BOARD OF SUPERVISORS
AGENDA ITEM

Meeting Date February 17, 2026
Item Number 02-09

SUBJECT: Application Number Z-2025-00304, Powhatan Road Solar/Larry Carr

REQUEST

Representatives from Powhatan Road Solar Farm, LLC/ESA (applicant) and Larry Carr Jr. (property owner) have applied for a Special Exception permit to construct a Medium Scale solar energy facility on approximately 24 acres zoned A-1, located at 8375 Powhatan Road.

PUBLIC HEARINGS

Planning Commission: December 9, 2025, 6:30 p.m., County Boardroom

Board of Supervisors: February 17, 2026, 5:30 p.m., County Boardroom

GENERAL INFORMATION

Tax Parcel: Portion of 32-1

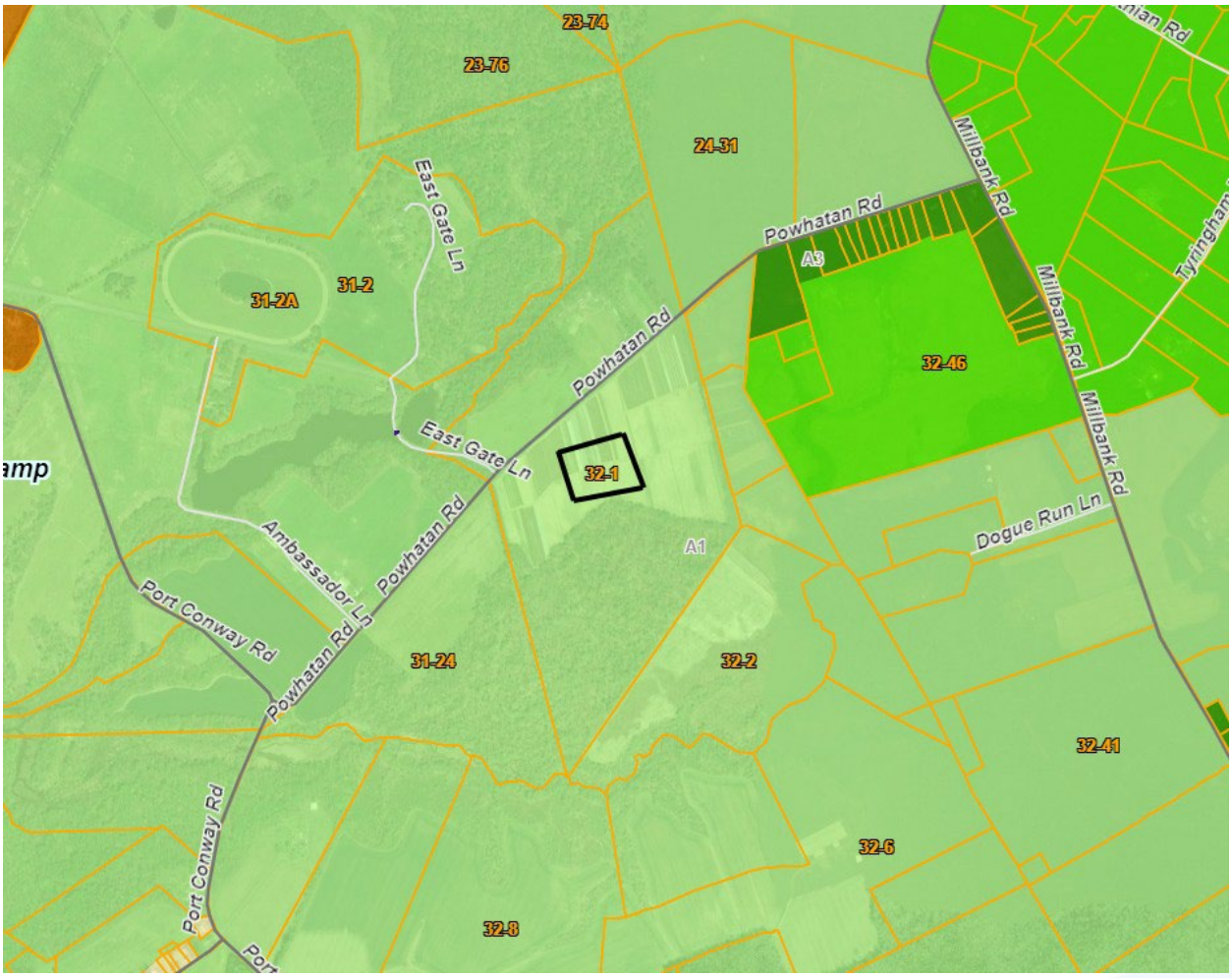
Size: Parcel is approximately 158 acres in size. Project is proposed to encompass approximately 24 acres.

Owner: Lawrence E. Carr, Jr.

Applicant: ESA/Powhatan Road Solar Farm, LLC

Zoning: A-1

Legal Review ____ Complete ____ N/A



ZONING MAP – SUBJECT PARCEL AND ADJOINING PROPERTIES ZONED A-1

STANDARDS AND PROCEDURES FOR REVIEW OF SPECIAL EXCEPTIONS

The standards and procedures for the review of Special Exception Permits are set forth in Section 3-4-1 and 3-4-3 of the King George County Zoning Ordinance:

Section 3-4-1. Purpose and Intent

(A) A use requiring a Special Exception Permit is a use that may be appropriate in a zoning district, but because of its nature, extent, or external effects, requires special consideration of its location, design, and methods of operation before it can be deemed appropriate in the district and compatible with its surroundings. The purpose of this division is to establish procedures and

standards for review and approval of Special Exception Permits that provide for such special consideration.

(B) The following will be met either by the proposal made in the application or by the proposal as modified and amended and made part of the Special Exception Permit:

(1) **Conformity with the Comprehensive Plan and policies**. *The proposal as submitted or as modified shall conform to the Comprehensive Plan of the County or to specific elements of such plan and to official policies adopted in relation thereto, including the purposes of this Ordinance.*

(2) **Impact on neighborhood**. *The proposal as submitted or as modified shall not have undue adverse impact on the surrounding neighborhood. Among matters to be considered in this connection are traffic congestion, noise, lights, dust, odor, fumes, and vibration with due regard for timing of operation, screening or other matters which might be regulated to mitigate adverse impact.*

Section 3-4-3 – Standards and Procedures

1. *Demonstrate that the proposed use, when complemented with additional measures, if any, will be in harmony with the purposes of the specific district in which it will be placed;*
2. *Demonstrate that there will be no undue adverse impact on the surrounding neighborhood in terms of public health, safety, or general welfare and show measures to be taken to achieve such goals;*
3. *Demonstrate that the use will not tend to create congestion in streets, roads, alleys, and other areas; and*
4. *Show that the proposal meets the applicable specific and general standards required by this Ordinance.*

CONSIDERATIONS

- The King George County Zoning Ordinance (Article VI – Use Matrix, Table VI-1) requires a Special Exception Permit in the A-1 Zoning District for "Solar Energy, Medium Scale".

- The King George County Zoning Ordinance Section 7-7-8 lists performance standards applicable to "Solar Energy, Medium Scale" facilities. The application addresses compliance with each of these standards.

- The application states: The project is sited on 24.34 acres of a 158.02-acre agricultural parcel and will participate in the Virginia Shared Solar Program, delivering renewable

energy to approximately 1,000 households, including guaranteed bill savings for low-to-moderate income subscribers.

- The facility preserves the parcel's rural and agricultural character by limiting ground disturbance and incorporating a grazing-ready design that supports continued grazing within and around the fenced area. The project occupies approximately 21% of the parcel, preserving the majority of the land for agriculture, recreation, and preservation.

- The project will connect to the existing Dominion Energy distribution system, providing upgrades to the lines and substation.

- Grading will be minimized; topsoil will be preserved and restored, and existing forest buffers will remain where feasible.

- The project will not cause a burden on the County schools, water, sewer, or road system. It will generate local tax revenue and subscriber savings, and will advance State goals for energy diversification and land-based solar development.

- The subject property lies within the Rappahannock River Rural Development Area, as designated in the Comprehensive Plan. A major goal of the Comprehensive Plan is to "Preserve, encourage and sustain the Rural Character of King George County in the non-primary settlement areas."

- One of the Industrial land use policies/implementation strategies listed in the Comprehensive Plan is to "Ensure that all new industrial uses provide adequate protection of adjacent existing land uses through techniques such as setbacks, landscaping, screening, noise, and lighting controls, access control, etc. The performance standards for Solar Energy, Medium Scale facilities are the method by which this policy will be achieved.

- A Goal for Utilities within the county, as laid out in the Comprehensive Plan, is to "Research and develop strategies to attract and support green energy such as solar and wind, while balancing preservation of environmental resources." There are several aspects of the project that accomplish this goal to balance solar development with preservation of environmental resources.

- The application includes analyses, assessments, studies, and plans required by the Ordinance including a Visual Impact Analysis, Community Impact Assessment, Environmental Impact Assessment, Traffic Study, and Decommissioning Plan.

- The applicant has discussed the proposed facility with County Fire and Rescue personnel and the Fire Chief. Several conditions requested by the Fire Chief are incorporated into the Resolution.

- Noise issues generated from construction are expected but should not interfere or be a nuisance to adjoining properties and will follow conditioned construction hours.

- In accordance with the Performance Standards in Section 7-7-8(N) of the County Code, the applicant has submitted a Preliminary Decommissioning plan to be implemented upon abandonment and/or in conjunction with removal of the facility.

COMMENTS FROM REVIEWING AGENCIES

Staff sent the special exception permit application and information to all County and State reviewing agencies, and their comments were addressed by the applicant throughout the review process. Agencies will be contacted for review and comment should the project proceed to the Site Plan stage.

PLANNING COMMISSION ACTION

The Planning Commission considered this special exception application at a public hearing on December 9, 2025, where they voted 6:1:1 to forward a favorable recommendation with conditions to the King George County Board of Supervisors.

OVERALL ANALYSIS AND RECOMMENDED DRAFT CONDITIONS (please be advised that the Conditions are subject to change prior to Board of Supervisors final approval of the permit)

Staff has reviewed this Special Exception permit application and has found it to meet the requirements in the King George County Zoning Ordinance. Staff has also found that the following proposed conditions will assist in addressing, protecting, and promoting the health, safety, and the general welfare of King George County citizens.

1. The following conditions will apply to the property identified on the "Powhatan Road Solar Farm Special Exception Application/Preliminary Concept Plan Set" dated 10/03/2025 prepared by Uneclipsed Energy, PLLC and ESA Solar Development Group, LLC and submitted with the application and shall be binding on Powhatan Road Solar Farm, LLC or any successors, assignees, current or future lessee, sub-lessee, or owner of the solar energy facility. Minor modifications that do not materially change the overall design, layout, or environmental impacts may be approved administratively by the Zoning Administrator.

2. Powhatan Road Solar Farm, LLC any successors, assignees, current or future lessee, sub-lessee, or owner of the solar energy facility will consent to administrative inspections by King George County staff for compliance with the requirements of this Special Exception Permit.

3. All federal, state, and local laws, regulations, permit requirements and ordinances will be adhered to, including but not limited to:
    a. All active solar systems will meet all requirements of the US Environmental Protection Agency (EPA), Federal Aviation Administration (FAA), and State Corporation Commission (SCC).
        i. Dominion Energy will inspect and commission the system to ensure it meets all operational and safety requirements before it becomes operational.
    b. All active solar systems will meet all requirements of the latest editions of the National Electrical Code (NEC), National Electrical Safety Code (NESC), American Society of Civil Engineers (ASCE), American National Standards Institute (ANSI), Institute of Electrical and Electronics Engineers (IEEE), Underwriters Laboratories (UL), or International Electrotechnical Commission (IEC) as applicable and state building code and shall be inspected by a county building inspector throughout the building permit process. If there are any conflicts between standards, the Uniform Statewide Building Code (USBC) shall control.
    c. The facility will meet all applicable NFPA and Virginia Statewide Fire Prevention Code (SFPC) standards.
    d. An Erosion and Sediment Control plan and a Stormwater Management Plan must be submitted and approved prior to any land disturbance.

4. Construction activities and traffic shall be limited to Monday through Saturday 8:00 AM to 7:00 PM, with no construction on Sundays or federal holidays.

5. A security fence around the perimeter of the solar equipment/panels will be installed, that is a minimum of six (6) feet in height. All fencing will meet National Electric Code. Woven wire shall be permitted.

6. All solar panels and other project materials will be designed to mitigate glare onto adjacent properties and roadways.

7. During operation, the solar facility will comply with the King George County Noise Ordinance.

8. Landscaping and screening will be provided in compliance with Buffer Type B per Article 8, Community Design Standards, Tables VIII-2 and VIII-3. Any modifications will follow the procedures established in Section 8-3-8 of the Ordinance.

9. The final site plan will demonstrate avoidance of any jurisdictional wetlands and streams identified in the wetland delineation report dated April 25, 2025. Should design modifications require impacts to jurisdictional features, the applicant shall obtain appropriate federal and state environmental permits prior to any ground disturbance in those areas.

10. The land under the solar array(s) will be utilized for pollinator habitat, using native grasses and pollinator species as ground cover.

11. Warning signage will be posted at the site, including the installer's contact information. Installation will be performed by a qualified Virginia solar installer.

12. The Applicant shall coordinate with the County's emergency services staff to provide materials, education, and/or training to the departments serving the solar energy facility regarding how to safely respond to on-site emergencies. The applicant shall coordinate with the Fire & Rescue Department during the site plan review process to establish appropriate emergency access routes, Knox Box or Knox Pad Lock locations, and emergency response procedures. The facility will comply with applicable NFPA and Virginia Statewide Fire Prevention Code (SFOC) standards.

13. A Construction Traffic Management Plan and mitigation measures shall be developed by the Applicant and submitted to the County and Virginia Department of Transportation (VDOT) for review. The Plan shall address traffic control measures, a

pre- and post-construction road evaluation, and any necessary repairs to the public road that are required as a result of damage from the Project. If a traffic issue arises during the construction of the Project, the Applicant shall develop with input from the County and VDOT appropriate measures to mitigate the issue.

14. Project entrance from Powhatan Road will meet all VDOT requirements.

15. All solar panels that are removed from service will be stored onsite in a dry waste container until they are removed from the Project. After removal, the solar panels will be reused, recycled, or disposed of in accordance with applicable federal and state regulations.

16. The applicant will establish a water quality baseline prior to land disturbance. Follow-up sampling will occur on the following schedule: (i) five years after commencement of operations; (ii) at decommissioning; and (iii) following any fire or structural failure of sufficient magnitude reasonably likely to release contaminants, as determined by the Zoning Administrator in consultation with DEQ. Sampling will occur at drainage locations pre-approved by the Zoning Administrator in consultation with DEQ. Testing parameters will include turbidity, total nitrogen, total phosphorus, and metals reasonably association with solar construction activities, as identified prior to land disturbance. Results will be submitted to the Zoning Administrator within 60 days of collection.

17. All inverters and critical electrical components will either: (i) be selected from models previously reviewed by the U.S. Navy or Department of Defense for electromagnetic compatibility near military installations, or (ii) be demonstrated by the applicant, through manufacturer documentation, to comply with Federal Communications Commission (FCC) part 15 standards for electromagnetic emissions and to contain no wireless communication modules beyond those expressly identified in manufacturer specifications. Evidence of compliance will be submitted to the Zoning Administrator prior to final site plan approval.

18. This Special Exception permit will expire in accordance with Section 3-4-4 of the King George County Code.

Attachments:

- Board Ordinance O-04-26
- Application Z-2025-00304
- Planning Commission Resolution PC-19-25

Copies to:

- Applicant
- File

BOARD OF SUPERVISORS
COUNTY OF KING GEORGE
VIRGINIA

O-04-26

At the regular meeting of the Board of Supervisors of the County of King George, in the Boardroom of the Revercomb Building in King George, Virginia, on the 17th day of February 2026:

Present:	Vote:
Cathy Binder	
Bryan Metts	
William S. Davis	
Kenneth A. Stroud	
David D. Sullins	

Motion was made by _____, seconded by _____, which carried ____ to adopt the following Ordinance:

AN ORDINANCE TO APPROVE SPECIAL EXCEPTION PERMIT APPLICATION Z-2025-00304, POWHATAN ROAD SOLAR/ESA AND LAWRENCE E. CARR, JR. TO AUTHORIZE THE CONSTRUCTION OF A MEDIUM SCALE SOLAR FACILITY ON A PORTION OF TAX PARCEL 32-1

WHEREAS, Lawrence E. Carr, Jr. (property owner) and representatives from Powhatan Solar Farm, LLC/ESA (applicant) have submitted a "Special Exception Permit Application" dated June 10, 2025; and

WHEREAS, said application requests a special exception permit to establish a Medium Scale solar energy facility on a portion of a parcel identified on the King George County digital map as Tax Map 32-1; and

WHEREAS, said application was considered by the King George County Planning Commission in accordance with applicable procedures at a formal and duly advertised public hearing on December 9, 2025, where they carefully considered the public comment received and voted 6:1:1 to forward a recommendation of approval to the Board of Supervisors; and

WHEREAS, within the timeframes established by the Code of Virginia and King George County Code, the Board of Supervisors scheduled and conducted a formal and duly advertised public hearing on February 17, 2026, and carefully considered the comments received, the application and conditions; and

WHEREAS, the Board of Supervisors has evaluated the application based on the current zoning of the parcel, which is A-1, the standards set forth in the Special Exception Permit Provisions of the Zoning Ordinance (Article III, Division 4 et seq.), and the proposed conditions contained herein; and

WHEREAS, the Board of Supervisors finds that approval of this application would address, protect, and promote public convenience, necessity, general welfare, and good zoning practices in the County;

NOW THEREFORE, BE IT ORDAINED that on this, the 17th day of February, 2026, by the King George County Board of Supervisors, that Special Exception Permit Application Z-2025-00304, submitted by Lawrence E. Carr, Jr. (property owner) and representatives from Powhatan Road Solar Farm, LLC/ESA (applicant) be, and it hereby is, approved, subject to the following conditions:

1. The following conditions will apply to the property identified on the "Powhatan Road Solar Farm Special Exception Application/Preliminary Concept Plan Set" dated 10/03/2025 prepared by Uneclipsed Energy, PLLC and ESA Solar Development Group, LLC and submitted with the application and shall be binding on Powhatan Road Solar Farm, LLC or any successors, assignees, current or future lessee, sub-lessee, or owner of the solar energy facility. Minor modifications that do not materially change the overall design, layout, or environmental impacts may be approved administratively by the Zoning Administrator.

2. Powhatan Road Solar Farm, LLC any successors, assignees, current or future lessee, sub-lessee, or owner of the solar energy facility will consent to administrative inspections by King George County staff for compliance with the requirements of this Special Exception Permit.

3. All federal, state, and local laws, regulations, permit requirements and ordinances will be adhered to, including but not limited to:
    a. All active solar systems will meet all requirements of the US Environmental Protection Agency (EPA), Federal Aviation Administration (FAA), and State Corporation Commission (SCC).

i. Dominion Energy will inspect and commission the system to ensure it meets all operational and safety requirements before it becomes operational.

b. All active solar systems will meet all requirements of the latest editions of the National Electrical Code (NEC), National Electrical Safety Code (NESC), American Society of Civil Engineers (ASCE), American National Standards Institute (ANSI), Institute of Electrical and Electronics Engineers (IEEE), Underwriters Laboratories (UL), or International Electrotechnical Commission (IEC) as applicable and state building code and shall be inspected by a county building inspector throughout the building permit process. If there are any conflicts between standards, the Uniform Statewide Building Code (USBC) shall control.

c. The facility will meet all applicable NFPA and Virginia Statewide Fire Prevention Code (SFPC) standards.

d. An Erosion and Sediment Control plan and a Stormwater Management Plan must be submitted and approved prior to any land disturbance.

4. Construction activities and traffic shall be limited to Monday through Saturday 8:00 AM to 7:00 PM, with no construction on Sundays or federal holidays.

5. A security fence around the perimeter of the solar equipment/panels will be installed, that is a minimum of six (6) feet in height. All fencing will meet National Electric Code. Woven wire shall be permitted.

6. All solar panels and other project materials will be designed to mitigate glare onto adjacent properties and roadways.

7. During operation, the solar facility will comply with the King George County Noise Ordinance.

8. Landscaping and screening will be provided in compliance with Buffer Type B per Article 8, Community Design Standards, Tables VIII-2 and VIII-3. Any modifications will follow the procedures established in Section 8-3-8 of the Ordinance.

9. The final site plan will demonstrate avoidance of any jurisdictional wetlands and streams identified in the wetland delineation report dated April 25, 2025. Should design modifications require impacts to jurisdictional features, the applicant shall obtain

appropriate federal and state environmental permits prior to any ground disturbance in those areas.

10. The land under the solar array(s) will be utilized for pollinator habitat, using native grasses and pollinator species as ground cover.

11. Warning signage will be posted at the site, including the installer's contact information. Installation will be performed by a qualified Virginia solar installer.

12. The Applicant shall coordinate with the County's emergency services staff to provide materials, education, and/or training to the departments serving the solar energy facility regarding how to safely respond to on-site emergencies. The applicant shall coordinate with the Fire & Rescue Department during the site plan review process to establish appropriate emergency access routes, Knox Box or Knox Pad Lock locations, and emergency response procedures. The facility will comply with applicable NFPA and Virginia Statewide Fire Prevention Code (SFOC) standards.

13. A Construction Traffic Management Plan and mitigation measures shall be developed by the Applicant and submitted to the County and Virginia Department of Transportation (VDOT) for review. The Plan shall address traffic control measures, a pre- and post-construction road evaluation, and any necessary repairs to the public road that are required as a result of damage from the Project. If a traffic issue arises during the construction of the Project, the Applicant shall develop with input from the County and VDOT appropriate measures to mitigate the issue.

14. Project entrance from Powhatan Road will meet all VDOT requirements.

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include turbidity, total nitrogen, total phosphorus, and metals reasonably association with solar construction activities, as identified prior to land disturbance. Results will be submitted to the Zoning Administrator within 60 days of collection.

17. All inverters and critical electrical components will either: (i) be selected from models previously reviewed by the U.S. Navy or Department of Defense for electromagnetic compatibility near military installations, or (ii) be demonstrated by the applicant, through manufacturer documentation, to comply with Federal Communications Commission (FCC) part 15 standards for electromagnetic emissions and to contain no wireless communication modules beyond those expressly identified in manufacturer specifications. Evidence of compliance will be submitted to the Zoning Administrator prior to final site plan approval.

18. This Special Exception permit will expire in accordance with Section 3-4-4 of the King George County Code.

BE IT FURTHER ORDAINED, that the County Administrator be, and he is hereby, directed to have a fully executed copy of this Ordinance recorded upon the Land Records of the County in the office of the Clerk of the Circuit Court.

Attest:

Matthew J. Smolnik County Administrator	David D. Sullins Chairman

Approved as to form:

Richard H. Stuart, P.C.
County Attorney

PC-19-25

PLANNING COMMISSION

COUNTY OF KING GEORGE

VIRGINIA

At the regular meeting of the Planning Commission of the County of King George, in the Boardroom of the Administration Building in King George, Virginia, on the 9th day of December, 2025:

Present:	Vote:
Joseph Dacorta	Aye
Peyton Moncure	Abstain
Ian Fox	Aye
Gary Kendrick	Aye
Bret Maffett	Aye
Denise Flatley	Aye
Roger Kniceley	Nay
Shawn Palivoda	Aye

Motion was made by Mr. Fox, seconded by Mr. Kendrick, which carried 6:1:1, to adopt the following resolution:

A RESOLUTION TO RECOMMEND APPROVAL OF
SPECIAL USE PERMIT APPLICATION Z-2025-00304,
POWHATAN ROAD SOLAR/ESA AND
LAWRENCE E. CARR, JR.
TO AUTHORIZE THE CONSTRUCTION OF A MEDIUM SCALE
SOLAR FACILITY ON A PORTION OF TAX PARCEL 32-1

WHEREAS, Lawrence E. Carr, Jr. (property owner) and representatives from Powhatan Solar Farm, LLC/ESA (applicant) have submitted a "Special Exception Permit Application" dated June 10, 2025; and

WHEREAS, said application requests a special exception permit to establish a Medium Scale solar energy facility on a portion of a parcel identified on the King George County digital map as Tax Map 32-1; and

WHEREAS, subsequent to receiving a complete application and within the timeframes established by Code, the Planning Commission scheduled and conducted a formal and duly advertised public hearing, carefully considering the public comment received; and

WHEREAS, the Planning Commission has evaluated the application based on the current zoning of the parcel, which is A-1, the standards set forth in the Special Exception Permit Provisions of the Zoning Ordinance (Article III, Division 4 et seq.), and the proposed conditions in the staff memo; and

WHEREAS, the Planning Commission finds that Application Z-2025-00304 is substantially in accord with the Comprehensive Plan; and

WHEREAS, the Commission finds that approval of Application Z-2025-00304 with the conditions stated herein is appropriate to address, protect, and promote public convenience, necessity, general welfare, and good zoning practices in the County and the health, safety, and general welfare of the Citizens in the County;

NOW THEREFORE, BE IT RESOLVED that on this, the 9th day of December, 2025, by the King George County Planning Commission, that Special Exception Permit Application Z-2025-00304, submitted by Lawrence E. Carr, Jr. (property owner) and representatives from Powhatan Road Solar Farm, LLC/ESA (applicant) be forwarded to the King George County Board of Supervisors with a recommendation of approval subject to the following conditions:

1. The following conditions will apply to the property identified on the "Powhatan Road Solar Farm Special Exception Application/Preliminary Concept Plan Set" dated 10/03/2025 prepared by Uneclipsed Energy, PLLC and ESA Solar Development Group, LLC and submitted with the application and shall be binding on Powhatan Road Solar Farm, LLC or any successors, assignees, current or future lessee, sub-lessee, or owner of the solar energy facility. Minor modifications that do not materially change the overall design, layout, or environmental impacts may be approved administratively by the Zoning Administrator.

2. Powhatan Road Solar Farm, LLC any successors, assignees, current or future lessee, sub-lessee, or owner of the solar energy facility will consent to administrative

inspections by King George County staff for compliance with the requirements of this Special Exception Permit.

3. All federal, state, and local laws, regulations, permit requirements and ordinances will be adhered to, including but not limited to:
    a. All active solar systems will meet all requirements of the US Environmental Protection Agency (EPA), Federal Aviation Administration (FAA), and State Corporation Commission (SCC).
        i. Dominion Energy will inspect and commission the system to ensure it meets all operational and safety requirements before it becomes operational.
    b. All active solar systems will meet all requirements of the latest editions of the National Electrical Code (NEC), National Electrical Safety Code (NESC), American Society of Civil Engineers (ASCE), American National Standards Institute (ANSI), Institute of Electrical and Electronics Engineers (IEEE), Underwriters Laboratories (UL), or International Electrotechnical Commission (IEC) as applicable and state building code and shall be inspected by a county building inspector throughout the building permit process. If there are any conflicts between standards, the Uniform Statewide Building Code (USBC) shall control.
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prior to land disturbance. Results will be submitted to the Zoning Administrator within 60 days of collection.

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18. This Special Exception permit will expire in accordance with Section 3-4-4 of the King George County Code.

Attested:

Denise Flatley

Ms. Denise Flatley, Chair
King George County Planning Commission

Powhatan Road Community Solar

Special Exception Permit
King George County, VA

October 2025

Powhatan Road Community Solar

King George County, VA

Special Exception Use Application Narrative

Applicant:
Powhatan Road Solar Farm, LLC
2250 Lucien Way, Suite 305
Maitland, FL 32751

Contact:
Cara Romaine, Community Solar Development Manager (cromaine@esa-solar.com)
Tamara Irving, Planner I (tirving@esa-solar.com)

In addition to the narrative, this application includes a site plan set and supporting documentation to demonstrate project compliance and feasibility. The following materials are included:

Conceptual Site Plan Set:

Sheet G001. Cover Sheet
Sheet G002. General Notes
Sheet G101. Site Plan
Sheet C101. Topographic Map
Sheet L101. Landscaping Plan

Appendix:

Appendix A.	Decommissioning Plan
Appendix B.	Health and Safety Assessment
Appendix C.	Wetland Delineation Report
Appendix D.	FAA Notice Criteria Results

Contents

Figure 1. Conceptual Site Plan

Executive Summary

The Powhatan Road Solar Project, proposed by Powhatan Road Solar Farm, LLC, is a 4.99 MWac medium-scale solar energy facility seeking a Special Exception to locate within the A-1 Agricultural Preservation District in King George County, Virginia.

The Project is sited on 24.34 acres of a 158.02-acre agricultural parcel (Tax Map #32-1) and will participate in the Virginia Shared Solar Program, delivering renewable energy to approximately 1,000 households, including guaranteed bill savings for low-to-moderate income subscribers.

Land Use and Compatibility

- The facility preserves the parcel's rural and agricultural character by limiting ground disturbance and incorporating an grazing-ready design that supports continued grazing within and around the fenced area.
- Setbacks of at least 50 feet and a Type B buffer with native plantings provide year-round visual screening and maintain compatibility with adjacent uses.
- The Project occupies approximately 21% of the parcel, preserving the majority of the land for agriculture, recreation, and preservation.

Infrastructure and Environment

- The Project connects to the existing Dominion Energy distribution system, providing upgrades to the lines and substation.
- Grading is minimized; topsoil will be preserved and restored, and existing forest buffers will remain where feasible.

Construction and Lifecycle

- Construction is expected to take 6 to 9 months, with ongoing operation requiring minimal maintenance traffic
- The Applicant has submitted a Decommissioning Plan, and will provide a financial surety to restore the site to its current condition.

Requested Modifications

The Applicant requests a modification from Buffer Type C to Type B, based on context and practical sourcing and maintenance.

Community Benefits

- No burden on County water, sewer, schools, or roads.
- Generates local tax revenue and subscriber savings.
- Advances County and state goals for energy diversification and land-based solar development.

Introduction

Project Overview

Powhatan Road Solar Farm, LLC (the "Applicant"), owned by ESA, respectfully requests Special Exception Permit approval for a 4.99 megawatt (MW) alternating current (ac) medium-scale solar energy facility (the "Project") in King George County, Virginia.

The Project will occupy approximately 24.34 acres of a 158.02-acre parcel at 8375 Powhatan Road (Tax Map #32-1), located west of Millbank Road and east of Port Conway Road. The Comprehensive Plan and Zoning Map designate the property for Agricultural/Forestal and Agriculture Preservation (A-1) respectively. Today, the land supports a private residence, horse pasture, and active crop production.

The Applicant has entered into an agreement that grants access to a portion of the parcel for solar energy generation while preserving the landowner's full use and enjoyment of the remaining acreage.

The Project will add 4.99 MWac of renewable energy to Dominion Energy Virginia's electric grid through the Virginia Shared Solar Program. Utility connections will be underground, except where necessary for direct connections to the distribution network. This project will provide at least 10% monthly electric bill savings for subscribers who qualify as Low to Moderate Income (LMI).

To forward the area's agricultural roots and preserve the land's working character, the Applicant has designed the facility to be grazing-ready to accommodate ongoing agricultural activities. The site plan protects open space, minimizes disruption to current uses, and enables continued farming both within and outside the fenced array.

Project Site and Context

The 24.34-acre project site is located in the Rappahannock River Settlement Area, between Dogue and Whites Corner communities. The parcel is currently zoned Agriculture Preservation, used for keeping livestock and farming produce. To the north, neighboring land supports horses and equestrian activities. To the south and east, a working farm raises cattle and grows produce. The Project will occupy less than 20% of the total parcel area, leaving the majority of the land available for continued agricultural use.

The closest home sits more than 300 feet from the solar array, buffered by existing trees and natural vegetation that already screen much of the viewshed. The Project will operate quietly and unobtrusively, with minimal routine traffic, low visual impact, and no night lighting, fully in keeping with the character and pace of the surrounding area.

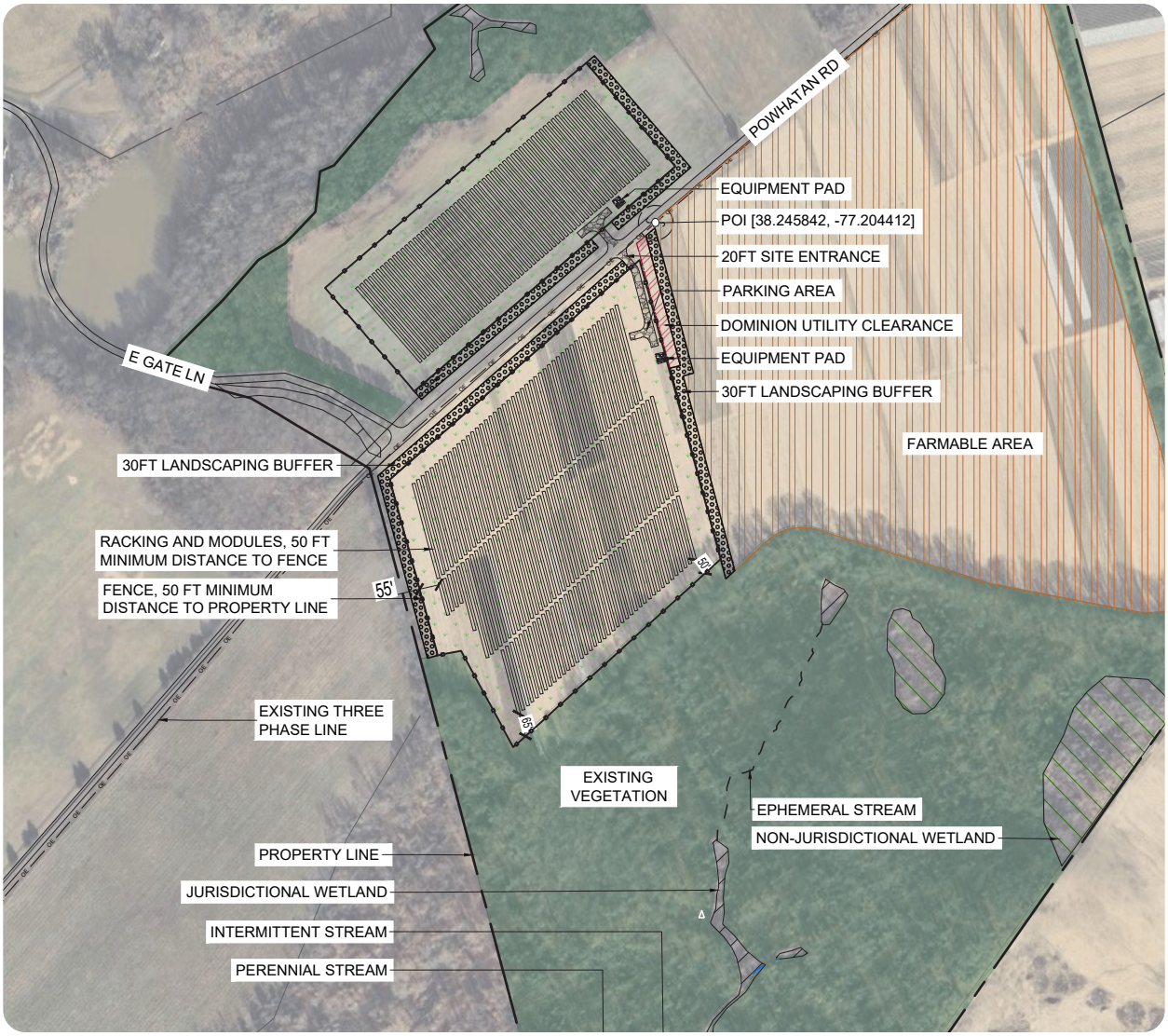


Figure 2. Sheet G101

Who We Are

ESA is a renewable energy development company based in Maitland, Florida with over 20 years of industry experience. ESA specializes in developing community and utility-scale solar, along with Battery Energy Storage Systems. Throughout the past decade, we have permitted 12 community solar farms in Virginia and over 100 across the United States.

Community Solar Explained

The Project will operate under the Virginia Shared Solar Program, which allows residents and businesses to subscribe to a local solar facility and receive credits on their electricity bills. Unlike rooftop systems, community solar does not require home installation, property ownership, or upfront costs. It offers a practical and affordable way to reduce energy bills, especially for customers whose homes aren't suitable for solar panels.

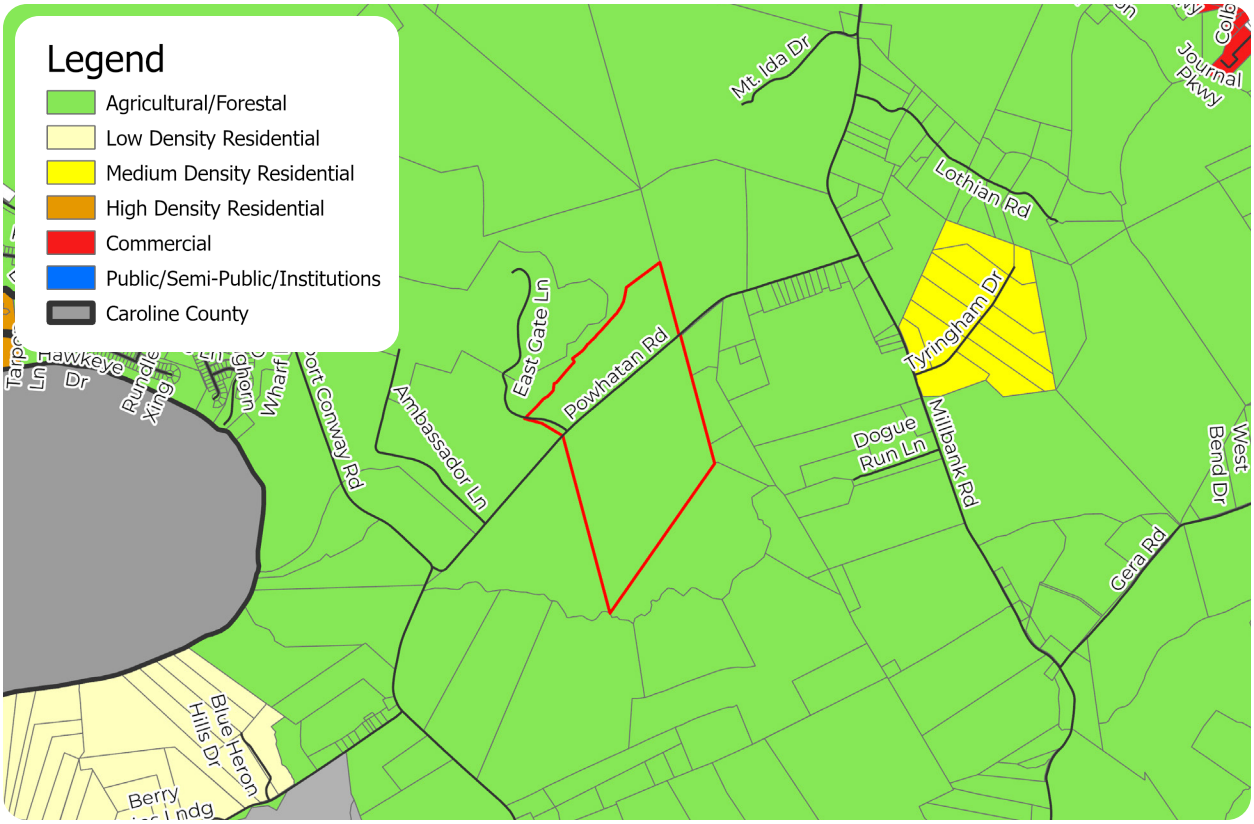


Figure 3. Land Use Map

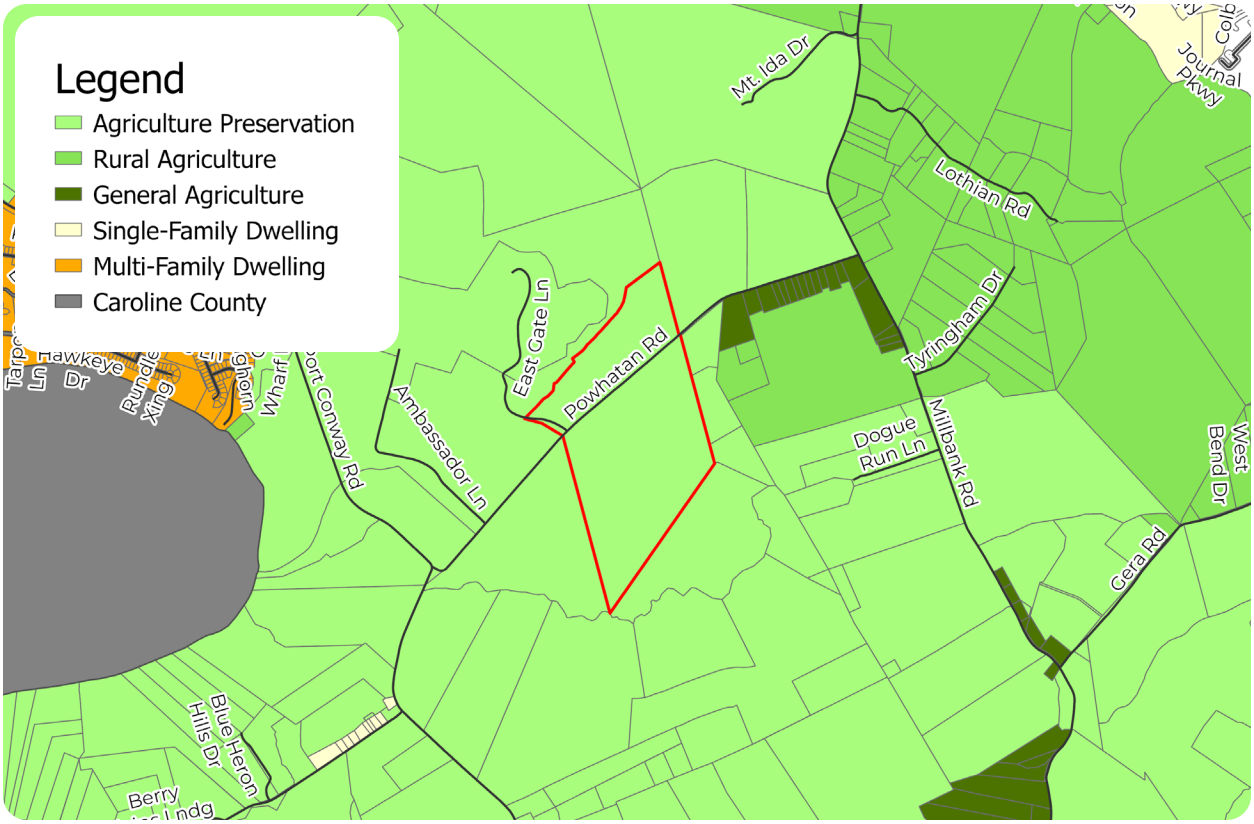


Figure 4. Zoning Map

Alignment with the Comprehensive Plan

Preservation of Agricultural Land

The Comprehensive Plan places strong emphasis on preserving King George County's rural character and agricultural base, especially within Rural Development Areas like the Rappahannock River Settlement Area, where this project is located. The Plan discourages high-density or scattered development in these areas to avoid sprawl and maintain farmland, forestland, and open space. This solar project directly supports those priorities by using only 15% of the 158-acre parcel, leaving the majority available for continued pasture and agricultural production.

The Project's grazing-ready design enables farming activities to continue within the fenced array, with 4 feet of clearance beneath the panels to accommodate low-impact grazing. The Applicant will also plant pollinator-friendly and native vegetation, promoting soil health, biodiversity, and long-term land productivity. Because the facility will operate under a lease rather than through subdivision or sale, the land remains intact and can fully revert to agricultural use upon decommissioning, preserving its long-term viability.

Environmental Protection

The Comprehensive Plan underscores the importance of protecting critical environmental resources, including water quality and natural habitats. The Applicant has incorporated best practices to align with these goals. The Project will preserve over 90% of the site's existing forested areas and maintain substantial natural buffers. The Project avoids jurisdictional waters, as shown in the Wetland Delineation Report (see Appendix C) and is outside any Resource Protection Areas. Native vegetation, low impervious surfaces, and robust stormwater management further reflect the Project's alignment with the County's goals under the Chesapeake Bay Preservation Act and broader environmental policies.

Economic Development

The Comprehensive Plan promotes a diversified rural economy that generates local tax benefits while maintaining community character. This community solar facility fulfills that vision by adding local energy infrastructure without imposing demands on public water, sewer, or transportation networks. The Project will participate in the Virginia Shared Solar Program, allowing residents and small businesses to subscribe and receive bill credits for their share of electricity produced. For Low-to-Moderate Income (LMI) households, the program ensures at least 10% monthly bill savings, offering direct economic benefit without the footprint or permanence of traditional development.

Conformance with the Zoning Ordinance

The Project qualifies as a medium-scale ground-mounted solar energy facility, with a rated capacity greater than 500 kilowatts (kW) and less than 5 megawatts alternating current (MWac). The facility will distribute energy for community consumption, aligning with the definition of "Solar Energy, Medium-Scale" use, as provided in Article XI of the King George County Zoning Ordinance. According to Table VI-1, medium-scale solar falls under the category of "Miscellaneous Use" and requires Special Exception (SE) approval in the A-1 zoning district.

The following tables demonstrate the Project's compliance with the ordinance, specifically:

- **Section 3-4-3.** Standards and Procedures for all Special Exception Uses
- **Section 7-7-8.** Design and Performance Standards for Medium-Scale Solar Energy

Section 3-4-3 Standards and Procedures for all Special Exception Uses

3-4-3 (A) Additional General Application Information		
(1)	Demonstrate that the proposed use, when complemented with additional measures, if any, will be in harmony with the purposes of the specific district in which it will be placed.	The Project maintains the area's agricultural character by occupying a limited footprint and incorporating an grazing-ready design that allows for continued agricultural use beneath the panels. Vegetative buffers and 50-foot setbacks along all boundaries provide visual separation and preserve rural views.
(2)	Demonstrate that there will be no undue adverse impact on the surrounding neighborhood in terms of public health, safety, or general welfare and show measures to be taken to achieve such goals.	The Project operates passively, producing no emissions, odors, or nighttime activity. Equipment generates minimal daytime noise, well below County thresholds, and the layout includes setbacks and screening to reduce visibility. Appendix B summarizes independent research confirming that solar facilities, when properly sited, do not pose health or safety risks. The Project also commits to decommissioning and land restoration per Virginia standards.
(3)	Demonstrate that the use will not tend to create congestion in streets, roads, alleys, and other areas.	The Project generates no routine traffic. After construction, maintenance crews will visit periodically using a single non-commercial vehicle. Pages 18-19 outline the construction-phase traffic plan, which will limit disruption and avoid long-term effects on road safety or capacity.

(4)	Show that the proposal meets the applicable specific and general standards required by this Ordinance.	The Project meets all applicable standards in the Zoning Ordinance, including the general criteria in Section 3-4-3 and the specific design and performance requirements for medium-scale solar in Section 7-7-8. The narrative addresses each standard and includes documentation supporting full compliance or justified modification requests.
3-4-3 (B) Concept Plan		
(1)	A certified plat of the subject property showing metes and bounds of all property lines, existing streets, and subdivisions.	A certified plat showing the metes and bounds, property lines, adjacent streets, and nearby subdivisions, will be provided prior to Special Exception permit approval.
(2)	Topography as shown by contour lines with a contour interval not more than five feet.	Sheet C101 shows existing topography with contour intervals no greater than five feet.
(3)	Proposed land uses to be developed.	The narrative describes the proposed use as a Medium-Scale Solar Energy System, including system layout and operational details.
(4)	The general layout, orientation, and information describing buildings and improvements, including but not limited to parking, landscaping, fencing, signs, and trash enclosures, height, setbacks, and restriction lines.	Sheet G101 provides a scaled site plan showing panel layout, setback lines, fencing, landscaping, and all proposed improvements.
(5)	If any, the approximate total number, density, type, and price range of dwelling units and the range of lot sizes for the various dwelling types.	The Project includes no dwelling units.
(6)	If any, the general location of proposed open space and recreational areas.	Sheet G101 identifies open farmable areas that will remain in agricultural use as preserved open space.
(7)	If any, the general location, and type of commercial uses to be developed.	The Project includes no commercial uses.
(8)	The general location and character of the proposed roads, pedestrian circulation, trails, public utility, and storm drainage systems.	Sheet G101 shows the layout of proposed access roads, public utilities, and stormwater features within the project area.
(9)	A statement on the proposed development schedule.	Page 19 of the narrative outlines the estimated construction schedule, which is expected to begin in late 2026 and last 6 to 9 months.

(10)	A written analysis of the public facilities, roadway improvements, and public utilities that will be required to serve the development.	Pages 14 describes utility use for the Project. The Project does not require any public facility upgrades, roadway improvements, or utility extensions.
(11)	Any additional information as deemed reasonably necessary by the Administrator.	The Administrator has not requested any additional information at this time.
(12)	Any special exception request for industrial uses shall include a noise analysis prepared by a credentialed professional as approved by the Zoning Administrator.	The ordinance does not require a noise study for miscellaneous uses. The Applicant anticipates using Siemens blueplanet 125 TL3 string inverters which are among the quietest in the industry with expected noise levels below 45 dBA at Powhatan Road or property lines.

Section 7-7-8 Design and Performance Standards for Medium-Scale Solar Energy

(B)	Compliance	The Applicant will comply with all applicable local, state, and federal regulations. The design and installation will follow all relevant industry standards for medium-scale solar energy systems.
(C)	Megawatts	The Project includes one photovoltaic system totaling 4.99 MWac.
(D)	Consumption	The electricity generated will participate in the Virginia Shared Solar Program, providing offsite energy access to subscribing customers.
(E)	Land Disturbance	Land disturbance will be limited to what is necessary for system installation and function. The site's flat topography reduces grading needs, helping preserve topsoil and minimize erosion during construction.
(F)	Grid Tied System	Dominion Energy is currently reviewing the Project for grid interconnection. The Applicant expects to execute a final agreement by late 2025 and will not begin installation until receiving full approval.
(G)	Height Limits	The facility is ground-mounted and will not exceed 15 feet in height at its tallest point, as shown on Sheet G101 of the Conceptual Site Plan.
(H)	Setbacks	The Project complies with all required principal structure setbacks in the zoning district. Fencing will maintain a minimum 50-foot setback from property lines, and solar panels will be set back at least 100 feet from property lines.

(I)	Landscaping & Screening	The Applicant requests a modification from the standard Buffer Type C required under Article VIII for medium-scale solar facilities. In its place, the Applicant proposes a Type B transitional buffer, with a 30-foot width and staggered plantings of 8 evergreen trees, 10 understory trees, and 20 native shrubs per 100 linear feet, as referenced in Tables VIII-2 and VIII-3. This buffer provides effective year-round visual screening while reducing planting density to a level that is more practical to source, establish, and maintain. Field experience from similar projects shows that dense Type C buffers often struggle with long-term survivability due to canopy competition, and that well-placed shrubs can deliver strong visual screening during early and mature growth phases. Where existing vegetation provides equal or better screening, the Project will preserve those buffers in lieu of new plantings.
(J)	7-7-8 (J) Design Standards	The Applicant will comply with the 4-foot maximum panel clearance to support the Project's grazing-ready design, enabling safe access for agricultural equipment, grazing, etc. All wiring not mounted on solar arrays will be installed underground, except where required to connect to the utility interconnection point.
(K)	Liability Insurance	The owner will provide proof of adequate liability insurance prior to construction and before the County issues any permits.
(L)	Inspection	The owner will grant access to County staff for inspection, with 24-hour advance notice when practicable. The owner will also reimburse the County for any costs related to third-party inspections required under local or state law.
(M)	Decommission & Reclamation Procedures	The Applicant has provided a Decommissioning and Reclamation Plan (Appendix A), as required under §7-7-8(N). At the end of the Project's useful life, or if inactive for 12 consecutive months, the owner or operator will remove all equipment at their expense, unless the system is being repowered or subject to a force majeure event. The County may request documentation to support delays in removal. The owner will notify the Administrator by certified mail of the proposed decommissioning date and removal plan. If the Administrator issues a notice of abandonment, the owner must either complete decommissioning or resume operations within 30 days. If the owner fails to decommission the site in accordance with the plan, the County may draw on the surety and enter the property to complete removal.
(N)	Decommission & Reclamation Plan	A qualified engineer or contractor with proven experience in solar facility removal will certify all Decommissioning and Reclamation Plans. Decommissioning will include removal of all system components, including solar arrays, buildings, cabling, electrical equipment, fencing, roads, foundations, and pilings. The Applicant will restore all disturbed agricultural land to a tillable and farm-ready condition. The site will be graded and re-seeded or replanted within 12 months of removal to return it to a pre-development condition, as close to natural as practicable. The Applicant will ensure safe disposal of any hazardous materials in full compliance with federal and state regulations..

Proposed Conditions

The Applicant proposes conditions below in response to the King George County Department of Community Development staff review comments of the resubmitted Powhatan Road Solar Farm Special Exception Permit application and the Community Focus Group Meeting

1. Code Compliance. The medium-scale solar energy facility shall be developed, constructed, operated, and maintained in full compliance with Section 7-7-8 of the King George County Zoning Ordinance and all other applicable local, state, and federal regulations.

2. Plan Consistency. Development shall occur substantially in accordance with the approved Concept Plan, entitled "Powhatan Road Solar Farm, LLC," prepared by Uneclipsed Energy, PLLC, dated August 28, 2025, as modified by these conditions. Minor modifications that do not materially change the overall design, layout, or environmental impacts may be approved administratively by the Zoning Administrator.

3. Permit Term. This Special Exception Permit is subject to the expiration provisions of Section 3-4-4 of the Zoning Ordinance.

4. Fencing. All fencing shall meet National Electric Code. Woven wire shall be permitted.

5. Noise. During operation, the solar facility shall not produce a noise level that exceeds 60 dBA as measured at the property line or 50 dBA as measured at the nearest neighboring dwelling, existing as of the date of this approval.

6. Type B Landscaping. Landscaping and screening shall be provided in compliance with Buffer Type B per Article 8, Community Design Standards, Tables VIII-2 and VIII3. Any modifications shall follow the procedures established in Section 8-3-8.

7. Stormwater Management. An Erosion and Sediment Control plan and a Stormwater Management Plan must be submitted and approved prior to any land disturbance, in accordance with applicable Virginia requirements.

8. Environmental Resource Protection. The final site plan shall demonstrate avoidance of jurisdictional wetlands and streams identified in the wetland delineation report dated April 25, 2025. Should design modifications require impacts to jurisdictional features, the applicant shall obtain appropriate federal and state environmental permits prior to any ground disturbance in those areas.

9. Fire Safety Coordination. The applicant shall coordinate with King George County Fire & Rescue Department during the site plan review process to establish appropriate emergency access routes, Knox Box or Knox Pad Lock locations, and emergency response procedures. The facility shall comply with applicable NFPA and Virginia Statewide Fire Prevention Code (SFPC) standards.

10. Construction Activities and Traffic. Construction activities and traffic shall be limited to Monday through Saturday 8:00 AM to 7:00 PM, with no construction on Sundays or federal holidays.

11. Water Quality Testing. The Applicant shall establish a water quality baseline prior to land disturbance. Follow-up sampling shall occur on the following schedule: (i) five years after commencement of operations; (ii) at decommissioning; and (iii) following any fire or structural failure of sufficient magnitude reasonably likely to release contaminants, as determined by the Zoning Administrator in consultation with DEQ. Sampling shall occur at drainage locations pre-approved by the Zoning Administrator in consultation with DEQ. Testing parameters shall include turbidity, total nitrogen, total phosphorus, and metals reasonably associated with solar construction activities, as identified prior to land disturbance. Results shall be submitted to the Zoning Administrator within 60 days of collection.

12. Military Compatibility. All inverters and critical electrical components shall either:

(i) be selected from models previously reviewed by the U.S. Navy or Department of Defense for electromagnetic compatibility near military installations, or (ii) be demonstrated by the Applicant, through manufacturer documentation, to comply with Federal Communications Commission (FCC) Part 15 standards for electromagnetic emissions and to contain no wireless communication modules beyond those expressly identified in manufacturer specifications. Evidence of compliance shall be submitted to the Zoning Administrator prior to final site plan approval.

Project Design

The Project's design balances technical requirements, the landowner's goals, and a desire to keep the land productive. Delivering up to 4.99 MWac using single-axis trackers requires a minimum system footprint of about 25 acres. At the same time, the landowner plans to continue using other parts of the property for horse pasture and recreation.

The soils on-site are well suited for agriculture, so the Applicant has worked to preserve as much farmland as possible, both within and outside the fenced array. By increasing row spacing and panel height, the Project creates space for equipment access, grazing, or other agricultural uses within the array area. This layout supports a dual-use of solar production and continued farming.

Site Layout and Access

The Project consists of two distinct panel areas on both sides of Powhatan Road. The Applicant will install 20-foot-wide gravel driveways providing access to both the north and south sections of the site. These driveways will share a single entrance from Powhatan Road, with adequate turning radius and spacing from nearby residential driveways. Each driveway will be secured with swing gates equipped with Knox boxes for emergency access. Signage will be posted per County requirements. A perimeter access lane will run along the fence line to support routine maintenance and allow emergency vehicle circulation.

The design also includes dedicated lanes and gates to support safe movement of livestock, farm equipment, and personnel between the panel area and preserved farm land. These layout features will be refined in collaboration with the participating farmer or grazer.

Utility Interconnection

The Project will connect to Dominion's three-phase distribution system along the south side of Powhatan Road. Dominion will identify any required upgrades, which the Applicant will fund. Where feasible, interconnection lines will run underground to reduce visual impact, though some new overhead utility poles will be necessary.

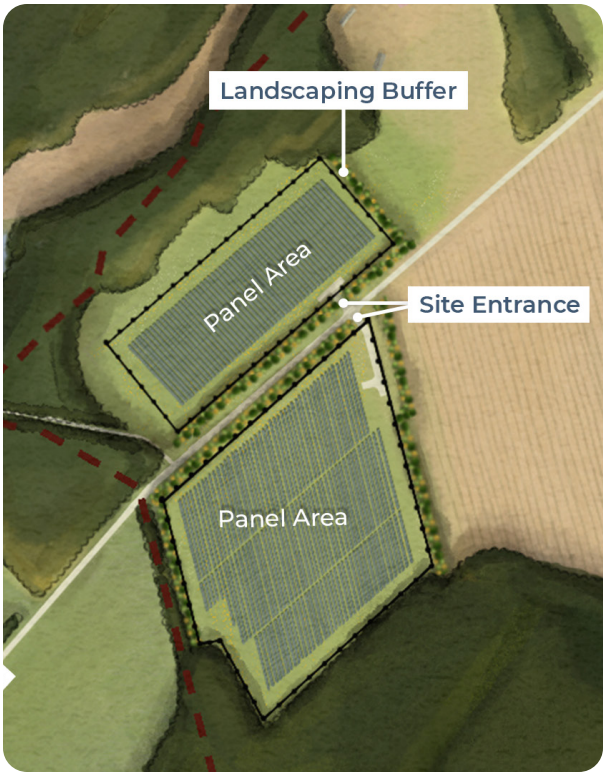


Figure 5. Proposed panel areas

Figure 6. Demonstration of Grazing-Ready design (White Oak Pastures, Georgia)

System Components

Solar Panels. The Project will use bi-facial, crystalline silicon solar modules, which absorb sunlight from both the front and rear surfaces to increase energy yield. Each panel features an aluminum frame and anti-reflective glass to reduce glare. Final panel selection will be confirmed prior to building permit issuance.

Racking. The panels will mount on a steel single-axis tracking system that follows the sun's path, tilting up to 55 degrees. The system is engineered to meet local wind and snow load requirements, ensuring structural durability.

String Inverters. Inverters convert the panels' direct current (DC) output into alternating current (AC) for grid use. These inverters are the primary noise source, though they operate only during daylight hours and are quieter than central inverters.

Control Systems. A real-time monitoring system will track the performance of the panels, enabling remote operation and rapid response should any issues arise.

Transformer. Step-up transformers located on the equipment pad will align the project's power output with the existing voltage of the distribution system, allowing electricity to serve local homes and businesses.

Fencing. The project area will be enclosed by woven wire fencing, which is also known as wildlife-friendly fencing, due to the holes that allow small animals to pass safely through. The fence will be at least 8′ in height as required by the National Electric Code.

Design & Performance Standards

Land Disturbance

The Project limits land disturbance to the minimum necessary to install the system efficiently and safely. Minimal grading will preserve the natural topography and protect the site's long-term agricultural viability.

To protect soil quality during construction, the Applicant will use best practices such as erosion controls, reseeding disturbed areas, and limiting equipment traffic. Where grading is unavoidable, topsoil will be removed and stored, then replaced and amended with compost after construction to restore soil structure and fertility.

The Applicant will follow all applicable state laws requiring stabilization and re-vegetation of disturbed ground. These steps are intended to maintain the site's long-term suitability for agriculture once the system is removed.

Height

All solar panels will remain under the 15-foot maximum height limit required by Section 7-7-8(G)(1) of the zoning ordinance. This keeps the project visually unobtrusive and consistent with County standards.

Setbacks

The Project meets or exceeds all minimum setbacks required in the A-1 zoning district. All solar equipment is located at least 50 feet from property lines and public roads. The nearest home is over 300 feet from the array. These setbacks help ensure compatibility with neighboring land uses and reduce visual and noise impacts.

Landscaping Plan

The Project's landscaping plan is designed to fit the rural character of King George County while meeting its screening and environmental goals. Although Section 7-7-8(F) of the Zoning Ordinance typically requires a Type C buffer for medium-scale solar facilities, the Applicant respectfully requests approval to use a Type B transitional buffer along all project boundaries.

The proposed Type B buffer will be 30 feet wide and planted at the following rate per 100 linear feet:

- **4 evergreen trees** (e.g., Eastern Red Cedar, American Holly)
- **8 understory trees** (e.g., Redbud, Serviceberry, Dogwood)
- **10 native shrubs** (e.g., Wax Myrtle, Arrowwood Viburnum, Inkberry Holly)

This buffer provides effective year-round screening while keeping planting density practical and maintainable. Shrubs offer strong screening performance, especially in the early years, and help create a dense visual barrier at eye level. In contrast, the higher-density tree plantings required under Type C can lead to canopy competition and reduced plant health, particularly in rural areas with limited nursery stock.

All vegetation will be planted in a staggered, natural layout to break up uniform lines and blend with the surroundings. Pollinator-friendly native groundcover will be planted throughout the site to reduce erosion, support infiltration, limit mowing, and enhance habitat value.

The Applicant will coordinate with local nurseries and landscape professionals to

Figure 7. Proposed vegetative buffer, along Powhatan Road, looking northeast

Figure 8. Proposed vegetative buffer, along Powhatan Road, looking southwest

finalize plant choices, prepare the site, and maintain plantings. A full planting and maintenance plan, including a two-year survivability guarantee, will be submitted with the final site plan. The Applicant will maintain all landscaping throughout the life of the Project.

This request reflects a site-specific, performance-based solution that fulfills the intent of the ordinance—ensuring effective screening while supporting long-term plant health, biodiversity, and ease of maintenance.

Project Management

Construction

Construction will begin once all required state and local permits are secured and is expected to take 6 to 9 months. Coordination with the landowner will minimize disruption to agricultural operations.

Before construction can occur, the process will start with stormwater management and erosion control measures, such as silt fences and sediment traps, to manage runoff. The project will comply with the Virginia Department of Environmental Quality Erosion and Sediment Control Handbook and Section 10-3-11 of King George County Code. An access road will be built using low-ground-pressure equipment to reduce soil compaction. Construction will be scheduled to avoid wet conditions whenever possible, minimizing soil disturbance.

Bulldozers and excavators will perform targeted grading per approved site plans. The project area will be seeded with native vegetation before racking installation to prevent erosion and improve soil structure. Steel pilings will support a steel racking framework for solar panels, followed by transformers, inverters, and control systems, with electrical wiring connecting the panels to the grid.

We proposed the construction work to be limited to Monday through Saturday, 8:00 AM to 7:00 PM, ensuring minimal disruption to neighbors.

Operation

The solar facility will operate quietly for an expected lifespan of 35 years with minimal disruption to the surrounding area. Mature vegetative buffers will screen the system from view, preserving the rural character of the site. Regular maintenance will include inspections of panels, inverters, and transformers to address any issues promptly. Vegetation will be managed to prevent shading and maintain a healthy groundcover.

Remote monitoring will track energy output and system health, enabling swift responses to any anomalies. Emergency response protocols will be coordinated with local emergency services, with access around the perimeter maintained for incident response.

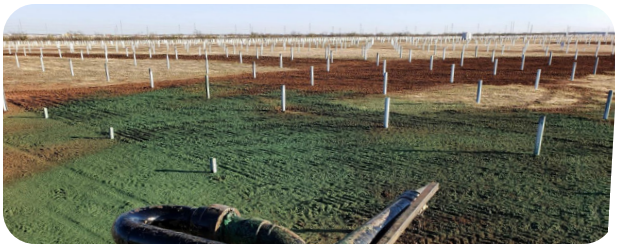
Decommissioning

The applicant has submitted a decommissioning plan and agreement (see Appendix A) which outlines the process for safely dismantling and removing the solar facility at the end of its operational life. In compliance with § 15.2-2241.2 of the Virginia Code and local requirements, the applicant must provide financial assurance for decommissioning the solar facility. This assurance, in the form of certified funds, cash escrow, a bond, letter of credit, or parent guarantee, protects the County from decommissioning expenses if in the unlikely case that the applicant fails to follow through on their obligations.

Figure 9. Anticipated traffic throughout life of project

[1]Some phases have overlapping duration [2]Commercial Driver's License (CDL)		Peak trips in a given day	
Phase	Duration[1]	CDL[2] Trips	Non-CDL[2] Trips
Site preparation	2-4 weeks	2	5
Racking and panel delivery	2-4 weeks	5	25
Panel/equipment installation	8-12 weeks	1	40
Operation	35 years	0	1
Decommissioning	6-8 weeks	10	25

Build access & grade. Earthmovers build driveways and spot grade the site.



Seed as needed. Seed to re-establish groundcover before post installation.

Deliver racking. Flatbed trucks deliver post and racking pieces.

Install posts. GPS enabled pile driver installs posts.

Assemble racking. Construction workers assemble racking.

Deliver modules. Flatbed trucks deliver solar modules.

Module installation. Workers install and wire panels, inverters, and transformer.

Interconnection. Test and connect the facility to the grid for power distribution.

Figure 10. Typical Construction Sequence

Supporting Analysis & Assessment

The following section summarizes supporting details that help contextualize the Project's potential impacts.

Health and Safety Assessment

A 2017 report by Tommy Cleveland and the NC Clean Energy Technology Center examined the health and safety impacts of solar PV systems. The report shows that when properly installed and maintained, utility-scale solar presents no significant risk to public health or safety.

Most modern panels, especially those made with crystalline silicon, are built with durable glass and polymer layers that prevent exposure to internal materials. Electromagnetic fields near solar equipment are well below household appliance levels and don't present a known health risk. The risk of fire is low, on par with other outdoor electrical systems, and existing electrical codes and permitting processes are designed to address it. Solar panels are also designed to minimize glare, and there's no evidence that solar farms increase ambient temperatures in the surrounding area.

In short, the report concludes that projects like this one can be safely integrated into rural communities without harming human health or the environment.

Wetlands Delineation

A field delineation conducted by Headwater Environmental identified three jurisdictional wetlands (Wetlands A, B, and C) and one stream feature (Stream A) within the project area. Wetlands A and C are adjacent to an intermittent section of Stream A, while Wetland B connects to the same stream via surface flow through an ephemeral drainage. Stream A originates on-site and transitions from intermittent to perennial before exiting the property.

Two isolated (non-jurisdictional) wetlands, labeled Wetlands D and E, were also identified in the eastern-central portion of the site. These features are regulated by Virginia DEQ and may require a State Surface Water Determination (SSWD) if they remain within the development boundary.

To confirm the jurisdictional status of all delineated features, the Applicant intends to pursue an Approved Jurisdictional Determination (AJD) from the U.S. Army Corps of Engineers. Should any jurisdictional features be impacted, the Applicant will submit the appropriate Joint Permit Application (JPA) to the USACE and VDEQ, and seek an SSWD if impacts to isolated wetlands are proposed.

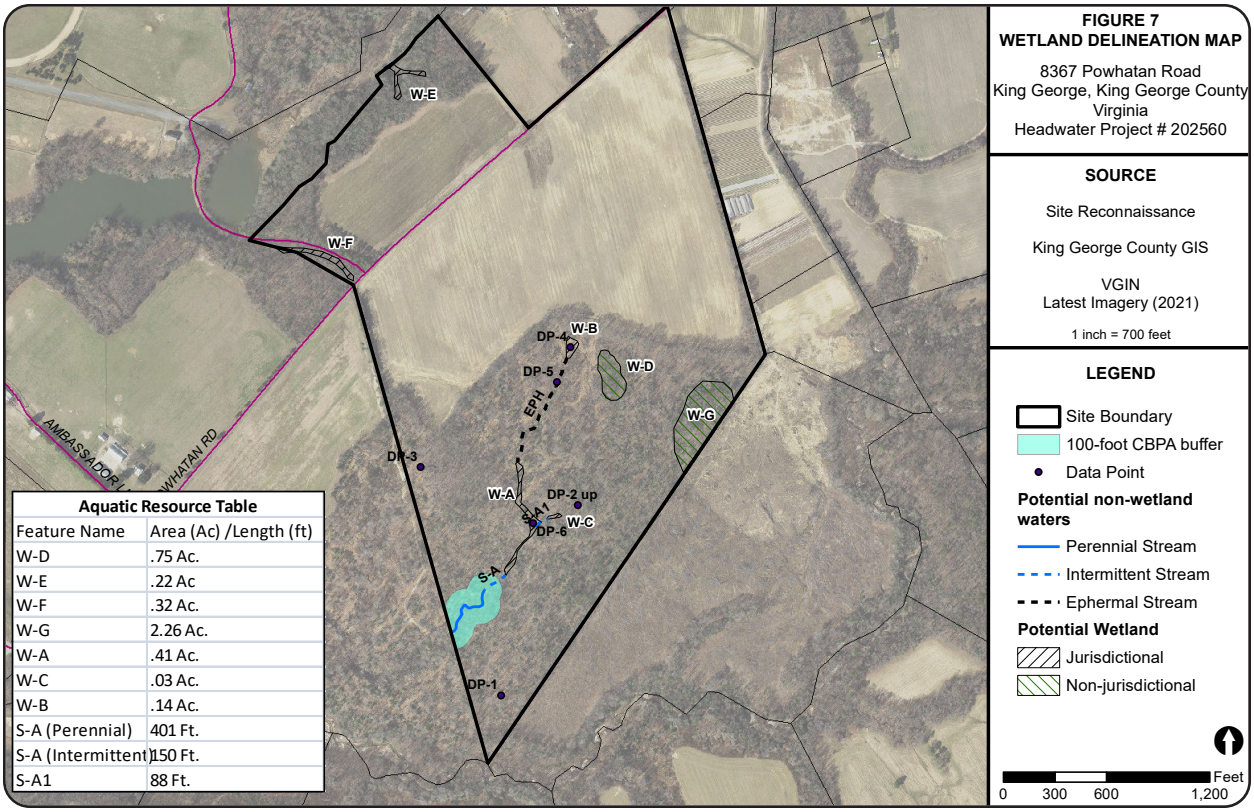


Figure 11. Wetland Delineation Map (see Appendix C)

FAA Determination

To evaluate compliance with §7-7-8(B)(1) and FAA standards, the Applicant used the FAA Notice Criteria Tool. The site elevation ranges from 72 to 126 feet above sea level, and four representative points were assessed (see Appendix D). None exceeded FAA notice thresholds, confirming that construction does not require FAA notification or further review.

Community Impact Assessment

Agriculture is central to life in King George County, and this project is designed to keep the land productive while generating local energy. Through an agrivoltaics approach, the site will support continued agricultural use, such as grazing, between and beneath the solar panels. This approach protects soil health, supports local food systems, and reflects a commitment to long-term land stewardship.

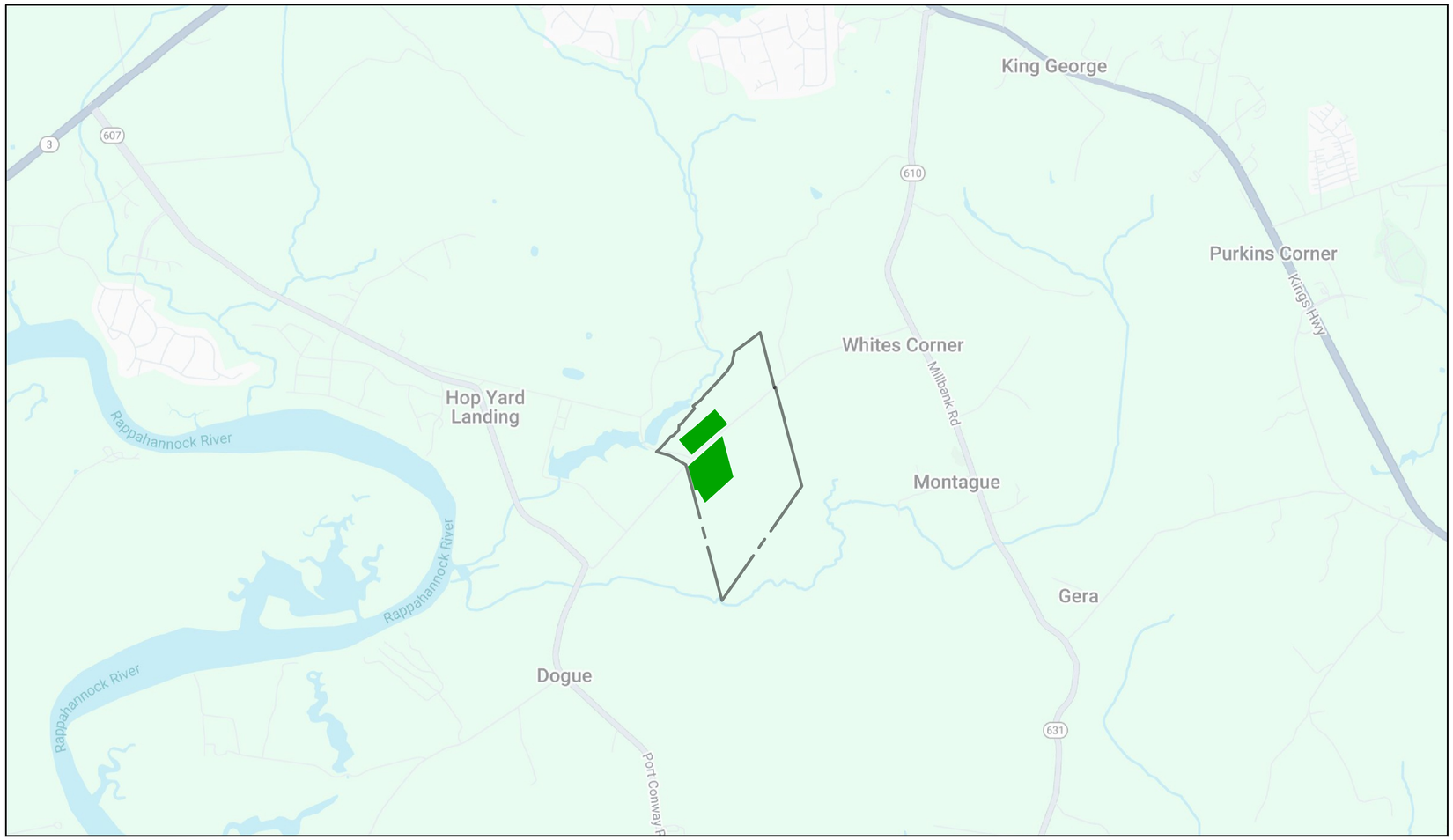
The Applicant is actively working to identify a local farmer to serve as a long-term partner for managing the agricultural use of the site. We have engaged with local producers and are coordinating with the King George Cooperative Extension to align the site's capacity with the needs of the area's farming community. To date, the Applicant has conducted door-to-door outreach and one-on-one conversations with neighboring residents. This engagement will continue through follow-up interviews, small focus groups, and a public community meeting, ensuring the project reflects local values and priorities.


esa

Powhatan Road Solar Farm

(4.99 MWAC)

King George County



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October 3, 2025

REV.	DATE	REVISION DESCRIPTION	DRN	CHK
06	2025-04-28	REVISION (REDESIGNED SITE TO AVOID WETLAND)	SM	GS
07	2025-06-21	REVISION (REDESIGNED ACCESS ROADS, LANDSCAPING BUFFERS)	SM	GS
08	2025-08-27	REVISION (CHANGED MW GOAL)	SM	GS
09	2025-10-03	ALTERNATE DESIGN	GS	SMc

REVISION	DRAWN	CHECKED	APPROVED
09	GS	SMc	DC

ENGINEER:	DAVID K. CLICK, PE
VA LIC #:	0402062143
NABCEP PV/PI#:	041704-8

SEAL (PRELIMINARY, UNLESS SEALED)

PRELIMINARY

UNECLIPSED ENERGY, PLLC
2250 Lucien Way, Suite 305
Maitland, FL 32751 USA

SOLAR DEVELOPMENT GROUP, LLC
2250 Lucien Way, Suite 305
Maitland, FL 32751 USA

PROJECT NAME:

Powhatan Road Solar Farm. LLC
King George County

ADDRESS
8375 Powhatan Rd
King George, VA 22485

COORDINATES
38.241653, -77.202853

SHEET SIZE
24" x 36"

N

SHEET TITLE
COVER SHEET

SHEET No.
G001

A1.7, DS_VA_9020_Powhatan Road Solar Farm_09_8.5x11.dwg, 8.5x11, ANSI B (11.00 x 8.50 Inches), George Sanchez

TABLE OF CONTENTS

LEGEND OF SYMBOLS

	PV MODULES		BUILDING
	FENCE		PANEL AREA
	PROPERTY LINE		PROPOSED POLE
	GRAVEL	OE	OVERHEAD ELECTRICAL
	EXISTING VEGETATION TO REMAIN		EXISTING DISTRIBUTION
	LANDSCAPING BUFFER		GROUND COVER
	JURISDICTIONAL WETLAND		EXISTING VEGETATION
	NON-JURISDICTIONAL WETLAND		EQUIPMENT PAD
	EPHEMERAL STREAM		DOMINION UTILITY CLEARANCE
	PERENNIAL STREAM		
	INTERMITTENT STREAM		

GENERAL NOTES

OUR SOLAR FARM WILL INCORPORATE THE FOLLOWING DETAILS:

1. REASONABLE AND APPROPRIATE SCREENING/BUFFERING/LANDSCAPING ACTIVITIES TO SHIELD THE PROJECT FROM ADJOINING AND ADJACENT PARCELS AT LEAST 30 FEET WIDE. LANDSCAPING AND SCREENING SHALL BE PROVIDED IN COMPLIANCE WITH BUFFER TYPE B IN ARTICLE 8, COMMUNITY DESIGN STANDARDS, TABLES VIII-2 AND VIII-3, OF THE KING GEORGE COUNTY ZONING ORDINANCE.
2. AN 8-FOOT-HIGH WOVEN FENCE WILL BE INSTALLED ON THE INTERIOR OF THE VEGETATIVE BUFFER.
3. ALL STRUCTURES SHALL COMPLY WITH THE SETBACK REQUIREMENTS OF THE UNDERLYING A-1 ZONING DISTRICT.
4. PROJECT WILL MEET ALL UNDERWRITERS AND REGULATIONS, INCLUDING NATIONAL ELECTRICAL CODE (NEC), AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI), AND UNDERWRITER'S LABORATORIES (UL).
5. THE SOLAR PANELS WILL HAVE TEMPERED, ANTI-GLARE, NON-REFLECTIVE SURFACES.
6. SOLAR ENERGY EQUIPMENT SHALL BE REPAIRED, REPLACED, OR REMOVED WITHIN 365 DAYS OF BECOMING NON-FUNCTIONAL.
7. THE SOLAR ENERGY COLLECTORS SHALL BE INSTALLED, MAINTAINED, AND USED ONLY IN ACCORDANCE WITH THE MANUFACTURER'S DIRECTIONS.
8. THE FACILITY SHALL NOT EXCEED A HEIGHT OF 15 FEET.
9. PROJECT WILL COMPLY WITH THE COUNTY NOISE ORDINANCE.
10. THE SOLAR FARM AND INSTALLATION USES WILL COMPLY WITH CONSTRUCTION CODE, ELECTRICAL CODE, AND OTHER STATE REQUIREMENTS.
11. NATIVE AND POLLINATOR FRIENDLY GROUND COVERS WILL BE MAINTAINED ON THE PROPERTY, UNTIL THE SITE IS DECOMMISSIONED.
12. THE UTILITY WILL PROVIDE SPECIFICATIONS OF WHERE THE POWER AND COMMUNICATION LINES WILL BE PLACED, EITHER ABOVE GROUND OR UNDERGROUND.
13. PROJECT WILL MEET ALL THE DEPARTMENT OF TRANSPORTATION REQUIREMENTS WHERE APPLICABLE.

REV.	DATE	REVISION DESCRIPTION	DRW	CHK
06	2025-04-28	REVISION (RESIDENCE SITE TO AVOID WETLAND)	SM	GS
07	2025-05-21	REVISION (RESIDENCE ACCESS ROUGH, LANDSCAPING BUFFERS)	SM	GS
08	2025-06-27	REVISION (CHANGED NW GOAL)	SM	GS
09	2025-10-01	ALTERNATE DESIGN	GS	SMc

REVISION	DRAWN	CHECKED	APPROVED
09	GS	SMc	DC

ENGINEER:	DAVID K. CLICK, PE
VA LIC #	0402062143
NABCEP PV/PII	041704-8

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PROJECT NAME:

Powhatan Road Solar Farm. LLC

King George County

ADDRESS	8375 Powhatan Rd King George, VA 22485
COORDINATES	38.241653, -77.202853
SHEET SIZE	24" x 36"

N

SHEET TITLE: GENERAL NOTES

SHEET No.: G002

A:\T_CS_VA_0003 (Powhatan Road Solar Farm. LLC)\5-plan\SHEETS\G002.dwg - George Sanchez

LEGEND

- LANDSCAPING BUFFER
- GROUND COVER
- FARMABLE AREA
- DOMINION UTILITY CLEARANCE
- EXISTING VEGETATION
- FENCE
- EQUIPMENT PAD
- PROPERTY LINE
- OVERHEAD ELECTRICAL LINE
- SINGLE AXIS TRACKER
- GRAVEL
- JURISDICTIONAL WETLAND
- NON-JURISDICTIONAL WETLAND

PARCEL DATA

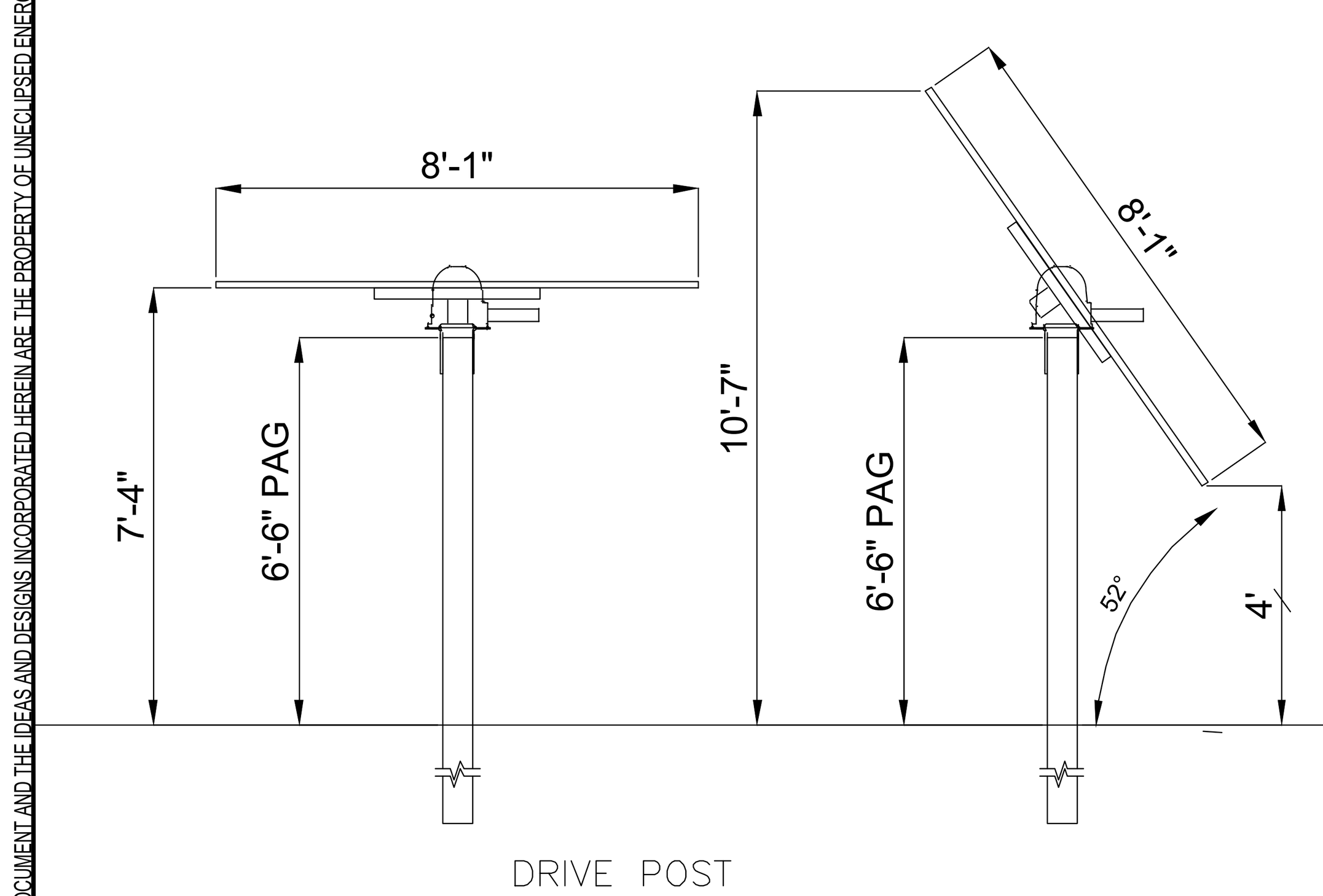
OWNER NAME	CARR LAWRENCE E
PARCELID	32 1
PARCEL AREA	158.02 ACRES
PROJECT AREA	24.34 ACRES

PV DATA

MODULE COUNT (APPROX.)	12,576
PEAK POWER	4.99 MWAC/ 7.56 MWDC
RACKING SYSTEM	SINGLE AXIS TRACKERS
MODULE TILT	+/-55 DEGREES
MODULE ORIENTATION	EAST/WEST (NORTHERN ARRAY AZ. 127°/53°) (SOUTHERN ARRAY AZ. 76°/104°)
MODULE HEIGHT (MAX TILT)	~11 FT
BASIS OF DESIGN	QCELLS Q.PEAK DUO XL-G11S.3 / BFG 600W

This site plan is preliminary and NOT FOR CONSTRUCTION, awaiting surveys as well as zoning. Layout is based on GIS information, and is subject to survey.

RACKING DETAIL



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09	2025-10-01	ALTERNATE DESIGN	GS	SMc

REVISION	DRAWN	CHECKED	APPROVED
09	GS	SMc	DC

ENGINEER:	DAVID K, CLICK, PE
VA LIC #:	0402062143
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PROJECT NAME:

Powhatan Road Solar Farm, LLC
King George County

ADDRESS
8375 Powhatan Rd
King George, VA 22485

COORDINATES
38.241653, -77.202853

SHEET SIZE
24" x 36"

SCALE: 1" = 150'
0 37.5' 75' 150'

N

SHEET TITLE: SITE PLAN

SHEET No. G101

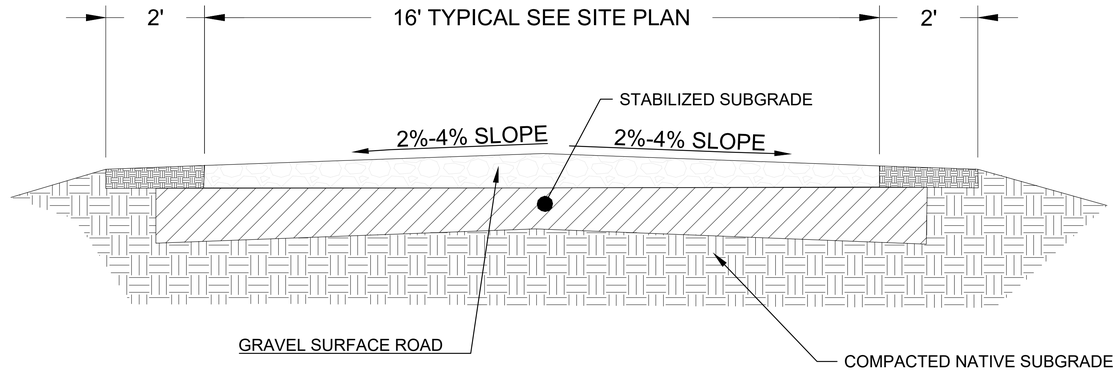
C101.1 TOPOGRAPHIC PLAN

SCALE: 0' - 1" = 300' - 0"

5 FT CONTOUR INTERVALS
72 - 126 FT ELEVATION

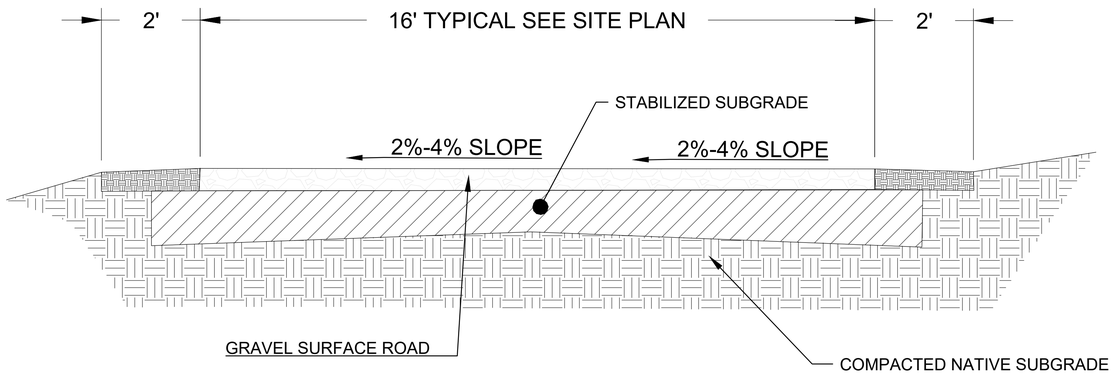
C101.2 CROWNED ACCESS ROAD SECTION DETAIL

SCALE: 0' - 1" = 1' - 5"



C102.3 CROSS SLOPE ACCESS ROAD SECTION DETAIL

SCALE: 0' - 1" = 1' - 5"



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REVISION	DRAWN	CHECKED	APPROVED
09	GS	SMc	DC

ENGINEER:	DAVID K. CLICK, PE
VA LIC #:	0402062143
NABCEP PV/PI#:	041704-8

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SHEET SIZE	24" x 36"

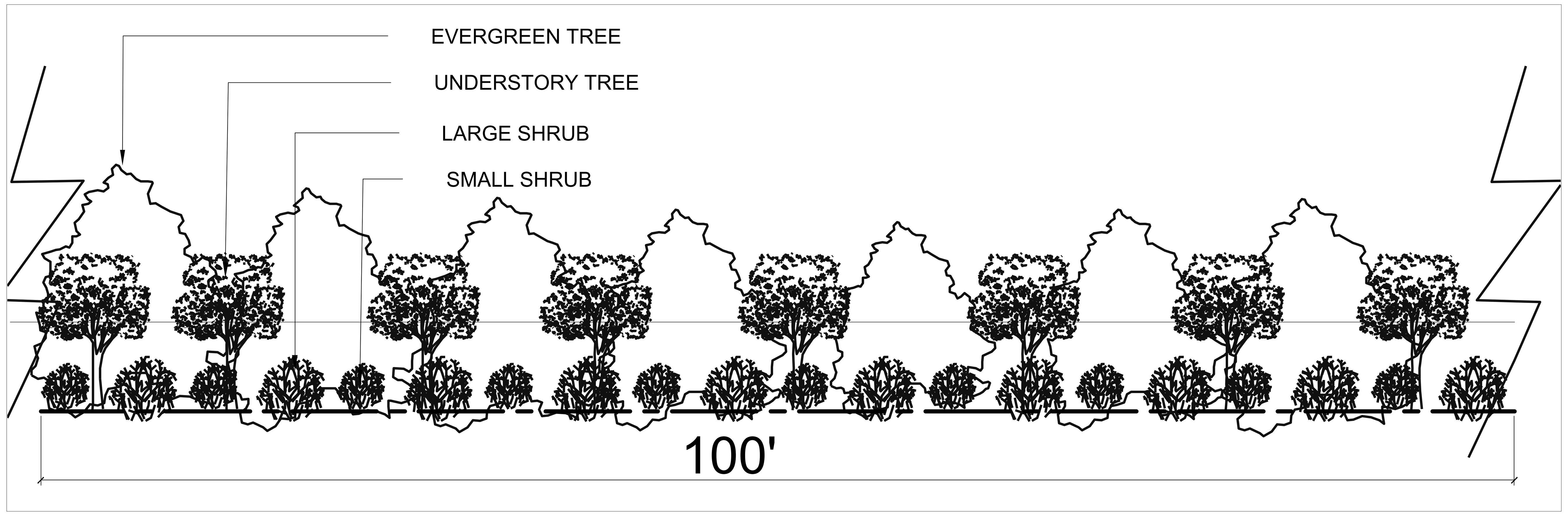
N

SHEET TITLE	TOPOGRAPHIC MAP
SHEET No.	C101

A:\7. CS_VA_2023 (Powhatan Road Solar Farm. (@ 2.5)\11-layout SAVED BY - George Sanchez

L101.1 :LANDSCAPE ELEVATION

SCALE: 1"=8'



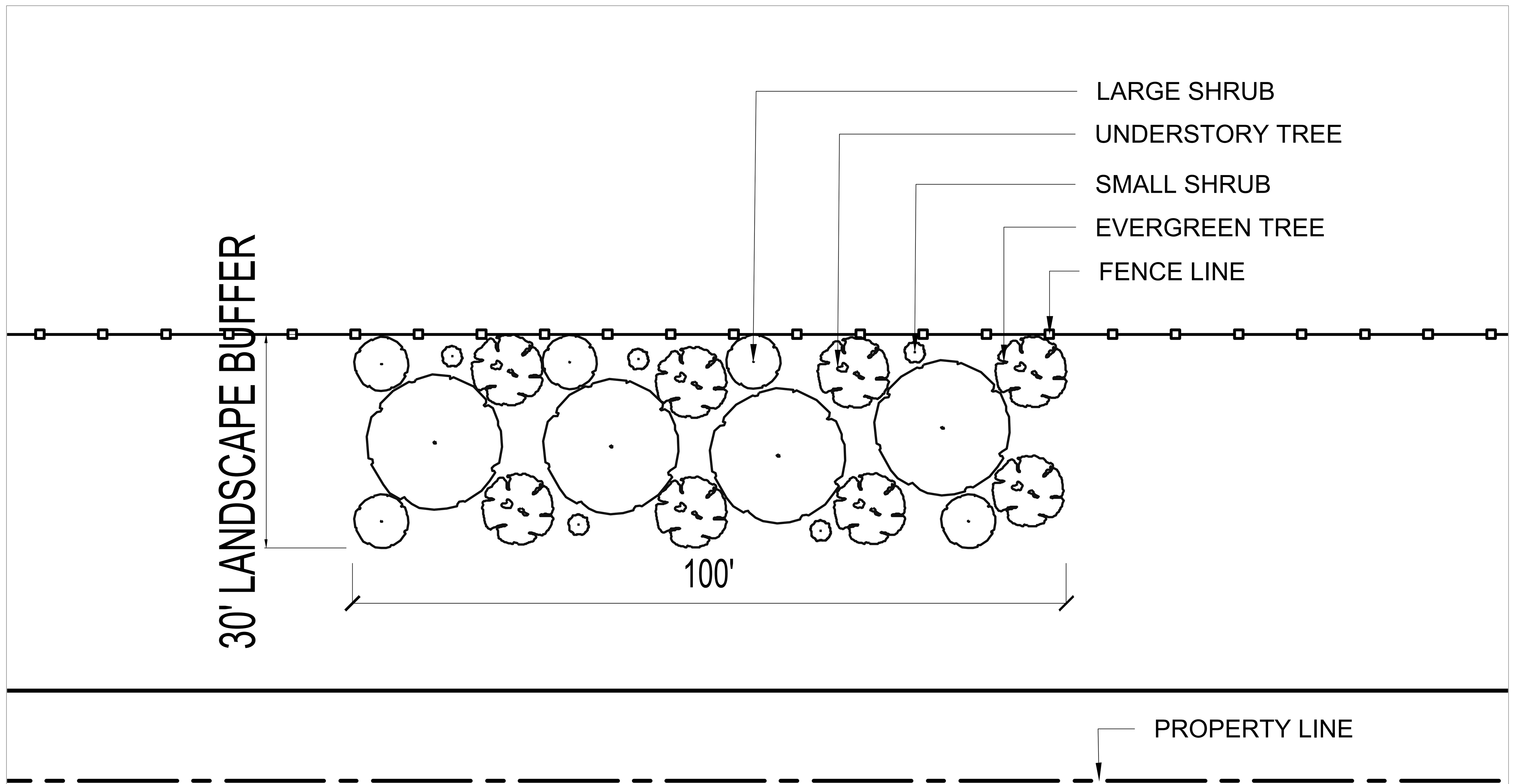
L101.3 :LANDSCAPE BUFFER SCHEDULE

Four (4) Evergreen trees that are at least 6 feet in height at the time of planting,
Eight (8) Understory trees that are at least 4 feet at planting, five (5) large evergreen shrubs,
and five (5) small shrubs at least 18 inches in spread or height for every 100 linear feet.
Species shown are illustrative examples and are subject to final approval and AVAILABILITY

EVERGREEN TREE:	**UNDERSTORY TREES:**	**SMALL SHRUBS:**	**VEGETATIVE GROUND COVER:**
EASTERN RED CEDAR	IRONWOOD TREE	SILKY DOGWOOD	NATIVE SPECIES OF WARM SEASON GRASSES AND POLLINATOR PLANTS

L101.2 :LANDSCAPE BUFFER PLAN

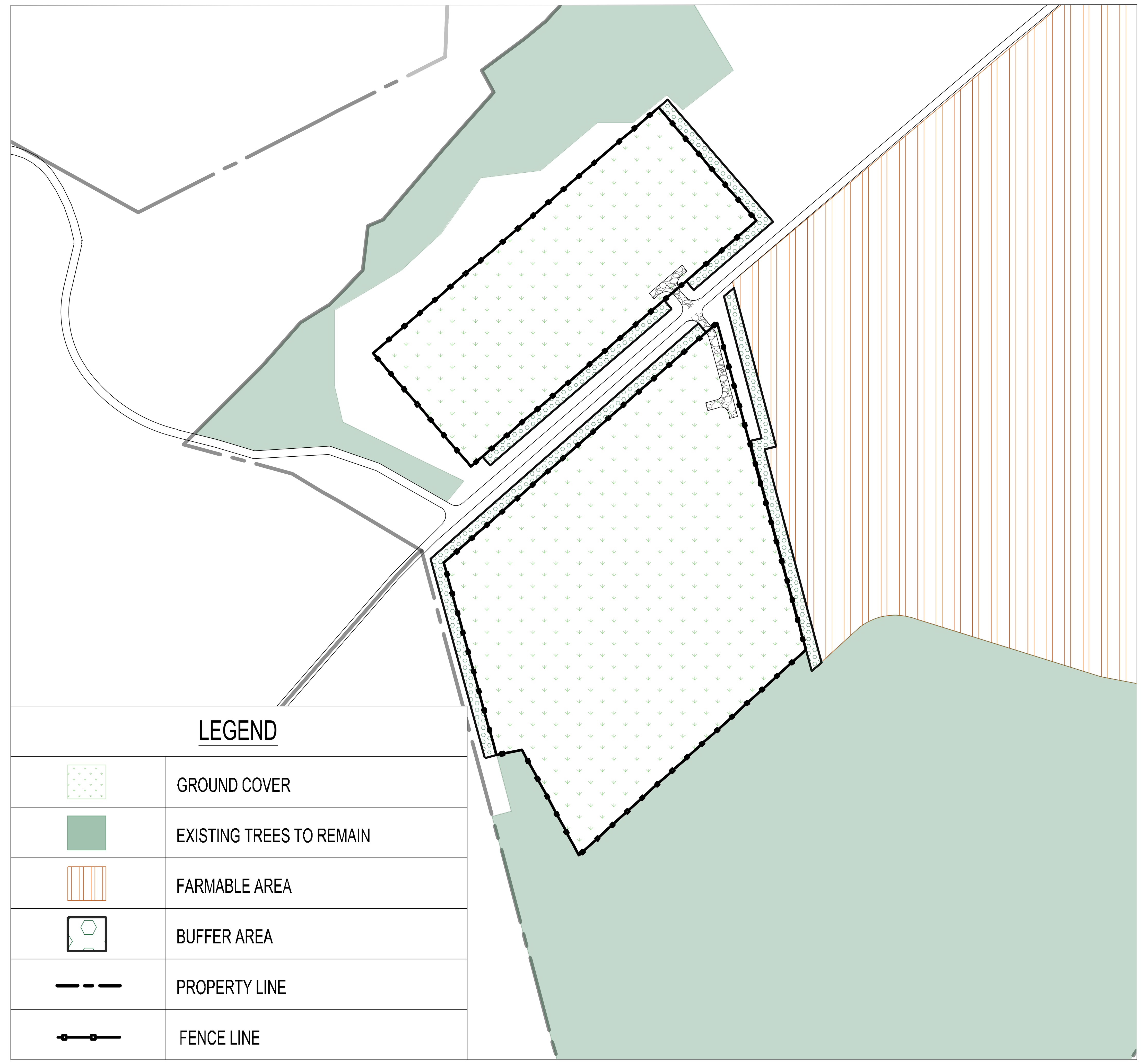
SCALE: 1"=12'



"PER ONE HUNDRED (100) LINEAR FEET"
- 4 EVERGREEN TREES
- 8 UNDERSTORY TREES
- 5 LARGE EVERGREEN SHRUBS
- 5 SMALL SHRUBS
- VEGETATIVE GROUNDCOVER

L101.4 :LANDSCAPING PLAN

SCALE: 1"=200'



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ENGINEER:	DAVID K, CLICK, PE
VA LIC #:	0402062143
NABCEP PVIP#:	041704-8

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SHEET TITLE
LANDSCAPING PLAN

SHEET No.
L101

PC Memorandum

To:	King George County Department of Community Development
From:	Tamara Irving, Planner I at ESA
Re:	Powhatan Questions Asked by PC Members
Date:	November 21, 2025

Overview

This document contains the Powhatan Road Solar Farm, LLC (Applicant) responses and clarifying points to the King George County Planning Commission Work Session held on November 12, 2025.

Table of Contents

King George County PC Comments:

1. Tree Removal

"Any tree removal?"

Applicant Response - We redesigned the project based off feedback at our Focus Group meeting to move the panels off the south forested area. While we do not expect to clear any trees for the solar panels, we expect to thin along the forest edge to mitigate impacts from shading on the panels.

The Project aims to preserve the existing vegetation that can provide equal or better screening with new plantings.

Please refer to Page 13 of the Narrative.

"The site you're going to construct on is already clear?"

Applicant Response – Yes, the project area is already clear of trees although, as previously mentioned, there may be some forest thinning along the project's southern perimeter to mitigate for shading impacts.

Please refer to Sheet G101 of the Site Plan.

2. Site Grading

"You mentioned leveling. Is the site not already relatively flat?" I would prefer that you follow the natural contour—what did you mean by leveling?"

Applicant Response - We will follow the natural contour of the site. Leveling will not be needed.

Please refer to Sheet C101 of the Site Plan to view the topographic contour map of the subject parcel.

3. Vegetation Management

"How do you handle vegetation during the life of the project?"

Applicant Response - If the site is not utilized for grazing, maintenance will entail mowing

Please refer to page 9 of Project Narrative.

"Are you just going to let stuff grow?"

Applicant Response – To some extent, groundcover will grow so that our native, pollinator ground over can grow enough to flower and establish deep roots. However, vegetation will be managed and maintained to prevent potential panel shading.

"How are you handling it—mowing or grazing?"

Applicant Response - At this time we have not made commitments or signed any maintenance agreements with grazers. However, the project is grazing ready with appropriate site considerations.

Please refer to Page 9 of the Narrative.

"Any chemical applications you anticipate?"

Spot applications of herbicides may be used in hard-to-reach corners and crevices for mowers. But this is not comparable to the applications used in standard farming practices.

Please refer to Page 26 of Appendix B. Health & Safety Assessment.

5. Panel Composition / Environmental Risk

"What fluids are in the collectors?"

Applicant Response - There are no liquids or circulating fluids inside the solar modules used for this project. Modern photovoltaic (PV) modules—such as the crystalline silicon panels anticipated here—are solid-state devices. Each module consists of:

- Semiconductor-based photovoltaic cells
- Encapsulant layers (typically EVA or POE polymers)
- A tempered glass front sheet
- A polymer or glass back sheet
- An aluminum frame

All of these components are laminated together under heat and vacuum, forming a sealed, solid structure. There are no coolants, oils, lubricants, or hydraulic fluids within the panels, and therefore no risk of fluid leakage under normal operation.

Please refer to Figure 2 on Page 18 of Appendix B. Health & Safety Assessment.

"Is there any environmental impact from the collectors themselves?"

Applicant Response - Solar modules are chemically stable and inert once manufactured. Silicon cells are encapsulated within multiple protective layers, and the materials used—glass, aluminum, and polymer encapsulants—are common in many manufactured products and have no pathway for environmental leaching under normal operating conditions. Modules are non-reactive, sealed, and stable, and they do not pose environmental risks in normal use or weather exposure.

Please refer to Page 20 of Appendix B. Health & Safety Assessment.

6. Decommissioning – Pile Removal

"When you pull the support columns out, what do you do with the holes?"

Applicant Response – When piles are removed, they typically leave a narrow, slit-like void, often only about half an inch wide. In most cases, the surrounding soil naturally collapses and fills the space almost immediately, and any remaining surface disturbance is eliminated the first time the land is tilled or returned to agricultural use. Because the voids are so small and self-healing, industry practice—and our decommissioning plan—does not require placing clean fill into each slot. The site will be restored to pre-construction conditions through standard reclamation practices consistent with agricultural reuse.

7. Soil Analysis

"Are you going to be doing soil analysis pre-construction?"

"Will you take baseline sampling so at the end of project life you can compare?"

Applicant Response – A soil analysis is not required for construction. However, we are open to coordinating with the Virginia Cooperative Extension to take baseline samples as an educational effort and for good-faith comparison at the end of project life.

8. Fire/EMS Coordination

"Have you had a chance to speak to our Fire Chief, Chief Moody, and take feedback?"

Applicant Response – Yes. We recently spoke with Chief Moody. His written review letter states that the applicant will comply with all NFPA and Virginia Statewide Fire Prevention Code requirements and will coordinate on Knox Box/lock locations and site plan review. He noted no concerns with the project.

Please see the email attached at the end of this document.

9. Horse Facilities / Pile-Driving Impacts

"Are you in communication with other horse properties in the area?"

Applicant Response - Yes. We have coordinated extensively with Powhatan Plantation staff and their attorney.

- On May 14, we met with the plantation manager to review the project and gather feedback.
- As a result, we relocated the project access road away from East Gate Lane, directly addressing their primary concern.
- Their attorney attended the September 3 Focus Group and raised standard project questions (glare, noise, viewshed, property values).
- We followed up multiple times to continue the conversation and offer additional meetings, but have not received further responses.

"How did they respond when you said you'd be driving piles for three weeks?"

Applicant Response – During the May meeting, the topic of pile driving was discussed, and the plantation attorney did express concern about potential noise impacts. We explained that compared to other pile driving projects (such as a cell phone tower) the noise from driving out piles is relatively minimal. In all the projects we've built, we've never had complaints from neighbors regarding construction noise.

However, we offered to discuss alternate construction approaches or mitigation measures to address those concerns. While we have not received further responses from the Plantation's attorney since our follow-up outreach, we remain fully open to coordinating with them to identify the best solution.

10. Community Solar Subscription

"What happens if you're over-subscribed—too many people want to sign up?"

Applicant Response – Virginia's shared solar program currently has a 250 MW statewide cap. Demand exceeds supply, which is why the State is actively working on program expansion.

"How is that allocated? First-come-first-served?"

Applicant Response - Individual projects are subscribed on a first-come, first-served basis.

11. Equipment Value / Tax Revenue

"What is the value of that equipment?"

Applicant Response – Approximately $11 million in capital investment.

"What would the county expect to receive in machinery & tools tax?"

Applicant Response - Over a 40-year period, the project is expected to generate approximately:

- $213,000 in Machinery & Tools tax
- $65,000 in Real Estate tax

"Will there be rollback taxes on the land use program?"

Applicant Response - Yes. Rollback taxes will apply, and they will be paid by the applicant.

12. Stormwater

"What are you planning for stormwater runoff?"

Applicant Response – As required by both County ordinance and Virginia DEQ regulations, the applicant must submit a full Erosion & Sediment Control Plan, and a Stormwater Management Plan.

These plans must be approved by DEQ and approved/accepted by the County before any land disturbance.

Please refer to the Project Narrative:

- Page 20, which outlines typical measures such as silt fence, sediment traps, and sequencing requirements.
- Page 14, Condition 7, which requires a stormwater management plan prior to site occupancy.

"There's a swale that drains toward the Rappahannock—how will runoff be controlled?"

Applicant Response – DEQ's stormwater review specifically evaluates runoff to sensitive downstream resources like the Rappahannock River. The project must meet state stormwater performance standards, which address both erosion control during construction and long-term hydrology after the project is built.

Please refer to Page 14, Condition 7 in the Project Narrative.

13. Interconnection Capacity

"Is the existing three-phase power line adequate to take the five megawatts?"

"Will Dominion need to upgrade the line or substation?"

"What modifications are required?"

Applicant Response - Yes. Dominion's interconnection, study, which was initiated in 2019 and completed this year, confirmed that the existing three-phase line can accommodate the project's 5 MW.

As part of the standard interconnection process, the developer enters a legally binding agreement with Dominion and funds any necessary minor equipment upgrades to ensure safe operation.

Please refer to Section 7-7-8 (F) on Page 12 of the project Narrative.

14. Panel Washing

"Do you wash panels, or does rainfall handle it?"

Applicant Response - Rainfall in the eastern U.S. is sufficient to keep panels clean. Appendix B notes that the region receives frequent heavy rainfall, eliminating the need for routine panel washing.

Please refer to page 26 of Appendix B. Health & Safety Assessment.

15. Decommissioning Experience

"Have you decommissioned a solar farm yet?"

Applicant Response - Yes. The company has decommissioned a ground-mounted solar project in Gainesville, Florida, as well as a few commercial-scale rooftop systems.

"How do you develop your decommissioning estimates when so few projects have reached end-of-life?"

Applicant Response – Decommissioning is essentially construction in reverse, and the industry has developed well-defined cost benchmarks. Many projects nationally have already been retired at 25–30 years, well ahead of the 40-year design life, allowing the industry to refine cost models based on real-world removals. We have also directly consulted with other contractors with more experience to confirm our numbers; also per ordinance these estimates will be reviewed over the life of the project to ensure that sufficient funding is reserved for this work.

16. Leaving Materials Buried

"State law allows things deeper than 36 inches to remain—do you leave anything behind?"

Applicant Response – Our Decommissioning Plan (Appendix A, p. 7) commits to:

- Removing all buried electrical conductors,
- Removing perimeter fencing, and
- Removing pole foundations,

and to excavate and backfill to a depth of at least 36 inches. This complies with Virginia Code requirements.

"What would be below that level (i.e., deeper than 36 inches)?"

Applicant Response – Industry research shows that standard 5 MW solar projects do not have infrastructure deeper than 36 inches. Underground electrical wiring is typically 24–30 inches deep, and piles are installed vertically but are fully removable using standard extraction equipment. Therefore, we do not expect any equipment to remain below 36 inches.

"Would you cut off piles at 36 inches if they can't be pulled?"

Applicant Response – Industry best practice, and our Decommissioning Plan requires us to remove piles entirely whenever possible. Where piles or other infrastructure cannot be practically removed, accepted practice is to cut the material below-grade (commonly ~36 inches) and backfill. If there are any exceptions to site restoration as laid out in the Decommissioning Plan, we must receive approval from the landowner and Board of Supervisors.

Please refer to page 7-8 of the Appendix.

Outlook

RE: Powhatan Road Solar - Fire Department Review

From David Moody <DavidM@co.kinggeorge.state.va.us>
Date Thu 11/13/2025 11:59 AM
To Cara Romaine <cromaine@esa-solar.com>

> **Caution:** This is an external email and has a suspicious subject or content. Please take care when clicking links or opening attachments. When in doubt, contact your IT Department

Hello Cara,
It was good speaking with you as well. Your company has agreed to all provisions as outlined in my letter and I look forward to coordinating these with you if the project is approved. Please don't hesitate to reach out if you have any questions.
Thanks,

KGFR
Our family protecting yours

DAVID W. MOODY *EFO, CFO, NRP*
County Fire & Rescue Chief / Fire Marshal
540-775-8900 (main) 540-775-8910 (direct)
Company 1 Fire & Rescue Headquarters
8122 Kings Highway, King George, VA 22485

From: Cara Romaine <cromaine@esa-solar.com>
Sent: Thursday, November 13, 2025 11:30 AM
To: David Moody <DavidM@co.kinggeorge.state.va.us>
Subject: Powhatan Road Solar - Fire Department Review

Chief Moody,

It was a pleasure speaking with you a few minutes ago regarding the Powhatan Road Solar project. I appreciate you confirming that your previous comments still apply and that you have no concerns so long as we continue to comply with NFPA and Virginia Statewide Fire Prevention Code standards and coordinate with your department on Knox Box or Knox Pad Lock locations during site plan review. It is our full intention to do this prior to site occupancy approval.

One of the Planning Commission members had asked that we follow up with you ahead of our hearing, so I wanted to note that we've done so and appreciate your input and feedback.

Thank you,
Cara Romaine

Cara Romaine

Project Development Manager

direct 561-351-7201

email cromaine@esa-solar.com

2250 Lucien Way, Suite 305
Maitland, FL 32751
www.esa-solar.com

Powhatan Road Community Solar

Special Exception Permit
King George County, VA

Appendices

esa

May 2025

Powhatan Road Community Solar

King George County, VA

Special Exception Use Application Narrative

Applicant:

Powhatan Road Solar Farm, LLC

2250 Lucien Way, Suite 305

Maitland, FL 32771

Contact:

Cara Romaine, Community Solar Development Manager
cromaine@esa-solar.com

Tamara Irving, Planner I
tirving@esa-solar.com

Contents

Appendix A Decommissioning Plan

May 8, 2025

Solar Facility Analyzed:
Powhatan Road Solar Farm
8375 Powhatan Road
King George, VA 22485

Project Owner:
Powhatan Road Solar Farm, LLC
2250 Lucien Way, Suite 305
Maitland, FL 32751
ATTN: Justin Vandenbroeck

Plan Prepared By:
Uneclipsed Energy, PLLC
2250 Lucien Way, Suite 305
Maitland, FL 32751
407.232.7440

Firm Background:
Uneclipsed Energy, PLLC (Uneclipsed) is a licensed engineering firm affiliated with ESA Solar Energy, LLC and Solar Development Group, LLC (SDG) for solar projects in Florida, Michigan, and Virginia among other states. Since 2002, the team behind these three entities has gained expertise through developing, designing, constructing, operating and maintaining solar PV systems of all sizes, from residential, commercial and municipal projects to large ground-mount utility-scale systems in the United States, Spain, and Italy, totaling thousands of megawatts.

Facility Description:
The proposed solar farm is located on parcel# 32 1 in King George, Virginia. The estimated 6.97 MWdc / 5 MWac solar farm is expected to include the following components:

- Approximately 12,384 PV modules
- Steel structural racking system, supported by driven piles
- Rack-mounted inverters to convert dc power to low-voltage (600V) ac power
- Concrete pad-mounted transformers and switchgear required to step up the voltage to medium voltage (distribution level, approximately 34.5kV)
- Overhead and underground wiring as appropriate for solar farm interconnection to electric grid

Decommissioning Process:

The system is expected to be capable of operation for at least forty years, with decommissioning at a time to be agreed upon by the system owner and the landowners leasing the land to the system owner. The Project is presumed to be at the end of its useful life if the facility generates no electricity for a continuous period of 12 months. Powhatan Road Solar Farm, LLC shall notify the Administrator by certified mail of the proposed date of discontinued operations and plans for removal. The following general decommissioning activities will occur. At the end of the project's life, the system owner shall complete the following list of activities to fully decommission the system. This list is prepared based on current procedures and experience, which will likely improve in the coming years as technology, construction processes and recycling infrastructures improve. Decommissioning activities shall be carried out according to applicable regulations and industry best practices, after obtaining any necessary permits for the decommissioning. The decommissioning activities are as follows, and shall be completed in accordance with the industry best practices, OSHA regulations, and state/federal requirements in effect at the time of decommissioning:

- Prepare a safety plan and train all site personnel as to appropriate safeguards and proper work techniques.
- Contact the Utility Company and communicate the cessation of business.
- Disconnect site electric power at the Point of Common Coupling by the site owner or utility. The utility will be responsible for removing all conductors, power poles, and hardware that is under utility ownership.
- Disconnect all dc source circuit wiring from the combiner boxes
- Disconnect all dc output circuit wiring from any combiner boxes to inverters.
- Unfasten PV modules from the structural racking system and stack in a staging area (this staging area will be used to store all equipment being removed from the site).
- Remove module home run wiring, raceways, and combiner boxes from the racking system.
- Unbolt the racking system components and stack and remove all driven piers.
- Dig up all buried conductors and backfill trenches to a depth of at least 36 inches.
- Coil and stack wire and conduits. Remove wire connectors and splices, dissemble, and sort as required to maximize recycling value.
- Dismantle Inverters, switchgear, and transformers on site when practical, or remove fully intact equipment pads from the site for off-site handling.
- Remove perimeter fencing and pole foundations to include a depth of at least 36 inches.
- Sell to a recycling facility any material that can be recycled, unless the original equipment manufacturer or another organization offers a buy-back program for equipment.
- Dispose of all other materials at appropriate handling facilities.
- Hazardous material from the property shall be disposed of in accordance with federal and state law.
- Dismantle any site roads and restore any compressed soils (under equipment pads, roads) with a subsoiler or flat lifter. Restore any compacted areas to the proper density and depth to remain consistent with the surrounding fields, adding new fill as necessary.

- Re-seed and re-vegetate disturbed areas of the site within 12 months of removal of the solar facility, ensuring that the land can return to its original state.
- Any exception to site restoration, such as leaving driveways, entrances, or landscaping in place, or substituting plantings, shall be requested by the landowner in writing, and this request shall be approved by the Board of Supervisors.

Decommissioning Cost Analysis:

The estimated costs or values for scrap material and disposal are provided in Figure 1 following. The projected estimated cost for each line item is rounded to the nearest $1,000.

Component	Size	Material	Feet	Quantity	Weight/unit	Weight	2019 Scrap Value	Project Value
Array PV Wire	10 AWG	Copper	240,000		0.057	13,680	$1.60/lb	$ 22,000
Array Home Runs	250 kcmil	Aluminum	69,700		0.321	22,374	$0.60/lb	$ 13,000
PV Module Laminates		Glass/Cells		12,384	50	619,200	($2.00/unit)	$ (25,000)
PV Module Frames		Aluminum		12,384	2	24,768	$0.59/lb	$ 15,000
AC Wiring	4/0	Aluminum	3,000		0.30	900	$0.59/lb	$ 1,000
Inverters		Steel / Electronics		40	75	3,000	$0.59/lb	$ 2,000
Transformers		Steel		2	12000	24,000	$0.05/lb	$ 1,000
Rack Posts and Rails		Steel	15	6,810	130	885,300	$0.05/lb	$ 44,000
Fencing		Steel	4,600		11	50,600	$0.05/lb	$ 3,000
Equipment Pads		Steel/Concrete	100		1	100	$0.05/lb	$ -
							SCRAP VALUE	**$ 76,000**

Figure 1: Decommissioning Costs and Values Breakdown

In 2019, the scrap value of the copper and aluminum wiring, aluminum solar module frames, steel posts and structural members is calculated at 75% of the commodity copper and aluminum pricing. It is conservatively assumed that this value will remain steady over time. Figure 2 and Figure 3 on the following page show Copper Pricing and Aluminum Pricing from 1989 through 2019. Steel is assumed to be valued at $100 per ton, or otherwise equal to $0.05 per lb. 2019 numbers are used here as they are considered more stable and consistent than those in 2020-2023, which have been more variable due to worldwide markets disruption from the COVID-19 pandemic. This brings the estimated scrap value of the system to approximately $76,000.

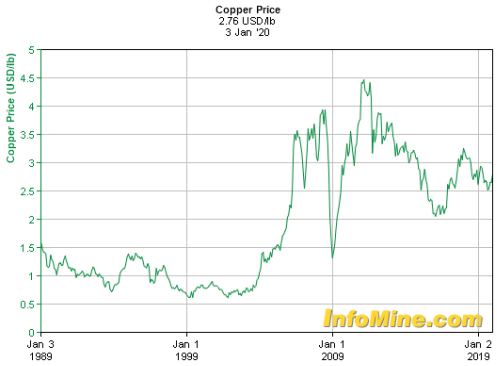

Figure 2: Copper Pricing in USD/lb, 1989-2019

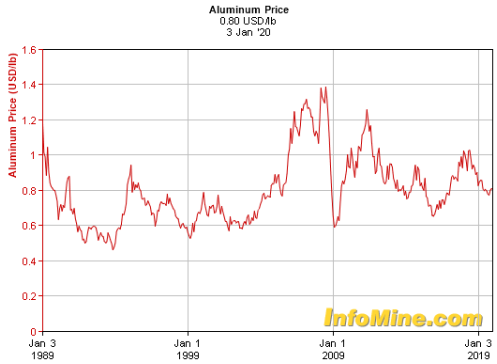

Figure 3: Aluminum Pricing in USD/lb, 1989-2019

The weight of each of the 12,384 solar modules (panels) is due primarily to the top glass within the frame, and we anticipate that the modules will be mostly recyclable during the decommissioning. As there has been a relatively low number of failed modules worldwide, there has not yet been a high demand for module recycling facilities, however in Europe and in the United States programs have been announced and small facilities exist. We expect that as more solar power is deployed, the recycling opportunities will grow accordingly to meet the demand of equipment disposal. It is estimated that there will be a net cost of $2.00 per module for disposal, or $25,000 for this estimate.

Although the bulk of decommissioning tasks are expected to be carried out by laborers, there will also be equipment operators and supervisors. We assume these fully-burdened rates for personnel trained in demolition:

Labor Type	Rate
Supervisor	$65.00
Equipment Operator	$55.00
Laborer	$40.00

In an effort to provide a conservative labor and material cost estimate for the decommissioning of the project, below is a breakdown of the anticipated costs:

Labor Type	Headcount	Hours/ Day	Rate	Days	Total Cost
Site Permit Allowance					$10,000
Administrative Fees					$7,500
Equipment / Labor Required (estimated):					
Excavator	1	8	$125.00	25	$25,000
Skid Steer	2	8	$50.00	25	$20,000
Chisel Plow	1	8	$50.00	25	$10,000
Pick-up Trucks	2	8	$14.50	25	$6,000
Supervisor	1	8	$65.00	25	$13,000
Equipment Operator	3	8	$55.00	25	$33,000
Laborer	6	15	$40.00	25	$90,000
Trucking	5	10	$125.00	20	$125,000
Tasks Completed					
Safety Plan / Coordination					
Medium Voltage Equipment Disassembly					
Disconnecting all Wiring					
Removing PV Panels					
Removing Above-Ground Wiring					
Disassemble Racks					
Remove Steel Foundation Posts					
Break Up, Remove Concrete Pads					
Uncover, remove underground wire/conduit					
Remove fence					
Road reclamation					
Remove, dispose of, and recycle equipment to the greatest practical extent					
Site restoration (light grading, seeding)					$15,000
Total Expenses					**$354,500**
Scrap Cost					$(76,000)
Net Price					**$278,500**

Assuming roughly four weeks' effort for labor costs, equipment usage, transportation costs, appropriate recycling and disposal costs, and an additional $15,000 allowance for full site restoration (to include regrading, reseeding, and landscape repair), the **costs of the decommissioning would total $354,500**, ignoring the estimated scrap value of $76,000.

All estimated costs were calculated using best industry standards and pricing currently available.

Given that 40 years of policy changes, technological improvements, and variable inflation rates have yet to occur, the accuracy of these estimates cannot be guaranteed. However, the landowner and county are protected from risk through the revision of the decommissioning cost estimate every five years after construction.

Respectfully submitted by:

David K. Click, PE
President
Uneclipsed Energy, PLLC

David Click
Digitally signed by David Click
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PROFESSIONAL ENGINEER

Appendix B
Health & Safety Assessment

WHITE PAPER

Health and Safety Impacts of Solar Photovoltaics

By Tommy Cleveland
May 2017

NC CLEAN ENERGY TECHNOLOGY CENTER

NC STATE UNIVERSITY

Contents

Health and Safety Impacts of Solar Photovoltaics

The increasing presence of utility-scale solar photovoltaic (PV) systems (sometimes referred to as solar farms) is a rather new development in North Carolina's landscape. Due to the new and unknown nature of this technology, it is natural for communities near such developments to be concerned about health and safety impacts. Unfortunately, the quick emergence of utility-scale solar has cultivated fertile grounds for myths and half-truths about the health impacts of this technology, which can lead to unnecessary fear and conflict.

Photovoltaic (PV) technologies and solar inverters are not known to pose any significant health dangers to their neighbors. The most important dangers posed are increased highway traffic during the relative short construction period and dangers posed to trespassers of contact with high voltage equipment. This latter risk is mitigated by signage and the security measures that industry uses to deter trespassing. As will be discussed in more detail below, risks of site contamination are much less than for most other industrial uses because PV technologies employ few toxic chemicals and those used are used in very small quantities. Due to the reduction in the pollution from fossil-fuel-fired electric generators, the overall impact of solar development on human health is overwhelmingly positive. This pollution reduction results from a partial replacement of fossil-fuel fired generation by emission-free PV-generated electricity, which reduces harmful sulfur dioxide (SO2), nitrogen oxides (NOx), and fine particulate matter (PM2.5). Analysis from the National Renewable Energy Laboratory and the Lawrence Berkeley National Laboratory, both affiliates of the U.S. Department of Energy, estimates the health-related air quality benefits to the southeast region from solar PV generators to be worth 8.0 ¢ per kilowatt-hour of solar generation.[1] This is in addition to the value of the electricity and suggests that the air quality benefits of solar are worth more than the electricity itself.

Even though we have only recently seen large-scale installation of PV technologies, the technology and its potential impacts have been studied since the 1950s. A combination of this solar-specific research and general scientific research has led to the scientific community having a good understanding of the science behind potential health and safety impacts of solar energy. This paper utilizes the latest scientific literature and knowledge of solar practices in N.C. to address the health and safety risks associated with solar PV technology. These risks are extremely small, far less than those associated with common activities such as driving a car, and vastly outweighed by health benefits of the generation of clean electricity.

This paper addresses the potential health and safety impacts of solar PV development in North Carolina, organized into the following four categories:
(1) Hazardous Materials
(2) Electromagnetic Fields (EMF)
(3) Electric Shock and Arc Flash
(4) Fire Safety

1 • Hazardous Materials

One of the more common concerns towards solar is that the panels (referred to as "modules" in the solar industry) consist of toxic materials that endanger public health. However, as shown in this section, solar energy systems may contain small amounts of toxic materials, but these materials do not endanger public health. To understand potential toxic hazards coming from a solar project, one

must understand system installation, materials used, the panel end-of-life protocols, and system operation. This section will examine these aspects of a solar farm and the potential for toxicity impacts in the following subsections:

(1.2) Project Installation/Construction
(1.2) System Components
  1.2.1 Solar Panels: Construction and Durability
  1.2.2 Photovoltaic technologies
    (a) Crystalline Silicon
    (b) Cadmium Telluride (CdTe)
    (c) CIS/CIGS
  1.2.3 Panel End of Life Management
  1.2.4 Non-panel System Components
(1.3) Operations and Maintenance

1.1 Project Installation/ Construction

The system installation, or construction, process does not require toxic chemicals or processes. The site is mechanically cleared of large vegetation, fences are constructed, and the land is surveyed to layout exact installation locations. Trenches for underground wiring are dug and support posts are driven into the ground. The solar panels are bolted to steel and aluminum support structures and wired together. Inverter pads are installed, and an inverter and transformer are installed on each pad. Once everything is connected, the system is tested, and only then turned on.

Figure 1: Utility-scale solar facility (5 MWAC) located in Catawba County. *Source: Strata Solar*

1.2 • System Components

1.2.1 Solar Panels: Construction and Durability

Solar PV panels typically consist of glass, polymer, aluminum, copper, and semiconductor materials that can be recovered and recycled at the end of their useful life.[2] Today there are two PV technologies used in PV panels at utility-scale solar facilities, silicon, and thin film. As of 2016, all thin film used in North Carolina solar facilities are cadmium telluride (CdTe) panels from the US manufacturer First Solar, but there are other thin film PV panels available on the market, such as Solar Frontier's CIGS panels. Crystalline silicon technology consists of silicon wafers which are made into cells and assembled into panels, thin film technologies consist of thin layers of semiconductor material deposited onto glass, polymer or metal substrates. While there are differences in the components and manufacturing processes of these two types of solar technologies, many aspects of their PV panel construction are very similar. Specifics about each type of PV chemistry as it relates to toxicity are covered in subsections a, b, and c in section 1.2.2; on crystalline silicon, cadmium telluride, and CIS/CIGS respectively. The rest of this section applies equally to both silicon and thin film panels.

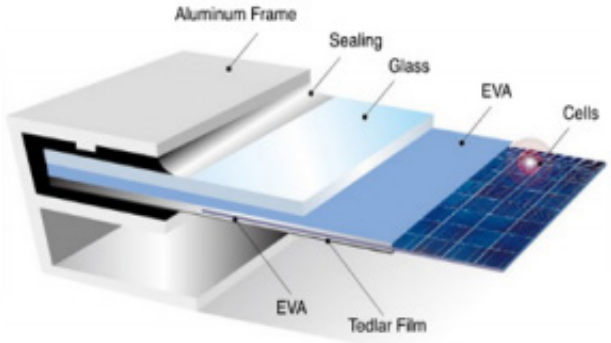

Figure 2: Components of crystalline silicon panels. The vast majority of silicon panels consist of a glass sheet on the topside with an aluminum frame providing structural support. Image Source: www.riteksolar.com.tw

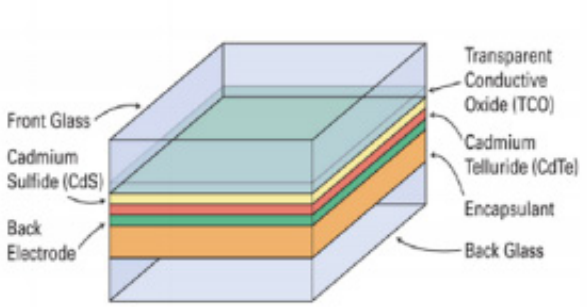

Figure 3: Layers of a common frameless thin-film panel (CdTe). Many thin film panels are frameless, including the most common thin-film panels, First Solar's CdTe. Frameless panels have protective glass on both the front and back of the panel. Layer thicknesses not to scale. Image Source: www.homepower.com

To provide decades of corrosion-free operation, PV cells in PV panels are encapsulated from air and moisture between two layers of plastic. The encapsulation layers are protected on the top with a layer of tempered glass and on the backside with a polymer sheet. Frameless modules include a protective layer of glass on the rear of the panel, which may also be tempered. The plastic ethylene-vinyl acetate (EVA) commonly provides the cell encapsulation. For decades, this same material has been used between layers of tempered glass to give car windshields and hurricane windows their great strength. In the same way that a car windshield cracks but stays intact, the EVA layers in PV panels keep broken panels intact (see Figure 4). Thus, a damaged module does not generally create small pieces of debris; instead, it largely remains together as one piece.

Figure 4: The mangled PV panels in this picture illustrate the nature of broken solar panels; the glass cracks but the panel is still in one piece. Image Source: http://img.alibaba.com/photo/115259576/broken_solar_panel.jpg

PV panels constructed with the same basic components as modern panels have been installed across the globe for well over thirty years.[3] The long-term durability and performance demonstrated over these decades, as well as the results of accelerated lifetime testing, helped lead to an industrystandard 25-year power production warranty for PV panels. These power warranties warrant a PV panel to produce at least 80% of their original nameplate production after 25 years of use. A recent SolarCity and DNV GL study reported that today's quality PV panels should be expected to reliably and efficiently produce power for thirty-five years.[4]

Local building codes require all structures, including ground mounted solar arrays, to be engineered to withstand anticipated wind speeds, as defined by the local wind speed requirements. Many racking products are available in versions engineered for wind speeds of up to 150 miles per hour, which is significantly higher than the wind speed requirement anywhere in North Carolina. The strength of PV mounting structures were demonstrated during Hurricane Sandy in 2012 and again during Hurricane Matthew in 2016. During Hurricane Sandy, the many large-scale solar facilities in New Jersey and New York at that time suffered only minor damage.[5] In the fall of 2016, the US and Caribbean experienced destructive winds and torrential rains from Hurricane Matthew, yet one leading solar tracker manufacturer reported that their numerous systems in the impacted area received zero damage from wind or flooding.[6]

In the event of a catastrophic event capable of damaging solar equipment, such as a tornado, the system will almost certainly have property insurance

that will cover the cost to cleanup and repair the project. It is in the best interest of the system owner to protect their investment against such risks. It is also in their interest to get the project repaired and producing full power as soon as possible. Therefore, the investment in adequate insurance is a wise business practice for the system owner. For the same reasons, adequate insurance coverage is also generally a requirement of the bank or firm providing financing for the project.

1.2.2 Photovoltaic (PV) Technologies

a. Crystalline Silicon

This subsection explores the toxicity of silicon-based PV panels and concludes that they do not pose a material risk of toxicity to public health and safety. Modern crystalline silicon PV panels, which account for over 90% of solar PV panels installed today, are, more or less, a commodity product. The overwhelming majority of panels installed in North Carolina are crystalline silicon panels that are informally classified as Tier I panels. Tier I panels are from well-respected manufacturers that have a good chance of being able to honor warranty claims. Tier I panels are understood to be of high quality, with predictable performance, durability, and content. Well over 80% (by weight) of the content of a PV panel is the tempered glass front and the aluminum frame, both of which are common building materials. Most of the remaining portion are common plastics, including polyethylene terephthalate in the backsheet, EVA encapsulation of the PV cells, polyphenyl ether in the junction box, and polyethylene insulation on the wire leads. The active, working components of the system are the silicon photovoltaic cells, the small electrical leads connecting them together, and to the wires coming out of the back of the panel. The electricity generating and conducting components makeup less than 5% of the weight of most panels. The PV cell itself is nearly 100% silicon, and silicon is the second most common element in the Earth's crust. The silicon for PV cells is obtained by high-temperature processing of quartz sand (SiO2) that removes its oxygen molecules. The refined silicon is converted to a PV cell by adding extremely small amounts of boron and phosphorus, both of which are common and of very low toxicity.

The other minor components of the PV cell are also generally benign; however, some contain lead, which is a human toxicant that is particularly harmful to young children. The minor components include an extremely thin antireflective coating (silicon nitride or titanium dioxide), a thin layer of aluminum on the rear, and thin strips of silver alloy that are screen-printed on the front and rear of cell.[7] In order for the front and rear electrodes to make effective electrical contact with the proper layer of the PV cell, other materials (called glass frit) are mixed with the silver alloy and then heated to etch the metals into the cell. This glass frit historically contains a small amount of lead (Pb) in the form of lead oxide. The 60 or 72 PV cells in a PV panel are connected by soldering thin solder-covered copper tabs from the back of one cell to the front of the next cell. Traditionally a tin-based solder containing some lead (Pb) is used, but some manufacturers have switched to lead-free solder. The glass frit and/or the solder may contain trace amounts of other metals, potentially including some with human toxicity such as cadmium. However, testing to simulate the potential for leaching from broken panels, which is discussed in more detail below, did not find a potential toxicity threat from these trace elements. Therefore, the tiny amount of lead in the grass frit and the solder is the only part of silicon PV panels with a potential to create a negative health impact. However, as described below, the very limited amount of lead involved and its strong physical and chemical attachment to other components of the PV panel means that even in worst-case scenarios the health hazard it poses is insignificant.

As with many electronic industries, the solder in silicon PV panels has historically been a leadbased solder, often 36% lead, due to the superior properties of such solder. However, recent advances in lead-free solders have spurred a trend among PV panel manufacturers to reduce or remove the lead in their panels. According to the 2015 Solar Scorecard from the Silicon Valley Toxics Coalition, a group that tracks environmental responsibility of photovoltaic panel manufacturers, fourteen companies (increased from twelve companies in 2014) manufacture PV panels certified to meet the European Restriction of Hazardous Substances (RoHS) standard. This means that the amount of cadmium and lead in the panels they manufacture fall below the RoHS thresholds, which are set by the European Union and serve as the world's de facto standard for hazardous substances in manufactured goods.[8] The Restriction of Hazardous Substances (RoHS) standard requires that the maximum concentration found in any homogenous material in a produce is less than 0.01% cadmium and less than 0.10% lead, therefore, any solder can be no more than 0.10% lead.[9]

While some manufacturers are producing PV panels that meet the RoHS standard, there is no requirement that they do so because the RoHS Directive explicitly states that the directive does not apply to photovoltaic panels.[10] The justification for this is provided in item 17 of the current RoHS Directive: "The development of renewable forms of energy is one of the Union's key objectives, and the contribution made by renewable energy sources to environmental and climate objectives is crucial. Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources (4) recalls that there should be coherence between those objectives and other Union environmental legislation. Consequently, this Directive should not prevent the development of renewable energy technologies that have no negative impact on health and the environment and that are sustainable and economically viable."

The use of lead is common in our modern economy. However, only about 0.5% of the annual lead consumption in the U.S. is for electronic solder for all uses; PV solder makes up only a tiny portion of this 0.5%. Close to 90% of lead consumption in the US is in batteries, which do not encapsulate the pounds of lead contained in each typical automotive battery. This puts the lead in batteries at great risk of leaching into the environment. Estimates for the lead in a single PV panel with lead-based solder range from 1.6 to 24 grams of lead, with 13g (less than half of an ounce) per panel seen most often in the literature.[11] At 13 g/panel[12], each panel contains one-half of the lead in a typical 12-gauge shotgun shell. This amount equates to roughly 1/750th of the lead in a single car battery. In a panel, it is all durably encapsulated from air or water for the full life of the panel.[14]

As indicated by their 20 to 30-year power warranty, PV modules are designed for a long service life, generally over 25 years. For a panel to comply with its 25-year power warranty, its internal components, including lead, must be sealed from any moisture. Otherwise, they would corrode and the panel's output would fall below power warranty levels. Thus, the lead in operating PV modules is not at risk of release to the environment during their service lifetime. In extreme experiments, researchers have shown that lead can leach from crushed or pulverized panels.[15, 16] However, more real-world tests designed to represent typical trash compaction that are used to classify waste as hazardous or non-hazardous show no danger from leaching.[17,18] For more information about PV panel end-of-life, see the Panel Disposal section.

As illustrated throughout this section, silicon-based PV panels do not pose a material threat to public health and safety. The only aspect of the panels with potential toxicity concerns is the very small amount of lead in some panels. However, any lead in a panel is well sealed from environmental exposure for the operating lifetime of the solar panel and thus not at risk of release into the environment.

b. Cadmium Telluride (CdTe) PV Panels

This subsection examines the components of a cadmium telluride (CdTe) PV panel. Research demonstrates that they pose negligible toxicity risk to public health and safety while significantly reducing the public's exposure to cadmium by reducing coal emissions. As of mid-2016, a few hundred MWs of cadmium telluride (CdTe) panels, all manufactured by the U.S. company First Solar, have been installed in North Carolina.

Questions about the potential health and environmental impacts from the use of this PV technology are related to the concern that these panels contain cadmium, a toxic heavy metal. However, scientific studies have shown that cadmium telluride differs from cadmium due to its high chemical and thermal stability.[19] Research has shown that the tiny amount of cadmium in these panels does not pose a health or safety risk.[20] Further, there are very compelling reasons to welcome its adoption due to reductions in unhealthy pollution associated with burning coal. Every GWh of electricity generated by burning coal produces about 4 grams of cadmium air emissions.[21] Even though North Carolina produces a significant fraction of our electricity from coal, electricity from solar offsets much more natural gas than coal due to natural gas plants being able to adjust their rate of production more easily and quickly. If solar electricity offsets 90% natural gas and 10% coal, each 5-megawatt (5 MWAC, which is generally 7 MWDC) CdTe solar facility in North Carolina keeps about 157 grams, or about a third of a pound, of cadmium *out* of our environment.[22, 23]

Cadmium is toxic, but all the approximately 7 grams of cadmium in one CdTe panel is in the form of a chemical compound cadmium telluride,[24] which has 1/100th the toxicity of free cadmium.[25] Cadmium telluride is a very stable compound that is non-volatile and non-soluble in water. Even in the case of a fire, research shows that less than 0.1% of the cadmium is released when a CdTe panel is exposed to fire. The fire melts the glass and encapsulates over 99.9% of the cadmium in the molten glass.[27]

It is important to understand the source of the cadmium used to manufacture CdTe PV panels. The cadmium is a byproduct of zinc and lead refining. The element is collected from emissions and waste streams during the production of these metals and combined with tellurium to create the CdTe used in PV panels. If the cadmium were not collected for use in the PV panels or other products, it would otherwise either be stockpiled for future use, cemented and buried, or disposed of.[28] Nearly all the cadmium in old or broken panels can be recycled which can eventually serve as the primary source of cadmium for new PV panels.[29]

Similar to silicon-based PV panels, CdTe panels are constructed of a tempered glass front, one instead of two clear plastic encapsulation layers, and a rear heat strengthened glass backing (together >98% by weight). The final product is built to withstand exposure to the elements without significant damage for over 25 years. While not representative of damage that may occur in the field or even at a landfill, laboratory evidence has illustrated that when panels are ground into a fine powder, very acidic water is able to leach portions of the cadmium and tellurium,[30] similar to the process used to recycle CdTe panels. Like many silicon-based panels, CdTe panels are reported (as far back ask 1998[31] to pass the EPA's Toxic Characteristic Leaching Procedure (TCLP) test, which tests the potential for crushed panels in a landfill to leach hazardous substances into groundwater.[32] Passing this test means that they are classified as non-hazardous waste and can be deposited in landfills.[33,34] For more information about PV panel end-of-life, see the Panel Disposal section.

There is also concern of environmental impact resulting from potential catastrophic events involving CdTe PV panels. An analysis of worst-case scenarios for environmental impact from CdTe PV

panels, including earthquakes, fires, and floods, was conducted by the University of Tokyo in 2013. After reviewing the extensive international body of research on CdTe PV technology, their report concluded, "Even in the worst-case scenarios, it is unlikely that the Cd concentrations in air and sea water will exceed the environmental regulation values."[35] In a worst-case scenario of damaged panels abandoned on the ground, insignificant amounts of cadmium will leach from the panels. This is because this scenario is much less conducive (larger module pieces, less acidity) to leaching than the conditions of the EPA's TCLP test used to simulate landfill conditions, which CdTe panels pass.[36]

First Solar, a U.S. company, and the only significant supplier of CdTe panels, has a robust panel take-back and recycling program that has been operating commercially since 2005.[37] The company states that it is "committed to providing a commercially attractive recycling solution for photovoltaic (PV) power plant and module owners to help them meet their module (end of life) EOL obligation simply, costeffectively and responsibly." First Solar global recycling services to their customers to collect and recycle panels once they reach the end of productive life whether due to age or damage. These recycling service agreements are structured to be financially attractive to both First Solar and the solar panel owner. For First Solar, the contract provides the company with an affordable source of raw materials needed for new panels and presumably a diminished risk of undesired release of Cd. The contract also benefits the solar panel owner by allowing them to avoid tipping fees at a waste disposal site. The legal contract helps provide peace of mind by ensuring compliance by both parties when considering the continuing trend of rising disposal costs and increasing regulatory requirements.

c. CIS/CIGS and other PV technologies

Copper indium gallium selenide PV technology, often referred to as CIGS, is the second most common type of thin-film PV panel but a distant second behind CdTe. CIGS cells are composed of a thin layer of copper, indium, gallium, and selenium on a glass or plastic backing. None of these elements are very toxic, although selenium is a regulated metal under the Federal Resource Conservation and Recovery Act (RCRA).[38] The cells often also have an extremely thin layer of cadmium sulfide that contains a tiny amount of cadmium, which is toxic. The promise of high efficiency CIGS panels drove heavy investment in this technology in the past. However, researchers have struggled to transfer high efficiency success in the lab to low-cost full-scale panels in the field.[39] Recently, a CIGS manufacturer based in Japan, Solar Frontier, has achieved some market success with a rigid, glass-faced CIGS module that competes with silicon panels. Solar Frontier produces the majority of CIS panels on the market today.[40] Notably, these panels are RoHS compliant,[41] thus meeting the rigorous toxicity standard adopted by the European Union even thought this directive exempts PV panels. The authors are unaware of any completed or proposed utility-scale system in North Carolina using CIS/CIGS panels.

1.2.3 Panel End-of-Life Management

Concerns about the volume, disposal, toxicity, and recycling of PV panels are addressed in this subsection. To put the volume of PV waste into perspective, consider that by 2050, when PV systems installed in 2020 will reach the end of their lives, it is estimated that the global annual PV panel waste tonnage will be 10% of the 2014 global e-waste tonnage.[42] In the U.S., end-of-life disposal of solar products is governed by the Federal Resource Conservation and Recovery Act (RCRA), as well as state policies in some situations. RCRA separates waste into hazardous (not accepted at ordinary landfill) and solid waste (generally accepted

at ordinary landfill) based on a series of rules. According to RCRA, the way to determine if a PV panel is classified as hazardous waste is the Toxic Characteristic Leaching Procedure (TCLP) test. This EPA test is designed to simulate landfill disposal and determine the risk of hazardous substances leaching out of the landfill.[43,44,45] Multiple sources report that most modern PV panels (both crystalline silicon and cadmium telluride) pass the TCLP test.[46,47] Some studies found that some older (1990s) crystalline silicon panels, and perhaps some newer crystalline silicon panels (specifics are not given about vintage of panels tested), do not pass the lead (Pb) leachate limits in the TCLP test.[48,49]

The test begins with the crushing of a panel into centimeter-sized pieces. The pieces are then mixed in an acid bath. After tumbling for eighteen hours, the fluid is tested for forty hazardous substances that all must be below specific threshold levels to pass the test. Research comparing TCLP conditions to conditions of damaged panels in the field found that simulated landfill conditions provide overly conservative estimates of leaching for field-damaged panels.[50] Additionally, research in Japan has found no detectable Cd leaching from cracked CdTe panels when exposed to simulated acid rain.[51]

Although modern panels can generally be landfilled, they can also be recycled. Even though recent waste volume has not been adequate to support significant PV-specific recycling infrastructure, the existing recycling industry in North Carolina reports that it recycles much of the current small volume of broken PV panels. In an informal survey conducted by the NC Clean Energy Technology Center survey in early 2016, seven of the eight large active North Carolina utility-scale solar developers surveyed reported that they send damaged panels back to the manufacturer and/or to a local recycler. Only one developer reported sending damaged panels to the landfill.

The developers reported at that time that they are usually paid a small amount per panel by local recycling firms. In early 2017, a PV developer reported that a local recycler was charging a small fee per panel to recycle damaged PV panels. The local recycling firm known to authors to accept PV panels described their current PV panel recycling practice as of early 2016 as removing the aluminum frame for local recycling and removing the wire leads for local copper recycling. The remainder of the panel is sent to a facility for processing the non-metallic portions of crushed vehicles, referred to as “fluff” in the recycling industry.[52] This processing within existing general recycling plants allows for significant material recovery of major components, including glass which is 80% of the module weight, but at lower yields than PV-specific recycling plants. Notably almost half of the material value in a PV panel is in the few grams of silver contained in almost every PV panel produced today. In the long-term, dedicated PV panel recycling plants can increase treatment capacities and maximize revenues resulting in better output quality and the ability to recover a greater fraction of the useful materials.[53] PV-specific panel recycling technologies have been researched and implemented to some extent for the past decade, and have been shown to be able to recover over 95% of PV material (semiconductor) and over 90% of the glass in a PV panel.[54]

A look at global PV recycling trends hints at the future possibilities of the practice in our country. Europe installed MW-scale volumes of PV years before the U.S. In 2007, a public-private partnership between the European Union and the solar industry set up a voluntary collection and recycling system called PV CYCLE. This arrangement was later made mandatory under the EU’s WEEE directive, a program for waste electrical and electronic equipment.[55] Its member companies (PV panel producers) fully finance the association. This makes it possible for end-users to return the member companies’ defective panels for recycling at any of the over 300 collection points around

Europe without added costs. Additionally, PV CYCLE will pick up batches of 40 or more used panels at no cost to the user. This arrangement has been very successful, collecting and recycling over 13,000 tons by the end of 2015.[56]

In 2012, the WEEE Directive added the end-of-life collection and recycling of PV panels to its scope.[57] This directive is based on the principle of extended-producer-responsibility. It has a global impact because producers that want to sell into the EU market are legally responsible for end-of-life management. Starting in 2018, this directive targets that 85% of PV products "put in the market" in Europe are recovered and 80% is prepared for reuse and recycling.

The success of the PV panel collection and recycling practices in Europe provides promise for the future of recycling in the U.S. In mid-2016, the US Solar Energy Industry Association (SEIA) announced that they are starting a national solar panel recycling program with the guidance and support of many leading PV panel producers.[58] The program will aggregate the services offered by recycling vendors and PV manufacturers, which will make it easier for consumers to select a cost-effective and environmentally responsible end-of-life management solution for their PV products. According to SEIA, they are planning the program in an effort to make the entire industry landfill-free. In addition to the national recycling network program, the program will provide a portal for system owners and consumers with information on how to responsibly recycle their PV systems.

While a cautious approach toward the potential for negative environmental and/or health impacts from retired PV panels is fully warranted, this section has shown that the positive health impacts of reduced emissions from fossil fuel combustion from PV systems more than outweighs any potential risk. Testing shows that silicon and CdTe panels are both safe to dispose of in landfills, and are also safe in worst case conditions of abandonment or damage in a disaster. Additionally, analysis by local engineers has found that the current salvage value of the equipment in a utility scale PV facility generally exceeds general contractor estimates for the cost to remove the entire PV system.[59,60,61]

1.2.4 Non-Panel System Components

(racking, wiring, inverter, transformer)

While previous toxicity subsections discussed PV panels, this subsection describes the non-panel components of utility-scale PV systems and investigates any potential public health and safety concerns. The most significant non-panel component of a ground-mounted PV system is the mounting structure of the rows of panels, commonly referred to as "racking". The vertical post portion of the racking is galvanized steel and the remaining above-ground racking components are either galvanized steel or aluminum, which are both extremely common and benign building materials. The inverters that make the solar generated electricity ready to send to the grid have weather-proof steel enclosures that protect the working components from the elements. The only fluids that they might contain are associated with their cooling systems, which are not unlike the cooling system in a computer. Many inverters today are RoHS compliant.

The electrical transformers (to boost the inverter output voltage to the voltage of the utility connection point) do contain a liquid cooling oil. However, the fluid used for that function is either a nontoxic mineral oil or a biodegradable non-toxic vegetable oil, such as BIOTEMP from ABB. These vegetable transformer oils have the additional advantage of being much less flammable than traditional mineral oils. Significant health hazards are associated with old transformers containing cooling oil with toxic PCBs. Transfers with PCB-containing oil were common before PCBs were outlawed in the U.S. in 1979. PCBs still exist in older transformers in the field across the country.

Other than a few utility research sites, there are no batteries on- or off-site associated with utility-scale solar energy facilities in North Carolina, avoiding any potential health or safety concerns related to battery technologies. However, as battery technologies continue to improve and prices continue to decline we are likely to start seeing some batteries at solar facilities. Lithium ion batteries currently dominate the world utility-scale battery market, which are not very toxic. No non-panel system components were found to pose any health or environmental dangers.

1.4 Operations and Maintenance – Panel Washing and Vegetation Control

Throughout the eastern U.S., the climate provides frequent and heavy enough rain to keep panels adequately clean. This dependable weather pattern eliminates the need to wash the panels on a regular basis. Some system owners may choose to wash panels as often as once a year to increase production, but most in N.C. do not regularly wash any PV panels. Dirt build up over time may justify panel washing a few times over the panels' lifetime; however, nothing more than soap and water are required for this activity.

The maintenance of ground-mounted PV facilities requires that vegetation be kept low, both for aesthetics and to avoid shading of the PV panels. Several approaches are used to maintain vegetation at NC solar facilities, including planting of limited-height species, mowing, weed-eating, herbicides, and grazing livestock (sheep). The following descriptions of vegetation maintenance practices are based on interviews with several solar developers as well as with three maintenance firms that together are contracted to maintain well over 100 of the solar facilities in N.C. The majority of solar facilities in North Carolina maintain vegetation primarily by mowing. Each row of panels has a single row of supports, allowing sickle mowers to mow under the panels. The sites usually require mowing about once a month during the growing season. Some sites employ sheep to graze the site, which greatly reduces the human effort required to maintain the vegetation and produces high quality lamb meat.[62]

In addition to mowing and weed eating, solar facilities often use some herbicides. Solar facilities generally do not spray herbicides over the entire acreage; rather they apply them only in strategic locations such as at the base of the perimeter fence, around exterior vegetative buffer, on interior dirt roads, and near the panel support posts. Also unlike many row crop operations, solar facilities generally use only general use herbicides, which are available over the counter, as opposed to restricted use herbicides commonly used in commercial agriculture that require a special restricted use license. The herbicides used at solar facilities are primarily 2-4-D and glyphosate (Round-up®), which are two of the most common herbicides used in lawns, parks, and agriculture across the country. One maintenance firm that was interviewed sprays the grass with a class of herbicide known as a growth regulator in order to slow the growth of grass so that mowing is only required twice a year. Growth regulators are commonly used on highway roadsides and golf courses for the same purpose. A commercial pesticide applicator license is required for anyone other than the landowner to apply herbicides, which helps ensure that all applicators are adequately educated about proper herbicide use and application. The license must be renewed annually and requires passing of a certification exam appropriate to the area in which the applicator wishes to work. Based on the limited data available, it appears that solar facilities in N.C. generally use significantly less herbicides per acre than most commercial agriculture or lawn maintenance services.

2. Electromagnetic Fields (EMF)

PV systems do not emit any material during their operation; however, they do generate electromagnetic fields (EMF), sometimes referred to as radiation. EMF produced by electricity is non-ionizing radiation, meaning the radiation has enough energy to move atoms in a molecule around (experienced as heat), but not enough energy to remove electrons from an atom or molecule (ionize) or to damage DNA. As shown below, modern humans are all exposed to EMF throughout our daily lives without negative health impact. Someone outside of the fenced perimeter of a solar facility is not exposed to significant EMF from the solar facility. Therefore, there is no negative health impact from the EMF produced in a solar farm. The following paragraphs provide some additional background and detail to support this conclusion.

Since the 1970s, some have expressed concern over potential health consequences of EMF from electricity, but no studies have ever shown this EMF to cause health problems.[63] These concerns are based on some epidemiological studies that found a slight increase in childhood leukemia associated with average exposure to residential power-frequency magnetic fields above 0.3 to 0.4 μT (microteslas) (equal to 3.0 to 4.0 mG (milligauss)). μT and mG are both units used to measure magnetic field strength. For comparison, the average exposure for people in the U.S. is one mG or 0.1 μT, with about 1% of the population with an average exposure in excess of 0.4 μT (or 4 mG).[64] These epidemiological studies, which found an association but not a causal relationship, led the World Health Organization's International Agency for Research on Cancer (IARC) to classify ELF magnetic fields as "possibly carcinogenic to humans". Coffee also has this classification. This classification means there is limited evidence but not enough evidence to designate as either a "probable carcinogen" or "human carcinogen". Overall, there is very little concern that ELF EMF damages public health. The only concern that does exist is for long-term exposure above 0.4 μT (4 mG) that may have some connection to increased cases of childhood leukemia. In 1997, the National Academies of Science were directed by Congress to examine this concern and concluded:

"Based on a comprehensive evaluation of published studies relating to the effects of power-frequency electric and magnetic fields on cells, tissues, and organisms (including humans), the conclusion of the committee is that the current body of evidence does not show that exposure to these fields presents a human-health hazard. Specifically, no conclusive and consistent evidence shows that exposures to residential electric and magnetic fields produce cancer, adverse neurobehavioral effects, or reproductive and developmental effects."[65]

There are two aspects to electromagnetic fields, an electric field and a magnetic field. The electric field is generated by voltage and the magnetic field is generated by electric current, i.e., moving electrons. A task group of scientific experts convened by the World Health Organization (WHO) in 2005 concluded that there were no substantive health issues related to electric fields (0 to 100,000 Hz) at levels generally encountered by members of the public.[66] The relatively low voltages in a solar facility and the fact that electric fields are easily shielded (i.e., blocked) by common materials, such as plastic, metal, or soil means that there is no concern of negative health impacts from the electric fields generated by a solar facility. Thus, the remainder of this section addresses magnetic fields. Magnetic fields are not shielded by most common materials and thus can easily pass through them. Both types of fields are strongest close to the source of electric generation and weaken quickly with distance from the source.

The direct current (DC) electricity produced by PV panels produce stationary (0 Hz) electric and magnetic fields. Because of minimal concern about potential risks of stationary fields, little scientific research has examined stationary fields' impact on human health.[67] In even the largest PV facilities, the DC voltages and currents are not very high. One can illustrate the weakness of the EMF generated by a PV panel by placing a compass on an operating solar panel and observing that the needle still points north.

While the electricity throughout the majority of a solar site is DC electricity, the inverters convert this DC electricity to alternating current (AC) electricity matching the 60 Hz frequency of the grid. Therefore, the inverters and the wires delivering this power to the grid are producing non-stationary EMF, known as extremely low frequency (ELF) EMF, normally oscillating with a frequency of 60 Hz. This frequency is at the low-energy end of the electromagnetic spectrum. Therefore, it has less energy than other commonly encountered types of non-ionizing radiation like radio waves, infrared radiation, and visible light.

The wide use of electricity results in background levels of ELF EMFs in nearly all locations where people spend time – homes, workplaces, schools, cars, the supermarket, etc. A person's average exposure depends upon the sources they encounter, how close they are to them, and the amount of time they spend there.[68] As stated above, the average exposure to magnetic fields in the U.S. is estimated to be around one mG or 0.1 μT, but can vary considerably depending on a person's exposure to EMF from electrical devices and wiring.[69] At times we are often exposed to much higher ELF magnetic fields, for example when standing three feet from a refrigerator the ELF magnetic field is 6 mG and when standing three feet from a microwave oven the field is about 50 mG.[70] The strength of these fields diminish quickly with distance from the source, but when surrounded by electricity in our homes and other buildings moving away from one source moves you closer to another. However, unless you are inside of the fence at a utility-scale solar facility or electrical substation it is impossible to get very close to the EMF sources. Because of this, EMF levels at the fence of electrical substations containing high voltages and currents are considered "generally negligible".[71,72]

The strength of ELF-EMF present at the perimeter of a solar facility or near a PV system in a commercial or residential building is significantly lower than the typical American's average EMF exposure.[73,74] Researchers in Massachusetts measured magnetic fields at PV projects and found the magnetic fields dropped to very low levels of 0.5 mG or less, and in many cases to less than background levels (0.2 mG), at distances of no more than nine feet from the residential inverters and 150 feet from the utility-scale inverters.[75] Even when measured within a few feet of the utility-scale inverter, the ELF magnetic fields were well below the International Commission on Non-Ionizing Radiation Protection's recommended magnetic field level exposure limit for the general public of 2,000 mG.[76] It is typical that utility scale designs locate large inverters central to the PV panels that feed them because this minimizes the length of wire required and shields neighbors from the sound of the inverter's cooling fans. Thus, it is rare for a large PV inverter to be within 150 feet of the project's security fence.

Anyone relying on a medical device such as pacemaker or other implanted device to maintain proper heart rhythm may have concern about the potential for a solar project to interfere with the operation of his or her device. However, there is no reason for concern because the EMF outside of the solar facility's fence is less than 1/1000 of the level at which manufacturers test for ELF EMF interference, which is 1,000 mG.[77] Manufacturers of potentially affected implanted devices often provide advice on electromagnetic interference that includes avoiding letting the implanted device get too close to certain sources of fields such as some

household appliances, some walkie-talkies, and similar transmitting devices. Some manufacturers' literature does not mention high-voltage power lines, some say that exposure in public areas should not give interference, and some advise not spending extended periods of time close to power lines.[78]

3. Electric Shock and Arc Flash Hazards

There is a real danger of electric shock to anyone entering any of the electrical cabinets such as combiner boxes, disconnect switches, inverters, or transformers; or otherwise coming in contact with voltages over 50 Volts.[79] Another electrical hazard is an arc flash, which is an explosion of energy that can occur in a short circuit situation. This explosive release of energy causes a flash of heat and a shockwave, both of which can cause serious injury or death. Properly trained and equipped technicians and electricians know how to safely install, test, and repair PV systems, but there is always some risk of injury when hazardous voltages and/or currents are present. Untrained individuals should not attempt to inspect, test, or repair any aspect of a PV system due to the potential for injury or death due to electric shock and arc flash, The National Electric Code (NEC) requires appropriate levels of warning signs on all electrical components based on the level of danger determined by the voltages and current potentials. The national electric code also requires the site to be secured from unauthorized visitors with either a six-foot chain link fence with three strands of barbed wire or an eight-foot fence, both with adequate hazard warning signs.

4. Fire Safety

The possibility of fires resulting from or intensified by PV systems may trigger concern among the general public as well as among firefighters. However, concern over solar fire hazards should be limited because only a small portion of materials in the panels are flammable, and those components cannot self-support a significant fire. Flammable components of PV panels include the thin layers of polymer encapsulates surrounding the PV cells, polymer backsheets (framed panels only), plastic junction boxes on rear of panel, and insulation on wiring. The rest of the panel is composed of non-flammable components, notably including one or two layers of protective glass that make up over three quarters of the panel's weight.

Heat from a small flame is not adequate to ignite a PV panel, but heat from a more intense fire or energy from an electrical fault can ignite a PV panel.[80] One real-world example of this occurred during July 2015 in an arid area of California. Three acres of grass under a thin film PV facility burned without igniting the panels mounted on fixed-tilt racks just above the grass.[81] While it is possible for electrical faults in PV systems on homes or commercial buildings to start a fire, this is extremely rare.[82] Improving understanding of the PV-specific risks, safer system designs, and updated fire-related codes and standards will continue to reduce the risk of fire caused by PV systems.

PV systems on buildings can affect firefighters in two primary ways, 1) impact their methods of fighting the fire, and 2) pose safety hazard to the firefighters. One of the most important techniques that firefighters use to suppress fire is ventilation of a building's roof. This technique allows superheated toxic gases to quickly exit the building. By doing so, the firefighters gain easier and safer access to the building, Ventilation of the roof also makes the challenge of putting out the fire easier. However, the placement of rooftop PV panels may interfere with ventilating the roof by limiting access to desired venting locations.

New solar-specific building code requirements are working to minimize these concerns. Also, the

latest National Electric Code has added requirements that make it easier for first responders to safely and effectively turn off a PV system. Concern for firefighting a building with PV can be reduced with proper fire fighter training, system design, and installation. Numerous organizations have studied fire fighter safety related to PV. Many organizations have published valuable guides and training programs. Some notable examples are listed below.

- The International Association of Fire Fighters (IAFF) and International Renewable Energy Council (IREC) partnered to create an online training course that is far beyond the PowerPoint click-andview model. The self-paced online course, "Solar PV Safety for Fire Fighters," features rich video content and simulated environments so fire fighters can practice the knowledge they've learned. www.iaff.org/pvsafetytraining
- Photovoltaic Systems and the Fire Code: Office of NC Fire Marshal
- Fire Service Training, Underwriter's Laboratory
- Firefighter Safety and Response for Solar Power Systems, National Fire Protection Research Foundation
- Bridging the Gap: Fire Safety & Green Buildings, National Association of State Fire Marshalls
- Guidelines for Fire Safety Elements of Solar Photovoltaic Systems, Orange County Fire Chiefs Association
- Solar Photovoltaic Installation Guidelines, California Department of Forestry & Fire Protection, Office of the State Fire Marshall
- PV Safety & Firefighting, Matthew Paiss, Homepower Magazine
- PV Safety and Code Development: Matthew Paiss, Cooperative Research Network

Summary

The purpose of this paper is to address and alleviate concerns of public health and safety for utility-scale solar PV projects. Concerns of public health and safety were divided and discussed in the four following sections: (1) Toxicity, (2) Electromagnetic Fields, (3) Electric Shock and Arc Flash, and (4) Fire. In each of these sections, the negative health and safety impacts of utility-scale PV development were shown to be negligible, while the public health and safety benefits of installing these facilities are significant and far outweigh any negative impacts.

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Appendix C Wetland Delineation Report

April 25, 2025

Cara Romaine
Powhatan Road Solar Farm, LLC
2250 Lucien Way, Suite 305
Maitland, FL 32751

Reference: Wetland Delineation
8367 Powhatan Road
King George County, Virginia
Headwater Project #202560

Cara:

Headwater Environmental, Inc. (Headwater) is pleased to provide the results of our Wetland Delineation for the above referenced property. The purpose of this report is to document and locate the extent of Waters of the U.S. within the study area.

PROJECT INFORMATION

The subject site is located at 8367 Powhatan Road in King George County, Virginia. According to King George County GIS, the site is approximately 158 acres, identified as Parcel Number 321 and is owned by Carr E. Lawrence Jr.

Regulatory Summary
In order to identify wetlands at the study area, Headwater utilized the "Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region", issued November 2010. Identification of wetlands is based on a three-factor approach involving indicators of hydrophytic vegetation, hydric soil, and wetland hydrology.

Federal authority to regulate activities in wetlands is contained in Section 404 of the Clean Water Act (33 USC 1344) and Section 10 of the Rivers and Harbors Act (33 USC 403). These Acts established a program for regulating the discharge of dredged and fill material into the "Waters of the United States", which includes wetlands and streams. Section 401 of the Clean Water Act authorizes States and Tribes to administer the water quality certification process to protect wetlands and other aquatic resources.

There have been some recent rulings and updates regarding how wetlands and streams are regulated:

- Sackett v. EPA, May 25, 2023: The United States Supreme Court ruled in favor of Sackett Family and determined their wetland was isolated (non-jurisdictional).

- "Amended Revised Definition of Waters of the U.S., August 29, 2023". The Environmental Protection Agency (EPA) will abandon the significant nexus process. This rule establishes limits that appropriately draw the boundary of waters subject to Federal protection. When upstream waters significantly affect the integrity of waters for which the Federal interest is indisputable—the traditional navigable waters, the territorial seas, and interstate waters—this rule ensures that Clean Water Act programs apply to protect those paragraph (a)(1)

> waters. Where waters do not significantly affect the integrity of waters for which the Federal interest is indisputable, this rule leaves regulation exclusively to the Tribes and States. The date for new regulatory guidance from the United States Army Corps of Engineers (USACE) is to-be-determined.

Certain ditches, artificially irrigated areas, certain artificial lakes and ponds, reflecting pool, swimming pools, certain waterfilled depressions, and certain swales/erosional features remain excluded from the new rule.

The Norfolk District of the USACE, in conjunction with the EPA, administers the federal wetlands program in this area. In addition, the Virginia Department of Environmental Quality (VDEQ) administers the wetlands program for the Commonwealth of Virginia as per Section 401 of the Clean Water Act.

In 1988, the Virginia General Assembly enacted the Chesapeake Bay Preservation Act (CBPA). The act was specifically designed to protect and improve the water quality of the Chesapeake Bay, its tributaries and other state waters. The CBPA consists of two areas, the Resource Protection Area (RPA) and the Resource Management Area (RMA).

A vegetated RPA buffer, a minimum of 100 feet in width, shall be located adjacent to and landward of perennial streams, tidal wetlands and non-tidal wetlands connected by surface flow that are contiguous to tidal wetlands or water bodies with perennial flow. Resource Management Areas (RMA's) include those lands contiguous to the inland boundary of the RPA which have a potential for degrading water quality or diminishing the functional value of the RPA, if not properly managed. The RMA is shown on the CBPA map and includes, but is not limited to, the following land use categories: floodplains, highly erodible soils, including steep slopes, highly permeable soils; and non-tidal wetlands not included in the RPA.

The CBPA RPA and RMA area are regulated by the respective county/municipality.

METHODOLOGY

Office Review

Headwater reviewed the 7.5-minute United States Geological Survey (USGS) quadrangle Port Royal and King George Virginia dated 1985 (**Figure 1**). According to the topographic quadrangle, the site is situated between 55 and 75 feet above mean sea level (MSL). An unnamed tributary of Dogue Run traverses through the southern and central portion of the Site. Dogue Run flows west to the Rappahannock River. An impoundment of Keys Run is located adjacent north and adjacent to the site. The northern portion of the site slopes downgradient to the north, the southern portion of the slopes towards the unnamed tributary.

Headwater reviewed the printed Soil Survey for King George County, Virginia provided by the Natural Resources Conservation Service (NRCS), dated 1974 (**Figure 2**). If streams are depicted as intermittent or perennial on the most recent printed version of the soil map, a stream determination is recommended. Two intermittent streams are mapped on the central-southern portion of the site.

According to the NRCS Web Soil Survey (WSS), 10 soil series are mapped within the site boundary (**Figure 3**). Refer to the table below for a description of the identified soils and to Figure 3 for a depiction of the mapped soils.

Table 1. NRCS mapped soil series within the site boundary.

Soil Type	Symbol	Drainage Class
Alluvial land, wet	Ae	Poorly drained
Altavista fine sandy loam (0-2% slopes)	AfA	Well drained
Altavista fine sandy loam (2-6% slopes)	AfB	Well drained
Augusta loam	Au	Poorly drained
Bibb fine sandy loam	Bb	Poorly drained
Caroline-Sassafras complex (10-15% slopes)	CdD	Well drained
Caroline-Sassafras complex (15-30% slopes)	CdE	Well drained
Dogue loam (0-2% slopes)	DoA	Well drained
Dogue loam (2-6% slopes)	DoB	Well drained
Galestown-Sassafras complex	GsE	Well drained

According to the FEMA Flood Map Panel 51099C0175D effective December 2, 2021, the floodplains associated with Key Run and Dogue Run slightly encroach within the northern and southern portions of the site. The remainder of the site is located in unshaded Zone X, an area outside of the 100-year and 500-year floodplains (**Figure 4**).

The United States Fish and Wildlife, National Wetlands Inventory (NWI) depicts one aquatic resource within the site boundary (**Figure 5**). Refer to Table 2 below for a description of the identified aquatic resource and to Figure 5 for a depiction of the mapped resources.

Table 2. USFWS National Wetlands inventory aquatic resource classifications of mapped resources on site.

Aquatic Resource Class	Cowardian Classification	Full Description
Freshwater Forested Shrub/Wetland	PFO1A	Palustrine, Forested, Broad-Leaved Deciduous, Temporarily Flooded

Headwater obtained LiDAR data from the National Oceanic and Atmospheric Administration (**Figure 6**). Elevation generally slopes downgradient towards the southern portion of the site. A pronounced drainage feature is visible on the central-southern portion of the site.

According to the Virginia Department of Conservation and Recreation (DCR), the site is located within the Rappahannock River-Mill Creek Watershed (Hydrologic Unit Code 020801040201).

Methodology

Following the office review, Headwater personnel completed the site reconnaissance on March 27 and 28, 2025. The field review involved a general site inspection, wetland observations, and wetland boundary delineation. The purpose of the site reconnaissance was to verify the published data, inspect the site for the presence of wetlands, and delineate the wetland/upland boundaries.

FINDINGS AND OBSERVATIONS

The weather during Headwaters' reconnaissance was sunny with high temperatures in the 60s (degrees Fahrenheit) on March 27 and 28, 2025. The parcel boundaries were not marked in the field at the time of our site visit. However, parcel boundaries were discernable by landmark features such as streams, tree lines, agricultural fields and roads.

Stream A originates in the central-southern portion of the site. Wetland A and Wetland C are adjacent and abutting the intermittent section of Stream A. Wetland B drains to an ephemeral drainage feature and is connected via surface flow to Stream A. Stream A transitions to perennial before flowing off-site. Two non-jurisdictional (a.k.a isolated) wetlands were identified on the eastern-central portion of the site. The two non-jurisdictional wetlands are identified as Wetland D and Wetland E.

Table 1

Feature Name	Dimensions (acreage and/or length x width	Regulatory Designation
Wetland A	0.41 Acres	Jurisdictional
Wetland B	0.14 Acres	Jurisdictional
Wetland C	0.03 Acres	Jurisdictional
Stream A (perennial)	401 Feet	Jurisdictional
Stream A (intermittent)	150 Feet	Jurisdictional
Wetland D	0.75 Acres	Non-jurisdictional
Wetland E	0.22 Acres	Non-jurisdictional

Figure 7 depicts the approximate locations of aquatic resources within the study area.

REGULATORY VERIFICATION

Headwater recommends coordinating with the USACE to verify the wetland and stream boundaries prior to development activities.

CONCLUSIONS AND RECOMENDATIONS

- Three (3) jurisdictional wetland systems were identified during site reconnaissance (Wetland A, B, and C). Wetland A and Wetland C are adjacent and abutting the intermittent section of Stream A. Wetland B drains to an ephemeral drainage feature and is connected via surface flow to Stream A

- One (1) stream feature was identified onsite. Stream A originates within the project limits and transitions from intermittent to perennial before flowing off-site.

- Two (2) non-jurisdictional (a.k.a isolated) wetlands were identified on the eastern-central portion of the site. The two non-jurisdictional wetlands are identified as Wetland D and Wetland E. Isolated wetlands are regulated by VDEQ. A State Surface Water Determination (SSWD) will likely be needed if the isolated wetlands remain within the site boundary.

- Headwater recommends obtaining an Approved Jurisdictional Determination (AJD) from the USACE to verify the jurisdictional status of the delineated wetland and streams within the site boundary.

- If the jurisdictional aquatic resources are to be impacted by development, a Joint Permit Application (JPA) must be submitted to USACE and Virginia DEQ. If impacts to non-jurisdictional wetlands occur, a State Surface Water Determination (SSWD) must be submitted to VDEQ.

LIMITATIONS

Observations, conclusions, and/or recommendations pertaining to the potential jurisdictional wetland areas within the subject site are limited to the conditions observed, and/or materials reviewed at the time this study was undertaken.

This report is provided for the exclusive use of Powhatan Road Solar Farm, LLC; their successors and/or assigns and is not intended to be used or relied upon in connection with other projects or by other unidentified third parties. The use of this report by an undesignated third party or parties will be at such party's sole risk and Headwater disclaims liability for such third-party use or reliance.

Headwater appreciates the opportunity to provide our environmental services for this project. If you have questions or need additional information, please contact us at (910) 777-3908.

Respectfully submitted,

Headwater Environmental, Inc.

C. Paul Pascarosa
President

Devynne Brown
Project Manager

Enclosure: Figures 1 to 7
Site Photographs

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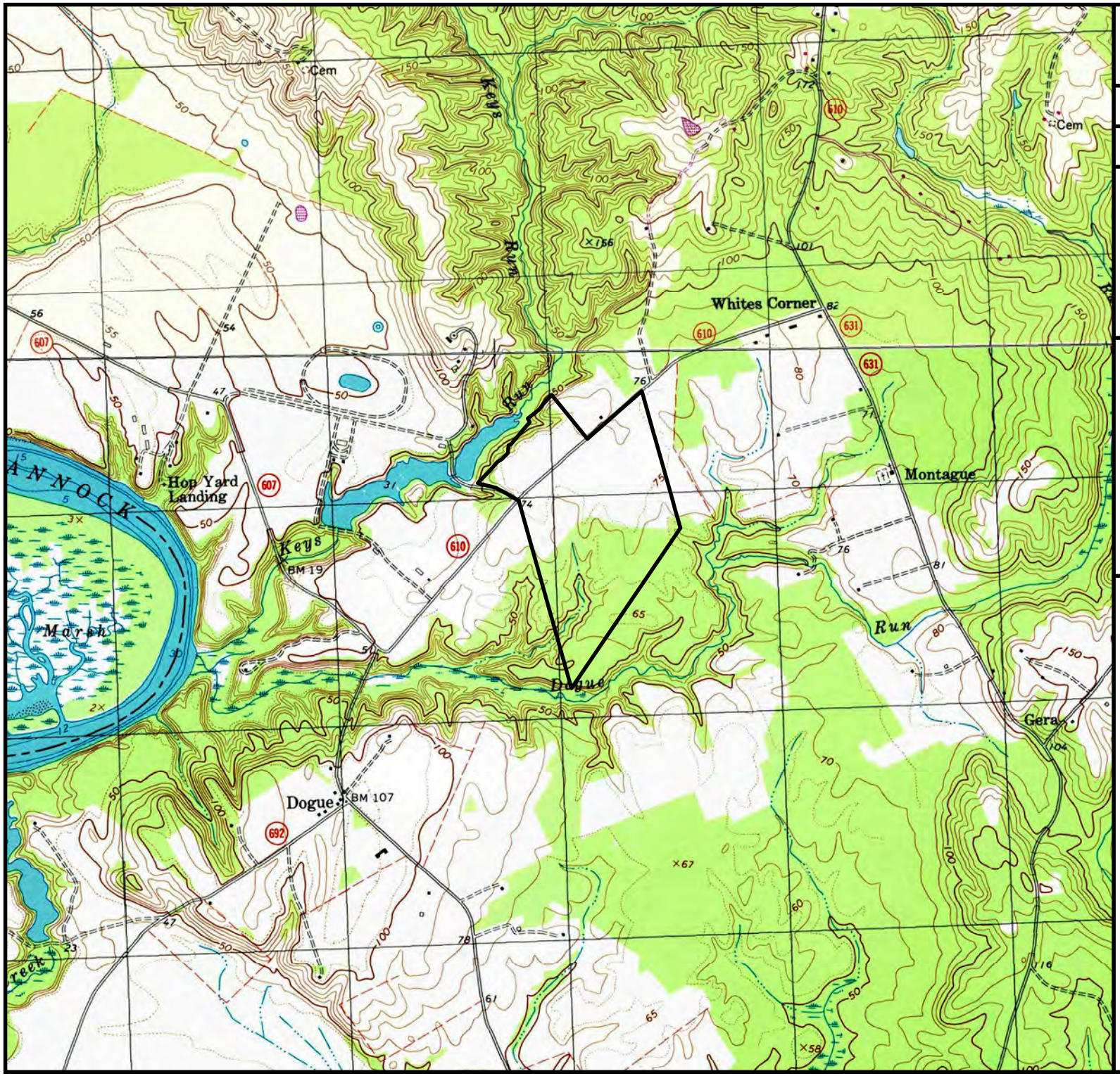


Headwater ENVIRONMENTAL INC.

Date:	03/17/2025
Prepared By:	DFH

FIGURE 1
TOPOGRAPHIC MAP

8367 Powhatan Roads
King George, King George County
Virginia
Headwater Project # 202560

SOURCE

USGS
7.5-minute Topographic Quadrangle

Port Royal, VA
King George
(1968)

Contour Interval = 10 Feet

1 inch = 2000 feet

LEGEND

Site Boundary

Feet
0 850 1,700 3,400

Headwater ENVIRONMENTAL INC.

Date:	03/17/2025
Prepared By:	DFH

FIGURE 2
PRINTED SOIL MAP

8367 Powhatan Road
King George, King George County
Virginia
Headwater Project # 202560

SOURCE

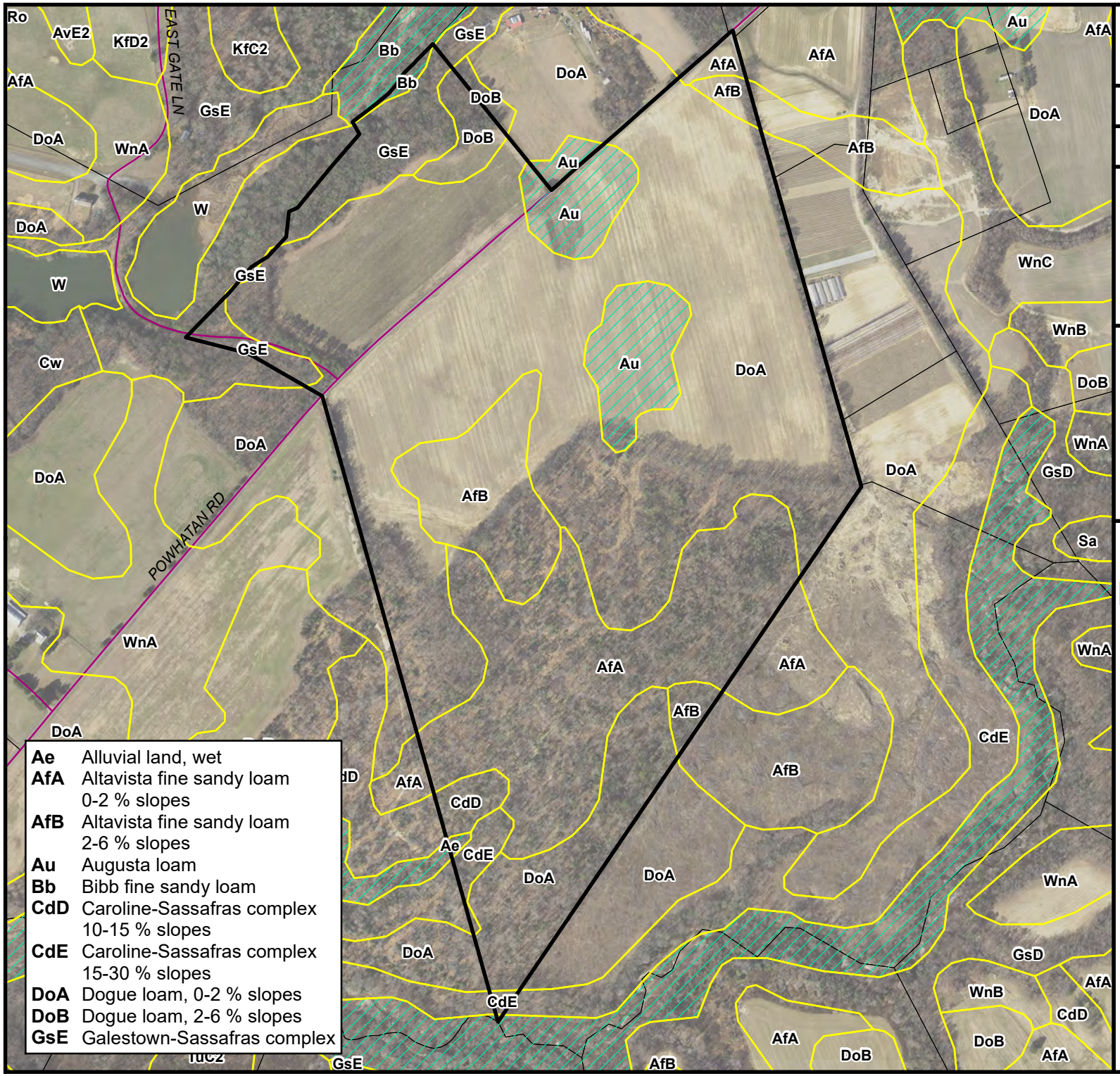
Natural Resources Conservation Service (NRCS),
Archived Soil Survey, dated 1974

1 inch = 600 feet

LEGEND

Site Boundary

Feet
0 255 510 1,020



Headwater ENVIRONMENTAL INC.

Date:	03/17/2025
Prepared By:	DFH

FIGURE 3
WEB SOIL SURVEY MAP

8367 Powhatan Road
King George, King George County
Virginia
Headwater Project # 202560

SOURCE

USDA
Web Soil Survey

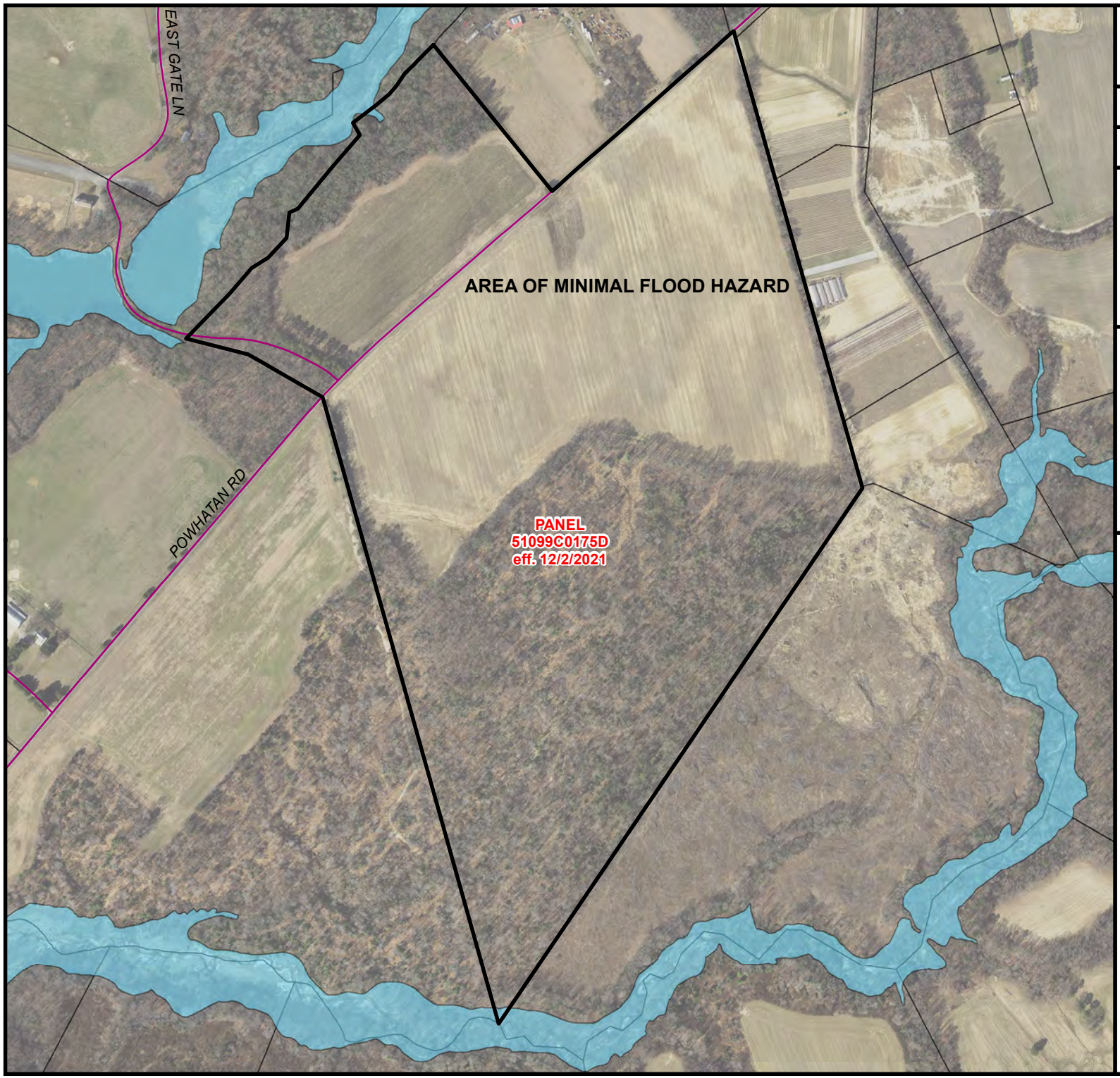
VGIN
Latest Imagery (2021)

1 inch = 600 feet

LEGEND

- Site Boundary
- Soils
- Poorly drained; Somewhat poorly drained; Very poorly drained
- King George County Parcels
- King George County Roads

0 255 510 1,020 Feet



Headwater ENVIRONMENTAL INC.

Date:	03/17/2025
Prepared By:	DFH

FIGURE 4
FEMA MAP

8367 Powhatan Road
King George, King George County
Virginia
Headwater Project # 202560

SOURCE

FEMA
Panel # 51099C0175D
Dated December 2, 2021

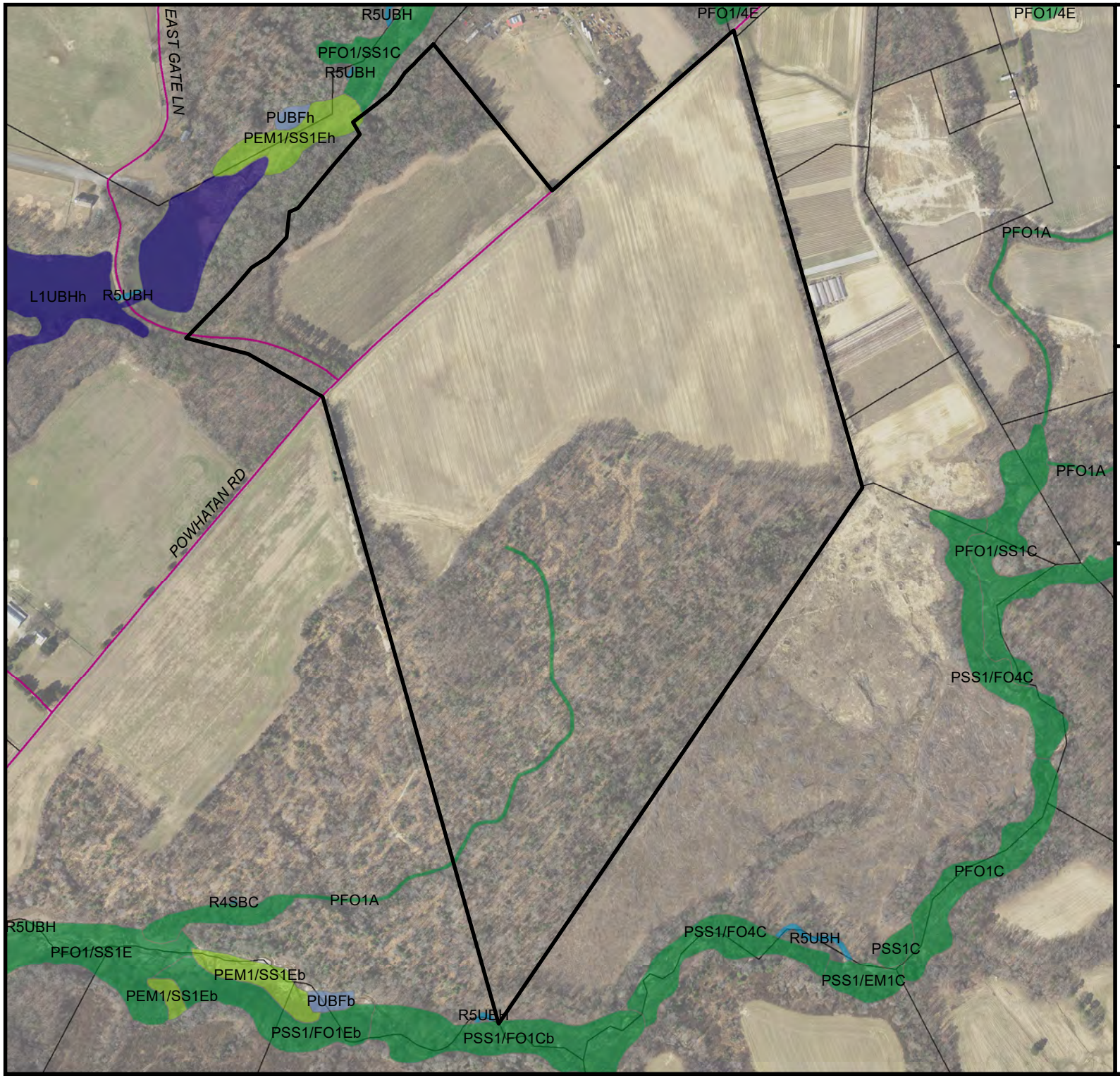
VGIN
Latest Imagery (2021)

1 inch = 600 feet

LEGEND

- Site Boundary
- FIRM Panels
- Zone A
- King George County Parcels
- King George County Roads

Feet
0 255 510 1,020



Headwater ENVIRONMENTAL INC.

Date:	03/17/2025
Prepared By:	DFH

FIGURE 5
NATIONAL WETLANDS INVENTORY MAP

8367 Powhatan Road
King George, King George County
Virginia
Headwater Project # 202560

SOURCE

UFWS
National Wetlands Inventory

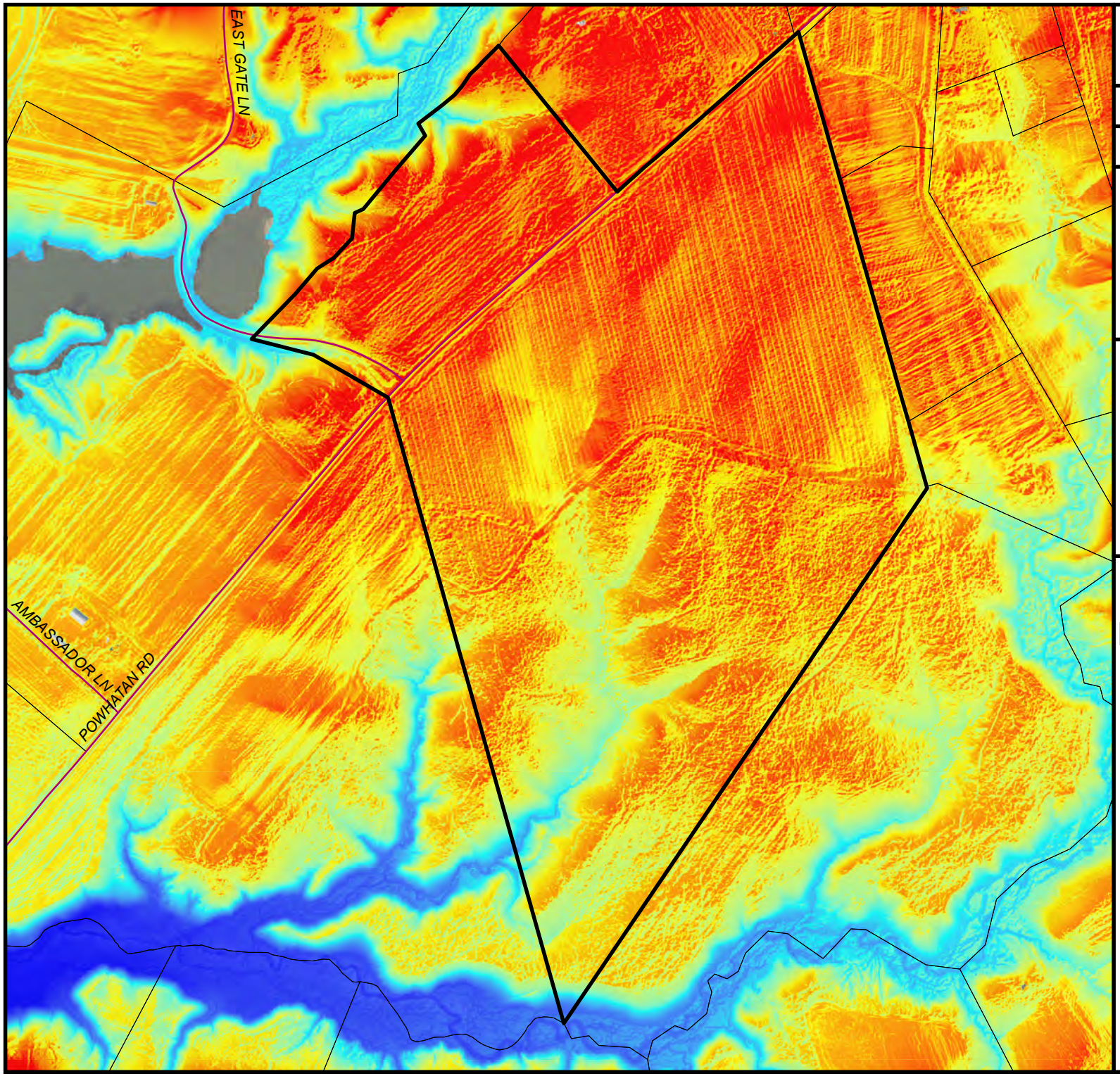
VGIN
Latest Imagery (2021)

1 inch = 600 feet

LEGEND

- Site Boundary
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Riverine
- King George County Parcels
- King George County Roads

Feet
0 255 510 1,020



Headwater ENVIRONMENTAL INC.

Date:	03/17/2025
Prepared By:	DFH

FIGURE 6
LIDAR MAP

8367 Powhatan Road
King George, King George County
Virginia
Headwater Project # 202560

SOURCE

NOAA
2020 USGS Lidar
North Chesapeake Bay, MD &
King George County, VA

VGIN
Latest Imagery (2021)

1 inch = 600 feet

LEGEND

- Site Boundary
- King George County Parcels
- King George County Roads

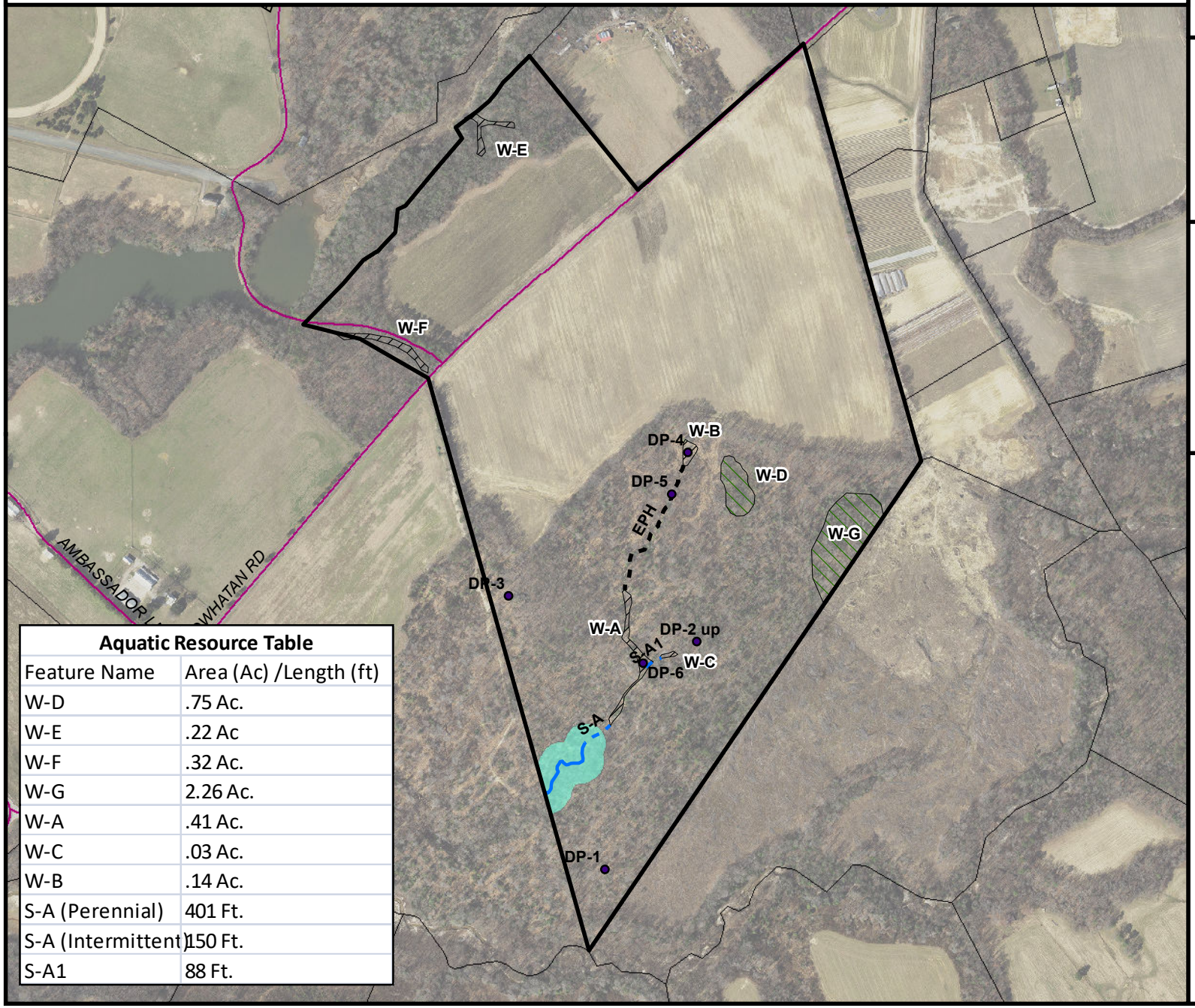
Elevation (ft) above MSL

High : 112.053

Low : 5.77

Feet
0 255 510 1,020

This is not a survey. All locations depicted on this figure are approximate. This Wetland Determination was completed by Headwater Environmental, Inc. (Headwater) in March, 2025. The aquatic resource locations were recorded with Trimble GPS devices. Headwater recommends obtaining regulatory verification prior to the development of this site.According to CBPA regulations, a 100-foot vegetated RPA buffer, shall be located adjacent to and landward of perennial streams, tidal wetlands and non-tidal wetlands connected by surface flow that are contiguous to tidal wetlands or water bodies with perennial flow.



Aquatic Resource Table	
Feature Name	Area (Ac) /Length (ft)
W-D	.75 Ac.
W-E	.22 Ac
W-F	.32 Ac.
W-G	2.26 Ac.
W-A	.41 Ac.
W-C	.03 Ac.
W-B	.14 Ac.
S-A (Perennial)	401 Ft.
S-A (Intermittent)	150 Ft.
S-A1	88 Ft.

Headwater ENVIRONMENTAL INC.

Date:	04/10/2025
Prepared By:	DFH

FIGURE 7
WETLAND DELINEATION MAP

8367 Powhatan Road
King George, King George County
Virginia
Headwater Project # 202560

SOURCE

Site Reconnaissance

King George County GIS

VGIN
Latest Imagery (2021)

1 inch = 700 feet

LEGEND

- Site Boundary
- 100-foot CBPA buffer
- Data Point

Potential non-wetland waters

- Perennial Stream
- Intermittent Stream
- Ephermal Stream

Potential Wetland

- Jurisdictional
- Non-jurisdictional

0 300 600 1,200 Feet

Data Points

Powhatan Solar- Headwater Project 202560

Photographs collected on March 27 and 28, 2025

Facing west.

Facing east.

Soils at DP-1

DP-1: upland

Data Points

Powhatan Solar- Headwater Project 202560

Photographs collected on March 27 and 28, 2025

Facing west.

Facing east.

Soils at DP-2

DP-2: upland

Data Points

Powhatan Solar- Headwater Project 202560

Photographs collected on March 27 and 28, 2025

Facing west.

Facing east, downhill.

Soils at DP-3

DP-3: upland

Data Points

Powhatan Solar- Headwater Project 202560

Photographs collected on March 27 and 28, 2025

Facing south, downhill.

Facing east, uphill towards farm field.

Soils at DP-4

DP-4: wetland

Data Points

Powhatan Solar- Headwater Project 202560

Photographs collected on March 27 and 28, 2025

Facing south, ephemeral feature

Facing north, towards Wetland B

Soils at DP-5

DP-5: wetland

Data Points

Powhatan Solar- Headwater Project 202560

Photographs collected on March 27 and 28, 2025

Facing north.

Facing south

Soils at DP-6

DP-6: wetland

Data Points

Powhatan Solar- Headwater Project 202560

Photographs collected on March 27 and 28, 2025

Facing east, conditions at isolated Wetland C.

Facing west, conditions at isolated Wetland C.

Data Point not collected. Outside project area.

Appendix D Airport And Federal Aviation Administration (FAA)

Federal Aviation Administration

« OE/AAA

Notice Criteria Tool

Notice Criteria Tool - Desk Reference Guide V_2018.2.0

The requirements for filing with the Federal Aviation Administration for proposed structures vary based on a number of factors: height, proximity to an airport, location, and frequencies emitted from the structure, etc. For more details, please reference CFR Title 14 Part 77.9.

You must file with the FAA at least 45 days prior to construction if:

- your structure will exceed 200ft above ground level
- your structure will be in proximity to an airport and will exceed the slope ratio
- your structure involves construction of a traverseway (i.e. highway, railroad, waterway etc...) and once adjusted upward with the appropriate vertical distance would exceed a standard of 77.9(a) or (b)
- your structure will emit frequencies, and does not meet the conditions of the FAA Co-location Policy
- your structure will be in an instrument approach area and might exceed part 77 Subpart C
- your proposed structure will be in proximity to a navigation facility and may impact the assurance of navigation signal reception
- your structure will be on an airport or heliport
- filing has been requested by the FAA

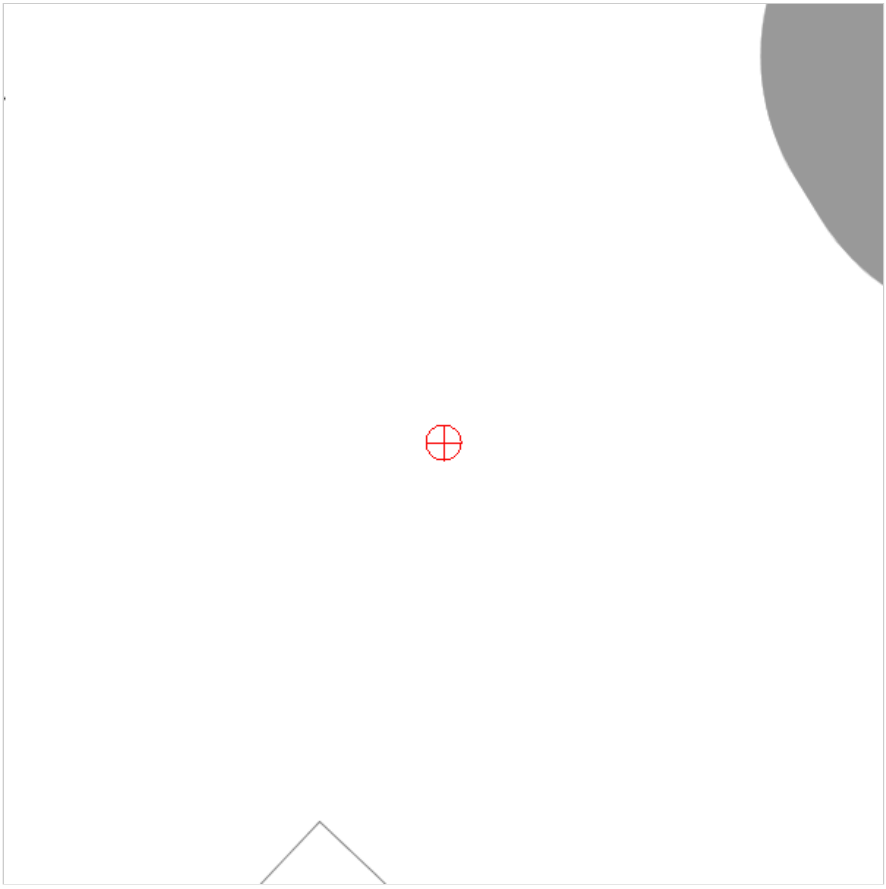
If you require additional information regarding the filing requirements for your structure, please identify and contact the appropriate FAA representative using the Air Traffic Areas of Responsibility map for Off Airport construction, or contact the FAA Airports Region / District Office for On Airport construction.

The tool below will assist in applying Part 77 Notice Criteria.

* **Structure Type:**	SOLAR | Solar Panel Please select structure type and complete location point information.
Latitude:	38 Deg 14 M 43.1 S N
Longitude:	77 Deg 12 M 24.7 S W
Horizontal Datum:	NAD83
Site Elevation (SE):	78 (nearest foot)
Structure Height :	15 (nearest foot)
Is structure on airport:	(●) No ( ) Yes

Results

You do not exceed Notice Criteria.



Federal Aviation Administration

« OE/AAA

Notice Criteria Tool

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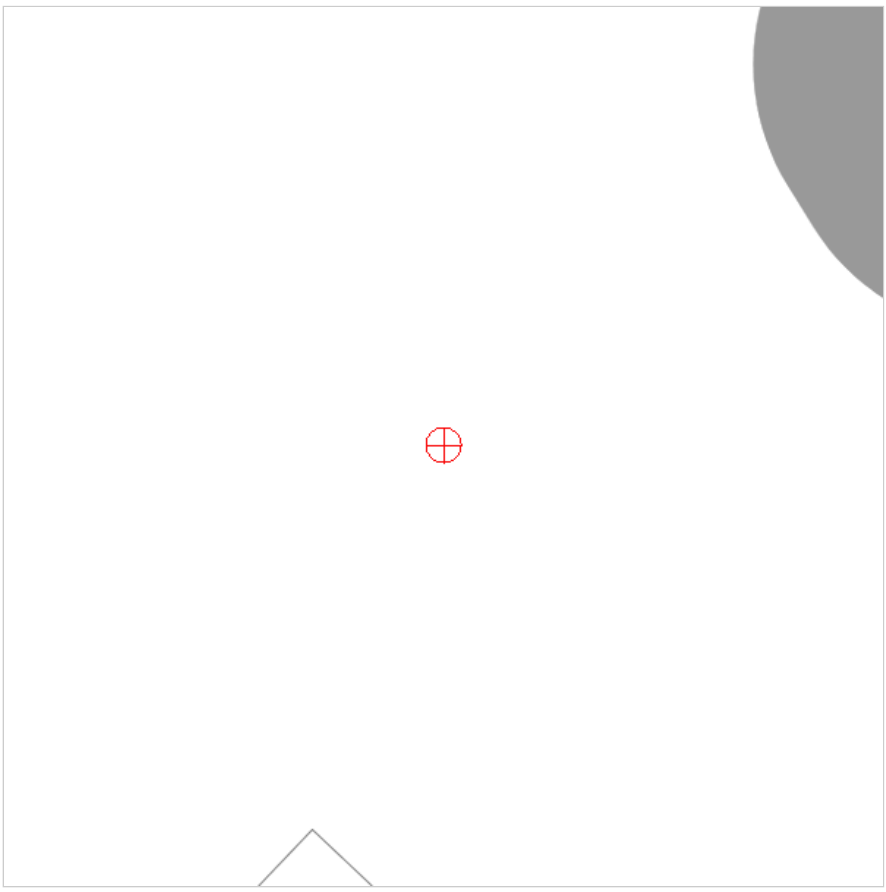
The tool below will assist in applying Part 77 Notice Criteria.

* **Structure Type:**	SOLAR | Solar Panel Please select structure type and complete location point information.
Latitude:	38 Deg 14 M 47.6 S N
Longitude:	77 Deg 12 M 16.7 S W
Horizontal Datum:	NAD83
Site Elevation (SE):	78 (nearest foot)
Structure Height :	15 (nearest foot)
Is structure on airport:	(●) No ( ) Yes

Results

You do not exceed Notice Criteria.



Federal Aviation Administration

« OE/AAA

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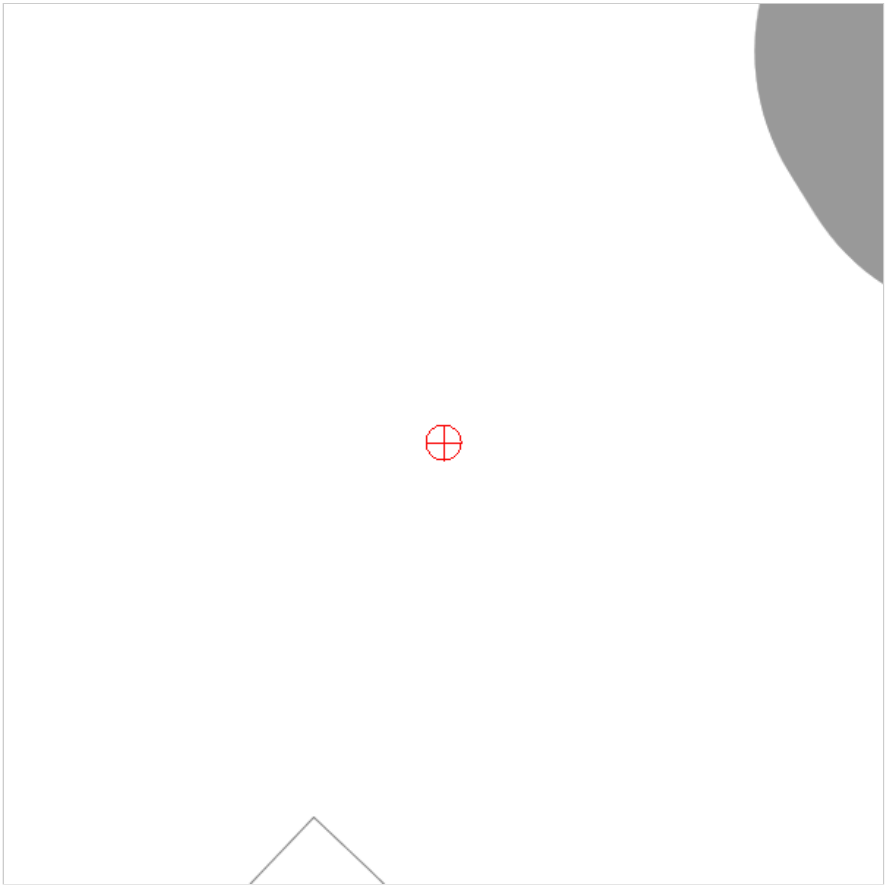
The tool below will assist in applying Part 77 Notice Criteria.

* **Structure Type:**	SOLAR | Solar Panel Please select structure type and complete location point information.
Latitude:	38 Deg 14 M 38.7 S N
Longitude:	77 Deg 12 M 18.2 S W
Horizontal Datum:	NAD83
Site Elevation (SE):	72 (nearest foot)
Structure Height :	15 (nearest foot)
Is structure on airport:	(●) No ( ) Yes

Results

You do not exceed Notice Criteria.



Federal Aviation Administration

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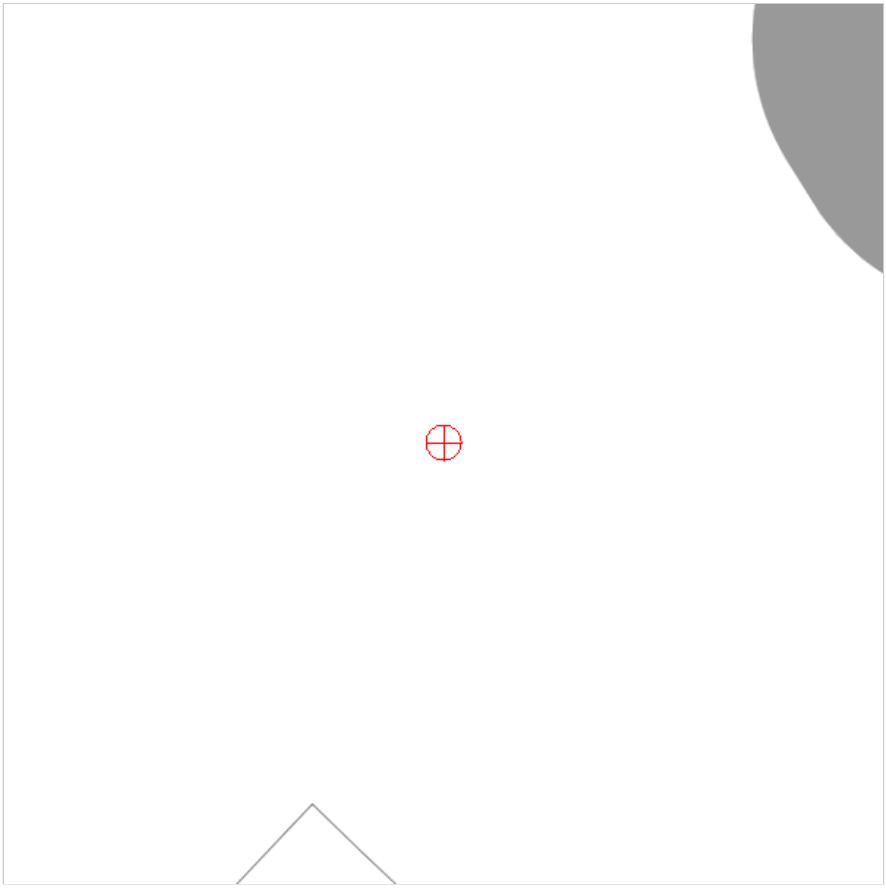
The tool below will assist in applying Part 77 Notice Criteria.

* **Structure Type:**	SOLAR | Solar Panel Please select structure type and complete location point information.
Latitude:	38 Deg 14 M 28.3 S N
Longitude:	77 Deg 12 M 15.7 S W
Horizontal Datum:	NAD83
Site Elevation (SE):	126 (nearest foot)
Structure Height :	15 (nearest foot)
Is structure on airport:	(●) No ( ) Yes

Results

You do not exceed Notice Criteria.

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