartridge and replace if necessary	Annually	
14.0	**MEDIUM-VOLTAGE TRANSFORMERS, SWITCHGEAR AND PROTECTION DEVICES – EXCLUSIVE TO FRONT OF THE METER INSTALLATIONS ONLY, WHERE MV GEAR IS SPECIFIC TO THE PROJECT.**		
14.1	**Transformer, Enclosure** Inspect enclosure and devices for corrosion, heat distortion, moisture entry, insect and rodent infestation, and exterior damage.	Annually	
14.2	**Transformer, Signage** Confirm that all signage and labeling are in place	Annually	

14.3	**Transformer, Anchorage** Inspect structural mounting pad, anchorage and alignment	Annually	
14.4	**Transformer, Bushings** Inspect bushings	Annually	
14.5	**Transformer, IR** Perform thermographic survey of all field terminations visually available from the opening of the cabinet	Annually	
14.6	**Transformer, Tap-changer.** Verify tap-changer position is set as specified		Additional System Service
14.7	**Transformer, Measurements** Check and record high-temperature pressure and fluid level		Additional System Service
14.8	**Transformer, Fluid and Gas Analysis** Test dissolved gases of oil, water content, color number, interfacial tension, neutralization number, power factor @ ROTC○C, relative density/specific gravity, furanic compounds in oil and inhibitor content.		Additional System Service
14.9	**Switchgear and Protection Devices, Enclosure** Inspect enclosure and devices for corrosion, heat distortion, moisture entry, insect and rodent infestation, and exterior damage.	Annually	
14.10	**Switchgear and Protection Devices, Signage** Confirm that all signage and labeling are in place	Annually	
14.11	**Switchgear and Protection Devices, Device** Record model number, serial number, firmware revision, software revision and rated control voltage	Annually	
14.12	**Switchgear and Protection Devices, Battery**	Annually	
14.13	**Switchgear and Protection Devices, Data** Download current data logs	Annually	
15.0	**WARRANTY ADMINISTRATION**		
15.1	Support the Owner in its management, supervision and verification of all Operators, Manufacturer and OEM warranties on the equipment installed. *Office Administration included in Basic System Services. Field support as additional System Service.	Ongoing*	Ongoing*
15.2	Manage and supervise all repairs and replacement of all equipment. *Office Administration included in Basic System Services. Field support, Packaging and Shipping an Additional System Service.	Ongoing*	Ongoing*
15.3	Inspect review and highlight areas of repair prior to end of warranty period	Annually	
16.0	**CORRECTIVE MAINTENANCE**		

16.1	Troubleshoot and Repair equipment and site conditions out of compliance as per the contract documents.		Additional System Service
17.0	**INVENTORY AND SPARE PARTS**		
17.1	Operator's technician to carry typical consumables in their vehicles at Operator's Expense and only billed to Owner as needed.	Ongoing	Additional System Service
17.2	Create a list of recommended Spare Parts (other than Consumables) to purchase, warehouse and purchase upon Owner's Approval. Administration and 10' x 10' warehouse area included in Basic System Services. Costs of Spare Parts, Shipping and Delivery to Facility to be an Additional System Service.	Ongoing	Additional System Service.
17.3	All Owner Inventory/Spare Parts to be tracked in Operator's CMMS System and detailed in Monthly Reports. Annual audits.	Ongoing	
18.0	**SITE MAINTENANCE**		
18.1	Visually inspect access and interior roads associated with System.	Annually	
18.2	Visually inspect equipment foundations of all equipment/ground interfaces for evidence of erosion.	Annually	
18.3	Visually inspect storm water management system (e.g., drainage channels, culverts, etc.) and erosion and sediment controls.	Annually	
18.4	Visually inspect fencing and security equipment.	Annually	
18.5	Visually inspect the Facility for trash each time Operator is on site. If trash is identified, remove and dispose of trash accordingly.	Quarterly or on an as requested basis	Additional System Service.
18.6	Visually inspect vegetation and weed growth per Appendix D.	Annually	Additional System Service.
18.7	**Snow plowing** Snowplow main entrance and all access roads. Shovel off medium-voltage equipment pads and main gate to ensure that access is not limited.	Annually	Additional System Service.
18.8	**Mowing and Trimming** Mow and trim all areas and equipment in the vicinity of equipment and within the fence line (if applicable) per Appendix D.	Annually	Additional System Service.

Additional Clarifications: The technician will perform a thorough inspection using the Operator's Computerized Maintenance Management System (CMMS) and will include a complete report generated through and sent to the Owner. All assets will be inspected as detailed below. Each inspection will receive a "Pass" or a "Fail" with representative pictures taken of each piece of equipment. For each asset that receives a "Fail", the report will indicate if the issue was resolved while on site, or if a return site is necessary to troubleshoot and repair. For all unresolved issues outstanding, a detailed description of the issue will be given along with a photo, and a budget to troubleshoot and repair.

If an issue is identified during a Preventative Maintenance ("PM") Inspection and it can be repaired within 15-20 minutes, that issue will be repaired during and as part of the PM Inspection. An issue identified during a PM Inspection that takes longer than 15-20 minutes to repair, requires additional parts, or requires more in-depth troubleshooting, i.e., contacting the manufacturer or pulling logs, etc., that issue requires a separate dispatch, billable at the contract rate for **Additional System Services**. There is an allowance of one-hour per megawatt of troubleshooting and repair work for the annual inspection. All time over this amount shall be billed as an Additional System Service. The Basic System Services Statement of work is as written above and does not include all manufacturer's requirements such as, but not limited to, additional requirements, five year and ten-year preventative maintenance requirements. These services can be performed as an **Additional System Service**.

APPENDIX C. OEM SPECIFC PREVENTATIVE MAINTENANCE PLAN

[Reserved for OEM detailed Preventative Maintenance Plan/Program]

APPENDIX D. VEGETATION MAINTENCE SCOPE OF WORK

1 PARTIES, PURPOSE & TERM

1.1.1 Owner seeks to contract a qualified Operations & Maintenance Contractor to maintain vegetation for safe, reliable, and compliant PV facility operations, minimizing shading, fire risk, and access impediments.

1.1.2 Term/Sites: Applies to the Facility identified in the Master Services Agreement (MSA) or Task Order(s).

2 DEFINITIONS

2.1.1 **Walkable Length**: Post-mow stubble height of 4–5 inches.

2.1.2 **Growing Season**: Unless otherwise directed by Owner, April–October at the Facility. Owner may adjust to local conditions by notice.

2.1.3 **Average Height**: Mean standing vegetation height within a defined zone (under-array, array perimeter, access roadsides), measured at ≥10 points per acre using a standard ruler/stick.

3 SCOPE OF SERVICES (INCLUDED IN PER-MOW UNIT)

The per-mow unit rate includes the following, performed safely around energized equipment:

3.1.1 **Inside the fence:** All areas, including but not limited to around equipment pads, combiner boxes, inverters, DAS components, and under modules.

3.1.2 **Mowing extent/perimeter:** Pricing assumes the mowing extent does not exceed a perimeter of 25 feet around the modules.

3.1.3 **Fence lines:** Trimmed on both sides (where accessible/applicable).

3.1.4 **Utility poles with solar equipment** (e.g., meters, reclosers): Maintain vegetation to Walkable Length with careful trimming at bases/conduits.

3.1.5 **Landfills (if applicable):** Maintain cable trays along the outside of the landfill; comply with landfill-cap restrictions and equipment load limits.

3.1.6 **Access roads:** Sides of access roads mowed and/or trimmed where applicable to preserve sight lines, storm water features, and access.

3.1.7 **Entrance gates:** Trim vegetation to ensure gates open/close fully; maintain ~3 ft clearance where feasible.

3.1.8 **Cutting debris:** Remove/disperse cuttings that obstruct gates, roads, drainage, or equipment pads.

3.1.9 **Photo documentation (before & after) for each visit:**

a) Equipment pads (all).
b) Under modules with images showing multiple rows.
c) Front of modules demonstrating grass trimmed low to minimize shading.
d) Fence line(s) and gate(s).

4 MOWING FREQUENCY & HEIGHT THRESHOLDS (PERFORMANCE STANDARD)

4.1.1 **Routine frequency**: During the Growing Season, the Operator shall proactively manage the site and schedule mowing as necessary to prevent vegetation from reaching the Maximum cap threshold defined below.

4.1.2 **Trigger thresholds:**

a) **Primary trigger:** If the average vegetation height exceeds 18 inches in any zone, Operator will submit a mowing request to Owner for approval. Alternatively, Operator can submit a mowing schedule to Owner for review and approval.

4.1.3 **Maximum cap:** Vegetation shall not exceed 24 inches at any time. If any area exceeds 24 inches, Operator shall:

a) notify Owner within 24 hours, and

b) proceed to mow accordingly once Owner has provided approval.

4.1.4 **Finish height**: After each mow, treated areas shall be left at 4–5 inches (Walkable Length), recognizing terrain/equipment limits.

4.1.5 **Non-growing season (Nov–Mar):** Monitor at least monthly; mow only if average height > 24 inches or at Owner's request.

4.1.6 **Spot/emergency trims:** Perform interim trims where vegetation threatens equipment clearances, signage visibility, stormwater features, fire lanes, or causes panel-front shading.

5 HERBICIDE PRACTICES (DOCUMENTED & COMPLIANT)

The Operator shall use an Integrated Vegetation Management (IVM) approach prioritizing mechanical methods, with targeted chemical treatments only where necessary.

5.1 Authorization & Product Controls

5.1.1 Owner pre-approval required for any herbicide use (active ingredients, products, and treatment areas).

5.1.2 **Regulatory status:** Use only EPA-registered (U.S.) or PMRA-registered (Canada) products labeled for commercial/industrial or utility Facilities; comply with all federal, state/provincial, and local regulations.

5.1.3 **Licensing:** Applications must be performed by properly licensed/certified applicators for the jurisdiction.

5.1.4 **Restrictions:** No Restricted Use Pesticides without Owner's prior written approval. No broadcast spraying under arrays unless expressly approved by Owner in writing.

5.2 Application Standards

5.1.5 **Targeted use:** Limit to spot treatments (e.g., fence lines, equipment pads, pole bases, invasive patches) unless Owner authorizes broader treatment.

5.1.6 **Weather & drift:** Do not apply during sustained winds > 10 mph, temperature inversions, or when precipitation is forecasted within the herbicide's label rainfast period.

5.1.7 **Buffers:** Adhere to label-mandated setbacks from waterways, drains/culverts, pollinator plots, sensitive habitats, and mapped underground routes.

5.1.8 **Signage and re-entry:** Post notices and observe REI (re-entry interval) per label.

6 DOCUMENTATION (DELIVERABLE)

Within 3 business days of any application, submit an Herbicide Application Record including: date/time; location map; product/active ingredient & EPA/PMRA Reg. No.; target species; mix rate & total volume; applicator name & license number; equipment/calibration method; weather (temp, wind, precipitation forecast); signage/REI details; photo(s); and current SDS + product label.

7 EPC RESPONSIBILE FOR FIRST-YEAR VEGETATION ESTABLISHMENT

7.1.1 **Responsibility period:** The Engineering, Procurement, and Construction contractor will retain full responsibility for vegetation establishment from Substantial Completion through the first full growing season or 12 months, whichever is longer, until written acceptance by Owner. At this point, the Facility's vegetation management will be the sole responsibility of the Operation and Management Contractor.

7.1.2 **Obligations:** Soil stabilization/erosion control; initial/follow-up seeding using Owner-approved mixes; watering/irrigation as needed; invasive/noxious weed suppression; establishment mowing and/or selective herbicide; repair of settlement/rills/washouts; reseeding.

7.1.3 **Performance criteria for Owner acceptance:**

a) $\geq$ 90% vegetative cover in maintained areas (roads/pads excluded).

b) $\leq$ 5% bare soil in maintained areas.

c) Invasive/noxious species $\leq$ 5% real coverage, with an active control plan.

d) Vegetation height at EPC to Operator handoff average $\leq$ Trigger Threshold and no zones > Maximum Cap.

e) Stable soils (no active erosion compromising infrastructure or stormwater compliance).

7.1.4 **Turnover package (EPC - Operator):** As-built seeding plan and mixes; application dates/rates; herbicide logs; watering logs; erosion-control inspections; photo record; establishment/warranty terms.

7.1.5 **Handoff**: Upon Owner's written Vegetation Establishment Acceptance, routine vegetation O&M transitions to the Operator per this SOW. Prior to acceptance, Owner may request limited Operator support on T&M, with cost recovery from the Operator per Owner–Operator contract.

8 SCHEDULING, ACCESS & COORDINATION

8.1.1 Provide ≥72-hour notice prior to each service visit; coordinate access and energized-work boundaries with Owner/Operator.

8.1.2 Comply with Facility orientation, LOTO, badging, and traffic plans.

8.1.3 Use low-profile equipment under arrays; avoid contact with modules, cabling, and racking; protect underground/overhead utilities.

9 QUALITY ASSURANCE, MEASUREMENT & REPORTING

9.1.1 **Height sampling log:** Record ≥10 points/acre per zone (under-array, perimeter, roadsides) pre- and post-service; submit with visit report to Owner for review and acceptance.

9.1.2 **Photo set:** Submit required "before/after" photos within 2 business days of each visit.

9.1.3 **Monthly summary:** Acres treated, services performed, variances, corrective actions, upcoming triggers, and any observed safety or environmental issues.

9.1.4 **Herbicide records:** Per Record and Reporting section 5.

9.1.5 **JHA/Job Brief:** Maintain daily and provide on request.

10 HEALTH, SAFETY & ENVIRONMENTAL (HSE)

10.1.1 Comply with all applicable federal, state/provincial, and local HSE laws and the Owner's Facility-specific HSE Plan, SWPPP, and SPCC (as applicable).

10.1.2 Maintain spill kits; handle/contain fuel, oils, and chemicals per Facility procedures.

10.1.3 Report incidents, near-misses, property damage, or environmental releases to Owner within 24 hours.

11 CHANGE CONDITIONS & EXTRA WORK (WHEN ADDITIONAL CHARGES APPLY)

11.1.1 Additional charges require prior written authorization (email acceptable). Triggers include:

a) Vegetation exceeds Trigger Threshold and requires more than two passes.
b) Work outside the included 25 ft perimeter or outside defined maintenance zones.
c) Clearing brush/woody species, tree work, or invasive-stand remediation
d) Slopes steeper than 3:1, saturated/soft ground, or obstructions requiring specialty equipment
e) Owner-directed frequency changes, emergency mobilizations, or scope additions
f) Operator shall provide a not-to-exceed (NTE) quote; Owner may approve, defer, or modify scope.

12 PERFORMANCE KPIS

12.1.1 **Height control:** No zone remains > Maximum Cap for more than 5 consecutive days in the Growing Season.

12.1.2 **Shading control:** Vegetation observed shading module fronts at sample points **≤ 1%** during daylight inspections.

12.1.3 **Reporting timeliness:** 100% of required photo sets, height logs, and herbicide records submitted within stated deadlines.

12.1.4 **Corrective actions:** Close identified deficiencies within 10 business days, unless otherwise agreed.

13 MEASUREMENT & PAYMENT

13.1.1 **Unit of measure**: Per-mow visit per Site/acreage or per Task Order.

13.1.2 **Invoicing:** Monthly, including visit dates, zones/acreage treated, before/after photos, height logs, and any approved Change Orders.

14 OWNER-FURNISHED INFORMATION

14.1.1 Owner will provide:

a) site maps with maintenance zones
b) no-mow/no-spray areas;
c) drainage and sensitive habitat features
d) underground routes/as-built drawings
e) approved seed mixes (reference)
f) landfill-cap rules (if applicable)

APPENDIX E. FEES

[Reserved for Scope of work Fee Breakdown]

EXHIBIT S: TRANSPORTATION ACCESS PLAN

Kimley»Horn

MEMORANDUM

To:	Zachary Farkes N Duncan Road Solar, LLC c/o ReWild Renewables, LLC
From:	Dan Marshall, P.E. Kimley-Horn and Associates, Inc.
Date:	March 25th, 2025
Re:	***N Duncan Road Solar, LLC – Transportation Access Plan*** ***Intersection of North Duncan Road and West Ford Harris Road, Champaign County, IL***

Introduction

Kimley-Horn and Associates, Inc (Kimley-Horn) serves as the engineering consultant for N Duncan Road Solar, LLC c/o ReWild Renewables, LLC. It is our understanding that N Duncan Road Solar, LLC is submitting for a Special Use Permit to construct a 5 MWac Solar Farm. The proposed Solar Farm is located on parcel 12-14-28-201-002, southwest of the intersection of North Duncan Road and West Ford Harris Road.

This memorandum provides information on the proposed Construction and Operations Access, as well as anticipated traffic and routes based on the project location and projects of similar size.

Pre-Development

The proposed project site is agricultural land with row crops. The site is bound north by agricultural farmland, west and south by agricultural farmland and U.S. Highway 74, and east by North Duncan Road. The site has proposed access off North Duncan Road.

See attached **Road Jurisdiction Map** for project location.

Construction

At the time of this memorandum, it is anticipated that site access during construction will be located off North Duncan Road to the east of the development. Prior to the beginning of construction, a temporary stabilized construction entrance consisting of 2” to 3” rock/stone at a minimum of 6 inches thick, 14’ wide, and 70’ long will be installed to provide a stable entrance for construction traffic at the proposed entrance location. Permits will be acquired from applicable jurisdictions prior to construction.

Based on similar commercial solar energy facilities of this size, it is estimated that approximately 25 to 40 deliveries via WB-67 Semi-Tractor Trailers will be required during the construction phase to deliver the piles, racking, modules, inverters, and electrical equipment. It is anticipated that at the peak of construction approximately 20 to 30 construction workers will be needed. Construction Phase of the Solar Farm is projected to be completed within 6 months. Equipment deliveries will typically occur during months 2 through 4 of the construction phase and taper off dramatically by the end of the 4th month. The peak for construction workers on site will occur around month 4 and will taper off by the end of the 5th month.

Based on the project location, we anticipate delivery trucks will access the site from Interstate 57 (state highway), west to W Olympian Drive (municipality road), and north to North Duncan Road (township road).

Kimley-Horn has preliminarily evaluated the roads surrounding the Project site and believe this route is the most likely to be used to access the property for material shipments and construction vehicles throughout the construction phase. While the anticipated route to the Project has been presented in the attached **Road Jurisdiction Map**, additional transportation routes may be utilized during construction. All routes of transportation used to get to the Project site will undergo required permitting to ensure that the Project remains in compliance with all local road authorities.

Post-Development/Operations

After construction is complete, the site will be accessed via the same entrance location that was utilized during construction. Gravel access roads will be utilized to access the interior of the site for operations and maintenance. Once the site is fully operational, it is anticipated that no more than 4 vehicles will visit the site on a quarterly basis for routine maintenance.

Attachments

- Road Jurisdiction Map

GRAPHIC SCALE IN FEET
0 500 1000 2000

NORTH

LEGEND

- STATE
- MUNICIPALITY
- TOWNSHIP
- PROJECT LOCATION
- SITE ACCESS

NOTES

1. THE ROUTE SHOWN IS THE ANTICIPATED DELIVERY TRUCK AND PERSONAL VEHICLE ROUTE FOR CONSTRUCTION AND OPERATION OF THE PROJECT. ALTERNATE OPTIONS MAY BE UTILIZED UNDER AGREEMENT WITH ROAD JURISDICTION OFFICIALS.
2. STATE, MUNICIPALITY, AND TOWNSHIP ROAD JURISDICTIONS PER ILLINOIS ROADWAY ANALYSIS DATABASE SYSTEM, ACCESSED ON 02/12/2025.

ROAD JUSRISDICTION INFORMATION

ROAD NAME	JURISDICTION LEVEL	JURISDICTION (AHJ)	CONTACT	CONTACT PHONE NUMBER
U.S. INTERSTATE 57	STATE	IDOT	IDOT DISTRICT 5 KENSIL GARNETT	(217) 465-4181
W OLYMPIAN DRIVE	MUNICIPALITY	CITY OF CHAMPAIGN	ASSISTANT CITY ENGINEER FOR TRANSPORTATION CHRIS SOKOLOWSKI	(217) 403-4700
N DUNCAN ROAD	TOWNSHIP	HENSLEY TOWNSHIP	HENSLEY TOWNSHIP ROAD COMMISSIONER ROBERT SHERMAN	(217) 600-3686

No. | REVISIONS | DATE

Rewild

Kimley»Horn

111 JACKSON BLVD STE 1320
CHICAGO, IL 60604
WWW.KIMLEY-HORN.COM

PRELIMINARY NOT FOR CONSTRUCTION

KHA PROJECT 268779005
DATE 03/25/2025
SCALE AS SHOWN
DESIGNED BY AT
DRAWN BY GG
CHECKED BY DM

ROAD JURISDICTION MAP

N DUNCAN ROAD SOLAR, LLC
CHAMPAIGN COUNTY, IL

SHEET NUMBER
EX-1

Call Before You Dig
JULIE
1-800-892-0123

EXHIBIT T: GLARE STUDY

Kimley»Horn

10/20/2025

N Duncan Road Solar

Re: N Duncan Road Solar Glare Analysis Executive Memo

4637 Chabot Drive
Suite 350
Pleasanton, California
94588

Dear Zachary Farkes,

Introduction

Kimley-Horn recently completed a preliminary glare analysis for the N Duncan Road Solar development in Champaign, Illinois. Our objective was to identify any potential hazardous glare that could impact three roads along the frontage and the nearby interstate and homes situated in a one-mile radius of the proposed solar project. The project is located in flatlands, therefore most homes have clear line of site to the project. There are two areas of existing trees, but not dense enough to offer glare mitigation, both were omitted from the model.

Methodology

Kimley Horn utilized the ForgeSolar Glare Gauge software tool to perform the glare analysis. If any receptor showed signs of glare, the tool calculated the retinal irradiance (brightness) and subtended angle (size divided by distance) of the glare source. By considering retinal irradiance and subtended angle, the analysis could predict ocular hazards ranging from low potential for temporary after-image to retinal burn. Based on the predicted retinal irradiance (intensity) and the subtended angle (size/distance) of the glare source to the receptor, the software categories glare into three levels shown by colors. The three glare levels are: "green" grade indicating a low potential for temporary after-image, "yellow" grade indicating the potential for temporary after-image, and "red" grade indicating the potential for retinal damage. For comparison, viewing the unfiltered sun is in the upper region of yellow glare near the red border, while solar panel glare tends to be on the border of green and yellow, approximately three orders of magnitude less than direct viewing of the sun. The three levels of glare were determined in “Ho, 2011”.

Glare Analysis Results

The panel specifications were single-axis rotation 60-degree, 10-foot tall from existing grade, anti-reflective coating, and 180-degree orientation. There were 13 homes modeled at a height of 16-foot to simulate a second story viewpoint, unobstructed at 360-degrees. This is overly conservative as it does not consider existing terrain, or man-made objects that could block potential glare produced from the proposed site, and assumes the viewer can see all around, versus just a single window. The only obstructions added to the model were (i) the existing tree line on the subject property and (ii) planting as proposed in the landscaping plan dated 10/16/2025. Please see Appendix A for more information.

The analysis anticipates no glare on nearby observation or roadway receptors. Please see Appendix A for detailed parameters for panels, roadways, and homes.

Recommendations

To replicate the results, the model inputs shown in Appendix A should be replicated. Any changes to the panels that differ from model could result in different results than those shown in this memo.

Sincerely,

KIMLEY-HORN

Kimley»Horn

APPENDIX A
ForgeSolar Glare Analysis Report

FORGESOLAR GLARE ANALYSIS

Project: **ReWild Glare Analyses (Ford Harris and Duncan)**
Site configuration: **N Duncan Rd**

Created 03 Mar, 2025
Updated 20 Oct, 2025
Time-step 1 minute
Timezone offset UTC-6
Minimum sun altitude 0.0 deg
DNI peaks at 1,000.0 W/m^2
Category 5 MW to 10 MW
Site ID 142928.24178

Ocular transmission coefficient 0.5
Pupil diameter 0.002 m
Eye focal length 0.017 m
Sun subtended angle 9.3 mrad
PV analysis methodology V2

Summary of Results No glare predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
PV array 1	SA tracking	SA tracking	0	0.0	0	0.0	-

Total glare received by each receptor; may include duplicate times of glare from multiple reflective surfaces.

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
County Road 900 E	0	0.0	0	0.0
Highway 74	0	0.0	0	0.0
W Ford Harris Road	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 13	0	0.0	0	0.0

Component Data

PV Arrays

Name: PV array 1
Axis tracking: Single-axis rotation
Backtracking: Shade-slope
Tracking axis orientation: 180.0°
Max tracking angle: 60.0°
Resting angle: 0.0°
Ground Coverage Ratio: 0.5
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

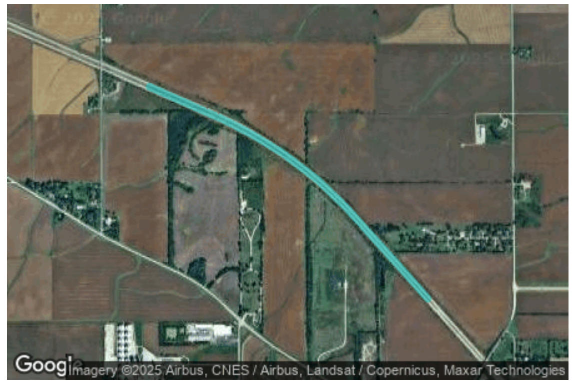
Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	40.171237	-88.310153	843.95	10.00	853.95
2	40.168949	-88.310153	828.73	10.00	838.73
3	40.167769	-88.308152	833.27	10.00	843.27
4	40.167768	-88.301063	830.99	10.00	840.99
5	40.168173	-88.301074	829.55	10.00	839.55
6	40.170156	-88.306018	833.52	10.00	843.52
7	40.171246	-88.309060	849.10	10.00	859.10

Route Receptors

Name: County Road 900 E
Path type: Two-way
Azimuthal view angle: 50.0°
Downward view angle: 0.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	40.175591	-88.296178	799.03	5.00	804.03
2	40.165458	-88.296071	810.92	5.00	815.92

Name: Highway 74
Path type: Two-way
Azimuthal view angle: 50.0°
Downward view angle: 0.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	40.172733	-88.321172	793.02	5.00	798.02
2	40.170987	-88.316011	811.33	5.00	816.33
3	40.170274	-88.314198	817.97	5.00	822.97
4	40.169276	-88.312054	823.07	5.00	828.07
5	40.167899	-88.309662	827.88	5.00	832.88
6	40.166428	-88.307661	828.59	5.00	833.59
7	40.164882	-88.305837	823.57	5.00	828.57
8	40.163357	-88.304013	818.53	5.00	823.53
9	40.161645	-88.302030	822.22	5.00	827.22

Name: W Ford Harris Road
Path type: Two-way
Azimuthal view angle: 50.0°
Downward view angle: 0.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	40.169672	-88.299509	823.03	5.00	828.03
2	40.169676	-88.298822	819.27	5.00	824.27
3	40.169717	-88.298726	818.57	5.00	823.57
4	40.169803	-88.298672	818.18	5.00	823.18
5	40.171176	-88.298710	810.60	5.00	815.60
6	40.171246	-88.298688	810.55	5.00	815.55
7	40.171291	-88.298592	810.02	5.00	815.02
8	40.171303	-88.298468	809.42	5.00	814.42
9	40.171287	-88.296147	802.98	5.00	807.98

Discrete Observation Point Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (ft)	Height (ft)
OP 1	1	40.164886	-88.303093	828.76	16.00
OP 2	2	40.165205	-88.302025	838.32	16.00
OP 3	3	40.165041	-88.300198	824.79	16.00
OP 4	4	40.165096	-88.299726	818.79	16.00
OP 5	5	40.165109	-88.299018	816.06	16.00
OP 6	6	40.165105	-88.298004	813.55	16.00
OP 7	7	40.165084	-88.297044	813.44	16.00
OP 8	8	40.165105	-88.296443	811.76	16.00
OP 9	9	40.170586	-88.297018	806.58	16.00
OP 10	10	40.174532	-88.295711	804.25	16.00
OP 11	11	40.177730	-88.324045	809.88	16.00
OP 12	12	40.172645	-88.324117	788.15	16.00
OP 13	13	40.165704	-88.323583	769.35	16.00

Obstruction Components

Name: Proposed Vegetation
Top height: 8.0 ft

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)
1	40.168924	-88.310250	827.77
2	40.167702	-88.308180	833.23
3	40.167711	-88.301056	830.89

Glare Analysis Results

Summary of Results No glare predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
PV array 1	SA tracking	SA tracking	0	0.0	0	0.0	-

Total glare received by each receptor; may include duplicate times of glare from multiple reflective surfaces.

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
County Road 900 E	0	0.0	0	0.0
Highway 74	0	0.0	0	0.0
W Ford Harris Road	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0

PV: PV array 1 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
County Road 900 E	0	0.0	0	0.0
Highway 74	0	0.0	0	0.0
W Ford Harris Road	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0

PV array 1 and Route: County Road 900 E

No glare found

PV array 1 and Route: Highway 74

No glare found

PV array 1 and Route: W Ford Harris Road

No glare found

PV array 1 and OP 1

No glare found

PV array 1 and OP 2

No glare found

PV array 1 and OP 3

No glare found

PV array 1 and OP 4

No glare found

PV array 1 and OP 5

No glare found

PV array 1 and OP 6

No glare found

PV array 1 and OP 7

No glare found

PV array 1 and OP 8

No glare found

PV array 1 and OP 9

No glare found

PV array 1 and OP 10

No glare found

PV array 1 and OP 11

No glare found

PV array 1 and OP 12

No glare found

PV array 1 and OP 13

No glare found

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
The algorithm does not rigorously represent the detailed geometry of a system; detailed features such as gaps between modules, variable height of the PV array, and support structures may impact actual glare results. However, we have validated our models against several systems, including a PV array causing glare to the air-traffic control tower at Manchester-Boston Regional Airport and several sites in Albuquerque, and the tool accurately predicted the occurrence and intensity of glare at different times and days of the year.
Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare. This primarily affects V1 analyses of path receptors.
Random number computations are utilized by various steps of the annual hazard analysis algorithm. Predicted minutes of glare can vary between runs as a result. This limitation primarily affects analyses of Observation Point receptors, including ATCTs. Note that the SGHAT/ ForgeSolar methodology has always relied on an analytical, qualitative approach to accurately determine the overall hazard (i.e. green vs. yellow) of expected glare on an annual basis.
The analysis does not automatically consider obstacles (either man-made or natural) between the observation points and the prescribed solar installation that may obstruct observed glare, such as trees, hills, buildings, etc.
The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
The variable direct normal irradiance (DNI) feature (if selected) scales the user-prescribed peak DNI using a typical clear-day irradiance profile. This profile has a lower DNI in the mornings and evenings and a maximum at solar noon. The scaling uses a clear-day irradiance profile based on a normalized time relative to sunrise, solar noon, and sunset, which are prescribed by a sun-position algorithm and the latitude and longitude obtained from Google maps. The actual DNI on any given day can be affected by cloud cover, atmospheric attenuation, and other environmental factors.
The ocular hazard predicted by the tool depends on a number of environmental, optical, and human factors, which can be uncertain. We provide input fields and typical ranges of values for these factors so that the user can vary these parameters to see if they have an impact on the results. The speed of SGHAT allows expedited sensitivity and parametric analyses.
The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
Refer to the Help page at **www.forgesolar.com/help/** for assumptions and limitations not listed here.

Default glare analysis parameters and observer eye characteristics (for reference only):

- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

EXHIBIT U: PRELIMINARY DECOMMISSIONING PLAN

Decommissioning and Site Reclamation Plan – N Duncan Road Solar, LLC

Renewable Energy Solar Project
Off North Duncan Road
Hensley Township, IL 61822
Champaign County

PIN: 12-14-28-201-002

Prepared by:
N Duncan Road Solar, LLC
c/o ReWild Renewables, LLC
PO Box 1320
Portsmouth, NH 03802

DocuSigned by:
Patrick Jackson
3E0BA96783094B9...

Signature of Applicant as required by:
§6.1.5(Q)of Champaign County Bylaws

Dated: November 7, 2025

1.0 INTRODUCTION

N Duncan Road Solar, LLC c/o ReWild Renewables, LLC (the Owner) is proposing to construct a solar photovoltaic energy project (the Project) in Champaign County, IL.

The proposed Project is located off N Duncan Road, northeast of the City of Champaign, on the southern portion of PIN: 12-14-28-201-002. The Project boundary encompasses approximately 42.9 acres within the fence on an approximately 113.7-acre parcel. The maximum nameplate generating capacity of the Project will be approximately 5.0 megawatts, alternating current $(MW)_{[AC]}$. Major components of the Project include solar modules, solar racking system, inverters and electrical equipment areas. The Project is currently considering bifacial poly-crystalline solar panels.

This Decommissioning and Site Reclamation Plan (the "Plan") provides a description of the decommissioning and restoration phase of the Project and is intended to conform to the requirements identified in Section 17 of the Standard Agricultural Impact Mitigation Agreement entered into with the Illinois Department of Agriculture as well as the Champaign County Zoning Ordinance, with specifically applicable sections provided herein (Schedules 1 and 2) at the request of the Senior Planner of the Champaign County Department of Planning and Zoning department. The Project will consist of the installation of the perimeter fencing; solar arrays and associated racking and racking foundations; inverter stations; access and internal roads; electrical equipment areas; overhead distribution lines and structures (Figure 1) and consistent with the Special Use Permit application package filed with Champaign County.

This Plan is applicable to the decommissioning/deconstruction and restoration phases of the Project. A summary of the components to be removed is provided in Section 1.1. A summary of estimated costs associated with decommissioning the Project is also provided in Section 4.0.

1.1 SOLAR FARM COMPONENTS

The main components of the Project include:

- Solar panels and racking system
- Racking Foundations
- Inverter stations
- Electrical cabling and conduits
- Site access roads
- Perimeter fencing
- Electrical equipment areas
- Overhead distribution lines and structures

1.2 EXPECTED LIFETIME OF PROJECT

If properly maintained, the expected lifetime of a large-scale solar facility is approximately 25 to 40 years with an opportunity for a project lifetime of 50 years or more with equipment replacement and repowering. Depending on market conditions and project viability, the solar arrays may be retrofitted with updated components (e.g., panels, frame, tracking system, etc.) to extend the life of the project. In the event that the modules are not retrofitted, or at the end of the Project's useful life, the panels and associated components will be decommissioned and removed from the Project site.

The value of the individual components of the solar facility will vary with time. In general, the highest component value would be expected at the time of construction with declining value over the life of the Project. Over most of the life of the Project, components such as the solar panels could be sold in the wholesale market for reuse or refurbishment. As efficiency and power production of the panels decrease due to aging and/or weathering, the resale value will decline accordingly. Secondary markets for used solar components include other large-scale solar facilities with similar designs that may require replacement equipment due to damage or normal wear over time; or other buyers (e.g., developers, consumers) that are willing to accept a slightly lower power output in return for a significantly lower price point when compared to new equipment.

Components of the solar facility that have resale value may be sold in the wholesale market. Components with no wholesale value will be salvaged and sold as scrap for recycling or disposed of at an approved offsite licensed solid waste disposal facility. Decommissioning activities will include removal of the arrays and associated components as listed in Section 1.1 and described in Section 2.

1.3 DECOMMISSIONING SEQUENCE

Decommissioning activities will begin within approximately three months of the Project ceasing operation and are anticipated to be completed 180 days. The Owner or its future affiliates or assigns will be the responsible party for implementing the decommissioning plan. Monitoring and site restoration may extend beyond this period to ensure successful revegetation and rehabilitation. The anticipated sequence of decommissioning and removal is described below; however, overlap of activities is expected.

- Reinforce access roads, if needed, and prepare site for component removal
- Install erosion control fencing and other best management practices (BMPs) to protect sensitive resources and control erosion during decommissioning activities
- De-energize solar arrays
- Dismantle panels and racking
- Remove structural foundations and backfill sites
- Remove inverter stations and foundations
- Remove electrical cables and conduits
- Remove access and internal roads and grade site (if required)
- Remove electrical equipment areas
- Remove overhead distribution lines and structures
- De-compact subsoils as needed, restore and revegetate disturbed land to pre- construction conditions to the maximum extent practicable

2.0 PROJECT COMPONENTS AND DECOMMISSIONING ACTIVITIES

The solar facility components and decommissioning activities necessary to restore the Project area, as near as practicable, to pre-construction conditions are described within this section.

2.1 OVERVIEW OF SOLAR FACILITY SYSTEM

The Project anticipates utilizing approximately 11,088 solar modules, with a total nameplate generating capacity of approximately 7.4 MW, direct current (DC) (5.0 $MW_{[AC]}$). The Project area encompasses approximately 45.7 acres and will be bounded by perimeter fencing as shown on Figure 1 (preliminary design; subject to modification). The land within the perimeter fencing is predominantly agricultural land that has been growing row crops. Statistics and estimates provided in this Plan are based on a 670-watt bifacial module although the final panel manufacturer has not been selected at the time of this report.

Foundations, steel piles, and electric cabling and conduit installed below the soil surface will be removed. Access roads may be left in place if requested and/or agreed to by the landowner; however, for purposes of this assessment, all access roads are assumed to be removed.

Estimated quantities of materials to be removed and salvaged or disposed of are included in this section. Many of the materials described have salvage value; although, there are some components that will likely have none at the time of decommissioning. Removed materials will be salvaged or recycled to the extent possible. Other waste materials will be disposed of in accordance with state and federal law in an approved licensed solid waste facility. For calculating the decommissioning costs, salvage values or re-sale values of the primary components were not factored into the calculation.

2.2 SOLAR MODULES

The Project is considering a bifacial poly-crystalline panel (670 watt) or a similar module for the Project. Each module assembly (with frame) has a total weight of approximately 84 pounds. The modules will be approximately 94 inches by 51 inches in size and are mainly comprised of non-metallic materials such as silicon, glass, composite film, plastic, and epoxies, with an anodized aluminum frame.

At the time of decommissioning, module components in working condition may be refurbished and sold in a secondary market yielding greater revenue than selling as salvage material. If not re-used or salvaged the material will be disposed of at an approved recycling facility.

2.3 RACKING SYSTEM AND SUPPORT

The solar modules will be mounted on a single axis tracker racking system, such as the one-in-portrait system manufactured Array Technologies, or similar system. Each row will vary in length as shown in Figure 1. The racking system is mainly comprised of high-strength galvanized steel and anodized aluminum; steel piles that support the system are assumed to be comprised of galvanized steel.

The solar arrays will be deactivated from the surrounding electrical system and made safe for disassembly. The steel piles will be completely removed from the ground.

The supports, racking system, and posts contain salvageable materials which can be sold to provide revenue to offset the decommissioning costs.

2.4 INVERTER STATIONS

The inverter stations generally sit on small concrete footings or piers on steel piles within the array. The inverters will be deactivated, disassembled and removed. For purposes of this report, it is assumed that piers with steel piles will be utilized. Depending on condition, the equipment may be sold for refurbishment and re-use. If not re-used, they will be salvaged, recycled, or disposed of at an approved solid waste management facility.

2.5 ELECTRICAL CABLING AND CONDUITS

The Project's underground electrical collection system will be placed at a depth of approximately three feet below the ground surface. All cabling will be removed and salvaged. Any material not re-used or salvaged will be disposed of at an approved solid waste management facility.

2.6 ELECTRICAL EQUIPMENT AREA

The Project will include one electrical equipment area, with an approximately 12-foot by 20-foot footprint. The equipment area will contain a gravel pad, concrete foundations, transformer and associated switchgear. The transformers and switchgear may be sold for re-use or salvage. Components of the electrical equipment that cannot be salvaged will be transported off-site for disposal at an approved waste management facility.

2.7 OVERHEAD DISTRIBUTION LINE

The Project will include a series of utility poles and a short overhead run to interconnect with Ameren's overhead utilities. The utility pole and overhead wires will be removed and transported off-site for disposal at an approved waste management facility.

2.8 PERIMETER FENCING AND ACCESS ROADS

The Project will include a security fence around the perimeter of the site. The fence will total approximately 6,425 feet in length. The perimeter fence will be removed and may be sold for re-use or salvage. Components of the fence that cannot be salvaged will be transported off-site for disposal at an approved waste management facility.

A gravel access drives will provide direct access to the solar facility from the public way and run to the center electrical equipment area. The site access drives will be approximately 16 feet in width and total approximately 2,900 feet in length. If required, the gravel will be removed from the site and may be sold for re-use. Material that cannot be re-used will be transported off-site for disposal.

3.0 LAND USE AND ENVIRONMENT

3.1 SOILS AND AGRICULTURAL LAND

Areas of the Project that were previously utilized for agricultural purposes will be restored to their pre-construction condition. Restored areas will be revegetated in consultation with the current landowner and in compliance with regulations in place at the time of decommissioning. Land disturbed by Project facilities will be restored in such a way to be used in a reasonably similar manner to its original intended use as it existed prior to Project construction.

3.2 RESTORATION AND REVEGETATION

Project sites that have been excavated and backfilled will be graded as previously described. Soils compacted during de-construction activities will be de-compacted, as necessary, to restore the land to pre-construction land use. Topsoil will be placed on disturbed areas and seeded with appropriate vegetation or in coordination with landowners within agricultural land. Work will be completed to comply with the conditions agreed upon by the Owner and the County's/State's permitting requirements in affect at the time of decommissioning.

3.3 SURFACE WATER DRAINAGE AND CONTROL

The proposed Project area is predominantly located on agricultural land. The terrain is relatively flat and protected by vegetated buffers. The Project facilities are being sited to avoid wetlands, waterways, and drainage ditches and tile. The existing Project site conditions and proposed BMPs to protect surface water features will be detailed in a Project Stormwater Pollution Prevention Plan (SWPPP) for the Project prior to the commencement of construction activities.

Surface water conditions at the Project site will be reassessed prior to the decommissioning phase. Construction storm water permits will also be obtained and a SWPPP prepared describing the protection needed to reflect conditions present at the time of decommissioning. BMPs may include construction entrances, temporary seeding, permanent seeding, mulching (in non-agricultural areas), erosion control matting, silt fence, filter berms, and filter socks.

3.4 MAJOR EQUIPMENT REQUIRED FOR DECOMMISSIONING

The activities involved in decommissioning the Project include removal of the above ground components of the Project and restoration as described in Sections 2 and 3.2.

Equipment required for the decommissioning activities is similar to what is needed to construct the solar facility and may include, but is not limited to: small cranes, low ground pressure (LGP) track mounted excavators, backhoes, LGP track bulldozers, LGP off-road end-dump trucks, front-end loaders, deep rippers, water trucks, disc plows and tractors to restore subgrade conditions, and ancillary equipment. Over-the-road dump trucks will be required to transport material removed from the site to disposal facilities.

4.0 DECOMMISSIONING COST ESTIMATE SUMMARY

Expenses associated with decommissioning the Project will be dependent on labor costs at the time of decommissioning. For the purposes of this report approximate 2025 average market values were used to estimate labor expenses. Fluctuation and inflation of the labor costs were not factored into the estimates.

4.1 DECOMMISSIONING EXPENSES

Project decommissioning will incur costs associated with disposal of components not sold for salvage, including materials which will be disposed of at a licensed facility, as required. For calculating the decommissioning costs, salvage values or re-sale values of the primary components were not factored into the calculation.

Decommissioning costs also include backfilling, grading and restoration of the proposed Project site as described in Section 2. The table below summarizes the estimates for activities associated with the major components of the Project.

Table of Estimated Decommissioning Expenses:

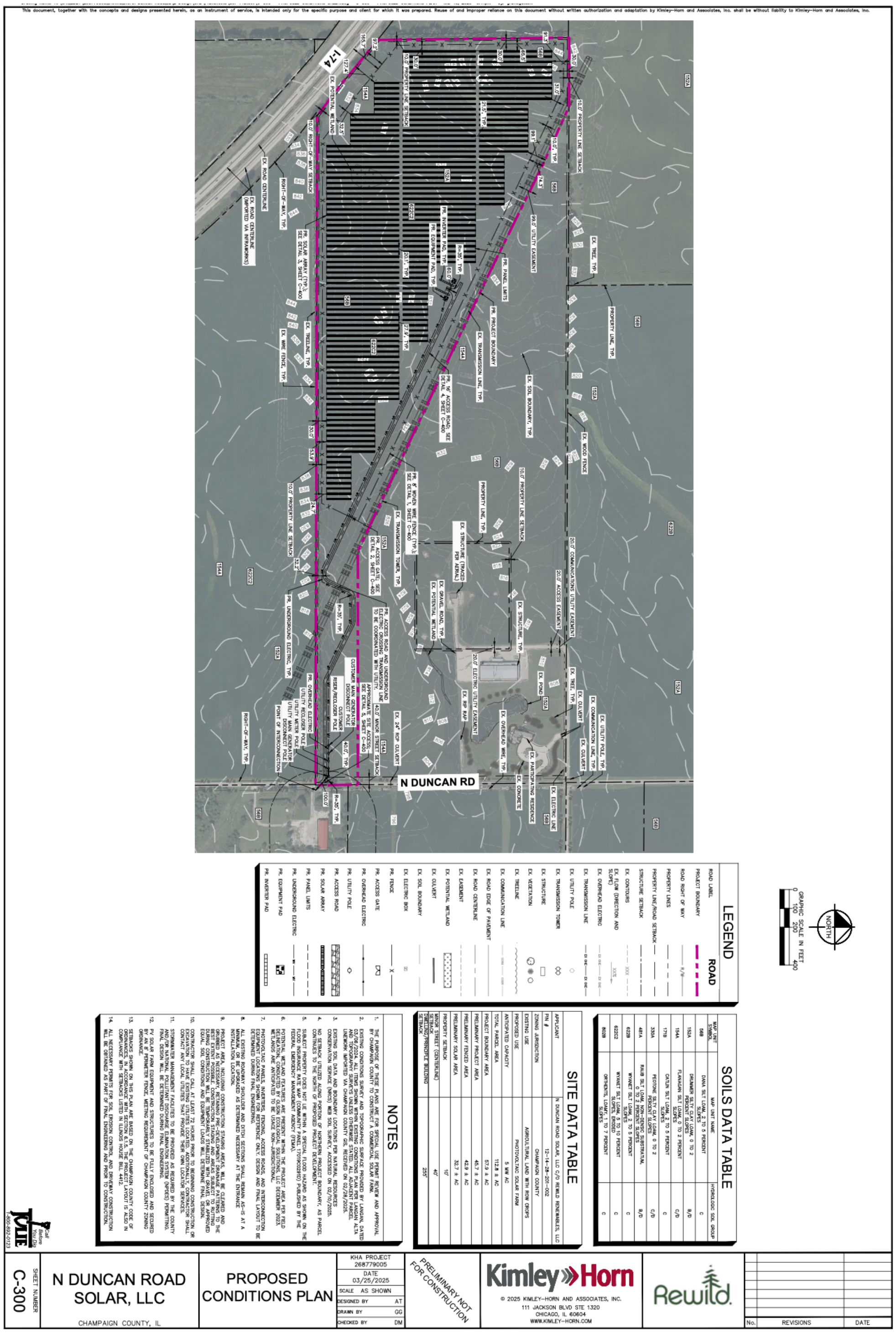
Activity	Unit	Quantity	Cost per Unit	Total Cost
Overhead and management (includes estimated permitting required)	Lump Sum	1	$80,000.00	$80,000
Solar modules; disassembly and removal	Each	11088	$5.67	$62,869
Racking System disassembly and removal	Linear Feet	19031	$3.25	$61,851
Steel pile/post removal	Each	1729	$8.95	$15,475
Remove buried cable	Linear Feet	9552	$0.40	$3,821
Inverter station removal	Each	1	$5,500.00	$5,500
Access road excavation and removal	Linear Feet	2900	$4.73	$13,717
Perimeter fence removal	Linear Feet	6425	$3.15	$20,239
Topsoil replacement for roads and rehabilitation of site	Lump Sum	10254	$2.20	$22,559
Erosion controls installation and removal	Linear Feet	7500	$2.35	$17,625
Electrical transmission structure removal (including utility poles)	Each	5	$1,000.00	$5,000
Electrical equipment area removal	Each	2	$2,500.00	$5,000
Champaign County Administrative Costs	% of Subtotal	2.50%	$7,841.37	$7,841
Total Decommissioning Cost				$321,496
Bond Amount (125% of cost)				$401,870

4.2 DECOMMISSIONING SUMMARY AND FINANCIAL ASSURANCE

The following is a summary of the summary of the net estimated cost to decommission the Project, using the information detailed in section 4.1. The total estimated decommissioning cost is $321,496. Per the requirements of the Champaign County Zoning Ordinance, the operator shall provide an irrevocable letter of credit in a form acceptable to the County to secure payment of 125% of the anticipated cost of removal of all associated site improvements and restoration of the site to its pre-development condition resulting in a total assured amount of $401,870, as shown above. The letter of credit will be funded per AIMA standards and as outlined in Section 17(D) of the AIMA.

FIGURES

Figure 1: Proposed Project Layout



Schedules

Schedule 1: Transcription of Sec. 6.1.5Q.(3) of the Champaign County Zoning Ordinance

Applicant agrees to the following stipulations and requirements:

a. A stipulation that the applicant or successor shall notify the GOVERNING BODY by certified mail of the commencement of voluntary or involuntary bankruptcy proceeding, naming the applicant as debtor, within ten days of commencement of proceeding.

b. A stipulation that the applicant shall agree that the sale, assignment in fact or law, or such other transfer of applicant's financial interest in the PV SOLAR FARM shall in no way affect or change the applicant's obligation to continue to comply with the terms of this plan. Any successor in interest, assignee, and all parties to the decommissioning and site reclamation plan shall assume the terms, covenants, and obligations of this plan and agrees to assume all reclamation liability and responsibility for the PV SOLAR FARM.

c. Authorization for the GOVERNING BODY and its authorized representatives for right of entry onto the PV SOLAR FARM premises for the purpose of inspecting the methods of reclamation or for performing actual reclamation if necessary.

d. A stipulation that at such time as decommissioning takes place the Applicant, its successors in interest, and all parties to the decommissioning and site reclamation plan are required to enter into a Roadway Use and Repair Agreement with the relevant highway authority.

e. A stipulation that the Applicant, its successors in interest, and all parties to the decommissioning and site reclamation plan shall provide evidence of any new, additional, or substitute financing or security agreement to the Zoning Administrator throughout the operating lifetime of the project.

f. A stipulation that the Applicant, its successors in interest, and all parties to the decommissioning and site reclamation plan shall be obliged to perform the work in the decommissioning and site reclamation plan before abandoning the PV SOLAR FARM or prior to ceasing production of electricity from the PV SOLAR FARM, after it has begun, other than in the ordinary course of business. This obligation shall be independent of the obligation to pay financial assurance and shall not be limited by the amount of financial assurance. The obligation to perform the reclamation work shall constitute a covenant running with the land.

g. The decommissioning and site reclamation plan shall provide for payment of any associated costs that Champaign COUNTY may incur in the event that decommissioning is actually required. Associated costs include all administrative and ancillary costs associated with drawing upon the financial assurance and performing the reclamation work and shall include but not be limited to: attorney's fees; construction management and other professional fees; and the costs of preparing requests for proposals and bidding documents required to comply with State law or Champaign COUNTY purchasing policies.

h. The depth of removal of foundation concrete below ground shall be a minimum of 54 inches. The depth of removal of foundation concrete shall be certified in writing by an Illinois Licensed Professional Engineer and the certification shall be submitted to the Zoning Administrator.

i. Underground electrical cables of a depth of 5 feet or greater may be left in place.

j. The hole resulting from the removal of foundation concrete during decommissioning shall be backfilled as follows:

(a) The excavation resulting from the removal of foundation concrete shall only be backfilled with subsoil and topsoil in similar depths and similar types as existed at the time of the original PV SOLAR FARM construction except that a lesser quality topsoil or a combination of a lesser quality topsoil and a subsoil that is similar to the native subsoil may be used at depths corresponding to the native subsoil but not less than 12 inches below grade.

(b) The native soils excavated at the time of the original PV SOLAR FARM construction may be used to backfill the concrete foundation excavations at the time of decommissioning provided that the soils are adequately stored throughout the operating lifetime of the PV SOLAR FARM. The methods for storing the excavated native soils during the operating lifetime of the PV SOLAR FARM shall be included in the decommissioning and site reclamation plan.

(c) If the excavated native soils are not stored for use for backfilling the concrete foundation excavations, a qualified soil scientist of Illinois Licensed Professional Engineer shall certify that the actual soils used to backfill the concrete foundation excavations are of equal or greater quality than the native soils or that, in the case of subsoil, the backfill soil meets the requirements of this paragraph. The certification shall be submitted to the Zoning Administrator.

(d) An Illinois Licensed Professional Engineer shall certify in writing that the concrete foundation excavations have been backfilled with soil to such a depth and with a minimum of compaction that is consistent with the restoration of productive agricultural use such that the depth of soil is expected to be no less than 54 inches within one year after backfilling.

k. A stipulation that should the decommissioning and site reclamation plan be deemed invalid by a court of competent jurisdiction the PV SOLAR FARM SPECIAL USE Permit shall be deemed void.

l. A stipulation that the Applicant's obligation to complete the decommissioning and site reclamation plan and to pay all associated costs shall be independent of the Applicant's obligation to provide financial assurance.

m. A stipulation that the liability of the Applicant's failure to complete the decommissioning and site reclamation plan or any breach of the decommissioning and site reclamation plan requirement shall not be capped by the amount of financial assurance.

n. If the Applicant desires to remove equipment or property credited to the estimated salvage value without the concurrent replacement of the property with property of equal or greater salvage value, or if the Applicant installs equipment or property increasing the cost of decommissioning after the PV SOLAR FARM begins to produce electricity, at any point, the Applicant shall first obtain the consent of the Zoning Administrator. If the Applicant's lien holders remove equipment or property credited t the salvage value, the Applicant shall promptly notify the Zoning Administrator. In either of these events, the total financial assurance shall be adjusted to reflect any change in total salvage value and total decommissioning costs resulting from any such removal or installation.

Schedule 2: Compilation of Sec. 6.1.1A.9. and Sec 6.1.5Q.(5) of the Champaign County Zoning Ordinance

Applicant agrees to the following stipulations and requirements:

The Zoning Administrator may draw on the funds to have said NON-ADAPTABLE STRUCTURE (the solar farm) removed when any of the following occur:

a. No response is received from the land owner within thirty (30) days from initial notification by the Zoning Administrator;

b. The land owner does not enter, or breaches any term of a written agreement with the COUNTY to remove said NON-ADAPTABLE STRUCTURE (the solar farm) as provided in Section 6.1.1A.8.;

c. Any breach or performance failure of any provision of the decommissioning and site reclamation plan;

d. The owner of record has filed a bankruptcy petition, or compromised the COUNTY's interest in the letter of credit in any way not specifically allowed by the decommissioning and site reclamation plan;

e. A court of law has made a finding that a NON-ADAPTABLE STRUCTURE (the solar farm) constitutes a public nuisance;

f. The owner of record has failed to replace an expiring letter of credit within the deadlines set forth in Section 6.1.1A.6. of the Zoning Ordinance; or

g. Any other conditions to which the COUNTY and the land owner mutually agree, as set forth in the decommissioning and site reclamation plan.

h. In the event that any PV SOLAR FARM or component thereof ceases to be functional for more than six consecutive months after it starts producing electricity and the Owner is not diligently repairing such PV SOLAR FARM or component

i. In the event that the Owner declares the PV SOLAR FARM or any PV SOLAR FARM component to be functionally obsolete for tax purposes.

j. There is a delay in the construction of any PV SOLAR FARM of more than 6 months after construction on that PV SOLAR FARM begins.

k. Any PV SOLAR FARM or component thereof that appears in a state of disrepair or imminent collapse and/or creates an imminent threat to the health or safety of the public or any person.

l. Any PV SOLAR FARM or component thereof that is otherwise derelict for a period of 6 months.

m. The PV SOLAR FARM is in violation of the terms of the PV SOLAR FARM SPECIAL USE Permit for a period exceeding ninety (90) days.

n. The Applicant, its successors in interest, and all parties to the decommissioning and site reclamation plan has failed to maintain financial assurance in the form and amount required by the SPECIAL USE Permit or compromised the COUNTY's interest in the decommissioning and site reclamation plan.

o. The COUNTY discovers any material misstatement of fact of misleading omission of fact made by the Applicant in the course of the SPECIAL USE Permit Zoning Case.

q. The Applicant has either failed to receive a copy of the certification of design compliance required by paragraph 6.1.5D. or failed to submit it to the COUNTY within 12 consecutive months of receiving a Zoning Use Permit regardless of the efforts of the Applicant to obtain such certification

r. The Zoning Administrator may, but is not required to, deem the PV SOLAR FARM abandoned, or the standards set forth above met, with respect to some, but not all, of the PV SOLAR FARM. In that event, the Zoning Administrator may draw upon the financial assurance to perform the reclamation work as to that portion of the PV SOLAR FARM only. Upon completion of that reclamation work, the salvage value and reclamation costs shall be recalculated as to the remaining PV SOLAR FARM

EXHIBIT V: ACP SOLAR FACT SHEET

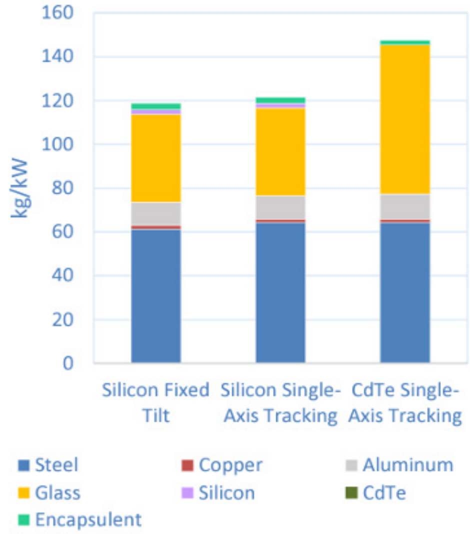
Solar Panels and Your Community

Solar energy has been growing rapidly across the United States. As facilities are proposed in more and more communities, community members have questions about what materials are included in solar photovoltaic (PV) panels, and if they pose an environmental or health risk to surrounding neighbors. The fact sheet below explores the materials in solar panels, and how utility-scale solar facilities are safe for your community.

What is inside of a solar panel?

Solar panels consist of glass, aluminum, copper, and semiconductor materials. Solar cells are made of either connected silicon atoms or thin layers of photovoltaic material that have been placed onto glass or metal and are responsible for converting energy from sunlight into electricity. The thin layer of solar cells is sealed on both sides and covered with glass and an aluminum frame. The primary solar cell technologies used are Crystalline silicon (c-Si) and thin film Cadmium telluride (CdTe). While several different solar cell technologies exist, over 90% of the U.S. solar market uses Crystalline silicon (c-Si) cells.[1]

20 MV PV Plant Component Materials by Weight (kg/kW)



Source: U.S. Department of Energy Solar Energy Technologies Office. Photovoltaics End-of-Life Action Plan. March 2022. Accessible: https://www.energy.gov/sites/default/files/2022-03/Solar-Energy-Technologies-Office-PV-End-of-Life-Action-Plan.pdf

Are the materials in solar panels safe?

Modern commercial solar panels do not contain sufficient hazardous materials to pose a danger to the environment and human health. The primary component in crystalline silicon solar cells is silicon, the second-most common element on earth and found in most consumer electronics, from cell phones to computer chips.[2,3] An assessment by the Ohio Department of Health highlighted the safety of crystalline silicone panels, concluding "Information to date does not indicate a public health burden from the use of crystalline silicone (c-Si) in solar farms...[as] crystalline silicone itself is non-toxic to humans."[4] Other components used in c-Si cells include boron and phosphorus, which are also non-hazardous to the environment and human health. While some older panels may contain trace amounts of lead used to join the c-Si cells, manufacturers are increasingly ceasing use of lead. Furthermore, the amount of lead needed to solder the cells is roughly 1/750th of the amount used in a conventional car battery or half of the amount in a single 12-gauge shotgun shell. While a large solar energy project contains hundreds of panels, the leaded portions of the panel are enclosed in nonporous, non-toxic substances like glass, preventing the lead material from escaping or leaching into the ground.[5]

Another trace element found in c-Si solar panels is cadmium, which is sometimes used in the glass frit, materials used for the electrodes to make electrical contact with the PV cell, or the solder, which is used to join cells. However, according to the North Carolina Clean Energy Technology Center, research demonstrates the amount of cadmium found in solar panels poses negligible toxicity risk to public health and safety.[6] Additionally, an assessment by the Ohio Department of Health determined that "the trace amounts of hazardous components used in solar panels...are not likely to enter the environment," as the materials are fully encapsulated by glass.[7]

Cadmium telluride (CdTe) is another trace component found in thin film solar panels; however, CdTe contains 1/100th the toxicity of free cadmium[8], has a much lower risk of being released, and is not soluble in water.[9] Additionally, researchers have found that use of cadmium telluride solar cells reduces the public's exposure to cadmium – as solar energy reduces the need for fossil fuel generation, which is a major source of cadmium exposure. For every five megawatts of solar power installed, it is estimated that 157 grams of cadmium are prevented from being released into the environment because of the reduction in traditional energy generation.[10]

Can solar panels leach chemicals or metals?

Solar panels are designed and manufactured to withstand harsh environmental conditions and extreme weather events. These hardened structures protect the solar cells from the elements and support plans to keep the facilities operating for 35+ years; therefore, the panels pose little risk of leaching during operation or during removal and disposal. In order to operate, the internal components of modules must be protected from the elements, particularly moisture, in order to prevent corrosion and the release of materials.

Furthermore, the EPA requires that solar panel modules pass toxicity characteristic leaching procedure (TCLP) testing before being disposed of in a landfill. TCLP testing assesses impacts of landfill conditions on solar panels, including leaching potential. This test is typically conducted during manufacturing to ensure the solar panels will meet the requirements of disposal at end-of-life. Testing has found that panels are durable and even capable of withstanding extreme weather events without leaching. In 2013, researchers at the University of Tokyo tested the environmental impact of CdTe panels being exposed to fires, floods, and earthquakes, and found that even under worst-case-scenario conditions, it is unlikely that the cadmium concentrations in air and sea water will exceed the environmental regulation values.

For more information on decommissioning solar facilities and disposal, please visit What Happens When a Solar Project is Decommissioned and Solar Panel Recycling and Disposal.

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[6] NC Clean Energy Technology Center. 2017. "Health and Safety Impacts of Solar Photovoltaics." NC State University. Accessed at: https://content.ces.ncsu.edu/health-and-safety-impacts-of-solar-photovoltaics

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Photovoltaics & Farmland

How Solar Power Enhances Rural Ecosystems

As more American households, businesses and utilities invest in clean energy to provide long-term price certainty, support economic development, and secure a cleaner environment, rural communities will see increased opportunities to host solar facilities. Developers often look to rural communities to find enough land to lease to construct and operate facilities of sufficient size to keep costs low, prices affordable, and to contribute to grid reliability. While tax revenue, construction jobs, and lease payments provide economic support to the community, solar facilities also present benefits to the local environment. These benefits are especially important to landowners and neighboring farmers, who rely on the long-term vitality of the land for their livelihood.

Below are important components to preserving and enhancing a healthy environment for farming, and how a solar facility may support a rural community over a generation.

Improved Soil Health

Healthy soil is vital to maintaining clean air and water, as well as ensuring productive lands for growing crops and grazing livestock.

A solar facility can passively enhance the soil through the establishment of regionally-appropriate perennial vegetation underneath and around the panels. Thus, solar facilities can improve soil quality by increasing nitrogen retention, total nitrogen, and soil organic carbon.[1] Healthy soil is obviously important to crop growth and grass growth for grazing livestock. Developers may also use vegetative buffers or prairie strips at the facility, resulting in a reduction in water, phosphorus, nitrate-nitrogen runoff, as well as soil loss.[2]

The solar industry is currently partnering with Argonne National Laboratory to further understand how site development, vegetation management, and other practices affect soil health over time, and compare to other land uses.[3]

Reduced Nutrient Runoff

Vegetation at solar facilities does not typically require long-term or routine applications of soil amendments, such as fertilizer. Thus, residual nutrients are less likely to be mobilized during runoff events compared to conventional agriculture. Perennial grasses and legumes further stabilize the soil, decrease runoff and erosion potential, and improve water quality by intercepting sediment and nutrients.

1 Missouri Prairie Foundation. Build Healthy Soil. Available: https://grownative.org/learn/build-healthy-soil/

2 Walston, et al. Modeling the ecosystem services of native vegetation management practices at solar energy facilities in the Midwestern United States. Ecosystem Services. February 2021. Available: https://www.sciencedirect.com/science/article/pii/S2212041620301698

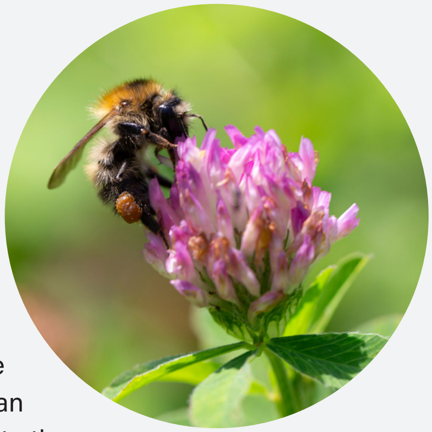
3 Department of Energy. Deploying Solar with Wildlife and Ecosystem Services Benefits (SolWEB) Funding Program. 2022. Available: https://www.energy.gov/eere/solar/deploying-solar-wildlife-and-ecosystem-services-benefits-solweb-funding-program

Enhanced Stormwater Management

From a bird's eye view, solar panels can appear as an impenetrable, or impervious, surface. In fact, once operational, a typical solar facility will maintain permanent vegetation on site and the spacing between individual panels and rows enables water to flow underneath and between panels. Perennial vegetation at a solar site reduces erosion and increases water retention, as the root system stabilizes the soil and helps absorb water. Researchers found that sediment export, a technical term for erosion, was 95% lower at a solar facility with native grass underneath than that of agricultural land, and water retention was also 9.5% higher. The study revealed that a solar facility paired with turf grasses also led to less sediment export and greater water retention than conventional agriculture.[4]

To regulate erosion and stormwater runoff concerns, a locality or state typically requires an erosion and sedimentation control plan before issuing a permit to a solar project. Some sites require grading prior to the construction process; if topsoil is removed, it can be stockpiled and redistributed to support soil stabilization and maintain quality. Some developers use preconstruction seeding as a mechanism to stabilize soil early in the installation process. The local authority or relevant state agency may often monitor the site until vegetative groundcover is established.

What is planted at a solar facility?



Many factors influence what type of seed mix is used and how it is planted and maintained. There is no one-size-fits all choice for vegetation on solar sites. Developers prepare site-specific plans. In general, developers aim to incorporate natural landscaping practices[5] into the solar facility to capture various ecosystem services at the site.[6] Tall grasses are not appropriate to plant underneath or between solar panels, as shading will limit the power output of the solar facility. Denser vegetation can also increase the risk of a fire. Some plant species with deeper root systems can take longer to grow compared to turf grasses and clover, which can establish quickly to manage runoff. As many native plant species can be expensive or challenging to procure at higher seeding rates, a diverse mix of species of grasses, sedges and forbs can provide a cost competitive seed mix that provides valuable ecosystem services to the land. Thus, developers need to balance these benefits and impacts of seed mixes accordingly.

4 Walston, et al. Modeling the ecosystem services of native vegetation management practices at solar energy facilities in the Midwestern United States. Ecosystem Services. February 2021. Available: https://www.sciencedirect.com/science/article/pii/S2212041620301698

5 Environmental Protection Agency. Green Landscaping: Greenacres. Available: https://archive.epa.gov/greenacres/web/html/chap2.html

6 American Clean Power Association. Beneficial Practices for Establishment and Maintenance of Vegetation at Utility-Scale Solar Sites. Available: https://cleanpower.org/wp-content/uploads/2022/05/Beneficial-Practices-for-Establishment-and-Maintenance-of-Vegetation-at-Utility-Scale-Solar-Sites_Final.pdf

Soil Formation and Retention

Soil compaction occurs when heavy machinery, livestock grazing, or inappropriate tillage practices are applied to a site. If not managed, compaction of topsoil or subsoil can limit future crop production, water filtration, and stormwater retention.

Given that construction involves installation of posts, beams, and access roads, farmers may be interested in the degree of soil compaction at solar sites. In general, compaction may occur at select parts of the project site: specifically, trenches, access roads, and pads for electrical equipment, such as inverters or transformers. Where compaction can occur, developers may aerate or till the soil, or plant deep rooted vegetation to mitigate these impacts.[7] This is consistent with federal and state construction permitting requirements, that require decompaction needs to occur where the permittee intends to use vegetation to stabilize the soil.[8]

Furthermore, tillage does not occur after construction. Thus, by reducing tillage practices, a landowner can reduce nitrous oxide emissions and increase carbon sequestration in many circumstances.[9]

Reduced Pesticide Use

Solar development does not require insecticides. Herbicides may be used during the site preparation process but is applied more targeted once the facility is in operation.

Furthermore, solar panels and racking systems upon which the panels are installed do not pose danger of leaking chemicals or other hazardous materials into the soil.[10] For more information on solar panel safety, please visit "Solar Panels in Your Community."

Image provided courtesy of Pattern Energy Group LP

Reduced Water Use

Solar facilities typically require little water during construction or operations, as rainfall is generally sufficient to settle dust and clean the panels. For regions where water access and supply are limited, converting farmland to solar generation for a period of time reduces irrigation needs and saves the community an important resource during operation. As noted above, the vegetation underneath a solar facility can also help retain stormwater and manage runoff.

Preserving Future Farm Opportunities

Given the challenges of modern farming, many families are choosing to lease land for solar generation to preserve their farm for the next generation by securing a stable source of income and avoiding pressures to sell land to developers who will permanently alter it and remove it from agriculture. Unlike residential or commercial real estate development, land set aside for solar energy can be returned to farming after the project's useful lifespan, if the landowner so chooses.[11] The subsequent income from solar lease payments can support other portions of the farming operation that can fluctuate based on commodity prices and weather events. Solar provides a stable, low-impact option for farmers who wish to keep the land in the family for at least a generation.

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EXHIBIT W: PROPERTY VALUE IMPACT ARTICLES

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Shedding light on large-scale solar impacts: An analysis of property values and proximity to photovoltaics across six U.S. states

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ABSTRACT

We examine the impact of large-scale photovoltaic projects (LSPVPs) on residential home prices in six U.S. states that account for over 50% of the installed MW capacity of large-scale solar in the U.S. Our analysis of over 1,500 LSPVPs and over 1.8 million home transactions answers two questions: (1) what effect do LSPVPs have on home prices and (2) does the effect of LSPVP on home prices differ based on the prior land use on which LSPVPs are located, LSPVP size, or a home's urbanicity? We find that homes within 0.5 mi of a LSPVP experience an average home price reduction of 1.5% compared to homes 2–4 mi away; statistically significant effects are not measurable over 1 mi from a LSPVP. These effects are only measurable in certain states, for LSPVPs constructed on agricultural land, for larger LSPVPs, and for rural homes. Our results have two implications for policymakers: (1) measures that ameliorate possible negative impacts of LSPVP development, including compensation for neighbors, vegetative shading, and land use co-location are relevant especially to rural, large, or agricultural LSPVPs, and (2) place- and project-specific assessments of LSPVP development and policy practices are needed to understand the heterogeneous impacts of LSPVPs.

1. Introduction

Large-scale photovoltaic projects (LSPVP), defined here as ground-mounted photovoltaic generation facilities with at least 1 MW of DC generation capacity, are an increasingly prevalent source of renewable energy. LSPVPs accounted for over 60% of all new solar capacity in the United States in 2021, and, as the largest resource by capacity in interconnection queues, are projected to continue growing (Bolinger et al., 2021). However, the local economic impacts of LSPVPs are poorly understood (Mai et al., 2014), despite surveys showing that local public support for large-scale solar is strongly related to perceived economic impacts, including the impact on property values (Carlisle et al., 2014). Concerns surrounding the property value impacts of solar power are reflected in solar industry and environmental advocacy communication that challenge the conception that solar power reduces property values (Center for Energy Education, n.d.; Solar Energy Industries Association, 2019), and in attempts by neighbors of solar plants to claim solar panels as a private nuisance (Westgate, 2017).

The purpose of this paper is to provide some of the first comprehensive evidence on the impact of LSPVPs on residential home values. Specifically, we seek to answer two related research questions: (1) what effect, if any, do LSPVPs have on residential home prices and (2) does the effect of LSPVPs on home prices differ based on the prior land use on which a LSPVP is located, the size of the LSPVP, or the urbanicity of a home's location? To address these questions we use data from CoreLogic on over 1.8 million residential property transactions that occurred within six years before and after a LSPVP was constructed in the five U.S. states with the highest concentration of LSPVPs as measured by number of installations: California (CA), Massachusetts (MA), Minnesota (MN), North Carolina (NC), and New Jersey (NJ), as well as in Connecticut (CT), chosen for its relatively high population density (i.e., urbanicity) near LSPVPs. We then combine the transaction data with other geospatial datasets including an original dataset of LSPVP footprints developed by the project team for this research, a suite of environmental amenities and dis-amenities, urban, rural, and suburban classifications, and historic land cover data. We identify the arguably causal impact of LSPVPs on residential property values using a difference-in-differences identification strategy that compares the sale price of residential homes located in close proximity to a LSPVP (e.g. 0–0.5 miles away) both before and after a LSPVP is constructed to the sale price of homes located farther away from a LSPVP (e.g. 2–4 miles away).

Our paper makes several important contributions. First, we examine the impacts of LSPVPs in a large set of U.S. states that account for the

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Abbreviations

A/D	amenities and dis-amenities
API	Application Programming Interface
CA	California
CT	Connecticut
DC	direct current
dB	decibel
DiD	difference-in-difference
EIA	Energy Information Administration
FE	fixed effects
GHG	greenhouse gas
LSPVP	large-scale photovoltaic project
MA	Massachusetts
MN	Minnesota
MW	megawatt
NJ	New Jersey
NLCD	National Land Cover Database
NY	New York
NC	North Carolina
PV	photovoltaic
RI	Rhode Island
RPS	Renewable Portfolio Standard
SB	Senate Bill
U.K.	United Kingdom
U.S.	United States
USDA	United States Department of Agriculture

majority of U.S. LSPVP capacity, most of which, to our knowledge, have not previously been studied with respect to the impact of LSPVPs on property values. Existing research on the property value impacts of LSPVPs provides mixed results from a limited set of geographies. Where researchers do find an adverse impact of LSPVPs on property values, as in studies from the Netherlands and from the U.S. states of RI, MA, and NC, they theorize a change in property values due to visual intrusion from panels (Abashidze, 2019; Dröes and Koster, 2021; Gaur and Lang, 2020) and land use change (Gaur and Lang, 2020). Conversely, one study based in the U.K. finds no statistically significant effect of LSPVPs on property values (Jarvis, 2021). Expanding the geographic scope of the literature, then, facilitates both generalization (Brinkley and Leach, 2019) and more location-specific policy insights.

Second, we investigate whether the effect of LSPVPs on home prices is heterogenous with respect to LSPVP area, prior LSPVP land use, and home urbanicity. One of the major concerns surrounding LSPVPs, as well as one of the major opportunities to explore the co-benefits of LSPVP development, are its land use requirements (Hernandez et al., 2014a; Hernandez et al., 2014b; Katkar et al., 2021). In particular, more adverse home price impacts might be found where LSPVPs displace green space (consistent with results that show higher property values near green space (Crompton, 2001)) or where LSPVPs are larger in area, and thus more visually intrusive. While some previous studies (Gaur and Lang, 2020) find that greenfield solar development is primarily responsible for their observed decrease in home prices when compared to brownfield development, our constructed dataset of LSPVP footprints allows us to more precisely identify the prior land use of a LSPVP (for instance, breaking up the "greenfield" category into agricultural and non-agricultural land uses). Our dataset of LSPVP footprints additionally allows us to accurately characterize the area of each LSPVP.

In section 2, we introduce the policy context for LSPVP development in the study area and review the existing literature on property value impacts of LSPVPs. In section 3, we detail the data used in this study, the geospatial methods used to combine datasets, and the difference-in-differences approach to assessing property value impacts of LSPVPs. In section 4, we present our base model, event study, and heterogeneity analysis results. In section 5, we summarize and discuss our findings. In section 6, we note the limitations of our study and describe avenues for future work. Finally, in section 7, we review the key conclusions and policy implications of our study.

2. Background and relevant literature

2.1. Policy context

The study area is defined as the six states of CA, CT, MA, MN, NC, and NJ. The states in the study area were chosen based on number of installations: CA, NC, MA, MN, and NJ represent the top five states in terms of number of >1 MW DC solar installations through 2019. Together, these states contain over 2,000 solar projects, or approximately 53% of the total MW DC capacity in the United States through 2019. We additionally include CT because of its relatively high population density near solar projects (U.S. Energy Information Administration, 2021a).

All six states face increasing demands for large-scale solar along with intensifying land use and permitting constraints on solar development. Both CA and CT have ambitious Renewable Portfolio Standards (RPSs), aiming for 100% of electricity retail sales to be supplied by renewable sources by 2045 and 2040, respectively (Schwartz and Brueske, 2020; U. S. Energy Information Administration, 2021a). In CA, this necessitates, by some estimates, a tripling of California's renewable energy production; of those possible renewable resources, solar PV is both the least expensive and has the largest technical potential in the state (Schwartz and Brueske, 2020). Though MA, MN, and NJ have less ambitious renewable energy development goals, state reports still estimate that building solar PV is a key strategy to meeting both MA and MN's GHG reduction and renewable electricity sourcing targets (Jones et al., 2020; Putnam and Perez, 2018), and NJ introduced legislation in 2021 that aims to double existing solar installations through incentives (NJ Department of Environmental Protection, 2021). NC's solar future is less definite: although the state has, historically, been a leader in solar installations, the dominant electric utility in the state, Duke Energy, has proposed an integrated resource plan that largely privileges fossil generation over renewables. This plan is currently under review by the NC Utility Commission, with challenges from multiple environmental groups (Southern Environmental Law Center, 2021).

State reports identify persistent LSPVP land use and permitting challenges. In CA, for instance, San Bernardino county voted to ban utility-scale solar farms on over a million acres of private land (Schwartz and Brueske, 2020), citing concerns about the industrializing impact of solar projects on rural or desert landscapes (Roth, 2019). Tradeoffs between land use and LSPVP development are also observed at the state level in CT, MN, and NJ. In CT, Public Act 17–218, enacted in 2017, limits PV development on forest and prime farmland[1]; this has resulted in a reduced number of approved commercial PV projects per year (CT Council on Environmental Quality, 2020). Before the passage of this act, in 2016, the CT Council on Environmental Quality reported that solar PV was the single largest type of development displacing agricultural and forest land (CT Council on Environmental Quality, 2017). MN, too, prohibits solar development on prime farmland: the state's Prime

[1] Both CT Public Act 17–218 and the MA Prime Farmland Rule cite 7 CFR 657 for the definition of "prime farmland"; 7 CFR 657 is a periodically updated set of federal regulations, administered by the Department of Agriculture, that defines prime and important farmlands (Legal Information Institute, n.d.).

Farmland Rule includes solar development as one of the prohibited industrial uses of select agricultural land (Bergan, 2021). The MN Prime Farmland Rule is currently being contested: legislation that allows more PV development on farmland is now under consideration in the MN legislature (Bergan, 2021), and the MN Department of Commerce has, in the past, issued guidance for developers on how to make their case for an exception to the rule (Birkholz et al., 2020). In NJ and NC, too, concerns about farmland preservation and LSPVPs have appeared in discussions among agricultural stakeholders, although neither state has adopted prime farmland legislation like CT or MN (American Farmland Trust, 2021; Cleveland and Sarkisian, 2019). In MA, state reports refer to siting difficulties due to high population densities, expensive land for development that is disconnected from transmission, and opposition to disturbance of natural land (Jones et al., 2020).

In summary, while LSPVP installations are prevalent in the six states analyzed in this, these states also represent regions where an increasing need for LSPVP is met with restrictions, opposition, and land-use tradeoffs. These restrictions are often specific to farmland, although concerns do extend to other landscapes (like high density areas, deserts, and forests). Investigating property value impacts of LSPVPs, both overall and by prior land use and installation size, can potentially provide policymakers, practitioners, and developers with valuable information on how LSPVPs affect residents' willingness to pay for properties located near LSPVPs. To the extent that these concerns represent possible burdens of LSPVP development, investigating property value impacts of LSPVPs also helps us understand how these burdens are distributed. These insights, in turn, can guide policy or best practices that seek to mitigate adverse impacts of LSPVP development to enable build-out that meets climate and clean energy goals.

2.2. Relevant literature

The property value impacts of LSPVPs have received only recent, limited attention (Abashidze, 2019; Al-Hamoodah et al., 2018; Dröes and Koster, 2021; Gaur and Lang, 2020; Jarvis, 2021). Studies on LSPVPs and property values employing difference-in-differences (DiD) analyses find mixed results. Studies based in the U.S., specifically, MA and RI (Gaur and Lang, 2020) and NC (Abashidze, 2019), and the Netherlands (Dröes and Koster, 2021), find a statistically significant negative effect for homes near solar projects compared to homes further away. One study, based in the U.K., finds no statistically significant effect of LSPVP proximity on home property values (Jarvis, 2021). Although none of the existing studies find evidence of an increase in sales prices for homes near solar projects, Abashidze (2019) finds an increase in agricultural land value for land in close proximity to transmission lines after a solar farm is built in the area. To our knowledge, only Gaur and Lang (2020) investigate the impact of prior land use using a DiD framework, finding that greenfield solar construction is associated with a statistically significant reduction in sale prices in both rural and non-rural areas, with greater reductions observed in rural areas. One study using a contingent valuation survey finds that respondent willingness to pay for large-scale solar developments is a function of prior land use, where brownfield solar developments are more desirable than greenfield developments (Lang et al., 2021). Both Jarvis (2021) and Abashidze (2019) find no evidence of heterogeneity in home price impacts by income or other socio-economic indicators.

The mixed results to date in the LSPVP and property value literature motivates studies that look at previously understudied geographies to develop a more comprehensive view of the possible property value impacts of LSPVPs. The existing literature also orients us to relevant heterogeneity analyses, including heterogeneity by prior land use. We extend this literature by looking at a more specific set of prior land uses beyond greenfield and brownfield, as well as by looking at heterogeneity of effects by LSPVP size and urbanicity.

3. Methods

3.1. Data

This project utilized five major sources of data, shown on the left-most side of Fig. 1. First, to characterize and locate LSPVPs, we utilized the U.S. Energy Information Administration's Form 860 (U.S. Energy Information Administration, 2021b), which provides latitude-longitude data on solar plants, their installed capacities (in megawatts, MW), and their operation start date. We kept only solar plants within the study area with an installed capacity over 1 MW and eliminated rooftop installations, leaving us with 1,630 solar plants. Second, to understand the impact of prior LSPVP land use on property values, we used land use data from the United States Geological Survey (USGS)'s Multi-Resolution Land Characteristics (MRLC) Consortium's National Land Cover Database (NLCD) from 2006 (Multi-Resolution Land Characteristics Consortium, 2006). Third, for information about home sales, we used transaction data from CoreLogic (CoreLogic, n.d.), which provided information on location, property characteristics and transaction characteristics. We filtered this dataset for only relevant, complete records; the criteria used to screen data are outlined in Table A.1. Fourth, to identify amenities or disamenities (herein referred to as A/D), or landscape characteristics that could positively or negatively impact the price of a home, we used the data sources summarized in Table A.2. Finally, to understand the impact of urbanicity on property value impacts, we used the U.S. Census Bureau's (U.S. Census Bureau, n.d.) urban-urban cluster-rural classification (a metric based on population density, where urban areas are the most dense, followed by urban clusters, then rural areas). These data sources were validated and combined to produce a final analytic dataset. Fig. 1 graphically depicts the data preparation steps, which we describe below.

Step 1: To obtain a polygon representation of each LSPVP from the EIA point data, we first verified installation locations using satellite imagery from Esri and DigitalGlobe and revised project centroid coordinates where necessary. We manually drew polygons around the boundaries of each LSPVP based on satellite imagery; for projects that consisted of multiple, non-contiguous groups of panels, we drew a multipart polygon around the boundaries of each group of panels. We calculated a construction start year for each LSPVP, assuming construction begins one year before the EIA-provided operation start date. Fig. A.1 shows an example of two LSPVPs and their corresponding polygons; Fig. 2 shows the location of LSPVP sites as well as the density of transacted homes for the six states in the study area.

Additionally, in this step we determined the predominant prior land use type of each LSPVP. We first determined the distribution of prior land cover types by area for each LSPVP; each LSPVP polygon is composed of some proportion of the NLCD land cover classes shown in the right-most column of Table 1 (15 of the 16 possible NLCD classes showed up in our sample). Each LSPVP's distribution of NLCD classes was grouped and summed as per the left-most column of Table 1, and each LSPVP was assigned the predominant prior land use type that constituted 50% or more of its land cover. If no single predominant prior land use type accounted for 50% or more of an LSPVP's prior land cover by area, that LSPVP was assigned a predominant prior land use type of "mixed".[2] Fig. 3 shows (a) the proportion of displaced LSPVP area and

[2] For instance, a solar installation on land that was, in 2006, 15% barren land, 25% cultivated crops, 25% herbaceous, and 35% hay/pasture, would be generalized as 60% agriculture and 40% greenfield, and would be given the predominant prior land use type of "agriculture". A solar installation on land that was, in 2006, 15% barren land, 25% developed, high intensity, 25% herbaceous, and 35% hay/pasture, would be generalized as 35% agriculture, 40% greenfield, and 25% brownfield, a would be assigned the predominant prior land use type of "mixed", because no single category amounted to greater than 50%.

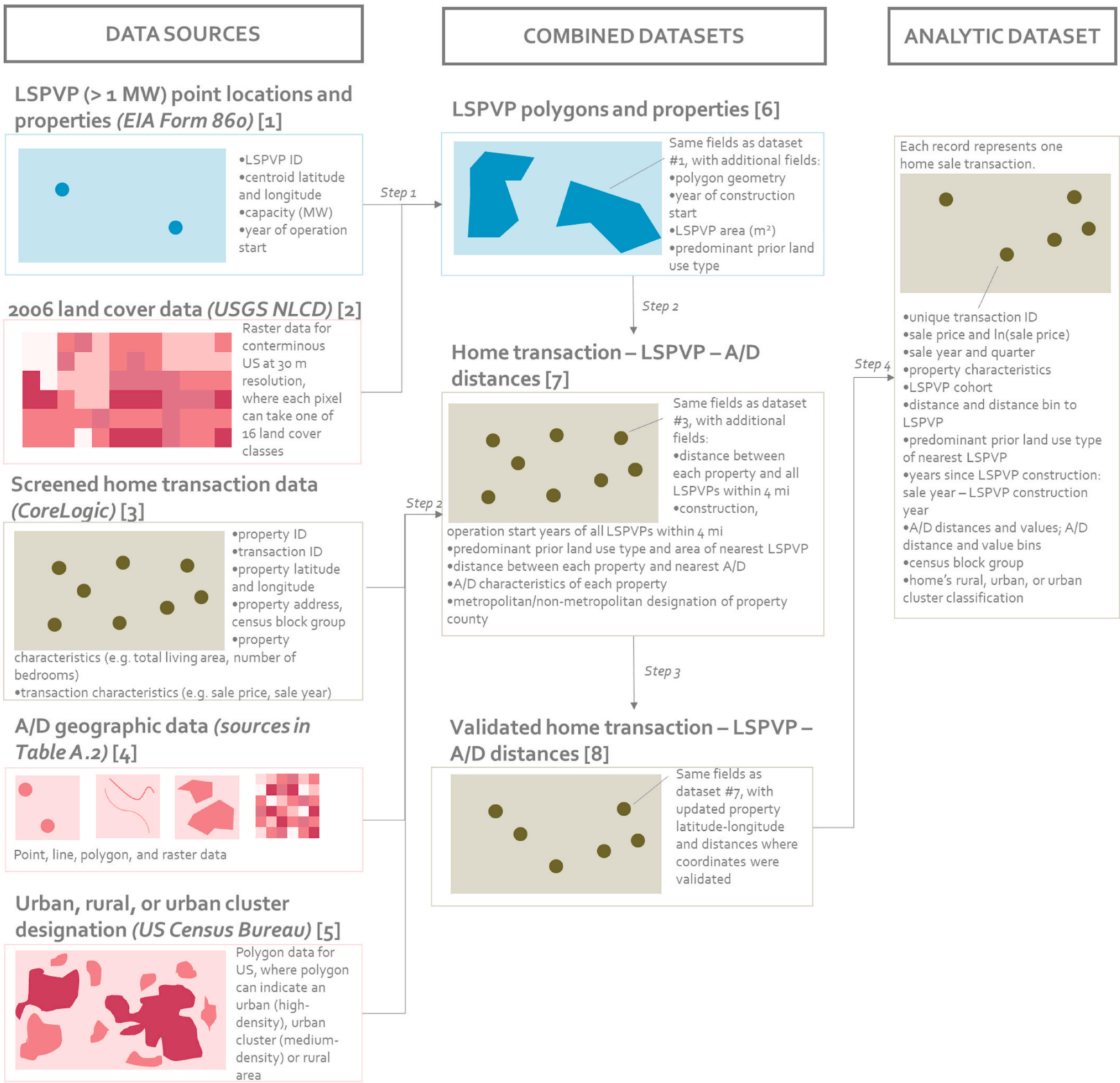

Fig. 1. Data sources and data preparation steps.

Table 1
Grouping of NLCD classes into predominant land use types; LSPVPs are assigned a predominant prior land use of "mixed" if their area does not contain 50% or more of the NLCD classes within a single predominant prior land use type.

Predominant prior land use type	NLCD classes
Agriculture	Cultivated Crops; Hay/Pasture
Brownfield	Developed, High Intensity; Developed, Low Intensity; Developed, Medium Intensity
Greenfield	Barren land; Deciduous forest; Developed, Open Space; Emergent Herbaceous Wetlands; Evergreen Forest; Herbaceous; Mixed Forest; Open Water; Shrub/Scrub; Woody Wetlands

Table 2
Transaction count by state in final analytic dataset.

State	Number of transactions
CA	933,037
CT	34,313
MA	291,325
MN	75,394
NC	204,134
NJ	297,756
6 state total	1,835,961

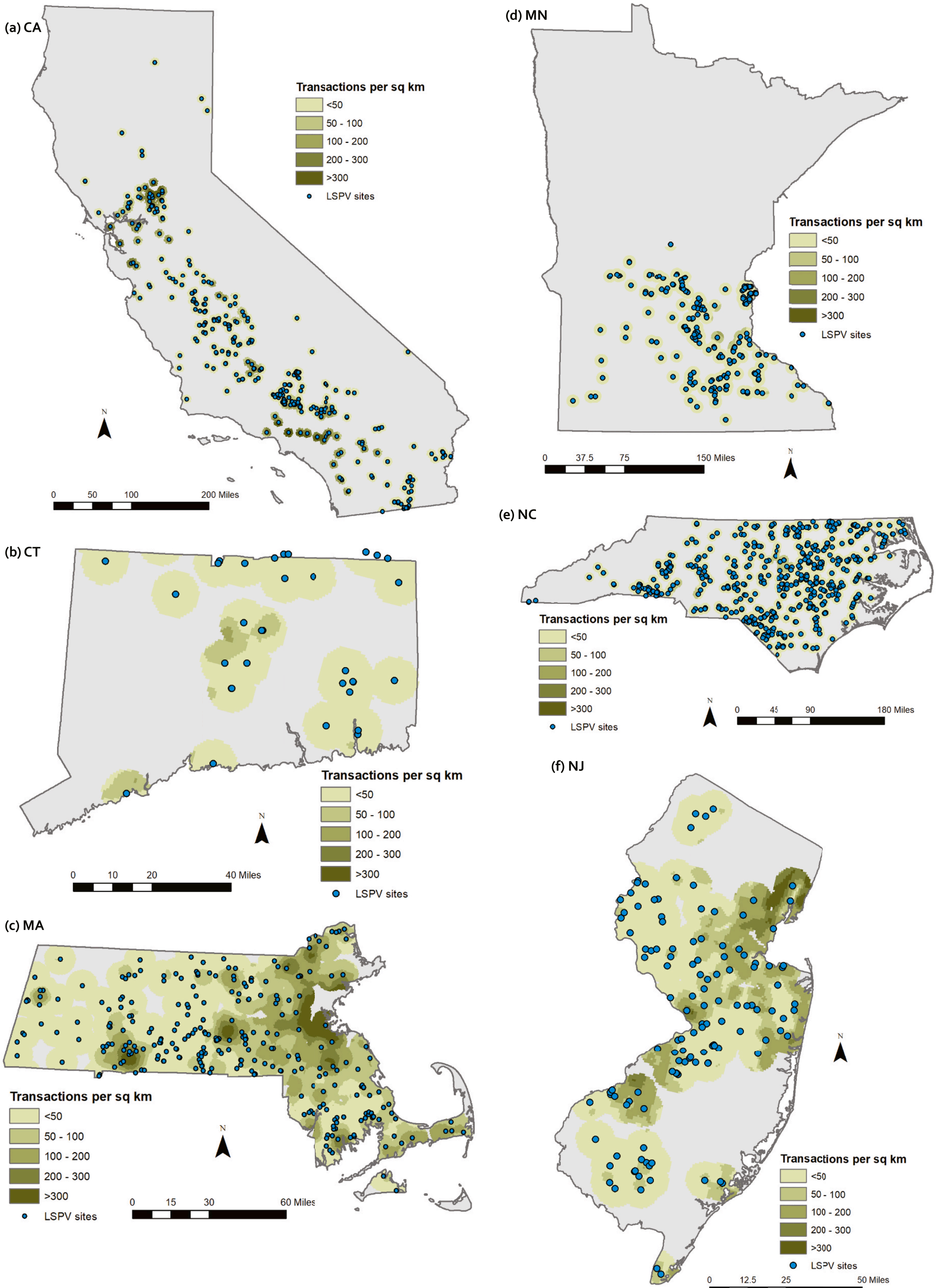

Fig. 2. Heat map of transacted home density within 5 miles of LSPVP sites in individual states.

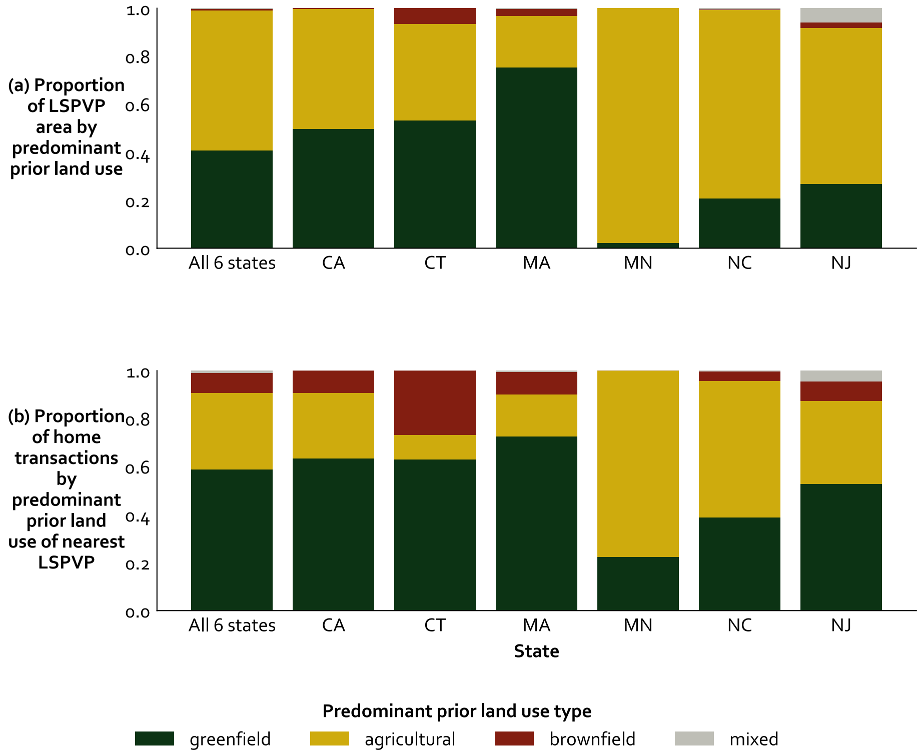

Fig. 3. Distribution of predominant prior land use by (a) LSPVP area and (b) number of homes near LSPVPs.

(b) the proportion of transactions near LSPVPs by predominant prior land use type.

Step 2: For each home we calculated the geodesic distance to the polygon boundary of the nearest LSPVP and to all A/D locations. We also determined underlying A/D characteristics, where appropriate, such as flood zone status and road/airport sound levels. Finally, we determined the urbanicity of each home's location. Fig. 4 shows the distribution of homes by state and urban, urban cluster, or rural designation.

Step 3: We validated the coordinates of select homes[3] that were sited near LSPVPs or A/D using the Google Geocoding API (Google Maps Platform, n.d.), which takes as input an address and returns a set of coordinates as well as a precision indicator. We dropped from our analysis any home transactions where there was inconsistency in the coordinates between CoreLogic and the Google Geocoding API. For some homes, we replaced the CoreLogic coordinates with coordinates from the Google Geocoding API where Google returned a high precision indicator.[4]

Step 4: Given validated coordinates and distances, we retained only the home transactions that were suitable for use in the final analysis. Specifically, we eliminated (1) properties that host a LSPVP (i.e. their coordinates fall within the boundaries of a LSPVP polygon), (2) properties that are over four miles away from a LSPVP, and (3) properties that transacted over 6 years before or after the operation start date of a LSPVP. We also calculated three sets of key values used in the analysis: the transaction's project cohort, LSPVP distance bin, and years since LSPVP construction.

The project cohort refers to the unique ID of the LSPVP that is nearest to a home transaction within 4 miles, and for which the operation start date occurred up to 6 years before or after a LSPVP began construction. If a given transaction belonged to more than one cohort, we retained only the nearest project cohort for that transaction.[5] The distance between the transacted home and the nearest LSPVP was binned into 4 categories: [0 mi, 0.5 mi), [0.5 mi, 1 mi), [1 mi, 2 mi), and [2 mi, 4 mi]. To calculate the number of years since LSPVP construction, we subtracted the LSPVP year of construction start from the sale year (recall that the construction start year is assumed to be the operation start year minus 1 year). The years since LSPVP construction were categorized into 1-year bins (i.e. a sale occurred [−5 years, −4 years), [−4 years, −3 years), …,[5 years, 6 years), [6 years, 7 years] since LSPVP construction). Our final analytic dataset consists of 1,836,053 transactions near 1,522 different LSPVPs.

Table 2 and Fig. 5 summarize the number of transactions, and the number and size of LSPVPs, respectively, by state. The final dataset contains a number of continuous and categorical property and transaction characteristics (e.g. sale price, sale year, number of bathrooms). Summary statistics for those continuous variables are shown in Table 3 for all six states; summary statistics for individual states are shown in Table A.3 to Table A.8. The categorical property characteristic variables are listed in Table A.9. Finally, Fig. 6 shows the total number of transactions within each distance bin by years since LSPVP construction and indicates that the sample has a robust set of transactions in all distance bins throughout the full sample period. While the home-level

[3] We selected properties that were <0.5 miles from an LSPVP or A/D; within a flood zone with at least 1% chance of flooding, or within an area with road or aviation noise exceeding 55 dB. Of the properties that satisfied these conditions, only those with an area greater than 1 acre or those with missing or non-unique coordinates were validated.

[4] We dropped home transactions from our analysis if the difference between the coordinates provided by the Google Geocoding API and CoreLogic was greater than 2 times the distance between that home and its nearest PV plant or A/D. We additionally dropped any duplicate coordinates within 0.5 mi of a PV plant. Where the Google Geocoding API returned a "rooftop" precision indicator, we replaced the CoreLogic coordinates with Google coordinates; for those homes, we recalculated distances to LSPVP and A/D using the process described in Step 2.

[5] In other words, if transaction T_1 is 0.5 miles from $LSPVP_1$ and 2 miles from $LSPVP_2$, and transacted within 6 years of the operation start date of both $LSPVP_1$ and $LSPVP_2$, we consider transaction T_1 to belong to the $LSPVP_1$ project cohort.

Fig. 4. Distribution of urban, urban cluster, and rural classifications by number of home transactions.

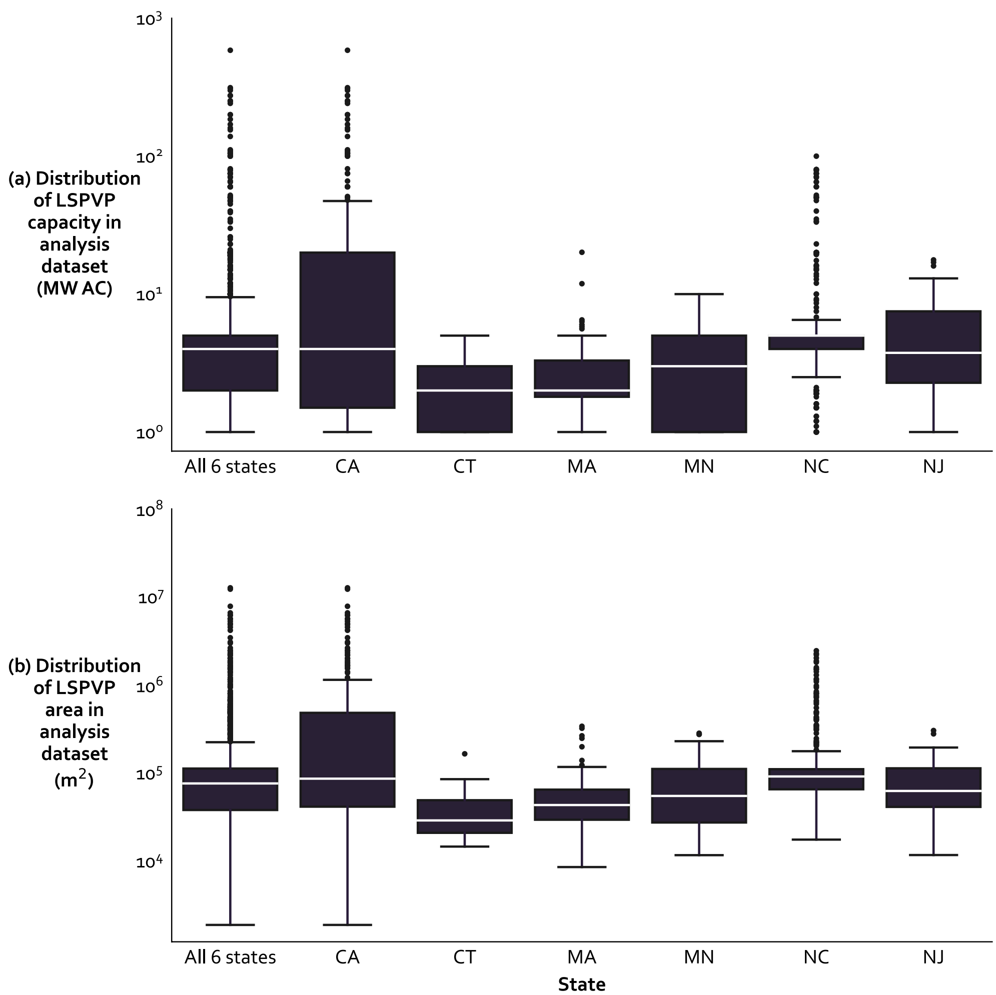

Fig. 5. Distribution of (a) capacity in MW AC and (b) ground-mount area in m^2 of unique LSPVPs in analysis dataset by state. Line represents median value; box limits represent 1st to 3rd quartiles; whiskers represent 4x the inter-quartile range.

transaction data used in this study is protected by a non-disclosure agreement and cannot be made publicly available, our dataset of LSPVP locations and associated sizes and prior land uses is available on Github (Elmallah et al., 2022).

3.2. Model specifications

3.2.1. Base difference-in-difference model

To examine the relationship between LSPVPs and residential property values we utilized a difference-in-differences (DiD) identification strategy that relates the timing of treatment (being close to an LSPVP post construction) to home prices for homes located [0 mi, 0.5 mi), [0.5 mi, 1 mi), and [1 mi, 2 mi) away from a LSPVP. Specifically, we first created 1,522 unique datasets, each representing a unique LSPVP and the residential home transactions that occurred within four miles of the LSPVP and transacted within 6 years before or after the first year of operation of the LSPVP. We call each of these unique datasets a "project cohort." We then stacked the 1,522 project cohorts to create our final

Table 3
Summary of dependent variables and property and transaction characteristics in full analysis dataset.

Variable	Description	Mean	Std. dev.	Min.	Med.	Max.
Sp	Sale price ($)	$406,552.22	$340,123.75	$5050.00	$321,000.00	$3,998,000.00
Lsp	log of sale price	12.65	0.74	8.53	12.68	15.2
Lsf	Living area (ft^2)	1936.53	1002.05	102	1720.00	120,215.00
acres	Land area (acres)	0.455	0.873	0.006	0.19	14.14
Age	Age of home at time of sale (years)	44.08	30.86	0	40	212
agesq	Age of home at time of sale, squared ($years^2$)	2895.66	3708.86	0	1600.00	44,944.00
salesqtr	Quarter of sale	2.27	0.87	1	2	4
salesyr	Year of sale	2015	3	2003	2015	2020

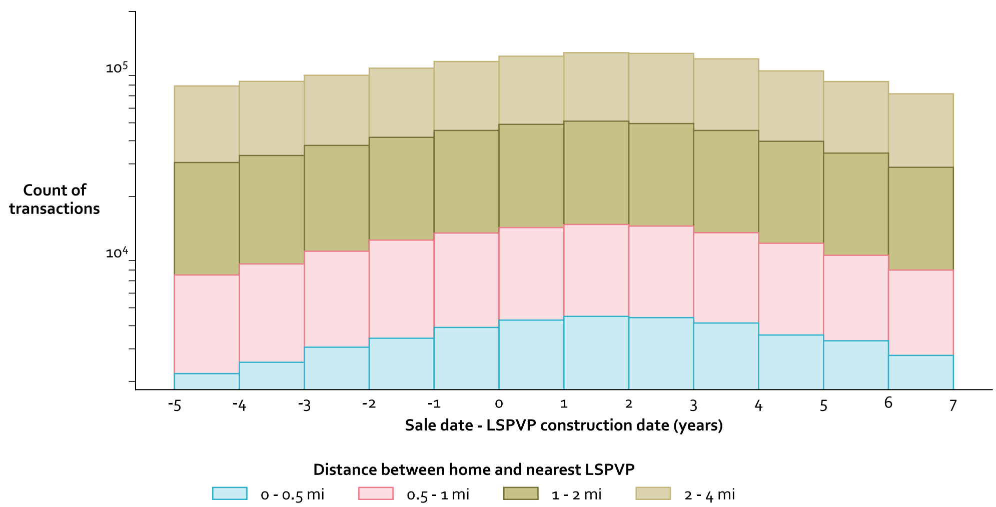

Fig. 6. Count of transactions in final analysis dataset by distance between transacted home and nearest LSPVP.

analytic dataset and specify a stacked difference-in-differences specification of the following form:

$$ln\left(P_{icdjqt}\right) = \beta\, \boldsymbol{T}_{idt} + \boldsymbol{X}_i\alpha + \delta_{dc} + \lambda_{tc} + \rho_{qc} + \varphi_j + \varepsilon_{icdjqt} \quad (1)$$

The dependent variable in (1) is the natural log of sales price P for residential home transaction i that belongs to a project cohort c within distance bin d and census block group j, that transacted in quarter q of year t. T_{idt} is a vector consisting of 3 distance bin indicators for homes located [0 mi, 0.5 mi), [0.5 mi, 1 mi), [1 mi, 2 mi) from a LSPVP, where each distance bin is interacted with an indicator for whether the home sale occurred after LSPVP construction. The omitted category for the distance bin indicators is homes located 2 to 4 miles from a LSPVP. δ_{dc}, λ_{tc} *and* ρ_{qc} are, respectively, distance bin-by-project cohort fixed effects (FEs), transaction year-by-project cohort FEs and transaction quarter-by-project cohort FEs. φ_j is a vector of census block group FEs, and ε_{icdjqt} is a random disturbance term. Finally, X_i is a vector of individual home characteristics including living square footage, land area, the age of the home at the time of sale, age squared, the number of full bathrooms and stories, the type of air conditioning (AC) and heating, the construction type and exterior wall type of the home, indicators for fireplaces and new construction, the type of garage, and the type of view a home has. The standard errors in (1) are clustered at the project cohort level.

The coefficients of primary interest in (1) are the β s which represent the DiD estimates of the effect of treatment (being close to an LSPVP post construction) on home prices for homes located [0 mi, 0.5 mi), [0.5 mi, 1 mi), and [1 mi, 2 mi) away from an LSPVP, respectively. Our DiD identification strategy is both transparent and intuitive. Specifically, each of the 1,522 project cohorts represents a unique quasi-experiment where the treatment group is homes located within [0 mi, 0.5 mi), [0.5 mi, 1 mi), and [1 mi, 2 mi) from a LSPVP and the control group is homes located 2 to 4 miles from a LSPVP. For each of these 1,522 quasi-experiments, our DiD framework then compares the sale price of homes located close to a LSPVP to the sale price of homes located farther away before and after LSPVP construction. The inclusion of distance bin-by-project cohort FEs, δ_{dc}, transaction year-by-project cohort FEs, λ_{tc}, and transaction quarter-by-project cohort FEs, ρ_{qc}, imply that our estimates are identified based only on within-project cohort variation in sale prices and distance from a LSPVP. Our coefficients of primary interest, β s, therefore represent the average treatment effect over the 1,522 quasi-experiments for homes located within each of our specified distance bins.

Another advantage of our stacked DiD framework is that it avoids the potential biases that can arise in standard DiD and event study models in the presence of staggered timing of treatment with heterogeneous treatment effects. Specifically, several recent studies have shown that DiD specifications relying on the staggered timing of treatment for identification may be biased in the presence of heterogeneous treatment effects due to the contamination of treatment effects from early versus later adopters from other relative time periods (Callaway and Sant'Anna, 2021; Goodman-Bacon, 2021; Sun and Abraham, 2021). As discussed by Cengiz et al. (2019) and Goodman-Bacon (2021), our stacked DiD model avoids this potential source of bias by ensuring that treatment effects are based only on within-project cohort comparisons.

3.2.2. Robustness checks

We investigated the robustness of the base model given by (1) to the choice of spatial FEs, time FEs, and treatment and control categories with three alternative specifications. Our first robustness check added a distance bin for homes located within 0.25 miles of a LSPVP.

Specifically, we augmented the distance bins in (1) to include four (rather than three) indicators for homes located in the [0 mi, 0.25 mi),[6] [0.25 mi, 0.5 mi), [0.5 mi, 1 mi), and [1 mi, 2 mi) distance bins; the indicator equals 1 if a transaction occurred within that distance bin in the same year or after LSPVP construction started, and 0 otherwise. This specification allows us to investigate the presence of a home price effect at even smaller distances. In our second robustness check we replaced the year-by-project cohort and quarter-by-project cohort FEs in the base model by a single vector of quarter-by-year-by-project cohort FEs to allow for more granular trending of home values across quarters and years. In our third robustness check we added the vector of A/D variables, consisting of distance and value bins described in section 3.1 to account for any potential correlation between the A/D variables and the timing and location of a LSPVP that may bias our base model estimates.[7]

3.2.3. Event study model

In addition to the base model specification in (1), we specified an event-study model, which allowed us to test the parallel trends assumption underlying the difference-in-differences model and to allow treatment effects to evolve non-parametrically post-construction. Specifically, we estimated a model of the following form:

$$\ln\left(P_{icdjqtk}\right) = \sum_{k=-5}^{7} T_{k,idt}\gamma_k + \boldsymbol{X}_i\kappa + \delta_{dc} + \lambda_{tc} + \rho_{qc} + \varphi_j + \eta_{icdjqtk} \qquad (2)$$

where $T_{k,idt}$ represents a series of lead and lag indicators for when a LSPVP began construction for each of the three distance bins defined in (1). We re-centered $T_{k,idt}$ so that $T_{0,idt}$ always equals one in the year the LSPVP began construction. We included a series of indicators from 1 to 5 years prior to a LSPVP being constructed ($T_{-5,idt}$ to $T_{-1,idt}$), and a series of indicators for 1–7 years after construction ($T_{1,idt}$ to $T_{7,idt}$). The omitted category for our treatment indicators (i.e. the reference year for all estimates) is the year of construction start for a LSPVP ($T_{0,idt}$). $\eta_{icdjqtk}$ is a random disturbance term and all other terms are as defined in (1).

The coefficients of primary interest in (2) are the γ_k's. The estimated coefficients on the lead treatment indicators (γ_{-5}, …, γ_{-1}) indicate whether the parallel trends assumption, which underlies all causal claims based on DiD models, appears to hold. Specifically, if LSPVP installation induces exogenous changes in home values, these lead treatment indicators should be small in magnitude and statistically insignificant, implying that the price of homes located close to a LSPVP (within 2 miles) were trending in a similar way to homes located farther away (2 to 4 miles) prior to LSPVP construction. The lagged treatment indicators ($\gamma_1, \ldots, \gamma_7$) allow the effect of distance to a LPSVP on home prices to evolve over time in the post treatment period in a non-parametric way.

3.2.4. Heterogeneity analyses

We conduct four heterogeneity analyses using the baseline model given by (1). First, we examined potential heterogeneity across states by estimating (1) separately for each of the six states in our sample. Second, we investigated the relationship between prior LSPVP land use and property value impacts by dividing our sample into four groups: home transactions near LSPVPs that were predominantly agricultural, greenfield, brownfield, or mixed land use prior to LSPVP construction. Third, we investigated the relationship between urbanicity and property value impacts by dividing our sample into one of the following U.S. Census Bureau designations: urban, urban clusters, or rural. Finally, we investigated the relationship between project size (area in square meters) and property values by applying the base model (1) to two subsets of the data: home transactions near LSPVPs below the 50th percentile of LSPVP areas and above the 50th percentile of LSPVP areas, where the 50th percentile is calculated from the set of unique LSPVPs in our sample.

4. Results

4.1. Base model and robustness check results

Table 4 shows results for the base model given by (1) and the robustness checks described above. As shown in column 1, we find an average 1.5% reduction in house prices for homes within 0.5 miles of a LSPVP that transacted post-LSPVP construction, and an average 0.82% reduction in home prices for homes 0.5–1 mi away from a LSPVP. Both estimates are statistically significant at the 5 percent level or better. As shown in column 2, we additionally find an average 2.3% reduction in home prices within 0.25 mi of a LSPVP. In both models, the estimated treatment effects for homes located 1 to 2 miles from a LSPVP are quite small in magnitude and statistically insignificant, suggesting that the impact of LSPVPs on home values fades relatively quickly with distance from a LSPVP. Further, all effects are monotonically ordered from closest distances to further away, which meets a priori expectations and provides us additional confidence in the model. As shown in columns 3 and 4 of Table 4, altering the time FEs by including quarter-by-year-by-project cohort FEs or controlling for other A/D does not notably alter the estimates from the base model.

4.2. Event study results

In Fig. 7 we present results from our event study specification given by (2), with coefficient estimates of our three distance bins shown as lines, and 95% confidence intervals shaded in similar colors. Homes located 2–4 miles from a LSPVP are once again the omitted category. Despite some noise in the estimates based on sales that occurred four or five years prior to LSPVP construction, in general there is very little evidence that home values were trending lower prior to the construction of a LSPVP: all of the estimated pre-treatment effects are small in magnitude and statistically insignificant. The lack of differential trending prior to the installation of a LSPVP provides evidence that our main identification assumption—the parallel trends assumption—holds. Fig. 7 also shows a relatively clear decline in home values that starts shortly after the beginning of LSPVP construction and continues up to six years post construction. The negative impact of LSPVPs on home values is particularly pronounced for homes located 0 to 0.5 miles from a LSPVP where we see home values declining by 4 percent six years after LSPVP construction.[8]

4.3. Heterogeneity analyses results

Fig. 8 shows results from all the heterogeneity analyses alongside the base model results; for ease of visualization, only the coefficients and 95% confidence interval for the 0–0.5 distance bin are shown, while Table 5 through Table 8 show more detailed results for each heterogeneity analysis. As shown in Table 5, which shows base model results for individual states, changes in sales price are not statistically significant for CA, CT, and MA. However, MN, NC, and NJ, show a statistically

[6] A total of 6,252 transactions occurred both within 0.25 mi of an LSPVP and after that LSPVP was constructed.

[7] For A/D distance bins, the omitted category is [2 mi, 4 mi) from a home; for noise levels, the omitted category is the <45 dB category; for flood zone, the omitted category is the missing category.

[8] When investigating results for individual states, both for the event study (section 3.2.3) and the heterogeneity analyses (section 3.2.4), our results largely agreed with the results for the full 6 state sample. However, our individual state estimates suffer from small sample sizes in individual time and distance categories for the event study and in individual subcategories for the heterogeneity analyses, so results are less reliable. Therefore, we do not present them in this paper. Results for individual states are available upon request from the authors.

Table 4
Average effect of LSPVP construction and proximity on home prices for all six states. Standard errors are clustered at the project cohort level and are in parentheses. Significance levels: ***p < 0.01, **p < 0.05, *p < 0.1

Dependent variable: the logarithm of house prices	Base model (1)	Including 0–0.25 mi distance bin	Including quarter-year-project cohort FEs	Including amenities and disamenities vector
Distance between home and LSPVP: [0 mi, 0.25 mi)		−0.0226*** (0.00767)		
Distance between home and LSPVP: [0.25 mi, 0.5 mi)		−0.0133** (0.00641)		
Distance between home and LSPVP: [0 mi, 0.5 mi)	−0.0154** (0.00630)		−0.0171*** (0.00642)	−0.0170*** (0.00589)
Distance between home and LSPVP: [0.5 mi, 1 mi)	−0.00820** (0.00413)	−0.00820** (0.00413)	−0.00941** (0.00424)	−0.00987** (0.00403)
Distance between home and LSPVP: [1 mi, 2 mi)	−0.000841 (0.00226)	−0.000841 (0.00226)	−0.00179 (0.00234)	−0.00131 (0.00225)
Home characteristics	✓	✓	✓	✓
Distance-project cohort FEs	✓	✓	✓	✓
Sale year-project cohort FEs	✓	✓		✓
Sale quarter-project cohort FEs	✓	✓		✓
Census block group FEs	✓	✓	✓	✓
Sale year-sale quarter-project cohort FEs			✓	
Amenities and disamenities				✓
Observations	1,832,888	1,832,888	1,826,915	1,778,533
R^2	0.835	0.835	0.839	0.835

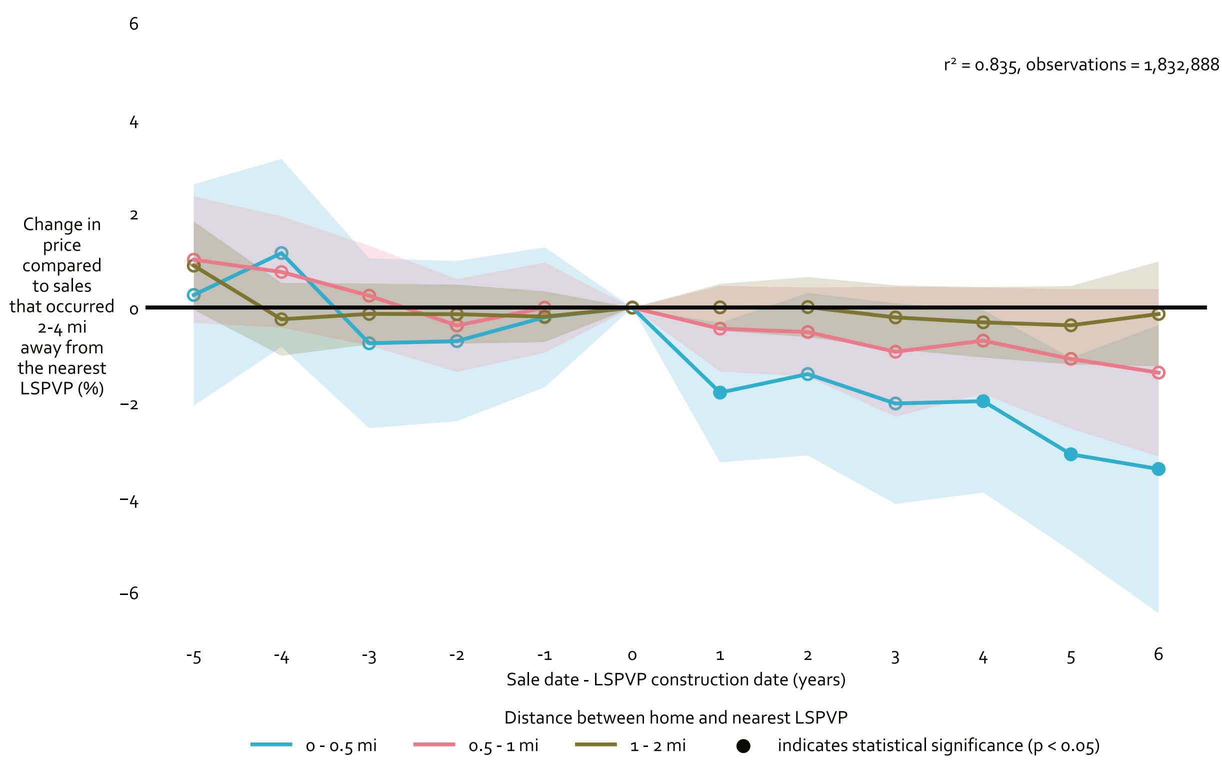

Fig. 7. Average effect of proximity to LSPVP by year of sale relative to year of LSPVP construction; shaded area represents 95% confidence interval; x-axis label represents lower bound of year range (e.g. −5 refers to all transactions that occurred [-5, −4) years before the construction date of the nearest LSPVP).

significant negative effect of 4%–5.6%, more than double that of the average across all states in the base model. In Table 6, where we examine potential heterogeneity by predominant prior land use of the nearest LSPVP,we find that statistically significant home value reductions are only observed for homes nearest to LSPVPs that are sited on previously agricultural land.[9] These findings are consistent with the results in

[9] We also tested the base model for a sample of only homes nearest to LSPVPs on previously forested land (NLCD classes of Deciduous Forest, Evergreen Forest, or Mixed Forest) and found no statistically significant results with p < 0.1.

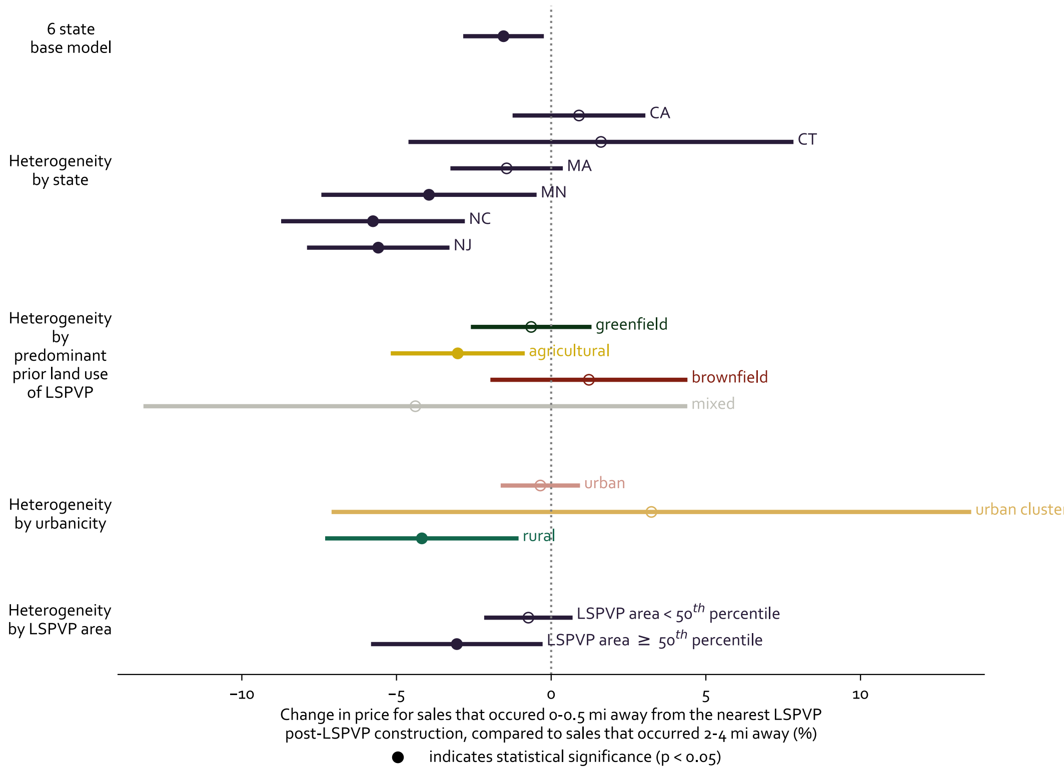

Fig. 8. Results from base model as well as each heterogeneity analysis, showing average effect of LSPVP construction and proximity for homes 0–0.5 mi away from nearest LSPVP. Range of change in price represents the 95th percent confidence interval.

Table 5
Effect of LSPVP construction and proximity on home prices in individual states, using base model specification. Standard errors are clustered at the project cohort level and are in parentheses. Significance levels: ***p < 0.01, **p < 0.05, *p < 0.1

Dependent variable: the logarithm of house prices	CA	CT	MA	MN	NC	NJ
Distance between home and LSPVP: [0 mi, 0.5 mi)	0.00899 (0.0106)	0.0161 (0.0314)	−0.0144 (0.00892)	−0.0395** (0.0174)	−0.0576*** (0.0148)	−0.0559*** (0.0114)
Distance between home and LSPVP: [0.5 mi, 1 mi)	0.000849 (0.00696)	0.0234 (0.0150)	−0.00933** (0.00469)	−0.0209** (0.00932)	−0.0473*** (0.0118)	−0.0135* (0.00698)
Distance between home and LSPVP: [1 mi, 2 mi)	0.00296 (0.00384)	0.0186** (0.00786)	−0.00190 (0.00319)	−0.0108* (0.00625)	−0.0117** (0.00570)	−0.00487 (0.00331)
Observations	931,735	34,135	291,403	74,905	203,005	297,677
R^2	0.881	0.774	0.777	0.708	0.735	0.751

Table 6
Average effect of LSPVP construction and proximity on home prices by predominant prior land use of nearest LSPVP to home, using base model specification. Standard errors are clustered at the project cohort level and are in parentheses. Significance levels: ***p < 0.01, **p < 0.05, *p < 0.1

Dependent variable: the logarithm of house prices	Greenfield	Agricultural	Brownfield	Mixed
Distance between home and LSPVP: [0 mi, 0.5 mi)	−0.00646 (0.00960)	−0.0302*** (0.0107)	0.0122 (0.0159)	−0.0439 (0.0445)
Distance between home and LSPVP: [0.5 mi, 1 mi)	−0.000991 (0.00480)	−0.0202*** (0.00629)	−0.00909 (0.0170)	−0.00679 (0.0342)
Distance between home and LSPVP: [1 mi, 2 mi)	0.000836 (0.00248)	−0.00408 (0.00498)	−0.00483 (0.00739)	−0.000377 (0.0191)
Observations	1,074,492	577,769	147,951	12,987
R^2	0.843	0.833	0.860	0.828

Table 7
Average effect of LSPVP construction and proximity on home prices by home urban, urban cluster, or rural designation, using base model specification. Standard errors are clustered at the project cohort level and are in parentheses. Significance levels: ***p < 0.01, **p < 0.05, *p < 0.1

Dependent variable: the logarithm of house prices	Rural	Urban cluster	Urban
Distance between home and LSPVP: [0 mi, 0.5 mi)	−0.0418*** (0.0156)	0.0324 (0.0524)	−0.00350 (0.00619)
Distance between home and LSPVP: [0.5 mi, 1 mi)	−0.0201* (0.0119)	0.0221 (0.0316)	−0.00342 (0.00437)
Distance between home and LSPVP: [1 mi, 2 mi)	0.00775 (0.00613)	−0.00597 (0.00896)	0.00137 (0.00222)
Observations	151,792	79,279	1,592,715
R^2	0.803	0.785	0.845

Table 8
Average effect of LSPVP construction and proximity on home prices by area of LSPVP, using base model specification. Standard errors are clustered at the project cohort level and are in parentheses. Significance levels: ***p < 0.01, **p < 0.05, *p < 0.1

Dependent variable: the logarithm of house prices	**LSPVP area < 50th percentile of area (75,138 m^2)**	**LSPVP area ≥ 50th percentile of area (75,138 m^2)**
Distance between home and LSPVP: [0 mi, 0.5 mi)	−0.00737 (0.00694)	−0.0305** (0.0138)
Distance between home and LSPVP: [0.5 mi, 1 mi)	−0.00483 (0.00521)	−0.0166** (0.00684)
Distance between home and LSPVP: [1 mi, 2 mi)	0.00225 (0.00287)	−0.00841** (0.00344)
Observations	1,291,762	537,189
R^2	0.841	0.833

Table 7, which shows that statistically significant effects were only observed for homes located in rural areas. Finally, in Table 8 we examine potential heterogeneity in property value impacts by the size of a LSPVP project. Specifically, we split the sample based on LSPVP areas and estimate separate models for homes located near LSPVPs that are above or below the median LSPVP area in our sample. Adverse effects are only observed for LSPVPs with an area larger than the median area of all unique LSPVPs in our sample[10].

5. Discussion

In this paper, we add to the growing body of research on the impact of LSPVPs on residential home values. By assembling an analysis dataset consisting of transaction data, an original dataset of LSPVP footprints, a suite of environmental amenities and dis-amenities, urbanicity classifications, and historic land cover data, we answer two related research questions.

First, we ask: what effect, if any, do LSPVPs have on residential home prices? Across the six states in the study area, we observe that homes within 0–0.5 mi of an LSPVP that transact after a LSPVP is constructed decline in sale price by an average of 1.5% compared to homes 2–4 mi away. At closer distances of 0–0.25 mi, the average decline in property values is 2.3%. This effect fades at further distances from a LSPVP; we observe a small adverse effect for homes 0.5–1 mi away of 0.8%, and no evidence of an effect at distances beyond 1 mi. Our estimates are robust to choices of time FEs and we control for other landscape characteristics that could impact property values. Our results are consistent with some prior literature (Dröes and Koster, 2021; Gaur and Lang, 2020) that find an overall adverse impact of LSPVP construction on property values.

Second, we ask: does the effect of LSPVPs on home prices differ based on the state, the prior land use on which a LSPVP is located, the size of the LSPVP, or the urbanicity of a home? When looking at individual states in our sample, we observe no effect on sales prices in CA, CT, and MA, but find sale price reductions for homes 0–0.5 mi away from a LSPVP of 4%, 5.8%, and 5.6% in MN, NC, and NJ, respectively. In those states where we do observe sale price reductions, the effect fades as distances from an LSPVP increases, as with the full 6 state model. When separating transactions by the prior land use and the area of the LSPVP to which they are closest, as well as by the urbanicity of the home, we observe statistically significant effects only for transactions near LSPVPs sited on previously agricultural land, transactions in rural areas, and transactions near larger LSPVPs by area. We observe decreases of 3%, 4.2%, and 3.1% for homes within 0–0.5 mi of LSPVPs on previously agricultural land, in rural areas, or near large LSPVPs, respectively, compared to homes 2–4 mi away. In all three cases, these effects fade with distance from a LSPVP. We observe no statistically significant effect of LSPVP construction and proximity on home prices in other categories for land use (greenfield, brownfield, or mixed land use sites), urbanicity (urban or urban cluster regions), or LSPVP area (where areas fall below the median LSPVP area in our dataset). Looking at the heterogeneity results by land use and urbanicity may help us understand the heterogeneity we observe by state: the states where we observe no statistically significant difference in sales price (in CA, CT, and MA) are also the states with lower proportions of LSPVP development on agricultural land (Fig. 3). CA additionally has very few transactions in rural areas (Fig. 4).

Our heterogeneity analyses show that the property value impacts of LSPVP development are highly contextual, and reinforce scholarly arguments that research on public support for solar energy should consider both project scale and proposed locations (Nilson and Stedman, 2022). Specifically, our results point to the importance of understanding the perceptions, economic impacts, and social dynamics of larger solar developments, rural developments, and developments built on previously agricultural land. Broader social science scholarship can contextualize these results: for instance, researchers have theorized that the siting of renewable energy in rural areas can counter personal, cultural, and political representations and understandings of rural landscapes (Batel et al., 2015). Our observed heterogeneity may reflect how large, agricultural, or rural developments potentially conflict more directly with those representations than smaller, non-agricultural, or urban developments. Furthermore, our results with respect to land use connect to an emerging literature on the co-location of solar and agriculture: surveys show that residents in agricultural communities are more likely to support solar development that integrates agricultural production (Pascaris et al., 2022), though scholarly reviews note that our understanding of perceptions of solar-agricultural systems remains limited (Mamun et al., 2022).

6. Limitations and future work

A key limitation of our research approach is that we consider only one aspect of the economic impacts of LSPVPs: property values. The impacts of local energy development are also shaped by local tax revenue and employment impacts, which have consistently been found to result in positive benefits (Brunner et al., 2021; Brunner and Schwegman, 2022a, 2022b), as well as by LSPVP ownership structures. This implies that homeowners can and do capitalize the positive impacts of renewable energy into home prices. Because this analysis compared home prices between homes around the same projects, any differences in value as compared to homes not near any LSPVP, and thus not subject to local tax or employment impacts, would have remained undiscovered. Furthermore, to the extent that property value changes reflect the revealed preferences of residents, they only reflect the preferences of the subset of residents who are homeowners. Where homeownership rates are lower – largely in urban areas, but in an increasing portion of rural areas as well (Pendall et al., 2016) – property value changes may not reflect the preferences of neighbors to the extent that they do where homeownership rates are higher. Considering these varied economic impacts would necessitate methodologies and data collection beyond the hedonic DiD analysis used in this paper.

These limitations suggest two major avenues for future work. First, more research attention is needed on the economic impacts of LSPVPs, broadly understood to encompass dimensions such as tax revenue, ownership structures, or employment. Added research on the local economic impacts of LSPVPs can position our findings on the average

[10] We also tested the base model for two additional samples: homes near very large LSPVPs (areas greater than the 75th percentile of areas of unique LSPVPs in our sample) and near very small LSPVPs (areas below the 25th percentile of areas of unique LSPVPs in our sample). For both subsets of our data, we found no statistically significant results with p < 0.1.

adverse impact of LSPVP development on home prices in a broader context of economic benefits and burdens due to LSPVP development. Second, more research is needed to understand the heterogeneity that we observe with respect to larger, agricultural, and rural LSPVPs. Here, surveys, qualitative research, mixed-methods, and case study-based approaches may indicate how neighbors of LSPVPs engage differently with their nearby solar installation based on its size, land use, or the urbanicity of their home.

7. Conclusion and policy implications

This paper provides some of the first comprehensive evidence on the impact of LSPVPs on residential home values. Specifically, we ask: (1) what effect, if any, do LSPVPs have on residential home prices and (2) does the effect of LSPVPs on home prices differ based on the prior land use on which an LSPVP is located, the size of the LSPVP, or the urbanicity of a home? In our six-state study area (CA, CT, MA, MN, NC, NJ), we find that homes within 0.5 mi of LSPVP experience an average home price reduction of 1.5% compared to homes 2–4 mi away; statistically significant effects are not measurable over 1 mi from a LSPVP. These effects are only measurable in certain states (MN, NC, and NJ), for LSPVPs constructed on agricultural land, for larger LSPVPs, and for rural homes.

Our study extends the existing literature in three ways. First, we consider a larger sample, both in terms of transactions and LSPVPs, than prior studies. Our six-state study area encompasses 53% of the total MW nameplate capacity of PV generators in the U.S., and our analysis included evidence from over 1,500 LSPVPs and over 1.8 million home transactions. The scope of our dataset allows us to provide average impact estimates for a much larger set of LSPVP projects within the United States. Second, to our knowledge, our study is the first study on LSPVP property values impacts to use a dataset of LSPVP footprints (as opposed to point locations or approximations of LSPVP area using circular buffers). By constructing and using footprint data, we can more precisely assess the land area and prior land use of LSPVPs, as well as reduce measurement error when calculating distances between homes and a LSPVP. Finally, we employ a stacked DiD specification with bin-by-project cohort FEs, which not only advances the methodology used for this type of analysis but also addresses recent concerns over DiD specifications that rely on staggered timing of treatment.

Our findings have two main policy implications. First, they point to the need for policy and development measures to ameliorate possible negative impacts of LSPVP development in some contexts. Our results suggest that there are adverse property value impacts of LSPVP construction for homes very close to a LSPVP and those predominantly in rural agricultural settings around larger projects. But we find that most impacts fade at distances greater than 1 mile from a LSPVP. In some cases – for homes near large LSPVPs, and in the states of MN and NC – negative effects persist at distances greater than 1 mile but are smaller than they are at nearer distances to a LSPVP. These results suggest that care should be taken in siting LSPVPs near homes in some contexts. Developers or policymakers considering siting LSPVPs very close to homes have several tools to employ, such as compensation schemes with neighbors and landscape measures like vegetative screening.

Second, the heterogeneity analyses reveal the importance of place and project-specific assessments of LSPVP development practices. Although we find adverse impacts of LSPVP construction on property values overall, we notably find no evidence of impacts in three states in our study area – including in CA, which alone accounts for over half of the transactions in our dataset. On the other hand, we do see evidence of adverse property value impacts of LSPVPs in the other three states in our dataset – including in MN, despite MN having arguably the most restrictive state-wide laws on LSPVP development in high-value agricultural areas of the states in our study area (Bergan, 2021). While our sample for individual states was too small to conclusively explore heterogeneity within states, our overall heterogeneity analysis suggests that adverse impacts of LSPVP development are present specifically in rural areas, where LSPVP displaces agricultural land uses, and where LSPVP installations are larger. For policy-makers, this heterogeneity may point to the importance of carefully considering siting strategies for rural, large, or agricultural installations – for instance, by exploring ways to co-locate agricultural land uses and solar development. However, this heterogeneity does not mean that economic impacts are negligible where property value impacts were insignificant (CA, CT, MN, as well as urban, non-agricultural, and smaller developments): as discussed in section 6, many economic impacts remain undiscovered by our methodology, some of which might increase home values, and future policy-relevant research is needed to understand the economic impacts of LSPVPs, broadly construed.

By combining a novel dataset of LSPVP footprints with home transaction data, our analysis provides comprehensive evidence that LSPVPs have an average adverse effect on home prices, but notably shows that these impacts are not uniform across geographies, land uses, or LSPVP size. In doing so, we contribute to the emerging literature on the economic impacts of LSPVPs and point to important avenues for future policy discussions and research.

CRediT authorship contribution statement

Salma Elmallah: Conceptualization, Methodology, Formal analysis, Data curation, Writing. **Ben Hoen:** Conceptualization, Methodology, Formal analysis, Writing, Project administration, Supervision, Funding acquisition. **K. Sydny Fujita:** Methodology, Formal analysis, Data curation, Writing. **Dana Robson:** Data curation, Writing. **Eric Brunner:** Conceptualization, Methodology, Formal analysis, Writing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Datasets related to this article that can be shared can be found at https://zenodo.org/record/7415662.

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Appendix

Table A.1
Retention criteria for transactions

Condition for retention	Rationale
Coordinate values are populated	Coordinates are needed to obtain distances between homes and LSPVP, amenities, and dis-amenities
Land area, year built, and home square footage are populated	Land area, year built, and home square footage are essential property characteristics to control for in analysis
Coordinates appear 20 times or less	Repeated, identical coordinates for multiple properties may indicate data quality issue
Property type is residential (including single family residence, condominium, duplex, apartment)	Analysis only considers homes (i.e. residential properties) sold in arms length transactions after the year 2000
Transaction is categorized as arms length	
Year of sale between 2000 and 2021	
Sale amount is greater than $5000 or the 1st percentile of sale price (whichever value is higher) and less than the 99th percentile of sale amount values within a given state	Removing outliers from analysis
Sale amount per unit area of living space is greater than the 1st percentile and less than the 99th percentile of sale amount per unit area of living space values within a given state	
Land area is greater than the 1st percentile and less than the 99th percentile of land area values within a given state	
Property was built before 2020, and after the 1st percentile of values for year built within a given state	
Sale amount is greater than the mortgage amount, or mortgage amount is missing	Any other relationship (between sale amount & mortgage amount, land area & living space area, sale year & year built, set of variables representing land area) may indicate data quality issues
Land area is greater than living space area	
Age of property (sale year minus year built) is non-negative	
Both variables representing land area converge within 0.01 acres	
Deed is not categorized as foreclosure	Sale amount in a foreclosure may not accurately represent the value of a home
Sale occurred over one year after last recorded sale for that property	Removes potentially “flipped” homes, or homes that undergo a rapid renovation and are re-sold, from dataset; for those homes, characteristics in CoreLogic dataset may not be representative of characteristics after renovation
Property address was not determined from mail	Address determined from mail may reflect the address of an absentee owner, not of the physical property location

Table A.2
Amenity and dis-amenity data sources

Amenity/dis-amenity	Data source	Data description	Reference
Aviation noise Road noise	U.S. Department of Transportation	Raster representing approximate average noise energy due to transportation noise sources over a 24-h period at the receptor locations where noise is computed, expressed in decibels (dB)	U.S. Department of Transportation (2020)
Flood zones	U.S. Federal Emergency Management Agency	Categorizes areas by likelihood of flood, ranging from minimal risk to 26% chance of flooding over the life of a 30-year mortgage	Federal Emergency Management Agency (2021)
Municipal, industrial, and transfer landfills	U.S. Department of Homeland Security	Provides locations of active permitted municipal solid waste facilities and construction and demolition debris facilities.	Department of Homeland Security (2020)
State and national parks	Esri	Provides boundaries of parks and forests in the United States at the national, state, regional, and local level	Esri (2021)
Nuclear power generation facilities	National Institute of Health	Provides locations of U.S. commercial nuclear power plants	Hochstein and Szczur (2006)
Coal power generation facilities	U.S. Environmental Protection Agency	Facility data (as of 2017) where primary or secondary fuel type is coal-related (e.g., Coal, Coal Refuse, and Petroleum Coke).	U.S. Environmental Protection Agency (2021)
Coastline	ABB Group	Locations of U.S. coastline, including bays, river outlets, and Great Lakes	ABB Group (2020)
Lakes		Locations of U.S. lakes, represented as polygons	
High-voltage lines		Transmission and distribution lines with a voltage of 100 V or greater, represented as polylines	

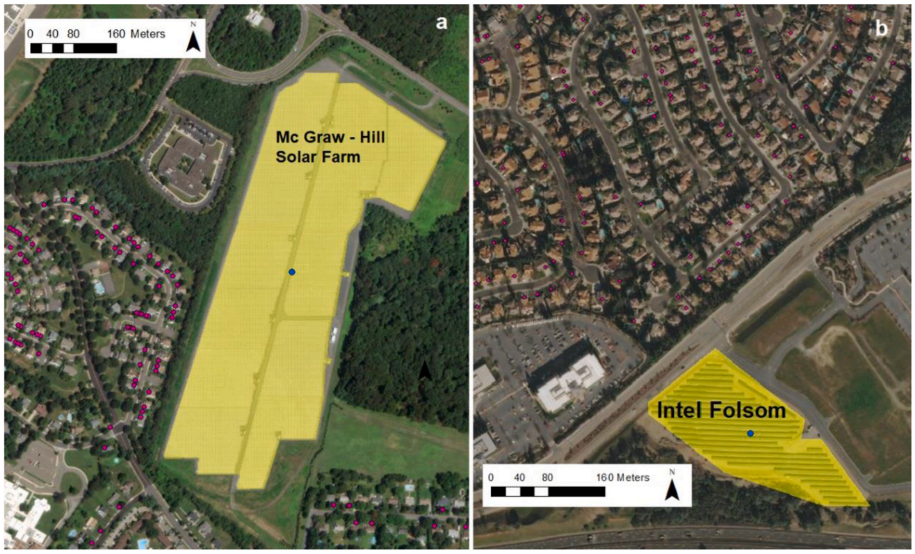

Fig. A.1. Satellite imagery showing examples of LSPVP centroids (blue dots) and polygons (yellow shaded areas) near homes including homes that transacted during our study period (pink dots): (a) McGraw-Hill Solar Farm, NJ and (b) Intel Folsom, CA

Table A.3
Summary of dependent variables and property characteristics, CA

Variable	Description	Mean	Std. dev.	Min.	Med.	Max.
Sp	Sale price ($)	$457,797.53	$403,489.03	$35,500.00	$350,000.00	$3,998,000.00
Lsp	log of sale price	12.75	0.75	10.48	12.77	15.2
Lsf	Living area (ft^2)	1868.69	1026.22	102	1654.00	98,694.00
Acres	Land area (acres)	0.336	0.7	0.018	0.165	7.231
Age	Age of home at time of sale (years)	36.94	24.79	0	34	112
Agesq	Age of home at time of sale, squared ($years^2$)	1979.42	2233.94	0	1156.00	12,544.00
Salesqtr	Quarter of sale	2.23	0.88	1	2	4
Salesyr	Year of sale	2014	3	2003	2015	2020

Table A.4
Summary of dependent variables and property characteristics, CT

Variable	Description	Mean	Std. dev.	Min.	Med.	Max.
Sp	Sale price ($)	$283,251.18	$184,202.97	$36,000.00	$239,900.00	$1,640,000.00
Lsp	log of sale price	12.4	0.56	10.49	12.39	14.31
Lsf	Living area (ft^2)	1916.21	951.46	196	1669.00	35,170.00
Acres	Land area (acres)	0.818	1.114	0.07	0.41	9.51
Age	Age of home at time of sale (years)	59.74	33.65	0	58	212
Agesq	Age of home at time of sale, squared ($years^2$)	4700.55	5311.95	0	3364.00	44,944.00
Salesqtr	Quarter of sale	2.32	0.83	1	2	4
Salesyr	Year of sale	2017	2	2011	2018	2020

Table A.5
Summary of dependent variables and property characteristics, MA

Variable	Description	Mean	Std. dev.	Min.	Med.	Max.
Sp	Sale price ($)	$428,122.04	$284,039.71	$5100.00	$360,000.00	$2,199,000.00
Lsp	log of sale price	12.78	0.63	8.54	12.79	14.6
Lsf	Living area (ft^2)	2019.36	961.96	173	1802.00	35,721.00
Acres	Land area (acres)	0.584	0.764	0.03	0.315	6.6
Age	Age of home at time of sale (years)	62.74	38.25	0	58	209
Agesq	Age of home at time of sale, squared ($years^2$)	5399.73	5906.47	0	3364.00	43,681.00
Salesqtr	Quarter of sale	2.35	0.84	1	2	4
Salesyr	Year of sale	2015	3	2005	2016	2020

Table A.6
Summary of dependent variables and property characteristics, MN

Variable	Description	Mean	Std. dev.	Min.	Med.	Max.
Sp	Sale price ($)	$274,027.53	$152,774.95	$5500.00	$240,000.00	$1,299,000.00
Lsp	log of sale price	12.38	0.56	8.61	12.39	14.08
Lsf	Living area (ft^2)	1956.58	978.6	155	1740.50	42,840.00
Acres	Land area (acres)	0.612	1.316	0.02	0.26	11.87
Age	Age of home at time of sale (years)	42.03	31.21	0	35	134
Agesq	Age of home at time of sale, squared ($years^2$)	2739.86	3587.53	0	1225.00	17,956.00
Salesqtr	Quarter of sale	2.31	0.82	1	2	4
Salesyr	Year of sale	2016	2	2010	2016	2020

Table A.7
Summary of dependent variables and property characteristics, NC

Variable	Description	Mean	Std. dev.	Min.	Med.	Max.
Sp	Sale price ($)	$233,970.66	$169,170.45	$5050.00	$194,000.00	$1,499,500.00
Lsp	log of sale price	12.12	0.75	8.53	12.18	14.22
Lsf	Living area (ft^2)	2091.02	1110.70	150	1852.00	120,215.00
Acres	Land area (acres)	0.788	1.437	0.021	0.36	14.14
Age	Age of home at time of sale (years)	29.48	24.08	0	22	114
Agesq	Age of home at time of sale, squared ($years^2$)	1448.56	2083.56	0	484	12,996.00
Salesqtr	Quarter of sale	2.26	0.86	1	2	4
Salesyr	Year of sale	2016	3	2004	2016	2020

Table A.8
Summary of dependent variables and property characteristics, NJ

Variable	Description	Mean	Std. dev.	Min.	Med.	Max.
Sp	Sale price ($)	$390,953.28	$243,373.52	$5143.00	$340,000.00	$1,599,999.00
Lsp	log of sale price	12.68	0.66	8.55	12.74	14.29
Lsf	Living area (ft^2)	1959.42	868.99	160	1786.00	19,176.00
Acres	Land area (acres)	0.393	0.656	0.006	0.185	6.167
Age	Age of home at time of sale (years)	56.92	30.02	0	57	139
Agesq	Age of home at time of sale, squared ($years^2$)	4140.35	3664.38	0	3249.00	19,321.00
Salesqtr	Quarter of sale	2.31	0.86	1	2	4
Salesyr	Year of sale	2014	4	2004	2014	2020

Table A.9
Categorical variables representing property characteristics (* = omitted category in regressions)

Variable	Category
Fullbaths	Number of full bathrooms missing*
	1 full bathroom
	2 full bathrooms
	3 full bathrooms
	4 full bathrooms
	≥ 5 full bathrooms
Actype	Air conditioning code missing*
	Central AC
	AC type unknown
	Refrigeration AC
	Separate AC system
	No AC
	Evaporative AC
	All other types of AC
Constrtype	Construction type missing*
	Wood construction type
	Frame construction type
	Wood metal/frame construction type
	All other construction types
Heattype	Heating type missing*
	Central heat
	Forced air
	Unknown heating type
	Forced hot water

(*continued on next page*)

Table A.9 (*continued*)

Variable	Category
	Heat pump
	Hot air
	Floor/wall furnace
	No heat
	Steam
	All other heating types
Extwalltype	Exterior wall type missing*
	Stucco
	Frame
	Vinyl
	Aluminum/vinyl
	Wood siding/shingle
	Brick
	Aluminum siding
	Wood siding
	Wood
	All other wall codes
Fireplace	No fireplace indicated*
	Fireplace present
Garagecode	Garage type missing*
	Undefined garage type
	Attached
	Attached frame
	Undefined type – 2 car
	Detached
	Finished
	Basement
	Carport
	Undefined type – 1 car
	Frame
	Attached finished
	Attached garage/carport
	All other garage codes
Stories	Number of stories missing*
	0 to 1 stories
	1 to 2 stories
	2 to 3 stories
	>3 stories
View	View category missing*
	Average view
	All other view categories
newconstruction	New construction not indicated*
	New construction

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Impact of Utility-Scale Solar Farms on Property Values in North Carolina

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Abstract

The aim of this paper is to investigate impacts of utility-scale solar farms on surrounding property values. Using data from CoreLogic, the Energy Information Administration (EIA), and the US Census Bureau, this study identifies a 12% statistically significant increase in sale values associated with high-income residential homes within three miles of a solar farm. However, low-income homes built near solar farms are associated with a -1.4% decrease in sale values.

As North Carolina continues to expand solar energy, specifically through photovoltaic utilities, understanding the impact of solar development on surrounding communities should be a priority and policies should aim to prevent property devaluations in low-income neighborhoods caused by solar farms.

JEL Classification: Q42, R11, Q58

Keywords: Solar farms, Property Values, Local Planning, Renewable Energy, Energy Justice

Introduction

Discussions about solar energy have become increasingly widespread as much of the nation's attention continues to turn toward renewable sources. In North Carolina, solar energy is an especially pertinent topic. According to the Solar Energy Industries Association (SEIA), North Carolina is ranked fourth in the nation for having the most solar installed at 7,811.21 MW, enough to power over one million homes and 8% of the state's electricity portfolio. In terms of economic impact, solar has contributed over 6,000 jobs and invested nearly $10.5 million in North Carolina (SEIA, 2021). The solar industry's strong presence in the state can be credited to North Carolina's state and regulatory policies designed to support the solar industry. For one, North Carolina's Renewable Energy and Energy Efficiency Portfolio Standard (REPS) required all municipal utilities and electric cooperatives to meet a target of 10% renewables by 2018 and have 0.2% of the state's electric power supplied by solar electric facilities (NC Clean Energy Technology Center, 2022). In 2008, North Carolina also announced it would exempt 80% of the appraised value of a solar energy electric system from property tax (NC Clean Energy Technology Center, 2021). Finally, North Carolina's Business and Energy Tax Credits provide a 35% state tax credit for renewable energy projects (NC Clean Energy Technology Center, 2019). These examples demonstrate that the state government has strongly supported solar interests in the past and allowed solar to expand its impact throughout the past decade.

Looking towards the future, solar in North Carolina is expected to continue growing. According to Governor Roy Cooper's 2019 Clean Energy Plan, which called for a 70% reduction in carbon emissions from the utility sector by 2030 and carbon neutrality by 2050, solar capacity is projected to increase by about 4,000 megawatts (MW) by 2025 (NC Department of Environmental Quality, 2019). This growth is aided by House Bill 589, also known as the Competitive Energy Solutions for North Carolina, which includes new programs for competitive renewable energy procurement, solar rebates and leasing, community solar, and specific studies related to renewable energy. Just this year, Governor Roy Cooper issued Executive Order No. 246 to reaffirm North Carolina's commitment to achieving a clean energy economy and net-zero greenhouse gas emissions by 2050 (Exec. Order No. 246, 2022). In a recent report created by the Duke University Nicholas Institute and UNC Center for Climate, Energy, Environment, and Economics, expanding solar is a necessary component to achieving these goals and decarbonizing North Carolina (Konschnik et al., 2021). All this considered, solar will likely continue to be emphasized in order to achieve the state's climate goals.

Though solar energy's environmental implications are widely known to the public, considering the economic and social impacts of implementing solar energy are just as essential. As solar technology improves and the costs of solar energy continue to decrease, it will become increasingly important to explore the potential consequences of such systems. In doing so, we can better prepare for and implement solar more equitably and efficiently.

The purpose of this paper is to explore a question that has often been discussed in the context of the potential externalities associated with solar: what are the potential impacts large-scale solar utilities, or solar farms, have on surrounding property values? By using empirical data on solar farms and house values in North Carolina, this study can help illuminate an important aspect of energy planning in an urban context as the state continues to transition to renewables.

Background

A solar farm can be defined as a large-scale solar installation of photovoltaic (PV) panels that is used to capture light from the sun and convert it to usable energy. On average, solar farms generate five MW, enough to provide electricity for 1200 homes and cut carbon dioxide emissions by 500g/kWh. A solar farm with a megaplate capacity of five MW would typically be built across 15 ha of land, with 30% of the area being covered by 20,000 solar panels (Jones, Hillier, & Comfort, 2014).

North Carolina is considered a leader in the United States for solar electric capacity, ranking fourth in the nation after California, Texas, and Florida (SEIA, 2021). Though the first solar farm in North Carolina only came into operation around 2008, the state now hosts around 335 solar entities with utility-scale solar systems (EIA, 2022). Of these entities, Duke Energy is the largest owner of solar in the state, producing about 3.7 gigawatts and operating 40 solar facilities (Duke Energy, 2021). These entities also include corporations that directly utilize solar energy—SAS has a 2.2 MW solar farm near their headquarters in Cary and Apple has 25 MW of solar capacity installed to power their data center in Maiden (EIA, 2022). In general, solar entities are major players in the expansion of solar; thus, in the discussion of solar farms' impact upon property values, it is helpful to first understand how these entities decide where to build solar farms.

When choosing a site, these solar developers go through a due diligence process that involves both offsite and onsite inspections using technology such as GIS, ALTA surveys, and Geotech surveys. Optimal sites include large stretches of clear land with limited topography but within close proximity of a transmission line. In terms of land cover types solar farms are typically developed on, they include a mix of agricultural, forested, and urban areas. The vast majority of solar energy is generated on former agricultural land (63.5%) because the land is easier to purchase or lease and does not require clearing forests in preparation (Figure 1).

Table 1: Percentage of land cover types in North Carolina and at solar utility locations

	Forest & Woodland	**Agriculture & Developed Vegetation**	**Developed & Other Human Use**	**Open Water**	**Recently Disturbed or Modified**	**Other**
NC	47.9%	20.9%	10.2%	9.4%	7.4%	4.1%
Solar Farms	12.3%	63.2%	16.7%	0.2%	7.1%	0.4%

Source: Curtis et al., 2020

However, developers may only start construction after going through the necessary permitting processes specified by the municipality that has jurisdiction over the site's territory. For North Carolina specifically, most local governments provide zoning and land use regulations but have yet to specify regulation of solar development. As of 2012, 87% of the state's municipalities and 79% of North Carolina's counties had adopted zoning ordinances. However, only 24 cities and 18 counties instituted solar developments into their codes (NC Clean Energy Technology Center, 2016). Included as one of those cities, Raleigh's municipality has specified that solar developers must prepare non-residential permit applications for constructing in all major zoning districts (Raleigh). Huntersville also requires the issuance of Special Use Permits (Huntersville). Though the number of municipalities with solar zoning ordinances is now higher, solar development regulation in the state is still rather inconsistent and permitting criteria undefined. As cities are developing to refine their solar development zoning regulations, understanding the impact that utility-scale solar development has on surrounding residential zones can be informative on what to permit and what not to permit.

Current Literature

Though there is considerable research about the impacts of wind turbines, power plants, and transmission lines on property values, there has yet to be a substantial amount of literature regarding a potential relationship between solar farms and property values. The only study specific to North Carolina is from Kirkland Appraisals, which used matched-pair analyses, essentially comparing prices of properties adjoining a solar farm and similar properties further away from a solar farm. This study observes a -5% to 5% difference in square-foot sales price, a range that Kirkland considers insignificant (Kirkland, 2016).

However, of the papers that have been released about the subject generally, there already have been some important insights regarding the communities that live near solar utilities. First, some community members who live or are expected to live near solar utilities have already expressed concerns regarding solar farms' impact on property value. For example, while pushing for the approval of a solar farm in Suffolk in England, the St. Edmundsbury Borough Council noted that "concerns have been expressed over the impact on neighboring property values from the proposed solar farm" but emphasized "they are not considered to be material to the assessment of this application" (The SolarTrade Association, 2013, as cited in Jones, Hillier, & Comfort, 2014). Other examples of community members expressing concerns over solar farms negatively impacting property values have also often been dismissed largely because current literature has not found clear evidence suggesting that is the case. For example, Al-Hamoodah et al. found that few homes are likely to be impacted by solar farms (2018).

Even so, solar farms continue to experience problems with community acceptance. In one study, it was found that larger projects are less likely to receive public support. Other factors such as trust in the "owners" of the project, land access and habitat preservation concerns, government involvement, and cost perception all affect community acceptance (Carlisle et al, 2015). In another study, it was found that each successive year taken to plan for installing solar farms decreased the likelihood of the project's completion by 21.5%. Thus, instead of solar farms facing more acceptance over time, solar utilities face more obstacles as planning continues. Furthermore, it was found that a unit increase in planned installed capacity also has a negative effect on the likelihood a solar farm would be successfully implemented. In fact, each unit increase resulted in about 2.2% decrease in the likelihood of a positive outcome (Roddis et al, 2018). It is important to understand the reasoning of why communities may be unaccepting towards utility-scale solar, especially if the state hopes to continue expanding it.

These examples of "cold feet" may be influenced by preexisting beliefs people may hold against solar farms. One survey found that while 80% of respondents support solar installations in the US and even their own county, 70% of respondents believe that large-scale solar installations will decrease property values (Carlisle et al., 2015, as cited in Al-Hamoodah et al., 2018). Another study conducted by the Idaho National Laboratory found that 43% of respondents from the southwest United States agree that being able to see a large-scale solar facility from their properties would decrease their homes' values. In the same survey, about 70% of respondents indicated that they would require the buffer zone around a solar facility to be at least one mile between the solar farms and residential areas (Idaho National Laboratory, 2013, as cited in Al-Hamoodah et al., 2018).

These concerns from community members indicate that more research should be dedicated to measuring any possible impacts solar utilities may have on surrounding property values. If negative impacts are discovered, urban planners can better use that information to implement solar more fairly. If no impacts are discovered, urban planners and renewable energy players can work to assuage community concerns.

Data and Methods

This paper uses data from the US Energy Information Administration EIA-860M, CoreLogic, and the US Census Bureau. The first dataset provides exact coordinates of all 700 operating solar photovoltaic electricity generators in North Carolina, as well as their operating years all the way up to November 2021 and nameplate capacity. The latter provides sale amounts and coordinates for North Carolina properties, as well as general characteristics of the home such as number of beds, bathrooms, and square footage. The CoreLogic data was cleaned so that it only included single-family homes with one to six bathrooms and bedrooms. Furthermore, only properties under 10 acres were used. The sold year was limited to between 2000 and 2016 to account for potential confounding variables associated with dramatic changes in the housing market over time. To account for outliers, any sale below $10,000 and the top 5% of transaction values were removed (above $309,500). Finally, the last data source supplied household income information to each property data point using census tract numbers.

ArcGIS was used to measure the line distance between the residential properties and their closest utility solar farm. Only properties within 10 miles of a solar farm were used. Of the cleaned CoreLogic and EIA-860M datasets, 101,700 properties were within 10 miles from a solar farm and 105 solar utilities had properties within 10 miles of them. After adding on the US Census Bureau data, 33,063 homes within the specified radius had income data. These homes preserved representation from all the 105 utilities specified above. The final dataset contained 33,063 observations and 105 solar utilities.

To explore whether the distance between a home and the nearest solar farm would significantly affect its property value, the following hedonic regression model was used:

$$\log(SP) = \alpha + \beta_1(Close) + \beta_2(SoldAfter) + \beta_3(YearBuilt) + \beta_4(SoldYear) + \beta_5(Plants) + \beta_6(Bedrooms) + \beta_7(Bathrooms) + \beta_8(Acres) + \beta_9(BuildingSqFt) + \beta_{10}(Close * SoldAfter) + \beta_{11}(LowIncome * SoldAfter) + \beta_{12}(LowIncome * Close) + \beta_{13}(Close * SoldAfter * LowIncome) + \varepsilon$$

The dependent variable of interest in this model is the sale price of homes throughout North Carolina, defined as *SP*. The log of *SP* was used to interpret the change in property value as a percentage. The main independent variables under investigation are 1) the interacting variable *Close*SoldAfter* and 2) the interacting variable *Close*SoldAfter*LowIncome*. The other covariates are listed below:

- ***Close*** as a dummy variable for properties built within three miles of a solar farm
- ***SoldAfter*** as a dummy variable for properties sold after the solar farm was built
- ***YearBuilt*** as dummy variables for every decade that homes were built in the dataset
- ***SoldYear*** as dummy variables for every year that homes were sold between 2000 and 2016
- ***Plants*** as dummy variables for each solar farm (accounting for location and other variables that may impact property value that is associated with location)
- ***Bedrooms*** as dummy variables that represent number of bedrooms (only 1-6 bedrooms are represented in the data)
- ***Bathrooms*** as dummy variables that represent number of bathrooms (only 1-6 bedrooms are represented in the data)
- ***Acres*** as the size of the property in acres, limited to 10 acres
- ***BuildingSqFt*** as the size of the home itself in square feet (without yard or anything outside the physical home)
- ***LowIncome*** is defined as any household that earns $45,518 or less. This amount was calculated by averaging the low-income threshold for each county in North Carolina; this data is provided by US Department of Housing and Urban Development. Because the sample size of high-income households is too small, middle- and high-income regions are not differentiated.

Table 2: North Carolina summary statistics

Variable	Descriptions	Mean	St. Dev.	Min	Max
Sale Price	The price at which the home is sold	125,500	60,798	10,000	309,500
Close	Marked 0 if the home is between 3 to 10 miles from the nearest solar farm and marked 1 if the home is within 3 miles from the nearest solar farm	0.322	0.467	0	1
Sold After	Marked 0 if the home is sold before the nearest solar farm is built and marked 1 if the home is sold after the nearest solar farm is built	0.078	0.268	0	1
Year Built	The year in which the home was built	1975	24.80	1750	2015
Acres	The number of acres the home occupies (both the building itself and the outside area surrounding the building)	0.686	0.957	0.010	10
Solar Farm Operating Year	The year in which the solar farm began operations	2015	2.290	2010	2021
Distance	The distance between the home and the nearest solar farm	4.796	2.621	0.076	9.975
Income	Average household income of the home's census tract	51,876	15,206	11,278	176,607
Low Income	Marked 0 if the associated household income is not considered low-income and marked 1 if it is low-income	0.386	0.487	0	1

Results

The results center around the coefficients for the interacting variables $\beta_{10}(Close * SoldAfter)$ and $\beta_{13}(Close * SoldAfter * LowIncome)$. β_{10} describes the effect solar farms would have on homes that are within three miles of a solar farm and sold after the solar farm was built. β_{13} has the added component of the home being in a low-income neighborhood. The final effect on low-income homes is reflected by taking both β_{10} and β_{13} into account ($\beta_{10} + \beta_{13}$).

These coefficients are shown in the figure below:

Table 3: Regression Table

Regression Table

	Dependent variable:
	log(sale_amount)
Close	-0.020^{*}
	(0.009)
Sold After	0.040
	(0.021)
Close * Sold After	0.120^{***}
	(0.028)
Close * Low Income	-0.071^{***}
	(0.013)
Sold After * Low Income	-0.015
	(0.025)
Close * Sold After * Low Income	-0.134^{***}
	(0.045)
Constant	15.23^{***}
	(0.037)
Observations	33,063
R^2	0.393
Adjusted R^2	0.389
Residual Std. Error	0.484 (df = 32816)
F Statistic	87.24^{***} (df = 244; 32816)
Note:	*p**p***p<0.01

As seen from the figure above, the difference in property values when accounting for distance to a solar farm and whether the property was built before or after the farm is statistically significant.

Specifically, there is a positive 12% change in home value when accounting for the said variables. However, that is only the case when accounting for high-income neighborhoods; there is a -1.4% change in home values for specifically low-income regions.

Alternative specifications in regressions were also analyzed to test whether the results would still be robust. For each different regression, a different set of covariates were utilized.

Table 4: Alternative Specifications

Dependent Variable: Log(sale price)	*A* (*S.E.*)	*B* (*S.E.*)	*C* (*S.E.*)	*D* (*S.E.*)	*E* (*S.E.*)	*F* (*S.E.*)	*G* (*S.E.*)	*H*[1] (*S.E.*)
Acres	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Square Feet of Residence	Yes	Yes	No	Yes	Yes	Yes	No	Yes
Bedrooms	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bathrooms	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Plant_ID	Yes	Yes	No	No	No	No	Yes	Yes
Regions	Yes	No	No	No	No	Yes	No	No
Built Year (Dummy Variable)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sale Year (Dummy Variable)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Low Income	No	Yes	Yes	Yes	Yes	Yes	Yes	No
Home within 3 miles of solar farm	-0.020* (0.009))	-0.021* (0.009)	-0.067*** (0.009)	-0.042*** (0.009)	-0.036*** (0.009)	-0.061*** (0.009)	-0.027* (0.009)	-0.020* (0.009)
Home sold after solar farm's operation year	0.041 (0.021)	0.041 (0.021)	0.309** (0.019)	0.058** (0.018)	0.016 (0.018)	-0.270*** (0.019)	0.045* (0.022)	0.040 (0.021)
Home within 3 miles sold after solar farm's operation year	0.120*** (0.028)	0.120*** (0.028)	0.119*** (0.031)	0.089** (0.029)	0.113*** (0.029)	0.145*** (0.030)	0.113*** (0.029)	0.120*** (0.028)
Low-income home within 3 miles of solar farm	-0.070*** (0.013)	-0.069*** (0.013)	-0.224*** (0.014)	-0.149*** (0.013)	-0.142*** (0.013)	-0.219*** (0.014)	-0.087*** (0.014)	-0.071*** (0.013)
Low-income home sold after solar farm's operation year	0.015 (0.025)	-0.014 (0.025)	0.035 (0.029)	0.0003 (0.027)	0.009 (0.026)	0.041 (0.028)	-0.033 (0.026)	0.015 (0.025)
Low-income home within 3 miles of solar farm and sold after solar farm's operation year	-0.134** (0.045)	-0.135** (0.045)	-0.063 (0.050)	-0.062 (0.048)	-0.079 (0.046)	-0.066 (0.050)	-0.105* (0.046)	-0.134** (0.045)
Constant	15.56*** (0.686)	15.23*** (0.037)	15.69*** (0.037)	15.34*** (0.041)	15.07*** (0.04)	15.07*** (0.040)	15.43*** (0.037)	15.23*** (0.037)
Observations	33,063	33,063	33,063	33,063	33,063	33,063	33,063	33,063
R^2	0.394	0.392	0.212	0.297	0.294	0.236	0.365	0.393
Adjusted R^2	0.389	0.388	0.211	0.296	0.293	0.235	0.36	0.389
Residual Std. Error	0.484 (df = 32816)	0.484 (df = 32819)	0.550 (df = 33019)	0.519 (df = 33016)	0.522 (df = 33209)	0.542 (df = 33018)	0.495 (df = 32819)	0.484 (df = 32818)
F Statistic	86.53*** (df = 246, 32816)	87.21*** (df = 243, 32819)	207.1*** (df = 43, 33019)	303.3*** (df = 46, 33016)	300.1*** (df = 46, 33209)	231.2*** (df = 44, 33018)	77.54*** (df = 243, 32819)	87.24*** (df = 244, 32818)
Note:	*p**p***p<0.01							

In alternative regressions A, B, and G, the results were significant for both interaction variables of interest. Interestingly, these regressions specify the solar farms that the properties are closest to, suggesting that there may be specific characteristics about the solar farms that may influence surrounding property values: location, size of the solar farm, or age. Because they follow the trend specified in the

[1] Original regression

original regression, they reaffirm the results presented above and the original regressions appears robust. However, more research should be done investigating whether specific characteristics of solar farms impact property values differently.

Discussion

The results show that we need two explanations to describe the results: one to explain why there is a positive impact on property values in middle- and high-income neighborhoods, and another to explain why there is a negative impact on low-income neighborhoods.

In explaining the positive impact on neighborhoods, there may be some parallels between price premiums often associated with solar panels or hybrid cars and an increase in property values after a solar farm is built. There have been multiple studies that have identified examples of "conspicuous conservation," or a consumer behavior in which typically high income, college-educated households are willing to invest in visible "green" options because it signals a "green" social status. In Bollinger et al., they discovered that the visibility of solar panels from the street positively affected solar adoption at distances of at least 500 meters (2019). This suggests that because homeowners understood that their solar panels would be seen by those passing by, they were more likely to build solar panels on their roofs. Another study by Sexton & Sexton identified a willingness to pay in the range of $430-$4200 for a Toyota Prius because it provided a "green signal" (2013). Finally, Dastrup et al. identified a 3.5% premium associated with solar panels. The premium was estimated to be even larger in communities with majority college graduates and registered hybrid vehicles (2012).

A limitation of this idea in the context of solar farms is that both solar panels and Toyota Prius are obviously visible signals. Solar farms, on the other hand, are not as easily visible both to surrounding properties as well as passersby. Thus, though the idea of "conspicuous conservation" may be associated with solar panels and hybrid vehicles, it does not provide a perfect parallel to solar farms.

In terms of explaining why solar farms may have a negative impact on low-income households' property values, there could be several potential explanations. For one, it may be a similar phenomenon as wind farms decreasing surrounding property values. In a study by Sunak, it was found that proximity to a wind farm causes significant negative impacts on nearby property values in Germany (2013). While there was a lack of evidence that the visibility of the wind turbines or shadow flickering affected property values, there was evidence that properties sold after the construction of the wind farm had lower values than properties sold before construction. If parallels can be drawn between wind turbines and solar farms, then perhaps the construction of the solar farms may have some impact on property values. However, more research is needed on this subject.

Potential ways to mitigate solar farms' negative impacts on property values should involve community members in planning and development processes. One study by Devine-Wright found that greater public engagement in the decision-making processes can increase public approval (cited in Carlisle et al., 2015). However, much like the previous explanation, more research is needed on this issue in order to better understand potential vulnerabilities and more effective solutions.

Conclusion

This paper aims to explore the potential impact solar farms have on nearby home values. Analyses of data from the EIA and North Carolina property values show that solar farms are generally located in ZIP codes with lower property values. When considering the needs of solar farms, this pattern makes sense: solar farms need flat and uninterrupted expanses of land, as well as areas with existing electricity infrastructure, which more commonly house lower-income residents (Roddis et al, 2018). However, hedonic regressions show that these properties are also associated with decreasing home values if within proximity of a solar farm.

These results show that potential negative impacts from solar farms will be felt only by lower-income homeowners. The growing number of solar farms being built in the United States only emphasizes the urgency of understanding this relationship. Just last year, Duke University partnered with a solar energy developer in North Carolina in attempts to reach their carbon neutral goals by 2024 (Duke, 2020). Though this decision is an important move in decreasing carbon emissions, it may also cause the unintended consequences of encouraging the construction of solar farms near residential areas, thus decreasing the property values of impacted neighborhoods. These results emphasize the continuing need to clarify the impacts solar farms have on surrounding communities.

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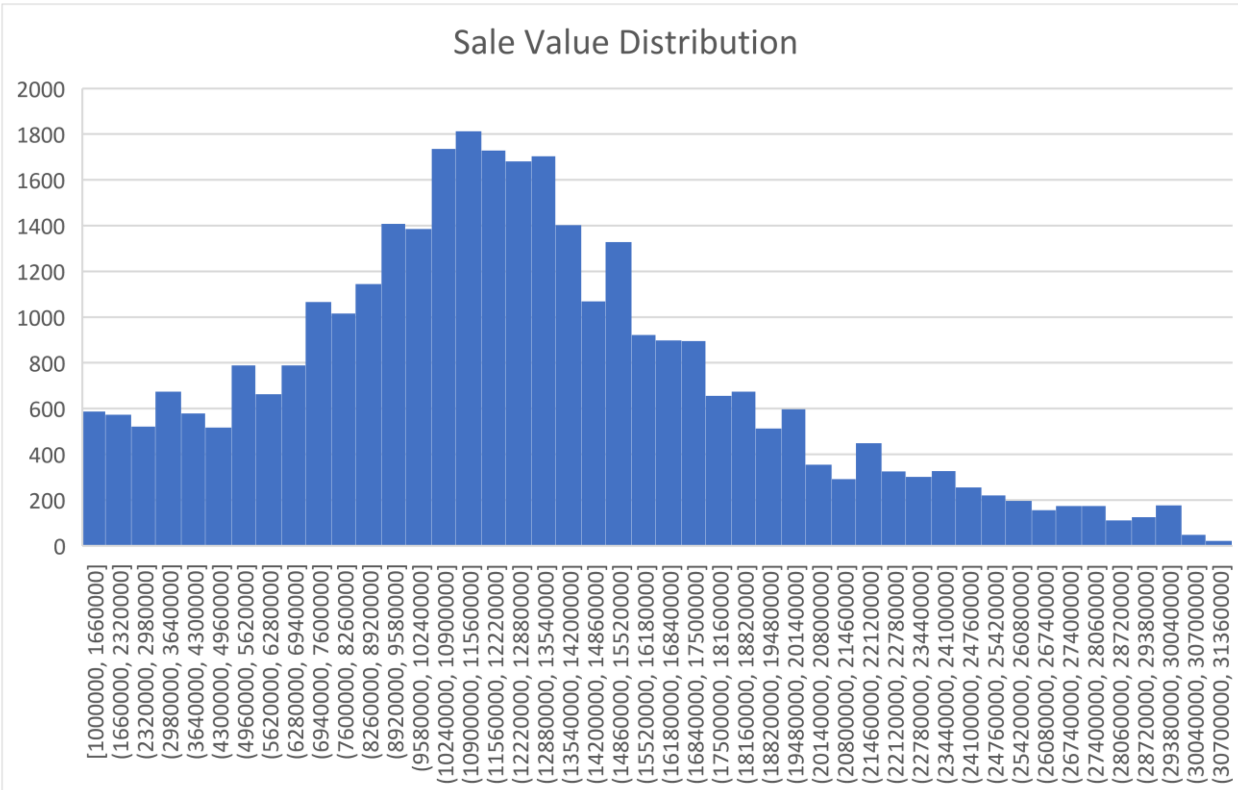
Appendix

A. Distribution of Sale Values



B. Multicollinearity Test for Hedonic Regression

	GVIF	Df	GVIFDf))
Close	2.558	1	1.599
Sold After	4.474	1	2.115
Built Year	4.593	9	1.088
Sale Year	22.256	16	1.102
Baths	2.223	5	1.083
Bedrooms	2.046	5	1.074
Acres	1.256	1	1.121

Building Square Feet	2.241	1	1.497
Plant	257.794	200	1.014
Low Income	1.920	1	1.386
Close * Low Income	3.284	1	1.812
Close * Sold After	2.698	1	1.643
Sold After * Low Income	2.516	1	1.586
Close * Sold After * Low Income	2.626	1	1.620

Because the *GVIFDf* measurement for all the variables are under 5, multicollinearity was not detected.

PROPERTY VALUE IMPACTS OF COMMERCIAL-SCALE SOLAR ENERGY IN MASSACHUSETTS AND RHODE ISLAND

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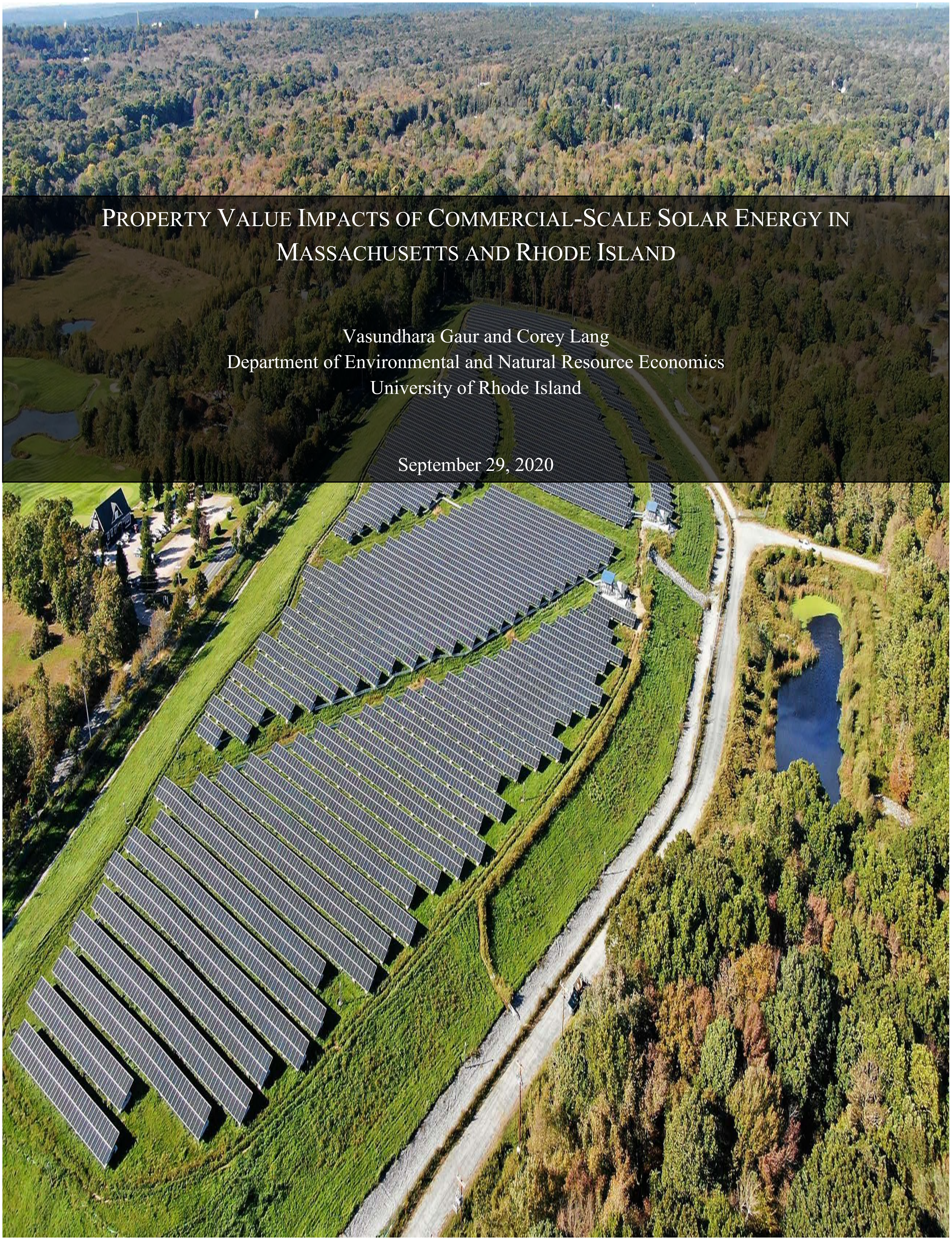
September 29, 2020



ABSTRACT

While utility-scale solar energy is important for reducing dependence on fossil fuels, solar arrays use significant amounts of land (about 5 acres per MW of capacity), and may create local land use disamenities. This paper seeks to quantify the externalities from nearby solar arrays using the hedonic method. We study the states of Massachusetts and Rhode Island, which have high population densities and ambitious renewable energy goals. We observe over 400,000 transactions within three miles of a solar site. Using a difference-in-differences, repeat sales identification strategy, results suggest that houses within one mile depreciate 1.7% following construction of a solar array, which translates into an annual willingness to pay of $279. Additional results indicate that the negative externalities are primarily driven by solar developments on farm and forest lands in non-rural areas. For these states, our findings indicate that the global benefits of solar energy in terms of abated carbon emissions are outweighed by the local disamenities.

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1 INTRODUCTION

Solar energy in the United States has grown at an average rate of 49% per year since 2009, making the US the second largest producer of solar energy in the world (EIA International Energy Outlook 2019). In 2019, solar energy accounted for 40% of all new capacity additions in the country, the largest ever in its history, and exceeding all other energy sources (Perea et al., 2020). By June 2020, the cumulative installed capacity of solar in the United States reached 81.4 gigawatts (GW), which is enough to power 15.7 million homes (Perea et al., 2020). Solar is predicted to overtake wind to become the largest source of renewable energy in the US by 2050, accounting for 46% of all energy produced from renewable sources (EIA Annual Energy Outlook 2018).

While there is a broad support for renewable energy in the United States (Bates & Firestone, 2015; Farhar, 1994; Firestone et al., 2018; Hoen et al., 2019; Krohn & Damborg, 1999), and for solar energy in particular (Carlisle et al., 2014, 2015; Farhar, 1994; Greenberg, 2009; Jacobe, 2013; Pew Research Center, 2019), the development of large-scale solar installations has not been obstacle free. One major hurdle to overcome before construction begins is the siting process. Solar installations require over ten times more land area than non-renewable sources to generate the same amount of energy, and the requirement of large tracts of land for their construction has become the largest cause of land use change in the United States (Trainor et al. 2016; Ong et al. 2013). Recently, the siting of large solar projects has become contentious in some parts of the country due to concerns about visual disamenities, impacts on ecosystems, siting of transmission lines, loss of a town's rural character, water pollution, fire risk, water use, and reduction in property values (Farhar et al., 2010; Gross, 2020; Lovich & Ennen, 2011). The debate is especially heated when solar development is proposed on existing farm and forest lands, which is common because these are the cheapest locations for development (Kuffner, 2018; Naylor, 2019).

The purpose of this paper is to quantify the externalities associated with proximity to utility-scale solar installations using hedonic valuation. Theory indicates that property values will reflect people's willingness to pay to avoid the cumulative disamenities of solar development (Bishop et al., 2019; Rosen, 1974). Our study focuses on the states of Massachusetts (MA) and Rhode Island (RI), which are ideal for two reasons. First, both states have recently experienced a sudden boom in the development of large-scale solar installations. This trend has been driven by the Renewable Portfolio Standards (RPS), regulations that require increased energy production from renewable energy sources, which have been adopted by both states. MA's RPS calls for 25% of electricity generated by renewable sources by 2030 and RI's RPS calls for 38.5% by 2035. Second, both states have high population density, ranked 2nd and 3rd among U.S. states. This level of development means that most solar sites are proximate to residential areas, which yields many observed transactions for precise estimates.

We analyze the impact of utility-scale solar installations sized 1 MW and above on nearby property prices in MA and RI.[1] We use a difference-in-differences (DID) identification strategy, which compares changes in housing prices after construction for nearby properties with those further away. We empirically estimate the spatial extent of treatment to be one mile from the solar installation and choose a cutoff for control properties of three miles. Our primary sample consists of 208 solar installations, 71,337 housing transactions occurring within one mile (treated group), and 347,921 transactions between one to three miles (control croup).

Across a variety of specifications, our results suggest that solar installations negatively affect nearby property values. Our preferred specification, which includes property fixed effects (i.e., repeat sales), month-year fixed effects, and county-year fixed effects, indicates that property values in the treatment group decline 1.7% (or $5,751) relative to the control group, and this estimate is statistically different from zero at the 1% level. These findings suggest that solar arrays create local, negative externalities, and the average household annual willingness to pay to avoid these externalities is $279. This helps explain local concerns and opposition and gives pause to current practices of not including proximate residents in siting decisions or compensating them after siting has occurred. While we cannot estimate producer and consumer surplus, we can compare external benefits and costs. Our estimates imply that the global positive external benefits of carbon mitigation are outweighed by local externalities costs at a ratio of 0.46. However, renewable energy in New England usually displaces natural gas use by power plants. Solar in more rural places (thus affecting fewer households) and solar that displaces coal would have a more favorable benefit-cost ratio.

We also examine heterogeneity in treatment effects in several ways. First, with respect to proximity, we find substantially larger negative impacts on homes located within 0.1 mile of

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[1] Following the U.S. Energy Information Administration (EIA), we define large-scale solar installations as those with an installed capacity of 1 MW or larger.

solar installations (-7.0%). Second, we estimate a series of models exploring heterogeneity based on prior land use (farm or forest vs. landfills or industrial areas) and rural character of a municipality (defined based on population density). The results suggest that the overall negative effects of solar arrays on nearby property values are driven by farm and forest sites in non-rural areas (non-rural is most akin to suburban, as there are very few solar sites in urban areas). Solar developments on landfills and industrial areas or in rural areas have smaller and statistically insignificant effects on prices. We posit that solar arrays on farm and forest lands cause greater externalities, given the dual loss of open space amenities and gain of industrial disamenities, and that this effect hinges on the scarcity of open space typical in non-rural areas.

2 Conceptual Framework

Environmental goods and services are often ‘non-market goods’, meaning they are not traded in any market. However, that does not mean that they have no value. Using economic theory, we can estimate environmental values by examining people’s decisions and how they make choices and tradeoffs regarding such goods.

One way of valuing environmental goods and services is through the revealed preference method where the preferences of individuals are inferred through their actual buying and selling decisions in a related market. For example, air quality is not transacted in any market, but people ‘reveal’ their value for it when they buy homes away from urban and industrial areas with high traffic volumes and poor air quality. In this example, air quality is the non-market good, the ‘actual buying and selling decision’ is the choice of purchasing a house with specific characteristics, and the ‘related market’ is the housing market.

A common application of the revealed preference method is the hedonic housing price technique. First theorized by Rosen (1974), the hedonic price model (HPM) measures the implicit price of each attribute of a bundled good. Applied to the housing market, the idea is that the price of a property can be broken down into the price of its various attributes. These attributes can be structural (e.g. lot size, living area, number of bedrooms and bathrooms, presence of air conditioning or pool, etc.), neighborhood (e.g. school quality, proximity to shopping, etc.), and environmental (e.g. air and groundwater quality, tree cover, proximity to brownfield, etc.). More formally, let us consider a house i, and let P_i denote its price, S_i the set of structural characteristics, N_i the neighborhood characteristics, and E_i the environmental characteristics of that house. Then the hedonic price function of the house can be represented mathematically as a function of its characteristics:

$$P_i = f(S_i, N_i, E_i) \quad (1)$$

When purchasing a house, the consumers make tradeoffs between their desired quantities of each of these attributes and price. Further, in equilibrium, prices adjust to reflect willingness to pay for the bundled attributes. By examining transacted properties with sales price and attributes, the implicit value of each attribute can be estimated. In the context of solar development, the value that people place on solar arrays can be estimated by examining transactions in close proximity to solar arrays compared to those further away.

The HPM is a well-established and frequently used tool for measuring nonmarket values. It has been used extensively in the literature for estimating the willingness to pay for environmental amenities like air quality (Bajari et al., 2012; Bayer et al., 2009; Bento et al., 2014; Chay and Greenstone, 2005; Grainger, 2012; Lang, 2015; Ridker and Henning, 1967) and open space (Anderson and West, 2006; Black, 2018; Geoghegan et al., 1997; Irwin, 2002; Lang, 2018), and also environmental disamenities like brownfields (Haninger et al., 2017; Lang and Cavanagh, 2018; L. Ma, 2019) and electrical transmission lines (Hamilton and Schwann, 1995). Several hedonic studies also estimate the public's valuation of non-renewable energy sources and infrastructure, particularly coal plants (Davis, 2011), nuclear energy (Gawande and Jenkins-Smith, 2001; Tanaka and Zabel, 2018), petroleum storage (Zabel and Guignet, 2012), and hydraulic fracturing (Boslett et al., 2016, 2019; Gopalakrishnan and Klaiber, 2014; Muehlenbachs et al., 2015).

The HPM produces intuitive and policy relevant results. For example, Haninger et al. (2017) analyze federal brownfield remediation and find that properties in close proximity to EPA-funded remediated brownfields appreciate 5-11% following cleanup, and that in aggregate this valuation exceeds the costs of remediation and hence the federal program passes a benefit-cost test. Lang (2018) examines municipal land conservation spending in the United States, and estimates that properties on average appreciate 0.68–1.12% for every $1000 per household of open space spending authorized. The positive appreciation implies that the valuation of open space amenities exceeds the costs of additional taxes, and further that land conservation is underprovided. Muehlenbachs et al. 2015 analyze hydraulic fracturing ("fracking") in Pennsylvania and find that properties within 1km of a well pad decline in value 16.5%, but only when the properties use well water, public water supply houses are unaffected. These results suggest that perception of risk is focused on contaminated drinking water.

The HPM has become increasingly popular for the valuation of renewable energy in recent years, with the most frequent applications focusing on wind energy. Within the United States, studies that use data with large numbers of observations close to turbines find no significant impact on property prices. Hedonic studies that find no negative externalities from onshore wind energy development include Hoen et al. (2011) for 24 wind facilities across the United States; Lang et al. (2014) for 10 wind turbine sites in Rhode Island; Hoen et al. (2015) for 67 wind facilities (with over 45,000 turbines) installed all over the United States through 2011, and Hoen and Atkinson-Palombo (2016) for 41 turbines in densely populated areas of Massachusetts. In contrast, studies in European countries find that wind turbines have a significantly negative impact on nearby properties, though the magnitude of the effect differs by region (Dröes & Koster, 2016; Gibbons, 2015; Sunak & Madlener, 2016). Vyn (2018) finds the Canadian experience to be heterogeneous and dependent on community acceptance. More recently, hedonic methods have focused on estimating externalities from offshore wind turbines. While this literature is still in its infancy, early studies indicate no negative impacts to property values in the vicinity of offshore wind turbines (Jensen et al., 2018) and positive impacts to tourism (Carr-Harris & Lang, 2019).

Hedonic valuation has also been applied to residential rooftop solar. General consensus is that houses installed with rooftop photovoltaic (PV) panels sell for a premium, though there is regional variation in the size of the effect: 3.5% in California (Dastrup et al., 2012; Hoen et al., 2012), 5.4% in Hawaii (Wee, 2016), 17% in Arizona (Qiu et al. 2017), and 3.2% in Western Australia (Ma et al. 2016). However, this literature is only tangentially related as it is about quantifying internalities (valuation of personal financial benefits), not externalities, and has nothing to do with land use.

In sum, there exists little information on the externalities associated with large-scale solar installations within the United States. It is therefore necessary to understand the value people place on solar structures in order to help state and municipal policy makers implement policies and decisions that reflect public preferences.

3 Data

To implement the hedonic analysis, we build a composite dataset that integrates: 1) the data on the location and attributes of all solar developments in MA and RI, and 2) the data on attributes and locations of residential properties in MA and RI.

3.1 Solar data

The dataset on solar installations is obtained from the Energy Information Administration's (EIA's) report EIA-860M, or the Monthly Update to the Annual Electric Generator Report. The EIA-860M contains data on the total capacity of electric generation facilities in the United States that have a capacity of 1 MW and above, their point location (latitude and longitude), and the month and year that generation begins. Figure 1 represents a map of 284 solar installations constructed prior to August 2019, which is when we set the cutoff for being in our sample. The installations are well dispersed across all regions in both states, which increases confidence that estimates will not be affected by unobserved regional differences. We exclude 76 solar installations (27% of all installations) that are built within 1 mile of each other, since property value impacts may be hard to measure for observations in the proximity of multiple installations.[2] This is similar to a sample cut made by Haninger et al. (2017).

Figure 2 graphs new and cumulative solar capacity by year. The first installation came online in December 2010. New capacity displays a continuous upward trend through 2014. There is a sharp fall in 2015, after which the trend rises again and peaks in 2017, before falling again in 2018. As of August 2019, the cumulative solar capacity in RI and MA is 817 MW. Capacity factors for this region are about 16.5% (EIA 2019), which means these solar installations are collectively producing 1180 GWh of electricity per year, which is enough to power 157,681 homes.

One limitation of our data is that we do not have shapefiles representing the exact footprint of the solar installations, thus we must approximate that using Geographic Information Systems (GIS) software. Solar installations require approximately 5 acres of land per MW of capacity (Denholm & Margolis, 2008; Ong et al., 2013). We assume that the point location is the

[2] Figure A1 in the online appendix represents a map of the resultant 208 solar installations.

centroid of the installation and then create a circle around it with an area equal to 5 times the capacity (in MW) of each array.[3]

We hypothesize that prior land use may affect property value impacts. Specifically, houses in proximity to farms and forests that are developed into solar may depreciate more than houses in proximity to a brownfield or capped landfill that is developed into solar.[4] Since farms, forests, and other open space are amenities and boost home values (Irwin, 2002; Lang, 2018), conversion of these types of lands may lead to larger price decreases because it is the combination of a loss of amenities and the gain of disamenities. To infer prior land use, we overlay the estimated circular footprints on 2005 land use data obtained from Massachusetts Bureau of Geographic Information and 2011 land use data obtained from Rhode Island Geographic Information System for the respective states. We then assign each installation a prior land use: 'greenfield' if it was formerly either a farm or forest land, and 'non-greenfield' if it was either a commercial site or a landfill.[5] 63% of installations and 70% of capacity is classified as greenfield (see Figure A2 in the online appendix).

3.2 Property data

We use ZTRAX housing transaction data from Zillow (http://www.zillow.com/data), which include information on property location (latitude and longitude), sales price, date of transaction, and many property characteristics (lot size, square feet of living area, number of bedrooms, number of bathrooms, year built, number of fireplaces, central air-conditioning, and

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[3] We manually crosscheck the EIA data with Google Maps, and correct the latitude and longitude when they do not correspond to the centroid of the array. We recognize that this approach could lead some properties to be misclassified as treatment or control, inducing a small amount of measurement error in treatment status. As a result, our DID estimates may be slightly attenuated.

[4] Solar developers prefer farm and forest lands because they have substantially lower construction costs compared to alternative sites like brownfields, landfills, superfunds and industrial lands.

[5] Several solar installations cover an area with multiple land uses. We obtain exactly one land use type per solar site in five additional steps. First, we classify the land use as 'landfill' if the installations have the term 'landfill' in their name, or if they are listed in the EPA's dataset of contaminated land. Second, we use a stratifying logic to group all land-use types under seven major categories: commercial, farm, forest, landfill, recreational, residential, and wetland. Third, we place *'transportation', 'urban public/institutional', 'industrial', 'powerline/utility'*, and *'junkyard'* under commercial; *'orchard', 'cropland', 'pasture', 'nursery',* and *'cranberry bog'* under farm; *'spectator recreation',* and *'participation recreation'* under recreation, *'multi-family residential', 'low density residential', 'medium density residential', 'very low density residential'*, and *'high density residential'* under residential; and *'forested wetland', 'water',* and *'non-forested wetland'* under wetland. Fourth, we rank all land use categories under each installation by area, such that the land use with the greatest area gets the highest rank. We drop all land use categories but the ones with the highest rank to obtain exactly one land use per installation in the following four major categories: commercial, farm, forest, and landfill.

swimming pool). The data include 2,095,835 property transactions from January 2005 to June 2019 in the states of RI and MA. Houses with missing observations for sales price, bedrooms, full bathrooms, and half bathrooms are dropped. We also drop groups of single-family residential properties with the same latitudes and longitudes, but different addresses. Sales prices are adjusted to 2019 levels using the Northeast regional housing Consumer Price Index from Bureau of Labor Statistics. After dropping transactions with prices of $100 or less, since these are clearly not arms-length transactions, we drop transactions in the bottom and top 5% of the sales price distribution to get rid of outliers. Further, we drop observations that have more than four stories, six bedrooms, five full bathrooms, or three half bathrooms. Houses that underwent major reconstruction are dropped since they may have different attributes in previous transactions. We exclude homes that sell before they were built, as there is evidence these are lot sales without improved property. We also drop single-family residential properties with lot sizes larger than 10 acres, since large plots could be potential sites for solar development and price impacts of nearby solar could be completely different. Condominiums are assigned a lot size value of zero acres and are identified with an indicator variable. The subjective condition of properties is defined by a dummy variable equal to 1 indicating above average condition.

Similar to prior land use, we hypothesize that existing development in areas surrounding solar arrays may impact property prices. Many rural areas pride themselves on their rural character and residents seek out that type of bucolic setting. Hence, construction of solar installations could be seen as an industrialization of the landscape and may cause larger negative impacts on property values. We proxy for rural character with municipality-level population density, which comes from the 2010 Census. We define an indicator variable $Rural$, which equals one if the town has a population density of 850 people per square mile or fewer. We chose this cutoff because 850 is the average population density of MA, which forms the bulk of the observations in our dataset, and, at this cutoff, almost a third of the properties and 60% of the solar installations are classified as rural, which we believe are reasonable proportions. However, we examine different cutoffs in the appendix. It is important to note non-rural properties should not be thought of as urban, but more suburban. Very few utility-scale solar developments are built in urban areas as there is just not space.

To build our main dataset, we spatially merge the solar data with the property dataset. We match every property to the nearest eventual site of solar development to infer proximity. We only include transactions occurring within three miles of any eventual solar installation to increase similarities in observable and unobservable characteristics for sample properties. For properties lying within three miles of two installations, we keep only those that transacted before both installations were built and those that transacted after both were constructed. This ensures cleaner identification of the pre-construction and post-construction periods in our model.

The final, composite dataset includes 419,258 property transactions representing 284,364 unique properties around 208 solar installations. Figure 3 shows the number of transactions by distance to nearest solar installation. We have roughly 18,000 transactions within half a mile, and 71,337 transactions within one mile of a solar installation. This is far more compared to many prior studies measuring externalities of wind energy, and it enables precise estimation of any effect that may be present. Further, 27.43% of transactions occur post-construction and 17.27% of the post-construction observations are within one mile.[6]

4 Methods

We use the difference-in-differences (DID) method in the hedonic framework to analyze the causal impact of solar installations on housing prices. We compare treated properties located near large-scale solar installations to similar control properties that are further away from such installations. The treated properties are defined as those that lie within some distance *d* of a solar site, and control properties are greater than distance *d* (and less than three miles). Our basic empirical specification is:

$$P_{it} = \beta_1 Treated_i + \beta_2 Post_{it} + \beta_3 (Treated_i \times Post_{it}) + \gamma X_{it} + \epsilon_{it} \quad (2)$$

Where P_{it} is the log sales price of house i at time t. $Treated_i$ is a dummy variable equal to 1 if a house is in the treatment group and 0 otherwise, $Post_{it}$ is an indicator for post-treatment, which equals 1 if a house sells after the construction of the nearest solar installation, X_{it} is a vector of housing variables (bedrooms, bathrooms, etc.), as well as census block fixed effects and month-year fixed effects. Month-year fixed effects capture macroeconomic trends that affect the entire region that could be correlated with solar development trends. Block fixed effects account for location-specific unobservable heterogeneity that could be correlated with solar development. Lastly, ϵ_{it} is the error term. β_1 is the pre-treatment price difference between treated and control

[6] Figure A3 in the online appendix presents the number of post-construction transactions by distance bin.

houses, and β_2 is the price difference between control properties, before and after treatment. The coefficient of interest is β_3, which is the differential price change from before to after solar development for treated properties relative to control properties.

In addition, we also estimate repeat sales models that include property fixed effects:

$$P_{it} = \beta_2 Post_{it} + \beta_3(Treated_i \times Post_{it}) + \gamma X_{it} + \alpha_i + \epsilon_{it} \quad (3)$$

This model uses only within-property variation to identify β_3, and thus controls for time-invariant unobservables at the property level. In this specification, X_{it} only includes temporal fixed effects, as other housing variables are time-invariant. In addition to this specification, we also estimate a model that adds county-year fixed effects, which allows for different county-specific trends in the housing market. Across all specifications, our preferred model includes property, month-year, and county-year fixed effects, as it best controls for unobservable determinants of price and most flexibly controls for regional price trends, both of which could be correlated with solar development. In all models, we cluster standard errors at the census tract level to allow for correlated errors within a larger area.

Since the extent of treatment is unknown, we first seek to empirically identify *d,* the distance up to which the effects of constructing a solar installation persist, and this will define the boundary for our treatment group. Following similar strategies as Davis (2011), Muehlenbachs et al. (2015), and Boslett et al. (2019), we estimate a series of DID models similar to our preferred specification, except with treatment defined by successive tenth-mile increments and control always being 2-3 miles. Figure 4 plots the estimates for each tenth-mile increment ranging from zero to two miles; each point and confidence interval represents a separate regression. Results indicate large, negative impacts for houses within 0.1 mile, but with large standard errors. Point estimates bounce around some, but more or less show effects diminishing with distance as expected. Beyond one mile, all estimates are statistically insignificant. Given this evidence, in all future specifications, we define the treatment group to be within one mile and the control group to be 1-3 miles.

We extend the analysis to investigate heterogeneity in treatment effect in multiple ways. First, we estimate a model that allows for heterogeneity in the impact based on distance. We identified treatment extending to one mile with Figure 4, but Figure 4 also suggests that treatment effects could be substantially larger within 0.1 mile. To explore this possibility more formally, we develop a model that defines multiple distance bands. The first (outermost) band represents control properties located two to three miles away from the nearest solar installation (per usual). The second (outer-middle) band includes treated properties located 1 – 2 miles from the nearest solar installation. The third (middle) band includes treated properties located 0.5 – 1 mile from the nearest solar installation. The fourth (inner-middle) band includes treated properties located 0.1 – 0.5 miles from the nearest solar installation. Finally, the fifth (innermost) band consists of treated properties within a distance of 0.1 mile from the closest installation. Our specification is:

$$P_{it} = \beta_2 Post_{it} + \sum_{k=2}^{5} \beta_3^k \left(dist_i^k \times Post_{it}\right) + \gamma X_{it} + \alpha_i + \epsilon_{it} \quad (4)$$

where $dist_i^k$ is a dummy variable equal to 1 if a property i lies within the k^{th} distance band. P_{it}, $Post_{it}$, X_{it}, and α_i are as defined in Equation 3. Our coefficients of interest are β_3^k, which are the differential changes in property prices from before to after the construction of solar installations, for homes in distance band k, compared to changes in property values of control houses (lying in distance band 1).

Second, we investigate heterogeneity in treatment effect by two more characteristics: prior land use and rural character. This is done by a triple difference analysis in which we interact the treatment effect term in Equation 3 with a variable for our characteristic of interest. The specifications are as follow:

$$P_{it} = \beta_2 Post_{it} + \beta_3(Treated_i \times Post_{it}) + \beta_4(Post_{it} \times Greenfield_i) + \beta_5(Treated_i \times Post_{it} \times Greenfield_i) + \gamma X_{it} + \alpha_i + \epsilon_{it} \quad (5)$$

$$P_{it} = \beta_2 Post_{it} + \beta_3(Treated_i \times Post_{it}) + \beta_4(Post_{it} \times Rural_i) + \beta_5(Treated_i \times Post_{it} \times Rural_i) + \gamma X_{it} + \alpha_i + \epsilon_{it} \quad (6)$$

where $Greenfield_i$ is an indicator variable equal to 1 if a property is located within the vicinity of a solar installation that was built on land that was formerly a farm or forest, and $Rural_i$ is an indicator variable equal to 1 if property i lies in a town with a population density of 850 people per square mile or fewer.

Our coefficients of interest in Equations 5 and 6 are β_3 and β_5. β_5 is interpreted as the difference in price impacts for greenfields relative to non-greenfield sites (Eq. 5) and the difference in price impacts for homes in rural areas relative to non-rural ones (Eq. 6). In Equation 5, we expect β_5 to be negative. We hypothesize that developments on farm and forest lands will lead to larger negative impacts on housing prices due to the more dramatic change in landscape compared to a commercial site or landfill and the loss of open space amenities. We also expect a negative sign on β_5 in Equation 6, reflecting a loss in the rural character of a town due to the construction of solar installations.

Intuition would suggest a positive correlation between $Greenfield$ and $Rural$, which indeed plays out in the data. To try to separate the effects and test for multiplicative effects, we estimate a quadruple difference model that includes both $Greenfield$ and $Rural$ fully interacted with $Treated$ and $Post$.

4.1 Summary statistics and assumptions

Having defined treatment and control, we now evaluate the comparability of those groups. The summary statistics for key variables are given in Table 1. The first column represents the mean values of our full sample. The mean sales price is $338,320. The average property in our data has a lot size of half an acre, has living area of just under 3000 square feet, approximately 3 bedrooms, and is about 49 years old. About 21% of the properties are condominiums, 45% are located within 3 miles of a greenfield development, and 34% are rural.

The second and third columns in Table 1 compare pre-treatment housing attribute means between the 0 – 1 miles (treated) and 1 – 3 miles (control) observations to examine similarity between the treatment and control groups. In the last column, we report the normalized differences in means, which is the difference in means between the treatment and control groups divided by the square root of the sum of their variances. None of the covariates have a normalized difference exceeding 0.25, which is the limit beyond which the difference in means becomes substantial.

The critical assumption for the DID design to yield causal estimates is the parallel trends assumption, which requires that the treatment and control properties have the same trend in outcomes if treatment did not occur. A common way of assessing the plausibility of this assumption is to examine pre-treatment trends in sales prices for the treatment and control groups. In Figure 5 we plot pre-treatment average sales prices of treatment and control groups up to 2010, which is the year in which the first solar installations were constructed. The price trends are similar for both groups, thus boosting our confidence that the assumption holds, and the control group serves as a good counterfactual.

5 RESULTS

5.1 Main results

We present our main results in Table 2. Column 1 results are obtained from estimating Equation 2, which includes housing covariates (described in detail in the notes of the table), census block fixed effects, and month-year fixed effects. Columns 2 and 3 are results obtained from estimating repeat sales models described by Equation 3. Both columns include month-year fixed effects, and Column 3 additionally includes county-year fixed effects. The coefficient on *Treated* is insignificant in Column 1 suggesting that, controlling for housing characteristics and spatial and temporal fixed effects, treated properties are not statistically significantly different from control properties pre-construction. The DID coefficient of interest ranges between -0.016 to -0.026 and is statistically significantly different from zero across all models. Our preferred specification is Column 3 which includes property, month-year, and county-year fixed effects. This model indicates that on average, houses lying within one mile of solar installations sell for 1.7% less post construction relative to properties further away, all else equal. This finding confirms our hypothesis that nearby solar installations are a disamenity.

We convert the percentage reduction to dollars by multiplying the coefficient and the average property price for treated properties prior to construction ($327,700), which equals $5,571. Assuming capitalization can be converted to a welfare measure in this context (see Kuminoff & Pope, 2014), we can then translate this price discount into an annual willingness to pay for avoiding proximity to solar. Assuming a 5% interest rate, average annual willingness to pay is $279 per household.

There are no other property value studies of solar arrays for us to compare our estimates to. To date, Botelho et al. (2017) is the only study to examine the negative externalities from large-scale solar facilities. Using a contingent valuation framework, they find that local residents in Portugal are willing to accept $12.93 – $56.64 per month on average as compensation for being in the vicinity of solar installations. While their methods are different and vicinity is defined differently, their results are consistent with ours ($25.17/month). In addition, Botelho et al. conduct a discrete choice experiment to delve into aspects of siting that drive the disamenity and estimate that respondents are willing to pay $8.65, $7.57, and $5.15 per month to avoid negative impacts on flora and fauna, landscape, and glare effects, respectively. Second, we extend the hedonic valuation literature on renewable energy to include large-scale solar.

First, we provide the first estimates of the non-market valuation of large-scale solar installation externalities in the United States.

5.2 Robustness checks

In Table 3 we present results from a series of robustness checks to ensure that the results from our preferred model are consistent to alternative data samples. In Column 1 we drop all observations with sales prices in the top and bottom 1% of the distribution (as opposed to 5% in the main sample) to assess whether the results are robust to including more high and low value properties. In Column 2 we restrict the sample to include only properties with a lot size of 5 acres or lesser, decreasing the maximum from 10 acres in our main sample. While it is unlikely that a solar array would be sited on a parcel of 5 – 10 acres, it is possible and so these properties may appreciate based on expectations of possible lease payments. Column 3 excludes all condominiums from the sample. Column 4 includes all 284 solar installations from our full sample, which means properties could be exposed to multiple treatments. Columns 5 and 6 explore different amounts of land required per MW of installed capacity, 4 acres in Column 5, and 6 acres in Column 6. By contracting and expanding the assumed size of installations, the set of properties that are designated as treatment control is altered. Across all columns, our coefficient of interest is statistically significant and the magnitude ranges between -0.014 to -0.017. In sum, we find that our results are robust across all specifications.

5.3 Heterogeneity in treatment effect

In Table 4, we examine the heterogeneity in treatment effect by three characteristics: proximity to solar installations, prior land use, and rural character of towns. Each panel represents a different regression and all panels include property fixed effects, month-year fixed effects, and county-year fixed effects.

In Panel A, we estimate the model described by Equation 4 that allows for heterogeneity in the impact on prices based on distance. The coefficient on the 1 – 2 miles band is statistically insignificant, which is congruent with our assumption that treatment effects do not persist beyond 1 mile. The coefficients on the 0.1 – 0.5 miles and 0.5 – 1 mile bands are significant and similar magnitude to the main results. The coefficient on the 0 – 0.1 mile band is -0.070, which is 4 times larger in magnitude than the 0.1 – 0.5 miles and 0.5 – 1 mile bands, though only significant at the 10% level. This suggests that property prices for homes lying within 0.1 mile from a solar installation fall by 7.0% ($23,682) post-construction, compared to houses further away. These results suggest extremely large disamenities for properties in very close proximity.

In Panel B, we provide estimates from the model described by Equation 5 where we explore heterogeneity by prior land use. The triple-interaction coefficient of interest is negative as expected, and implies that farm and forest lands that are developed into solar arrays decrease property values 0.8% more than brownfields and industrial areas. However, this coefficient is statistically insignificant, meaning the differential impact is imprecise and could even be zero.

In Panel C, we examine heterogeneity by rural character of towns and report the coefficients from the specification defined in Equation 6. The coefficient on $Treated \times Post$ is larger in magnitude (-0.024) than the main results. The coefficient on $Treated \times Post \times Rural$ is essentially the same magnitude as the coefficient on $Treated \times Post$, but the opposite sign. Taken together, these results suggest that the treatment effect in rural areas is effectively zero (a statistically insignificant 0.1%), and that the negative externalities of solar arrays are only occurring in non-rural areas. These findings go against our intuition. One possibility is that land is abundant in rural areas, so the development of some land into solar does little to impact scarcity, whereas in non-rural areas it makes a noticeable impact. A second possibility is that there are unobserved visibility differences across sites. If visibility is a key driver of negative impacts and installations in rural locations are less visible on average (due to land abundance for vegetative buffers), then this could produce the results observed.

In Panel D we further explore heterogeneity by land use and rural character. This is done by estimating a quadruple difference model that interacts the treatment effect term in Equation 2 with both the $Greenfield$ and $Rural$ indicator variables.[7] The coefficient on $Treated \times Post$, which represents the effect of non-greenfield solar arrays in non-rural areas is -0.014, which is slightly smaller than the overall average effect observed in Table 2, but is also imprecisely estimated. The coefficient on $Treated \times Post \times Greenfield$, which applies to greenfield sites in non-rural areas, is -0.036 and is statistically significant. This suggests a large additional effect of greenfield sites in non-rural areas relative to non-greenfield sites, and a total effect of -5.0%.

[7] Tables A2-A4 in the online appendix examine the robustness of the results presented in Table 4, including different regression specifications and different population density cutoff values that define $Rural$. The results are broadly consistent with the findings presented.

The coefficient on $Treated \times Post \times Rural$, which applies to non-greenfield sites in rural areas, is 0.002 and is statistically insignificant. This suggests no statistical difference between the property value effect of non-greenfield sites in rural versus non-rural areas. Lastly, the coefficient on $Treated \times Post \times Greenfield \times Rural$, which applies to greenfield sites in rural areas, is 0.056 and is statistically significant. This indicates a counter-effect to the negatives seen for $Treated \times Post$ and $Treated \times Post \times Greenfield$, and the total effect for greenfield sites in rural areas is a positive 0.008. The total effect is statistically indistinguishable from zero. Taken together, the results of Panel D suggest that the overall negative effects of solar arrays on nearby property values are driven by greenfield sites in non-rural areas. Similar developments on farm and forest lands in rural areas have no impact on nearby properties. These findings are consistent with the ideas that greenfield developments cause greater externalities, given the dual loss of open space amenities and gain of industrial disamenities, but that effect hinges on the scarcity of open space.

In the online appendix, we also present results that test for heterogeneity by size of installation and time since construction (see Tables A5 and A6). In both cases we find no evidence of differential property value impacts by size and by time.

6 Conclusion

This paper estimates the valuation of externalities associated with nearby utility-scale solar installations using revealed preferences from the property market. Using the DID empirical technique, we estimate regression models with treatment and control groups defined by distance to the nearest solar installation. We observe 71,337 housing transactions occurring within one mile (treated group), and 347,921 transactions between one to three miles (control croup) of 208 solar installations in MA and RI.

Our preferred model suggests that property values in the treatment group decline by 1.7% ($5,751) on average compared to those in the control group after the construction of a nearby solar installation, all else equal. This translates to an annual willingness to pay of $279 per household to avoid disamenities associated with proximity to the installations. However, this average effect obscures heterogeneity. We find substantially larger negative effects for properties within 0.1 miles and properties surrounding solar sites built on farm and forest lands in non-rural areas.

While a full cost-benefit analysis of solar arrays is beyond the scope of this paper, because we do not know anything about consumer and producer surplus, we can still compare the negative local externalities to the global benefits of carbon mitigation to gain a more holistic understanding of local opposition.[8] We therefore conduct the following back-of-the-envelope calculations. On the cost side, we first consider the point estimate from our preferred specification which translates to a loss of $5,751 per household for treated homes close to solar installations. Our complete sample (prior to any data cuts) consists of 289,254 unique properties located within 1 mile of all solar installations in the dataset. Put together, we estimate a net loss of $1.66 billion in aggregate housing value due to proximate solar installations in MA and RI.

To quantify the benefits from solar installations, we first calculate net generation from solar installations. Assuming a capacity factor of 16.5%, the 817 MW of installed solar capacity in MA and RI generates is 1,180,892 MWh (megawatt hours) of electricity per year.[9] Current non-renewable generation in MA and RI comes almost entirely from natural gas. According to the EIA, 0.42 mt (metric tons) of CO_2 are emitted from each MWh of electricity that is generated from natural gas, implying that a total of 495,975 mt of CO_2 are abated annually from solar energy generation. Assuming that an average solar installation lasts 30 years, we estimate 14.88 million mt of CO_2 are abated in their entire life-span. The EPA (Environmental Protection Agency) estimates a social cost of $51.80 per metric ton of CO_2, which translates to $771 million in lifetime benefits from the production of energy from solar installations (US EPA). We find that, considering only externalities, the benefit-cost ratio is 0.46, with a net loss of $893 million.

However, we caution against generalizing the benefit-cost findings to other regions in the United States for two main reasons. First, over 90% of the energy generated in MA and RI comes from natural gas, which emits only half as much CO_2 as coal. It is possible for benefits to outweigh the costs in states where coal dominates the fuel mix for electricity generation. Second, MA and RI are the 3rd and the 2nd most densely populates states in the country, respectively, which makes the siting of solar installations away from residential areas a herculean task. Careful siting of installations in states that have large tracts of open land available and around sparsely populated regions may allow for more favorable cost-benefit ratios.

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[8] To be sure, significant amounts of money are part of the market transactions. A developer quoted us that they offer landowners $15-20,000 per MW per year of installed capacity. It is unknown how much is profit and whether some portion of that could be used to compensate proximate households.

[9] $Net\ generation\ (MWh) = \%\ Capacityfactor \times 365\ days \times 24\ hours \times Installed\ capacity\ (MW)$

The demographic and geographical differences across states have implications for their respective RPS goals. For densely populated New England states with ambitious RPS targets, wind energy may be the better choice. Onshore wind turbines require a fraction of the land area per MW of installed capacity compared to solar, while offshore turbines require none. Furthermore, unlike solar installations, wind turbines in the United States (both onshore and offshore), have been found to have no disamenities associated with their proximity (Carr-Harris & Lang, 2019; Hoen et al., 2011, 2015; Hoen & Atkinson-Palombo, 2016; Lang et al., 2014). Moving forward, states should customize plans to meet renewable energy targets that work best with their respective geographies.

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Figures and Tables

Figure 1: Map of solar installations across Massachusetts and Rhode Island

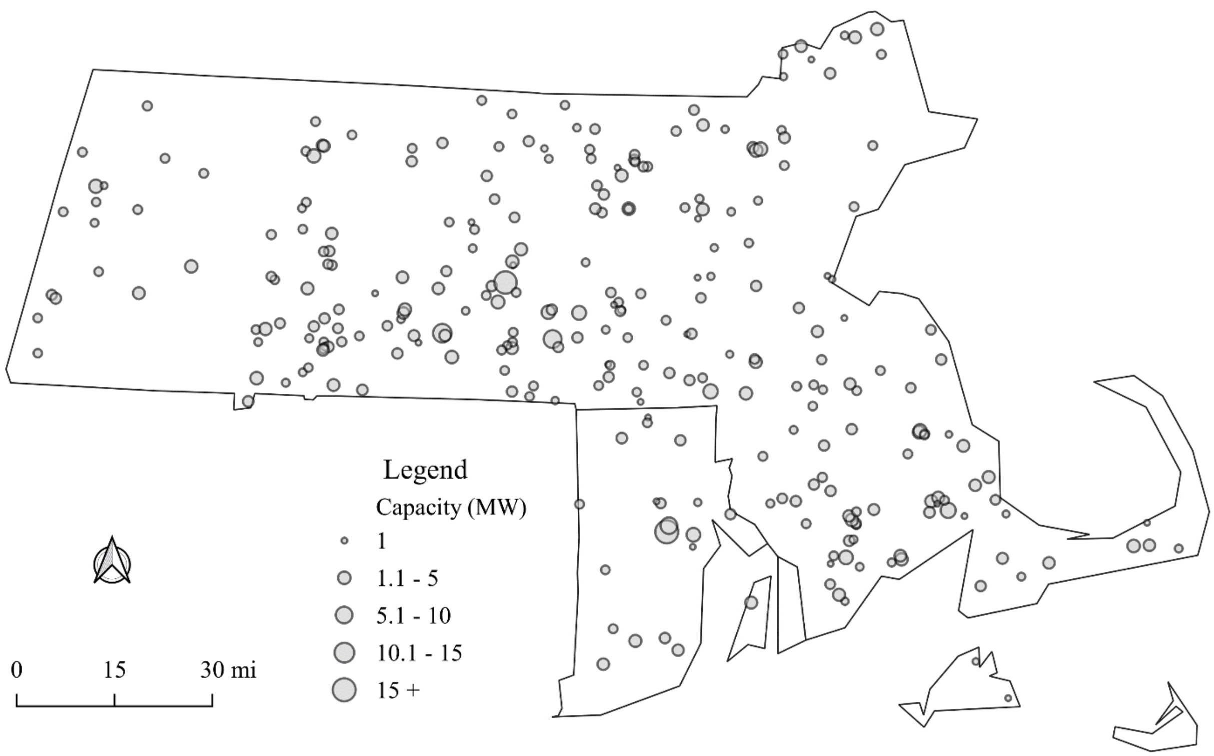


Figure 2: New and cumulative utility-scale solar capacity by year

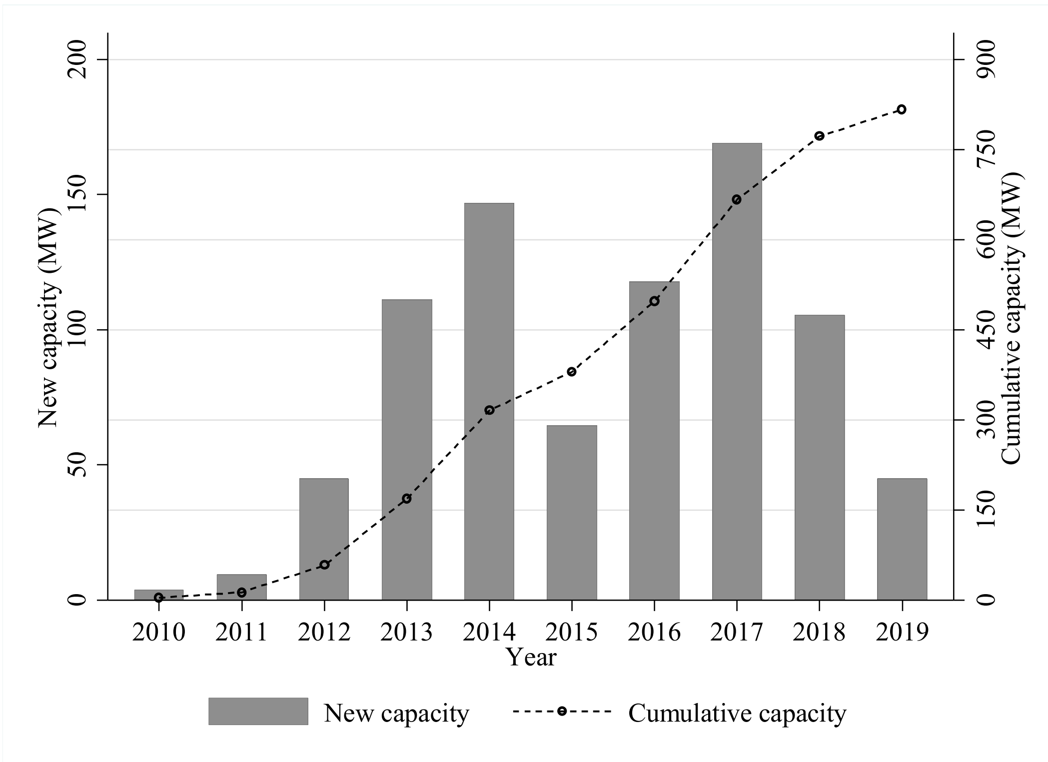
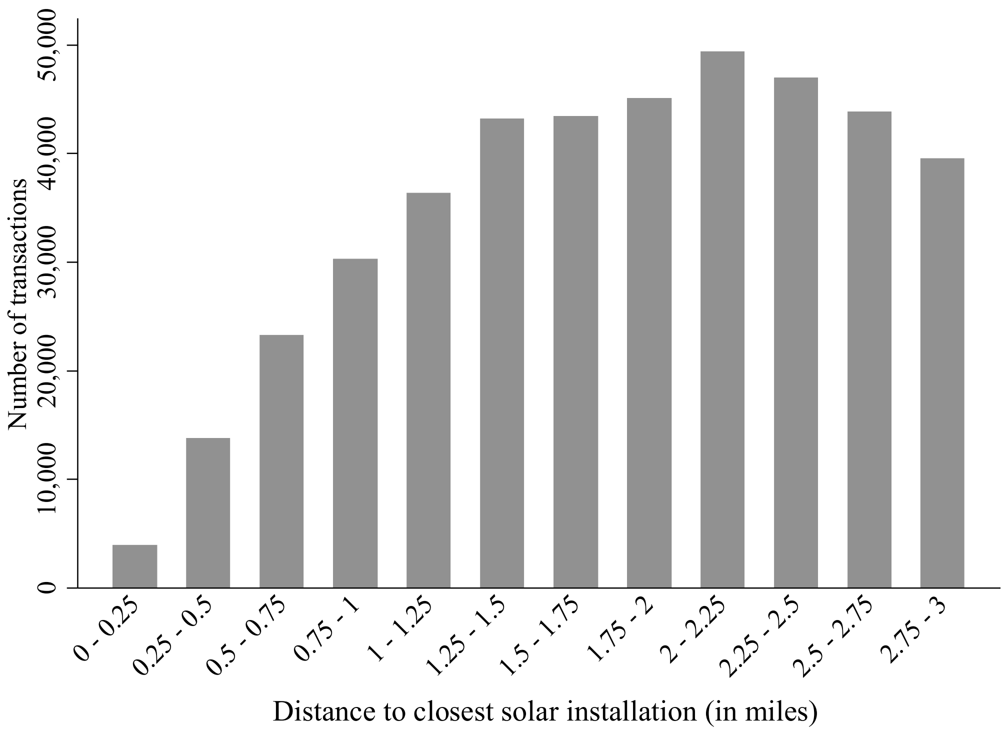
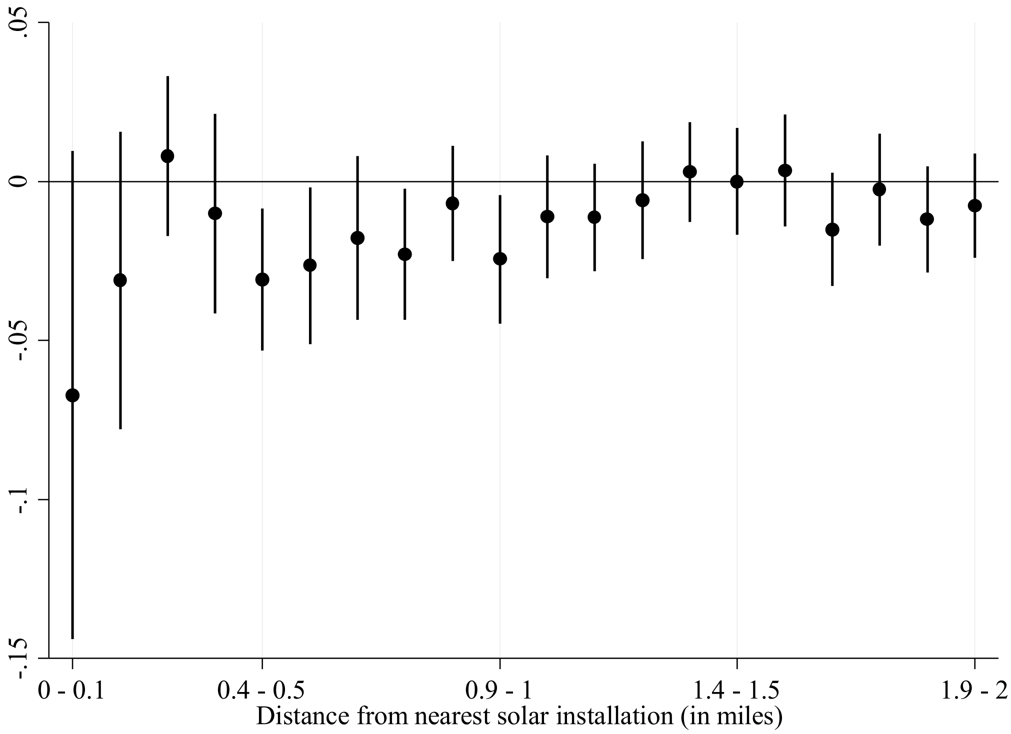


Figure 3: Number of transactions by distance to nearest solar installation



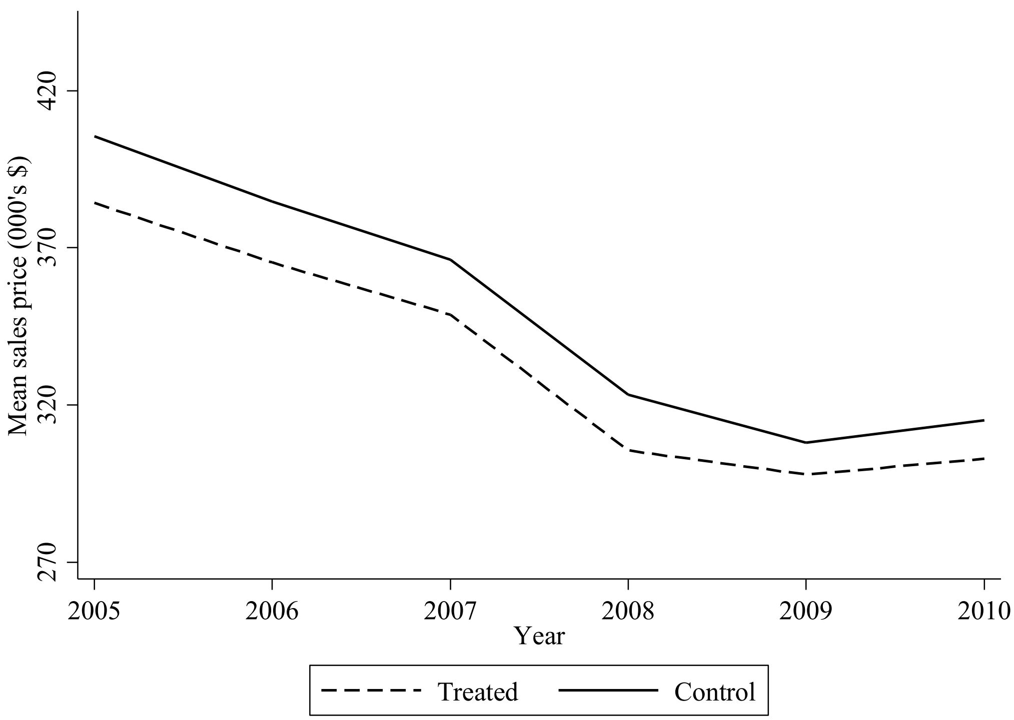
Notes: These transactions occur near eventual solar installations, since the data span across the years 2005 – 2019, and the construction of the installations is staggered throughout that time period.

Figure 4: Distance bin coefficient estimates



Notes: The treatment variable is defined as a bin variable, with treated properties lying within 1/10 mile distance bands up to 2 miles. Control properties are those lying 2 – 3 miles away from the nearest solar installation. The coefficients are obtained by estimating a series of DID models similar to Equation 2 that regresses log sales price on 1/10 mile distance bands up to 2 miles, along with month-year, county-year, and property fixed effects. Resulting coefficients and 95% confidence intervals are graphed.

Figure 5: Pre-treatment trends between treatment and control groups



Notes: The graph represents all transactions occurring pre-construction. Treated are properties within one mile of an eventual solar installation, and Control is between one and three miles. The sample size is 181,190.

Table 1: Housing attribute means by treatment status

Variables	Full sample	Pre-treatment means 0 - 1 mile	Pre-treatment means 1 - 3 miles	Normalized difference in means
Sales price (000's)	338.32	327.70	340.74	-3.11e-07
Lot size (acres)	0.49	0.50	0.48	0.017
House area (sq. feet)	2874.92	2849.70	2865.73	-5.83e-06
Bedrooms	2.91	2.88	2.91	-0.027
Full bathrooms	1.56	1.56	1.56	-0.012
Half bathrooms	0.52	0.52	0.52	-0.009
Age of home (years)	49.23	43.06	48.11	-0.003
Condo (1=yes)	0.21	0.22	0.21	0.058
Pool (1 = yes)	0.04	0.04	0.04	-0.027
Air conditioning (1 = yes)	0.43	0.47	0.43	0.121
Fireplace number	0.41	0.38	0.42	-0.076
Condition (1 = above average)	0.26	0.22	0.26	-0.150
Greenfield (1 = yes)	0.45	0.46	0.46	0.021
Rural (1 = yes)	0.34	0.40	0.34	0.199
Observations	419,258	51,471	252,773	

Notes: Sales prices are adjusted to 2019 levels using the CPI. Normalized difference in means calculated according to Imbens and Wooldridge (2009). Normalized differences exceeding 0.25 in absolute value are considered statistically different.

Table 2: Difference-in-differences estimates of the impact of solar installations on property prices

Independent variables	Dependent variable: Sale price (ln)		
	(1)	(2)	(3)
Treated	0.002		
	(0.005)		
Post	0.015***	0.011**	-0.006
	(0.004)	(0.005)	(0.004)
Treated × Post	-0.016***	-0.026***	-0.017***
	(0.005)	(0.007)	(0.006)
Fixed Effects			
Month-year	Y	Y	Y
Block	Y		
Property		Y	Y
County-year			Y
Observations	419,258	231,503	231,503
R^2	0.804	0.889	0.893

Notes: Treat = 1 if a house is within 1 mile of a solar construction and Post = 1 if a house sells post-construction. Column 1 includes the following control variables: lot size, house area, number of bedrooms, full bathrooms, half bathrooms, and fireplaces, indicator variables for condos, the condition of the house, and for the presence of a pool and air conditioning, capacity of installation (in MW) and greenfield. Standard errors are clustered at the tract level and shown in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1%, respectively.

Table 3: Robustness checks

Independent variables	Dependent variable: Sale price (ln)					
	Price cuts at top and bottom 1%	Lot size no more than 5 acres	Drop Condos	Keep all installations	1 MW = 4 acres	1 MW = 6 acres
	(1)	(2)	(3)	(4)	(5)	(6)
Treated × Post	-0.015**	-0.016***	-0.014***	-0.017***	-0.016***	-0.017***
	(0.007)	(0.006)	(0.005)	(0.006)	(0.006)	(0.005)
Observations	258,562	230,100	179,387	273,878	233,943	231,977
R^2	0.865	0.894	0.880	0.897	0.894	0.893

Notes: Treated = 1 if a house is within 1 mile of a solar construction, and Post = 1 if a house sells post-construction. All specifications include property, month-year, and county-year fixed effects. Standard errors are clustered at the tract level and shown in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1%, respectively.

Table 4: Heterogeneity of treatment effects

Independent variables	Dependent variable: Sale price (ln)
Panel A: Heterogeneity by proximity	
(1 – 2 miles) × Post	-0.005
	(0.005)
(0.5 – 1 mile) × Post	-0.019***
	(0.007)
(0.1 – 0.5 miles) × Post	-0.017*
	(0.009)
(0 – 0.1 miles) × Post	-0.070*
	(0.038)
Panel B: Heterogeneity by prior land use	
Treated × Post	-0.013*
	(0.008)
Treated × Post × Greenfield	-0.008
	(0.011)
Panel C: Heterogeneity by population density	
Treated × Post	-0.024***
	(0.008)
Treated × Post × Rural	0.025**
	(0.011)
Panel D: Heterogeneity by population density and land use	
Treated × Post	-0.014
	(0.009)
Treated × Post × Greenfield	-0.036**
	(0.014)
Treated × Post × Rural	0.002
	(0.017)
Treated × Post × Greenfield × Rural	0.056**
	(0.022)
Observations	231,503

Notes: Treated = 1 if a house is within 1 mile of a solar construction and Post =1 if a house sells post-construction. In Panel A, (1 – 2 miles), (0.5 – 1 mile), (0.1 – 0.5 miles) and (0 – 0.1 mile) are dummy variables = 1 if properties lie within the respective distances from the nearest solar installation, and distance bin for 2 – 3 miles is omitted. Greenfield = 1 if the prior land use is farm or forest land, and Rural = 1 if the population density per square mile is ≤ 850. Panel B includes an interaction term Post*Greenfield and Panel C includes Post*Rural. Additional interactions included in Panel D are: Treated*Rural, Treated*Greenfield, Post*Rural, Post*Greenfield, Rural*Greenfield, Post*Greenfield*Rural, and Treated*Rural*Greenfield. All models include month-year, county-year, and property fixed effects. Standard errors are clustered at the tract level and shown in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1%, respectively.

APPENDIX

This appendix provides supplemental figures and tables to our main results.

Figure A1 maps the location and capacities (in MW) of the 208 solar installations that are included in our main results.

Figure A2 depicts the increase in new and cumulative solar capacity over time by prior land use.

Figure A3 represents the number of sample post-treatment transactions by distance to nearest solar installation, in quarter mile intervals.

Figure A4 shows the distribution of solar installations by capacity.

Table A1 provides post-treatment means and the normalized differences in means between the treated and control groups for key property attributes.

Table A2 assesses robustness of results presented in Table 4 of the main text. We present two additional specifications: month-year fixed effects and block fixed effects in Column 1, and month-year and property fixed effects in Column 2. Column 3 is the same as the results presented in Table 4. In Panel A, we find that the large, negative coefficient found for $(0 - 0.1\ miles)\ x\ Post$ is only found when property fixed effects are included. In Panels B, C, and D, results are largely similar across columns.

Table A3 explores how different population density cutoff values that define the variable $Rural$ affect the results presented in Panel C of Table 4 in the main paper. 850 people/square mile is the cutoff used in the main text. The results in the first three columns (500 people/square mile, 850 people/square mile, and 1000 people/square mile) are quite consistent. The results in columns 4 and 5 (1200 people/square mile, 1500 people/square mile) are qualitatively similar to the previous results, but the coefficient on $Treated\ x\ Post\ x\ Rural$ is smaller in magnitude and not statistically significantly different from zero. In the final column (2000 people/square mile), the coefficient on $Treated\ x\ Post\ x\ Rural$ is negative and statistically insignificant, and the coefficient on $Treated\ x\ Post$ is statistically insignificant as well. The trend in results is expected as more areas are classified as rural. Given that we find that negative property value impacts of solar are strongest in non-rural (suburban) areas, as these places are increasingly classified as rural, the coefficient on $Treated\ x\ Post\ x\ Rural$ is a mixture of the zero impacts in rural areas and the negative impacts in non-rural areas.

Table A4 explores how different population density cutoff values that define the variable $Rural$ affect the results presented in Panel D of Table 4 in the main paper, similar to Table A3. We specify different cutoff values of population density per square mile and report results using our main specification. The coefficients are consistent with the results of Panel D in Table 4, for all cutoff values except the highest one (2000 people/square mile).

Table A5 explores heterogeneity in treatment effect by the size of the solar installations. We define $LargeCapacity$ as an indicator variable = 1 if the size of the installation (in MW) is greater than the median value in our sample (2 MW). We find no evidence of heterogeneity by installation size, the coefficient is small and statistically insignificant, implying no additional disamenities from solar developments larger than 2 MW. We additionally explore an alternative specification (results not provided) where capacity is treated as a linear variable and is interacted with $Treated \times Post$. These estimates yield the same conclusion to those in Table A3. This result indicates that the presence of utility-scale solar is a disamenity regardless of size. Given that the smallest installations in our analysis are still quite large at five acres in size (about 3.8 football fields), it could be that there is no additional impact of size because it is difficult or even impossible to see beyond five acres from ground level. However, one limitation of this analysis is that the range of observed sizes is narrow. Of the 208 installations in our dataset, almost 50% have a capacity of 2 MW or lesser, and only 13 (6%) are 5 MW or larger.

Table A6 examines heterogeneity in treatment effect by time elapsed. We split our $Post$ variable into two sub-categories: $Post\ (Less\ than\ 3\ years)$ and $Post\ (3\ or\ more\ years)$, where $Post\ (Less\ than\ 3\ years)$ is a dummy variable = 1 if a property transacts less than three years post-construction, and $Post\ (3\ or\ more\ years)$ is a dummy variable = 1 if a property transacts 3 or more years post-construction. We interact both variables with $Treated,$ and find that both coefficients are significant and almost equal across the board, implying no change in the effect over time.

Figure A1: Map of solar installations at least 1 mile apart across Massachusetts and Rhode Island

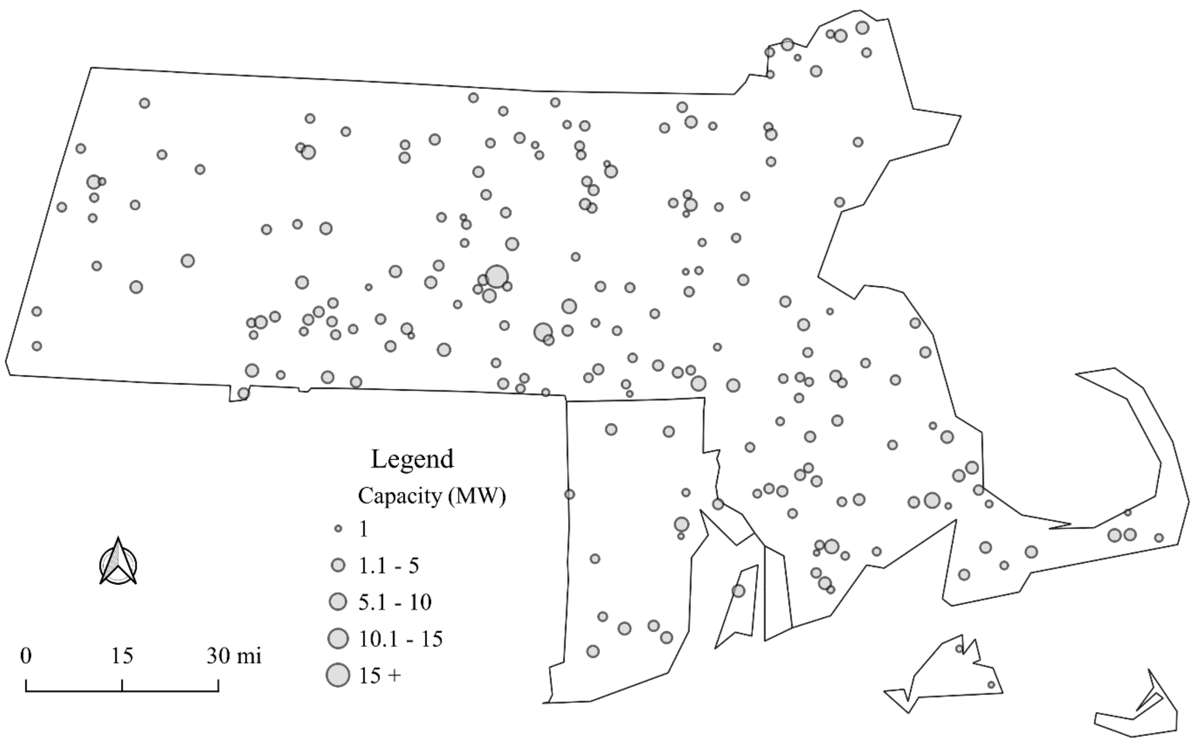


Figure A2: New and cumulative capacity by year and land use

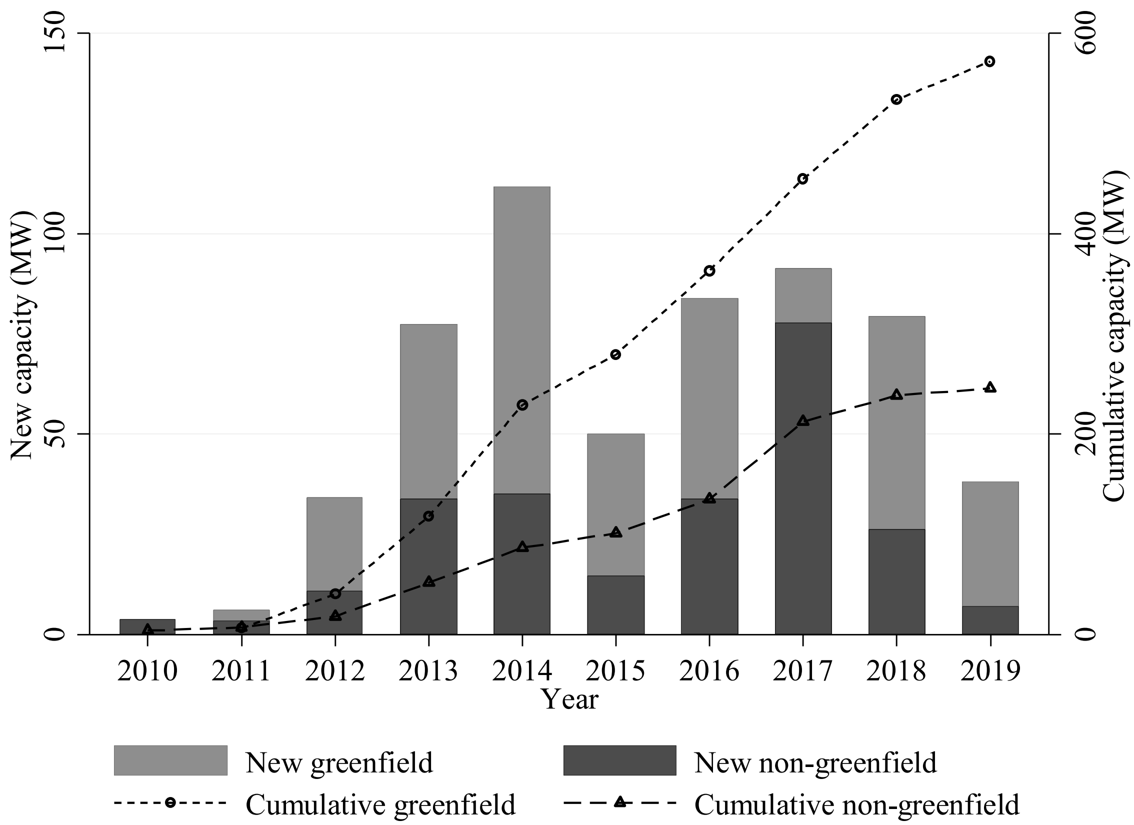
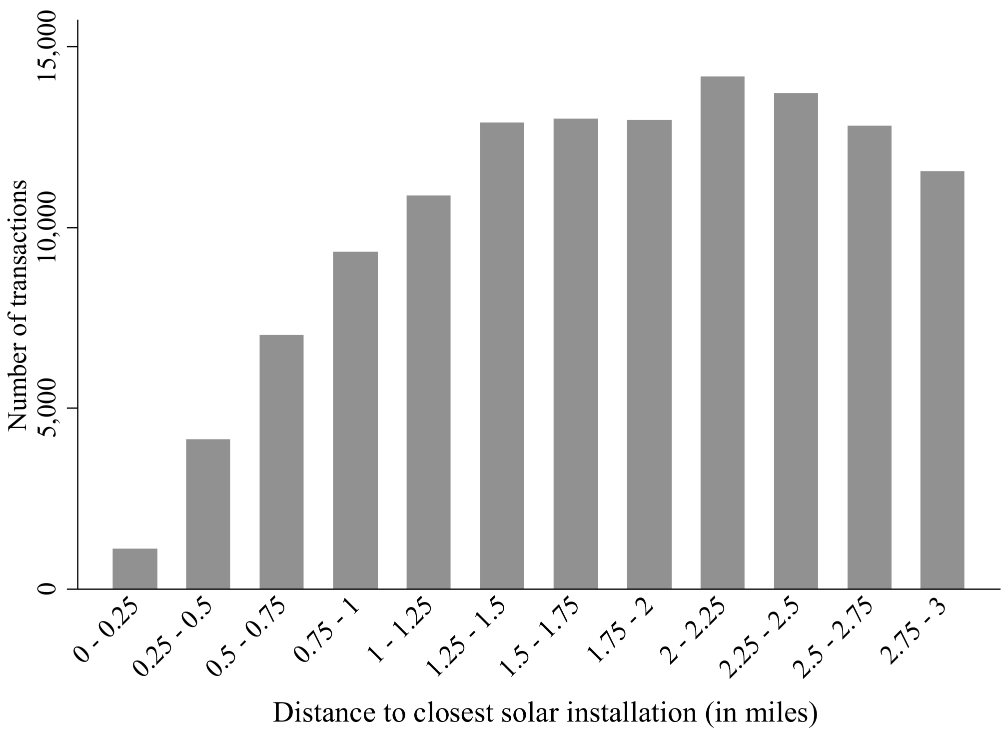


Figure A3: Number of post-construction transactions by distance to nearest solar installation



Notes: These transactions occur near eventual solar installations, since the data span across the years 2005 – 2019, and the construction of the installations is staggered throughout that time period.

Figure A4: Frequency of solar installations by capacity

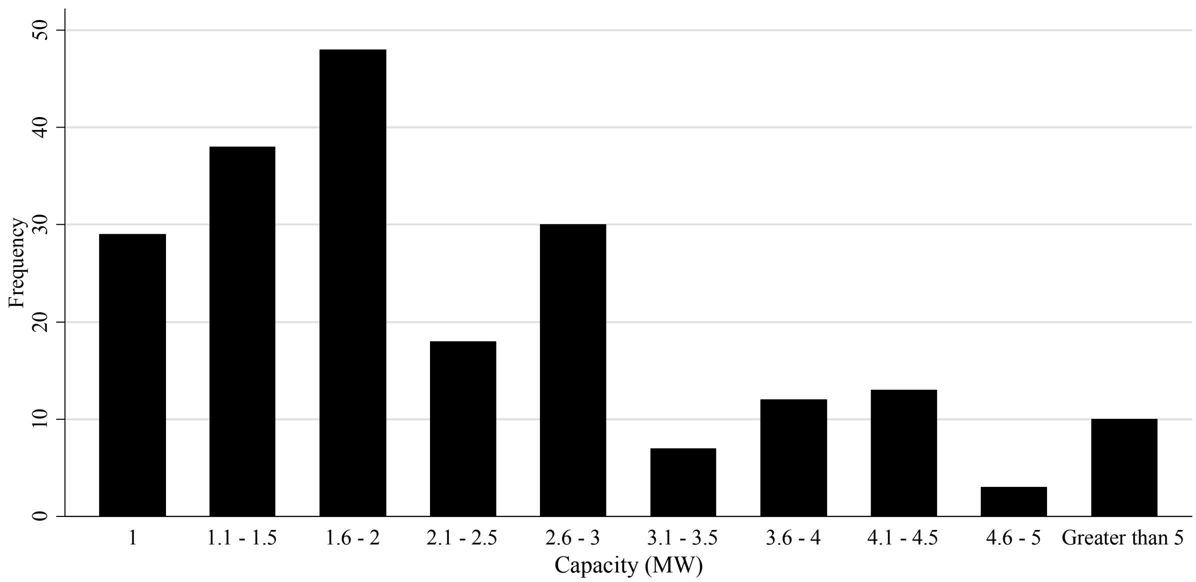


Table A1: Housing attribute means by treatment status, post construction

Variable	Post-treatment means		Normalized difference in means
	0 - 1 mile	1 - 3 miles	
Price (000's)	321.02	341.25	-4.64e-07
Lot size (acres)	0.48	0.50	-0.013
House area (sq. feet)	2872.97	2913.40	-1.47e-05
Bedrooms	2.90	2.93	-0.024
Full bathrooms	1.56	1.57	-0.020
Half bathrooms	0.53	0.53	0.001
Age of home (years)	52.17	54.95	-0.001
Condo (1=yes)	0.21	0.20	0.041
Pool (1 = yes)	0.04	0.04	-0.033
Air conditioning (1 = yes)	0.45	0.43	0.078
Fireplace number	0.35	0.40	-0.117
Condition (1 = above average)	0.25	0.28	-0.013
Greenfield (1 = yes)	0.39	0.42	-0.095
Rural (1 = yes)	0.40	0.32	0.239
Observations	19,866	95,148	

Table A2: Heterogeneity of treatment effects

Independent variables	Dependent variable: Sale price (ln)		
	(1)	(2)	(3)
Panel A: Heterogeneity by proximity			
(1 – 2 miles) × Post	-0.009*	-0.006	-0.005
	(0.005)	(0.006)	(0.005)
(0.5 – 1 mile) × Post	-0.019***	-0.027***	-0.019***
	(0.007)	(0.009)	(0.007)
(0.1 – 0.5 miles) × Post	-0.025***	-0.030***	-0.017*
	(0.008)	(0.011)	(0.009)
(0 – 0.1 miles) × Post	-0.037	-0.092**	-0.070*
	(0.028)	(0.036)	(0.038)
Panel B: Heterogeneity by prior land use			
Treated × Post	-0.013	-0.024**	-0.013*
	(0.008)	(0.010)	(0.008)
Treated × Post × Greenfield	-0.009	-0.005	-0.008
	(0.010)	(0.014)	(0.011)
Panel C: Heterogeneity by population density			
Treated × Post	-0.022***	-0.034***	-0.024***
	(0.008)	(0.010)	(0.008)
Treated × Post × Rural	0.024**	0.034**	0.025**
	(0.010)	(0.014)	(0.011)
Panel D: Heterogeneity by population density and land use			
Treated × Post	-0.013	-0.024*	-0.014
	(0.010)	(0.013)	(0.009)
Treated × Post × Greenfield	-0.029**	-0.030	-0.036**
	(0.014)	(0.019)	(0.014)
Treated × Post × Rural	0.008	0.011	0.002
	(0.014)	(0.019)	(0.017)
Treated × Post × Greenfield × Rural	0.041**	0.051**	0.056**
	(0.019)	(0.026)	(0.022)
Fixed Effects			
Month-year	Y	Y	Y
Block	Y		
Property		Y	Y
County-year			Y
Observations	419,258	231,503	231,503

Notes: Treated = 1 if a house is within 1 mile of a solar construction and Post =1 if a house sells post-construction. In Panel A, (1 – 2 miles), (0.5 – 1 mile), (0.1 – 0.5 miles) and (0 – 0.1 mile) are dummy variables = 1 if properties lie within the respective distances from the nearest solar installation, and distance bin for 2 – 3 miles is omitted. Greenfield = 1 if the prior land use is farm or forest land, and Rural = 1 if the population density per square mile is ≤ 850. Panel B includes an interaction term Post*Greenfield and Panel C includes Post*Rural. Additional interactions included in Panel D are: Treated*Rural, Treated*Greenfield, Post*Rural, Post*Greenfield, Rural*Greenfield, Post*Greenfield*Rural, and Treated*Rural*Greenfield. All models include month-year, county-year, and property fixed effects. Standard errors are clustered at the tract level and shown in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1%, respectively.

Table A3: Heterogeneity of treatment effects by population density

Independent variables	Population density per square mile cutoff					
	500	850	1000	1200	1500	2000
Treated × Post	-0.020***	-0.024***	-0.024***	-0.023***	-0.018**	-0.006
	(0.006)	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)
Treated × Post × Rural	0.022*	0.025**	0.023**	0.016	0.008	-0.013
	(0.012)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Observations classified as rural						
Solar installations	40%	61%	69%	76%	82%	87%
Properties	16%	32%	39%	46%	53%	62%
Observations	231,503	231,503	231,503	231,503	231,503	231,503
R^2	0.894	0.894	0.894	0.894	0.894	0.894

Notes: Dependent variable is Sale price (ln) in all specifications. Treated = 1 if a house is within 1 mile of a solar construction, Post =1 if a house sells post-construction, and Rural = 1 if the population density per square mile is ≤ column heading value. All models include month-year, county-year, and property fixed effects. Standard errors are clustered at the tract level and shown in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1%, respectively.

Table A4: Heterogeneity of treatment effects by population density and land use

Independent variables	Population density per square mile cutoff					
	500	850	1000	1200	1500	2000
Treated × Post	-0.014*	-0.014	-0.016	-0.014	-0.006	0.005
	(0.008)	(0.009)	(0.010)	(0.010)	(0.010)	(0.010)
Treated × Post × Greenfield	-0.018	-0.036**	-0.028*	-0.031**	-0.041***	0.005
	(0.012)	(0.014)	(0.015)	(0.015)	(0.016)	(0.010)
Treated × Post × Rural	0.000	0.002	0.008	0.002	-0.013	-0.055***
	(0.018)	(0.017)	(0.016)	(0.016)	(0.015)	(0.018)
Treated × Post × Greenfield × Rural	0.038*	0.056**	0.039*	0.040*	0.057***	-0.029**
	(0.023)	(0.022)	(0.021)	(0.021)	(0.021)	(0.014)
Observations classified as rural						
Solar installations	40%	61%	69%	76%	82%	87%
Properties	16%	32%	39%	46%	53%	62%
Observations	231,503	231,503	231,503	231,503	231,503	231,503
R^2	0.894	0.894	0.894	0.894	0.894	0.894

Notes: Dependent variable is Sale price (ln) in all specifications. Treated = 1 if a house is within 1 mile of a solar construction, Post =1 if a house sells post-construction, and Rural = 1 if the population density per square mile is ≤ column heading value. All models include month-year, county-year, and property fixed effects. Standard errors are clustered at the tract level and shown in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1%, respectively.

Table A5: Heterogeneity of treatment effects by solar installation size

Independent variables	Dependent variable: Sale price (ln)		
	(1)	(2)	(3)
Treated × Post	-0.012*	-0.024***	-0.019***
	(0.007)	(0.009)	(0.007)
Treated × Post × LargeCapacity	-0.011	-0.005	0.004
	(0.011)	(0.015)	(0.012)
Fixed Effects			
Month-year	Y	Y	Y
Block	Y		
Property		Y	Y
County-year			Y
Observations	419,258	231,503	231,503
R^2	0.801	0.889	0.893

Notes: Treated = 1 if a house is within 1 mile of a solar construction and Post =1 if a house sells post-construction and LargeCapacity = 1 if the capacity of the installation is greater than 2 MW. Column 1 includes the following housing controls: lot size, house area, number of bedrooms, full bathrooms, half bathrooms, and fireplaces, a set of dummy variables for the age of the house at purchase, indicator variables for condos, the condition of the house, and for the presence of a pool and air conditioning. Standard errors are clustered at the tract level and shown in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1%, respectively.

Table A6: Heterogeneity of treatment effects by years since construction of installation

Independent variables	Dependent variable: Sale price (ln)		
	(1)	(2)	(3)
Treated × Post (Less than 3 years)	-0.016**	-0.026***	-0.016**
	(0.006)	(0.009)	(0.007)
Treated × Post (3 or more years)	-0.016**	-0.024***	-0.016**
	(0.006)	(0.008)	(0.007)
Fixed Effects			
Month-year	Y	Y	Y
Block	Y		
Property		Y	Y
County-year			Y
Observations	419,258	419,258	231,503
R^2	0.491	0.801	0.889

Notes: Post (Less than 3 years) = 1 if a house sells within 3 years post-construction, and Post (3 or more years) = 1 if a house sells 3 or more years post-construction. Columns 1 includes the following controls: lot size, house area, number of bedrooms, full bathrooms, half bathrooms, and fireplaces, a set of dummy variables for the age of the house at purchase, indicator variables for condos, the condition of the house, and for the presence of a pool and air conditioning, capacity of installation (in MW) and greenfield. Standard errors, clustered at the tract level, are in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1%, respectively.

EXHIBIT X: SOLAR MODULE TOXICITY ARTICLE

https://doi.org/10.1038/s41567-023-02230-0

Unfounded concerns about photovoltaic module toxicity and waste are slowing decarbonization

Heather Mirletz, Henry Hieslmair, Silvana Ovaitt, Taylor L. Curtis & Teresa M. Barnes

Unsubstantiated claims that fuel growing public concern over the toxicity of photovoltaic modules and their waste are slowing their deployment. Clarifying these issues will help to facilitate the decarbonization that our world depends on.

Harnessing the potential of photovoltaic (PV) electricity generation is a key part of the transition to less carbon-intensive energy sources. The most recent energy production forecasts call for a massive 75 TW of global PV capacity by 2050 to have a chance of limiting global temperature rise to 1.5 °C and minimizing the impacts of climate change. This is more than a tenfold increase in the current manufacturing and deployment rate in less than 15 years[1]. PV modules are new to many people, so increasing PV deployment has led to growing concerns about the quantity of waste that may arise from decommissioning them (if they are not recycled), and their potential to leach toxic metals. Debunking misinformation about PV modules and PV module waste is the first step in addressing these concerns that are unnecessarily slowing PV deployment[2].

A drop in the ocean

Articles that raise concerns about PV module waste typically cite a prediction from the 2016 IRENA end-of-life report[3] that 60 million metric tons of cumulative PV module waste will be produced by 2050. Since that report, module lifetimes have increased from 12 years to over 35 years through accelerated testing and improved standards. However, estimates of the required PV capacity have increased dramatically, to 75 TW by 2050. We have updated these projections (shown on the right-hand side of Fig. 1) to take these two factors into account. These new estimates show the best-case and worst-case scenarios for cumulative PV module waste are between 54 million and 160 million metric tons cumulatively by 2050[4].

Although this seems like a large amount of waste, Fig. 1 shows that 35 years of cumulative PV module waste (2016–2050) is dwarfed by the waste generated by fossil fuel energy and other common waste streams (if we assume constant annual waste at present rates). For example, if we do not decarbonize and transition to renewable energy sources, coal ash and oily sludge waste generated from fossil fuel energy would be 300–800 times and 2–5 times larger, respectively, than PV module waste. Also, both coal ash and oily sludge are known to be toxic[5,6]. In fact, we globally produce and manage approximately the same mass of coal ash per month as the amount of PV module waste we expect to produce over the next 35 years. Compared another way, globally we will generate up to 440–1,300 times more mass of municipal waste than PV module waste by 2050.

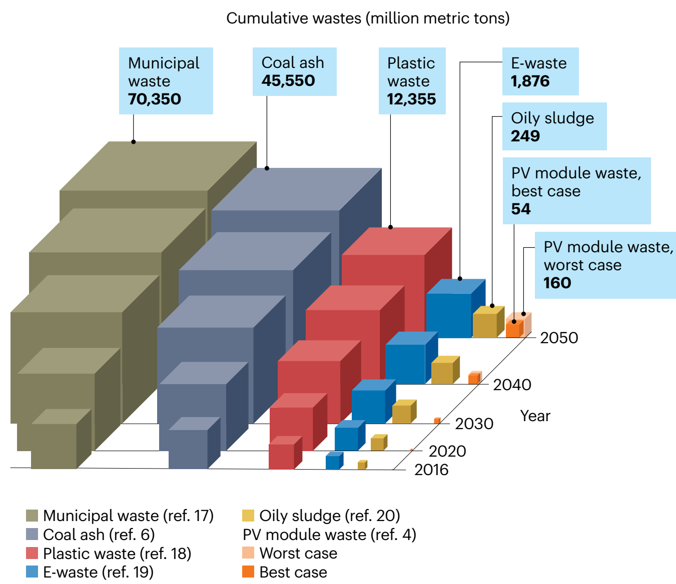


Fig. 1 | Global cumulative wastes from 2016 to 2050. We compare best-case and worst-case scenario PV module waste estimates[4] to municipal waste[17], coal ash[6], plastic waste[18], e-waste[19] and cumulative oily sludge from crude oil production[20] (assuming constant annual waste generation at present rates) in million metric tons. Best-case scenario represents long-lived, high-quality modules, whereas the worst-case scenario represents regular-quality modules with below average lifetimes[21].

Therefore, by transitioning away from fossil fuels, a substantial reduction in waste mass and toxicity is possible and the remaining waste is well within our capabilities to manage responsibly.

Correcting misinformation about PV toxicity

Incorrect information about toxic materials in PV modules is leading to unsubstantiated claims about the harms that PV modules pose to human health and the environment, fuelling public concern and opposition to PV development[2]. For example, several US state health department websites provide a list of potential toxins in PV modules, including arsenic, gallium, germanium and hexavalent chromium[7–10]. However, the vast majority of PV modules are either crystalline silicon or cadmium telluride (CdTe) (97% and 3% global market share, respectively, in 2022).

In fact, these two most common types of PV contain almost none of these harmful materials. Crystalline silicon PV modules are 77% glass, 10% aluminium, 3% silicon and 9% polymers, with less than 1% copper, silver and tin, and less than 0.1% lead[11]. CdTe modules are 80–85% glass, 11–14% aluminium, 2–4% polymers, less than 0.4% copper, and less than 0.1% tellurium and cadmium[11].

We have not found any evidence that either of these PV technologies contain arsenic, gallium, germanium, hexavalent chromium or perfluoroalkyl substances. Arsenic and gallium are used in only high-efficiency PV modules for aerospace applications. Germanium was once used in some amorphous silicon modules that were never produced at scale. We cannot find any evidence that chromium was ever used in PV modules outside of laboratory cells in the 1970s. We believe that hexavalent chromium is listed because it was once used for plating chrome onto solar thermal water heaters (not photovoltaics). Finally, while some backsheets are fluoropolymer-based, free perfluoroalkyl substances are not present in PV modules[12].

The International Energy Agency confirmed that the only potential human health and environmental concerns in commercially produced PV modules are the trace amounts of lead in the solder of crystalline silicon modules and the cadmium in CdTe modules[13]. While the <15-µm-thick solder coatings of wires and ribbons in a crystalline silicon module contain small fractions of lead, this risk may be reduced as many manufacturers are seeking to adopt lead-free solders[14]. The CdTe compound in commercially available thin-film solar modules is extremely stable and does not pose the same toxicological hazard as elemental cadmium. The thin CdTe film (typically they are less than 3 µm thick) means that the total amount of cadmium is less than 0.1% by weight[11]. CdTe modules are currently collected and both cadmium and tellurium are recycled into new modules.

Despite the differences in lifetime and small solder content, PV modules are sometimes incorrectly categorized as e-waste. However, the concentration of solder in PV modules is much lower, and the structure of the module greatly reduces lead-leaching risks. The toxicity of PV module waste is also much lower than both coal ash and oily sludge from crude oil production[5,6]. Treating decommissioned PV modules as a commodity and opportunity for material recovery, and not as hazardous waste would be environmentally and economically beneficial.

Improving PV module sustainability

The solar industry is proactively investing in circular strategies, including reduce, reuse and recycle, to address PV module waste concerns and advance sustainable development practices. Manufacturers have reduced the amount of silicon raw materials and energy embedded in modules by using more efficient diamond wafer sawing, ingot growth processes and wafer geometries. The PV industry is also reducing the total number of modules needed to be manufactured and deployed to meet capacity targets by designing more efficient and longer-lasting products. Indeed, efforts are underway to develop a module with a 50-year lifetime. Our research found that giving priority to designing PV modules and systems with long lifetime, low power degradation and high energy yield leads to lower costs[15], less material demand and waste[16], and enables streamlined decarbonization benefits because each system produces more power over time and requires fewer replacements.

The solar industry is also investing in reuse by analysing secondary market options and studying repair and refurbishing technologies to extend the lifetime of PV systems and modules. Simply leaving systems in operation after the planned project lifetime can be an extremely efficient form of reuse.

Recycling PV modules is critical to decarbonizing the PV supply chain and minimizing waste and is the prominent circular strategy studied and implemented by the solar industry today. Once the amount of PV modules that require recycling is large enough, scaling of reprocessing facilities will greatly reduce cost and diversify the supply chain, increasing the security and sustainability of PV module material sourcing.

Conclusions

Communities, government agencies and policymakers may be operating under outdated or false assumptions about PV module waste and toxicity hazards resulting in delay or unnecessary impediments to the rapid deployment of PV needed to meet decarbonization goals. Placing the expected PV module waste stream in context, the transition to replace fossil-based energy with renewables represents a substantial reduction in mass and toxicity of waste. The PV industry is further minimizing the expected waste stream by developing longer-lasting PV modules, markets to re-use PV modules and processing for recycling-based resource recovery of PV modules. Due to the long lifetimes and consistent profitability of PV systems, there is ample time to scale PV module re-use and recycling industries while rapidly deploying the multi-terawatts of PV that are vital to meet our climate goals by 2050.

The solar industry can contribute to decarbonization efforts worldwide through continued research on reliability, low-carbon materials, high-yield PV modules and systems and advancing circular pathways for PV. The solar industry must also effectively communicate the facts and benefits of PV with communities and governments to meaningfully address concerns, and collaborate with allied industries to craft sustainable and responsible PV development practices that consider the entire lifecycle of the system. Objective research and good communication can address community concerns and empower decision-makers to make informed decisions about their energy future.

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Competing interests
The authors declare no competing interests.

EXHIBIT Y: VEGETATION MANAGEMENT AT SOLAR FACILITIES ARTICLE

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Full Length Article

Modeling the ecosystem services of native vegetation management practices at solar energy facilities in the Midwestern United States

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ABSTRACT

The increasing pressure on land resources for food and energy production along with efforts to maintain natural systems necessitates the development of compatible land uses that maximize the co-benefits of multiple ecosystem services. One such land sharing opportunity is the restoration and management of native grassland vegetation beneath ground-mounted solar energy facilities, which can both protect biodiversity and restore related ecosystem services. In this paper, we applied the InVEST modeling framework to investigate the potential response of four ecosystem services (carbon storage, pollinator supply, sediment retention, and water retention) to native grassland habitat restoration at 30 solar facilities across the Midwest United States. Compared to pre-solar agricultural land uses, solar-native grassland habitat produced a 3-fold increase in pollinator supply and a 65% increase in carbon storage potential. We also observed increases in sediment and water retention of over 95% and 19%, respectively. We applied these results to project the potential benefits of adoption of native grassland management practices in current and future solar energy buildout scenarios. Our study demonstrates how multifunctional land uses in agriculture-dominated landscapes may improve the provision of a variety of ecosystem services and improve the landscape compatibility of renewable energy and food production.

1. Introduction

Solar photovoltaic (PV) energy technologies have exponentially increased across the globe over the past decade (Kabir et al., 2018; Irsyad et al., 2019). Currently, there are over 33 gigawatts (GW) of ground-based large-scale (>1 MW) solar PV energy production in the U. S. (EIA, 2019a), representing about 1.5% of total U.S. electricity generation in 2018 (EIA, 2019b). The proliferation of large-scale solar energy developments is expected to continue across the U.S. over the next decade. For example, the U.S. Department of Energy's National Renewable Energy Laboratory, through its Standard Scenarios Report, estimates around 200 GW of installed electric capacity among ground-mounted solar facilities by 2040 under its Mid-Case scenario, and more than 500 GW of ground-mounted solar facilities by 2040 under its Low-PV Cost scenario (Cole et al., 2019). Like other forms of energy development, land use represents a major challenge for future solar energy deployment. Ground-based solar energy developments require between 2.5 and 3.5 ha per megawatt (MW) (Ong et al., 2013; Hernandez et al., 2014), and approximately 7500 km^2 of total land will be needed to meet 2030 projected solar energy production (Hartmann et al., 2016), roughly the combined size of the states of Delaware and Rhode Island.

Given their large land requirements, questions about the sustainability of solar energy developments have emerged in terms of their compatibility with other land uses such as agriculture (Moore-O'Leary et al., 2017; Hernandez et al., 2019). Ground-based solar energy developments are increasing in agricultural landscapes, due in large part to the siting of utility-scale solar energy developments on former agricultural fields (Adelaja et al., 2010; Adeh et al., 2019). Croplands are generally flat, open, and relatively undeveloped, making them ideal locations for solar energy development (Adeh et al., 2019). This pattern of conversion from agriculture to solar energy development can represent a land use tradeoff between food production and renewable energy production (e.g., Krishnan and Pearce, 2018). As the pressure intensifies on land resources for energy and food production, greater emphasis has been placed on solutions that maximize mutual benefits of multiple

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ecosystem services. Recent approaches have suggested the integration of solar energy with food production, biodiversity conservation, and other ecosystem services (i.e., the energy-food-ecology nexus; Moore-O'Leary et al., 2017; Hernandez et al., 2019). For example, the co-location of solar energy and agriculture, often termed as "agrivoltaic systems", could improve the land-use potential of solar sites for energy and food production (Ravi et al., 2016; Dinesh and Pearce, 2016; Hoffacker et al., 2017; Barron-Gafford et al., 2019). In one study, Barron-Gafford et al. (2019) found that shading by solar PV arrays benefitted the production of crops such as Chiltepin peppers (*Capsicum annuum var. glabriusculum*), jalapenos (*C. annuum* var. *annuum*), and tomatoes (*Solanum lycopersicum var. cerasiforme*) by increasing yields and reducing water requirements while also creating cooler microclimate conditions that improved solar energy production.

Other research surrounding the energy-food-ecology nexus of solar energy has focused on the restoration of native grassland vegetation at ground-mounted solar facilities ("solar-native vegetation") to improve biodiversity and other ecosystem services such as pollination of adjacent croplands (Moore-O'Leary et al., 2017; Walston et al., 2018; Hernandez et al., 2019). In the United States, this approach has focused on vegetation management efforts at solar facilities aimed at establishing native grassland vegetation, such as milkweed (*Asclepias* spp.), native forbs and wildflowers, and other pollinator-friendly vegetation, either among the solar PV arrays or elsewhere within the solar facility footprint area, that attract and support native insect pollinators and other beneficial insect predators by providing food resources, refugia, and nesting habitat. Highlighting the potential significance of this approach, recent research found that over 3500 km^2 of agricultural land near existing solar energy facilities in the U.S. may benefit from increased pollination services through the establishment of solar-native vegetation (Walston et al., 2018).

Conventional ground management approaches at solar facilities often involve the establishment and management of low-growing turfgrass (Walston et al., 2018). While turfgrass provides some ecosystem service value for biodiversity and soil and water control, shifting to native grassland management practices at these locations has the potential to improve the ecosystem services potential of solar energy facilities. Compared to conventional turfgrass approaches, native grassland vegetation may improve ecosystem services related to biodiversity, carbon storage, water conservation, soil retention, and pollination of nearby croplands. Favorable microclimate conditions created by solar PV arrays, such as lower temperatures and greater soil moisture, can improve the performance of native grasses, which increases aboveground biomass and related carbon sequestration (Armstrong et al., 2016; Adeh et al., 2018). In addition, native grasses and forbs typically have deeper root systems than row crop agriculture and turfgrass (Schenk and Jackson, 2002), with root depths of some native grassland species exceeding 2–5 m (Packard and Mutel, 1997). Deeper root systems create the potential for improved soil stabilization and reduced water runoff (Hernandez-Santana et al., 2013). To date, however, these solar-native vegetation ecosystem service benefits have not been adequately quantified or evaluated in a common framework that allows for an understanding of a suite of ecosystem services. Thus, to build upon the previous efforts to understand the ecosystem service benefits of solar-native vegetation, this paper focuses on modeling the potential supply of ecosystem services resulting from different vegetation management approaches at solar energy facilities. Specifically, we were interested in addressing the following question: *What are the multiple ecosystem service benefits of solar-native vegetation compared to pre-existing land uses and other types of vegetation management practices at solar facilities*? To address this question, we conducted a geospatial land use change assessment for solar energy facilities in the Midwest and we developed spatially-explicit models at a regional scale aimed at quantifying differences in the following ecosystem services associated with solar-vegetation management options: pollinator supply, carbon storage, soil retention, and water yield. We then project these results to examine ecosystem service implications of future solar energy development within the region.

2. Methods

2.1. Study area

We examined ecosystem services associated with vegetation management practices at solar energy facilities within the Midwestern region of the United States (Fig. 1). This region is approximately 1.1 million km^2 in size and includes the states of Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, and Wisconsin. The predominant land use in this region is agriculture (37% of the study area), followed by forest (33%) and grasslands and other herbaceous land cover types (17%). The climate is humid temperate, with an average annual precipitation of 725 to 1100 mm (USDA, 2019). Average annual minimum and maximum temperatures in the region are −9 degrees Celsius (°C) and 29 °C, respectively (USDA, 2019).

Euro-American settlement and associated agricultural intensification has resulted in the decline of the region's grasslands, a diverse vegetation system that was much more dominant and widespread throughout the region prior to the mid-1800s. For example, over 99% of the tallgrass prairie in Illinois, Indiana, Iowa, Minnesota, and Missouri have been lost primarily due to agricultural expansion (Samson and Knopf, 1994). As such, many of the current terrestrial ecological restoration objectives within the region focus on restoration of native grassland and prairie systems. For solar sites in the Midwest, increasing emphasis has been placed on native grassland restoration among the PV arrays (Clean Energy States Alliance, 2020), which is a more compatible habitat type for solar energy development than other habitat types such as forests or wetlands.

2.2. Identification of solar energy facilities and data preparation

We identified the location of large-scale ground-based solar energy facilities (>1 MW) from the U.S. Energy Information Administration (EIA) for the year 2018 (EIA, 2019). The EIA reports generator-level specific information on electricity production facilities, including latitude and longitude information for facility locations and nameplate electricity capacity (MW). We queried the EIA database to only those sectors that were utility or industrial ground-based facilities (sectors 1 and 2). By doing so, we omitted large commercial rooftop facilities from our study. We then used a Geographic Information System (GIS; ArcGIS version 10.6.1) to map the approximate point location of each facility using the latitude and longitude coordinates reported by the EIA. We overlaid these points with the latest online World Imagery basemap within ArcGIS (ESRI, 2019) and digitized the footprint boundaries of all solar sites observable in the imagery. Solar facility polygons were drawn to include the PV panel area plus other areas observable within the fenced area of the facility (e.g., disturbed soil, laydown areas, operations facilities). Most of the World Imagery available for the region was obtained in 2018. We then calculated the size (ha) of each digitized solar facility's footprint polygon. For these facilities, we correlated facility electric capacity (MW) and footprint size (ha) and we used this relationship to estimate the footprint size for solar facilities that were not observed or incomplete in the satellite imagery. The 2018 list of all solar energy facilities in the Midwest, along with corresponding footprint sizes, is provided in Supplement 1.

We conducted a land use change assessment to determine what percentage of solar facilities in the Midwest were developed on former agricultural fields or other land use-land cover (LULC) types. We performed this assessment only for those solar facility footprints that could be delineated in a GIS. Because large-scale solar energy development largely did not appear in the Midwest until 2012, we used 2010 LANDFIRE Existing Vegetation Types (http://www.landfire.gov/evt.php) as the pre-solar land use dataset and determined the composition

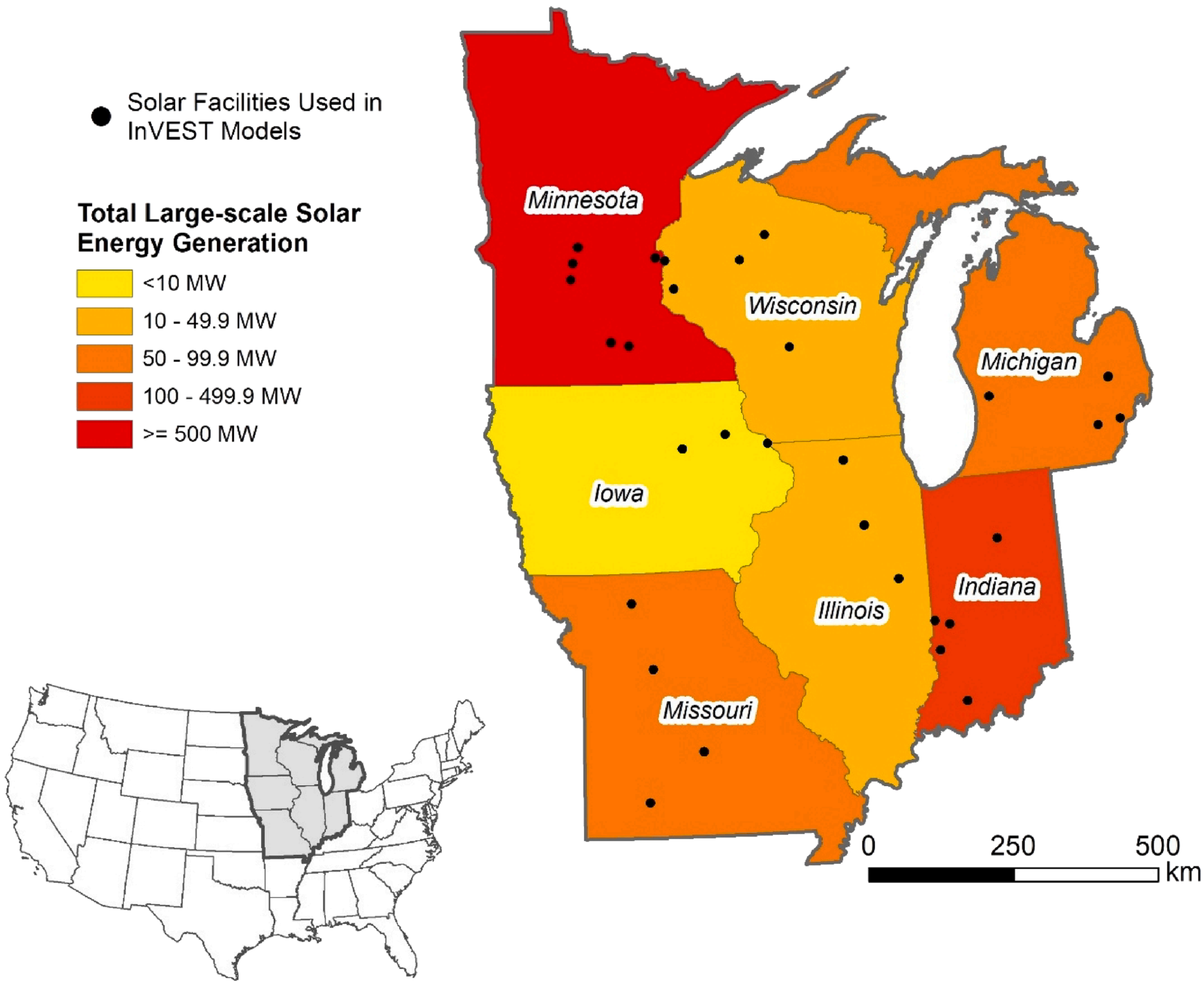

Fig. 1. Total 2018 large-scale (>1 MW) solar energy generation in States of the Midwest region of the United States (source: EIA, 2019). Locations of the thirty solar energy facilities used in InVEST modeling are shown in black.

of 2010 land use types intersecting the solar facility footprints as the measure of LULC change (see Supplement 1).

2.3. Scenarios

To determine the ecosystem services among vegetation management activities at mapped solar energy facilities, we designed three land use scenarios for the solar energy facility footprints: an agriculture scenario (the baseline “pre-solar development” land use) and two solar energy development scenarios – a solar-turfgrass scenario and a solar-native grassland scenario (Fig. 2). Because we assumed the majority of solar facilities in the region were previously under corn-soybean agricultural production (Supplement 1), we replaced all land uses in the solar footprint polygons with agriculture to represent the pre-solar land use. We considered this scenario to be the baseline scenario for comparison. The second scenario we evaluated was a solar-turfgrass vegetation scenario in which we assumed the sodding of cool-season turfgrass within the solar facility. This scenario also involves regular vegetation maintenance at the solar facility such as active mowing and herbicide applications to minimize or prohibit the growth of vegetation (<0.3 m high) within the solar facility footprint. Turfgrass is a common vegetation management practice at solar facilities and this scenario was considered to be the business as usual (“BAU”) scenario for operating solar facilities. The third scenario we evaluated was a solar-native grassland scenario in which we assumed the intentional establishment of native prairie grasses and forbs in the solar facility footprint that provide forage and nesting habitat for native insect pollinators. Compared to the turfgrass scenario, the solar-native grassland scenario involves management activities that allow the vegetation to flower and reach heights up to 1 m within the solar PV arrays (the maximum height typically allowed at solar PV arrays to avoid shading of the panels). Because native grasses and forbs typically have deeper root systems than turfgrass (Schenk and Jackson, 2002), we assumed greater above- and below-ground vegetation biomass under the solar-native grassland scenario compared to the solar-turfgrass scenario.

2.4. Modeling framework

We used a multiple service model called Integrated Valuation of Environmental Services and Tradeoffs (InVEST, version 3.6; Sharp et al., 2018) to evaluate ecosystem services under each of the three land use scenarios at the Midwest solar energy facilities. The InVEST suite of tools has been developed to assist decision makers in comparing the impacts of different land use scenarios on the provision of ecosystem services. To our knowledge, this is the first application of InVEST to examine ecosystem service response to solar energy land uses. We used the following four existing InVEST models: Pollinator Model (for pollinator habitat quality), Carbon Storage Model, Sediment Delivery Ratio (SDR) Model (for soil retention), and Water Yield Model (for water retention). A detailed description of our modeling methods and parameters can be found in Supplement 2. Each of these InVEST models incorporate spatial datasets on land use-land cover (LULC) and some of them use elevation,

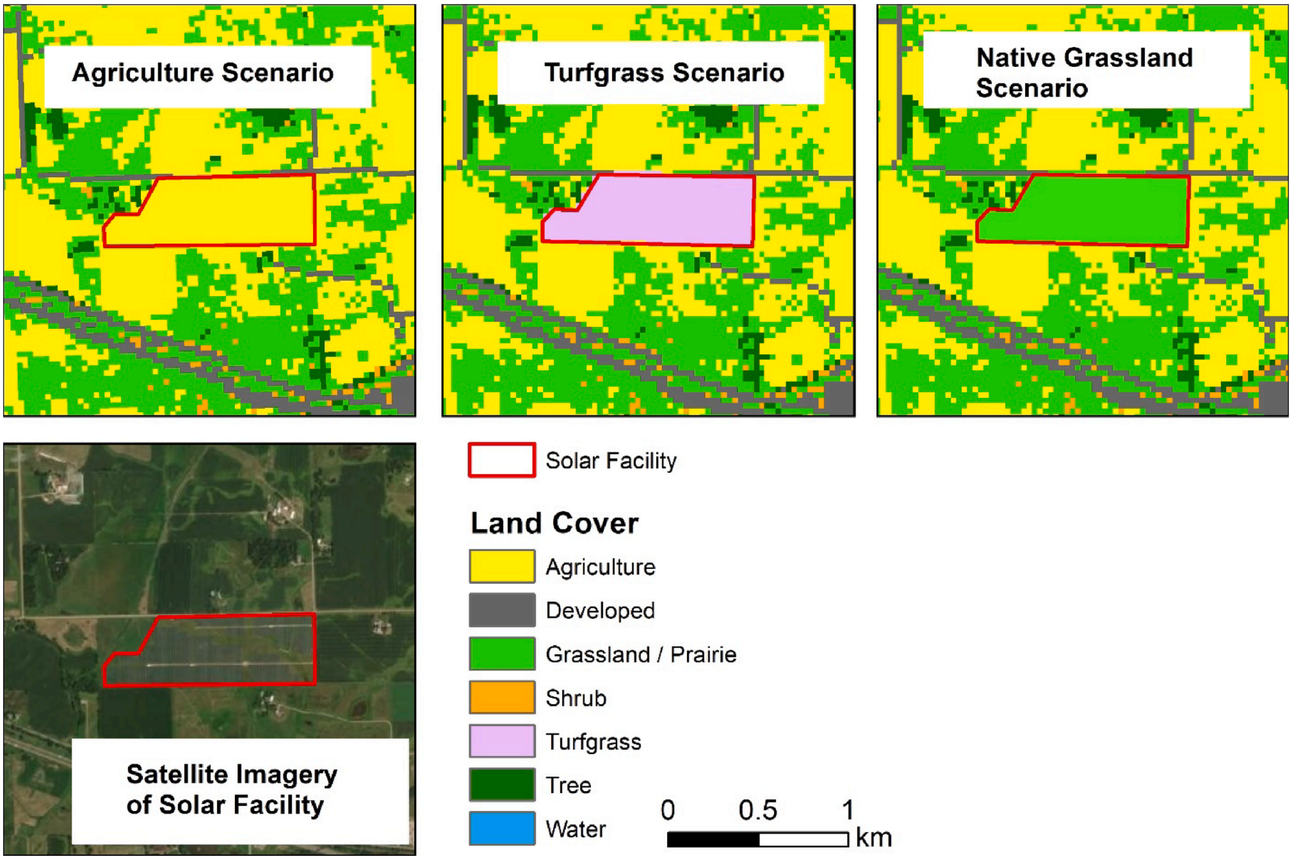

Fig. 2. Vegetation scenarios evaluated in this study. The agriculture scenario represents the pre-solar land use.

rainfall, and soil and vegetation properties, along with tabular biophysical parameters, to conduct spatially-explicit assessments of ecosystem services. The spatial datasets used in the models are also described in Supplement 2.

For this LULC dataset, we used a 30 m raster dataset of vegetated land cover from the 2014 LandFire Program (Existing Vegetation Types; http://www.landfire.gov/evt.php). We initially summarized the LULC map across the entire Midwest region into seven broad LULC classifications based on vegetation life form: developed, agriculture, barren or sparsely vegetated, grassland, shrubland, forested, and water and wetlands. We then updated the LULC map to create an eighth LULC classification representing solar energy facility developments using the footprint polygons delineated from satellite imagery. We selected a total of 30 solar facility footprint polygons, with a minimum of 3 footprints in each state, to update the LULC raster dataset (Fig. 1). This LULC update was performed by overlaying the facility footprint polygons on the initial LULC map and reclassifying the underlying pixels of the LULC map to a unique solar-specific LULC code.

All of the InVEST models also require tabular biophysical parameters to relate land cover types from the LULC map to the individual ecosystem service processes. We reviewed the existing literature to identify studies utilizing these InVEST models in the United States to parameterize each model. Surrogate vegetation and LULC types were used to identify the biophysical parameters to include in each scenario (Table 1).

We used the surrogate LULC types to review existing literature from previous InVEST modeling studies in the United States and summarize the biophysical parameters for each model (Table 2). We ran each model using upper- and lower-bound parameter values based on the 25% and 75% quartile range of values reported in the literature. We used this range to estimate the uncertainty in models and we used the midpoint (average) values in comparing ecosystem services across scenarios. For

Table 1
Land use-land cover (LULC) surrogates for the three land use scenarios modeled in this study.

Scenario	Surrogate LULC types
Agriculture (baseline pre-solar land use)	Row crop agriculture LULC types (e.g., corn-soybeans).
Solar-turfgrass	Residential, suburban, and turfgrass LULC types.
Solar-native grassland	Native grassland and prairie LULC types.

all ecosystem service estimates, we focused on the change in the service delivery for the solar-native grassland scenario compared with the solar-turfgrass scenario and the baseline agriculture scenario. For each scenario, we assumed the surrogate vegetation (Table 1) was consistently and uniformly distributed across all solar facilities. We were not able to use InVEST to model the effect of solar panels on these ecosystem services so we assumed this effect to be constant across all three land use scenarios.

The InVEST Carbon Storage Model is a carbon stock estimation model that is explicitly connected to land cover type. This model calculates total carbon storage (Mg C/ha) for each land cover type based on the aggregation of four carbon pools: aboveground carbon density, belowground carbon density, soil organic carbon density, and dead organic matter carbon density (Sharp et al., 2018). We used this model to examine differences in total carbon storage associated with each scenario.

The InVEST Pollinator Model was designed to model and map patterns of pollinator habitat quality and potential pollination service values across landscapes (Sharp et al., 2018). This model utilizes information on floral resource availability (associated with each LULC type), along with tabular inputs on nesting and foraging parameters for individual pollinator species or species groups, to estimate the supply,

Table 2
Biophysical parameters used in the InVEST Models. The range represents the upper- and lower-bound parameter values used in the models

	Carbon storage model[a]	Pollinator model[b]		Sediment (SDR) model[c]	Water yield model[d]	
Scenario	Total carbon storage (Mg C/ha)	Ground nest availability	Floral resource availability	USLE C-factor	Root restricting layer (mm)	Kc
Agriculture	68.0–88.6	0.137–0.213	0.270–0.400	0.30–0.43	775–925	0.55–0.60
Solar-turfgrass	87.0–104.4	0.310–0.530	0.460–0.580	0.03–0.08	775–925	0.65–0.75
Solar-native grassland	108.0–148.1	0.430–0.570	0.675–0.825	0.01–0.03	1250–1750	0.75–0.85

[a] Sources: Grafius et al. (2016); Johnson et al. (2012); Kovacs et al. (2013); Liebman et al. (2013); Polasky et al. (2011); Sharp et al. (2018); Sun et al. (2018).
[b] Sources: Davis et al. (2017); Kennedy et al. (2013); Zhao et al. (2019). Cavity nest availability assumed to be 0 in all scenarios.
[c] Sources: Bai et al. (2019); Chaplin-Kramer et al. (2016); Grafius et al. (2016) Sharp et al. (2018); Sun et al. (2018).
[d] Sources: Bai et al. (2019); Redhead et al. (2016); Sharp et al. (2018). Kc = Plant Evaporation Coefficient.

abundance, and service value of insect pollinators across the landscape. In this study, we used the pollinator supply InVEST output to assess the ability of each scenario vegetation type to support insect pollinators. As described by the InVEST model (Sharp et al., 2018), pollinator supply is a unitless index (between 0 and 1) indicating where pollinators originate on the landscape. For the purpose of comparing the different vegetation scenarios, we used native bumblebees (Family Apidae) and native sweat bees (Family Halictidae) as the modeled guilds (Supplement 2).

The InVEST Sediment Delivery Ratio (SDR) Model estimates the overland movement of sediment based on topography, climate, soil, and land cover properties. The SDR model is a spatially-explicit model working at the spatial resolution of the input digital elevation model raster (Sharp et al., 2018). For each pixel, the model computes the amount of annual soil loss from that pixel based on a revised Universal Soil Loss Equation (USLE). It then calculates the SDR, which is the proportion of soil loss that reaches the catchment. Finally, the model uses the USLE and SDR to calculate erosion as total catchment sediment export (tons/ha). Inputs for the SDR model include raster maps for LULC, elevation, rainfall, and soil erodibility, along with tabular biophysical attributes related to sediment retention based on land cover type (Supplement 2). We used this model to estimate the amount of surface soil erosion associated with each vegetation scenario. Because sediment erosion represents a negative impact on the landscape, we considered erosion to be the inverse of a positive ecosystem service – soil retention, or the ability of a modeled vegetation type to retain soil.

The InVEST Water Yield Model calculates the net water yield at pixel-based and watershed scales based on the difference between precipitation and actual evapotranspiration. Actual evapotranspiration is a function of reference evapotranspiration, root restricting layer depth, plant available water content, and land cover type (Sharp et al., 2018). Following the methods described by Bai et al. (2019), we used the Water Yield model as an interim step in quantifying water retention: the ability of the modeled land cover type to intercept water from runoff. Water retention is calculated by subtracting runoff from water yield as follows:

$$WR_{ij} = WY_{ij} - Runoff_{ij}$$

where WR_i is the annual water retention (mm/yr) for pixel i on LULC type j, WY_{ij} is the annual water yield (mm/yr) for pixel i on LULC type j (calculated from InVEST), and $Runoff_{ij}$ is the annual surface runoff (mm/yr) for pixel i on LULC type j. Runoff is a product of annual precipitation and a runoff coefficient for each LULC type based on slope and soil type (Supplement 2). Because most solar energy developments are constructed on low slopes (<10%; Hartmann et al., 2016) and most agricultural areas in the region are loamy soils (Hollinger, 1995), we calculated LULC-specific erosion coefficients based on assumed slope of <10% and loamy soil properties.

2.5. Synthesis

We compared the output from the four InVEST models among the three vegetation scenarios. These comparisons were made on a unit-area basis for the 30 modeled solar energy developments and projected to the current amount of large-scale solar energy development in the Midwest region. We also explored the future potential for these ecosystem services by projecting these results to a future solar energy development scenario. Based on solar energy targets identified from state legislation and energy websites (e.g., Illinois Future Energy Jobs Act [S.B. 2814, 2016]; SEIA, 2019; MISO, 2019), we estimated the total foreseeable potential large-scale solar energy development within the Midwest region in the next 10–15 years (2030–2034). Using a solar land use-MW relationship calculated from delineated existing solar footprints in the region (Supplement 1), we estimated the future aggregate solar footprint size and projected our InVEST model results to this scenario.

3. Results

3.1. Solar energy development

We identified 276 large-scale solar facilities in the Midwest region that were operating in 2018, representing a total nameplate electricity capacity of 1183.8 MW (Supplement 1). The state of Minnesota contained most of the region's solar energy development both in terms of the number of facilities and total electricity capacity (Fig. 1; Table 3). Approximately 59% of the solar facilities and over 62% of the region's solar electricity capacity occurred in Minnesota. The state of Iowa contained the fewest number of solar facilities (n = 5) and the lowest amount of large-scale solar electricity generation (9.2 MW).

We identified and mapped the facility footprints of 192 solar facilities from the ESRI World Imagery. The remaining 84 solar facilities were either incomplete or not yet constructed at the time the satellite imagery was collected. We determined a land use-MW relationship of 3.0 ha per MW for all 192 delineated solar facilities (Supplement 1) and applied this relationship to estimate the footprint sizes for the remaining 84 solar facilities. Using the GIS-derived and estimated solar footprint sizes, we determined the total current footprint size among all solar facilities in the Midwest to be approximately 3416 ha (34.2 km^2).

Table 3
Summary of current (2018) large-scale solar energy development in the Midwest region.[a]

State	Current number of solar facilities	Current total nameplate capacity (MW)	Total current estimated footprint size (ha)[b]
Illinois	6	38.5	86.7
Indiana	60	214.3	574.2
Iowa	5	9.2	15.9
Michigan	13	98.3	250.1
Minnesota	163	741.5	2252.7
Missouri	17	61.1	173.2
Wisconsin	14	20.9	63.2
Regional total	276	1183.8	3416.0

[a] Sources: Data for 2018 solar facility development obtained from EIA (2019).
[b] Estimated total footprint size was based on solar footprint polygons digitized in GIS (for those facilities that could be mapped and located with satellite imagery) a land use relationship of 3.0 ha per MW of nameplate capacity for those facilities that could not be located within satellite imagery (Supplement 1).

We determined the pre-solar construction land uses by identifying and quantifying the amount of 2010 LULC types within the 192 delineated solar facility footprints. By far, the dominant pre-construction LULC type converted to solar energy was row crop agriculture, comprising 70% of the 2010 LULC types within the solar footprint polygons (Supplement 1). This represents a conversion of approximately 2391 ha (23.9 km^2) of row crop agriculture to current ground-based solar energy development. Other forms of LULC conversion included developed areas (15.0%, 512.4 ha), pasture and hay fields (5.4%, 184.5 ha), and forest and riparian areas (4.5%, 153.7 ha).

3.2. InVEST model results

Ecosystem service model results for the 30 Midwest solar facilities, averaged by state, are presented in Table 4 (see Supplement 2 for more detailed results). Differences in modeled ecosystem service results among scenarios were primarily related to LULC changes. We used the variability in reported biophysical parameter values (Table 2) to calculate the range (and midpoint average) of ecosystem service results under each scenario. We found the patterns of ecosystem service provision among scenarios were consistent for the entire Midwest (Fig. 3). For example, the solar-native grassland scenario retained more water than the solar-turfgrass scenario, which retained more water than the agriculture scenario (solar-native grassland > solar-turfgrass > agriculture). We therefore present remaining results using the regional averages of modeled ecosystem services.

Carbon Storage. On average for the entire Midwest region, the solar-native grassland scenario had a potential carbon storage capacity of 129.3 Mg C/ha, which was 65% and 35% greater than the agriculture and solar-turfgrass scenarios, respectively (Table 4; Fig. 3).

Pollinator Supply. On average, the solar-native grassland scenario improved pollinator supply by 3-fold and 30% compared to the agriculture and solar-turfgrass scenarios, respectively (Table 4; Fig. 3).

Sediment Export. On average, sediment export under the solar-native grassland scenario was 0.007 tons/ha/year, which was a reduction of over 95% and 77% compared to the agriculture and solar-turfgrass scenarios, respectively (Table 4; Fig. 3).

Water Retention. On average, water retention under the solar-native grassland scenario was 885.0 mm/yr, which was 19% and 9.5% greater than the agriculture and solar-turfgrass scenarios, respectively (Table 4; Fig. 3).

Table 4
State and Midwest regional average ecosystem service results.

State	Agriculture scenario	Turfgrass scenario	Native grassland scenario
Carbon storage (Mg C*ha^{-1})			
All States	78.3	95.7	129.3
Pollinator supply (unitless index)			
Illinois	0.032	0.071	0.094
Indiana	0.032	0.072	0.094
Iowa	0.032	0.074	0.093
Michigan	0.032	0.076	0.095
Minnesota	0.033	0.074	0.098
Missouri	0.034	0.076	0.101
Wisconsin	0.034	0.079	0.100
Regional average	0.033	0.074	0.096
Sediment export (tons*ha^{-1}*yr^{-1})			
Illinois	7.084	0.536	0.131
Indiana	2.935	0.237	0.062
Iowa	2.165	0.168	0.041
Michigan	0.837	0.065	0.017
Minnesota	3.449	0.258	0.063
Missouri	10.252	1.061	0.263
Wisconsin	0.528	0.039	0.009
Regional average	0.327	0.030	0.007
Water retention (mm*ha^{-1}*yr^{-1})			
Illinois	832.3	910.0	1007.4
Indiana	740.3	812.6	900.1
Iowa	666.8	725.0	791.5
Michigan	733.0	783.2	842.4
Minnesota	748.3	803.2	869.3
Missouri	748.9	820.5	907.3
Wisconsin	762.2	824.7	904.1
Regional average	744.3	808.0	885.0

3.3. Projections to current and future energy scenarios

Using the Midwest regional averages for all calculations, the solar-native grassland scenario for all existing solar facilities (3416 ha) had the potential above- and below-ground carbon storage capacity of 267,473 Mg C, which was 174,216 Mg and 114,778 Mg greater than the agriculture and solar-turfgrass scenarios, respectively (Table 5). The solar-native grassland scenario conserved over 1000 tons more sediment from erosion than the agriculture scenario and 79 tons more sediment than the solar-turfgrass scenario. For existing solar energy developments, the solar-native grassland scenario retained over 4,800,000 m^3 and 2,600,000 m^3 more water than the agriculture and solar-turfgrass scenarios, respectively (Table 5). Because InVEST calculates pollinator supply as a unitless index value, we did not make future projections for pollinator habitat quality.

Based on solar energy targets identified from state legislation and energy websites (e.g., Illinois Future Energy Jobs Act [S.B. 2814, 2016]; SEIA, 2019; MISO, 2019), we conservatively estimated the amount of large-scale solar energy development for a future 2030–2034 time period to be approximately 10,000 MW (10 GW). This represents about 5% of the national 2030 goal for ground-mounted solar set forth by the U.S. Department of Energy (U.S. Department of Energy, 2012). Several Midwestern states such as Minnesota, Illinois, Indiana, and Wisconsin already have a queue of expected solar projects that would collectively reach this level of development in the next 5 years. Based on our calculated regional solar land use estimate of 3.0 ha per MW (Supplement 1), we estimated this future regional solar development footprint to occupy approximately 30,000 ha (300 km^2). If all solar facilities incorporated native grassland vegetation management strategies under this future energy scenario, the total above- and below-ground carbon storage potential of these facilities could exceed 3,800,000 Mg C, which would represent 1,500,000 Mg C and 1000,000 Mg C greater storage potential than agriculture and solar-turfgrass scenarios, respectively (Table 5). Under this future energy scenario, region-wide adoption of solar-native grassland management strategies has the potential to conserve over 9000 tons of sediment loss from erosion annually and retain over 40,000,000 m^3 of water from runoff annually (Table 5).

4. Discussion

Ecosystem services of vegetation management options at solar energy facilities are an emerging field of study. Our study demonstrates how multifunctional land uses in agricultural-dominated landscapes have the potential to improve the provision of a variety of ecosystem services. Numerous studies have demonstrated the effectiveness of native grassland restoration in agricultural landscapes in conserving insect pollinators and restoring important ecosystem services (e.g., Hernandez-Santana et al., 2013; Blaauw and Isaacs, 2014; Schulte et al., 2017). While field studies at solar facilities are currently under way to measure the ecosystem services of different vegetation management options, it will take several years for these field data to become available. To obtain initial estimates, we focused on examining the potential ecosystem services in a spatially-explicit manner using secondary data sources and scaled our model results to regional estimates. Our models included input parameters from previous studies in the U.S. that evaluated ecosystem service tradeoffs among various land uses, including

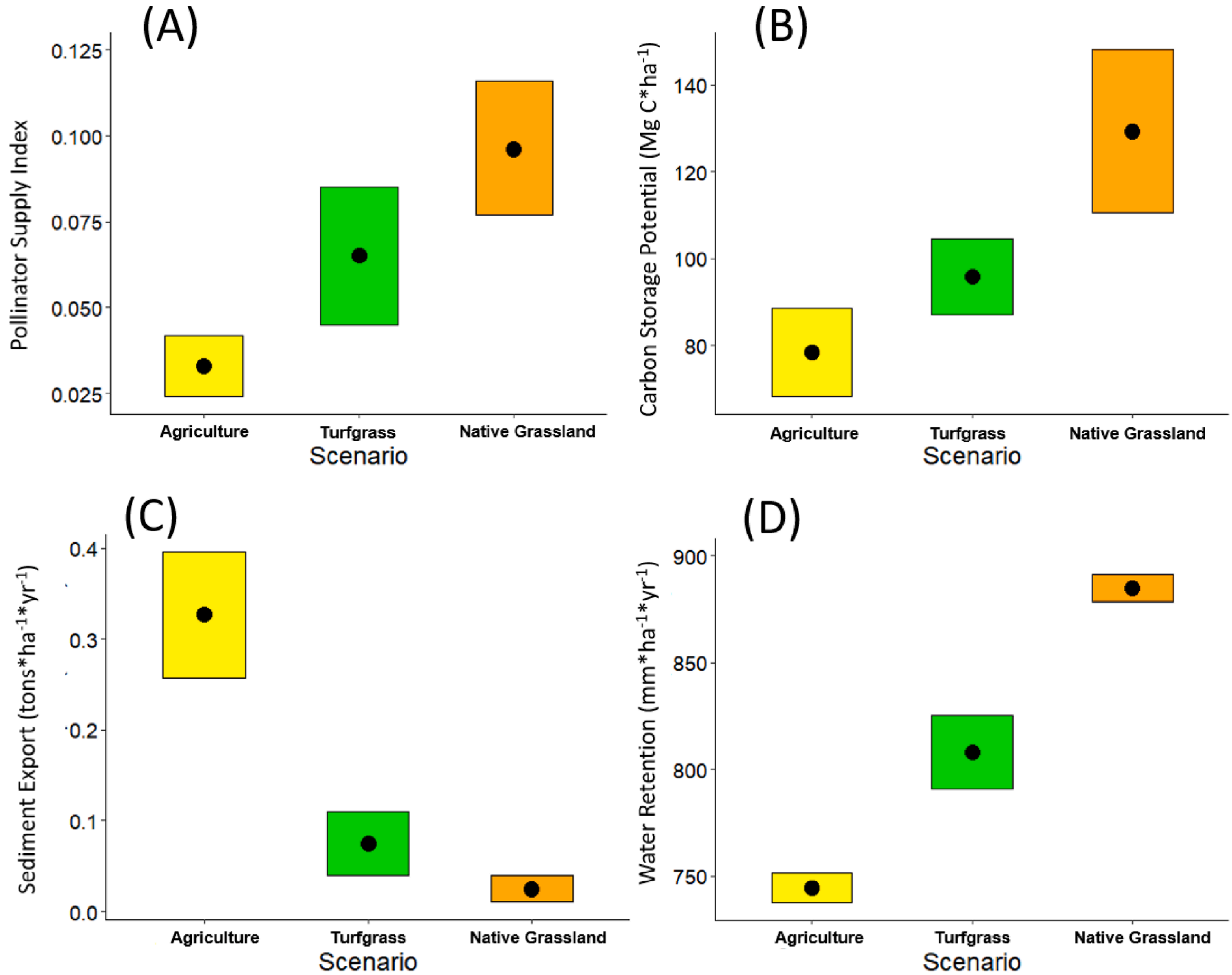

Fig. 3. Average ecosystem service values for the thirty Midwest solar facilities modeled with InVEST: (A) pollinator supply, (B) carbon storage, (C) sediment export, and (D) water retention. Tiles represent the upper- and lower-bound estimates based on the 25% and 75% quartiles. Points represent the midpoint average values.

Table 5
Ecosystem services projected to the entire current and future solar energy development footprints in the Midwestern U.S.

Solar development time peirod[a]	Agriculture scenario	Turfgrass scenario	Pollinator scenario
Carbon storage (Mg C)			
Current	267,473	326,911	441,689
Future	2,349,000	2,871,000	3,879,000
Sediment export (tons*yr^{-1})			
Current	1117.0	102.5	23.9
Future	9810.0	900.0	210.0
Water retention (m^3*yr^{-1})			
Current	25,425,300	27,601,300	30,231,600
Future	223,290,000	242,400,000	265,500,000

[a] Current time period refers to existing solar energy facilities in the Midwest as of 2018 (1.2 total GW), with a total estimated footprint size of 3416 ha (34.2 km^2) (EIA, 2019). Future time period refers to a future solar energy development scenario (10 GW), with an estimated footprint size of 30,000 ha (300 km^2).

our land use surrogates (agriculture, native grassland and prairie, and turfgrass/suburban land use types). This approach allowed us to examine the potential tradeoffs in vegetation management land uses at solar energy facilities.

There is ample research supporting the InVEST ecosystem service model parameters and output related to our surrogate land cover types (see Table 2 and Supplemental 2). For example, in a study of land use impacts on ecosystem services in Minnesota, Johnson et al. (2012) examined tradeoffs in total carbon storage using estimates of 108 Mg C * ha^{-1}, 100 Mg C * ha^{-1}, and 67.7 Mg C * ha^{-1} for native grassland, developed, and agricultural land use types, respectively. In Wisconsin, Meehan et al. (2013) used the InVEST pollinator model with biophysical parameters similar to ours to associate pollinator habitat with LULC types. They found that switching from annual row crop agriculture (corn) to perennial grasses in Wisconsin would increase pollinator abundance by an average of 11%. In Iowa, Schulte et al. (2017) discovered that prairie strips in corn-soybean dominated agricultural settings reduced total water runoff from catchments by 37%, resulting in the retention of 20 times more soil as compared to an agricultural baseline scenario.

As expected, our models suggest that solar-native grassland improves habitat for local insect pollinators. Overall, we detected a 3-fold increase in pollinator supply under the solar-native grassland scenario compared to the pre-solar development land use scenario (agriculture) and a 30% increase in pollinator supply compared to the solar-turfgrass scenario. The implementation of pollinator-friendly vegetation at current and future solar energy facilities has the potential to benefit biodiversity by providing habitat for insect pollinators and other wildlife (e.g., birds; Clean Energy States Alliance, 2020). In addition, increased abundance and diversity of native pollinators associated with solar-native grassland could improve the services these organisms provide for pollination of nearby agriculture. A number of studies have found direct correlations between pollinator habitat enhancements in agricultural settings and improved agricultural production associated with beneficial increases in pollinator services (Blaauw and Isaacs, 2014; Pywell et al., 2015; Venturini et al., 2017). In the Midwest, dominant crops such as soybeans may benefit from the presence of native pollinators. For example, pollinator habitat enhancement around soybean fields in Ohio increased native pollinator visitation to soybean flowers and increased soybean yields by up to 23% (Cunningham-Minnick et al., 2019). There are nearly 400 km^2 of soybean fields within 1.5 km of existing solar facilities across the seven Midwest states in this study (Walston et al., 2018), highlighting the potential agricultural pollinator service implications of solar-native grassland.

Compared to baseline agricultural land uses, our models suggest that solar-native grassland has the potential to increase the total carbon storage capacity of all current and future solar energy sites in the Midwest by over 170,000 Mg C and 1,500,000 Mg C, respectively. Putting these estimates into context, compared to the agricultural baseline scenario, the potential total future solar-native grassland carbon storage benefit is equivalent to offsetting the CO_2 emissions from over 5000 GWh of electricity generated from coal-fired power plants (World Nuclear Association, 2011). There are also future implications of solar-native grassland for sediment and water retention. The future solar-native grassland scenario has the potential to reduce over 9000 tons of sediment loss as a result of surface erosion annually and retain over 40,000,000 m^3 of surface water runoff annually from future solar sites. These increases in ecosystem services are equivalent to offsetting the amount of erosion and runoff of over 1000 ha (10 km^2) of row crop agriculture in the Midwest annually (NRCS, 2010).

It is important to clarify that the full ecosystem service benefits modeled in our study may not be immediately observed after the establishment of solar-native grassland. Rather, ecosystem services may gradually increase over time as the native grassland community matures. For example, soil organic carbon accumulates at former row-crop agricultural fields that have been restored to native prairie grasses at a rate of approximately 0.68 Mg $C*ha^{-1}*yr^{-1}$ (McLauchlan et al., 2006). At this rate, an average 10 MW solar facility (30 ha) situated on land formerly used for agriculture that has been planted with native grassland vegetation will accumulate over 200 Mg of soil organic carbon after 10 years of operation. Over the timeframe of a solar energy facility lease period (which may be 20–30 years), therefore, we expect the site's ecosystem service potential to increase and more closely resemble modeled outcomes. Nevertheless, some ecosystem service benefits of solar-native grassland may be more quickly realized. For example, in as little as 3 years post-seeding, newly established native grasslands in Iowa are capable of reducing erosion and runoff in agricultural landscapes (Hernandez-Santana et al., 2013). In another study in Michigan, the establishment of native wildflowers in agricultural systems doubled the abundance of native bees and increased their visitation to nearby blueberry crops by 25% in less than 3 years after wildflower planting (Blaauw and Isaacs, 2014).

Our study focused on comparing the potential ecosystem services of different land management scenarios at solar energy facilities. We recognize some practical considerations in our study that warrant further investigation. First, the InVEST models we used have unique assumptions that relate land use classifications to ecosystem services (Sharp et al., 2018). Therefore, our modeling results were limited by the accuracy of the 30 m land use raster dataset we used and the general ecosystem service relationships that have been developed for those land use classifications. Second, our models did not incorporate sensitivity analyses or field-based validation efforts with primary data collected at solar facilities. Instead, we focused on examining a range of possible ecosystem service outcomes based on secondary sources of data from previous InVEST studies that examined surrogate land use types. This approach allowed us to understand the uncertainty in model results and we used average values to compare scenarios. Validation of our models consisted of comparisons to other InVEST studies that evaluated our land use surrogates. As discussed above, the relative differences in our model results were consistent with these previous studies. Third, we were not able to measure how solar panels may influence the modeled ecosystem services so we assumed the influence of solar panels to be constant. However, the presence of solar panels may influence ecosystem processes. For example, soil evapotranspiration processes may decline by 10–30% under solar panels compared to open sites (Marrou et al., 2013). For these reasons, greater emphasis should be placed on interpreting the relative implications of our results rather than the actual ecosystem service value calculations. Additional work is needed to collect the primary data on ecosystem services at solar energy facilities, collect data on the temporal patterns of these ecosystem services in relation to habitat establishment, and examine the effects of solar panels on processes such as runoff, erosion, and carbon storage.

5. Conclusions

The establishment of native grassland vegetation at solar energy facilities is a strategic land use practice to improve the landscape compatibility of solar energy development (Walston et al., 2018; Hernandez et al., 2019). Recent attention on this strategy from the solar industry, natural resource agencies, conservation organizations, and state governments underscores the amount of multidisciplinary coordination involved in implementing solar-native grassland (EPRI, 2019; Clean Energy States Alliance, 2020). In regions where native grasslands have been lost to other human activities such as agriculture, native grassland restoration at solar energy facilities represents a win-win solution for energy and the environment through the improved ecosystem services provided by the native habitat that may encourage future solar energy adoption. While several states have passed legislation and scorecards to guide the implementation of solar-native vegetation habitat standards, decisions regarding establishment of solar-native grassland also consider the costs of particular seed mixes and costs of seedling establishment, vegetation height restrictions, and long-term maintenance needs (Clean Energy States Alliance, 2020).

This paper is the first to compare the potential ecosystem services related to vegetation management practices at solar energy facilities. Since none of the calculated ecosystem service benefits of solar-native grassland accrue solely to the solar industry or any other group of stakeholders, the calculated values may be better considered as benefits for society-as-a-whole. These findings may be used to build cooperative relationships between the solar industry and surrounding communities to better integrate solar energy into agricultural landscapes. We focused on the potential non-monetary aspects of these ecosystem services in this study. Additional work is needed to collect the primary data that would support economic evaluations to inform solar-native grassland business decisions for the solar industry and quantify the economic benefits of services provided to nearby farmers, landowners, and other stakeholders.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to have influenced the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.ecoser.2020.101227.

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