PSC Case No. 9477
PPRP Exhibit___(HS-3)

MARYLAND DEPARTMENT OF NATURAL RESOURCES

PPRP

DRAFT

Project Assessment Report for Cherrywood Solar I

December 13, 2018

MARYLAND POWER PLANT RESEARCH PROGRAM

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1.0 INTRODUCTION

Cherrywood Solar I, LLC, submitted an application to the Maryland Public Service Commission (PSC) on January 23, 2018 for approval to construct a 202 megawatt (MW) alternating current (AC) solar photovoltaic (PV) project in Caroline County, Maryland. As part of the licensing process, the Maryland Department of Natural Resources Power Plant Research Program (PPRP), in coordination with other State agencies, evaluated the facility's potential impacts to environmental and cultural resources in Maryland, pursuant to Section 3-304 of the Natural Resources Article of the Annotated Code of Maryland.

This report summarizes PPRP's evaluation of the project in the following sections:

- Section 2 provides a description of the proposed site and facility components;
- Section 3 describes the Project's effect on biological resources;
- Section 4 presents socioeconomic resources and associated impacts;
- Section 5 presents the noise impacts from the Project;
- Section 6 discusses electromagnetic field impacts; and
- Section 7 summarizes the findings of PPRP's evaluations.

Throughout this document, PPRP based the descriptions of the proposed Project and its impacts on the Cherrywood Solar application and associated Environmental Review Document (ERD). PPRP has reviewed Cherrywood Solar's plans and conducted independent analyses as appropriate. Appendix A includes selected data request responses from Cherrywood Solar that PPRP has referenced in this report.

2.0 PROJECT DESCRIPTION

2.1 Site Description

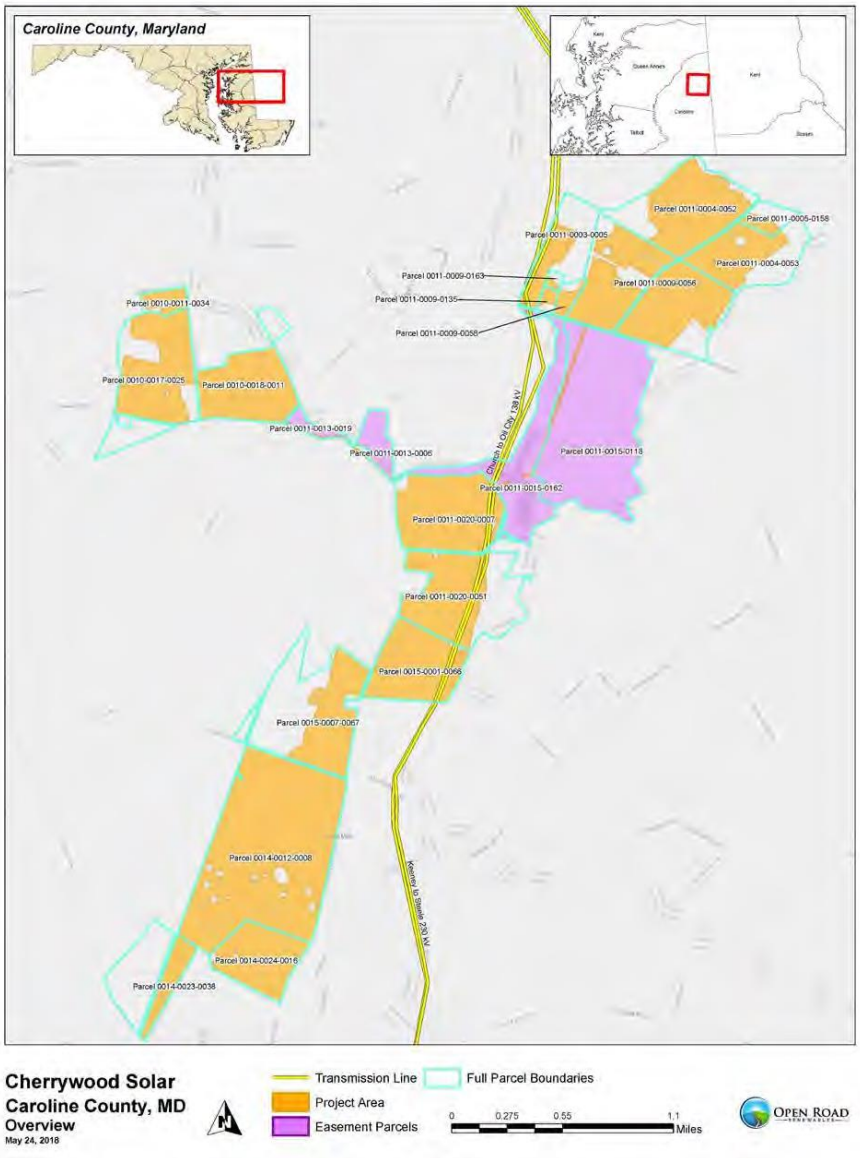
The proposed Cherrywood Solar I facility (Project) will be located on properties that run from southwest to northeast between the Towns of Greensboro and Goldsboro just west of the Choptank River (Figure 1). The Project is within a 1,088-acre portion of 1,723 acres of parcels. The property consists of 18 parcels and 4 additional parcel easements used to accommodate connector lines. Cherrywood Solar I, LLC (Cherrywood Solar) has entered into long-term lease agreements or purchased the parcels from the landowners.

The Project is in a rural area surrounded by a mixture of agricultural, residential, and commercial/industrial use land. According to the Applicant's ERD, there are 12 non-participating residences with line-of-sight to the Project. Lands with active mining permits and an existing small-scale solar project are also within close proximity to the Project parcels.

The Project parcels are all zoned Rural (R) and all have agriculture as the existing property use. Cherrywood Solar states in its CPCN application that the Project is a commercial use that will undergo site plan review consistent with Caroline County's Commercial Site Plan Checklist. Caroline County has a Solar Ordinance that limits utility scale solar projects to 2,000 acres of farmland. This project would be well within the 2,000-acre limit for agricultural land.

The Project parcels are in three sections: Upper, Middle, and Lower. The majority of parcels consist of mostly flat agricultural land. In its ERD, Cherrywood Solar states that minimal tree clearing will be necessary to accommodate the project. As currently proposed, the Project will maintain a minimum 35-foot setback from the drip line of the trees.

Figure 1 Cherrywood Solar Project Location

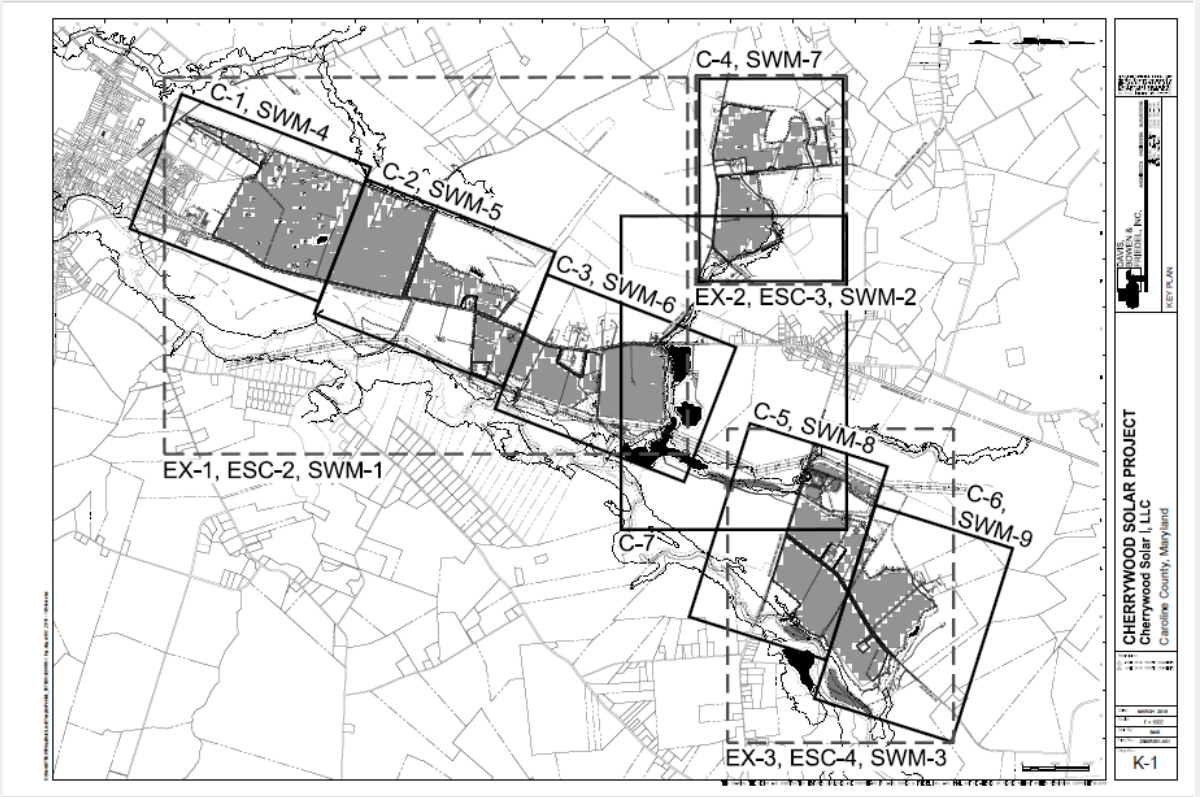


The Project is located within the Upper Choptank River Basin. The Maryland Critical Area Commission has determined that the Project is not located in the Chesapeake Bay Critical Area. Wetlands are present on the property. While construction of the solar panels themselves will not affect any jurisdictional waters, the Maryland Department of the Environment (MDE) has determined that Cherrywood Solar must obtain a wetlands permit, due to the project size and the total number of minor crossings needed to accommodate emergency vehicle access to the site.

2.2 Project Components

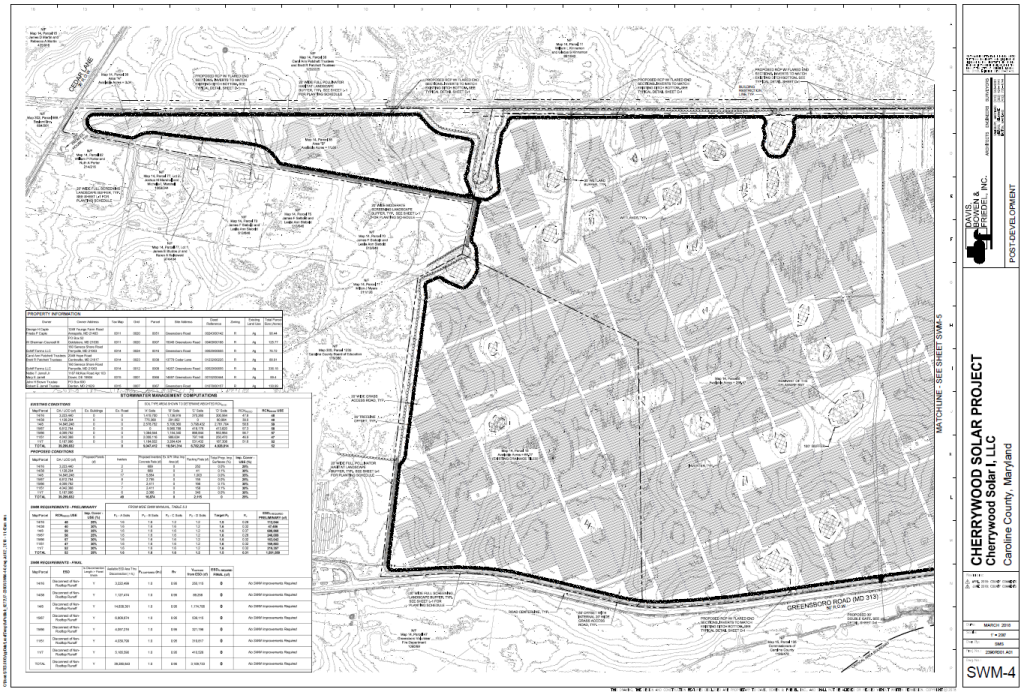
This section describes the Project as proposed by Cherrywood Solar. The Project will involve the design, construction, and operation of a 202 MW AC solar generating facility as shown in Figures 2a through 2g. The Project will interconnect to the PJM distribution system by tapping the nearby existing Keeney-Steele 230 kV circuit.

Figure 2a Cherrywood Solar Project Layout Map



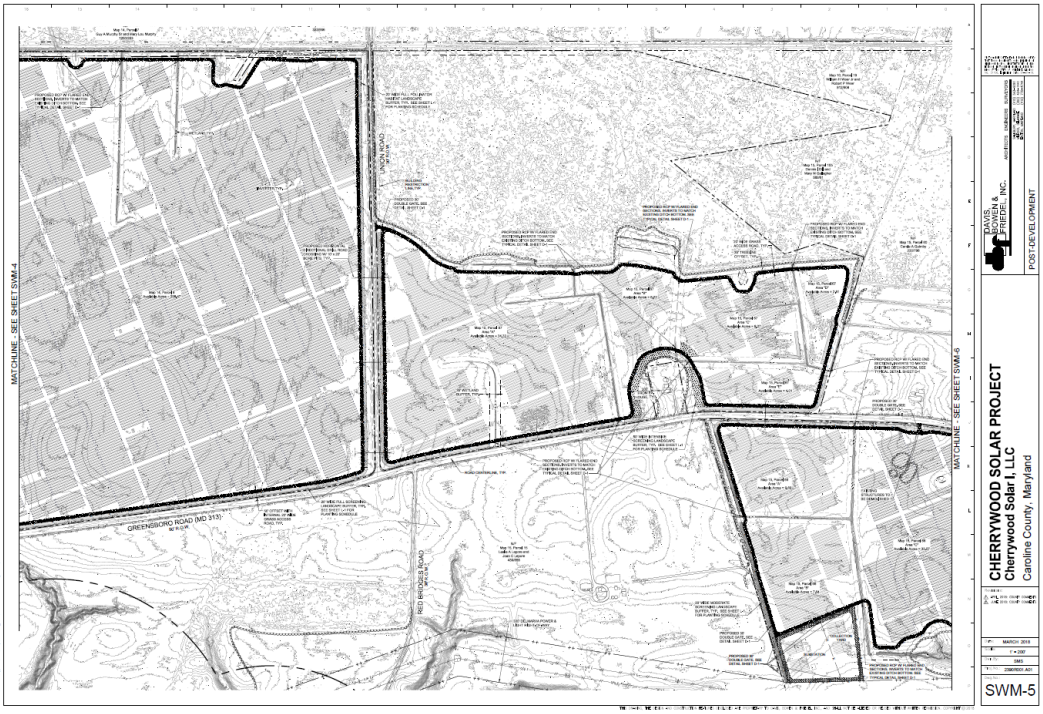
Source: Cherrywood Solar Site Plan July 2018

Figure 2b Cherrywood Solar Section SWM-4 Layout Map (Lower Section)



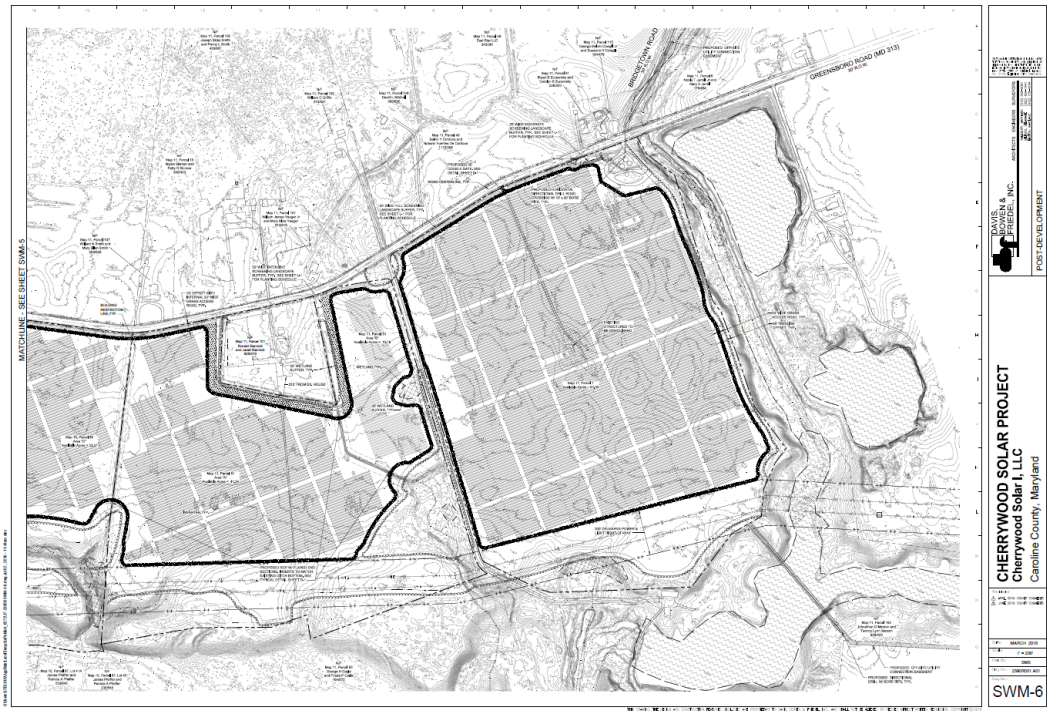
Source: Cherrywood Solar Site Plan July 2018

Figure 2c Cherrywood Solar Section SWM-5 Layout Map (Lower Section)



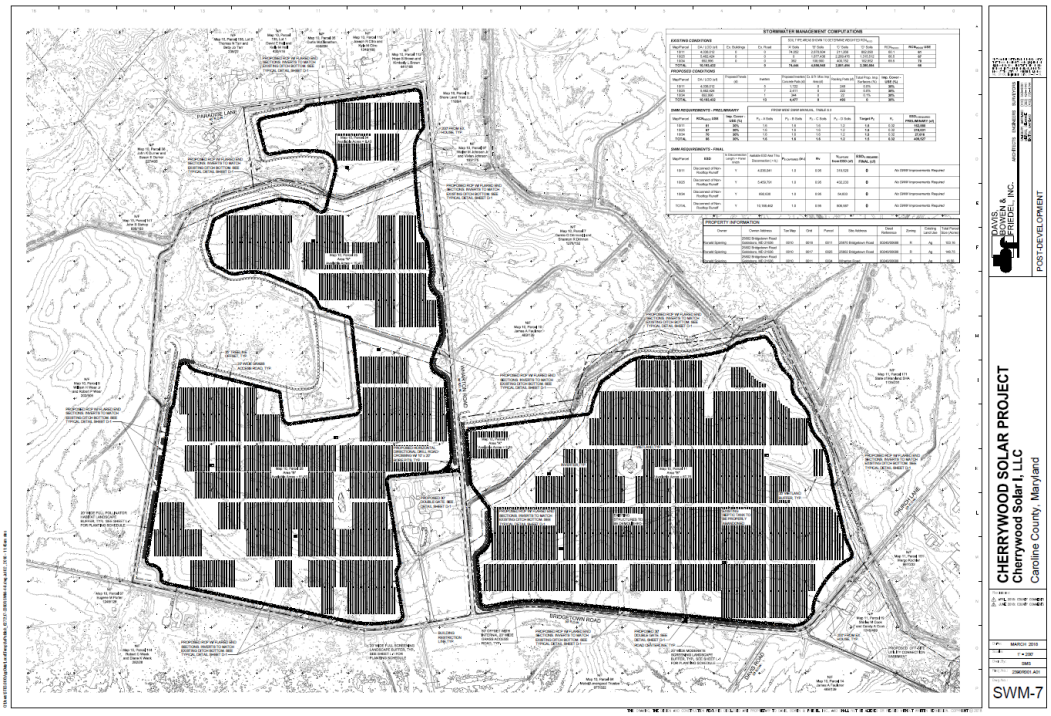
Source: Cherrywood Solar Site Plan July 2018

Figure 2d Cherrywood Solar Section SWM-6 Layout Map (Lower Section)



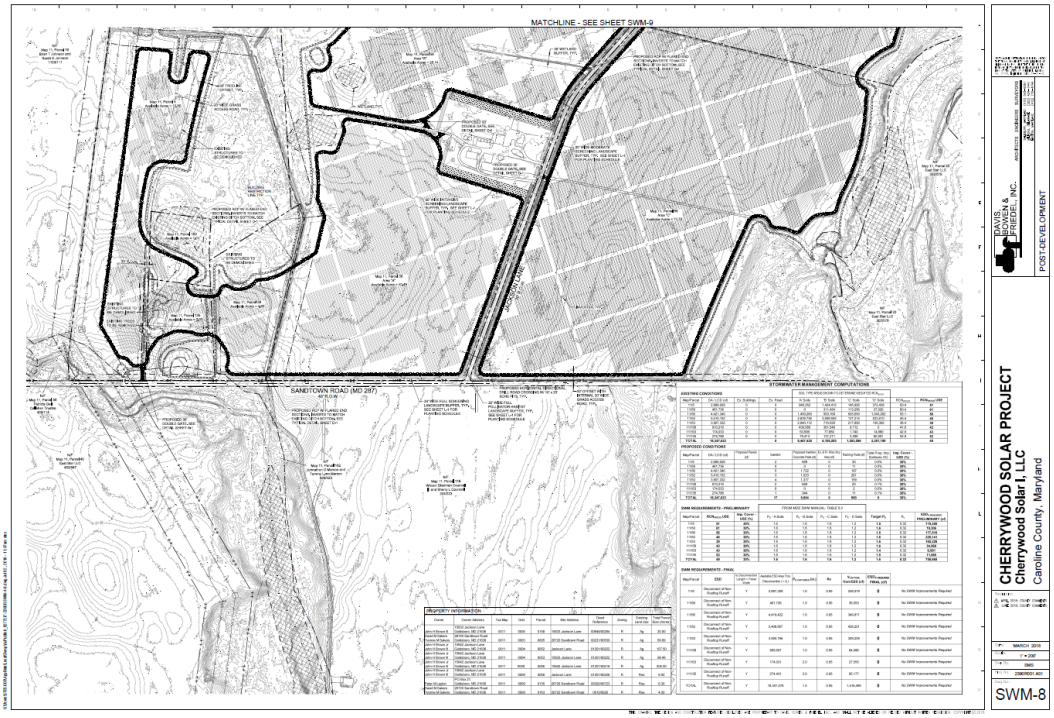
Source: Cherrywood Solar Site Plan July 2018

Figure 2e Cherrywood Solar Section SWM-7 Layout Map (Middle Section)



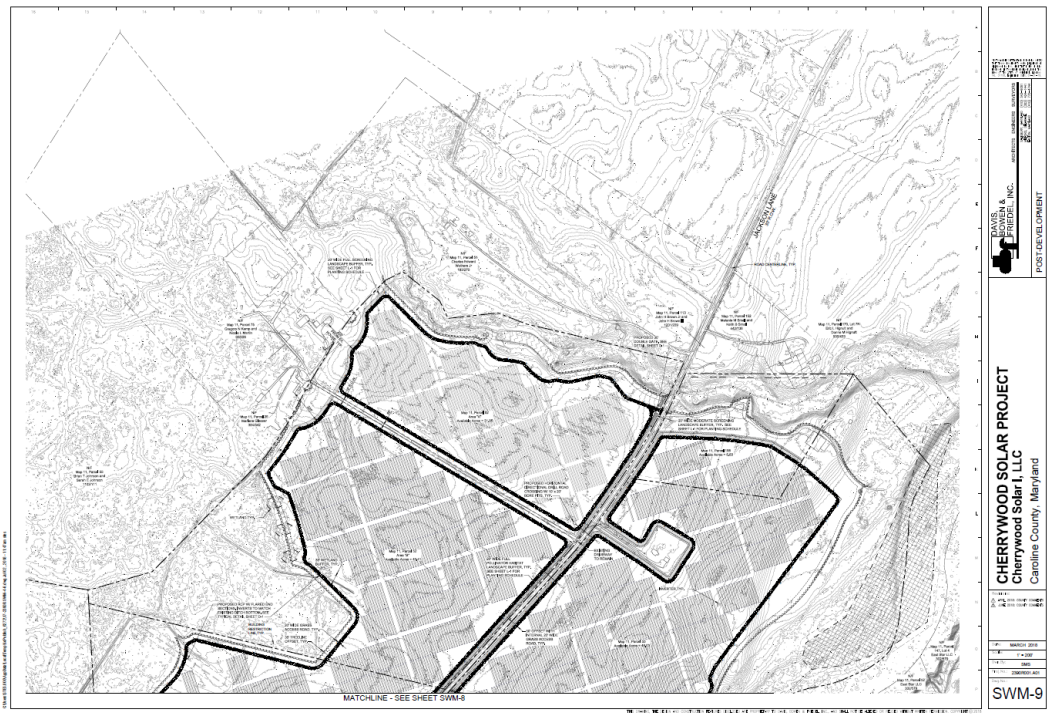
Source: Cherrywood Solar Site Plan July 2018

Figure 2f Cherrywood Solar Section SWM-8 Layout Map (Upper Section)



Source: Cherrywood Solar Site Plan July 2018

Figure 2g Cherrywood Solar Section SWM-9 Layout Map (Upper Section)



Source: Cherrywood Solar Site Plan July 2018

The Project includes approximately 499,086 solar PV panels, a racking system, power inverters, medium-voltage transformers, control and distribution cabinets, a medium-voltage collection system, project switchgear, and equipment needed to interconnect the Project to the regional bulk transmission system. The current conceptual design includes 81 separate power stations, each containing a direct current (DC)-to-AC inverter and a liquid AC transformer.

The proposed PV panels are secured to a single-axis tracking system. The PV panels, once installed, will have a maximum top height of approximately 8 feet above grade and will be arranged with approximately 17 feet between each row. Cherrywood Solar will construct the solar PV panels following the existing site topography. Solar panels will occupy approximately 1,073 acres out of the 1,088-acre Project footprint.

A 6-foot chain-link fence will enclose and protect the panel arrays. There will be access gates provided for the maintenance of the arrays and as needed for the farmer and/or maintenance crews to access adjacent grounds. Cherrywood Solar plans to provide landscape buffers. The landscape buffers will be installed on the outside of the fence where there are adjoining residential uses to eliminate view of the solar array.

The Project does not need water and sewer utilities because there will be no operations or maintenance facilities and no full-time personnel located at this Site. Normal rain events will keep manual cleanings to a minimum. If required, Cherrywood Solar will truck in water to manage dust during construction if required.

The Project will be located in the PJM service territory and connected to the local grid by tapping the Delmarva Power & Light (DPL) Keeney-Steele 230 kV regional bulk transmission circuit. Cherrywood Solar will install a new three-breaker 230 kV ring bus substation to interconnect. Cherrywood Solar will be responsible for all costs of the interconnection upgrades needed for tapping the line. The electricity produced by the Project solar panels and inverters will be delivered into the PJM Interconnection System.

2.3 Construction Details

This section describes key elements of Cherrywood Solar's plans for site development, and identifies relevant requirements imposed by State and local regulations.

Wetlands and Waterways

Cherrywood Solar must comply with the following State and federal regulations intended protects Maryland wetlands and waterways from loss and degradation:

- Nontidal Wetlands – COMAR 26.23.01 applies to activities conducted in nontidal wetlands and wetland buffer.
- Waterway Construction – COMAR 26.17.04 applies to regulations governing construction activities in nontidal waters and floodplains.

The proposed Cherrywood Solar project will entail directional drill operations to install underground transmission cables between Project subareas and the interconnection with the Delmarva Power & Light network. Cherrywood Solar must meet the standards for construction, maintenance, or repair of underground utility lines in stream or wetland areas that are enumerated in Section IV.B.1.c.(1) of the Maryland State Programmatic General Permit-5 issued by the U.S. Army Corps of Engineers. Section 3.7 of this report further discusses directional drilling and its potential impacts.

Erosion & Sediment Control, Stormwater Management

The State of Maryland has comprehensive programs for stormwater management, and erosion and sediment control, to reduce adverse impacts of development on stormwater runoff. These regulations address both the temporary and the permanent impacts associated with development activities. Cherrywood Solar must comply with COMAR 26.17.01, which applies to the preparation, submittal, review, approval, and enforcement of erosion, sediment and storm water control plans, including any dewatering plans and associated water recycling plans. COMAR 26.08.01 through 26.08.04 also regulate discharges to waters of the State and maintenance of surface water quality.

To comply with these regulations, the Project must obtain the following permits and approvals:

- Pollutant Discharge Elimination System (NPDES) General Permit: All projects that will ultimately disturb one acre or more must obtain a General or Individual Permit for Stormwater Associated

with Construction Activity before beginning earth disturbance on the first part of the project. The permit is necessary to protect water quality and to meet federal and State requirements under Code of Federal Regulations 40 CFR 122.26 and 40 CFR 450, as well as Code of Maryland Regulations COMAR 26.08.04.09A. MDE has put in place an electronic system for entities to submit Notices of Intent (NOIs) to MDE, track the status of NOIs and permits, and perform actions like transferring and terminating permits. The completed NOI form is considered a formal application for coverage and intent to comply with the terms of the General Permit.

Applicants for the General Permit include information on their NOIs listing the stormwater BMPs they expect to use at the time of application. The General Permit requires that permittees obtain approval (from the appropriate approval authority, in this case Caroline County) for the Stormwater Management Plan prior to beginning earth disturbance, unless exempt or waived by the approval authority.

- Soil Erosion and Sediment Control (ESC): An approved ESC plan is required to manage stormwater during construction, if the project involves earth disturbances of 5,000 square feet or more and 100 cubic yards or more. The Caroline County Department of Planning & Codes and Soil Conservation District review and approve these plans. Cherrywood Solar must maintain the site controls during construction and keep a record of daily inspections to the controls.

- Grading Permit: A grading permit, issued by the Caroline County Department of Planning & Codes, and Soil Conservation District, is required prior to the start of any construction. Cherrywood Solar will apply for a Grading Permit after the Construction Drawing approval.

Oil Pollution Control

Cherrywood Solar must comply with oil spill control procedures specified in federal regulations (40 CFR 112) as well as COMAR 26.10.01.12. These regulations are relevant due to the presence of oil in the transformer installed as part of the on-site substation as well as the smaller transformers associated with each inverter.

Water and Sewer

There are no water or sewer requirements since there are no planned on-site operations or maintenance activities once Project construction is completed.

Air Emissions

Because it is a non-combustion process relying on the direct conversion of solar energy into electrical energy, the operation of a solar PV facility does not produce air emissions. Electricity generated by solar PV facilities represents a way of meeting the region's growing demand for electric power without emitting combustion-related air pollutants.

The only sources of emissions from the project will be those associated with construction activities, including site clearing, grading, and the use of construction equipment, which will be for a temporary period.

Cherrywood Solar must comply with the following State regulations intended to minimize air quality impacts during construction activities:

- COMAR 26.11.06.03D — Particulate Matter from Materials Handling and Construction – A person may not cause or permit any material to be handled, transported, or stored, or a building, its appurtenances, or a road to be used, constructed, altered, repaired, or demolished without taking reasonable precautions to prevent particulate matter from becoming airborne.

- COMAR 26.11.06.08 — Nuisance – An installation or premises may not be operated or maintained in such a manner that a nuisance or air pollution is created.

- COMAR 26.11.06.09 — Odors – A person may not cause or permit the discharge into the atmosphere of gases, vapors, or odors beyond the property line in such a manner that a nuisance or air pollution is created.

Local Permits

Cherrywood Solar must obtain approval of its site plan from Caroline County Department of Planning & Codes, demonstrating compliance with relevant portions of the County's Land Use Ordinance that address site planning, floodplain management, sediment and erosion control, and stormwater management. The Applicant is also required to work in close coordination with Caroline County to secure the appropriate and necessary building permits issued by the Caroline County Department of Planning & Codes.

2.4 Decommissioning

In general, the developers of solar PV facilities design their projects for a finite operating life span. Typical land leases for solar projects include lease terms extending between 20 and 30 years. At the end of the project's operating life, the facility's owner must be prepared to dismantle it and remove all components. Whenever solar projects are constructed on agricultural land, the reviewing State agencies recommend that the PSC require the development of robust decommissioning plans to ensure that future landowners can use the parcels for agricultural or other purposes.

To ensure that the State or the County does not become financially responsible for decommissioning (for instance, if Cherrywood Solar or a subsequent purchaser becomes insolvent in the future), Cherrywood Solar must provide a financial guarantee in the form of a bond, letter of credit, or alternative arrangement approved by the PSC and listing the PSC as the obligee. Cherrywood Solar must also provide an estimate of decommissioning costs by a third-party consultant to determine the amount of the decommissioning performance bond, or letter of credit. The cost estimate shall address provisions for the safe removal and proper disposal of all components of the Project, including any components containing hazardous or toxic materials. Every five years, over the life of the Project, Cherrywood Solar is required to prepare an updated estimate of decommissioning costs to adjust for inflation, changes in salvage market conditions, and any other necessary changes. Based on this estimate, the financial guarantee mechanism shall be adjusted to cover the revised estimate of decommissioning.

The reviewing State agencies recommend that the Applicant's decommissioning cost estimate be subject to review and approval as part of the overall decommissioning plan. Salvage value of the panels themselves should not be considered as part of the decommissioning cost estimate. The future value of the panels being installed today, and their component materials, is not well understood and thus a reliable cost estimate is not available. By requiring that updated cost estimates be prepared every five years, the State agencies' recommended license condition would allow Cherrywood Solar or its successors to incorporate salvage value in the future as market conditions change.

<u>Recommended Condition 11 (Solar Decommissioning):</u>

a. At least 30 days prior to the start of construction, Cherrywood Solar shall submit a decommissioning plan to the PSC and PPRP for review. The decommissioning plan shall describe the responsible party(ies), timeframes, and estimated costs for decommissioning,

dismantling, and legal disposal of all components, including cables, wiring, and foundations below and above ground. The plan shall address site conditions after decommissioning, including stabilization, grading and seeding all disturbed areas and evenly distributing topsoil if stockpiled onsite. The plan shall maximize the extent of component recycling and reuse, where practicable, and ensure all materials are handled in accordance with applicable federal, State, county, and local requirements. Cherrywood Solar shall not begin construction until Cherrywood Solar has addressed all written comments from the PSC, PPRP, and Caroline County; the PSC has approved the plan; and all specified financial guaranties are in place. The approved plan, and any updated plans, shall be filed in the PSC docket for Case No. 9477.

b. Cherrywood Solar shall implement a financial mechanism to ensure that decommissioning costs are not borne by the State and/or the County at the end of the useful life of the Project or in the event of abandonment of the Project. The Project will be considered to be abandoned if there is no output from the project to the grid for a period of twelve (12) consecutive months or if the County deems it no longer viable. The financial instrument may be in the form of a surety bond, a letter of credit issued by a financial institution, or other alternative arrangement and must be in place prior to the commencement of construction of the Project. The financial mechanism is subject to the evaluation and approval of the PSC as to the credit-worthiness and financial capabilities of the counter-party(ies).

c. Cherrywood Solar shall develop an estimate of decommissioning costs by a third-party consultant to determine the amount of the decommissioning surety bond, letter of credit, or other alternative arrangement. The cost estimate shall address provisions for the safe removal and proper disposal of all components of the Project, including any components containing hazardous or toxic materials.

d. Over the life of the Project, Cherrywood Solar shall update the decommissioning cost estimate and corresponding bond every five (5) years after the issuance of the CPCN to adjust for inflation and any other necessary changes. The salvage value of the panels may only be included in a five (5) year update as an offset to decommissioning costs if Cherrywood Solar can provide evidence that a recycling market exists for such panels and the value is commercially supported. Cherrywood Solar shall provide the revised cost estimate to the PSC for approval, file the revised cost estimate in the PSC docket for Case No. 9477, and execute an adjustment to the financial guarantee mechanism.

e. Cherrywood Solar shall begin implementation of the approved decommissioning plan within 12 months after the Project ceases to generate electricity for sale. Prior to starting implementation, Cherrywood Solar shall notify the PSC and PPRP of its intent to decommission.

3.0 BIOLOGICAL RESOURCES

The following sections provide a review of the potential environmental effects of the proposed Cherrywood Solar project on biological resources, including vegetation; wildlife; rare, threatened and endangered (RTE) species; and wetlands and streams. Also included is an assessment of the potential biological impacts associated with the interconnection to the Delmarva Power and Light (DPL) transmission system. PPRP based its assessment on information from the Applicant's environmental review document and subsequent data request responses; from publicly available environmental information; from Maryland DNR documents, web pages, and agency communications; and from site visits by PPRP staff and consultants on February 27, 2018 and June 28, 2018.

3.1 Vegetation

According to the Revised Cherrywood Solar Project Environmental Review Document (ERD) dated May 25, 2018 (Attachment C to the Direct Testimony of Dane S. Bauer), the Project Site consists of 1,722.86 acres of level to rolling agricultural fields spread across 18 parcels in Caroline County. Landowners actively farm portions of all of the properties with typical crops including soy, corn, and wheat. While the cultivated areas support little permanent vegetation, the environmental surroundings of the parcels vary, resulting in four distinct groupings of parcels (Figure 3) with significant vegetation and habitat resources. Note that these environmental groupings differ from the three subsections used in the Applicant's Project ERD: The ERD Upper Section is Area A in this report, the ERD Middle Section is Area B, and the ERD Lower Section is split into Areas C and D.

Figure 3 The four areas of the project and associated environmental resources

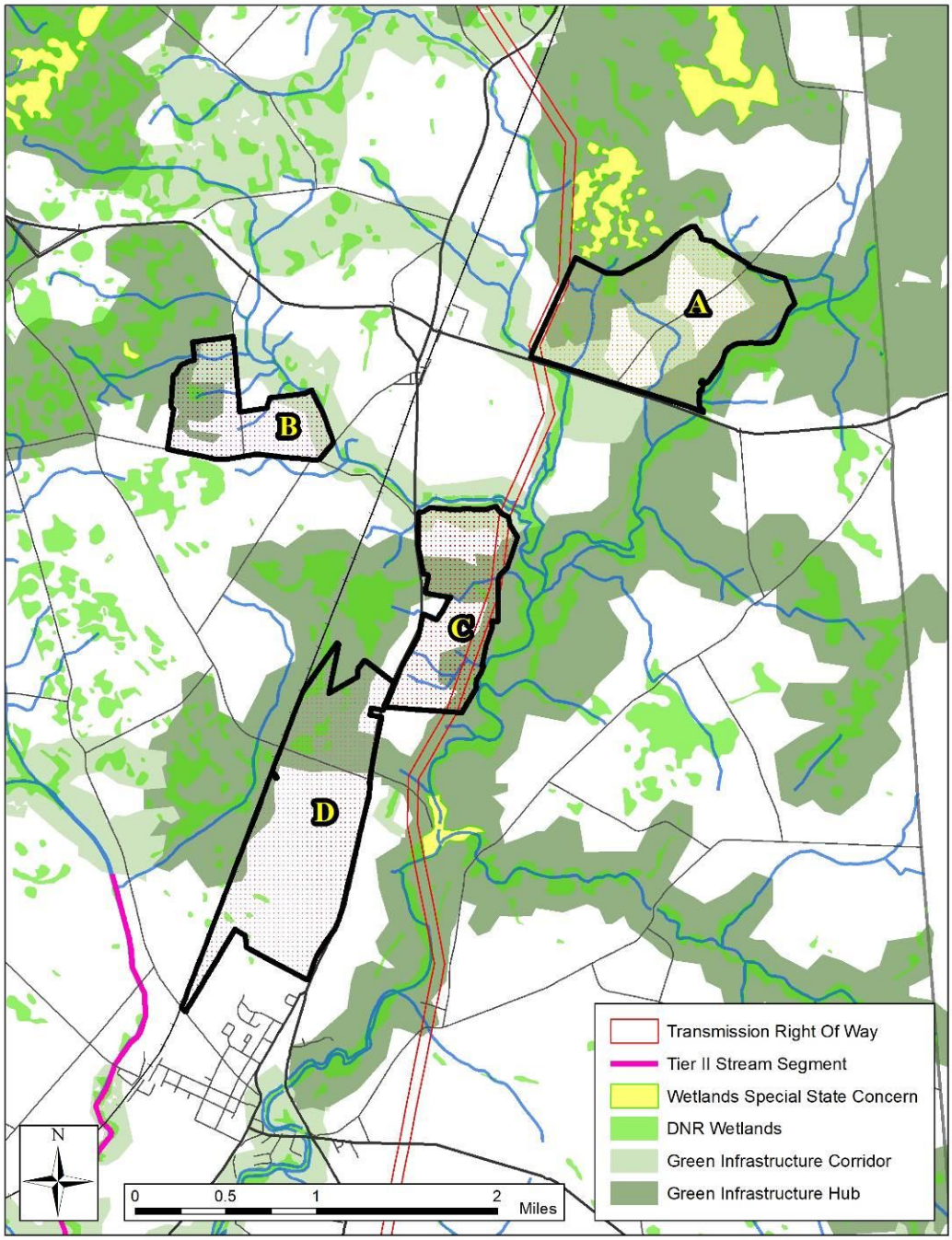


Figure 3 illustrates the four Project areas in relation to Maryland's Green Infrastructure Network. The Maryland Department of Natural Resources developed the Maryland Green Infrastructure Assessment to identify ecologically important lands and define a network of large blocks of intact

forests and wetlands, or hubs, connected by habitat corridors. Maryland's Green Infrastructure represents Maryland's highest priority lands for protection in order to preserve and protect reproducing populations of Maryland's vital forest species[1]. Although the Project ERD characterizes the 18 parcels as agricultural fields, each of the four groupings of parcels contains substantial amounts of natural vegetation and Green Infrastructure areas that contribute to a landscape matrix supporting Forest Interior Dwelling Species (FIDS), RTE species, and high quality habitats for diverse aquatic, terrestrial, and avian populations.

The northernmost set of parcels, Area A, lies north of Sandtown Road. The DPL transmission right of way forms the western perimeter and the Choptank River forms the eastern perimeter. To the northwest of the area is a Green Infrastructure hub containing an extended upland region of forested Wetlands of Special State Concern (WSSC), and directly north of the area along Jackson Lane is The Nature Conservancy's Jackson Lane Preserve[2]. The Preserve is a sensitive area containing rare species and Delmarva Bays that has been the focus of an extensive interagency wetland restoration effort. The drainage along the northern boundary of the project parcels provides an important corridor linking the Green Infrastructure hub that contains the wetlands to the Green Infrastructure area surrounding the Upper Choptank River. The western half of Area A drains to Broadway Branch, another Green Infrastructure corridor that links hubs to the west to the Choptank system.

The Applicant proposes an underground utility connection easement between Area A and Area C. This connection would run just east of and parallel to Broadway Branch between Sandtown Road and Lake Bonnie, and then cross in a southwesterly direction below the lake. The route would intersect nontidal forested wetlands (characterized as palustrine forest broad leaf deciduous seasonal) and an existing Forest Stewardship conservation easement[3]. The horizontal directional drilled (HDD) connection underneath Lake Bonnie would also require borehole pits within a forested wetland area.

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[1] http://dnr.maryland.gov/land/Pages/Green-Infrastructure.aspx

[2] See:
http://www.mde.state.md.us/programs/water/WetlandsandWaterways/AboutWetlands/Pages/jackson_lane.aspx and
https://www.fws.gov/chesapeakebay/newsletter/Spring06/Jackson%20Lane/jacksonlane.htm

[3] See Appendix B – Certification of Forest Management Plan, John and Tammy Merson, Tax Map 11, Parcel 162.

The westernmost set of parcels, Area B, is located approximately one mile southwest of Goldsboro, north of Bridgetown Road and south of Oldtown Branch. On the west, it is adjacent to a large forested wetland complex, and there are mature forest patches on site and along Oldtown Branch and its tributaries. There is a Green Infrastructure corridor along Oldtown Branch that connects the forested wetland complex (a Green Infrastructure hub) to the Choptank River Green Infrastructure hub. The Project interconnection between Area B and Area C runs within the Oldtown Branch Green Infrastructure corridor, which is largely composed of forested wetlands.

Area C, which includes the proposed project substation, lies between Route 313 and the upper Choptank River, south of Oldtown Branch. The eastern border of this area includes the Green Infrastructure hub surrounding the Choptank River and the DPL transmission line ROW. There are two small, forested wetlands in this Area, which are within the Choptank River Green Infrastructure Hub. A Green Infrastructure corridor also runs along Oldtown Branch and the northern boundary of Area C to Lake Bonnie. The Area C parcels drain to the Choptank River, which flows south through forested wetland for about one mile into a WSSC surrounding the confluence with Gravelly Branch. The Chesapeake Bay Critical Area begins at the northern tip of the WSSC, approximately 0.5 mile from the proposed substation location. The Critical Area at this point, including the WSSC and the adjacent County-owned Christian Park[4], is a Resource Conservation Area, in which development is limited to protect Chesapeake Bay.

Area D, located to the west of Route 313 and north of Greensboro, drains to the west through forested wetlands into a Tier II stream known as Forge Branch. There is forested wetland in Area D that is part of an extensive Green Infrastructure hub that connects the Choptank River hub and the WSSC at the confluence with Gravelly Branch to the Green Infrastructure corridor associated with Forge Branch. Wetlands in the southern part of this area include a remnant Delmarva Bay. Delmarva Bays are seasonal isolated depressional wetlands that are unique to the mid-Atlantic region and particularly abundant in the Delmarva Peninsula. They are important for surface water storage and recharge, as well as for the ecosystems that form around them (EPA 2005).

Cherrywood Solar does not propose removing forests or directly disturbing the non-linear wetland features on the Project site.

[4] http://www.carolinemd.org/Facilities/Facility/Details/Christian-Park-8

Cherrywood Solar will, however, remove trees from certain parcels (Map 10 Parcel 11, Map 11 Parcels 5, 7, 58, 135, and 163, and Map 15 Parcel 66). The Project ERD states that "very few" specimen trees may be removed. To construct the necessary access roads across the expansive site, Cherrywood Solar proposes installing 51 reinforced concrete culvert crossings over vegetated linear wetlands and ditches. During the June 2018 site visit, PPRP observed a variety of grasses, shrubs, flowers and seedlings growing in the drainage ditches throughout Area D.

According to Table 2 of Cherrywood Solar's Project ERD, the proposed construction will create 1.6 acres of impervious area, along with approximately 53.5 acres of grass access roads[5]. The Project substation will add approximately 2.1 acres of impervious area[6]. There are approximately 46,000 feet (8.7 miles) of ditches or linear wetland features inside the parcel boundaries, and approximately 20,000 feet (3.8 miles) inside the limit of disturbance[5]. These features can support a more diverse plant community than the open fields used for solar arrays. Local agencies will provide vegetation management for ditches/wetlands designated as Public Drainage Association ditches, as described in Section 3.5. The reviewing State agencies' Recommended Condition 13 will require Cherrywood Solar to apply an Integrated Vegetation Management approach to the remaining ditch and wetland features to achieve improvements in water quality and wildlife habitat.

Using the September 2017 SSURGO Soils Dataset[7] and the Project limit of disturbance (LOD) of 1,217 acres, PPRP determined that approximately 771 acres, or 63% of the LOD, is prime farmland[8]. If uncultivated, this

[5] Calculated from the GIS data provided in response to PPRPDR6-3

[6] Applicant's response to PPRPDR3-7

[7] Accessed August 2018 from NRCS Web Soil Survey
https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

[8] Prime farmland is "land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is also available for these uses. It has the soil quality, growing season, and moisture supply needed to produce economically sustained high yields of crops when treated and managed according to acceptable farming methods, including water management. In general, prime farmlands have an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt and sodium content, and few or no rocks. They are permeable to water and air. Prime farmlands are not excessively erodible or saturated with water for a long period of time, and they either do not flood frequently or are protected from flooding. [SSM, USDA Handbook No. 18, October 1993]" Extracted from

portion of the site could support a wide variety of vegetation cover types and productive ecosystems similar to those described above.

Cherrywood Solar expects that, as designed, the elevated solar panel system will permit permanent vegetation to grow under the panels so that the fields will become largely vegetated. The Project includes planting and maintaining the entire site during the operational lifetime of the project in a low-height cover grass in accordance with plans as approved by local agencies. During construction, as part of its Sediment and Erosion Control and Stormwater Management Plans, the Applicant will develop a stormwater pollution prevention plan, implement BMPs, and reseed disturbed areas. Cherrywood Solar proposes to use a low-maintenance native seed mix that provides low growth for the vegetation beneath and around the arrays when possible, with the objective of controlling erosion and promoting stormwater infiltration under and between the panels. PPRP notes that achieving effective stormwater infiltration will be dependent on avoiding soil compaction during construction, or re-loosening compacted areas before planting the cover grass (see further discussion in Section 3.5).

Cherrywood Solar has not yet developed an operational grounds maintenance plan; Recommended Condition 13 addresses the requirements for developing such a plan. Regular vegetation management will likely be required to control undesirable plant species, keep the panels from being shaded, and maintain reliable access for operations, maintenance, and emergency response purposes. The Applicant proposes planting native grasses to create a community of low-growth and low-maintenance vegetation, that is recommended by the Caroline County Soil Conservation District Office. Additionally, the Applicant proposes planting wild flowers to promote pollinator habitat. Once this vegetation community is established, minimal mowing will occur to maintain the grass height below the bottom edge of the panels and to prevent grass from obscuring notices or disconnects that require view and access by first responders.

In PPRP's view, the most beneficial ecological result is achieved when vegetation is not mowed at any time to a height less than 10 inches and mowing is restricted during the nesting season of ground nesting birds (May through August). Grass heights lower than 8 inches discourage nesting by desirable birds (WHS 2017), and may also damage or kill warm

http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/nra/nri/?&cid=nrcs143_014052 on 11/1/16.

season grasses (KYDFWR 2017). A self-sustaining, low-growing vegetation community that requires little if any mowing and provides wildlife and pollinator habitat can be achieved using a native seed mix and an integrated vegetation management (IVM) approach. Applying an IVM approach to the maintenance of the buffers for the wetland, stream, ditch, and 100-year floodplain areas that occur on the site is particularly important to protect these resources and maintain refuge habitat for species sensitive to mowing.

The physical presence of the solar panels may change the heat and moisture balances in the fields and affect on-site and nearby vegetation. This effect is discussed further in Section 3.6.

Recommended Condition 13 (Vegetation Management):

The area of the Project site beneath and between the solar panels shall be planted and established with native, warm season grasses and low-growing pollinator-friendly plant species. Further, Cherrywood Solar shall, prior to commencement of Project construction, develop and submit to PPRP for review a grounds management plan that includes the following:

a. Description of grasses and plant species to be maintained at the site;

b. Schedule for mowing that avoids or minimizes mowing activities during the nesting season of most ground-nesting birds (i.e., May through August);

c. Restriction of grass mowing height at all times to not less than 10 inches except in areas where this would present a fire hazard or impede required access to equipment;

d. Protocol for managing invasive plant species, consistent with Caroline County regulations;

e. Plan for avoiding or minimizing the use of herbicides or pesticides at the Project site, including specific conditions under which such substances will be used. Herbicides or pesticides shall be EPA-registered at the time of application and shall only be applied in accordance with label recommendations, applicable law, and landowner requirements;

f. An Integrated Vegetation Management (IVM) approach for creating and maintaining 35-foot-wide buffer areas on either side of the streams and drainage ditches that run through the properties as self-sustaining, low-growing vegetation communities that require

little if any mowing and provide wildlife and pollinator habitat; and

g. Promotion of natural revegetation of the areas to the east of the Delmarva Power transmission line ROW on Map 15 Parcel 66 and Map 11 Parcel 51, which will not be used for solar panels, by eliminating all mowing and other vegetation management activities.

3.2 Forest Conservation

In 2013, the General Assembly established that it is the policy of the State to achieve no net loss of forest[9]. The term "no net loss of forest" means that 40% of all land in Maryland is covered by tree canopy (Natural Resources Article, Section 5-101(i)). That is, the statewide total of forest losses and gains must be balanced to maintain the 40% cover objective. The Forest Conservation Act (FCA; Natural Resources Article 5-1601 through 5-1613) provides the mechanism for distributing those losses and gains among development projects to achieve the net balance. An individual project, such as the Cherrywood Solar project, is not evaluated directly against the no net loss standard. The FCA establishes specific forest cover thresholds for land development that make the identification and protection of forests and other sensitive areas an integral part of the site planning process. The FCA provides a set of *minimum* criteria for developers to follow when designing a new project.

The FCA applies two tests to determine the amount of forest cover that a project must establish, replant, or retain to contribute to the statewide no net loss goal. The first test is based on a minimum forest cover percentage for each land use type, called the Afforestation Threshold. Post construction, the FCA requires that the project meet the Afforestation Threshold (preferably on site) even if no trees are cut or removed. In the second test, the FCA requires that the developer replace any existing trees/forest that it removes, either on the development site or at another acceptable location. Forest losses between the Afforestation Threshold and the Forest Conservation Threshold (an equal or higher forest cover percentage) require 2:1 replacement, while losses above the Forest Conservation Threshold may be replaced at a lower (1:4) ratio (NRA 5-1606(b)). Depending on the land use type, zoning, initial forest cover of a

[9] p. 14, Forest Conservation Act and Other Forestry Programs in Maryland. Department Of Legislative Services, Office of Policy Analysis, Maryland General Assembly, November 2017. http://dls.maryland.gov/pubs/prod/NatRes/Forest-Conservation-Act-and-Other-Forestry-Programs-in-Maryland.pdf

project site, and the amount of forest retained, some projects will contribute more than the no net loss 40% cover percentage and some less. The state achieves the overall statewide goal of 40% forest cover using both afforestation and replacement/reforestation rules across many projects; the "no-net-loss" policy cannot be applied on an individual project basis.[10]

In general, County and municipal governments are responsible for making sure that the State's Forest Conservation standards are met through local ordinances, but may choose to implement more stringent criteria than required by the FCA. In CPCN cases, however, Section 5-1603(f) of the Natural Resources Article instructs the PSC to make an appropriate determination about afforestation and reforestation under the provisions of the State FCA:

> After December 31, 1992, the Public Service Commission shall give due consideration to the need to minimize the loss of forest and the provisions for afforestation and reforestation set forth in this subtitle together with all applicable electrical safety codes, when reviewing applications for a certificate of public convenience and necessity issued pursuant to § 7–204, § 7–205, § 7–207, or § 7–208 of the Public Utilities Article.

Through this process, the PSC can give the appropriate weight to State forest conservation policy and regulations, local jurisdictional preferences, and the specialized nature of electrical power facilities in determining the developer's FCA obligations.

Caroline County has deferred to the PSC evaluation for the Cherrywood Solar Project, stating that the Applicant will be exempt from the local FCA regulations if the PSC issues a CPCN in accordance with the State FCA under NRA 5-1603(f) (Letter from K. Freeman to R. Showalter, May 30, 2018; see Appendix C). The County, therefore, did not perform or require an evaluation of the FCA mitigation requirements, noting only the Applicant's intent to avoid forest removal. As a result, Cherrywood Solar has not yet prepared a complete Forest Stand Delineation and Forest Conservation Plan.

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[10] The Applicant's ERD, page 15, errs in stating that there is a "statutory exemption" in the Forest Conservation Act for facilities that satisfy a "no net loss" criterion. The term "no net loss" does not appear in the FCA (NRA 5-1601 through 5-1613) and, as explained above, this statewide policy goal does not apply to individual parcels or projects.

PPRP has been unable to verify the accuracy of the forest area estimates provided by the Applicant because the "Simplified Forest Stand Delineation" included in the Project ERD is based on an inadequate web-source map of unknown vintage and lacks appropriate methodological discussion, data source documentation, or clear parcel-by-parcel summary forest statistics. The material supplied does not meet the statutory standard for FCA mitigation evaluation. Therefore, PPRP independently compiled and analyzed the most current and accurate spatial data available from State of Maryland and other reliable sources to estimate the actual forest present and calculate the afforestation requirement[11]. Using the standard state FCA calculations methods and thresholds, this analysis determined that 87.00 acres of afforestation would be required to increase the existing forest on the parcels (246 acres, or 14.7%) to the Afforestation Threshold of 333 acres, or 20% forest cover (Appendix D).

The State FCA includes a preferred mitigation sequence that emphasizes *on-site* afforestation and reforestation. The highest priority areas for afforestation or reforestation are establishing or enhancing buffers adjacent to intermittent and perennial streams, establishing or increasing forest corridors, and establishing or enhancing forest buffers adjacent to critical habitats or on 100-year floodplains (NRA 5-1607(d)). In evaluating the forest resources and State FCA afforestation requirement, PPRP has identified numerous opportunities for afforestation, reforestation, and conservation on the project parcels that meet these criteria[12]. For example, since Cherrywood Solar will not use the cleared lands between the DPL Transmission Line ROW and the Choptank River for solar panels, they could reforest that area and place it in conservation easements to enhance the valuable habitat and natural resources of the Choptank Green Infrastructure corridor. There are at least 30 acres available on-site for this kind of "in-fill" afforestation. There are an additional 14 acres of onsite afforestation available if Cherrywood Solar cooperates with Delmarva Power to plant the western 100-foot-wide portion of the DPL ROW within their parcels in which utility vegetation management is discontinued under Condition 12(a) of Order 87156 issued in CPCN Case No. 9367[13].

[11] PPRP obtained the following datasets in August 2018: Chesapeake Conservancy High Resolution Land Cover Dataset; MD IMAP Aerial imagery; Tax Map Parcel Boundaries. The calculated area of the 18 Project parcels was 1665 acres. PPRP manually estimated approximately 246 acres of existing forest on the Project parcels. See Appendix D.

[12] See Appendix E

[13] Included as Appendix F

The purpose of this Condition was to achieve reforestation of the unused portion of the ROW.

PPRP's evaluation has not identified any unusual burden that meeting FCA afforestation/reforestation requirements would place on the Applicant, nor any peculiarity of the facility compared to other solar facilities that would prohibit meeting these requirements. Further, PPRP has determined that there are significant natural resource areas onsite, including designated Green Infrastructure areas, that Cherrywood Solar could enhance with minimal impact to the Project to achieve the forest conservation goals. If appropriately located, these enhancements would be synergistic with previous PSC conditions (in Case 9367) directing that utility vegetation management should cease in some areas of the Project site to encourage reforestation and protect the State's valuable natural resources.

The Applicant has proposed that 29.92 acres of landscape buffers be used to address the State's FCA requirements. The DNR Forest Service has agreed that this amount constitutes an acceptable contribution to the State's "no net loss of forest" afforestation goals. The reviewing State agencies' Recommended Condition 12 will require Cherrywood Solar to develop an on-the-ground Forest Stand Delineation and to submit a Forest Conservation Plan with final details, for review and approval by the Maryland Department of Natural Resources Forest Service. In addition, to meet the mitigation priorities of the FCA, the reviewing State agencies recommend that approximately 20 acres of existing forest areas on the properties owned by the Applicant be placed into conservation easements and be maintained in perpetuity as forests as defined by statue (NRA 5-1601(k)).

<u>Recommended Condition 12 (Forest Conservation):</u>

To satisfy Forest Conservation Act requirements for development, Cherrywood Solar shall develop and implement a forest planting plan that includes not less than 29.92 acres of forest planting and landscape buffers.

a. Prior to the start of construction, Cherrywood Solar shall prepare and submit to Maryland DNR for review and approval a Forest Stand Delineation as described by NRA 5-1604 and a Forest Conservation Plan as described by NRA 5-1605, notwithstanding Caroline County's position that no afforestation mitigation is required to meet County requirements.
b. Within 5 years of planting, all areas to be counted toward the 29.92 acres shall meet the statutory definition of forest in NRA 5-1601.k.

c. To the maximum extent practicable, the planted areas shall connect with existing forests, provide corridors between existing forest patches, and provide buffers between developed areas of the project parcels and streams, ditches, and wetlands.

d. For a period of 5 years subsequent to the planting of the forest areas, Cherrywood Solar shall maintain these areas free of invasive species and shall monitor them to ensure survival of the plantings. During this period, the areas shall be restocked annually to the planned stem density to compensate for seedling mortality.

e. During the 5-year monitoring period, annual monitoring reports - including the number of dead trees replaced with new plantings; statistical estimates of live stem density, average stem diameter, average height, and biomass; and a professional assessment of the general condition of the trees - shall be provided to the DNR Forest Service and PPRP.

f. The existing forest areas on parcels that are purchased and owned by Cherrywood Solar or its successors, specifically including approximately 20.21 acres of forest located on parcels that are adjacent to the Choptank River (Map 15 Parcel 66 and Map 11 Parcel 51), shall be placed in permanent Forest Conservation easements approved by DNR.

3.3 Wildlife

The proposed Cherrywood Solar Project site occupies 18 property parcels that contain a diverse array of wildlife habitats. Although the farmed areas of the site are intensively managed, limiting nesting by birds or direct occupancy by other wildlife, they provide valuable open space and forage areas for birds and mammals such as deer, skunks, foxes that make their homes in the adjacent stream, forest, and wetland areas. The numerous drainage ditches and wetlands across the Project site also provide habitat for a variety of wildlife such as frogs, turtles, snakes, and gophers. Surrounding the project site are Tier II streams, Wetlands of Special State Concern, and other stream reaches in the Upper Choptank Stronghold watershed that provide abundant permanent wildlife habitat, including habitat for Federally-listed endangered species. Stronghold Watersheds are defined by DNR as locations with high biodiversity and likely to contain rare and endangered fish, amphibians, reptiles and mussels[14].

[14] https://dnr.maryland.gov/streams/Pages/streamhealth/Maryland-Stronghold-Watersheds.aspx

The Wildlife and Heritage Service (WHS) Response Letter provided as Appendix 14 in the Applicant's Testimony states that FIDS habitat exists in the forests throughout the Project site. Similarly, the Forest Stewardship Plan for Map 11 Parcel 162 shows potential Forest Interior Dwelling Species (FIDS) habitat surrounding Lake Bonnie, near the proposed underground directional drill to connect the Upper and Lower Sections of the Cherrywood Project. The Forest Stewardship Plan also indicates that a Bald Eagle nest is present, but does not confirm the location relative to the proposed interconnection construction activities[15]. The Applicant has not performed a raptor survey, which would normally be required before construction in areas of raptor habitat. However, in the environmental review for the Church-Steele Transmission Line Rebuild (CPCN Case 9367), Delmarva Power performed a raptor survey that found raptor nests near the Cherrywood Solar Project. The area is located in the seasonal bird migration route known as the Atlantic Flyway and contains important bird habitat that supports both resident birds and transients. The Myrtle Simon Pelot bird sanctuary is located across the Choptank River in the Red Bridges area[16].

Given the size of its footprint, the proposed Project could result in both temporary and long-term changes to the ecosystem including the associated wildlife. While there is agreement that covering the land with structures, breaking up open areas with fencing, changing vegetation types, and disturbing soils will have an impact on wildlife, there is limited research available on these impacts, particularly with respect to utility scale conversion of farmland (Turney and Fthenakis 2011). Harrison *et al.* (2016) found "No peer reviewed experimental scientific evidence exists relating solely to the ecological impacts of solar PV developments." Therefore, without a site-specific study of the wildlife and ecosystem before conversion, it is not possible to quantify the likely impacts or determine whether they will be beneficial or detrimental. In the case of Cherrywood Solar, an abundance of caution is necessary because of the presence of nearby wildlife habitats that support sensitive species.

The Project will cause significant changes in open space, forage availability, water retention, and runoff. At a minimum, wildlife usage that is displaced to nearby agricultural fields will increase competition for

[15] The U.S. FWS provides management guidelines and conservation measures for nesting Bald Eagles. https://www.fws.gov/northeast/ecologicalservices/eagleguidelines/constructionnesting.html . Accessed August 2018.

[16] https://mdbirds.org/conservation/refuges-sanctuaries/pelot/

those resources. The reduced amount of open farmland in the local area will be less able to support the existing wildlife populations, and population sizes may decrease if the farmland is a limiting resource. There may also be changes in the species present because of the habitat changes resulting from converting farmland to a solar facility. For example, birds adapted to the narrower, fragmented spaces offered by arrays of solar panels may replace birds that hunt over large open spaces. Border fences may hinder terrestrial species that use open spaces for travel. Aquatic and amphibious species that use the stream and wetland habitat within and adjacent to the Project boundaries may not be directly affected, but construction noise, inverter operation noise, runoff, fugitive dust, and changes in hydrology could have detrimental impacts on these species.

The Project ERD states that the Applicant will plant and maintain the site in low cover grasses with wild flower seed mixes to promote pollinator habitat. PPRP recognizes that this proposed development approach provides benefits to wildlife, with little cost to the project. Following the installation of the solar panel arrays, the Applicant must plant areas below and between the solar panels with native, warm season grasses and low-growing pollinator-friendly plant species, to encourage ground-nesting birds and pollinators. Suitable pollinator habitats consist of native herbaceous plants that attract a variety of pollinator species (e.g., Bee Balm, Butterfly Milkweed, Black-eyed Susan, Joe-Pye Weed). Although warm season grasses may take longer to establish, they offer a number of ecological benefits including strong root systems that hold soil in place and act as a filter of stormwater runoff by removing sediment. They remain standing throughout the winter, thereby providing cover for wildlife.

Maintaining a minimum vegetation height of 10 inches and eliminating mowing during the nesting season of ground-nesting birds (from the beginning of May through August of each year) will attract and support wildlife communities. Grass heights lower than 8 inches discourage nesting by desirable birds (WHS 2017), and may also damage or kill warm season grasses (KYDFWR 2017). These grass heights are generally achievable on all parts of a solar facility (including under the solar panels, which do not come closer to the ground than 24 inches at the lower edge) using commercially available mowing equipment. In addition, PPRP encourages Cherrywood Solar to adopt the pollinator friendly criteria established in Senate Bill 1158, passed in Maryland's 2017 legislative session, and pursue future designation by DNR as a "pollinator friendly" solar facility.

There are numerous non-linear wetland areas on the site inside the limits of disturbance, totaling approximately 5.16 acres. The Applicant proposes placing these wetlands and an associated 35-foot buffer aside, which will protect 11.76 acres of currently farmed wetlands, improve wetland habitats, and likely support additional wildlife.

There are also approximately 20,000 feet (3.8 miles) of ditches or linear wetland features inside the limit of disturbance, and an additional approximately 25,900 feet (4.9 miles) inside the parcel boundaries. Vegetation on these buffers could provide over 70 acres of quality wildlife habitat and passageways if maintained for that purpose using Integrated Vegetation Management (IVM) Protocols[17], with limited if any mowing.

3.4 Rare, Threatened, and Endangered (RTE) Species

The Applicant has not coordinated with the U.S. Fish and Wildlife Service (FWS) regarding federally endangered species on the Project site. The FWS Environmental Conservation Online System[18] reports that there are two endangered species in Caroline County (Dwarf wedge mussel and Canby's dropwort). PPRP conducted an online check for endangered species using the FWS tool called Information for Planning and Conservation (IPaC)[19], which did not report federally endangered species on the Project parcels.

The Maryland Department of Natural Resources Wildlife and Heritage Service (WHS) provided reviews of all the parcels included in the Cherrywood Project. Two letters from L. Byrne to D. Bauer dated 11/30/2017 and 5/24/2018 identified several areas of potential concern.

The Upper Section (Area A) resides in the drainage area of the Crescent macrosite, a nontidal wetland complex that supports the following State listed plants: *Fimbristylis perpusilla* (endangered), *Hypericum denticulatum* (threatened), *Eleocharis melanocarpa* (endangered), and *Hottonia inflata* (endangered). WHS suggests that Cherrywood Solar plan its construction and operation to avoid any adverse impacts to surrounding hydrology or water quality in order to protect these species.

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[17] See, for example, *Best Management Practices: Integrated Vegetation Management (IVM) on Electric Utility Rights-of-Way* (R. Miller, International Society of Arboriculture, 2007)

[18] Accessed August 2018. https://ecos.fws.gov/ecp/

[19] Accessed August 2018. https://www.fws.gov/southeast/conservation-tools/information-for-planning-and-consultation/

The Middle Section (Area B) contains no known populations of RTE species within the limits of construction. The Lower Section (Areas C and D) is in close proximity to records of state endangered plants (*Echinodorus cordifolius*), state rare insects (*Calopteryx dimidiate* and *Enallagma weewa*), and state endangered mussel Triangle Floater (*Alasmidonta undulata*).

A portion of the Lower Section (Area D) drains westward to a Tier II segment of Forge Branch, while the remainder of the Cherrywood Solar Project Site (Upper, Middle and Lower Sections) drains to the Upper Choptank River upstream of a Wetland of Special State Concern (WSSC). This WSSC is at the confluence with Gravelly Branch, less than a mile from the proposed substation location. This portion of the Upper Choptank River contains the state endangered mussel Triangle Floater (*Alasmidonta undulata*). WHS performed a more detailed assessment of the WSSC and the Upper Choptank River south of Lake Bonnie for Delmarva Power's Church-Steele Transmission Line rebuild in a letter dated February 5, 2014 [20]. Portions of this transmission line ROW, including the location of the Project interconnection to the regional bulk transmission network, are adjacent to or included in the Project parcels (see section 3.7 for details). In this letter, WHS noted that this area supports the federally endangered Dwarf Wedge Mussel (*Alasmidonta heterodon*), as well as state endangered plants (*Trachelospermum difforme* and *Echinodorus cordifolius*).

The dwarf wedge mussel is an extremely rare freshwater species found only in Maryland, New England, and North Carolina. It has very specific habitat requirements, including a stable, silt-free streambed and well-oxygenated water free of pollutants. The mussel serves as an indicator species, as it is extremely intolerant to water quality pollution. The presence of this mussel in streams is indicative of extremely high water quality. The Triangle Floater mussel is similarly susceptible to siltation and changes in water quality. Freshwater mussels are filter feeders, and require a fish host for their life cycles, so it is crucial to maintain water quality and hydrology in their habitats and watersheds.

The proposed construction of the Cherrywood Solar facility would occur upstream of known populations of the listed species mentioned above,

[20] Included in Appendix G. Maryland Department of Natural Resources, Wildlife Heritage Service. Letter to Delmarva Power Environmental Planning. February 5, 2014. Environmental Review for Pepco Holdings, Inc. – Church Substation (Millington) to Steele Substation (Denton) Transmission Line Project, Existing 138kV Line rebuild with 230kV Line, Queen Anne's and Caroline Counties, Maryland.

and sediment or contaminants discharged from the site could affect sensitive locations downstream via tributary streams, ditches, and surrounding wetland areas. The challenge to the project will be to protect the water quality through strict sediment and erosion control BMPs.

Additionally, although agricultural fields in general do not provide habitat for RTE plant species, associated small streams and drainage ditches may still provide such habitat. As noted in the WHS letters, any nontidal wetlands present could be potential habitat for several of the species described above. Given the extensive stream/ditch drainage system, the abundant sensitive resources surrounding the site, and the known presence of several RTE species, vigilance is necessary during all activities. If any additional RTE species are identified prior to or during construction, the Applicant should coordinate with WHS to institute appropriate avoidance and/or minimization measures.

Recommended Condition 14 (Rare, Threatened, or Endangered Species):

Cherrywood Solar shall minimize construction disturbance to all rare, threatened, endangered (RTE), or disturbance-sensitive species that may be present in or adjacent to the Project area, including the use of fencing around known habitat areas, restricting construction during breeding or growing seasons, and implementing a third-party environmental monitoring program during construction activities, reporting to DNR Wildlife and Heritage Service (WHS).

a. All direct disturbance to or indirect effects on the streams and wetlands of the Upper Choptank River system and the Crescent macrosite, which have been identified by DNR WHS as being known habitat for Federally-listed RTE species (*Alasmidonta heterodon*) and State-listed RTE species (*Alasmidonta undulata*, *Echinodorus cordifolius*, and several others), shall be avoided or minimized to the maximum extent practicable.

b. Prior to construction, Cherrywood Solar shall conduct a raptor nest survey and notify and consult with the US Fish and Wildlife Service to determine appropriate mitigation if any raptor nests are found. Construction activities that would cause disturbance or disruption to DNR-designated Forest Interior Dwelling Species (FIDS) areas adjacent to the Project site or interconnection routes, raptor nests, or ground-dwelling birds within the Project site shall be avoided to the maximum extent practicable during the breeding seasons for these species.

c. Cherrywood Solar shall notify and consult with the Maryland Department of Natural Resources, Wildlife and Heritage Service to determine appropriate actions if any additional rare, threatened, or

endangered species are encountered during planning, construction, operation, or maintenance of this facility.

3.5 Wetlands and Streams

The Cherrywood Solar site is located in the Choptank River Watershed within the Upper Eastern Shore Tributary Basin. The site contains numerous wetland areas, and neighbors several areas of environmental importance including the Chesapeake Bay Critical Area, the Jackson Lane Wetlands of Special State Concern, a Tier II Segment of Forge Branch, and Maryland DNR Stronghold Watersheds.

According to the Project ERD, the surface topography of the site is mostly flat with zero to five percent slopes. However, the slopes on the Project parcels outside of the Project LOD are variable, with elevation changes of 20 feet or more and slopes up to 20% where the fields roll off to the Choptank River valley. The majority of the soils on site are classified as moderate to well-drained, although there is a large percentage of the site that is poorly drained. These poorly drained areas were made farmable using subsurface drain tiles, drainage ditches, and Public Drainage Association ditches (PDAs).

MDE regulates the streams that drain the site as Use I waters[21]. Use I waters are designated for water contact recreation and protection of nontidal warmwater aquatic life and may be used for agricultural or industrial water supply[22]. The Applicant proposes a 35-foot buffer around all stream, wetland, and ditch features identified on the Project site. The Applicant has entered into an agreement with the Caroline County Soil Conservation District regarding easements, maintenance, and access for these PDAs (response to PPRP DR2-2).

Cherrywood Upper Section

The Upper Section (Area A) of the Cherrywood Project includes seven parcels with approximately 295 acres in the limit of construction. The northern and eastern portions of this section drain eastward directly into

[21] COMAR 26.08.02.08 and http://mde.maryland.gov/programs/Water/TMDL/WaterQualityStandards/Pages/DesignatedUsesMaps.aspx.

[22] COMAR 26.08.02.02

the Choptank River, a DNR Stronghold watershed[23]. The southwestern portion of the Upper Section drains south into Broadway Branch, then into Lake Bonnie. Figure 4 illustrates the environmental features in and surrounding this Section.

As with many agricultural fields in the area, a network of subsurface drainage tiles and surface drainage ditches draw water off the western portion of the Upper Section. There are six proposed wetland crossings, three of which are PDAs, and one additional ditch crossing. There are approximately 2,374 feet (0.45 mile) of ditches or linear wetland features inside the limit of disturbance. There are several forested wetland areas in the parcels of the Upper Section, but outside the fence line. There are two wetland areas inside the limit of disturbance with a total area of approximately 0.56 acres. The Applicant proposes to protect all wetland areas and ditches with 35-foot buffers.

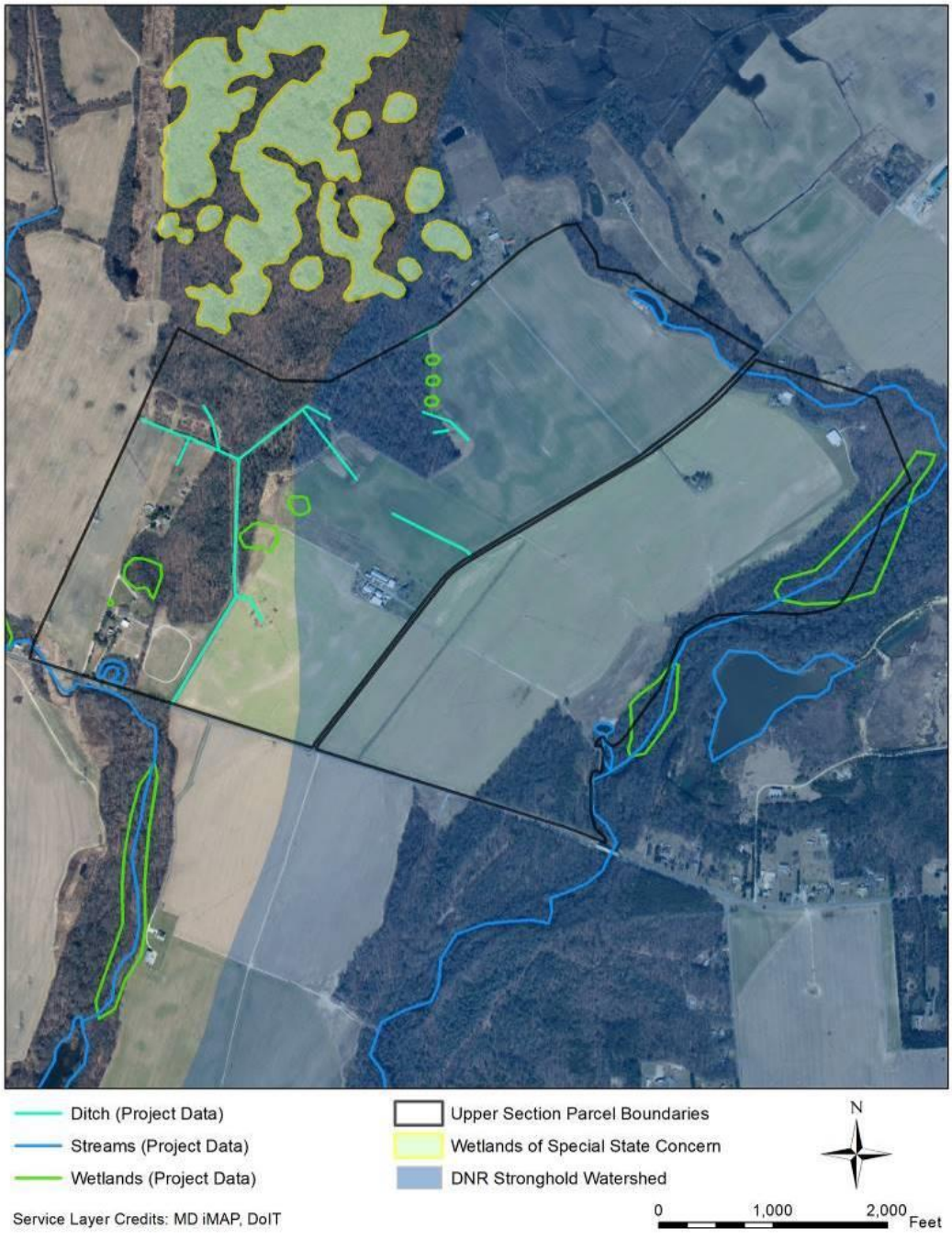
The parcels in the Upper Section drain into a nontidal wetland complex known as the Crescent macrosite (see Section 3.4) and are immediately adjacent to a Wetland of Special State Concern. The Jackson Lane Preserve is located approximately one mile to the north. In Maryland, certain wetlands that support rare, threatened, or endangered species or unique habitat receive special attention. COMAR 26.23.06.01 and .02 identifies these Wetlands of Special State Concern and affords them certain protections from development, including a 100-foot-wide buffer zone. The Jackson Lane Preserve wetland mitigation site receives exceptionally high scores from MDE[24] and supports several rare plants and animals[25]. The Cherrywood Solar Project does not encroach on the 100-foot buffer for this area, and PPRP does not expect that the Project will disrupt the hydrology of the Preserve.

[23] Stronghold Watersheds are defined by DNR as locations with high biodiversity and likely to contain rare and endangered fish, amphibians, reptiles and mussels.

[24] https://mde.maryland.gov/programs/Water/WetlandsandWaterways/AboutWetlands/Pages/jackson_lane.aspx

[25] https://www.fws.gov/chesapeakebay/newsletter/Spring06/Jackson%20Lane/jacksonlane.htm

Figure 4 Environmental features (wetlands and streams) in Area A of Cherrywood Solar Site



The Applicant has proposed an underground horizontal directional drilling (HDD) connection between the Upper and Lower sections of the Cherrywood Project. This connection will run parallel to Broadway Branch in a forested wetland area, and then cross underneath Lake Bonnie, a jurisdictional wetland. The HDD technique always has the

potential for an inadvertent release of drilling fluids into such wetland areas; Section 3.7 discusses this matter further.

Cherrywood Middle Section

The Middle Section of the Cherrywood Project (Area B) includes three parcels with approximately 149 acres in the limit of construction. This section drains into Oldtown Branch, which feeds into Lake Bonnie.

According to the Project ERD and the Caroline County SSURGO Soils Data, the soils in the Middle Section are not as well drained, and are generally more hydric, than the soils in the Upper Section. PPRP analysis[26] indicated that approximately 58 acres (or 32% of the approximately 180-acre LOD) is "poorly drained" or "very poorly drained", with a hydric rating greater than 80%. These classifications reflect the high number of drainage ditches and three PDAs running through the parcels. There are sixteen proposed stream and wetland crossings, five of which are over PDAs. There are approximately 5,560 feet (1.05 miles) of ditches, streams or linear wetland features inside the limit of disturbance. The Middle Section contains two wetland areas inside the limits of disturbance, totaling approximately 0.23 acres. The Applicant proposes to protect all wetland areas and ditches with 35-foot buffers.

An underground connection between the Middle and Lower sections of the project runs parallel to Oldtown Branch on the north side of Bridgetown Road. This portion of Oldtown Branch forms the core of a Green Infrastructure corridor that consists primarily of forested wetland habitat.

Cherrywood Lower Section

The Lower Section of the Cherrywood Project is the largest of the three sections and includes seven parcels with approximately 628 acres in the limit of construction. The portions to the east of Greensboro Rd (Area C) drain into the Choptank River. The majority of the remaining parcels (Area D) drain west into Forge Branch. Only one parcel in this section

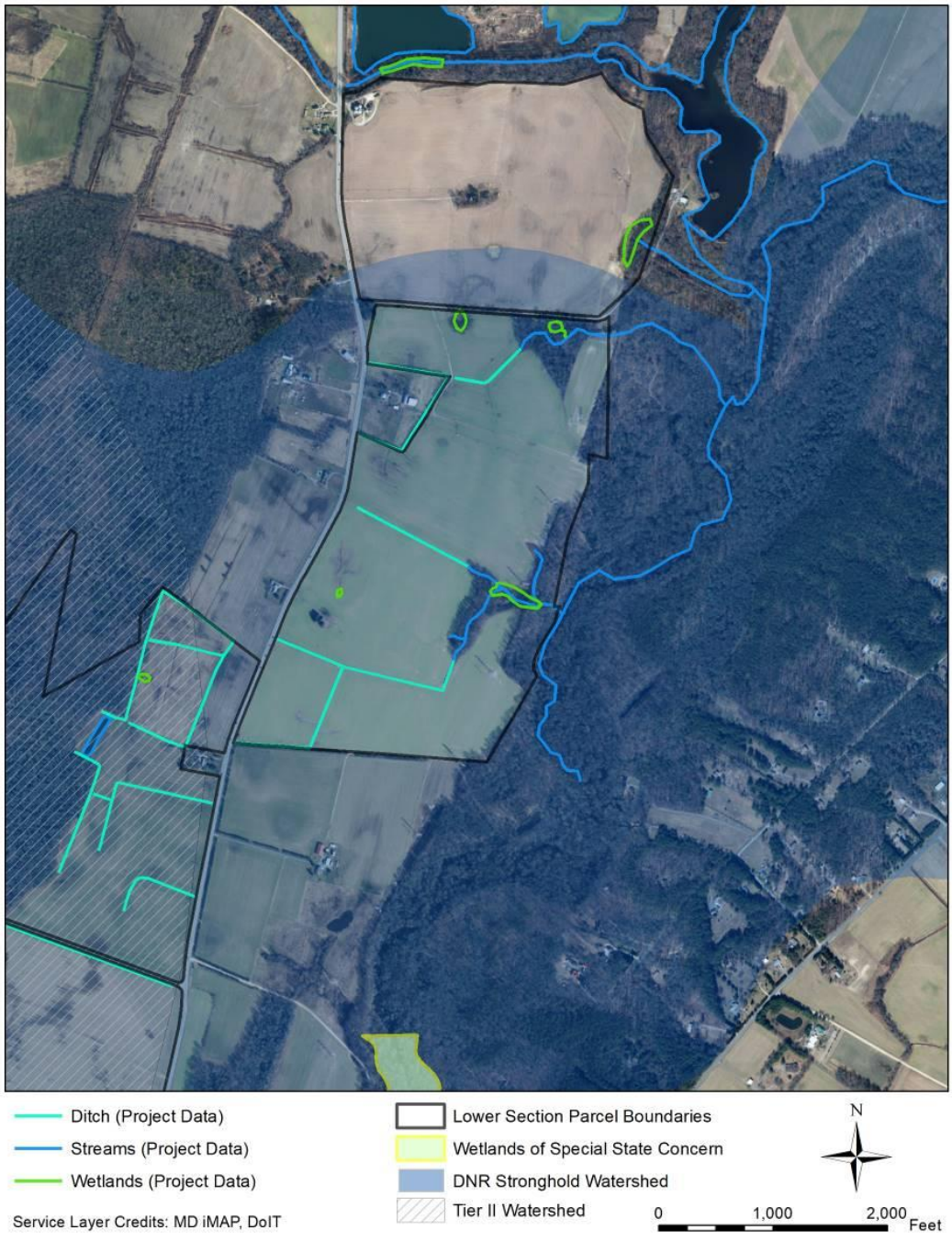
[26] The September 2017 Caroline County Soil Survey data were extracted from the NRCS Web Soil Survey, intersected with the Project Limit of Disturbance (provided in response to PPRPDR6-3), and analyzed for various properties using the NRCS Soil Data Viewer ESRI Add-In with an Aggregation Method of "Dominant Condition".

(Map 11, Parcel 7) is outside the DNR Stronghold watershed area for the Choptank River, as shown in Figure 5.

Soils in this Section span from poorly drained to moderately well drained, with several soil components meeting hydric criteria. Approximately 175 acres (or 25% of the approximately 708-acre LOD) is "poorly drained" or "very poorly drained", with a hydric rating greater than 75%. There are many wetland ditches, but no PDAs in this Section. The Applicant defines at least 28 culvert crossings (response to PPRP DR3-1). There are approximately 13,890 feet (2.63 miles) of ditches or linear wetland features inside the limit of disturbance. The Lower Section also contains several non-linear wetland areas inside the limits of disturbance, totaling approximately 4.3 acres.

The proposed Project substation and collection yard are located in Area C in the Lower Section of the Cherrywood Site, along the western edge of a Delmarva Power and Light transmission line right-of-way (ROW). The ROW contains two transmission lines – the recently rebuilt Church-Steele 138-kV line and the Keeney-Steele 230-kV line on separate structures. This area drains immediately into the Choptank River, approximately ½ mile upstream from a Wetland of Special State Concern at the confluence of Gravelly Branch and the Choptank River. Runoff with sediment or contaminants would travel unimpeded into these environmentally sensitive areas.

Figure 5 Environmental features (wetlands and streams) in Area C of Cherrywood Site

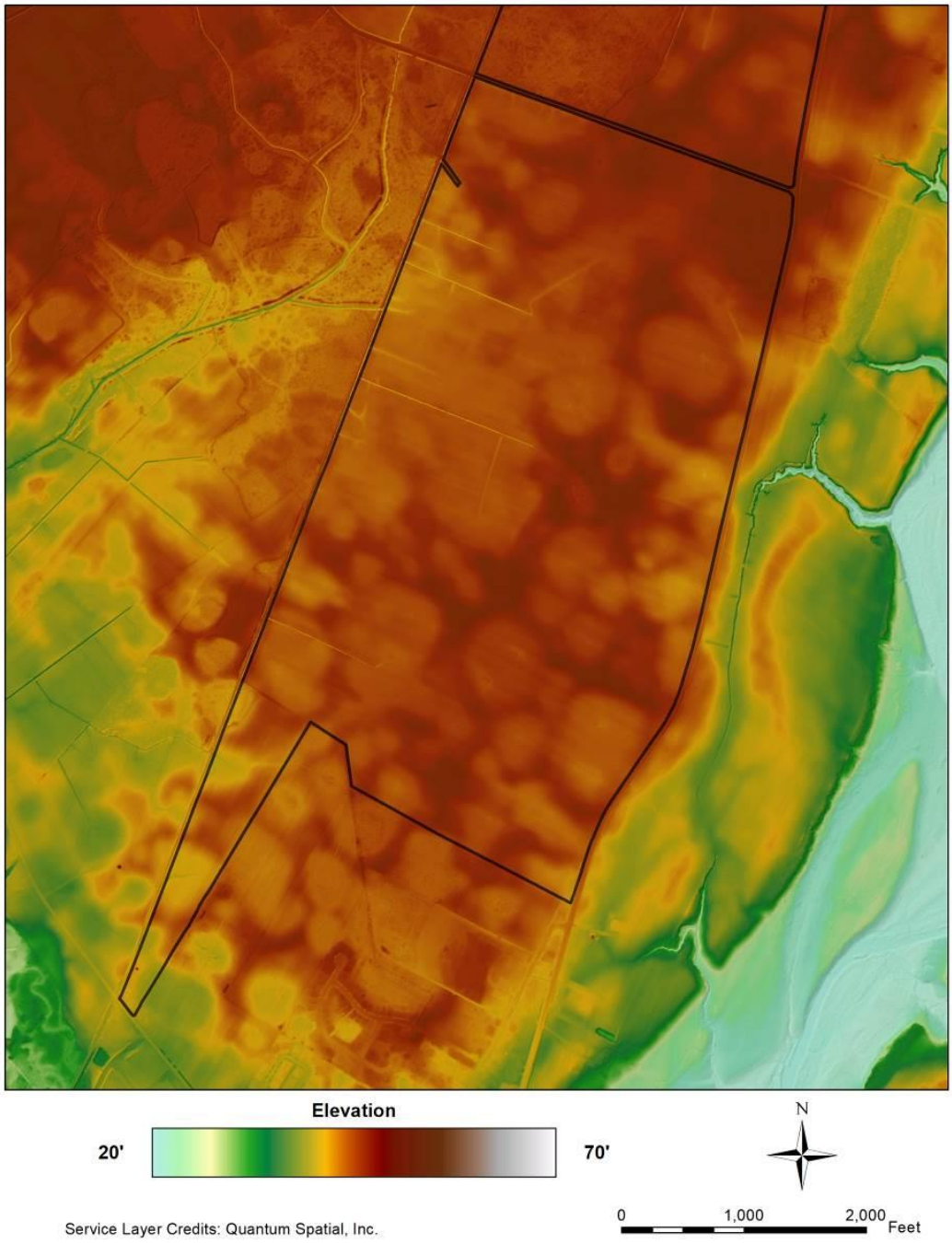


Examination of LiDAR-based elevation data (Figure 6) shows that the surface of Area D is pockmarked with a series of isolated crater-like depressions rather than composed of dendritic watershed drainages. This type of topography is typical in many areas of the Delmarva Peninsula, and is associated with vernal pools, Delmarva Bays, and other seasonal

wetland features. One Delmarva Bay and over 20 distinct wetland areas are inside the limit of construction. The Applicant proposes that the Delmarva Bay will receive a 100-foot buffer, while all other wetland features receive a 35-foot buffer. As with the other Sections, property owners installed subsurface drainage tiles and surface drainage ditches through otherwise wet areas to make the areas farmable. The wetlands will return if these artificial drainages are not maintained by the Applicant.

Area D in the Lower Section of the Project is in close proximity to the Chesapeake Bay Critical Area, as shown in Figure 7. Maryland's Critical Area Act, passed in 1984, identifies the "Critical Area" as all land within 1,000 feet of Maryland's tidal waters and tidal wetlands. It also includes the waters of the Chesapeake Bay, the Atlantic Coastal Bays, their tidal tributaries, and the lands underneath and the air space above these tidal areas. A developer must obtain approval from the local jurisdiction and/or the Critical Area Commission (CAC) before conducting any construction activity within the Critical Area. The entire Project lies just upstream of a Resource Conservation portion of the Choptank River Critical Area, and is less than 1,000 feet away from that area at some points. However, because the Cherrywood Solar site does not intersect the Critical Area, it does not require any approval and review by the CAC.

Figure 6 Digital Elevation Model map showing the terrain in Area D of the Cherrywood Site



A significant portion of Area D in the Lower Section (most of Map 14, Parcels 8, 16, 38, and Map 15 Parcel 67) drains west to a Tier II Stream segment, shown in Figure 7. Tier II waters are Use I stream segments in which water quality is better than minimum requirements; activities that have potential to affect the water quality of these segments are subject to

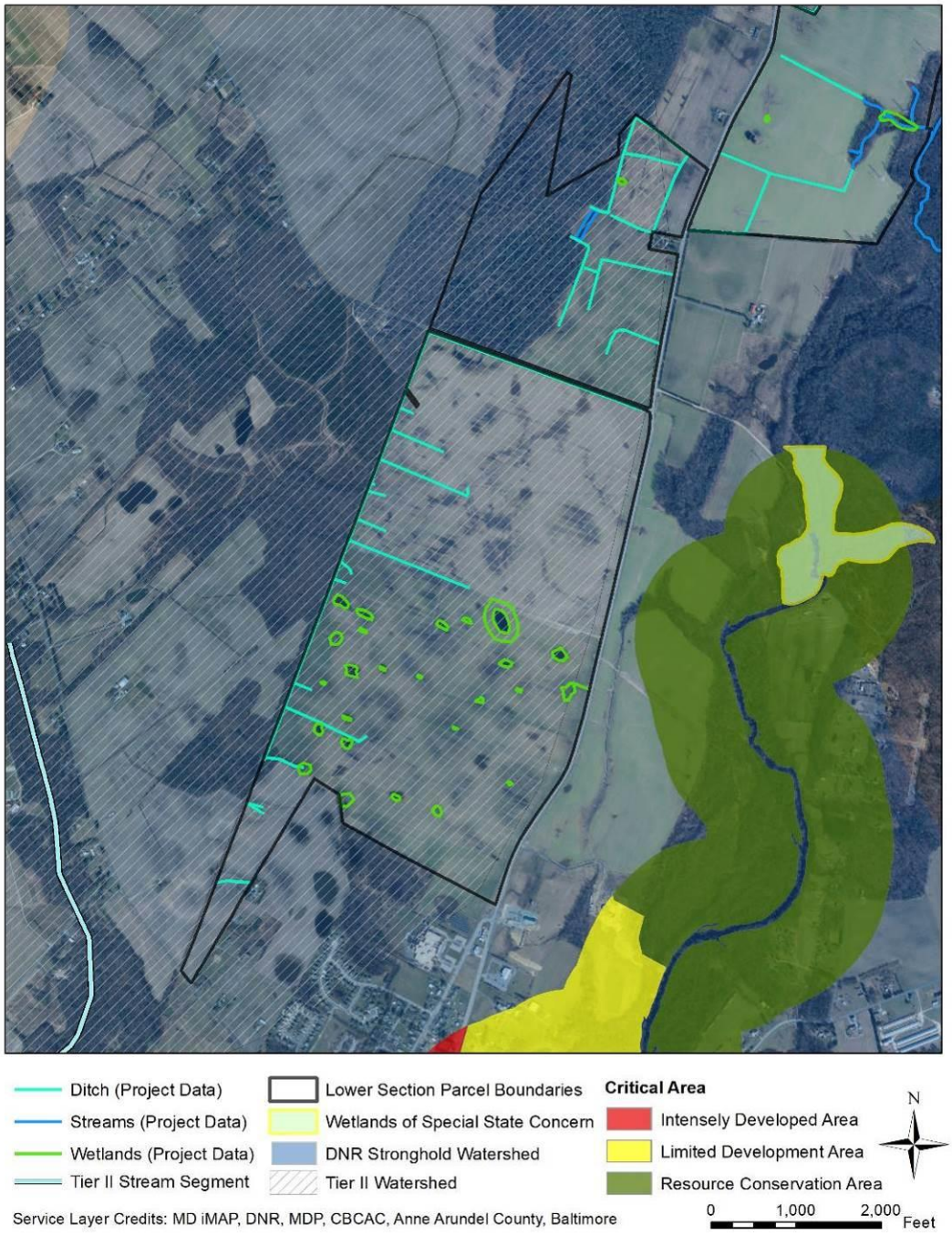
an MDE anti-degradation review[27]. A Tier II Segment of Forge Branch[28] runs just west of the Lower Section of the Project. The wetlands and ditches in the area feed into tributaries of this Tier II segment. Contaminants or sediments from the site have the potential to degrade water quality in the Tier II segment, and changes in hydrology can affect sensitive downstream habitats.

It is likely that compliance with the recommended conditions will protect the Tier II stream and its resources. However, to ensure this result MDE's Environmental Assessment and Standards Program will require monitoring the biological, chemical, and physical condition of the Tier II stream segment near the Patchett Parcel (Map 14 Parcel 38) before construction and at 1-, 3-, and 5-year intervals after construction using Maryland Biological Stream Survey (MBSS) protocols. The reviewing State agencies' recommended license conditions include a requirement that the Applicant perform this monitoring and apply additional stormwater controls, buffers, or mitigation if there is any deterioration in biological condition.

[27] COMAR 26.08.02.04-1

[28] This segment is designated as "Forge Branch 1" in MDE's GIS layer "Tier II Stream Segments 2016", updated 9/2016 and available from http://geodata.md.gov/imap/rest/services/Hydrology/MD_WaterQuality

Figure 7 Environmental features (wetlands and streams) in Area D of Cherrywood Solar Site



Cherrywood Site-Wide

The Cherrywood Solar Project Site drains to the Choptank River. The Applicant's Project ERD describes the water quality of the Upper

Choptank as "poor". However, the majority of the Project is within a DNR designated Stronghold Watershed with high biodiversity. Furthermore, the Maryland Biological Stream Survey (MBSS) has several sampling sites in and around the Cherrywood Project Site[29] that show good fish and benthic conditions[30]. The Upper Choptank River Watershed Characterization Report[31] states that while there are issues with nutrients and sediment, the river contains valuable fisheries resources and supports healthy fish communities. Triangle Floater, Sparkling Jewelwing, Dwarf Wedge Mussel, and other rare, threatened or endangered species are known or suspected to live downstream of the Project site. WHS advises stringent erosion and sediment control, and avoiding impacts to hydrology and water quality, as many species are sensitive to siltation and pollution from runoff. These endangered species are indicative of very high water quality, so even minor degradation to the streams will be significant.

In total, there are 51 proposed culvert crossings for the Cherrywood Solar Project, approximately 53.4 acres of 20-foot-wide access roads, 1.6 acres of impervious area and 2.1 acres of impervious Substation grounds to be constructed[32]. There are approximately 5.2 acres of wetlands and 20,000 feet (3.79 miles) of channels inside the approximately 1,217-acre limit of disturbance. Minor local environmental impacts may accumulate over such an extensive Project site to a level that merits concern and remediation. The parcel-scale stormwater calculations provided by the Applicant satisfy MDE requirements for stormwater management (Environmental Site Design in the Maryland Stormwater Design Manual, Volumes I and II (2000) with Supplement No. 1). However, these calculations cannot fully capture the scale of the project and the potential total effects to downstream hydrology and water quality. The proposed concrete culverts have lower roughness coefficients than the existing vegetated ditches, which can increase the velocity of concentrated runoff

[29] Data taken from DNR Stream Health Map, August 2018. https://geodata.md.gov/streamhealth/

[30] Site UPCK-204-R-2000, on Broadway Branch just below the Upper Section, showed a Fish Index of Biological Integrity (FIBI) classified as "Good". Site UPCK-202-R-2016, on Gravelly Branch just east of the Lower Section, showed both a Benthic Index of Biological Integrity (BIBI) and FIBI classified as "Good". Site UPCK-403-H-2010, on the Choptank River near the Lower Section, showed a BIBI classified as "Good". Site UPCK-311-R-2000, on the Tier II Forge Branch segment just west of the Lower Section, showed both a BIBI and FIBI classified as "Good".

[31] http://dnr.maryland.gov/waters/Documents/WRAS/ucr_char.pdf

[32] Data from Project ERD, and Applicant's response to PPRPDR3-1, 3-7, and 6-3.

leaving the site. Annual inspection and maintenance of the culverts will be required to minimize erosion and downstream sedimentation. Runoff from impervious areas is warmer than runoff from vegetated areas. Compliance with the reviewing State agencies' Recommended Condition 13f regarding IVM for the ditch features will provide runoff management as well as wildlife habitat.

Construction activities are likely to compact the soil and reduce the ability of the site to infiltrate water. Although the site will not be mass graded, even light vehicle traffic has been shown to diminish the hydrologic function of soil (Gregory 2006, Millward 2011, Haynes 2013). Once construction is complete, the fields will no longer receive the frequent tilling and husbandry associated with active agriculture, and any compaction resulting from construction will persist. Although the grass access roads are technically pervious, vehicle traffic will compact the soils and reduce the ability of the roads to infiltrate stormwater, leading to increased runoff. Guidance on identifying, avoiding, and managing soil compaction is widely available[33]. Recent work (Schwartz and Smith 2016; SHA 2016; Haynes *et al*. 2013) shows that soil decompaction and amendment can be highly effective at improving stormwater infiltration and providing deeper, longer water storage after compaction from construction activities. In compacted areas (e.g. graded areas, staging areas, or heavily trafficked areas), PPRP recommends that ripping (to a depth of 12") and compost amendment be performed to ensure the proper post-construction runoff characteristics.

To avoid impacts to aquatic resources resulting from construction-related siltation and sedimentation, an approved Erosion and Sediment Control Plan that contains appropriate stormwater quality and quantity control measures is required. The Applicant is required to obtain an NPDES general permit for construction activities over one acre. The Cherrywood Solar Project ERD does not explicitly address the sediment and erosion impacts to stormwater during construction. PPRP recommends the use of standard Best Management Practices (BMPs)[34] to accommodate a majority of the control requirements during construction, since there are gentle slopes for the Project site. For parcels draining to the Tier II stream

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[33] See:
https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_053258.pdf,
https://www.ars.usda.gov/ARSUserFiles/60100500/csr/researchpubs/raper/raper_06d.pdf,
https://extension.psu.edu/avoiding-soil-compaction

[34] Maryland Department of the Environment (MDE), *2011 Maryland Standards and Specifications for Soil Erosion and Sediment Control*

segment, PPRP recommends enhanced BMPs[35] such as super silt fence to preserve water quality. In accord with NPDES permit requirements, the Applicant must maintain site controls during construction and keep a record of daily inspections to the controls for the MDE inspector to review upon site visits.

The Applicant will follow Maryland Stormwater Management and Erosion & Sediment Control Guidelines and will implement storm water quality and quantity controls to prevent water quality impacts. In addition, PPRP is recommending License Condition 16 to ensure that the Applicant protects the stream, wetland, and floodplain areas from unintended releases of contaminants from the transformers. Depending on the types and volumes of such potential contaminants, environmental oil pollution control regulations (EPA 40 CFR 112 and COMAR 26.10.01.12) may also require that a Spill Prevention, Control and Countermeasure (SPCC) Plan be developed and implemented to minimize the potential for unintended releases of hazardous chemicals during Project construction and operation.

The net effect on ground water resources from removing these parcels from cultivation, installing panels, and planting a permanent vegetation cover cannot be assessed definitively with the information available. The Project ERD states that stabilizing the Project site with permanent vegetative cover will improve downstream water quality. With proper construction techniques, stormwater management, and adherence to licensing conditions, PPRP agrees that this Project can maintain or improve water quality and allow downstream habitats to continue supporting diverse biological communities.

Recommended Condition 18 (Spill Control):

The streams, ditches, and wetlands on the project parcels, the offsite streams and wetlands to which these flow, and all adjacent properties shall be protected from spills or leaks of transformer fluids or other biologically detrimental substances by appropriate containment structures. Redundant containment structures shall be used around the Project substation to protect the Choptank River.

[35] Maryland Department of the Environment (MDE), *Enhanced Best Management Practices for Tier II Waters*

Recommended Condition 10 (Sediment Control)

Cherrywood Solar shall implement erosion and sediment control best management practices (BMPs) presented in the Maryland Department of the Environment (MDE) document titled, *2011 Maryland Standards and Specifications for Soil Erosion and Sediment Control*, and as otherwise may be approved or required by Caroline County. All portions of the Project site disturbed during construction shall be stabilized as soon as practicable after the cessation of construction activities within that portion of the site, followed by seed application, in accordance with the above-cited document. In no instance shall non-native species be seeded or otherwise planted.

Recommended Condition 15 (Stream/Wetland Impacts):

All direct or indirect impacts (temporary or permanent) to wetlands and to streams and their 100-year floodplains shall be assessed by Cherrywood Solar prior to the start of any construction activities.

a. Cherrywood Solar shall apply for and obtain permits from MDE for all construction in or disturbance to permanent and intermittent streams ditches, floodplains, and nontidal wetlands or their regulatory buffers, including but not limited to culverts to be installed in streams or ditches for access roads or other purposes.
b. All culverts in ditches or streams shall be inspected annually for structural damage and erosion at the outfall point. Structural damage or erosion below the outfall invert shall be corrected as soon as practicable.

Recommended Condition 16 (Tier II Stream Protection):

The southwestern portion of the Project site (Parcels 8 and 38 of Tax Map 14 and Parcel 67 of Tax Map 15) is located within the watershed of the designated high quality Tier II stream segment of Forge Branch 1. All reports, documentation or notifications required under this condition shall be sent to PPRP and to MDE's Environmental Assessment and Standards Program at: Maryland Department of the Environment, Environmental Assessment and Standards Program, c/o Angel Valdez, 1800 Washington Boulevard, Suite 420, Baltimore, Maryland, 21230.

a. Cherrywood Solar shall implement applicable practices identified in the MDE document, *Enhanced Best Management Practices for Tier II Waters*.
b. Cherrywood Solar shall have certified persons conduct Maryland Biological Stream Survey (MBSS) benthic macroinvertebrate and fish monitoring at one location , prior to construction, 1 year, 3 year, and 5 year post-construction, at the Forge Branch 1 Tier II

baseline station UPCK-311-R-2000 located at Latitude 38.980081, Longitude -75.817775. If this is not possible, Cherrywood Solar shall select another location on the designated Tier II stream segment of Forge Branch 1, downstream of the baseline station. The new location must be approved by MDE prior to monitoring.

i. All monitoring protocols and analysis methods shall follow the Maryland Biological Stream Survey (MBSS) Round Four Sampling Manual (https://dnr.maryland.gov/streams/Publications/R4Manual.pdf) using individuals certified in MBSS benthic and fish sampling protocols. Fish and benthic macroinvertebrate IBIs should be calculated as described in the DNR document *New Biological Indicators to Better Assess the Conditions of Maryland Streams (https://dnr.maryland.gov/streams/Publications/ea-05-13_new_ibi.pdf)*. Analyses of data should meet guidelines provided in the MDE document, *MDE Requirements for Use of In-Situ Biological Stream Data*.

ii. Cherrywood Solar shall obtain a Scientific Collections Permit/License from the DNR Wildlife and Heritage Division a minimum of 30 days prior to conducting MBSS sampling.

iii. Cherrywood Solar shall provide notice and satisfactory justification if the construction schedule does not allow for baseline MBSS monitoring during approved sample periods.

iv. Cherrywood Solar shall provide for review to MDE a biological monitoring plan, no later than 60 days prior to monitoring. If directed by MDE, Cherrywood Solar shall update the monitoring plan to meet all data quality guidelines.

v. Cherrywood Solar shall prepare a report that provides monitoring results, including raw data and field sheet copies, and shall submit the reporting in electronic and hardcopy formats to PPRP and to MDE by January 30, following each monitoring event.

c. If any evidence of likely deterioration of IBI scores is found, MDE's Environmental Assessment and Standards Program shall be consulted as to what additional stormwater controls, buffers, or mitigation shall be applied.

Recommended Condition 17 (Upper Choptank Stronghold Watershed): To preserve water quality in the Choptank River, to which Parcels 66 of Tax Map 15 and Parcels 7 and 51 of Tax Map 11 drain, Cherrywood Solar shall implement all applicable practices identified in the MDE document "Enhanced Best Management Practices for Tier II Waters." During construction, flagging, fencing, access barriers, and any other necessary measures shall be used to ensure that onsite drainages to the Choptank River system are not disturbed by construction personnel, equipment, or activities. Special effort shall be made to retain fine particle silt, sand, and clay sediments, including the incorporation of redundant/additional control measures in the erosion and sediment control plan to ensure maximum filtration of any sediment-laden runoff (e.g., accelerated stabilization, super silt fence instead of silt fence, etc.).

Recommended Condition 19 (Soil Compaction Management):

Soil inside the Project Limits of Construction should be effectively managed for compaction according to the guidance provided in the NRCS Soil Quality – Agronomy Technical Note No. 17 "Soil Compaction: Detection, Prevention and Alleviation". Ripping (to a minimum depth of 12") and compost amendment shall be performed in compacted areas (e.g. graded areas, staging areas, or heavily trafficked areas) to ensure planting success and the proper post-construction runoff characteristics.

Recommended Condition 9 (Grading and Stormwater Management):

Cherrywood Solar shall provide PPRP and the PSC Engineering Staff with copies of all plans that Cherrywood Solar submits to Caroline County in connection with the Project for grading the site, and all permits received for such grading, within fifteen (15) calendar days of submitting such plans or receiving such permits. Grading and associated stormwater controls shall be designed to minimize hydrological changes to off-site streams and wetlands and to maintain the existing flow regime to these streams and wetlands. In no case shall such plans include removal of topsoil from the site.

3.6 Cumulative and Outside the Fence Effects

In addition to local impacts on individual resources, the Cherrywood Solar Project has the potential to affect the environmental condition of neighboring properties, modify the ecological functioning of the landscape matrix as a whole, degrade future use of the land as farmland, or overwhelm the resilience of the environment by the accumulation of multiple small impacts. As mentioned above, there are potentially direct

effects outside of the limits of disturbance resulting from the reduction of open space and the displacement of wildlife (Section 3.3). Discharges to streams or changes in hydrology from development would affect offsite and downstream water quality (Section 3.5) and RTE species (Section 3.4), especially given the large scale of the Project and the installation of 51 concrete culverts. The Project is dispersed over an area of more than 30 square miles, in a landscape teeming with sensitive habitats and natural resources. The effects of a biologically instantaneous conversion of a significant portion of this area to an industrial facility are not quantifiable, but are much larger than a simple sum of the wetlands and trees within the limits of disturbance. All of the interdependent biological elements of the landscape will respond to these changes; the environmental character of the landscape will change.

Maryland DNR defines Targeted Ecological Areas (TEAs) as lands and watersheds of high ecological value that are conservation priorities[36]. A significant portion of the Project is inside TEAs. The Natural Heritage Program of DNR's WHS also developed the Biodiversity Conservation Network (BioNet) digital map to define priority areas for terrestrial and freshwater biodiversity conservation[37]. There are five Tiers in the BioNet, ranging from areas "Critically Significant for Biodiversity Conservation" (Tier 1) to areas "Significant to Biodiversity Conservation" (Tier 5). The Cherrywood Solar Project site contains BioNet areas within all Project Areas, as shown in Figure 8. Areas A and C impinge upon lands in the top two BioNet tiers, raising a clear warning that the construction of this Project has the potential to significantly change and possibly degrade Maryland's biodiversity resources.

Solar facilities do not generally affect farmland unless construction requires grading, topsoil removal, soil compaction, or changes in hydrology. As discussed above, most other impacts are reversible if the solar panels are removed at a future date. With suitable planning to avoid permanent disturbance to soils, it is possible to resume productively using the farmland later (NCTECH 2017). In some cases, where enhanced wildlife or pollinator habitat is not desired or practicable, grazing (e.g. by sheep) can reduce mowing requirements and maintain the land as a productive farm element (NCTECH 2017).

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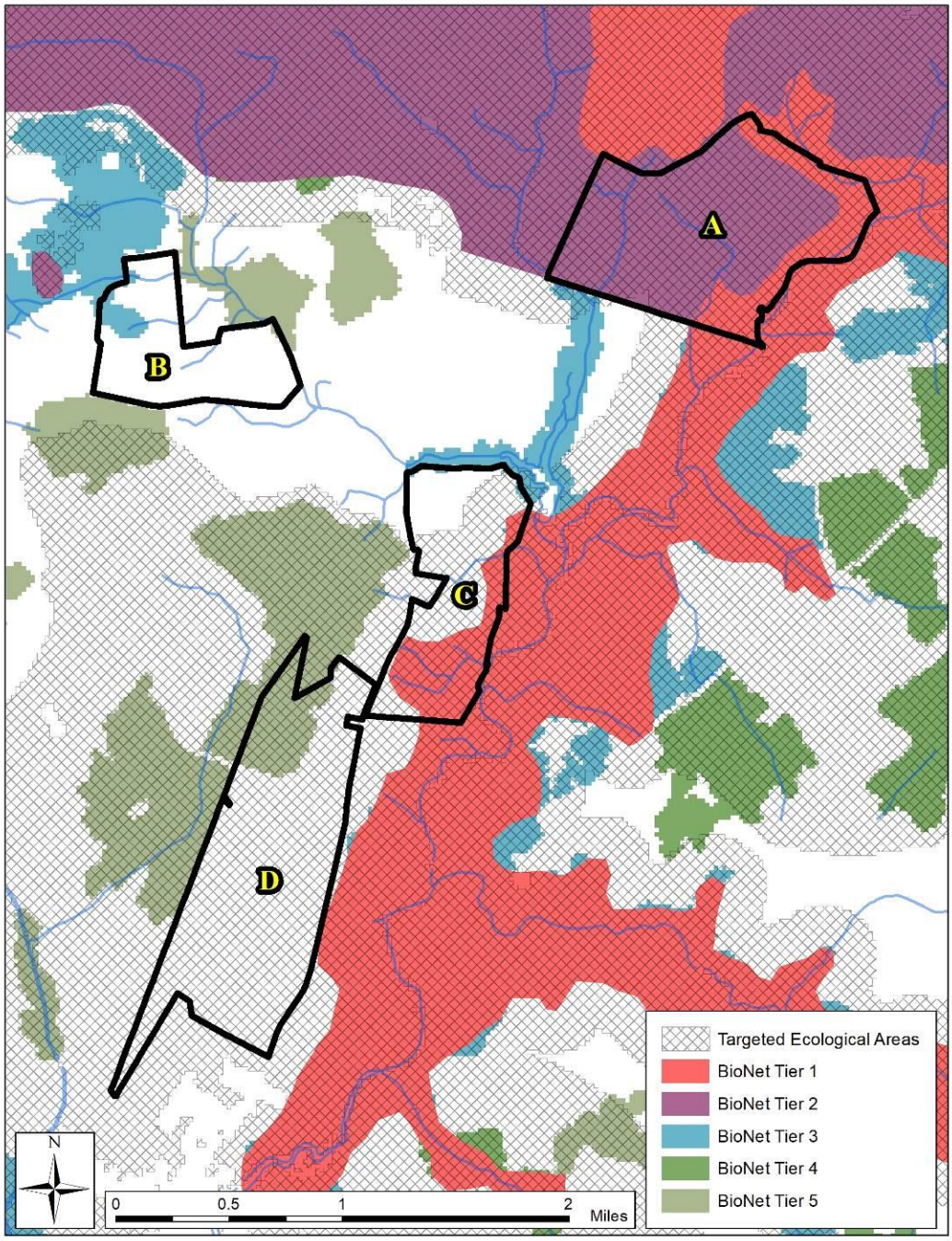
[36] Accessed August 2018.
http://data.imap.maryland.gov/datasets/a56174cc59914d44812184ee925b9e51_1

[37] Bionet fact sheet dated January 8, 2016, available at:
http://dnr.maryland.gov/wildlife/Documents/BIONET_FactSheet.pdf

Figure 8 DNR Biodiversity Conservation Network (BioNet) in Cherrywood Site



The physical characteristics of the solar panels themselves may have environmental effects. Solar panels change the absorption, reflection, conversion, and emission of solar energy by the land surface compared to either bare ground or crops. The "land surface energy balance" that results from these factors depends on the topography and soil moisture of the land surface, as well as the vegetation or materials that cover it. Solar

facilities convert approximately 15% of the incoming solar radiation to usable form (electricity) while vegetation only uses about 2% for photosynthesis. On the other hand, solar facilities must re-radiate excess heat directly to the air while vegetation uses the excess energy to move and evaporate soil water into the atmosphere (evapotranspiration). Measuring the components of the energy flows can quantify these differences.

Land surface energy balance, and the resulting fluxes of heat and water, are well studied for vegetated areas (Sellers, et al., 1995), but less effort has been devoted to measuring the fluxes at solar facilities. Fthenakis and Yu (2013) reported observations of wind, temperature, solar irradiance, relative humidity, and rainfall in and near a solar facility. They found that annual average temperatures above the solar panels were slightly higher than areas without solar panels (1.9 deg. C), with above-ambient temperatures occurring during the day and below-ambient temperatures at night. This heat effect dissipated rapidly in the vertical direction (within 5 to 20 meters) and rolled off a little more gradually in the horizontal direction (within 300 m). The authors indicated that these differences were insufficient to cause adverse microclimate changes. Another study found that the surface below photovoltaic panels remained cooler during the day and warmer at night than exposed surfaces (Dominguez *et al*. 2011). In farm fields, such differences could reduce soil water evaporation and enhance growing conditions for grasses below the panels, depending on the panel configuration. A National Renewable Energy Laboratory study (NREL 2017) found that vegetation growth below sun-tracking panels was different on the east and west sides of the panels. The study attributed this to consistent time-of-day differences in shading and precipitation runoff: clouds and rain events occurred primarily in the afternoon in their test area, while mornings were predominantly sunny and dry.

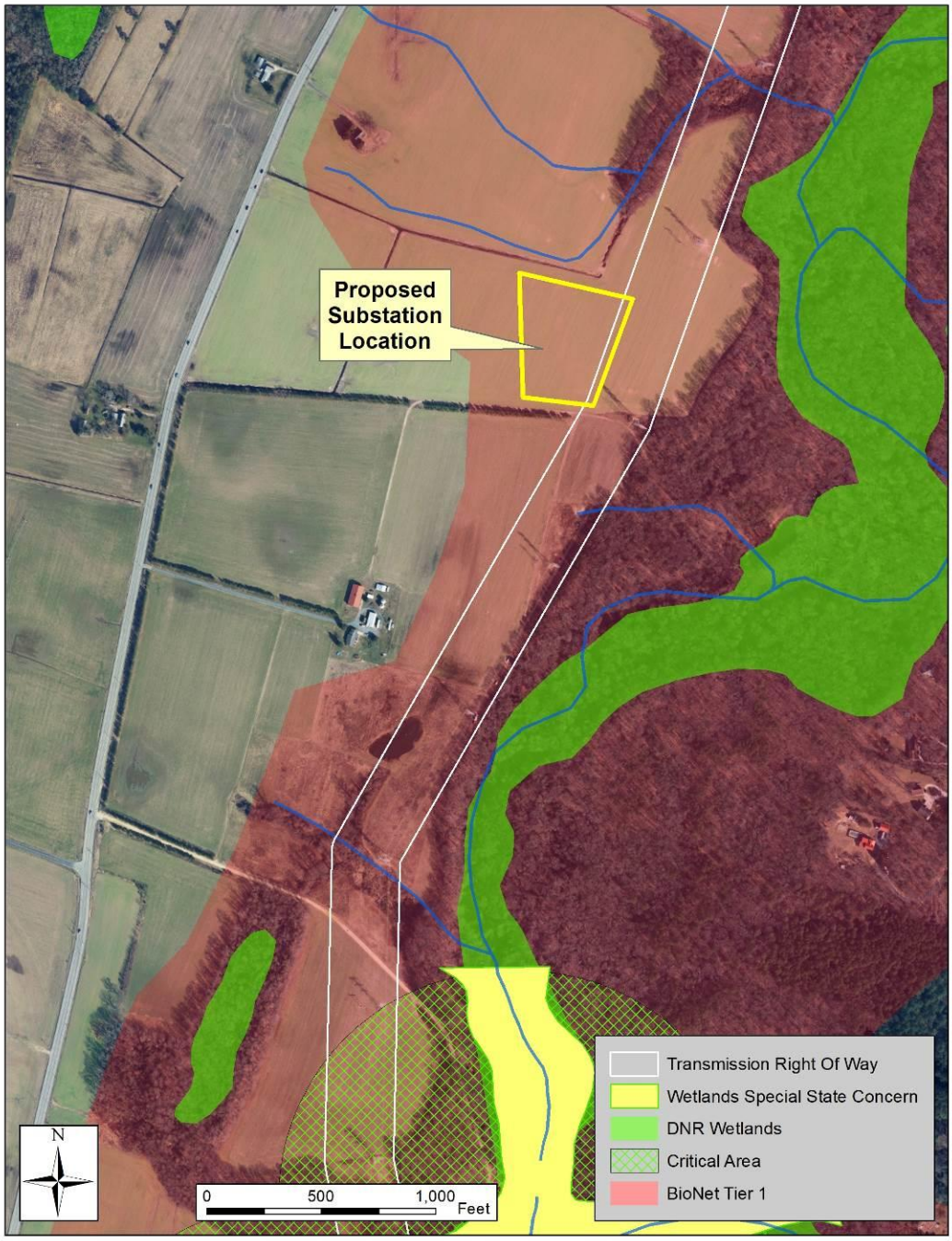
PPRP finds that the available studies indicate that the direct physical effects of solar panels on environmental conditions such as temperature and energy balance are relatively small and local in nature. However, the accumulated biological impacts of 1,073 acres of panel construction, including 51 new culverts on streams and ditches, are likely to be significant to surrounding and downstream environmentally sensitive areas. Of particular concern for the Cherrywood Solar Project is the potential for extensive, widespread land use conversion to cause irreversible degradation of the highly connected matrix of sensitive ecosystems in the Upper Choptank River landscape.

3.7 Generator Interconnection

The Cherrywood Solar Project requires power connections between the separated project segments, as well as a connection to the regional bulk transmission grid, via underground cables at high voltages. There will be potential environmental impacts associated with all of these connections. The Applicant proposes to construct a new substation on Tax Map 15 Parcel 66 to transform the power from 34.5 kV to 230 kV and inject it into the regional bulk power transmission network via the adjacent Keeney to Steele transmission line. This interconnection at bulk transmission voltages raises different environmental issues than the taps into the local distribution grid typical of most Maryland solar facilities.

The proposed substation location is in an environmentally sensitive area, as shown in Figure 9. The BioNet Tier 1 area is designated Critically Significant for Biodiversity Conservation. The Project substation will create approximately 2.1 acres of impervious area draining into the Choptank River just upstream of a Wetland of Special State Concern and the habitat of several endangered species. Any contaminants from the substation – for example, leaks of transformer oil – would rapidly enter these environmentally sensitive areas. Consequently, PPRP's Recommended Condition 16 related to spill control includes a specific requirement for redundant containment structures around the Project substation.

Figure 9 Environmental Resources surrounding the proposed Substation



The proposed HDD interconnection between the Area A and Area C of the Cherrywood Project site will run parallel to Broadway Branch and cross underneath Lake Bonnie, a jurisdictional wetland. The Project ERD describes borehole pits for this HDD inside a forested wetland area surrounding the lake, and has the potential for an inadvertent release of drilling fluids into wetland areas during construction that Cherrywood

Solar will need to address. Constructing the underground transmission line using horizontal directional drilling (HDD), jack and bore, or similar techniques may disturb these areas. While it is possible that these techniques may be able to bore a path under the ground without disturbing the surface, previous projects in Maryland have shown that, in practice, adverse environmental impacts can result from the inadvertent release of drilling fluids into sensitive habitats.

An inadvertent release of drilling lubricant (known as a "frac-out") occurs when there is insufficient overburden above the borehole to contain the pressurized drilling lubricant. The lubricant, which is usually a bentonite slurry, is pushed upward in a fluid-like way from the borehole through soils, sediments, and even rocky substrates along paths provided by tree roots, fissures, and fractures or broken/weak sections of rocks. Bentonite is a non-toxic, fine clay material, but if it is released into wetlands or waterways, the fine particles can smother fish and their eggs, benthic invertebrates, and aquatic and terrestrial plants. The bentonite can remain suspended for long periods and be transported downstream to remote habitats where it will have similar detrimental effects. The high-quality stream and wetland resources and aquatic RTE species downstream of the proposed underground crossing location warrant additional caution during drilling. PPRP's Initial Recommended Licensing Conditions therefore specifically incorporate the protections afforded by Section IV.B.c.(1) of the Maryland State Programmatic General Permit–5 (MDSPGP-5) for the construction, maintenance, or repair of underground utility lines in stream or wetland areas.

An interconnection running along Bridgetown Rd will connect Area B to Area C. The proposed interconnection runs between Bridgetown Rd and Oldtown Branch, and will cross underneath a railroad ROW. The Applicant has indicated that they will use directional boring to minimize surface disturbance, and that construction will not require any tree clearing[38]. However, the borehole below the railroad ROW will excavate material from the subsurface railroad embankment that may have been obtained from contaminated sources or have absorbed contaminants during railroad operations. For example, older railroad ties that were frequently pressure-treated with creosote are carcinogenic and environmentally disruptive. PPRP recommends testing of the removed material and disposing of the material in a licensed hazardous material disposal site if required.

[38] Applicant's response to PPRPDR6-6 and 6-7

Recommended Condition 20 (Underground Transmission Cables):

While conducting directional drill operations required for the underground transmission cables that connect Project subareas, and the Project interconnection, Cherrywood Solar shall protect surface waters above the drill path and adjacent lakes, streams, and wetlands from all construction and operations impacts.

a. Cherrywood Solar shall meet the standards for construction, maintenance, or repair of underground utility lines in stream or wetland areas that are enumerated in Section IV.B.c.(1) of the Maryland State Programmatic General Permit–5 (MDSPGP-5) issued by the U. S. Army Corps of Engineers. These requirements include, but are not limited to, developing a remediation plan for inadvertent returns of drilling fluid (IV.B.c.(1)(c)(xiv)).
b. Cherrywood Solar shall not begin construction of the underground transmission cable until it has formulated contingency plans to immediately address and contain inadvertent releases of drilling fluid or other materials that occur while constructing the boreholes for the underground transmission lines, and has provided these plans for review to PPRP and any other cognizant agencies.
c. Cherrywood Solar shall ensure that its contingency plans are ready to be implemented before starting drilling operations, including the presence of monitoring and response equipment onsite. During any drilling or boring operations work authorized by this CPCN, Cherrywood Solar shall provide an onsite Independent Environmental Monitor (IEM) to ensure compliance with this Condition. The IEM shall report directly to the MDE's Compliance Program and notify the Program of any reported, or observed, violations or noncompliance with the conditions and requirements of this CPCN.
d. During construction, Cherrywood Solar shall record all release events and report them within 24 hours of occurrence to PPRP, the PSC, and all agencies that have issued permits for the construction. Reports shall include the location, volume, and duration of the release, the action(s) taken to stop the release, the containment procedures used to minimize the effects of the release, and the initial assessment of the clean-up or restoration actions that will be required to repair any natural resources damages resulting from the release.
e. The material removed from the borehole during the directional drilling below the railroad track crossing on Bridgetown Road shall be tested for contaminants, and if found to be contaminated, disposed of in an approved facility.

4.0 SOCIOECONOMIC IMPACTS

4.1 Economic and Fiscal Impacts

The project will install approximately 499,000 PV modules within a development envelope of 1,088 acres in Caroline County, Maryland. Most of the parcels comprising the project are currently under agricultural cultivation. Construction will occur over a 10-month period beginning in November 2019. The project will create between 250 and 350 jobs during the peak construction period and begin operations in October 2020. Most construction activities will not require highly specialized skills. As a result, the local labor pool will be the source for many construction jobs if area subcontractors competitively bid for the work. This will have a positive effect on the local economy from construction worker payrolls and subsequent consumption expenditures, local purchases of common construction materials, tax revenues, and associated multiplier effects. Not all benefits will accrue to Maryland since specialized components, particularly PV panels, are manufactured elsewhere and must be imported into the State.

With no permanent operations and maintenance (O&M) workforce and most of the construction workforce within daily commuting distance, the project will have a *de minimis* effect on population and housing, or population-related public service provision. With public service levels largely unaffected, the net economic benefit of project construction will be positive.

Caroline County, the State and surrounding jurisdictions will experience fiscal benefits from taxes on construction worker wages, consumption expenditures, supplier sales receipts and property. The corporate income tax rate on Maryland taxable income is 8.25 percent. Maryland's sales and use tax rate is 6 percent. Personal income tax rates in Maryland range from 2 to 5.75 percent, and the County's piggyback rate is 2.73 percent.[39] Property tax revenues will accrue to the extent that the project increases the value of real property. Real property is taxed at a rate of $0.8471 per $100 valuation.[40]

[39] http://taxes.marylandtaxes.com/Individual_Taxes/Individual_Tax_Types/Income_Tax/Tax_Information/Tax_Rates/Local_and_County_Tax_Rates.shtml

[40] http://dat.maryland.gov/Documents/statistics/Taxrate_July2017.pdf

For tax purposes, Maryland classifies the facility as a non-utility generator. Caroline County applies a tax of 2.45% to ordinary business personal property and utilities. PPRP has estimated that personal property taxes from the project could be more than $1 million in the first full year of operations, declining to about $400,000 in Year 30 (2018 $), depending on the final design, equipment specification and other factors.

4.2 Land Use

The project is located in an unincorporated part of Caroline County near the towns of Greensboro and Goldsboro. Parcels associated with the project are located along MD 313 between Greensboro and Goldsboro, and along Bridgetown Road south of Goldsboro. Most properties are farmland.

The project is outside the municipal boundaries of Greensboro and Goldsboro, although some parcels are within town- or county-designated growth areas. Growth area boundaries serve as a line between urban/suburban land uses and rural land uses, and define a planned, long-range build-out limit for both the county and its municipalities (Caroline County 2010). Designated growth areas include the county's existing Priority Funding Areas (PFAs) and existing developed regions around towns that may require public infrastructure and services in the future.

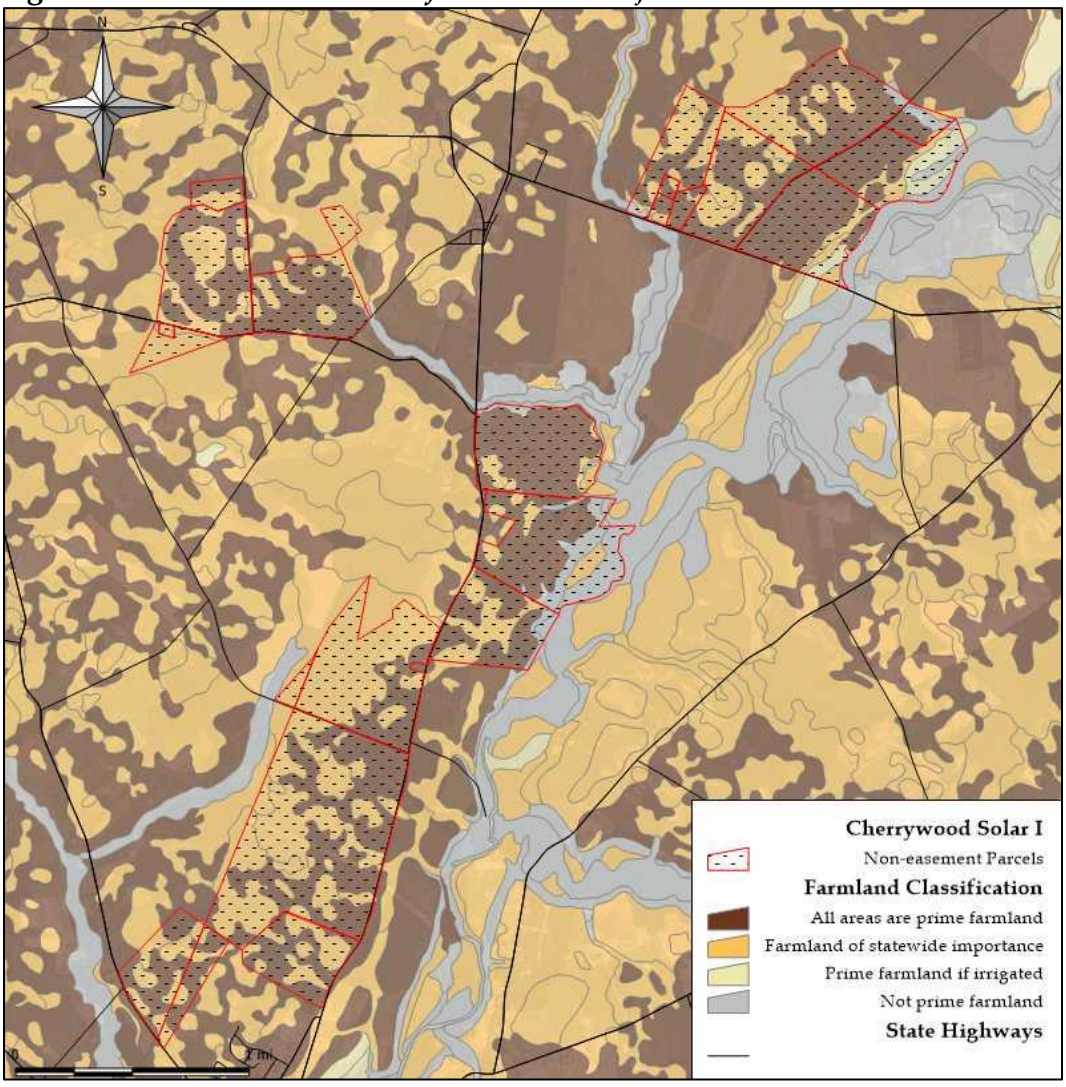
Within the Middle Section, an easement parcel is within a county-designated growth area around Goldsboro identified as Planning District 3 in the 2003 North Caroline County Comprehensive Plan. This area, outside the municipal boundaries of the town, is a potential expansion area that could be annexed at some future date, but is currently subject to county policies and guidelines (Town of Goldsboro 2009). The district is not designated a transfer of development rights (TDR) receiving area in Caroline County's comprehensive plan, although the plan seeks to establish additional receiving areas in the future.

Although outside Greensboro's municipal boundary, three parcels (Property 14, 15, 16) in the Lower Section are within the town's growth area and two are within its Priority Funding Area. The town's comprehensive plan envisions these and other parcels as targets for annexation, which could be developed for mixed use residential and employment uses now that a new sewage treatment plan has opened to serve North County towns (Town of Greensboro 2010). In April, the Town of Greensboro expressed its opposition to the parts of the project located within its growth area (Town of Greensboro 2018a), but

subsequently withdrew such opposition subject to Cherrywood's consent to annex the three parcels into the town (Town of Greensboro 2018b).

Of the total acreage of parcels comprising the project (1,722.86 acres), most is in agriculture or forest. Most acreage within the project's limit of disturbance is prime farmland or farmland of statewide importance (Figure 10). The total operational footprint of the Project is approximately 1,088 acres. The generator tie line will tap into a 230kV circuit that traverses the eastern edge of the Middle Section.

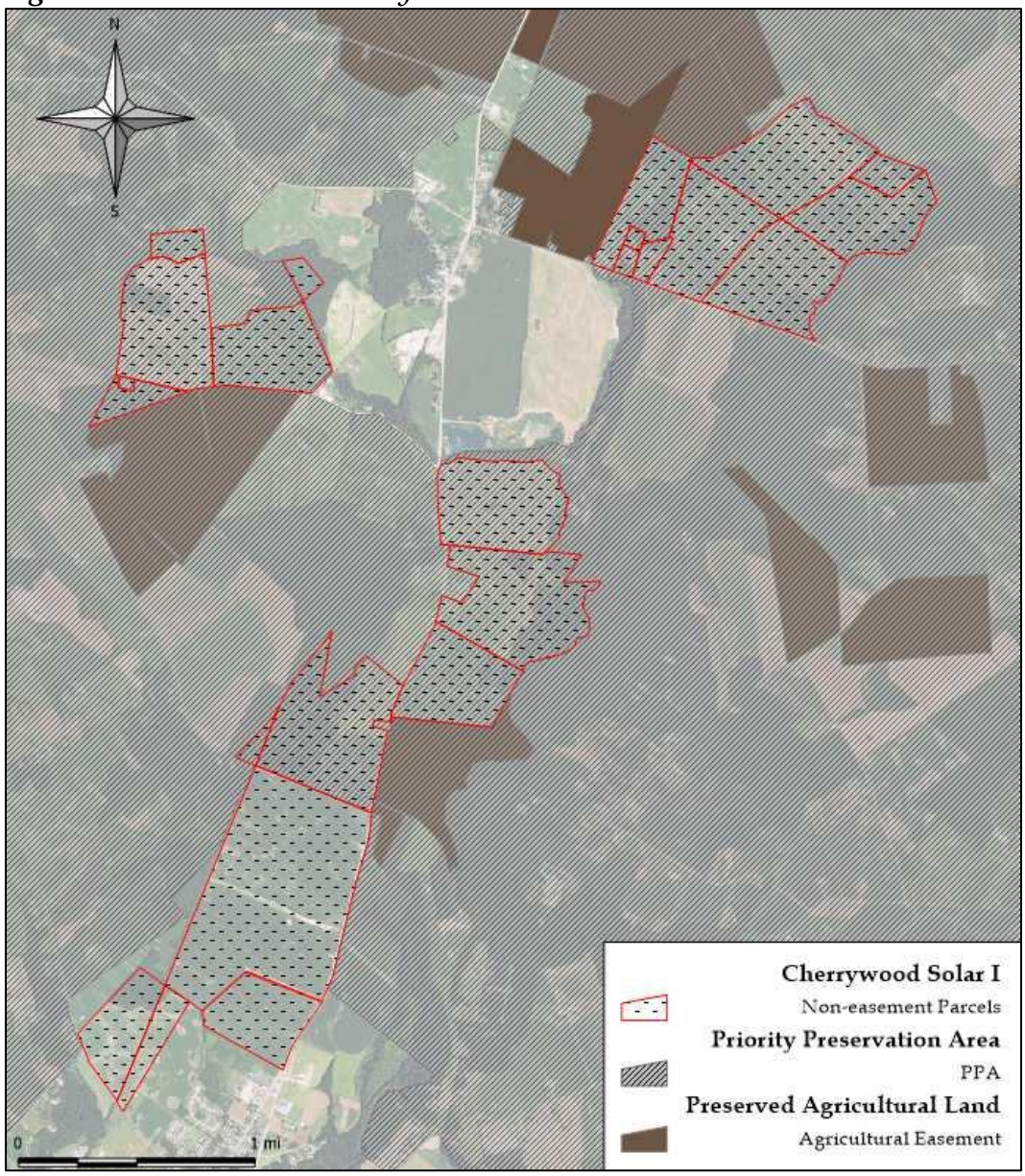
Figure 10 Farmland Classification in Project Area



Caroline County's Priority Preservation Area (PPA) includes all land in the unincorporated areas of the county not designated as a TDR receiving area, municipal growth area, or Priority Funding Area (PFA). It encompasses 176,760 acres, of which 161,792 acres are eligible for conservation. The county has set a goal of preserving 135,000 acres by

2030 (Caroline County 2010). Through September 2016, 42,754 acres were under easement (Caroline County 2017). Most project parcels are located within the county's PPA (Figure 11). No agricultural or other land preservation easement protects the project property or any adjoining parcels.

Figure 11 Caroline County PPA and Preserved Lands



All non-easement project parcels are zoned R – Rural District. The Rural District is intended to protect and preserve areas of the county that are currently rural or agricultural in character and use. It allows a full range of agricultural activities, limited low-density residential development in minor subdivisions, and rural major subdivisions in the county's TDR

receiving area.[41] Except when the combined additional aggregate acreage throughout the county exceeds 2,000 acres, a commercial solar energy system is a permitted use subject to special use exception in the R-district unless the land is located in TDR receiving areas or is under preservation easement (excepting ROWs for underground infrastructure). If a solar energy system is located in a "greenbelt" or "growth area", the affected jurisdiction must be notified. The Caroline County Board of Zoning Appeals (BZA) hears petitions for special use exception. Special use exception is subject to site plan review and approval, as described in Article XIV of the county's zoning bylaws, and design standards annotated in §175-85. The BZA granted Cherrywood Solar a special use exception on July 17, 2018.

The County's Chesapeake Bay Critical Area (CBCA) program regulates land development within 1,000 feet of tidal waters and wetlands of Chesapeake Bay, a requirement of Maryland's Chesapeake Bay Critical Area Act of 1984. The Critical Area recognizes three types of management areas, Intensely Developed Area (IDA), Limited Development Area (LDA) and Resource Conservation Area (RCA), which allow different uses. The Critical Area buffer, which lies within 100 feet of tidal waters, wetlands and tributary streams, and Habitat Protection Areas afford additional protection. In Caroline County, the Chesapeake Bay Critical Area Law affects all properties within 1000 feet of the Choptank River, and the Tuckahoe and Marshyhope Creeks and their tributaries. No part of the project is within the Critical Area.

Maryland's Smart Growth initiative is a set of policies designed to protect rural areas by targeting development toward designated growth areas. One of the requirements of the 1997 Smart Growth Act imposed on Maryland's counties is to identify PFAs. PFAs provide the focus for development by directing state and local resources to areas where there is public infrastructure that can support it. Most project parcels are not within a PFA, although two non-easement parcels within Greensboro's designated growth area and one easement parcel within Goldsboro's greenbelt area are. The project is not dependent on State infrastructure funding.

Construction will involve some excavation to reduce slopes (to optimize production from the PV modules), trenching for cables, and grading for access roads. Given its spatial extent, construction staging areas will migrate through the project parcels.

[41] https://www.carolinemd.org/249/Zoning-Districts#1

PPRP has concluded that Planning Commission review following the granting of a special use exception by the Caroline County Board of Appeals is necessary to ensure that the final site plan complies with all existing local laws, regulations and ordinances, and provides a basis for the issuance of building and grading permits.

Post construction, the land uses of other properties in the area will not change if the Applicant adopts all PPRP recommended license conditions.

Recommended Condition 21 (Land Use):

- Cherrywood Solar shall certify to the PSC and to PPRP that it has designed the facility in substantial conformity to Caroline County's design standards as codified in §175-85 of Caroline County's Zoning Regulations, and has received site plan approval and all required local permits prior to the commencement of construction.

4.3 Transportation

The project will generate traffic during the construction period. Construction vehicles will access the site from multiple entry points off MD 313, Bridgetown Road and MD 287. The Applicant has stated it will use improved farm lane entrances as access roads wherever possible. Entrances for commercial or industrial site access (new or modified) from State highways will require access permits from Maryland State Highway Administration (SHA) Access Management. All new entrance or improved entrances onto a county road require an access permit per Chapter 152 of the Caroline County Code of Public Laws.

Between Greensboro and Goldsboro, the SHA classifies MD 313 (Greensboro Road) as a rural minor arterial (SHA 2016a). The average annual daily traffic (AADT) averaged 1,684 vehicles between MD 313's intersection with Union Road (north of Greensboro) and Goldsboro. Approximately 8.6% of vehicles on this segment were trucks, with nearly two percent being combination vehicles. East of Goldsboro, SHA classifies MD 287 (Sandtown Road) as a rural major collector with an AADT of 2,422 vehicles. Near the Delaware line, 12.86% of vehicle traffic was trucks, of which about 4% was combination vehicles (SHA 2016b). From Oakland Road near the Queen Anne's County line to MD 313, Bridgetown Road is under the jurisdiction of the Caroline County. Where it bypasses the project, Bridgetown Road is a paved two-lane road with 10-foot lanes and no shoulders.

The project will add construction worker traffic to background traffic volumes, primarily on weekdays at the beginning and end of each workday. The Applicant estimates approximately 315 vehicles will arrive at the project site daily and leave at the end of the workday during the peak construction period, which is anticipated to last 4-5 months. Staffing before and after the peak construction period will be less than half the peak workforce. Construction activities will be limited to Monday-Friday between 6:30am and 5:00pm. Given existing conditions, the additional construction worker traffic will not affect the level of service (LOS) of major or minor roads near the project even if coincident with morning and evening peak hour traffic.

Trucks will deliver all materials for project construction. Between 60 and 70 trucks will deliver excavation and other site preparation equipment to the project site at the beginning of the construction period. Deliveries of panels, racking and piles, inverters, cabling and other project components plus aggregates and materials for internal roads and other improvements will occur throughout construction. The Applicant estimates about 560 trucks delivering racking and miscellaneous materials will arrive onsite in the first 60-90 days, followed by deliveries of array modules, inverters and switchgear. Overall, the project will generate nearly 1,500 truck deliveries over the construction period. The Applicant's preliminary construction plan estimates deliveries will occur between 9:00am and 2:00pm to minimize disruption to commuter traffic, and trucks will be onsite for about two hours. No more than four trucks will be onsite at any given time. Given the project's location, PPRP has concluded that truck traffic will have a *de minimis* effect on existing motor vehicle traffic near the project. Post construction, the facility will not be a significant traffic generator. Most traffic to the site during operations will be light vehicles.

Although not anticipated by the Applicant, some loads transporting equipment to or from the project site during construction could be oversize or overweight. The SHA requires hauling permits for transporting oversize or overweight loads on Maryland highways. Caroline County does not have a permit process for oversize or overweight loads. Title 24, Subtitle 1 of the Transportation Article of the Annotated Code of Maryland defines an oversize or overweight vehicle. Occupancy of State highway ROWs is subject to SHA's utility policy (SHA 1998).

<u>Recommended Condition 22 (Road Permits):</u>

- Cherrywood Solar shall comply with all permit requirements and restrictions for use, crossing and occupancy of State and Caroline County roads and obtain appropriate approvals, as necessary.

The SHA reviewed the project for potential conflicts with highway projects in Caroline County and noted it is currently designing a replacement of the existing drainage structure and pipe that run parallel to MD 313 along the southbound side at the intersection of Bridgetown Road. Design completion is estimated to be spring 2018, with construction to begin when funding becomes available. The SHA indicated concern that culvert replacement may conflict with proposed utilities for the solar project at the MD 313/Bridgetown Road intersection.

Recommended Condition 23 (SHA Consultation):

- Cherrywood Solar shall certify to the PSC and PPRP that it has consulted with both the Office of Highway Development and District 2 Utilities of the Maryland Department of Transportation State Highway Administration regarding potential conflicts between culvert replacement at the MD 313/Bridgetown Road intersection and proposed utilities for the solar project.

Federal Regulation Title 14 Part 77 establishes standards and notification requirements for objects affecting navigable airspace, including determining the potential hazardous effect of the proposed construction on air navigation. Part 77 also provides the Federal Aviation Administration (FAA) with the authority to conduct aeronautical studies of proposed activities that could affect airspace. These studies review physical incursions of proposed structures into airspace, interference with radar communications and any other conditions that might negatively affect air traffic. Maryland Aviation Administration (MAA) rules regarding navigable airspace, as annotated in COMAR 11.03.05, are consistent with FAA regulations.

Regardless of height or location, all solar projects at airports must submit to the FAA a Notice of Proposed Construction Form (Form 7460-1) to ensure the project does not penetrate the imaginary surfaces[42] around the

[42] Airport imaginary surfaces delimit volumes of airspace around airports that exist to prevent existing or proposed manmade objects, objects of natural growth or terrain from extending upward into navigable airspace. They either slope out and up from all sides and ends of runways or are a horizontal plane or a sloping plane above public use airports. Federal Air

airport or cause radar interference or glare. For off-airport projects, local governments, solar developers, and other stakeholders near an airport have the responsibility to inform the FAA about proposed projects so that the agency can determine if the project presents any safety or navigational problems (FAA 2010).

In 2013, the FAA issued interim policy for the review of solar energy projects on federally obligated airports (FAA 2013). The policy adopted the Solar Glare Hazard Analysis Plot as the standard for measuring the ocular impact of any proposed solar energy system.[43] Furthermore, to obtain FAA approval for a solar installation and/or a "no objection" to a Notice of Proposed Construction Form, an airport sponsor is required to demonstrate that the proposed solar energy system meets the following standards:

- No potential for glint or glare in the existing or planned airport traffic control tower.

- No potential for glare or "low potential for after-image" along the final approach[44] path for any existing landing threshold or future landing thresholds as shown on the current FAA-approved Airport Layout Plan.

Ocular impact must be analyzed over the entire calendar year in one-minute intervals from sunrise to sunset. FAA interim policy requires the use of the Solar Glare Hazard Analysis Tool (SGHAT), a web-based application, to determine whether a proposed solar energy project would result in a potential ocular impact.

FAA standards and notification requirements for objects affecting navigable airspace apply only to public use airports[45], military airports,

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Regulation Part 77 defines imaginary surfaces for civil airports (§77.19), Department of Defense airports (§77.21) and heliports (§77.23).

43 The Solar Glare Hazard Analysis Plot is generated by the Solar Glare Hazard Analysis Tool (SGHAT) Version 2.0, a web-based simulation model developed and maintained by Sandia National Laboratories, U.S. Department of Energy. The model is currently licensed to Forge Solar under the trade name GlareGauge.

44 The final approach path is defined as two miles from fifty feet above the landing threshold using a standard three-degree glide path.

45 A "public use airport" is any airport, whether publicly or privately owned, at which the owner or persons having a right of access and control invite, encourage, or allow flight operations by the public without the need for prior permission (COMAR 11.03.05.01(B)(16)).

and heliports. However, the FAA strongly urges proponents of solar energy systems located on off-airport property or on non-federally-obligated airports to consider the policy's requirements when siting such systems (FAA 2013).

Four airports are within 5 miles of project arrays. Spiering Airport, a private use airport with a single turf runway, is approximately one mile from the project. No other airport, public or private, is closer. Ridgely Airpark is the closest public use airport, approximately 3 miles southwest of the project. Our Domain Airport is two miles north of the Upper Section of the project, while Carmean Airport is 5 miles southwest of the Lower Section, in Ridgely. Both of the latter are private use airports with turf runways. Dover Air Force Base, in Delaware, is more than 16 miles from the project.

PPRP undertook a glare analysis on the flight paths into the runways of all public and private use airports within 5 miles of the project, analyzing reflections from the project onto runway glide paths from two miles out to the landing threshold. In no instance is glare from the project predicted.[46] PPRP has concluded the project will not have an adverse effect upon air navigation.

4.4 Visual Impacts

The terrain within the project site, much of which is open farmland, exhibits little vertical relief. Views of the site from roads and highways adjacent to the project are mostly unencumbered by vegetation. Except where the project abuts residences, the Applicant's site plan shows solar panels and associated equipment enclosed within a 20-foot grass covered access road, 6-foot chain link fence, and one of three 20-foot landscape buffer options. Where the project is adjacent to visually impacted residential properties, the Applicant has proposed a fourth option comprising a 50-foot landscape buffer within a 200-foot setback. The landscape options are as follows.

- Option 1 "Full Screening" – Standard twenty-foot (20') buffer. The landscape buffer includes two (2) rows of trees varied in height between five feet (5') to seven feet (7') comprised of evergreens and deciduous trees, shrubs, pollinators, and ornamental grasses.

[46] Glare analysis results are included in Appendix H.

- Option 2 "Moderate Screening" – Modified twenty-foot (20') buffer somewhat less robust than Option 1 to include more shrubs, pollinators, and ornamental grasses with fewer trees.
- Option 3 "Full Pollinator Habitat" – Twenty-foot (20') buffer with a mixture of ornamental grasses and pollinators.
- Option 4 "Intensive Screening" – Fifty-foot (50') buffer with more intensive buffer plantings. This Option is limited to very few highly impacted residential neighbors.

Based upon PPRP's review of the project's site plan, Option 1-3 buffers are set within a 40 to 50-foot setback that also includes a perimeter fence and grass-covered interior access road. Option 4 buffers are set within a 70 to 75-foot setback. Where the project bypasses a residential property, project structures are no less than 200 feet from the primary residential structure within it, not the property boundary.

Design standards in §175-85 of Caroline County's zoning bylaw require setbacks to meet the minimum zoning setback for the zoning district in which it is located or 25 feet, whichever is greater. Solar energy systems must be located at least 200 feet from residentially zoned parcels and existing residences, although additional setbacks may be required to mitigate aesthetic, noise, safety, glare, or any other identified significant impact, or to provide for designated road or utility corridors. A screening design standard is included "to ensure the solar energy system does not cause negative significant impacts to the aesthetic and scenic quality of the project area/location." Screening buffers, where required, must be opaque within three years.

Sitting between 2 and 8 feet above ground, the solar arrays will have a low visual profile. Structures will be most visible when panels are at their maximum tracking orientation (±60° from horizontal), which occurs after sunrise and before sunset. At the maximum tracking orientation, the top two feet of panels will be visible above the 6-foot perimeter fence. The tops of other components such as inverters may be visible as well.

In theory, under ideal viewing conditions a 6-foot human can see the top of an 8-foot structure from a distance of 4.6 miles. However, atmospheric conditions, terrain variations, objects within one's line-of-sight and a host of other factors significantly limit such "far" views. Even when a distant object is visible, it may not impart a reaction from the viewer until it is closer (Shang and Bishop 2000). Using a concept site plan (dated March 2018), PPRP estimated the visual extent of the project taking into account bare earth terrain elevations, areas of mature forest, proposed landscape buffers, and physical characteristics of the array. PPRP estimated the

project's visual "footprint" (excluding glare) within a combined one-kilometer buffer around non-easement parcels both at the commencement of operation and after three years. Landscape buffers, by option, were placed around arrays according to site plan drawings, and "grown" from initial to Year 3 heights using common growth rates for the species specified in the landscaping plan. In both cases, landscape buffers were assumed to be completely opaque.[47]

Before presenting its findings, PPRP notes inherent limitations of the viewshed analysis methodology. First, it doesn't take into account many encumbrances to views, which can include small copses of (or even individual) trees, domestic, commercial and agricultural buildings, utility distribution lines, even fences and low-growing vegetation, all of which diminish or obscure views. Views are also attenuated by various atmospheric conditions, usually related to humidity, and by distance. Conversely, views obscured by forest may be less so when deciduous trees lose their leaves, although woody masses remain in sight lines. Finally, the methodology does not consider "visual sensitivity," the relative degree of public interest in visual resources and concern over adverse changes in the quality of that resource. Within these limitations, visible footprints presented here are conservative, representing a "worst case" estimate of viewsheds.

In general, where landscaping is not proposed, natural buffering afforded by existing forest and woodland edges block views of solar panels from most perspectives. Visual trespass outside the project's limit of disturbance is mostly attributable to the absence of a landscape buffer or deployment of a "full pollinator habitat", the latter composed of grasses and wildflowers. Many unobstructed views, however, are from agricultural parcels that do not contain residences. Where landscape buffers are the primary source of visual mitigation, natural growth and maturing of trees and shrubs will reduce the visual footprint of the project over time. Specific observations follow.

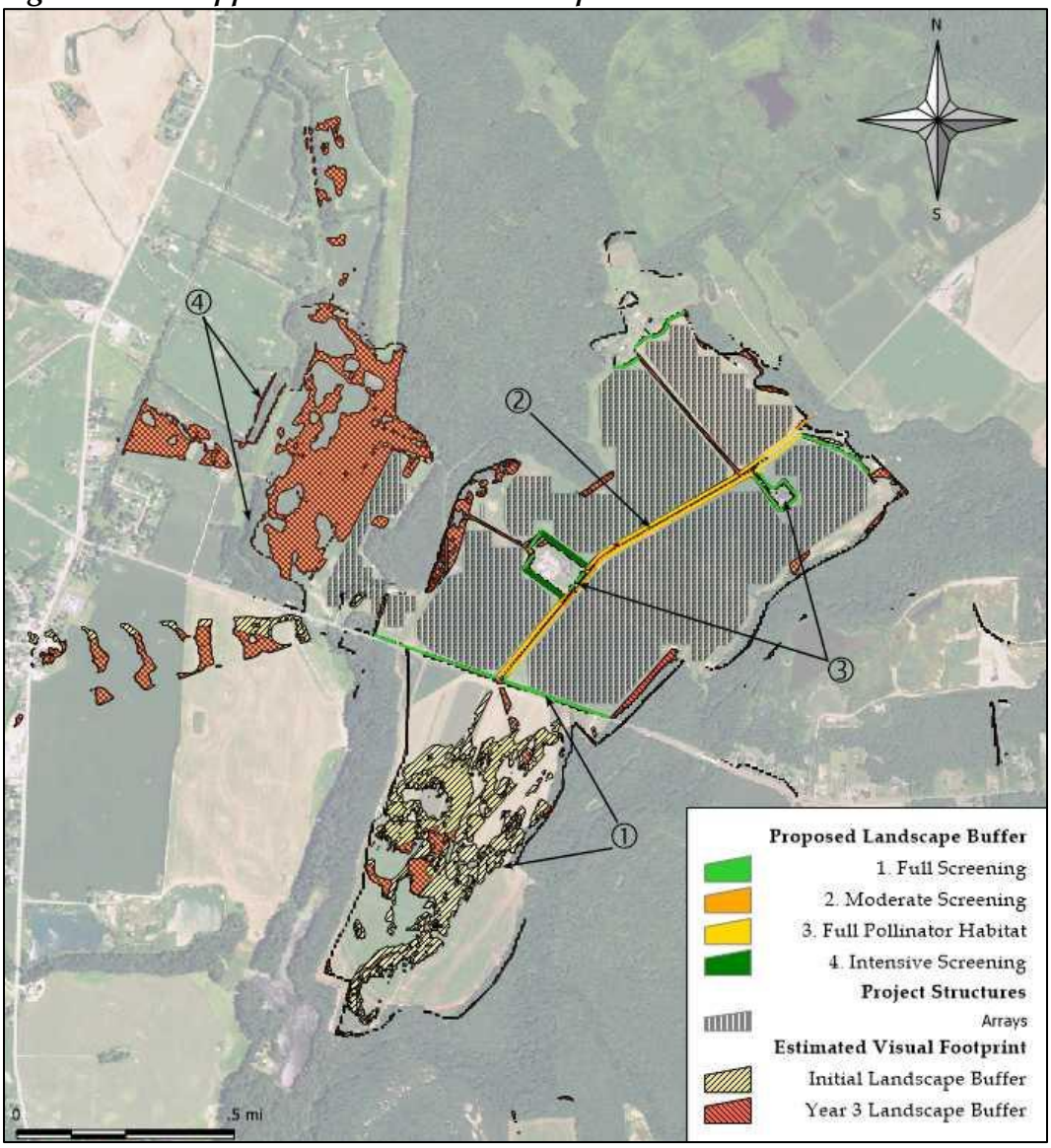
Upper Section

(1) The proposed "full screening" buffer along the northern edge of Sandtown Road (MD 287), part of the Harriet Tubman Underground Railroad Byway, appears adequate for blocking views of Upper Section

[47] The site plan's landscape buffer plant schedule specifies 6 to 7-foot evergreen trees at planting, which typically grow from 1 to 2 feet per year. PPRP assumed an initial buffer height of 6 feet, and a 12-foot buffer in the project's 3rd year of operation.

array structures, although parts of the project may be seen from agricultural lands to the south (Figure 12). (2) Deployment of a "full pollinator habitat" buffer along both sides of Jackson Lane allows views of the project to trespass onto the road surface. (3) "Full screening" and "intensive screening" buffers around residences off Jackson Lane tucked within the Upper Section appear to block views of solar panels. (4) Even though the arrays nearest Goldsboro are unbuffered, existing forest blocks views from the west, sparing town residents from views of the project.

Figure 12 Upper Section Viewshed Impacts



Middle Section

(1) "Full screening" and "moderate screening" buffers planned for the Middle Section appear to be effective, although openings for access gates

and other project needs could result in unintended views of arrays from some locations. (Figure 13.) (2) The Middle Section is fully visible from lands west of the project due to the use of a "full pollinator habitat" buffer along the project's western perimeter. (3) Most affected lands are under agricultural production although several houses along Union Road could be within the project's viewshed. (4) Visual buffering of two residential properties on Church Lane is dependent on an existing tree line along the eastern edge of the array parcel, which may not be adequate. A street-level level toward the Middle Section from this location is shown in Figure 14.

Figure 13 Middle Section Viewshed Impacts

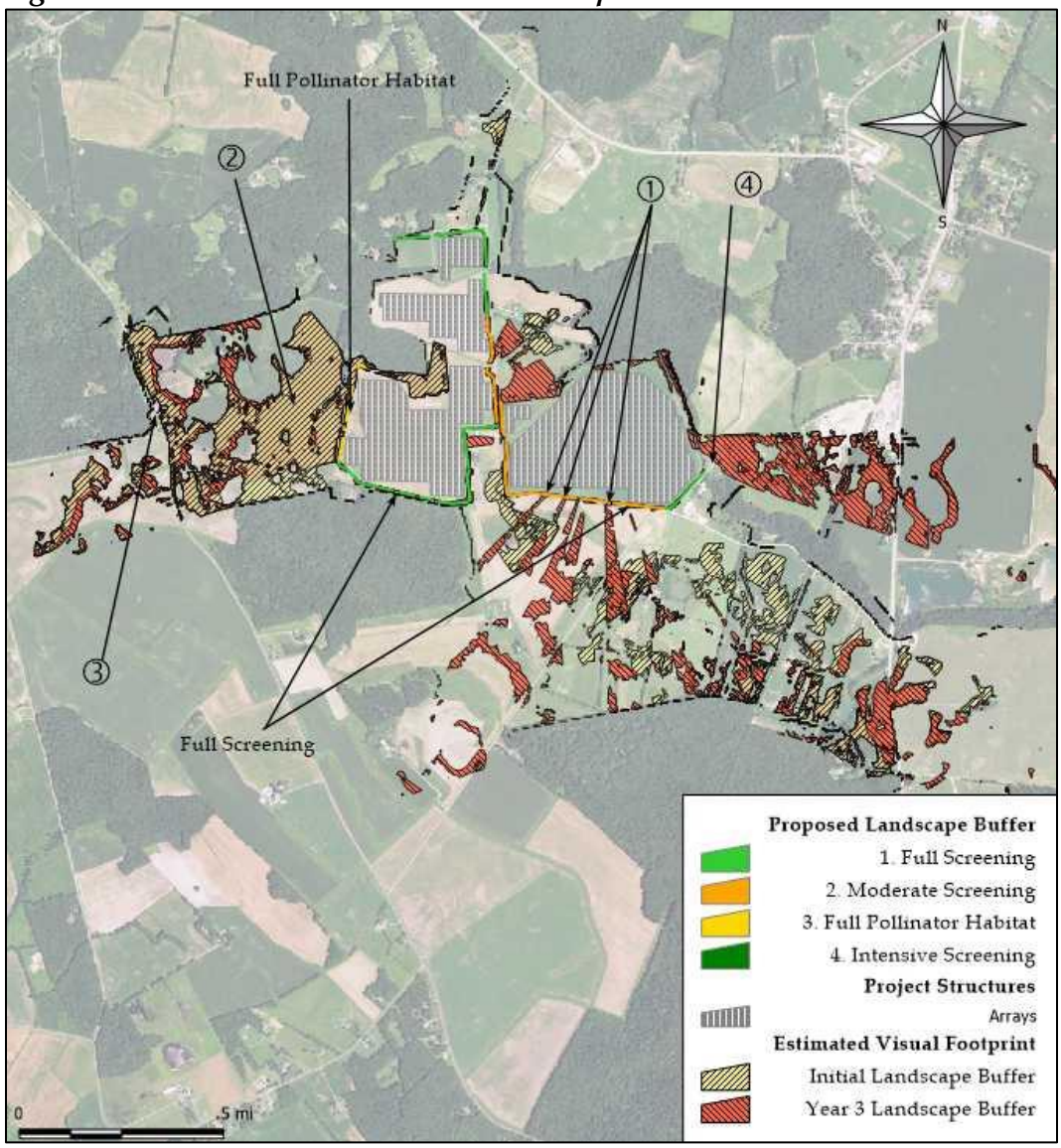
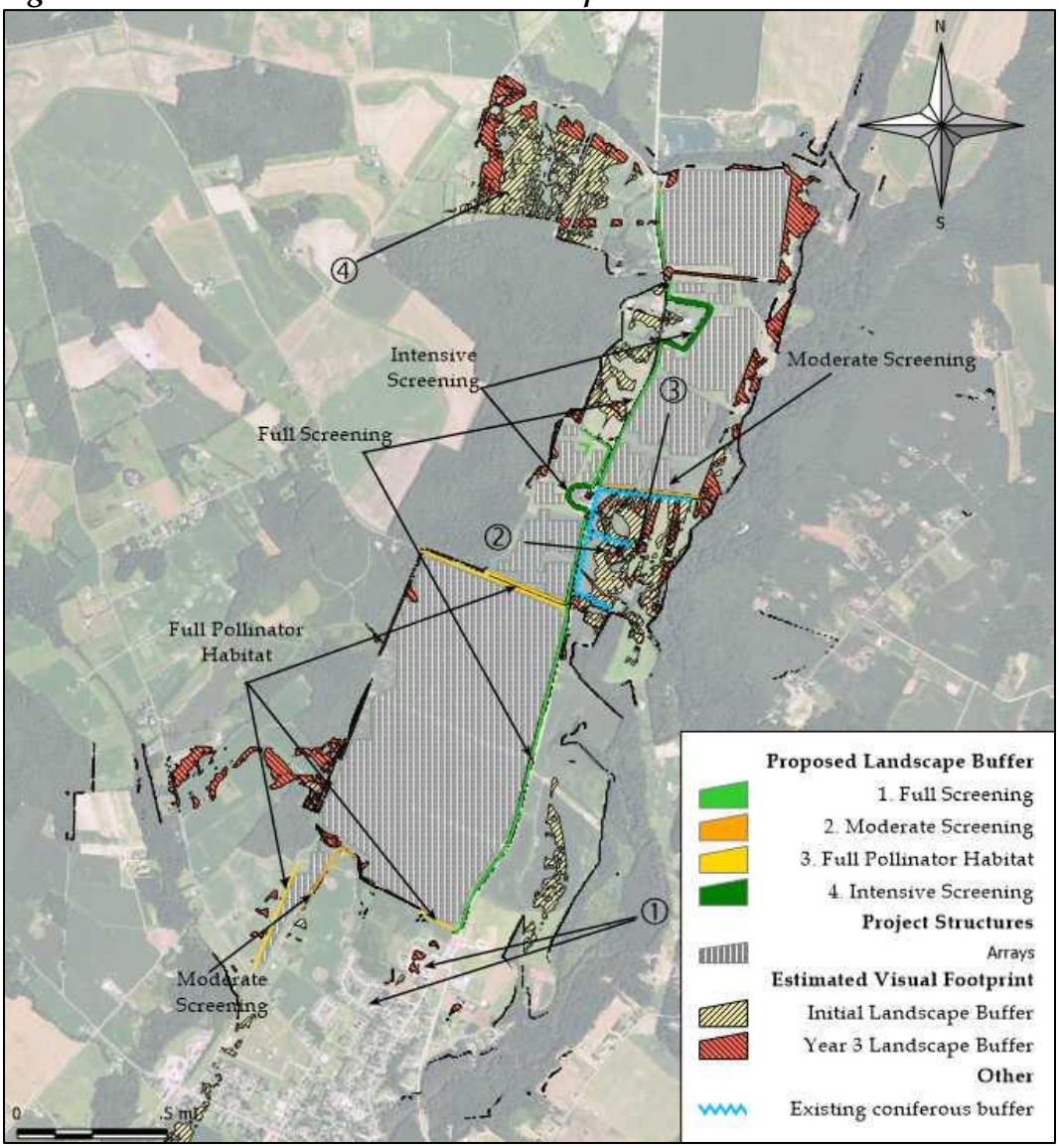


Figure 14 Street Level View of Middle Section from Church Lane

Lower Section

Where there is no landscape buffer, existing natural woodland edges appear sufficient to block views of the southernmost arrays of the Lower Section (Figure 15). (1) Natural and proposed landscape buffers block views from Greensboro Elementary School and residential areas north of Greensboro. (2) Until the "full screening" buffer matures, views of arrays north of Union Road may extend across MD 313 to a non-participating property, although the impact will be partly mitigated by an existing coniferous buffer around the perimeter of the affected property. (3) The same perimeter buffer will also supplement a "moderate screening" buffer to mitigate views of arrays from the north. (4) Distant views of the northernmost arrays of the Lower Section from agricultural lands west of MD 313 are likely to persist until the proposed landscape buffer matures, even though the Tubman byway and houses just west of MD 313 are not expected to be visually affected.

Figure 15 Lower Section Viewshed Impacts



Although the landscape screen and existing natural vegetation will mitigate much of the project's visual impact, it does not mean that existing views toward the project site will be unchanged. Agricultural fields that dominate foreground views from State and county roads that bypass the project, and from properties overlooking the project area, will no longer be visible, for example. Landscaping may even create a visual contrast to viewers due to their linearity and uniformity of design. Still, PPRP has concluded the landscape plan in the project's site plan satisfies design standards in §175-85 of Caroline County's zoning bylaw. Landscaping that meets the county's design standards for solar arrays will mitigate the project's appearance and reduce incompatibilities with other land uses in the project area.

Recommended Condition 24 (Visual Impacts):

- Cherrywood Solar shall develop a process to document and address complaints related to visual impacts associated with structures within the project's perimeter fence. An admissible complaint shall be one formally submitted in writing to Cherrywood Solar within two (2) years of the Project's commencement of operation. Cherrywood Solar shall provide to the PSC and PPRP both a copy of the complaint and its response to the complaint. Cherrywood Solar's response to any written complaint shall clearly inform the aggrieved party that if not satisfied with Cherrywood Solar's response, the aggrieved party may seek relief by filing a complaint with the PSC. If the PSC determines after notice and an opportunity to be heard that the complaint is justified, it may direct Cherrywood Solar to prepare and implement a screening plan to mitigate impacts from reflective glare upon the affected property. The screening plan shall be in conformance with all applicable State and local laws and regulations.

As part of the local approval process, the Applicant will be required to enter into a landscaping maintenance agreement with the county. PPRP reviewed the proposed landscaping agreement and concluded the agreement will ensure the buffer is protected, monitored and maintained to the County's specifications over the life of the project.

Recommended Condition 25 (Landscaping Agreement):

- Cherrywood Solar shall submit to the PSC and to PPRP a copy of an executed landscaping maintenance agreement that is in conformance with §175-85 of the Code of Public Local Laws of Caroline County.

The Applicant stated there are no lighting requirements for the project. However, lighting could be required during construction or operation to provide illumination to achieve safety and security objectives. For utility-scale photovoltaic facilities, these objectives are achievable using downward-facing, shielded luminaires and sensor-triggered lights. Design standards for solar energy systems in Caroline County include a condition that lighting must be in accordance with exterior lighting standards codified in §175-85.B.(8) of the Code, which are consistent with industry guidelines. PPRP has concluded that the project will not create a new source of substantial light if its lighting plan satisfies the county's exterior lighting standards, as negotiated during the site plan approval process.

Glare is a very harsh, bright or dazzling light that causes an uncomfortable or disabling visual sensation in the eye. It can occur from direct or reflected sunlight or from artificial light. Reflected glare occurs when incident rays from a natural or artificial light source reflect off a smooth or polished surface, such as a solar panel. It is sometimes called glint when a surface reflects a momentary flash of bright light. To increase electricity production efficiency a PV panel is designed to maximize absorption and minimize reflection. However, some sunlight is invariably reflected off its surface. With an anti-reflective (A/R) coating, PV panels reflect as little as 2% of incoming sunlight, depending on the angle of the sun. Reflected light from a solar panel is predominantly specular (as opposed to diffuse), a more concentrated type of light that occurs when a surface is smooth or polished. In the case of specular reflection, light reflects off surfaces in a very predictable manner with a reflected ray having the same angle to the surface normal as the incident ray. The reflectivity of solar panels is similar to water, but less than bare soil, vegetation, white concrete or snow (Spaven Consulting 2011).

The potential for glare from a PV energy facility is related to a number of factors:

- Position of the sun in the sky relative to the array, as a function of time of day and time of year.
- Intensity of the sunlight reaching the array, as a function of time of day and time of year.
- Tracking technology.
- Reflectivity of the panels.
- Degree to which light reflected from the panels is specular.
- Position of observers relative to the panels.

Broadly speaking, the impact of glare declines with increased distance from the source, but increases with the size and orientation of the reflective surface. Finally, one's light sensitivity can affect the perception of glare.

Cherrywood Solar plans to install single-axis tracking arrays within the project's limit of disturbance. Single-axis tracking pivots solar panels around a horizontal axis that rotates from east to west, tracking the sun's path during the course of each day with the axis of rotation oriented

north-south. When the sun is at its highest point for the day, the panels are in the horizontal position, like a tabletop. For Cherrywood, the maximum rotation of the panels from horizontal is 60°. What this means is that when the sun is at approximately 30° or more above the horizon (east or west), tracking technology keeps the solar panels perpendicular to the sun's rays to maximize the sun's intensity on the panels. In other words, for most of the day, any reflection from the panels is directly toward the sun[48] and never less than 30° relative to the ground under normal operating conditions, which translates to a slope of 57.73%. This means that a ray of light that reflects off the bottom edge of a solar panel – typically 2 feet above ground at its maximum rotation – is at a height of nearly 60 feet at a distance of 100 feet from the point of reflection when reflections are closest to the ground. This is in contrast to fixed tilt arrays, where the angle of incidence of reflected light from fixed tilt solar panels is near 90°at sunrise and sunset, declining to zero when the sun is at its apogee.[49] The tilt of the panels has a minor influence on reflections since the distance between top and bottom edges is less. Without appropriate landscaping, off-site glare can be an issue with fixed tilt arrays shortly after sunrise and shortly before sunset when reflections asymptotically approach the height of the panel.

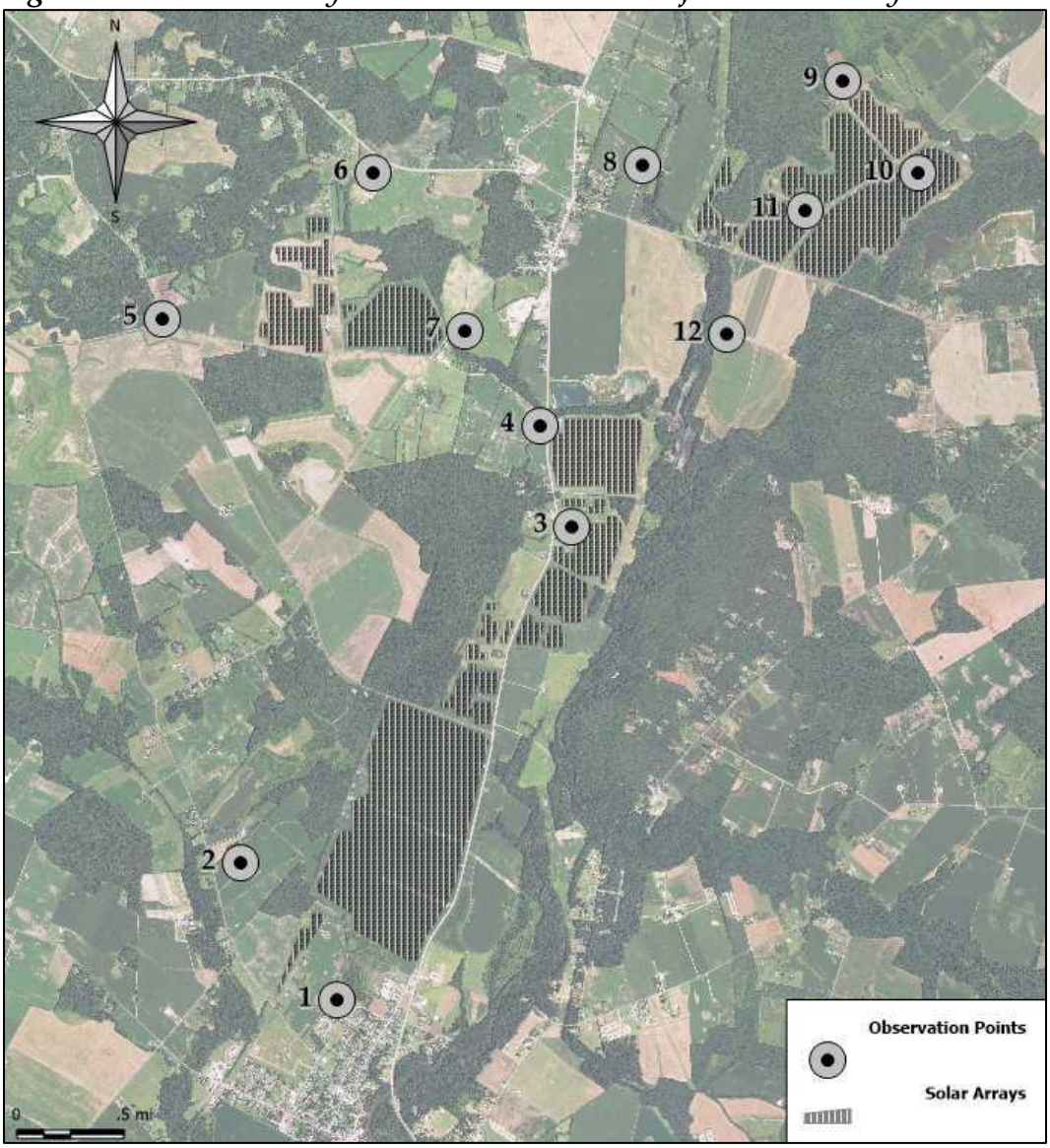
PPRP undertook a glare analysis of the project estimating the intensity, time-of-day and duration of glare for stationary observation points (OPs) representing views from nearby residences and public roads (Figure 16). Assuming single-axis tracking, a maximum tracking angle of 60° and no landscaping along exposed edges of the property, in no case is glare predicted to be cast upon any observation point.[50] PPRP has concluded that it is extremely unlikely that reflected sunlight from solar arrays will affect nearby properties or traffic on roads bypassing the project. While glare is not expected given the specified tracking technology and Caroline County's setback and landscaping requirements for utility-scale solar arrays, PPRP has added a condition requiring Cherrywood Solar to address complaints related to unanticipated solar reflections.

[48] In technical terms, the angle of incidence and angle of reflection, measured from the normal to the surface, are both 0°.

[49] Fixed-tilt solar panels are oriented to the south and present a horizontal plane relative to the earth's horizon.

[50] Glare analysis results are included in Appendix A

Figure 16 Stationary Observation Locations for Glare Analysis



Recommended Condition 24 (Reflective Glare):

- Cherrywood Solar shall develop a process to document and address admissible complaints related to potential solar reflections. An admissible complaint shall be one formally submitted in writing to Cherrywood Solar within two (2) years of the Project's commencement of operation. Cherrywood Solar shall provide to the PSC and PPRP both a copy of the complaint and its response to the complaint. Cherrywood Solar's response to any written complaint shall clearly inform the aggrieved party that if not satisfied with Cherrywood Solar's response, the aggrieved party may seek relief by filing a complaint with the PSC. If the

PSC determines after notice and a hearing opportunity that the complaint is justified, it may direct Cherrywood Solar to prepare and implement a screening plan to mitigate impacts from reflective glare upon the affected property. The screening plan shall be in conformance with all applicable State and local laws and regulations.

4.5 Cultural and Aesthetic Resources

No property on the National Register of Historic Places (NRHP) is within one-half mile of the project site. Several properties on the Maryland Inventory of Historic Properties (MIHP) are within one-half mile, including four that are within the project's limit of disturbance. In addition to these properties, the Maryland Historical Trust (MHT) lists the Greensboro and Goldsboro historic districts in the MIHP. No MHT preservation easement is within one-half mile.

In its review of the project, the MHT noted some parcels within the project's limit of disturbance are in areas that are archeologically sensitive, particularly those along the Choptank River and Oldtown Branch. Furthermore, six prehistoric archeological sites are within the project area. Given the area's moderate to high potential for containing additional archeological deposits, MHT recommended Phase I archeological investigations be conducted within eight of the parcels within the project's limit of disturbance. MHT received the revised draft Phase I archeological report from the Applicant on September 14, 2018 and issued comments on October 23. Among its findings, MHT determined no further archeology work is warranted as part of the undertaking.

MHT also requested National Register (NR) Determination of Eligibility (DOE) submissions for 16 parcels, plus any other resources over 50 years of age, upon which the project could potentially have direct or indirect effects on historic buildings and landscapes. Following a subsequent consultation after the project boundaries were revised and the limit of disturbance was expanded to a parcel on Sandtown Road, MHT requested a DOE form for this additional parcel.

In MHT's response to submitted DOE forms, two properties were determined eligible for listing in the National Register of Historic Places. Both the Sherman Councell House (MIHP No. CAR-167, Parcel No. 0011-0020-0007) and 14875 Greensboro Road (MIHP No. CAR-404, Parcel No. 0011-0020-0101) were determined eligible under criterion C for their architecture. With respect to the property at 14875 Greensboro Road, MHT determined that Cherrywood Solar's proposed buffer plan will mitigate

any potential adverse effect to the historic property. However, the Sherman Councell House is located within the project area, and the Applicant plans to demolish the structure. MHT has advised the Applicant that avoidance of any potential adverse effect would require removing the solar arrays from the NR-eligible property and leaving the structure standing. Otherwise, the undertaking will have an adverse effect on the property, which will require mitigation.

Recommended Condition 27 (Cultural Resource Mitigation):

In the event the NR-eligible Sherman Councell House will be demolished, Cherrywood Solar shall undertake the mitigation measures described in paragraphs (a) through (c):

a. Documentation
    i. Cherrywood Solar shall provide an updated Maryland Inventory of Historic Properties (MIHP) form for the Sherman Councell House (CAR-167). The form shall be completed by a qualified architectural historian, preservationist, or historian and accompanied by supporting materials as described in *General Guidelines for Compliance-Generated Determinations of Eligibility* and *Standards and Guidelines for Architectural and Historical Investigations in Maryland.*
    ii. The photographs shall conform to the standards described on pages 36-7 of the *Standards and Guidelines for Architectural and Historical Investigations in Maryland* (Standards and Guidelines) and the standards described in the Maryland Historical Trust's "Guidelines for Digital Images."
    iii. Photographs shall be taken after adjacent trees have been removed from the property.
    iv. The MIHP form shall include a complete set of floor plans.
    v. Cherrywood Solar shall ensure the completed MIHP forms are submitted to the MHT for review and comment. If the MHT does not respond within a 30-day review period, Cherrywood Solar may assume that the documentation package has been accepted by the MHT.
    vi. Cherrywood Solar or its qualified consultant shall submit the completed documentation package within six (6) months of exercising the land option(s) to lease the property from the landowner.

b. Salvage

i. Prior to initiating demolition of the Sherman Councell House, Cherrywood Solar shall notify the Caroline County Historical Society and at least one other salvage organization of the planned demolition regarding the planned demolition of historic resources, and offer the opportunity to salvage architectural elements from the interior and exterior of the buildings slated for demolition with coordination and approval by the landowner, as feasible. Cherrywood Solar shall provide priority to the Caroline County Historical Society when selecting a salvage organization.

ii. If any such organization shows an interest in the architectural salvage, Cherrywood Solar shall coordinate with the landowner to provide reasonable access to the site to recover building components as approved by the landowner.

iii. If no organization expresses an interest in salvaging within 10 days, any materials from the buildings slated for demolition, Cherrywood Solar may proceed with the demolition.

iv. Cherrywood Solar shall provide the MHT, PPRP and the PSC with a written explanation of its efforts for providing opportunities for salvage, and the results of those efforts, with the submission of the documentation package.

c. Signage

i. Cherrywood Solar shall fund the development, fabrication and installation of a permanent sign (1)reasonably close to the Sherman Councell House in a publically-accessible location, taking into account visual access, site safety and security, and (2) at the Caroline County Historical Society Visitor Center dedicated to the history of the site.

ii. Cherrywood Solar shall ensure the illustrations of the planned display, including proposed text, images, materials and placement, will be submitted to the MHT for review and comment. If the MHT does not respond with a 30-day review period, then it can be assumed that the package has been accepted by the MHT.

iii. Cherrywood Solar shall install the final exhibit or wayside display within one (1) year of demolition.

iv. Cherrywood Solar shall provide the MHT with photographs (non-archival digital images) of the completed exhibit within sixty (60) days of completion.

d. In the event the NR-eligible Sherman Councell House will not be demolished, Cherrywood Solar shall (1) implement a ¼ acre buffer around the Sherman Councell House and (2) provide access from the buffer area to a roadway to allow the landowner to access the house for maintenance purposes conducted at the discretion of the landowner.

Recommended Condition 28 (Archeological Discoveries):

- In the event that construction reveals relics of unforeseen archeological sites, the Applicant, in consultation with and as approved by the MHT, shall develop and implement a plan for avoidance and protection, data recovery, or destruction without recovery of such relics or sites.

The Maryland Heritage Areas Program preserves the State's historical, cultural, archeological, and natural resources for sustainable economic development through heritage tourism. The Program designates Heritage Areas, defined by a distinct focus or theme that makes a place or region different from other areas of Maryland. The Maryland Heritage Areas Authority (MHAA) certifies and governs Heritage Areas. A management plan sets forth the strategies, projects, programs, actions, and partnerships that will be involved in achieving each Heritage Area's goals. Once certified, a Heritage Area management entity becomes eligible for State-matching grants for operating assistance and marketing activities. Local jurisdictions and non-profit organizations in a Heritage Area may also qualify for State matching grants for planning, design, interpretation, and programming. Key components of a Certified Heritage Area (CHA) are the Target Investment Zone (TIZ), a designated area with exceptional potential to attract investment and enhance tourism, and Certified Heritage Structures, which are National Register properties, contributing resources within a National Register district or locally designated historic properties. There are 13 CHAs in Maryland.

Most of the project lies within the programmatic boundaries of the Stories of the Chesapeake CHA (SCCHA). It includes portions of Caroline, Kent, Queen Anne's and Talbot counties and occupies one of the oldest working landscapes in North America, and one of the last and largest intact colonial and early American landscapes (Eastern Shore Heritage, 2005).

Cultural resources include historical properties and archeological sites, and numerous assets held in the public domain and by preservation organizations and private citizens.

Scenic resources, an important element of heritage tourism, vary throughout the area that comprises the Stories of the Chesapeake CHA but are highest along major waterways and in coastal areas. Except for lands along the upper reaches of the Choptank River, the landscape within the project's area of potential effect has "medium" scenic value (Eastern Shore Heritage 2005).

Under the Maryland Heritage Area Law, State units must consult with certified heritage areas regarding actions that may affect a heritage area. PPRP has consulted with Eastern Shore Heritage, Inc., the heritage area's management unit, in fulfillment of its consultation requirement.

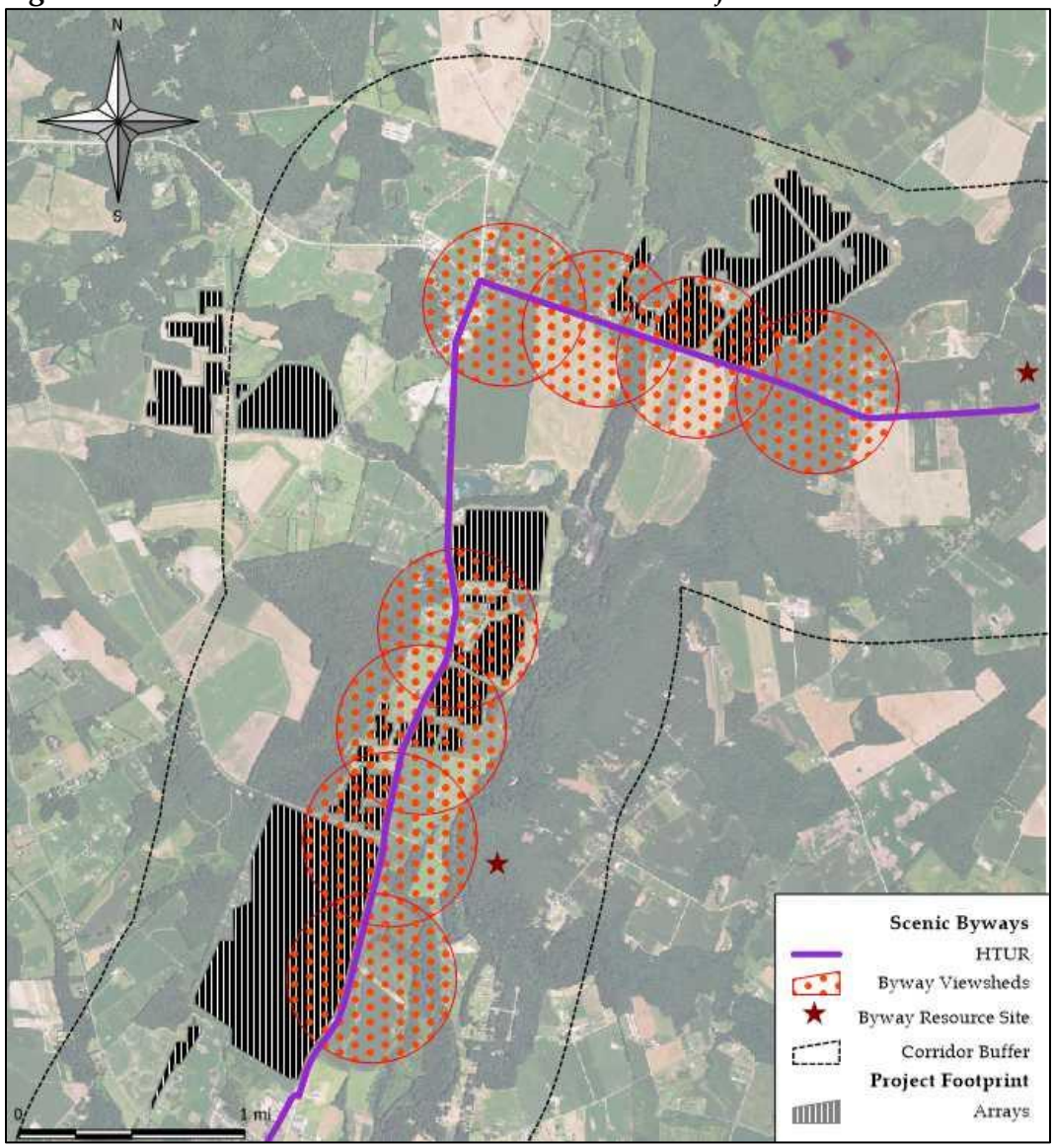
The Harriet Tubman Underground Railroad (HTUR) Byway, a National Scenic Byway, bypasses much of the project. The byway follows MD 313 between Greensboro and Goldsboro before turning east on MD 287. According to its Corridor Management Plan (CMP), the HTUR Byway possesses regionally significant historic and recreational intrinsic qualities, with many historic and cultural resources located in scenic settings intimately connected to the surrounding landscape. It makes particular note of farms along MD 313 and MD 287 north of Greensboro where, in some places, the landscape has largely remained the same for the last 200-plus years, and specifically identifies key views north of Greensboro along MD 313 and east of Goldsboro on MD 287 (Mary Means & Associates 2007).

While Maryland's Scenic Byways program does not have regulatory authority over land development within scenic byway corridors, SHA coordinates with other State agencies and local governments to achieve its programmatic goals. The Maryland Department of Planning's Scenic Byways Resource Protection Application[51] is an example of this. A GIS mapping tool that inventories and analyzes both protected and vulnerable byways, it helps local and State agencies decide which byways are in most need of immediate conservation action, allowing them to prioritize and protect their historic and natural resources. The tool identifies four views from the byway between Greensboro and Goldsboro, and four east of Goldsboro that the Project could potentially affect (Figure 17). As noted earlier, though buffers will mitigate much of the project's visual impact

[51] http://mdpgis.mdp.state.md.us/BywayResourceTool/Map.html

through screening, landscapes beyond the project that contribute to the byway's intrinsic qualities will no longer be visible. Furthermore, until the buffer provides the required level of opaqueness through maturation, scenic quality along the HTUR in the project area will be degraded.

Figure 17 HTUR Corridor and Resources in Project Area



PPRP consulted with SHA's Regional and Intermodal Planning Division (RIPD) to review the project for consistency to the Scenic Byways program. PPRP's description of the byway's intrinsic qualities and specifically referenced farms along MD 313 and MD 287 as among the byway's most attractive views reflect RIPD's comments. Since the project will cover several farms within the byway's viewshed with solar panels, SHA expressed a preference for full screening or intensive screening where the HTUR bypasses these parcels. PPRP has confirmed from the

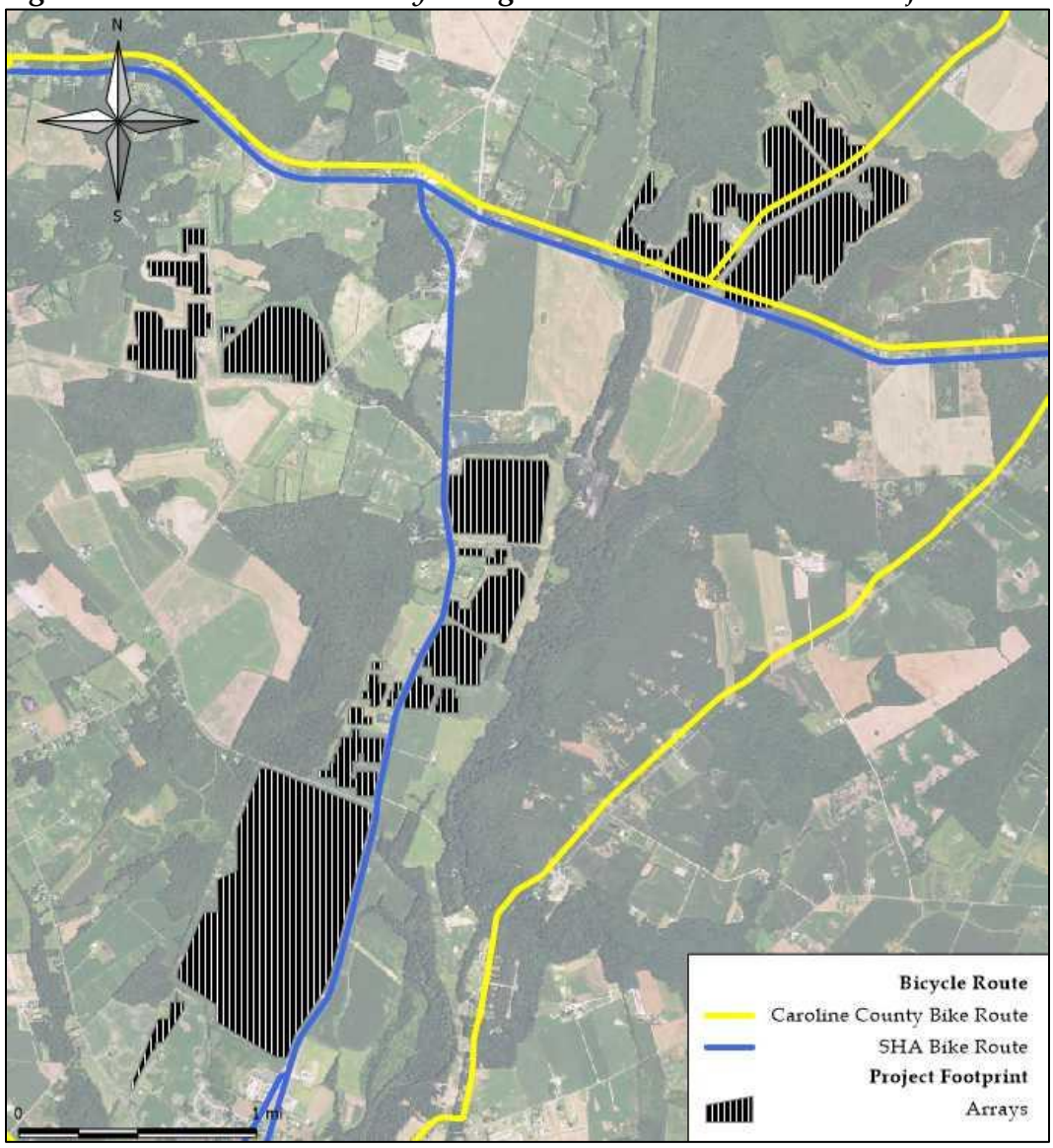
project's site plan that full screening landscape buffers are planned where solar arrays are adjacent to the HTUR byway.

Recommended Condition 29 (HTUR Viewshed Protection):

- Should it modify its landscaping plan for the project that, in any way, changes the type or composition of landscape buffers along the Harriet Tubman Underground Railroad National Scenic Byway, Cherrywood Solar shall submit the plan to the PSC and PPRP for review and approval by the Regional and Intermodal Planning Division, Maryland Department of Transportation State Highway Administration.

Because of its flat terrain, numerous paved roads and low traffic volumes, the Eastern Shore is a popular venue for bicycling. The SHA has designated MD 313 between Greensboro and Goldsboro, MD 287 east of Goldsboro, and several highways leading to the project area as bike routes (Figure 18). These SHA rates these routes as being of lesser difficulty due to moderate speed limits, paved shoulders, and light to medium traffic volume (SHA 2015c). Caroline County's cycling guide maps 11 cycling routes, including two that bypass the Project on MD 287 (Caroline County 2007).

Figure 18 SHA and County Designated Bike Routes Near Project



Between Greensboro and Goldsboro, MD 313 has two marked 12-foot lanes with 8 to 10-foot shoulders in both directions (SHA 2016a). East of Goldsboro, MD 287 has two 11-foot lanes and 4 to 5-foot shoulders. Other highways leading to the project area, which are also designated bike routes, have similar characteristics. During construction of the project, increased truck traffic could potentially affect cycling safety on these designated routes, particularly where traffic enters and leaves the road. By Maryland law, bicycles are vehicles. COMAR §11-176 defines a "vehicle" as any device in, on, or by which any individual or property is or might be transported or towed on a highway. As such, cyclists have rights and responsibilities as do drivers of motor vehicles. Among other provisions, Maryland traffic laws require a vehicle overtaking another vehicle, including a bicycle, to proceed with due regard for the other

vehicle on the approach, overtaking and clearance of the overtaken vehicle, and to yield to an overtaken bicycle before making any turns[52].

The low volume of truck traffic servicing the facility, and a construction schedule that is expected to commence in November 2019, when cycling activity seasonally declines, are expected to mitigate impacts to cyclists during construction. Still, PPRP is concerned that the additional truck traffic delivering supplies and services, particularly during the peak construction period, could compromise the safety of cyclists on nearby designated bike routes.

Recommended Condition 30 (Cycling Safety):

- Cherrywood Solar shall instruct its suppliers and contractors to be aware of on-road bicycle route designations near the Project and Maryland traffic laws regarding bicycles on the road, and include the condition in all contracts with suppliers or contractors.

4.6 Public Services and Safety

During construction and operation, no additional public services will be required to support the project under normal conditions. In the event of a fire or accident, the Emergency Management Service Division within the Caroline County Department of Emergency Services dispatches emergency responders (Caroline County 2010). Volunteer fire departments respond to regional needs. The Goldsboro Volunteer Fire Company (VFC) and Greensboro VFC are closest to the project. Both are all-volunteer organizations. Caroline County provides emergency medical services through a combination of volunteer and career providers. The Caroline County Sheriff's Office is the primary law enforcement agency in the county. The Greensboro Police Department is responsible for the delivery of law enforcement services within the Greensboro town limits.

Solar panels and associated electrical equipment are largely free of flammable materials. Modules for the project will be comprised of crystalline solar cells. Although potential health hazards have been associated with toxic materials released during fires from cadmium telluride, copper indium diselenide, and gallium arsenide photovoltaic modules (Moskowitz and Fthenakis 1990), crystalline solar cells, which are primarily made of silicon, are not considered to be hazardous to the

[52] http://www.mva.maryland.gov/safety/mhso/program-bicycle-safety.htm

environment (Alchemie 2013). Still, respiratory exposure to combustion products associated with PV components should be avoided (FPRF 2013, UCS 2015). With respect to other components, some modern transformers use mineral oil as a coolant while others use dry-type cooling. The flashpoint of mineral oil is 335°F, significantly higher than the U.S. Occupational Safety and Health Administration (OSHA) standard, which defines a flammable liquid as any liquid having a flashpoint at or below 199.4 °F (29 C.F.R. § 1910.106(a)(19)).

Post-construction, the risk of fire from ground-mounted photovoltaic systems will be low if site preparation and maintenance has removed potential fuels from under and around solar arrays (Planning Solutions 2014). Fire prevention guidance for ground-mounted PV installations is contained within the National Fire Protection Association's NFPA 1 Fire Code Handbook and NFPA 70 National Electrical Code.

Although the likelihood of fire is low, a challenge facing firefighters during fireground operations at PV facilities is the risk of electrical shock (FPRF 2013). This is because PV panels generate electricity when exposed to sunlight. Even at night, apparatus-mounted scene lighting may produce enough light to generate an electrical hazard. Under a continuous electrical load, any conduit or components between PV modules and disconnect switches will remain energized. Inverters may also provide voltage during daylight hours for several minutes on both sides of a disconnect, even when opened (FPRF 2013). The Fire Protection Research Foundation also recommends the use of respiratory protection during fireground operations involving PV systems.

While guidelines for fire operations at PV facilities have been published (NREL 2013, CalFire 2010, Orange County 2010), the fire companies in Caroline County are all-volunteer organizations that may not address fireground operations at PV facilities in their emergency response protocols. Caroline County does not address emergency response in §175-85 of its zoning bylaws.

<u>Recommended Condition 31 (Fire Safety):</u>

- Cherrywood Solar shall design, install and maintain the Project to meet all applicable minimum standards set forth in the National Fire Protection Association (NFPA) 70: National Electrical Code and all applicable minimum standards appropriate for ground-mounted solar facilities set forth in NFPA 1: Fire Code. Prior to commencement of construction, Cherrywood Solar shall contact the Goldsboro Volunteer Fire Company (VFC), the Greensboro VFC,

and the Caroline County Department of Emergency Services to develop appropriate protocols for addressing on-site emergencies.

4.7 Property Values

To date, the impact of utility scale solar photovoltaic systems on nearby property values has been the subject of little research. This may be partly because utility scale photovoltaic land requirements favor rural locations where adjacency issues are not as prevalent, or because repeat sales data, which might capture such effects, are simply not available. Still public perceptions that solar farms adversely affect property values remain.

Limited evidence from real estate appraisal methods has mostly supported the contention that solar farm development does not influence property values. Expert opinion from a past siting case in Massachusetts, for example, concluded that utility scale photovoltaic energy systems that are not visible from surrounding properties would have no impact on their market values (Franklin County 2014). A paired comparison of market values of residential and agricultural properties near solar farms in North Carolina came to a similar conclusion (Kirkland Appraisals 2014).

In another solar case filed with the Maryland PSC[53], a real estate appraisal study was commissioned by the project developer to investigate the potential impact of the project on neighboring property values using paired sales analysis of properties within and outside a half-mile radius of selected operational solar farms in Maryland (Treffer Appraisal Group 2016). Although the methodology and limited sample size do not allow one to draw a statistical inference from the data, the study nevertheless adds support to other appraisal findings.

With a minimal vertical profile and existing and proposed vegetative buffering along the perimeter of the site, the project will be largely out of sight from nearby properties. The project's operation will not emit significant traffic, noise, air or water pollutants, or generate any hazardous waste that could potentially affect public health. At the end of the facility's useful life, a decommissioning plan will return the project site to its original state. In other words, the local environment will be largely unaffected by the project. That the proposed facility will have a moderately benign local presence once the facility is operational suggests that property values will be unaffected.

[53] PSC Case #9429. In the matter of the application of LeGore Bridge Solar Center LLC for a CPCN to construct a 20.0MW solar photovoltaic generating facility in Frederick County, Maryland.

5.0 NOISE IMPACTS

This licensing review incorporates an evaluation of noise impacts to ensure compliance with State noise regulations. The analysis of potential noise impacts focuses on the potential for sound pressure from generating equipment to exceed numerical limitations at the nearby noise sensitive areas.

5.1 Definition of Noise

Noise generally consists of many frequency constituents of varying loudness. The smallest change in sound intensity that the human ear can detect is approximately three decibels (dB) . A tenfold increase in the intensity of sound is expressed by an additional 10 units on the dB scale, a 100-fold increase by an additional 20 dB. Because the sensitivity of the human ear varies according to the frequency of sound, a weighted noise scale is used to determine impacts of noise on humans. This A-weighted decibel (dBA) scale weights the various components of noise based on the response of the human ear. For example, the ear perceives middle frequencies better than low or very high frequencies; therefore, noise composed predominantly of the middle frequencies is assigned a higher loudness value on the dBA scale. Subjectively, a tenfold increase in sound intensity (10 dB increase) is perceived as an approximate doubling of sound. Typical A-weighted sound levels for various noise sources are shown in Table 1.

Table 1 Typical Sound Levels for Common Sources (dBA)

Noise Source	**Typical Sound Pressure Level**
Lowest sound audible to human ear	10
Soft whisper in a quiet library	30-40
Light traffic, refrigerator motor, gentle breeze	50
Air conditioner at 6 meters, conversation	60
Busy traffic, noisy restaurant, freight train moving 30 mph at 30 meters	70
Subway, heavy city traffic, factory noise	80
Truck traffic, boiler room, lawnmower	90
Chain saw, pneumatic drill	100
Rock concert in front of speakers, sand blasting, thunder clap	120
Gunshot, jet plane	140

Sound energy dissipates with increasing distance from the noise source. For every doubling of the distance, the sound pressure level produced by a given noise source decreases by approximately 6 dBA.

5.2 *Summary of Regulatory Requirements*

Maryland noise regulations specify maximum allowable noise levels, shown in Table 2 (COMAR 26.02.03). The maximum allowable noise levels specified in the regulations vary with zoning designation and time of day. The noise limit for residential areas is 55 dBA during nighttime hours and 65 dBA during daytime hours. A noise source should not create noise that exceeds the allowable levels, as measured at the receiving property.

Table 2 Maximum Allowable Noise Levels (dBA) for Receiving Land Use Categories

	Zoning Designation		
	Industrial	**Commercial**	**Residential**
Day	75	67	65
Night	75	62	55

Source: COMAR 26.02.03

Note: Day refers to the hours between 7 AM and 10 PM; night refers to the hours between 10 PM and 7 AM.

The State regulations exempt certain noise sources and noise generating activities. For example, motor vehicles on public roads are exempt from Maryland noise regulations; however, while on industrial property, trucks are considered part of the industrial source and are regulated as such. The regulations also allow construction activity to generate noise levels up to 90 dBA during daytime hours, but the nighttime standard may not be exceeded during construction.

While the State has established target levels for noise, enforcement authority for noise regulations rests with local government (in this case, Caroline County).

5.3 *Noise Impact Evaluation*

Operational noise from photovoltaic (PV) facilities is typically low. The PV panels and support equipment do generate some noise, primarily associated with the power inverters and electrical transformers. While there is some audible noise associated with the motors in the solar panel tracking mechanism, a 2013 report from Argonne National Laboratory

concluded that such mechanical noise was not a significant source of noise for off-site receptors (ANL 2013).

PPRP conducted an independent modeling analysis of the potential noise impacts from project operation. The main sources of noise from the Project will be a 250 MVA central AC step-up transformer at the new substation and multiple rack mounted 2.5 MW inverters. The site has 81 inverters, which will connect to the single central AC step-up transformer. The proposed substation area would be located adjacent to Tax Map 15 Parcel 66, east of "Area B" (see Project site plan with revised county comments on June 2018, Drawing No. C-2). The conceptual layout data provided by the Applicant (see response to Item No. PPRPDR2-13, April 30 2018) provide the location coordinates for each power inverter. Table 3 provides the noise emission profiles for the Project site. Figure 19 shows an aerial view of the proposed locations of the central transformer (substation) and the 81 inverters. The figure also shows the closest residences within 200 feet of the proposed project boundaries.

Table 3 Noise Emission Profiles for the Cherrywood Solar Project

Equipment Description	Total Sound Power Level, dB(A)[1,2]	Sound Pressure Level at 3 feet[3]	Source Location	Noise Control Measure
Central step-up transformer, 250 MVA	99.6	91.6	Outdoors	Uncontrolled
Inverter (SMA 220-2500 model), 2.5 MW	66.4	58.4	Outdoors	Uncontrolled

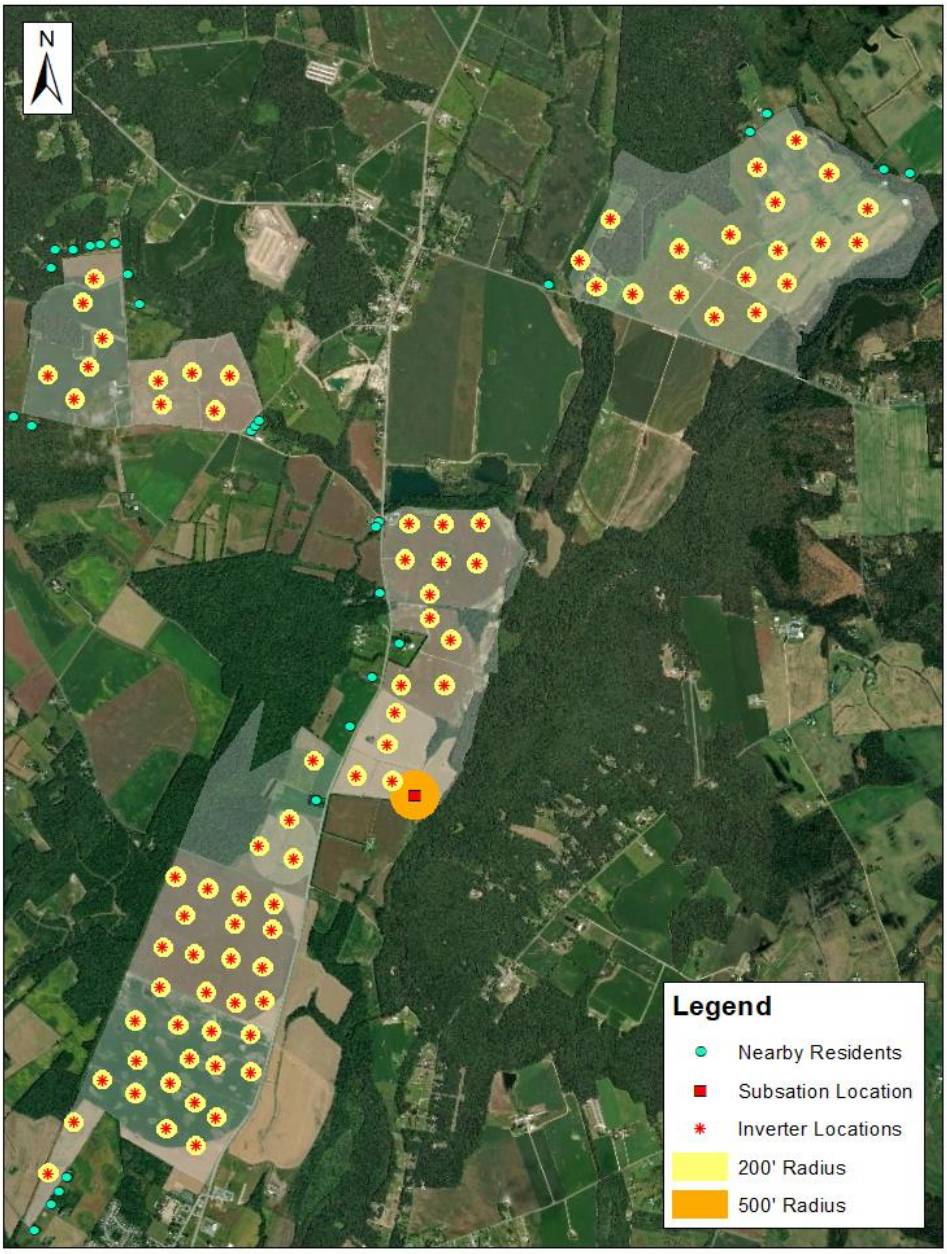
MVA = mega volt ampere, dB(A) = A-weighted decibel

[1] Overall A-weighted sound power level for the central step-up transformer was calculated based on the transformer MVA rating using methodology described in Engineering Noise Control, Fifth Edition (Bies et al 2018).

[2] Overall A-weighted sound power level for each inverter was based on vendor information i.e., sound power levels of 64.3 to 66.4 dB for the SMA 220-2500 model (see response to PPRPDR1-18, March 14, 2018). The upper bound sound power level was used for the noise modeling.

[3] For hemispherical propagation, sound pressure level at distance, R from the noise source (i.e., 3 feet) in dB(A) = source sound power level – (20*log(R) – 2.3).

Figure 19 Aerial View of the Cherrywood Solar Project Site Showing the Proposed Substation, Inverters, and Nearest Residences



PPRP used *Bruel & Kjaer's* Predictor Type 7810 noise modeling software (Version 12.0) to calculate noise emissions from the Project. The Predictor noise model uses the ISO 9613-2 industrial standards for sound propagation (Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation) (ISO 1996). ISO 9613-2 is a widely used and generally accepted standard for the evaluation of noise impact in environmental assessments. The computer model allows for

calculation of noise from multiple noise sources, as well as computation of distance losses, source directivity (all noise sources for this Project were modeled as non-directional point sources), atmospheric absorption (assumed a temperature of 27 degree Celsius (˚C) and relative humidity of 60%), reflection from surfaces, screening by obstacles, and ground attenuation. A ground absorption coefficient of 0.5 (i.e., 50% soft ground and 50% hard ground) was assumed for all modelled areas. The model assumed meteorological conditions favorable to sound propagation per ISO 9613-2 i.e., downwind propagation in all directions. The model assumes a flat terrain because the topography of the area is mostly relatively flat.

The Predictor model was first configured by importing ArcGIS shape files of the Project site and noise sources (see Figure 20). By doing this, the positions of all noise sources (81 inverters and one central transformer), source dimensions, and distance between sources can be assured to a high degree of accuracy. The specified noise levels provided in Table 3 were then entered into the model. The model is then used to generate noise contours at a resolution of 50 m x 50 m. The noise contours are overlaid onto the background tax map, visually illustrating the extent of the solar facility's noise impact on the surrounding community. Finally, the model was used to evaluate resulting noise levels for compliance with Maryland standards for environmental noise at residential areas (COMAR Section 26.02.03.02).

The model result show that noise generated by the proposed substation will meet the regulatory limit of 65 dBA at a distance of 70 feet. As shown on Figure 19, no nearby residences are located within that distance; in fact, the nearest residences are more than 1,000 feet from the substation. Our analysis also found that noise from the inverters will fall below regulatory levels within approximately 3 feet of the inverter pad, so no offsite impacts are expected.

The predicted hourly noise results ($L_{Aeq(h)}$) as contours are provided in Figure 20. Noise from the facility does not exceed 45 dBA at any of the nearby receptors; for most receptors, the facility will not create noise above 35 dBA, and will not be noticeable above existing background noise.

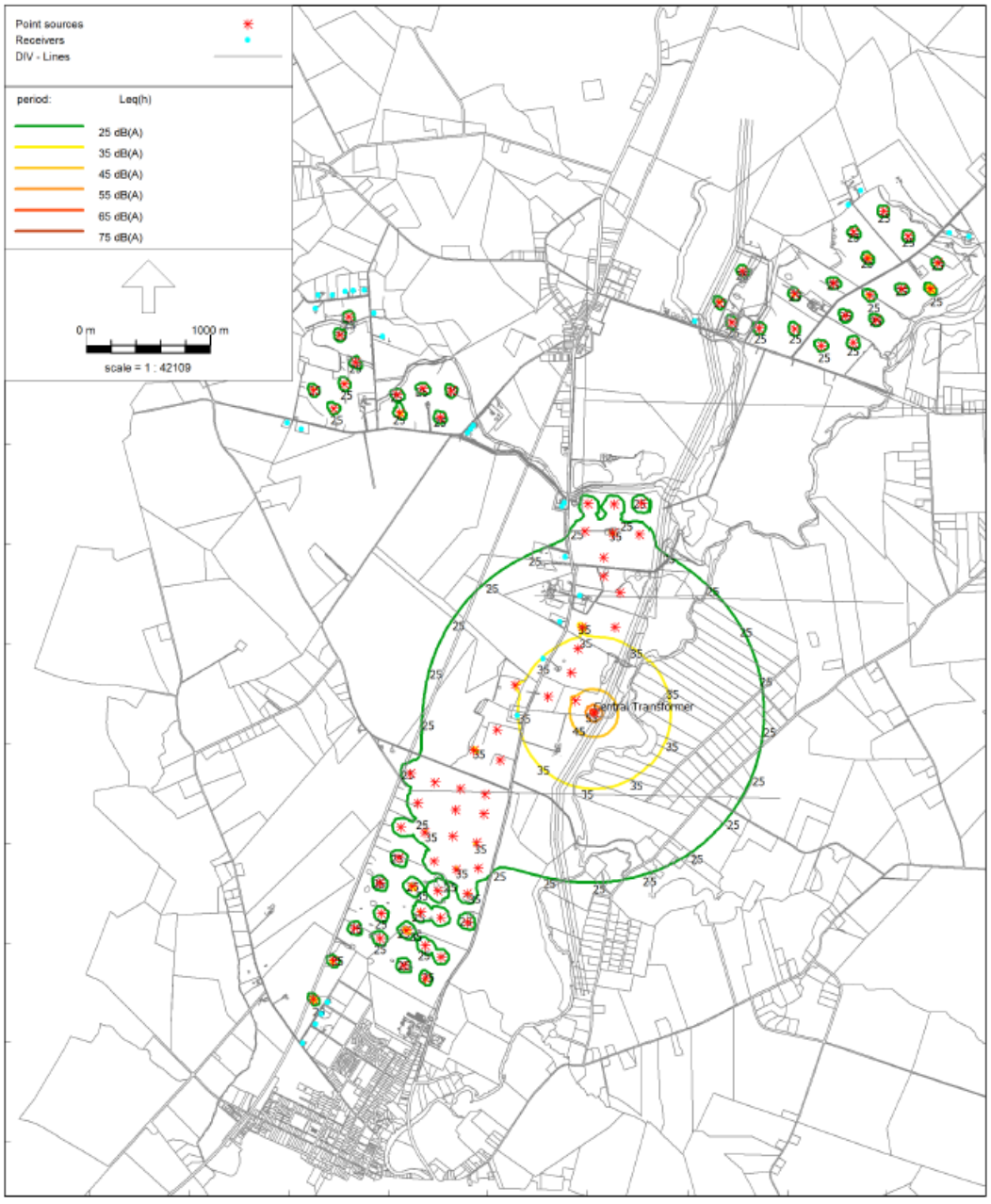
PPRP's recommended license conditions would require that the construction and operation of the proposed solar facility comply with the State's regulatory standards of 65 dBA (day) and 55 dBA (night), and the 90 dBA level during daytime construction. PPRP anticipates that noise

from the project, as proposed, will meet these construction and operational noise limits.

Recommended Condition 4.j (Noise):

- COMAR 26.02.03 applies to noise regulations whereby Cherrywood Solar shall construct the proposed Project in such a way that it complies with the Maryland noise regulations and with relevant Caroline County noise ordinances.

Figure 20 Predicted Noise Contours for Cherrywood Solar Project



6.0 ELECTROMAGNETIC FIELD IMPACTS

Electric and magnetic fields, referred to collectively as electromagnetic fields (EMF), are naturally occurring and result from the generation, transmission, and use of electric power. These fields are present around such things as appliances, electronics, electric wiring, and power lines.

For electric fields, the strength of a field is dependent on the voltage level and the amount of current flow. For example, the amount of current flowing through a power line varies as the demand for electric power changes. Voltage produces electric fields, measured in units of volts per meter (V/m) and increase in strength as the voltage increases. Magnetic fields, measured in units of gauss (G) or tesla (T) result from the flow of current through wires or electrical devices and increase in strength as the current increases. Wavelength, frequency, and amplitude characterize electric fields and magnetic fields. The frequency of the field, measured in hertz (Hz), describes the number of cycles that occur in one second. Electricity in North American alternates through 60 cycles per second, or 60 Hz.

Electric fields are shielded or weakened by materials that conduct electricity (i.e., trees, buildings, and human skin), while magnetic fields pass through most materials and are more difficult to shield. Both electric and magnetic fields decrease rapidly as the distance from the source increases. However, since magnetic fields are not easily shielded, most research in recent years has focused on the potential health effects from magnetic field exposure. Estimated average background levels of 60 Hz magnetic fields in most homes, away from appliances and electrical panels, range from 0.5 to 5.0 milligauss (NIEHS 2002). Table 4 shows typical magnetic field levels for common household appliances.

The potential health effects of exposure to EMF in the extremely low (ELF) frequency range from power transmission facilities have been the subject of scientific and public scrutiny for almost 30 years. The International Commission on Non-Ionizing Radiation Protection (ICNIRP) in its 2010 Guidelines concluded that neither a causal relationship between ELF-EMF and increased risk of cancer nor other long-term effects can be established (ICNIRP 2010). Research and assessments done by international expert panels from 2009 to 2018 have reached similar conclusions (Scientific Council on Electromagnetic Fields 2018; SCENIHR 2015).

Table 4 Typical Magnetic Field Levels of Common Appliances

Source	Field Strength at 12 inches (milligauss)	Field Strength at 3 feet (milligauss)
Coffee Maker	0.09 to 7.3	0 to 0.61
Copy Machine	0.05 to 18.38	0 to 2.39
Television	1.8 to 12.99	0.07 to 1.11
Vacuum Cleaner	7.06 to 22.62	0.51 to 1.28
Microwave oven	0.59 to 54.33	0.11 to 4.66
Computer monitor	0.2 to 134.7	0.01 to 9.37

Source: California Department of Health Services

6.1 *EMF and Solar Facilities*

PV solar panel arrays convert solar energy into DC electricity. A solar invertor, a component of a PV system, converts the DC output of a solar panel into AC that can be fed to the electrical grid. AC electricity produces "power frequency magnetic fields" and DC electricity produces "static magnetic fields."

Humans are constantly exposed to EMF throughout daily life, but EMF can cause negative health effects if exposure exceeds certain health-based thresholds. The most rigorous exposure guidelines for EMF are those developed by the ICNIRP. For the public, the ICNIRP has established a threshold for acute exposure of 830 milligauss for power frequency magnetic fields and 4 million milligauss for static magnetic fields.

Solar energy systems produce magnetic fields significantly below the minimum thresholds established by the ICNIRP. Solar energy systems will produce power frequency magnetic fields from their AC inverters and grid interconnection, while the DC electricity generated by the PV modules will produce static magnetic fields. A typical solar PV invertor may produce a power frequency magnetic field of about 3 milligauss at a distance of 10 feet; this level is comparable to the levels produced by common household appliances at a distance of only 3 feet. By design, solar energy systems will be located at least 50 feet from any residences, and EMF levels will be insignificant at these distances. Table 5 provides an

example of calculated EMF levels for a typical solar PV energy system, specifically the West Linn Highway project in Oregon.

Table 5 EMF Levels at the Proposed 3 MW West Linn Highway Solar Project, Oregon

Source	Field Type	Field Strength at 3 feet (milligauss)	Field Strength at 10 feet (milligauss)	Corresponding ICNIRP exposure limit for the general public (milligauss)
Parallel string of PV modules	Static	1,697	509	4,000,000
DC to AC power invertors	Power frequency	344	3	830
Grid interconnection	Power frequency	14	N/A	830

Source: ODOT 2010, Scaling Public Concerns of Electromagnetic Fields Produced by Solar Photovoltaic Arrays

This evaluation of the proposed West Linn Highway Solar project found that the calculated field strength of 509 milligauss measured at 10 feet from the PV modules is well below the ICNIRP static threshold of 4 million milligauss and the field strength of the DC to AC power invertors of 3 milligauss is well below the 830 milligauss power frequency threshold. At the Cherrywood Solar Project Site, the closest resident to the proposed PV modules is located approximately 200 feet away. EMF levels at this distance will be well below the reported thresholds and PPRP does not expect them to pose potential health risks to nearby residents.

The United States Department of Energy ordered the National Renewable Energy Laboratory (NREL) to conduct a study on the emission of EMFs by solar panels (DOE 2009). NREL found that the magnitude of EMF measured at the perimeter of PV (photovoltaic, i.e., solar panels) installations is indistinguishable from background EMF, and is lower than that from many household appliances such as televisions and refrigerators.

6.2 Mitigation Strategies

As previously discussed, electric fields are shielded or weakened by materials that conduct electricity, while magnetic fields pass through most materials and are more difficult to shield. However, both electric and magnetic fields decrease rapidly as the distance from the source increases. Therefore, the most effective strategy for limiting exposure at solar energy systems is to provide adequate buffer space between the invertors and PV modules and nearby residential properties. As described above, magnetic field levels will fall below threshold human health standards at a distance of 3 feet; for the Cherrywood Solar Project, the buffer distance from the fence line is sufficient so that EMF levels from the solar energy systems are not anticipated to pose a potential health risk to nearby residents.

7.0 SUMMARY

PPRP concludes that the Cherrywood Solar Project has the potential for significant impacts to environmental and socioeconomics resources as proposed. Therefore, the reviewing State agencies have developed a number of recommended license conditions (PPRP_Exhibit (HS-2)) to control or mitigate for these impacts. Adherence to these conditions will be necessary to build the Project without generating adverse effects.

Because it is a non-combustion process relying on the direct conversion of solar energy into electrical energy, the operation of a solar PV facility does not produce air emissions. This differs significantly from conventional fossil-fired electric power plants. Electricity generated by solar PV facilities represents a way of meeting the region's growing demand for electric power without emitting combustion-related air pollutants. Therefore, there will be no significant impact to air quality.

PPRP assessed the Cherrywood Solar Project's potential environmental effects to biological resources, including vegetation; wildlife; rare, threatened and endangered (RTE) species; and wetlands and streams. The Project is dispersed across 18 non-contiguous agricultural fields located within a landscape matrix of streams, wetlands, and forests that supports FIDS, RTE species, and diverse aquatic, terrestrial, and avian populations. The construction of the Project will disrupt portions of Maryland's Green Infrastructure Network and change the character of areas central to DNR's Biodiversity Conservation Network. The cumulative effects of these impacts, distributed throughout a region of 30 square miles in an ecologically sensitive area of the Upper Choptank River watershed will be large and difficult to mitigate. Permanent change to the environmental quality of the region is likely.

Caroline County has deferred to the PSC's Forest Conservation evaluation for the Cherrywood Solar Project, stating that the Applicant will be exempt from the local FCA regulations if the PSC issues a CPCN in accordance with the State FCA under NRA 5-1603(f). PPRP determined that afforestation under the FCA is required to meet the State's no net loss of forest goals. PPRP has also found that there are significant natural resources, including designated Green Infrastructure areas that could be enhanced by afforestation on or near the facility, with minimal impact to the Project. In addition, the PSC previously determined that utility vegetation management should cease in some areas of the Project Site to encourage reforestation and protect the State's valuable natural resources. Therefore, the reviewing State agencies recommend that the License

Conditions for the CPCN for this facility require completion of a Forest Stand Delineation and development of a Forest Conservation Plan that includes not less than 29.92 acres of afforestation.

The proposed Cherrywood Solar Project site contains a diverse array of wildlife habitats. Although the farmed areas of the site have been intensively managed, limiting nesting by birds or direct occupancy by other wildlife, they provide valuable open space and forage areas for arthropods, amphibians, reptiles, birds, and mammals that make their homes in the adjacent stream, forest, and wetland areas. The numerous drainage ditches and wetlands across the Project site also provide habitat for a variety of wildlife. Surrounding the project site are Tier II streams, Wetlands of Special State Concern, and other stream reaches in the Upper Choptank Stronghold watershed that provide abundant permanent wildlife habitat, including habitat for Federally-listed endangered species. Forest Interior dwelling birds and raptors have been observed in the area.

The Upper Section (Area A) lies in the drainage area of the Crescent macrosite, a nontidal wetland complex that supports State listed plants, and includes Wetlands of Special State Concern and a Nature Conservancy Preserve with rare species of dragonflies. A portion of the Lower Section (Area D) drains westward to a Tier II stream segment of Forge Branch, while the remainder of the Cherrywood Project Site (Upper, Middle and Lower Section) drains to the Upper Choptank River into a Wetland of Special State Concern at the confluence with Gravelly Branch, less than a mile from the proposed substation location. This portion of the Upper Choptank River is known to contain the state endangered mussel Triangle Floater (*Alasmidonta undulata*) and is upstream of habitat for the Dwarf Wedge Mussel. Sediment or contaminants discharged from the site during construction or operations would be conveyed to sensitive habitats for these species via tributary streams, ditches, and surrounding wetland areas.

The majority of the Project is within a DNR designated Stronghold Watershed with high biodiversity. Furthermore, the Maryland Biological Stream Survey (MBSS) has several sampling sites in and around the Cherrywood Project Site that show good fish and benthic conditions. The Upper Choptank River Watershed Characterization Report states that while there are issues with nutrients and sediment, the River contains valuable fisheries resources and supports healthy fish communities.

In addition to local impacts on individual resources, the Cherrywood Solar Project has the potential to affect the environmental condition of neighboring properties, modify the ecological functioning of the

landscape matrix as a whole, degrade future use of the land as farmland, or overwhelm the resilience of the environment by the accumulation of multiple small impacts. The accumulated biological impacts of 1,073 acres of panel construction, including 51 new culverts on streams and ditches, are likely to be significant to surrounding and downstream environmentally sensitive areas. Of particular concern for the Cherrywood Solar Project is the potential for extensive, widespread land use conversion to cause irreversible degradation of the highly connected matrix of sensitive ecosystems in the Upper Choptank River landscape.

In addition to the above, biological impacts that may be caused by the transmission line interconnection were assessed. The Cherrywood Solar Project requires power connections between the separated project segments as well as a connection to the regional bulk transmission grid. There will be potential environmental impacts associated with all of these connections, which will be achieved by underground cables at high voltages. The underground HDD boring below Lake Bonnie may result in a frac-out that releases drilling fluid into the Lake and the Choptank River system. The underground HDD boring below an abandoned railroad embankment may encounter contaminated materials. The proposed Substation Location is in an environmentally sensitive area just upstream of a Wetland of Special State Concern and the habitat of several endangered species. Any contaminants released from the Substation, including transformer insulating oils, would rapidly enter these environmentally sensitive areas unless protective barriers are in place.

The license conditions recommended by the reviewing State agencies will protect these resources from significant adverse impacts.

The project will create temporary construction jobs and generate fiscal benefits to the State and Caroline County. PPRP does not anticipate permanent population and housing impacts given the short duration of the construction schedule. Fiscal benefits will be in the form of corporate income tax, State and county personal income tax, sales tax and property tax revenues.

In terms of land use, the project will consume about 1,088 acres. Most acreage with the project's limit of disturbance is prime farmland or farmland of statewide importance. Most project parcels are located within the county's PPA. No agricultural or other land preservation easement protects the project property or any adjoining parcels. The project is outside the municipal boundaries of Greensboro and Goldsboro, although some parcels are within town- or county-designated growth areas. Most project parcels are not within a PFA, although two non-

easement parcels are within Greensboro's designated growth area and one easement parcel is within Goldsboro's greenbelt area. The project is not dependent on State infrastructure funding.

All non-easement project parcels are zoned R – Rural District. A commercial solar energy system is a permitted use subject to special use exception in the R-district except upon parcels located in TDR receiving areas and parcels under land preservation easements. PPRP has concluded that Planning Commission review following the granting of a special use exception by the Caroline County Board of Appeals is necessary to ensure that the final site plan complies with all existing local laws, regulations and ordinances. The recommended license conditions will require that the project receive site plan approval and all applicable local permits prior to the commencement of construction.

Post-construction, the project is not expected to influence land uses of other properties in the area.

Construction worker traffic added to background traffic volumes at the beginning and end of each workday will not affect the level of service on roads near the project. PPRP has concluded that truck traffic will not affect existing motor vehicle traffic near the project. Post construction, the facility will not be a significant traffic generator. With respect to FAA standards and notification requirements, glare from the project will not affect air traffic safety.

The terrain within the project site exhibits little vertical relief, and views of the site are mostly unencumbered by vegetation. The solar arrays will have a low visual profile. Where landscaping is not proposed in the project's site plan, natural buffering afforded by existing forest and woodland edges block views of solar panels from most perspectives. The Project incorporates landscaping buffers to provide vegetative screening from certain vantage points. Many unobstructed views are from agricultural parcels that do not contain residences. Where landscape buffers are the primary source of visual mitigation, maturing of trees and shrubs will reduce the visual footprint of the project over time. PPRP has concluded the project's site plan satisfies design standards in §175-85 of Caroline County's zoning bylaw. Although the project will change the area's visual setting, PPRP has concluded that landscaping that meets the county's design standards for solar arrays will mitigate the project's appearance and reduce incompatibilities with other land uses in the project area.

PPRP has concluded that the project will not create a new source of substantial light if its lighting plan satisfies the County's exterior lighting standards. PPRP's independent assessment of glare concluded that it is extremely unlikely that reflected sunlight from the solar arrays will affect nearby properties or traffic on roads bypassing the project. If any complaints do arise as a result of glare or any other issues, the recommended license conditions will require Cherrywood Solar to address those complaints.

Regarding cultural resources, MHT noted some parcels with the project's limit of disturbance are in areas that are archeologically sensitive, and recommended a number of Phase I archeological investigations. After reviewing the survey results, MHT determined no further archeology work is warranted as part of the undertaking. MHT also requested National Register Determination of Eligibility (DOE) submissions for several properties and any other affected resources over 50 years of age. After reviewing the submissions, MHT determined two properties were eligible for listing in the National Register of Historic Places, although it concluded the proposed buffer plan will mitigate any potential adverse effect on one of the properties. For the other property, MHT concluded that avoidance of any potential adverse effect would require removing the solar arrays from the parcel and leaving the structure standing. Otherwise, the undertaking will be required to mitigate the adverse effect on the property. A license condition specifies the actions that Cherrywood Solar must take to resolve these issues, as determined in consultation with MHT.

Most of the project lies within the programmatic boundaries of the Stories of the Chesapeake CHA. PPRP has consulted with Eastern Shore Heritage, Inc., the heritage area's management unit, in fulfillment of its consultation requirement.

The Harriet Tubman Underground Railroad (HTUR) Byway bypasses much of the project. The SHA reviewed the project for consistency to the Scenic Byways program and expressed a preference for full screening or intensive screening where the HTUR bypasses the project. PPRP has confirmed from the project's site plan that Cherrywood Solar plans to install full screening landscape buffers where solar arrays are adjacent to the HTUR byway.

Two State highways bypassing the project site are SHA and/or county-designated bicycle trails. The low volume of truck traffic servicing the facility and a construction schedule that will commence when cycling activity seasonally declines are expected to mitigate impacts to cyclists

during construction. PPRP has recommended a license condition to enhance the safety of cyclists sharing the road with construction vehicles servicing the project.

The reviewing State agencies recommend a license condition to ensure that the project conforms to national fire and electrical codes and that emergency response protocols are in place in the unlikely event of a fire or other emergency. Overall, the project's operation will not create significant traffic, noise, air emissions, or water pollution, or generate any hazardous waste that could potentially affect public health. PPRP has concluded that property values will be unchanged by the project.

The reviewing State agencies also recommend a license condition requiring all of the noise sources associated with the Project to comply with State noise regulations, as listed in COMAR 26.02.03. The available information provided by Cherrywood Solar indicates that the Project will comply with both the construction and operational noise limits. PPRP's independent analysis confirms this finding.

EMF levels, in particular magnetic field levels, from solar panels and inverters have been shown to fall below threshold human health standards at a distance of 3 feet. Given that the distance from the Project to the nearest adjacent homes is approximately 200 feet, PPRP does not anticipate that EMF levels from the Project will pose a serious health risk to nearby residents.

8.0 REFERENCES

Alchemie 2013. Solar Facts and Advice. Alchemie Ltd. http://www.solar-facts-and-advice.com/monocrystalline.html. Accessed January 6, 2015.

ANL 2013. An Overview of Potential Environmental, Cultural, and Socioeconomic Impacts and Mitigation Measures for Utility-Scale Solar Energy Development. Environmental Science Division, Argonne National Laboratory. ANL/EVS/R-13/5. June 2013.

CalFire 2010. Fire Operations for Photovoltaic Emergencies. Office of the State Fire Marshall. November 2010.

Caroline County 2007. Cycling in Caroline County Maryland. Caroline County Office of Tourism. 2007. Accessed August 16, 2018 at https://visitcaroline.org/listings/cycling-in-caroline/.

Caroline County 2017. Land Preservation, Parks, and Recreation Plan. Caroline County Recreation and Parks. Final Draft, 2017.

Caroline County 2017. Land Use Ordinance. Caroline County, Maryland. Amended through October 3, 2017.

DOE 2009. Department of Energy letter to Allison Hamilton of the Oregon Department of Transportation. November 12, 2009.

Dominguez, Anthony, Jan Kleissl, and Jeffrey C. Luvall. 2011. "Effects of Solar Photovoltaic Panels on Roof Heat Transfer". Solar Energy, Vol. 85, No. 9, pp. 2244-2255.

Eastern Shore Heritage, 2005. Stories of the Chesapeake Heritage Area Management Plan. Eastern Shore Heritage, Inc., Chestertown, Maryland. Fall 2005.

EPA 2005. Lesley J. Brown and Robin E. Jung, *An Introduction to Mid-Atlantic Seasonal Pools*, EPA/903/B-05/001, June 2005. Available at https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1002R0O.pdf.

FAA 2010. Technical Guidance for Evaluating Selected Solar Technologies on Airports. Federal Aviation Administration, Office of Airports, Office of Airport Planning and Programming. Washington, DC. November 2010.

FAA 2013. Interim Policy, FAA Review of Solar Energy System projects on Federally Obligated Airports. Federal Aviation Administration, Department of Transportation. Federal Register, Vol. 78, No. 205. October 23, 2013.

FPRF 2013. Fire Fighter Safety and Emergency Response for Solar Power Systems. Final Report. Prepared by Casey C. Grant, P.E. The Fire Protection Research Foundation. May 2010. Revised October 2013.

Franklin County 2014. Commissioner's Agenda Information Sheet. Item: Request for Special Use Permit – Sarah Solar, LLC, Parts 2 and 3. June 16, 2014.

Fthenakis, Vasilis and Yuanhao Yu. 2013. "Analysis of the Potential for a Heat Island Effect in Large Solar Farms." Proc. 39th IEEE Photovoltaic Specialists Conference. June 16-21, 2013. Pages 3362-3366.

Gregory, J. H., Dukes, M. D., Jones, P. H., & Miller, G. L. 2006. "Effect of Urban Soil Compaction on Infiltration Rate." Journal of Soil and Water Conservation, Vol. 61, No. 3, pp. 117-124.

Harrison, Chris, Huw Lloyd, and Chris Field, 2016. "Evidence review of the impact of solar farms on birds, bats and general ecology." Prepared by Manchester Metropolitan University, August 2016. Published by Natural England (www.gov.uk/natural-england) as Technical Report NEER012, March 2017.

Haynes, Matthew A., Richard A. McLaughlin, and Joshua L. Heitman. 2013. "Comparison of methods to remediate compacted soils for infiltration and vegetative establishment." Open Journal of Soil Science, Vol. 3, No. 05, p. 225.

ICNIRP 2010. International Commission on Non-Ionizing Radiation Protection, *ICNIRP Guidelines for Limiting Exposure to Time Varying Electric and Magnetic Fields (1 Hz - 100 kHz),* Health Physics, vol. 99, no. 6, pp. 818-836.

Kirkland Appraisals 2014. Letter from Richard C. Kirkland, Jr., Kirkland Appraisals, LLC to Mr. Louis Iannone, Strata Solar, July 24, 2014. http://www.chathamnc.org/RezoningSubdivisionCases/2014/9-15-14_BOC/Strata%20Solar%20No%204%20US%2064%20W/CUP%20

Application/Appraisal%20Consult%20on%20Pit%2064%20Solar.pdf. Accessed December 24, 2015.

Kittel 2014. Personal communication re: Rockfish Solar Array project from Laura Kittel, Franchise Tax and Utility Valuation Manager, Maryland Department of Assessments and Taxation, July 15, 2014.

KYDFWR, 2017. Kentucky Department of Fish and Wildlife Resources. "Mowing." Downloaded March 23, 2017 from https://fw.ky.gov/Wildlife/Documents/mowing.pdf

Mary Means & Associates 2007. The Harriet Tubman Underground Railroad Byway. Corridor Management Plan. Prepared by Mary Means & Associates, Inc. with Kittleson Associates, Inc., Tony Cohen, Kate Cliffor Larson, Andy Kalback. 2007.

Maryland Stormwater Design Manual, Volumes I and II (2000) with Supplement No. 1 http://www.mde.state.md.us/programs/Water/StormwaterManagementProgram/MarylandStormwaterDesignManual/Pages/Programs/WaterPrograms/SedimentandStormwater/stormwater_design/index.aspx

Massachusetts Clean Energy Center 2012. Study of Acoustic and EMF Levels from Solar Photovoltaic Projects. Prepared by Tech Environmental, Inc., Waltham, MA, for Massachusetts Clean Energy Center. December 2012.

MDOT 2018. Draft FY 2018-2023 Draft Consolidated Transportation Program. State Highway Administration. Caroline County. Maryland Department of Transportation. August 1, 2015.

Millward, Andrew A., Kamal Paudel, and Suzanne E. Briggs. 2011. "Naturalization as a Strategy for Improving Soil Physical Characteristics in a Forested Urban Park." Urban Ecosystems, Vol. 14, No. 2, pp. 261-278.

Moskowitz and Fthenakis 1990. "Toxic materials released from photovoltaic modules during fires: health risks." Paul D. Moskowitz and Vasilius M. Fthenakis. Solar Cells, January 1990, Vol. 29, No. 1, p. 63-71.

National Institute of Environmental Health Sciences (NIEHS) 2002. EMF – Electrical and magnetic Fields Associated with the use of Electric Power, Questions and Answers.

NCTECH 2017. Balancing Agricultural Productivity with Ground-Based Solar Photovoltaic (PV) Development. NC Clean Energy Technology Center. August 2017. https://nccleantech.ncsu.edu/wp-content/uploads/Balancing-Ag-and-Solar-final-version-update.pdf

NREL 2013. On-site PV Guidance. Prepared jointly by the General Services Administration and the National Renewable Energy Laboratory. October 2013.

NREL 2017. Native Vegetation Performance under a Solar PV Array at the National Wind Technology Center. NREL Technical Report TP-1900-66218 prepared by Brenda Beatty, Jordan Macknick, James McCall, and Genevieve Braus, National Renewable Energy Laboratory, and David Buckner ESCO Associates Inc. May 2017

ODOT 2010. Scaling Public Concerns of Electromagnetic Fields Produced by Solar Photovoltaic Arrays. Prepared for the Oregon Department of Transportation by Good Company, Eugene, OR. http://www.oregon.gov/odot/hwy/oipp/docs/emfconcerns.pdf. Accessed November 13, 2015.

Orange County 2010. Guideline for Fire Safety Elements of Solar Photovoltaic Systems. Orange County Fire Chiefs Association. July 17, 2008. Revised January 1, 2010.

Planning Solutions 2014. Kahe Utility-Scale Photovoltaic project. Draft Environmental Assessment. Prepared by Planning Solutions for Hawaiian Electric Company Inc. May 2014.

RETF 2010. Caroline County, Maryland. Renewable Energy Task Force. Established March 9, 2010.

SCENIHR 2015. Opinion on Potential Health Effects of Exposure to Electromagnetic Fields (EMF). Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR), Brussels, Belgium.

Schwartz, Stuart S., and Brennan Smith. 2016. "Restoring hydrologic function in urban landscapes with suburban subsoiling." Journal of Hydrology, Vol. 543, pp. 770-781.

Scientific Council on Electromagnetic Fields 2018. Recent Research on EMF and Health Risk. Swedish Radiation Safety Authority, April 2018.

Sellers, P.J., M.D. Heiser, F.G. Hall, S.J. Goetz, D.E. Strebel, S.B. Verma, R.L. Desjardins, P.M. Schuepp, and J.I. MacPherson. 1995. "Effects of Spatial Variability in Topography, Vegetation Cover, and Soil Moisture on Area-Averaged Surface Fluxes: A Case Study using the FIFE 1989 data." J. Geophys. Research, Vol. 100, No. 012, pp. 25,607-25,629.

SHA 1998. SHA Utility Policy. Maryland State Highway Administration, Utilities Section. Hanover, Maryland. Revised March 1998.

SHA 2016a. Caroline County Highway Location Reference. Maryland Department of Transportation, State Highway Administration, Data Services Division. Data as of December 31, 2016.

SHA 2016. Schwartz, Stuart S., and Brennan Smith. "Sustainable Landscaping Practices for Enhancing Vegetation Establishment." Maryland State Highway Administration Research Report MD-16-SHA/UMBC/1-1. (2016)

SHA 2016b. Truck Volume Maps by County, 2014-2016. Maryland Department of Transportation, State Highway Administration, Data Services Division. Data as of December 31, 2016.

Shang and Bishop 2000. Visual Thresholds for Detection, Recognition and Visual Impact in Landscape Settings. Haidong Shang & I. D. Bishop. Journal of Environmental Psychology 20, 125-140.

Six & Associates 2016. Letter to Mr. Jack Stern from A. Wayne Six, SRA. January 22, 2016.

Spaven Consulting 2011. Solar Photovoltaic Energy Facilities: Assessment of Potential for Impact on Aviation. Report No. 10/344/RPS/1. January 2011.

Town of Goldsboro 2009. Goldsboro Comprehensive Plan 2009. Prepared by Goldsboro Planning Commission with assistance from Community Planning and Assistance, Maryland Development Corporation. Adopted September 14, 2009.

Town of Greensboro 2010. Greensboro Comprehensive Plan 2010. Adopted June 17, 2010.

Town of Greensboro 2018a. Re: Case No. 9477 – Cherrywood Solar 1, LLC. Letter to Secretary Collins, Public Service Commission of Maryland from Mayor Joseph J Noon, Town of Greensboro. April 19, 2018.

Town of Greensboro 2018b. Re: Case No. 9477 – Cherrywood Solar 1, LLC. Letter to Terry J. Romine, Public Service Commission of Maryland from Brynja M. Booth, Town Attorney for the Town of Greensboro. August 6, 2018.

Treffer Appraisal Group 2016. An External Obsolescence Study Related to Proposed Solar Farms in Frederick County, Maryland. Prepared by Treffer Appraisal Group for Coronal Development Services. January 18, 2016.

Turney, Damon and Vasilis Fthenakis. 2011. "Environmental Impacts from the Installation and Operation of Large-scale Solar Power Plants." Renewable and Sustainable Energy Reviews, Vol. 15, No. 6, pp. 3261-3270.

UCS 2015. Environmental Impacts of Solar Power. Union of Concerned Scientists. http://www.ucsusa.org/clean_energy/our-energy-choices/renewable-energy/environmental-impacts-solar-power.html#bf-toc-2. Accessed January 7, 2015.

USDA 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. Soil Survey Division Staff. 1993.

WHS 2017. Mowing and Upland Wildlife. http://dnr.maryland.gov/wildlife/Pages/habitat/mowinginfo.aspx

Appendix A
Data Request Responses

PSC Case 9477
Cherrywood Solar Project

CASE NO. 9477

CHERRYWOOD SOLAR I
RESPONSE TO PPRP DATA REQUEST NO. 2
RESPONSE DATE: April 30, 2018

Item No.: PPRPDR2-2 In the response to PPRPDR1-3, the applicant referenced an MDE memorandum dated January 19, 2018 that was included in Appendix 11 of the Project ERD.

a) Please describe any qualifications or updates that have been made to this memorandum since January 19th, either written or verbal, directed to project staff, consultants, or contractors. Please provide copies or summaries of same.

b) If any additional concerns have been raised subsequent to this memorandum with regard to ditch filling, impacts to wetlands, or underground electrical interconnections, please describe the potential impact of those concerns on the project design and construction timeline, if any.

RESPONSE:

a) The Applicant's consultant (H&B Solutions) received an email from Mr. Kampmeyer on February 5th and responded on February 6th (see ***Attachment A***). Although the ERD mentioned we had avoided wetlands, we omitted to identify the ditch crossings needed for the perimeter road to be provided for emergency vehicle access. DBF has prepared the necessary exhibits and ECS is working to complete the wetlands permit application to acquire the MDE wetlands permit approval which will be needed prior to construction.

   In addition, the Applicant also received communication from MDE indicating the above information regarding the permit should be supplemented to the PSC in order to augment Appendix 11 in the ERD.

b) The Applicant and its consultants met with the SCD on April 9th to discuss their cross-parcel PDA ditch concern. Although these electric connections will be made via directional drilling, there was concern the fencing around various parcels would create access problems for those responsible with tax ditch maintenance.

   In response to their concern, the Applicant has identified two approaches for satisfying the PDA ditch maintenance concern. For land associated with the Project that has existing PDA's, the Applicant will enter into an appropriate agreement with the Association for the continuation of maintenance and payment for these services. For areas outside of the Project where Project infrastructure (ex. fences across a shared drainage ditch) impacts the accessibility of those areas for repairs and maintenance, the Applicant will provide access

through gates at property locations and/or compensate the Association for additional time and resources required to access those areas as a result of Project infrastructure constraints.

Another item discussed with SCD on April 9th was the need to identify methods for locating and avoiding subsurface tile drainage lines during construction.

The Applicant and its consultants have coordinated with Mr. Biddle on this item and the Applicant has also worked with Mr. Biddle and the individual property owners to identify these subsurface tile systems. The current plans include best available information for avoidance. To the extent needed and during the construction document preparation field verification will be performed using a combination of aerial imagery, ground penetrating radar, and field verification to confirm existing drainage locations.

In summary the Applicant, through the local process with the Planning Commission and SCD is modifying the design approach in order to effectively address these items; neither of which will impact the project schedule.

CASE NO. 9477

CHERRYWOOD SOLAR I
RESPONSE TO PPRP DATA REQUEST NO. 3
RESPONSE DATE: June 22, 2018

Item No.: PPRPDR3-1 PPRP requires additional information to evaluate the cumulative impacts of perimeter access roads and culvert installations.

a) Please provide the total number of proposed reinforced concrete pipe culvert crossings over each of the following features: (1) PDA, (2) ditch, (3) stream, (4) wetland; as these features are defined in the GIS data provided in Applicant's response to PPRPDR2-7.

b) Please summarize the status of Applicant's coordination with Maryland Department of the Environment (MDE), Soil Conservation District (SCD), or any other agencies regarding the appropriate sizing of the proposed culverts, and provide copies of any written correspondence.

RESPONSE:

a) Culvert Crossing Types

Type	Lower	Middle	Upper	Total
Ditch – Not in Wetland or Stream	1	0	1	**2**
Stream	0	4	0	**4**
Wetland	27	12	6	**45**
Total	**28**	**16**	**7**	**51**

PDA
*Note – the PDA numbers are included in the stream/wetland numbers above.

Type	Lower	Middle	Upper	Total
PDA & Stream	0	4	0	**4**
PDA & Wetland	0	1	3	**4**
Total	**0**	**5**	**3**	**8**

b) The Applicant is in the process of updating its draft application for MDE permitting of these crossings. ***Attachment A*** includes a typical cross section and map which identifies their location. This document is currently being updated to reflect the crossings noted in the ERD. Once complete, the updated application will be submitted to MDE for review/approval.

CASE NO. 9477

CHERRYWOOD SOLAR I
RESPONSE TO PPRP DATA REQUEST NO. 3
RESPONSE DATE: June 22, 2018

Item No.: PPRPDR3-7 In the response to PPRP DR2-5, the Applicant indicated that details of substation construction and transmission interconnection to the DPL 230-kV network were still under discussion with DPL.

a) Please provide an update on the status of these discussions.

b) Please provide a list of persons at DPL with whom the Applicant has discussed the project in person or telephonically or with whom the Applicant has communicated via email or other written documents.

c) Please provide copies of any substation or interconnection plans and schedules that have been provided directly by DPL to the Applicant. This request is independent from and does not include the PJM interconnection studies which have already been submitted in the Applicant's ERD and testimony.

RESPONSE:

a) As stated in **PPRPDR2-5**, on April 25th, Cherrywood received an update from DPL that, while the substation design is not yet final, the actual footprint of the proposed substation is 394' x 232' which is approximately 2.1 acres within the 7-acre tract set aside for this purpose. On June 8, 2018, DPL indicated that they are "a couple weeks" away from submitting a final report to PJM for review. On June 13, 2018, DPL confirmed by email that the crossing of the 138 kV line segment by the 230 kV line into the new substation would be a buried crossing (i.e. not overhead). This is the extent of the additional information the Applicant has received from DPL since the response to **PPRPDR2-5**.

b) Mark S. Okonowicz, PMP, Principal Project Manager
Kevin Campbell, Account Manager

c) No plans or schedules have been provided by DPL to the Applicant.

CASE NO. 9477

CHERRYWOOD SOLAR I
RESPONSE TO PPRP DATA REQUEST NO. 6
RESPONSE DATE: August 29, 2018

Item No.: PPRPDR6-3 Please provide GIS data layers for the following features, shown in the most recent Site Plans provided 7/23/18:

a) Access Roads

b) Landscape Buffers

c) Limit of Disturbance / Limit of Construction

RESPONSE:

a) ***Attachment A*** includes the GIS data layers for the most recent Site Plans provided 7/23/18.

b) See ***PPRPDR6-3 a)***.

c) See ***PPRPDR6-3 a)***.

CASE NO. 9477

CHERRYWOOD SOLAR I
RESPONSE TO PPRP DATA REQUEST NO. 6
RESPONSE DATE: August 29, 2018

Item No.: PPRPDR6-6 Page 3 of the ERD indicates that the Project will make a 66 ft easement crossing under an abandoned railroad track owned by the Department of Transportation.

a) Please indicate the status of discussions with DOT with respect to the easement.

b) Please describe how the crossing will be constructed, including depth below the railroad track and amount of material that will be removed.

c) Please indicate how the removed material will be handled, including whether the material will be tested for contaminants that might remain from railroad operations and the plans for disposal of the material.

d) Please identify any other potential environmental impacts that may occur from this disturbance to the railroad bed and right of way, such as required tree removals and sediment runoff to nearby streams or wetlands.

RESPONSE:

a) MTA has granted a license for this installation, which will be installed as described in the ERD via directional boring. The Applicant is currently engaged in the process of requesting an easement that represents a superior real estate right vs. the license that has already been granted.

b) In order to avoid the surface disturbance of burying two (2) conduits, the Applicant agreed with MTA to utilize a single ten-inch (10") diameter pipe which requires an installation depth of twenty-five feet (25') below the surface of the railroad via directional boring to meet MTA standards. No surface disturbance or tree clearing will occur within the sixty-six feet (66') of DOT property. Thus, no material will be removed and there will be no environmental impact or disturbance to the railroad bed or right-of-way.

c) See **PPRPDR6-6 b)**.

d) See **PPRPDR6-6 b)**.

CASE NO. 9477

CHERRYWOOD SOLAR I
RESPONSE TO PPRP DATA REQUEST NO. 6
RESPONSE DATE: August 29, 2018

Item No.: PPRPDR6-7 Please describe the methods that will be used to construct the underground power interconnection between the middle and lower sections of the project along the north side Bridgetown Road, and specifically indicate whether there will be any tree removals required to complete this section of the project.

RESPONSE:

As described in the ERD, the Bridgetown Road underground power interconnection will be installed using directional bore methodology in order to avoid potential impacts associated with other methods of installation. The specific location of boring pits along the northern edge of the road have not yet been determined and are the subject of discussions with Caroline County, who is exploring plans unrelated to the Project to widen Bridgetown Road in order to facilitate a nearby proposed gravel mining operation.

Installation of the Bridgetown Road underground power interconnection will require no tree removal. Please reference the revised Frac Out Plan provided as an Attachment in **PPRPDR3-17** for technical information on the underground boring process and safeguards that will be implemented during installation.

Appendix B
Certification of Forest Management Plan, John and Tammy Merson, Tax Map 11, Parcel 162

PSC Case 9477
Cherrywood Solar Project

MARYLAND
DEPARTMENT OF
NATURAL RESOURCES

Larry Hogan, Governor
Boyd Rutherford, Lt. Governor
Mark Belton, Secretary
Joanne Throwe, Deputy Secretary

October 3, 2017

Mr. Keith Bobbick
Department of Assessments and Taxation
207 South Third Street
Denton, Maryland 21629

Re: Certification of Forest Management Plan
John and Tammy Merson, Tax Map 11, Parcel(s) 162 Account # 1-016105

Dear Mr. Bobbick:

The Department of Natural Resources - Forest Service recognizes the agricultural use assessment of woodland as an important tool in the conservation and management of Maryland's forestland.

A Forest Management/Stewardship Plan prepared by a professional forester, provides an inventory of resources with recommendations based on the objectives of the ownership. Compliance with the Plan is determined through periodic inspections of the property and updates and revisions to the Plan. The normal term of a Plan is 15 years.

The 106.51 acres of woodland owned by John and Tammy Merson, located at 14955 Greensboro Road, is currently in compliance with a Forest Stewardship Plan prepared by the Department of Natural Resources - Forest Service. This Plan is dated June 10, 2011 and will need to be revised and updated by June 10, 2026. Inspection of the property for compliance will occur every three years. As per our current procedures this parcel qualifies for an agricultural use assessment.

If you have any further questions or need further assistance please contact our office.

Best regards,

James E. Harris
Forester

cc: J. & T. Merson

FOREST STEWARDSHIP PLAN

Stewardship FOREST
Maryland Department of Natural Resources

For

JOHN & TAMMY MERSON
14736 POPLAR STREET
GOLDSBORO, MD 21636
410-482-9194 HOME

Location

14955 Greensboro Road, South of RT 287 and east of RT313.

Maryland Grid: 439/1145.5
Tax Map(s): 11
Parcel(s): 162
Soil Sheet(s): 8 (5, 7)
Tax Account #: 1-016105

In

Caroline County

On

140.81 Total Acres
106.51 Woodland Acres
6.20 Field Acres
5.60 Power Line Right-A-Way Acres
19.3 Pond Acres
3.2 Home and/or Other Acres

Prepared by

J. Harris - Forester
D. Albers - Technician

June 10, 2011

STAND DESCRIPTION AND RECOMMENDED PRACTICES

Property Overview: The property is located in the Upper Choptank River Watershed. Two streams, Oldtown Branch and Broadway Branch drain into "Lake Bonnie" that then drains into the Choptank River. The site also contains potential Forest Interior Dwelling Species (F.I.D.S.) Habitat, a Bald Eagle nest and a Sensitive Species Project Area as identified by the MD Wildlife and Heritage Division. The U.S. Fish & Wildlife Service has identified potential non-tidal wetlands on the site according to their guidance maps.

Owners Primary Objective: Soil and Water Quality Protection

Owners Secondary Objective: Wildlife Habitat

Stand #: 1

Area Acres: 66.51

Dominant Overstory Species: Yellow Polar, White Oak, Red Oak, Hickory, Virginia Pine

Dominant Understory Species: Holly, Beech, Laurel, Musclewood

Development Stage: Pole to sawtimber

Age: Uneven

Stocking/Basal Area: 120 to 160 sq.ft./acre

Site Growth Potential: Good

Soil Type: GaB - Galestown loamy sand, 2-5% slopes - Loblolly pine is the favored species for this soil. There is little erosion hazard except for wind erosion on newly planted areas and water erosion on the steeper slopes. Site Index for loblolly pine is 75 to 90.

SnA - Sassafras sandy loam, 0-2% slopes - Loblolly pine is the favored species for this soil. There is little erosion hazard except for wind erosion on newly planted areas and water erosion on the steeper slopes. Site Index is 75 to 90 for loblolly pine.

SnE - Sassafras sandy loam, 15-30% slopes - Loblolly pine is the favored species for this soil. There is little erosion hazard except for wind erosion on newly planted areas and water erosion on the steeper slopes. Site Index is 75 to 90 for loblolly pine.

SnF - Sassafras sandy loam, 30-60% slopes - Loblolly pine is the favored species for this soil. There is little erosion hazard except for wind erosion on newly planted areas and water erosion on the steeper slopes. Site Index is 75 to 90 for loblolly pine.

This stand may contain jurisdictional wetlands, which may or may not have been officially delineated by the U.S. Army Corps of Engineers. The final authority for all Non-Tidal Wetland Regulation is with the U.S. Army Corps of Engineers. Normal silvicultural activities for forestry practices are currently allowed under State and Federal Regulations.

Recommendations/Practices:

The stand had a "Selection Harvest" done by the previous owner in 2009/10. This is the higher, drier part of the woodland. There is still some merchantable timber scattered throughout the stand and

possibly be harvested in 10-20 years. The site would have to be reviewed again for impacts to the Choptank River Wetland of Special State Concern (WSSC). The stand could provide a source of firewood if needed in the future. The selective removal of dead, diseased, poor quality and undesirable species would shorten the time for the stand to reach a marketable size. This type of selective tree removal is referred to as "non-commercial timber stand improvement". The MD – Forest Service can assist you in selecting these trees for removal, there would be a per acre technical service fee charged for the marking which at this time is $12.00/acre. This removal of some of the competition allows the remaining trees to increase their growth a little more each year. This also improves wildlife habitat by allowing more sunlight to reach the forest floor increasing herbaceous food and usually increases the mast (seed) production of species such as oak for wildlife to eat.

The property lines need to be located and marked. The lines may need to be repainted every couple of years. A recognized method of marking property lines within the state are to place a vertical stripe at least 2 inches wide, 8 inches long and at least 3 feet, but not over 6, feet from the ground. The paint must be oil-based and bright blue.

The existing roads and trails should be maintained to provide access into the woodland in case of wildfire. If you are establishing a new road or trail you should be aware of the location of any potential non-tidal wetland areas, as these must be avoided due to government restrictions. These roads and trails can also provide wildlife habitat when seeded with an herbaceous cover beneficial to wildlife. Information on a variety of seed mixtures can be obtained from the local Soil Conservation District or the Maryland Wildlife Division (410-376-3236).

Numerous species of insects and diseases will infect any part of a tree. As a landowner you should make periodic inspections throughout the woodland during different times of the year to note any signs of symptoms. You can contact the Maryland Forest Service or the Maryland Dept. of Agriculture – Forest Pest Management Section (410-479-2047) in Denton should you have any concerns.

STAND DESCRIPTION AND RECOMMENDED PRACTICES

Stand #: 2

Area Acres: 40.0

Dominant Overstory Species: Ash, Red Maple, Black Gum, Sweet Gum, Yellow Poplar, White Oak

Dominant Understory Species: Holly, Sweet Pepper Bush, Beech, Red Maple, Sweet Gum, Service Berry

Development Stage: Pole to sawtimber

Age: Uneven

Stocking/Basal Area: 80 to 120 sq.ft./acre

Site Growth Potential: Good

Soil Type: Jo - Johnston loam - This soil is well suited to hardwoods with sweet gum and oak species being favored. Yellow poplar should be encouraged on the better drained sites. Erosion is no problem except for some scouring during flooding. Equipment limitations tend to be severe due to the poor drainage. Plant competition tends to be moderate to severe. Site Index for hardwoods would be 80 to 90.

Mt - Mixed alluvial land - This soil is well suited to hardwoods with sweet gum and oak species being favored. Yellow poplar should be encouraged on the better drained sites. Erosion is no problem except for some scouring during flooding. Equipment limitations tend to be severe due to the poor drainage. Plant competition tends to be moderate to severe. Site Index for hardwoods would be 80 to 90.

Sw – Swamp – Unclassified soil material. These areas are subject to overflow from fresh-water streams. Some areas can be used for wetland forest and to provide food and cover for wildlife.

This stand may contain jurisdictional wetlands, which may or may not have been officially delineated by the U.S. Army Corps of Engineers. The final authority for all Non-Tidal Wetland Regulation is with the U.S. Army Corps of Engineers. Normal silvicultural activities for forestry practices are currently allowed under State and Federal Regulations.

Recommendations/Practices:

This stand also had a "Selection Harvest" done along with stand one in 2009/10. As in stand one there is still some merchantable timber that could be harvested in 10-20 years and would also have to be reviewed for impacts to the Choptank River Wetland of Special State Concern (WSSC). Due to the Ash tree species in the stand it should be monitored for Emerald Ash Borer (EAB) as this is a non-native invasive insect that has been found in southern and central Maryland. It is deadly to ash trees if they become infected. You could install some wood duck boxes in the stream, bottomland areas to provide some additional habitat.

As in stand 1, the property lines should be located, marked and maintained. The existing roads and trails should be maintained to provide access into the woodland in case of wildfire. If you are establishing a new road or trail you should be aware of the location of any potential non-tidal wetland

areas, as these must be avoided due to government restrictions. These roads and trails can also provide wildlife habitat when seeded with an herbaceous cover beneficial to wildlife. And you should make periodic inspections throughout the stand during different times of the year to note any signs of symptoms of possible insect and disease problems.

Other Considerations:

- ★ Good woodland management can minimize the effects of insects and diseases.
- ★ Good forest practices will increase the value of your woodland.
- ★ Good timber management is good wildlife management.
- ★ Good woodland management requires planning.
- ★ Rental income can come from hunting rights.

ADMINISTRATIVE PRACTICE SCHEDULE

COMPLETION DATE	PRACTICE	STAND	ACRES
May 2013	Re-inspection of Forest Stewardship Plan for Agricultural Assessment	All	106.51
May 2016	Re-inspection of Forest Stewardship Plan for Agricultural Assessment	All	106.51
May 2019	Re-inspection of Forest Stewardship Plan for Agricultural Assessment	All	106.51
May 2022	Re-inspection of Forest Stewardship Plan for Agricultural Assessment	All	106.51
May 2025	Re-inspection of Forest Stewardship Plan for Agricultural Assessment	All	106.51

NON-TIDAL WETLAND KEY

Example: P FO 1/4 A
I II III IV

I. P - Palustrine

II. FO - Forest

III. 1 - Broad Leaved Deciduous

2 - Needle Leaved Deciduous

3 - Broad Leaved Evergreen

4 - Needle Leaved Evergreen

5 - Dead

6 - Deciduous

7 - Evergreen

IV. Water Regime

A. Temporary
B. Saturated
C. Seasonal
D. Seasonal Well Drained
E. Seasonal Saturated
F. Semi-Permanent
G. Intermittently Exposed
H. Permanent
J. Intermittently Flooded
K. Artificial
Z. Intermittently Exposed/Permanent
W. Intermittently Flooded/Temporary
Y. Saturated/Semi-Permanent/Seasonal
U. Unknown

Legend

Property Line — Stand Boundary

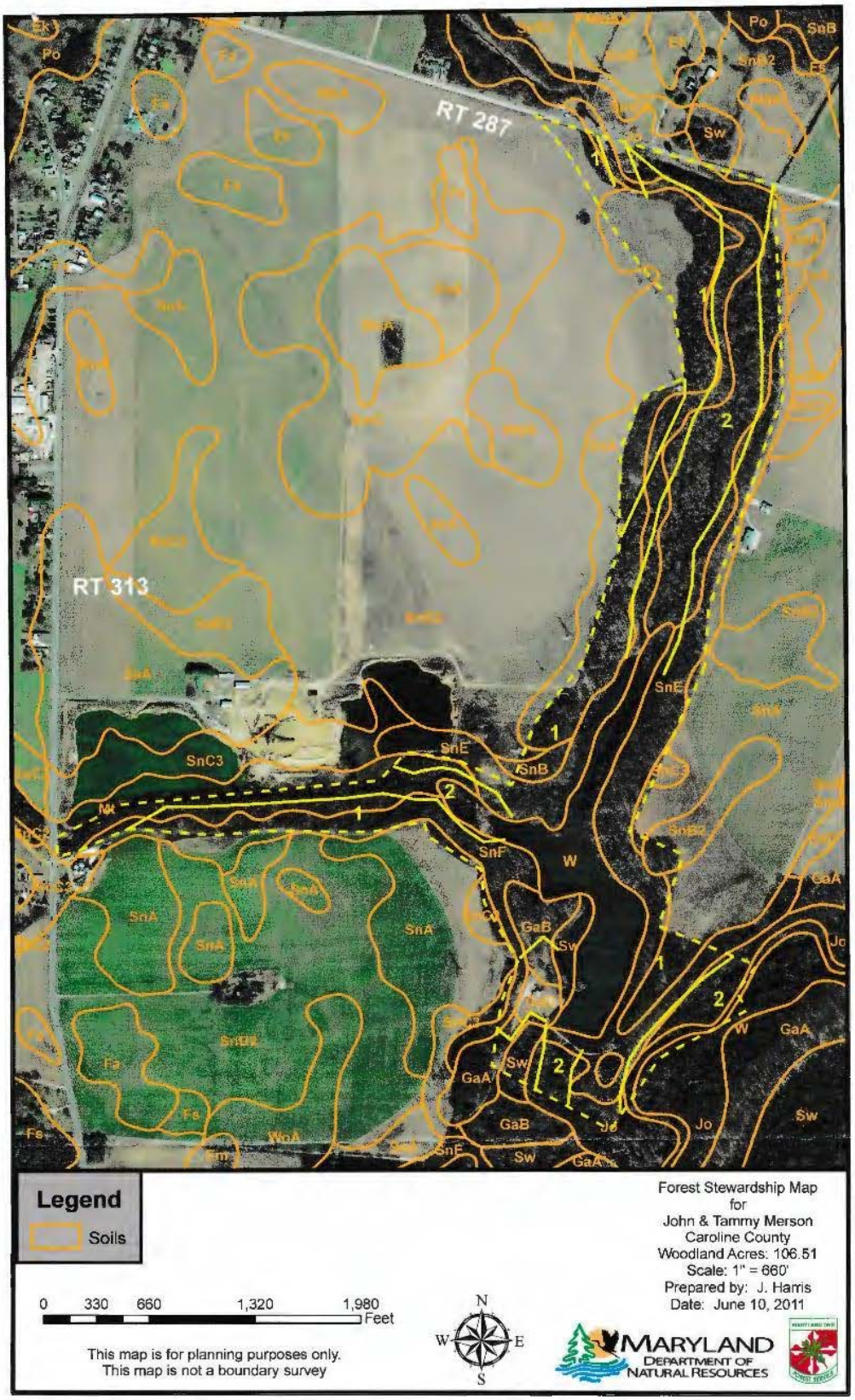
0 330 660 1,320 1,980 Feet

This map is for planning purposes only.
This map is not a boundary survey

N
W E
S

Forest Stewardship Map
for
John & Tammy Merson
Caroline County
Woodland Acres: 106.51
Scale: 1" = 660'
Prepared by: J. Harris
Date: June 10, 2011

MARYLAND
DEPARTMENT OF
NATURAL RESOURCES


RT 287
RT 313
Legend
Soils
Forest Stewardship Map
for
John & Tammy Merson
Caroline County
Woodland Acres: 106.51
Scale: 1" = 660'
Prepared by: J. Harris
Date: June 10, 2011
0 330 660 1,320 1,980
Feet
This map is for planning purposes only.
This map is not a boundary survey
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MARYLAND
DEPARTMENT OF
NATURAL RESOURCES


RT 287
RT 313
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Legend
Forest Interior Dwelling Species
0 330 660 1,320 1,980 Feet
This map is for planning purposes only.
This map is not a boundary survey
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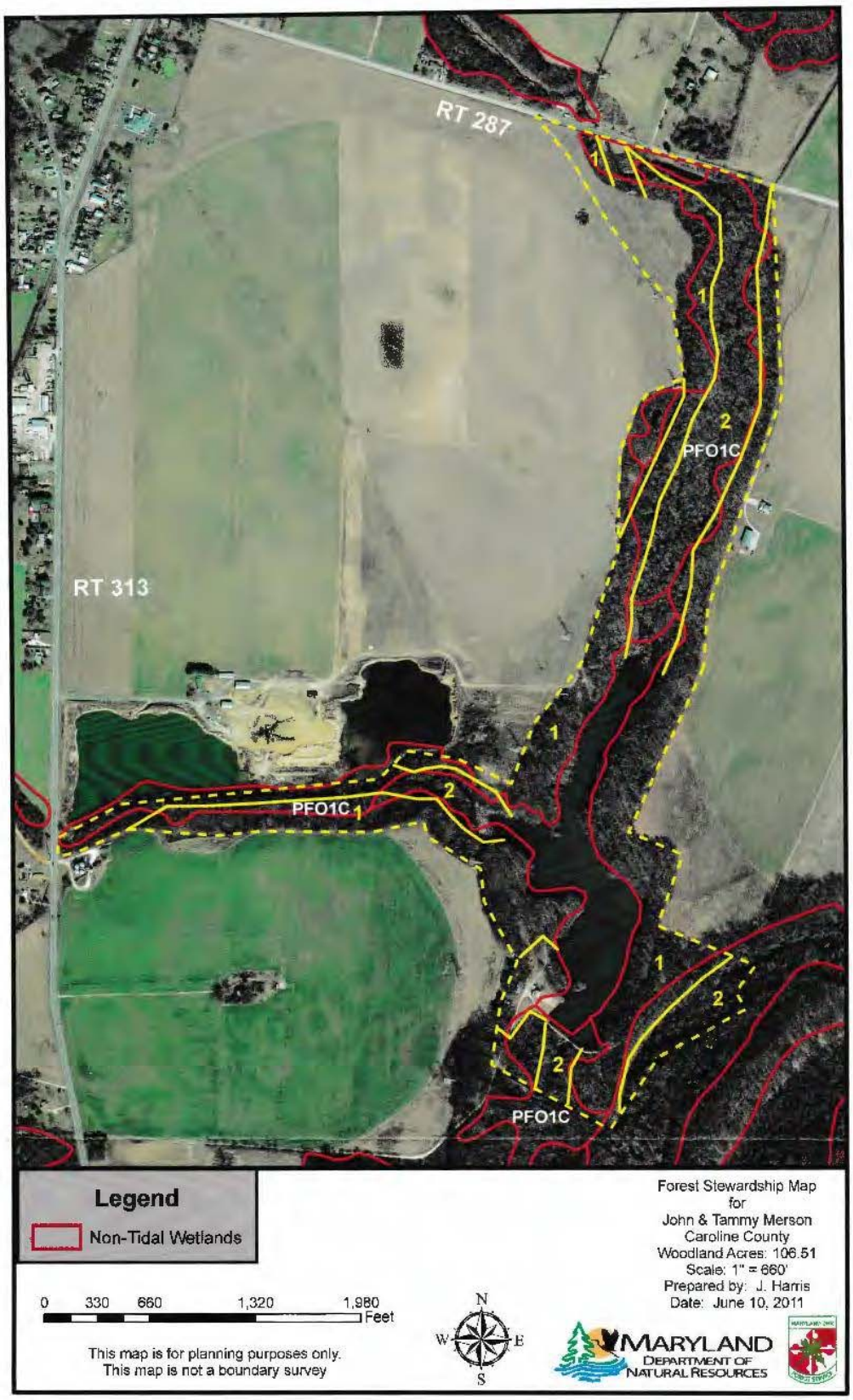
Forest Stewardship Map
for
John & Tammy Merson
Caroline County
Woodland Acres: 106.51
Scale: 1" = 660'
Prepared by: J. Harris
Date: June 10, 2011
MARYLAND
DEPARTMENT OF
NATURAL RESOURCES


RT 287
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Legend
Non-Tidal Wetlands
0 330 660 1,320 1,980
Feet
This map is for planning purposes only.
This map is not a boundary survey
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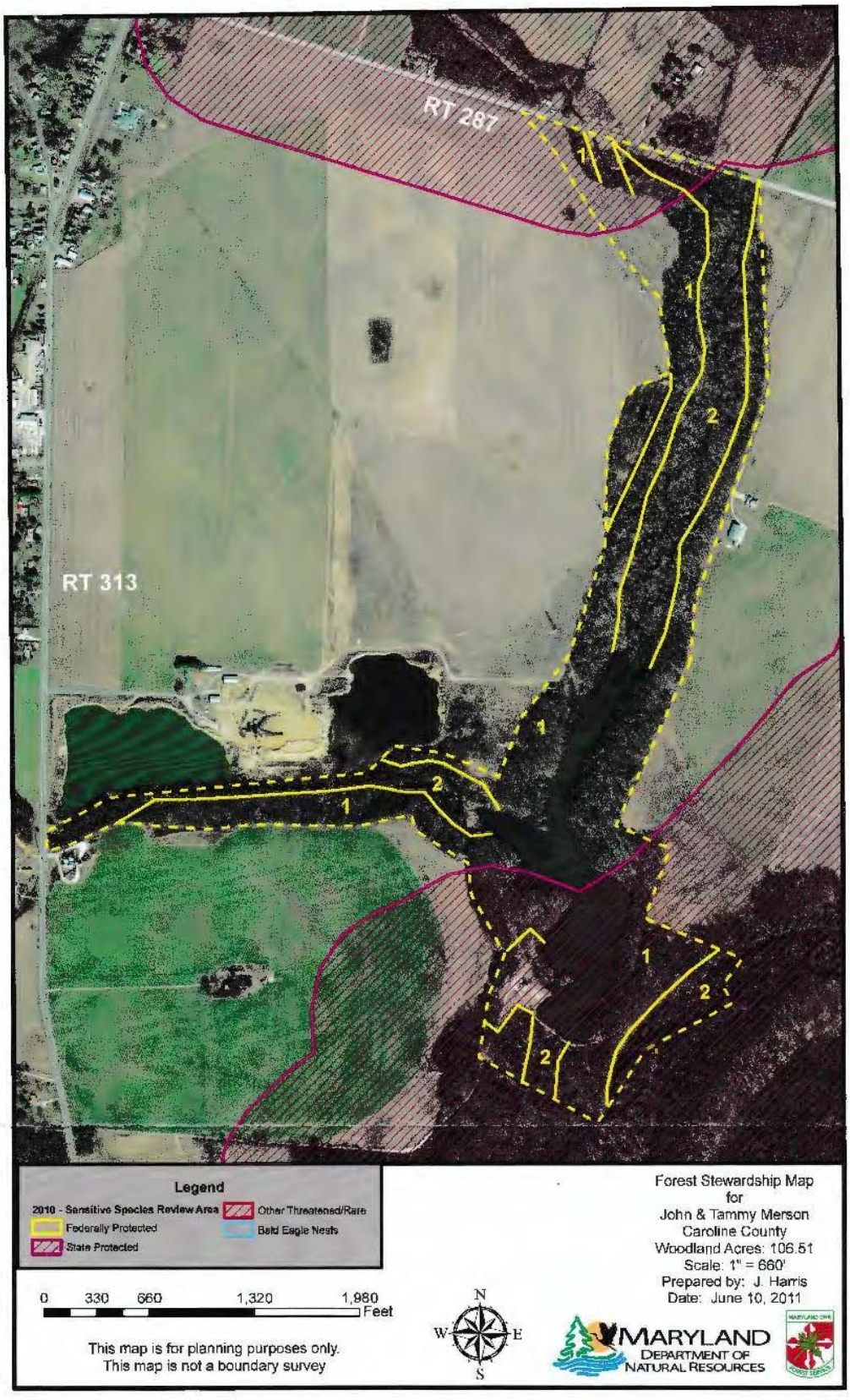
Forest Stewardship Map
for
John & Tammy Merson
Caroline County
Woodland Acres: 106.51
Scale: 1" = 660'
Prepared by: J. Harris
Date: June 10, 2011
MARYLAND
DEPARTMENT OF
NATURAL RESOURCES


RT 287
RT 313
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2
1
2
1
2
1
2
2
Legend
2010 - Sensitive Species Review Area
Federally Protected
State Protected
Other Threatened/Rare
Bald Eagle Nests
0 330 660 1,320 1,980 Feet
This map is for planning purposes only.
This map is not a boundary survey
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Forest Stewardship Map
for
John & Tammy Merson
Caroline County
Woodland Acres: 106.51
Scale: 1" = 660'
Prepared by: J. Harris
Date: June 10, 2011
MARYLAND
DEPARTMENT OF
NATURAL RESOURCES

Appendix C
Forest Conservation Exemption Letter, Cherrywood Solar I, LLC. Caroline County Department of Planning & Codes

PSC Case 9477
Cherrywood Solar Project

Caroline County
Department of Planning & Codes

Katheleen Freeman, Director
Crystal Dadds, Assistant Director of Codes

Health & Public Services Bldg.
403 South 7th Street, Suite 210
Denton, Maryland 21629-1335
Telephone: 410-479-8100
Facsimile: 410-479-4187

May 30, 2018

Ryan D. Showalter
McAllister, DeTar, Showalter & Walker
100 N. West Street
Easton, Maryland 21601

Re: Forest Conservation Exemption, Cherrywood Solar I, LLC

Dear Mr. Showalter,

The Caroline County Department of Planning & Codes has reviewed the simplified forest stand delineation for the 202 MW solar generation project proposed by Cherrywood Solar I, LLC. No clearing of forest is proposed by this project. Buffers of forest vegetation will be established along portions of the project and will remain in place at least for the duration of the use, which we understand may be 30+ years.

Pursuant to Section 109-3(B)(5) of the Caroline County Code, the proposed land development activity for a solar electric generating station licensed under Section 7-207, 7-208 or 7-205 of the Public Utility Companies Article of the Maryland Code is exempt from the requirements of the Forest Conservation Chapter, provided that:

(a) A required certificate of public convenience and necessity ("CPCN") is issued in accordance with Natural Resources Article § 5-1603(f), Annotated Code of Maryland; and
(b) Cutting or clearing of the forest is conducted to minimize the loss of forest.

Development of the project will require a CPCN from the Maryland Public Service Commission. The avoidance of forest clearing and planting of trees for landscape buffers, even if temporary, are consistent with the State's policy of no-net-loss of forest and warrant exemption from the provisions of the Forest Conservation Chapter of the Code.

This letter shall confirm the project's exemption from Caroline County forest conservation requirements, unless the project (i) is able to be constructed without a CPCN, or (ii) changes to include clearing of forest. If any forest clearing is proposed, this exemption will be revisited.

Sincerely,

Katheleen Freeman, AICP
Director, Caroline County Planning & Codes

Appendix D
PPRP Analysis: Estimate of Existing Forests for Cherrywood Project

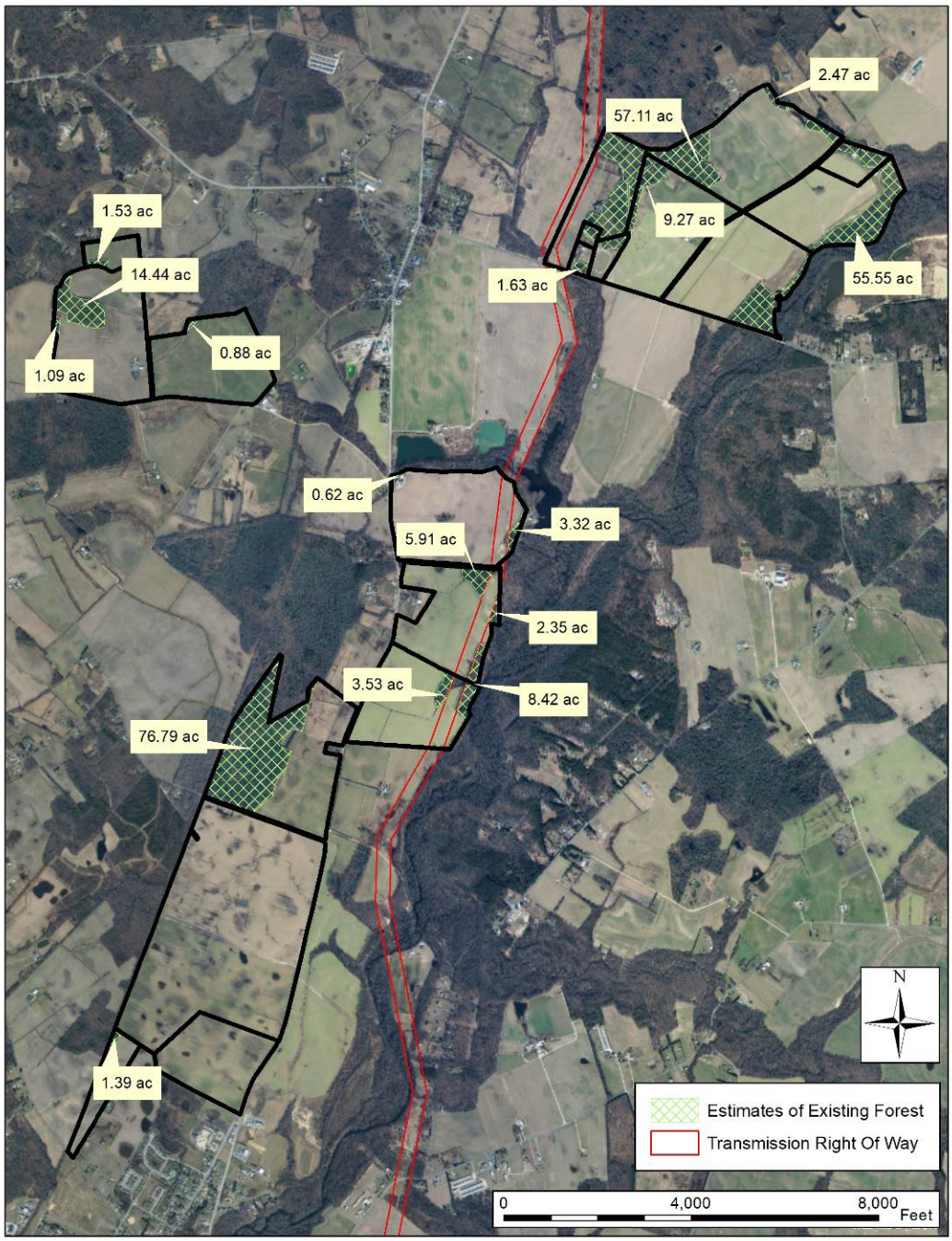
PSC Case 9477
Cherrywood Solar Project

The following datasets were obtained August 2018: Chesapeake Conservancy High Resolution Land Cover Dataset; MD IMAP Aerial imagery; Tax Map Parcel Boundaries; Maryland Department of Planning Land Use Land Cover 2010.

The calculated area of the 18 Project parcels was 1665 acres. PPRP manually delineated forest areas in a Geographic Information System and estimated approximately 246 acres of existing forest on the Project parcels (see Figure). The corresponding state FCA worksheet showing a planting requirement of 87.00 acres is:

Forest Conservation Worksheet 2.2

Net Tract Area								
A.	Total Tract Area						A =	1665.00
B.	Deductions						B =	0.00
C.	Net Tract Area						C =	1665.00
Land Use Category								
		Input the number "1" under the appropriate land use zoning, and limit to only one entry						
	ARA	MDR	IDA	HDR	MPD	CIA		
	1	0	0	0	0	0		
D.	Afforestation Threshold (Net Tract Area x 20%)						D =	333.00
E.	Conservation Threshold (Net Tract Area x 50%)						E =	832.50
Existing Forest Cover								
F.	Existing Forest Cover within the Net Tract Area						F =	246.00
G.	Area of Forest Above Conservation Threshold						G =	0.00
Break Even Point								
H.	Break Even Point						H =	246.00
I.	Forest Clearing Permitted Without Mitigation						I =	0.00
Proposed Forest Clearing								
J.	Total Area of Forest to be Cleared						J =	0.00
K.	Total Area of Forest to be Retained						K =	246.00
Planting Requirements								
L.	Reforestation for Clearing Above the Conservation Threshold						L =	0.00
M.	Reforestation for Clearing Below the Conservation Threshold						M =	0.00
N.	Credit for Retention above the Conservation Threshold						N =	0.00
P.	Total Reforestation Required						P =	0.00
Q.	Total Afforestation Required						Q =	87.00
R.	Total Planting Requirement						R =	87.00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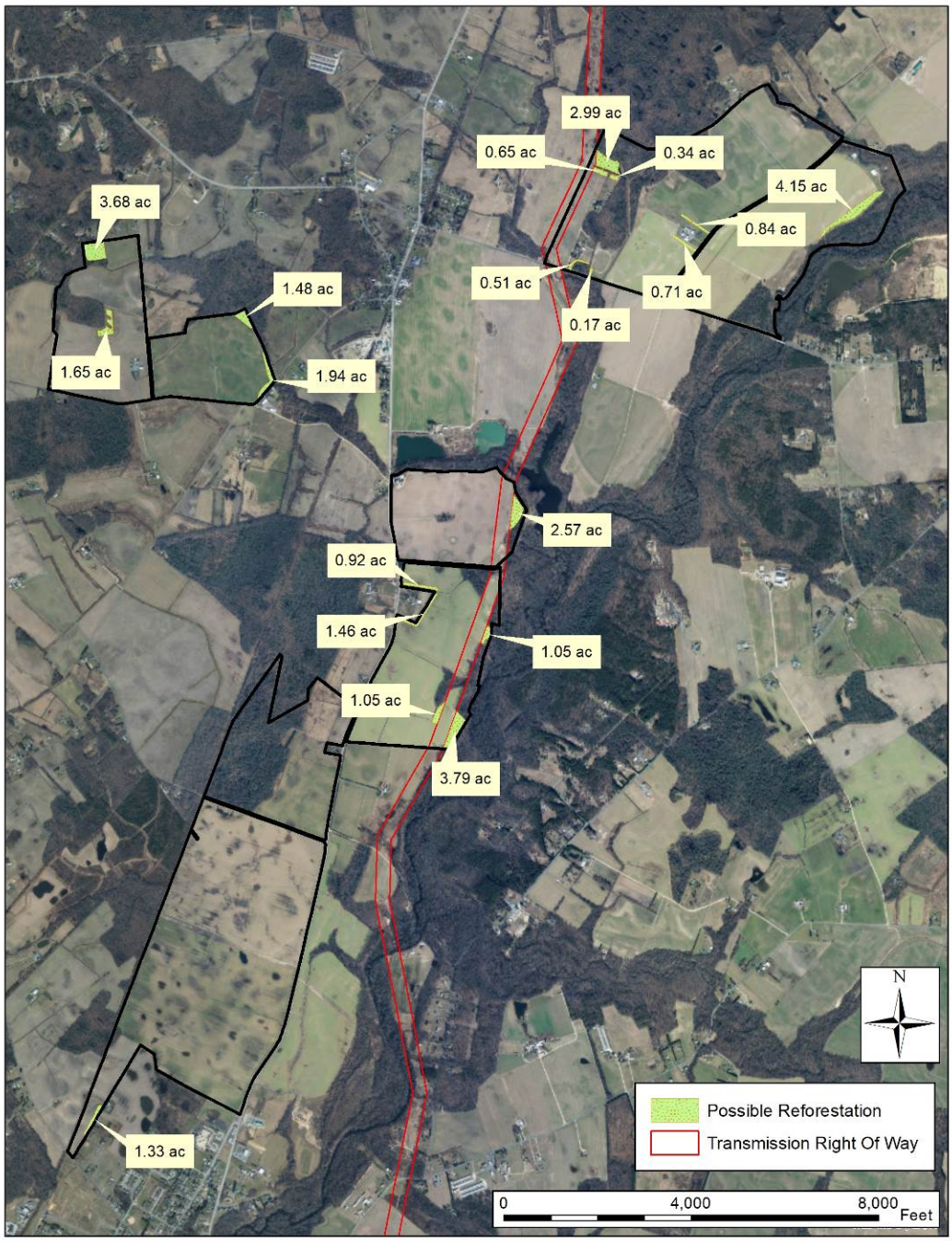
57.11 ac
9.27 ac
55.55 ac
1.53 ac
14.44 ac
1.63 ac
0.88 ac
1.09 ac
0.62 ac
3.32 ac
5.91 ac
2.35 ac
3.53 ac
8.42 ac
76.79 ac
1.39 ac
N
Estimates of Existing Forest
Transmission Right Of Way
0
4,000
8,000
Feet

Appendix E
PPRP Analysis: Potential Reforestation Areas for Cherrywood Project

PSC Case 9477
Cherrywood Solar Project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4.15 ac
3.68 ac
0.84 ac
1.48 ac
0.51 ac
0.71 ac
0.17 ac
1.65 ac
1.94 ac
2.57 ac
0.92 ac
1.46 ac
1.05 ac
1.05 ac
3.79 ac
1.33 ac
N
Possible Reforestation
Transmission Right Of Way
0
4,000
8,000
Feet

Appendix F
Licensing Conditions for
Church-Steele Transmission
Line ROW

PSC Case 9477
Cherrywood Solar Project

the ROW shall be avoided to the maximum extent practicable during the breeding seasons for these species. Should construction be scheduled during the months of April to July of a given year, Delmarva Power shall conduct a follow-up raptor survey one month prior to construction to ensure that no raptor nests are present at that time. Delmarva Power shall notify and consult with WHS to determine appropriate impact mitigation if any raptor nests are found.

h. In any case where conditions (a) – (g) cannot be met, Delmarva Power shall contact the PPRP and the WHS for technical assistance before disturbing the sensitive areas.

10. Delmarva Power shall notify and consult with the WHS to determine appropriate actions if additional rare, threatened, or endangered species are encountered during planning, construction, or maintenance of this facility.

11. Delmarva Power shall coordinate construction and maintenance activities in the ROW with State, County, and local agencies that are managing or pursuing projects affecting natural resources in or adjacent to the ROW to achieve the minimum impact on and maximum practicable synergy with the goals and objectives of those agencies. These agencies and projects include, but are not limited to:

    a. Caroline County concerning the Goldsboro Christian Park along the Choptank River and at the ROW crossing of the Choptank, and

    b. Any applicable Public Drainage Associations concerning vegetation management along the banks of the "tax ditches" traversed by the ROW.

12. To conserve natural resources and preserve environmental quality, Delmarva Power shall (with appropriate permissions from land owners other than Delmarva Power) manage the ROW vegetation by employing the measures specified in paragraphs (a) through (e) below, utilizing the wire zone/border zone definitions and management approaches specified in *Best Management Practices: Integrated Vegetation Management (IVM) on Electric Utility Rights-of-Way* (R. Miller, International Society of Arboriculture, 2007). As defined in that document, the border zone on each side of the ROW begins at the outer edge of the ROW and ends roughly 10 feet from the outermost conductor(s), while the wire zone is the section of the ROW directly under the wires and extending outward roughly 10 feet on each side of the outermost conductor. Specific to the Church to Steele Project ROW, an extended border zone shall be defined on the western side of the ROW, in addition to the standard wire zone and a border zone defined by engineering constraints, as follows: the wire zone shall extended to the west approximately 27.5 feet from the centerline of the 138-kV line (approximately 10 feet outside of the outermost wire) and the border zone

shall extend from the wire zone boundary approximately another 22.5 feet to the edge of the 50 foot engineered ROW defined by Delmarva Power. The roughly 100-foot wide extended border zone on the western edge of the ROW shall be the area of the ROW from the western edge of the engineered ROW to the legal boundary of the ROW that is located approximately 150 feet west of the 138-kV centerline. The wire zone shall extend continuously between the 138-kV poles and the 230-kV towers, without an intermediate border zone. The resulting vegetation clearances are to be compliant with applicable North American Electric Reliability Corporation (NERC) and Federal Energy Regulatory Commission (FERC) rules, guidance, policies, procedures, and/or regulations.

a. In any part of the ROW that bisects designated MD DNR Green Infrastructure or other forested parcels, and which is not under active cultivation, Delmarva Power shall, to the extent feasible, (with appropriate permissions from landowners other than Delmarva Power) maintain the ROW such that 1) the wire zone supports a low-growing plant community dominated by grasses, herbs, forbs, and small shrubs [under 3 feet in height at maturity], 2) scattered, small native trees and woody shrubs grow within the border zone of the ROW, and 3) unmanaged natural vegetation, up to and including full forest tree canopies, shall be allowed to grow in the extended border zone, except for the removal of specifically identified hazard trees. Delmarva Power shall prepare detailed vegetation management plans, as described in Licensing Condition 12(e) below, for the following nine (9) areas between the following New Poles: 46-49, 90-93, 103-104, 109-110, 116-117, 130-132, 138-139, 145-146, and 170-172. Delmarva Power shall submit these plans to PPRP for review and comment at least 30 days prior to the start of construction. PPRP shall provide any comments on the vegetation management plans within 30 days. Any access tracks through these areas that require mowing shall follow mowing conditions noted in Licensing Condition 12(b) below. The ROW shall be maintained as such while the ROW is in use by Delmarva Power and its successors or assignees.

b. Post-construction, Delmarva Power, subject to landowner consent and local grass height ordinances, shall not mow areas within the ROW maintained as grasses and forbs during the breeding season for ground nesting birds from May through August of each year. If mowing is necessary outside of the May through August breeding season, the mowed height will be no less than 10 inches in the border zone and no less than 6 inches in the wire zone, with the exception of areas under special management for invasive species control. Vegetation within the border zone will be maintained as a low-growing plant community dominated by small native trees and woody shrubs. In the extended

Appendix G
Maryland Department of Natural Resources, Wildlife Heritage Service. Letter to Delmarva Power Environmental Planning. February 5, 2014.

PSC Case 9477
Cherrywood Solar Project

February 5, 2014

Mr. Jim Hunt
Delmarva Power
Environmental Planning
P.O. Box 9239
Newark, DE 19714-9239

RE: Environmental Review for Pepco Holdings, Inc. – Church Substation (Millington) to Steele Substation (Denton) Transmission Line Project, Existing 138kV Line rebuild with 230kV Line, Queen Anne's and Caroline Counties, Maryland.

Dear Mr. Hunt:

The Wildlife and Heritage Service's database indicates that there are areas of potential concern along the project route that are associated with rare, threatened and endangered (RT&E) species. Further consultation with WHS is recommended to develop avoidance and minimization measures for possible impacts to these areas:

- South of Millington Substation approximately 750 feet, the project route overlaps in part with a portion of a wetland that is designated in state regulations as a Nontidal Wetland of Special State Concern (NTWSSC). This wetland is associated with a tributary to Unicorn Millpond and such NTWSSCs are regulated, along with their 100-foot upland buffer, as such by Maryland Department of Environment. Your project may need review by Maryland Department of Environment for any necessary permits associated with this wetland. We would encourage stringent adherence to all appropriate best management practices for sediment and erosion control during all work at this site, in order to reduce the likelihood of adverse impacts to the RT&E species occurring downstream in Unicorn Branch.

- Approximately 1990 feet south of Hackett Corner Road, the project route crosses another tributary to Unicorn Branch. Although this portion of Unicorn Branch is not designated as a NTWSSC, we would still encourage stringent adherence to all appropriate best management practices for sediment and erosion control during all work at this site.

- Approximately 350 feet south of Sudlersville Cemetery Road, the project route crosses another tributary to Unicorn Branch. Although this portion of Unicorn Branch is not designated as a NTWSSC, we would still encourage stringent adherence to all appropriate best management practices for sediment and erosion control during all work at this site.

- South of Duhamel Corner Road, extending to Anderson Corner Road, is a wetland complex which overlaps this portion of the project route. Due to the RT&E species in this wetland system, we would again encourage stringent adherence to all appropriate best management practices for sediment and erosion control during all work at this site.

- Immediately north of Anderson Corner Road, there is a portion of the project route that supports occurrences of these RT&E plant and animals species:

Scientific Name	Common Name	State Status
Carex lupuliformis	Hop-like Sedge	Rare
Hypericum adpressum	Creeping St. John's-wort	Endangered
Ambystoma tigrinum	Eastern Tiger Salamander	Endangered
Hyla gratiosa	Barking Treefrog	Endangered

  They occur in a nontidal wetland habitat within the actual transmission line right-of-way itself, and may be directly impacted by the proposed project. Further evaluation of this part of the project is recommended.

- Immediately south of the Queen Anne's/Caroline County line, the project route crosses two tributaries to Long Marsh/Mason Branch stream system which is known to support several species of RT&E fish and freshwater mussels. As these species are especially susceptible to changes in water quality and hydrology, we would emphasize the need for stringent adherence to all appropriate best management practices during all work at these sites.

- North of Bee Tree Road the project route overlaps in part with a wetland complex which is known to support numerous occurrences of RT&E species associated with its many Delmarva bays. Due to the RT&E species in this wetland system, we would again encourage stringent adherence to all appropriate best management practices for sediment and erosion control during all work at this site.

- Immediately south of Bee Tree Road the project route comes very close to the East Melville Pond site, which is designated in state regulations as an NTWSSC. It supports occurrences of state-listed threatened Walter's Paspalum (*Paspalum dissectum*) and state-listed endangered Harper's Fimbristylis (*Fimbristylis perpusilla*), as well as species considered watchlist in Maryland. The project route appears to be located farther than 100 feet from the mapped boundary of the NTWSSC, but we would still encourage stringent adherence to all appropriate best management practices for sediment and erosion control, and caution the applicant to avoid any changes in hydrology of this seasonal pond.

- The project route passes through the Persimmon Preserve site at a location extending from approximately 2500 feet to 4600 feet south of Bee Tree Road. The wetland here is designated as an NTWSSC on either side of the transmission line right-of-way. There is a population of Creeping St. John's-wort that is known to occur in the right-of-way itself at this location. Other RT&E species that occur in this NTWSSC outside of the actual right-of-way include:

Scientific Name	Common Name	State Status
Sagittaria engelmanniana	Engelmann's Arrowhead	Threatened
Scleria reticularis	Reticulated Nutrush	Rare/watchlist
Rana virgatipes	Carpenter Frog	Watchlist
Muhlenbergia torreyana	Torrey's Dropseed	Endangered
Paspalum dissectum	Walter's Paspalum	Threatened
Fimbristylis perpusilla	Harper's Fimbristylis	Endangered

- The project route crosses through the Jackson Lane wetland site which is located approximately 3000 feet southeast of MD Route 311 (where the project route turns sharply south) and the wetland located here for approximately 3500 feet south of MD Route 311 is designated in state regulations as an NTWSSC. In this NTWSSC immediately adjacent to the powerline right-of-way is an occurrence of Harper's Fimbristylis, described as occurring in an open seasonal pond. Impacts to this occurrence need to be avoided and all appropriate best management practices for sediment and erosion control should be stringently enforced here.

- South of Lake Bonnie the project route crosses through the headwaters of the Upper Choptank River which supports numerous RT&E species, the closest occurrences being:

Scientific Name	Common Name	State Status
Alasmidonta heterodon	Dwarf Wedge Mussel	Endangered, also federally endangered
Trachelospermum difforme	Climbing Dogbane	Endangered
Echinodorus cordifolius	Upright Burhead	Endangered

Other records in the Upper Choptank River in the vicinity but not as closely located, are:

Scientific Name	Common Name	State Status
Calopteryx dimidiate	Sparkling Jewelwing	Rare
Ilex decidua	Deciduous Holly	Rare
Cyperus refractus	Reflexed Cyperus	Rare
Enallagma weewa	Blackwater Bluet	Rare

- At the junction of the project route with Red Bridges Road, there is an NTWSSC which may be located close enough to fall within the regulated 100-foot buffer.

- At the edge of the powerline cut in Myrtle Simon Pelot MOS Sanctuary there are records for RT&E freshwater mussels documented in close proximity to the project route. As freshwater mussels require fish hosts for part of their life cycle, and are filter-feeders, they are extremely susceptible to changes in water quality and hydrology. We would like to emphasize the need for stringent adherence to all appropriate best management practices for sediment and erosion control during work at this site.

- Immediately adjacent to the river bank on the north and south side of Red Bridges Road along the project route, there is a population of Upright Burhead. It is described in old muddy flood channel habitat here, so impacts to this habitat here should be avoided to the extent practicable, and all appropriate best management practices for sediment and erosion control should be stringently enforced.

- Where the project route crosses Tubmill Branch, south of MD Route 314, there are records for RT&E fish. We would like to emphasize the need for stringent adherence to all appropriate best management practices for sediment and erosion control during work at this site.

There are several wetland sites within the vicinity of this project route that have been known to support the state-listed endangered Eastern Tiger Salamander (*Ambystoma tigrinum*). Vernal pools and Delmarva bays, both wetland types that typically dry up during the summer months, are important breeding sites for tiger salamanders as they do not harbor predatory fish populations.

Adjacent forested lands are important for the adult life stages. Activities that would result in erosion, sediment deposition, draining, filling, or diking within any such wetland basins should be avoided. Surveys for the Eastern Tiger Salamander and state-listed endangered Barking Treefrog (*Hyla gratiosa*) may be considered for portions of this project route where suitable habitat has been identified. Scott A. Smith is the contact for the specifics of these efforts. He can be contacted at (410) 827-8612 or by email at sasmith@dnr.state.md.us .

If any of the upgrades will require clearing of vegetated portions of the existing right-of-way, then we may have additional comments regarding RT&E species or potential Forest Interior Dwelling Birds habitat for this project route.

Thank you for allowing us the opportunity to review this project. If you should have any further questions regarding this information, please contact me at (410) 260-8573.

Sincerely,

Lori A. Byrne

Lori A. Byrne,
Environmental Review Coordinator
Wildlife and Heritage Service
MD Dept. of Natural Resources

ER# 2013.1740.qacn
Cc: W. Knapp, DNR
S. A. Smith, DNR
S. Patty, DNR

Appendix H
Glare Analysis

PSC Case 9477
Cherrywood Solar Project

FORGESOLAR GLARE ANALYSIS

Project: **Cherrywood Solar**
Proposed solar project in Caroline County, MD

Site configuration: **Cherrywood Solar Center Single Axis PPRP**
Analysis conducted by Peter Hall (perrie@metamet.com) at 21:49 on 15 Aug, 2018.

U.S. FAA 2013 Policy Adherence

The following table summarizes the policy adherence of the glare analysis based on the 2013 U.S. Federal Aviation Administration Interim Policy 78 FR 63276. This policy requires the following criteria be met for solar energy systems on airport property:

- No "yellow" glare (potential for after-image) for any flight path from threshold to 2 miles
- No glare of any kind for Air Traffic Control Tower(s) ("ATCT") at cab height.
- Default analysis and observer characteristics (see list below)

ForgeSolar does not represent or speak officially for the FAA and cannot approve or deny projects. Results are informational only.

COMPONENT	STATUS	DESCRIPTION
Analysis parameters	PASS	Analysis time interval and eye characteristics used are acceptable
Flight path(s)	PASS	Flight path receptor(s) do not receive yellow glare
ATCT(s)	N/A	No ATCT receptors designated

Default glare analysis and observer eye characteristics are as follows:

- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

FAA Policy 78 FR 63276 can be read at https://www.federalregister.gov/d/2013-24729

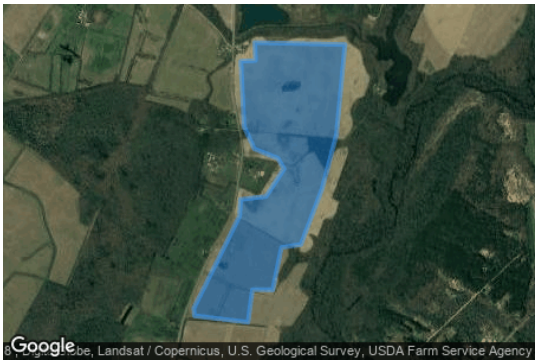
SITE CONFIGURATION

Analysis Parameters

DNI: peaks at 1,000.0 W/m^2
Time interval: 1 min
Ocular transmission coefficient: 0.5
Pupil diameter: 0.002 m
Eye focal length: 0.017 m
Sun subtended angle: 9.3 mrad
Site Config ID: 20429.3444

PV Array(s)

Name: LPV1
Axis tracking: Single-axis rotation
Tracking axis orientation: 0.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Resting angle: 60.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	39.021671	-75.786805	49.90	2.00	51.90
2	39.021706	-75.785743	49.00	2.00	51.00
3	39.022718	-75.785785	47.40	2.00	49.40
4	39.022604	-75.779244	43.60	2.00	45.60
5	39.017553	-75.779861	40.00	2.00	42.00
6	39.014483	-75.780916	39.30	2.00	41.30
7	39.011373	-75.782442	42.20	2.00	44.20
8	39.011204	-75.783860	42.30	2.00	44.30
9	39.008819	-75.784490	40.00	2.00	42.00
10	39.008835	-75.785963	42.30	2.00	44.30
11	39.007000	-75.786288	42.70	2.00	44.70
12	39.007361	-75.790172	44.60	2.00	46.60
13	39.007775	-75.790224	46.50	2.00	48.50
14	39.012982	-75.786894	47.60	2.00	49.60
15	39.013901	-75.786819	47.70	2.00	49.70
16	39.014066	-75.784989	45.70	2.00	47.70
17	39.015616	-75.783666	43.90	2.00	45.90
18	39.016218	-75.784127	46.00	2.00	48.00
19	39.016742	-75.785828	46.70	2.00	48.70
20	39.017991	-75.786573	50.00	2.00	52.00

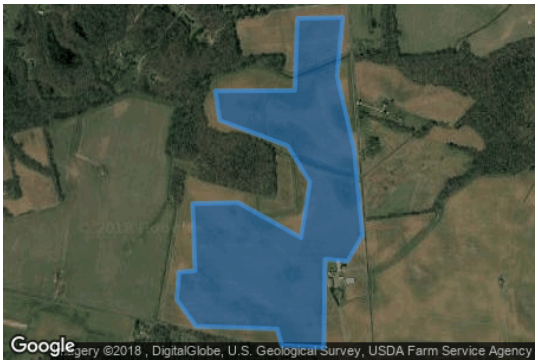
Name: LPV2
Axis tracking: Single-axis rotation
Tracking axis orientation: 0.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Resting angle: 60.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	39.010100	-75.792718	46.35	2.00	48.35
2	39.007313	-75.794474	47.75	2.00	49.75
3	39.005389	-75.795155	46.22	2.00	48.22
4	39.003514	-75.796130	48.12	2.00	50.12
5	39.003476	-75.796837	48.27	2.00	50.27
6	39.003062	-75.796844	49.43	2.00	51.43
7	39.001925	-75.793564	48.69	2.00	50.69
8	39.002098	-75.792500	47.85	2.00	49.85
9	39.005448	-75.791913	45.92	2.00	47.92
10	39.006422	-75.792780	48.32	2.00	50.32
11	39.007613	-75.792348	47.39	2.00	49.39
12	39.007463	-75.791113	50.03	2.00	52.03
13	39.008974	-75.790498	46.57	2.00	48.57

Name: LPV3
Axis tracking: Single-axis rotation
Tracking axis orientation: 0.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Resting angle: 60.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

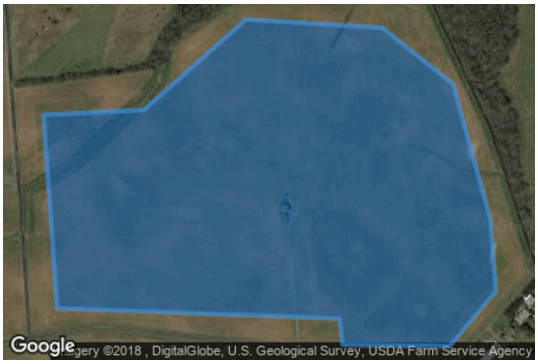
Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	39.003568	-75.801314	45.30	2.00	47.30
2	39.000953	-75.792991	50.10	2.00	52.10
3	38.989588	-75.796660	46.80	2.00	48.80
4	38.985939	-75.799490	42.60	2.00	44.60
5	38.988156	-75.804932	47.00	2.00	49.00
6	38.989168	-75.804974	45.00	2.00	47.00
7	38.989780	-75.806377	46.00	2.00	48.00
8	38.983991	-75.811305	39.70	2.00	41.70

Name: MPV1
Axis tracking: Single-axis rotation
Tracking axis orientation: 0.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Resting angle: 60.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	39.036600	-75.807832	57.10	2.00	59.10
2	39.034578	-75.807925	52.70	2.00	54.70
3	39.034562	-75.810814	54.60	2.00	56.60
4	39.033732	-75.810651	58.10	2.00	60.10
5	39.033018	-75.808187	55.70	2.00	57.70
6	39.031998	-75.807379	55.90	2.00	57.90
7	39.030438	-75.807700	60.60	2.00	62.60
8	39.031427	-75.809982	59.10	2.00	61.10
9	39.031398	-75.811633	57.30	2.00	59.30
10	39.029512	-75.811547	58.40	2.00	60.40
11	39.029472	-75.812137	59.00	2.00	61.00
12	39.028691	-75.812209	58.70	2.00	60.70
13	39.027948	-75.811514	59.90	2.00	61.90
14	39.027872	-75.808568	58.70	2.00	60.70
15	39.027411	-75.808399	58.60	2.00	60.60
16	39.027349	-75.806867	60.80	2.00	62.80
17	39.029831	-75.806826	61.00	2.00	63.00
18	39.029777	-75.806001	57.40	2.00	59.40
19	39.030507	-75.805459	58.40	2.00	60.40
20	39.032947	-75.805771	58.80	2.00	60.80
21	39.034976	-75.806386	52.40	2.00	54.40
22	39.036630	-75.806181	54.60	2.00	56.60

Name: MPV2
Axis tracking: Single-axis rotation
Tracking axis orientation: 0.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Resting angle: 60.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	39.031842	-75.801133	51.00	2.00	53.00
2	39.030574	-75.802982	54.50	2.00	56.50
3	39.030500	-75.804810	57.40	2.00	59.40
4	39.027785	-75.804561	61.00	2.00	63.00
5	39.027641	-75.799435	54.30	2.00	56.30
6	39.027272	-75.799383	54.10	2.00	56.10
7	39.027252	-75.797438	51.10	2.00	53.10
8	39.028025	-75.796599	50.90	2.00	52.90
9	39.029038	-75.796700	49.20	2.00	51.20
10	39.030930	-75.797376	47.80	2.00	49.80
11	39.031725	-75.798659	48.90	2.00	50.90

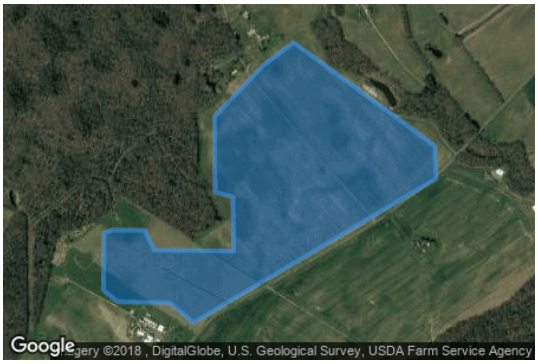
Name: UPV1
Axis tracking: Single-axis rotation
Tracking axis orientation: 0.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Resting angle: 60.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	39.040314	-75.771276	47.80	2.00	49.80
2	39.036253	-75.774176	44.30	2.00	46.30
3	39.035240	-75.774075	38.10	2.00	40.10
4	39.035146	-75.773841	37.90	2.00	39.90
5	39.038345	-75.772018	51.90	2.00	53.90
6	39.038154	-75.771313	52.10	2.00	54.10

Name: UPV2
Axis tracking: Single-axis rotation
Tracking axis orientation: 0.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Resting angle: 60.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	39.035718	-75.771414	43.80	2.00	45.80
2	39.034710	-75.771785	37.50	2.00	39.50
3	39.033097	-75.767038	44.40	2.00	46.40
4	39.035188	-75.764703	44.30	2.00	46.30
5	39.035741	-75.764811	43.90	2.00	45.90
6	39.036166	-75.765924	43.90	2.00	45.90
7	39.037225	-75.766024	44.20	2.00	46.20
8	39.037236	-75.767084	45.30	2.00	47.30
9	39.037743	-75.767253	47.80	2.00	49.80
10	39.037660	-75.768079	46.20	2.00	48.20
11	39.036419	-75.768101	42.90	2.00	44.90
12	39.036426	-75.768749	42.70	2.00	44.70
13	39.035377	-75.769593	43.20	2.00	45.20

Name: UPV3
Axis tracking: Single-axis rotation
Tracking axis orientation: 0.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Resting angle: 60.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	39.044788	-75.759525	49.20	2.00	51.20
2	39.044156	-75.760597	47.80	2.00	49.80
3	39.042704	-75.762391	45.70	2.00	47.70
4	39.040588	-75.762369	42.90	2.00	44.90
5	39.040444	-75.761723	44.00	2.00	46.00
6	39.038926	-75.761690	45.00	2.00	47.00
7	39.038957	-75.764579	44.00	2.00	46.00
8	39.039512	-75.764923	43.50	2.00	45.50
9	39.039524	-75.766102	44.30	2.00	46.30
10	39.039435	-75.766398	44.80	2.00	46.80
11	39.037827	-75.766426	44.90	2.00	46.90
12	39.037499	-75.765901	43.60	2.00	45.60
13	39.037479	-75.764015	44.00	2.00	46.00
14	39.036918	-75.763140	45.20	2.00	47.20
15	39.040963	-75.754344	42.50	2.00	44.50
16	39.041883	-75.754387	45.80	2.00	47.80

Name: UPV4
Axis tracking: Single-axis rotation
Tracking axis orientation: 0.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Resting angle: 60.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

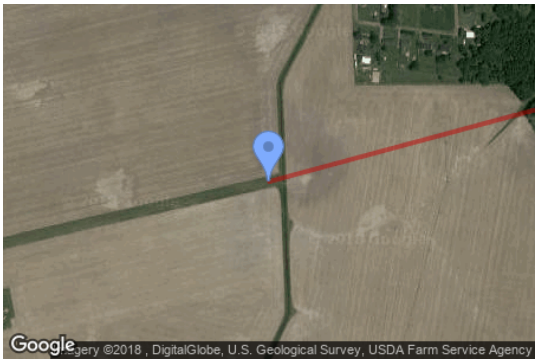
Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	39.040722	-75.753287	45.00	2.00	47.00
2	39.040731	-75.754112	42.50	2.00	44.50
3	39.040187	-75.754888	42.70	2.00	44.70
4	39.038935	-75.753908	41.80	2.00	43.80
5	39.038615	-75.754090	39.00	2.00	41.00
6	39.038022	-75.754513	38.20	2.00	40.20
7	39.039000	-75.755675	43.10	2.00	45.10
8	39.039105	-75.756853	42.90	2.00	44.90
9	39.036817	-75.762258	43.30	2.00	45.30
10	39.033769	-75.765317	44.40	2.00	46.40
11	39.032710	-75.765217	44.00	2.00	46.00
12	39.031847	-75.761872	41.90	2.00	43.90
13	39.033208	-75.760139	42.80	2.00	44.80
14	39.034034	-75.759948	40.60	2.00	42.60
15	39.034022	-75.758828	39.10	2.00	41.10
16	39.033420	-75.758426	27.20	2.00	29.20
17	39.034685	-75.756340	27.10	2.00	29.10
18	39.036108	-75.756139	37.40	2.00	39.40
19	39.036054	-75.755373	37.10	2.00	39.10
20	39.038539	-75.751262	33.00	2.00	35.00
21	39.039919	-75.751297	40.00	2.00	42.00

Flight Path Receptor(s)

Name: Carmean Runway 09
Description: None
Threshold height: 50 ft
Direction: 76.5°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	38.932631	-75.892977	56.80	50.00	106.81
Two-mile	38.925872	-75.929157	59.70	600.53	660.23

Name: Carmean Runway 270
Description: None
Threshold height: 50 ft
Direction: 254.9°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	38.933683	-75.887076	53.70	50.00	103.71
Two-mile	38.941215	-75.851148	51.70	605.43	657.13

Name: Our Domain Runway 210
Description: None
Threshold height: 50 ft
Direction: 211.3°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	39.069557	-75.728375	47.30	50.00	97.30
Two-mile	39.094269	-75.709022	56.00	594.73	650.73

Name: Ridgely Runway 12
Description: None
Threshold height: 50 ft
Direction: 109.0°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	38.972032	-75.873579	63.40	50.00	113.41
Two-mile	38.981445	-75.908783	56.20	610.73	666.93

Name: Ridgely Runway 30
Description: None
Threshold height: 50 ft
Direction: 289.0°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	38.969330	-75.863515	63.20	50.00	113.21
Two-mile	38.959917	-75.828313	32.40	634.23	666.63

Name: Spiering Runway 17
Description: None
Threshold height: 50 ft
Direction: 157.8°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	38.981282	-75.777663	52.60	50.00	102.61
Two-mile	39.008057	-75.791715	47.20	608.83	656.03

Name: Spiering Runway 35
Description: None
Threshold height: 50 ft
Direction: 339.3°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 50.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	38.978113	-75.775903	49.70	50.00	99.70
Two-mile	38.951060	-75.762766	56.50	596.73	653.23

Discrete Observation Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (ft)	Height (ft)
OP 1	1	38.983390	-75.806309	43.50	12.00
OP 2	2	38.992797	-75.814592	42.00	12.00
OP 3	3	39.015375	-75.785280	46.60	12.00
OP 4	4	39.022277	-75.788027	41.80	12.00
OP 5	5	39.029845	-75.820814	59.20	12.00
OP 6	6	39.039579	-75.802275	56.80	12.00
OP 7	7	39.028778	-75.794456	48.30	12.00
OP 8	8	39.039879	-75.778792	46.70	12.00
OP 9	9	39.045412	-75.761196	51.90	12.00
OP 10	10	39.039045	-75.754716	45.20	12.00
OP 11	11	39.036645	-75.764587	43.90	12.00
OP 12	12	39.028311	-75.771582	44.50	12.00

GLARE ANALYSIS RESULTS

Summary of Glare

PV Array Name	Tilt (°)	Orient (°)	"Green" Glare min	"Yellow" Glare min	Energy kWh
LPV1	SA tracking	SA tracking	0	0	-
LPV2	SA tracking	SA tracking	0	0	-
LPV3	SA tracking	SA tracking	0	0	-
MPV1	SA tracking	SA tracking	0	0	-
MPV2	SA tracking	SA tracking	0	0	-
UPV1	SA tracking	SA tracking	0	0	-
UPV2	SA tracking	SA tracking	0	0	-
UPV3	SA tracking	SA tracking	0	0	-
UPV4	SA tracking	SA tracking	0	0	-

Total annual glare received by each receptor

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
Carmean Runway 09	0	0
Carmean Runway 270	0	0
Our Domain Runway 210	0	0
Ridgely Runway 12	0	0
Ridgely Runway 30	0	0
Spiering Runway 17	0	0
Spiering Runway 35	0	0
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
OP 6	0	0
OP 7	0	0
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0

Results for: LPV1

Receptor	Green Glare (min)	Yellow Glare (min)
Carmean Runway 09	0	0
Carmean Runway 270	0	0
Our Domain Runway 210	0	0
Ridgely Runway 12	0	0
Ridgely Runway 30	0	0
Spiering Runway 17	0	0
Spiering Runway 35	0	0
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0

Flight Path: Carmean Runway 09

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Carmean Runway 270

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Our Domain Runway 210

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Ridgely Runway 12

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Ridgely Runway 30

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Spiering Runway 17

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Spiering Runway 35

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 4

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 5

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 6

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 7

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 8

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 9

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 10

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 11

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 12

0 minutes of yellow glare
0 minutes of green glare

Results for: LPV2

Receptor	Green Glare (min)	Yellow Glare (min)
Carmean Runway 09	0	0
Carmean Runway 270	0	0
Our Domain Runway 210	0	0
Ridgely Runway 12	0	0
Ridgely Runway 30	0	0

Receptor	Green Glare (min)	Yellow Glare (min)
Spiering Runway 17	0	0
Spiering Runway 35	0	0
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0

Flight Path: Carmean Runway 09

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Carmean Runway 270

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Our Domain Runway 210

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Ridgely Runway 12

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Ridgely Runway 30

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Spiering Runway 17

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Spiering Runway 35

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 4

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 5

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 6

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 7

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 8

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 9

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 10

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 11

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 12

0 minutes of yellow glare
0 minutes of green glare

Results for: LPV3

Receptor	Green Glare (min)	Yellow Glare (min)
Carmean Runway 09	0	0
Carmean Runway 270	0	0
Our Domain Runway 210	0	0
Ridgely Runway 12	0	0
Ridgely Runway 30	0	0
Spiering Runway 17	0	0
Spiering Runway 35	0	0
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0

Flight Path: Carmean Runway 09

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Carmean Runway 270

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Our Domain Runway 210

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Ridgely Runway 12

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Ridgely Runway 30

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Spiering Runway 17

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Spiering Runway 35

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 4

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 5

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 6

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 7

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 8

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 9

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 10

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 11

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 12

0 minutes of yellow glare
0 minutes of green glare

Results for: MPV1

Receptor	Green Glare (min)	Yellow Glare (min)
Carmean Runway 09	0	0
Carmean Runway 270	0	0
Our Domain Runway 210	0	0
Ridgely Runway 12	0	0
Ridgely Runway 30	0	0
Spiering Runway 17	0	0
Spiering Runway 35	0	0
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0

Flight Path: Carmean Runway 09

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Carmean Runway 270

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Our Domain Runway 210

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Ridgely Runway 12

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Ridgely Runway 30

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Spiering Runway 17

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Spiering Runway 35

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 4

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 5

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 6

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 7

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 8

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 9

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 10

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 11

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 12

0 minutes of yellow glare
0 minutes of green glare

Results for: MPV2

Receptor	Green Glare (min)	Yellow Glare (min)
Carmean Runway 09	0	0
Carmean Runway 270	0	0
Our Domain Runway 210	0	0
Ridgely Runway 12	0	0
Ridgely Runway 30	0	0
Spiering Runway 17	0	0
Spiering Runway 35	0	0
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0

Receptor	Green Glare (min)	Yellow Glare (min)
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0

Flight Path: Carmean Runway 09

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Carmean Runway 270

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Our Domain Runway 210

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Ridgely Runway 12

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Ridgely Runway 30

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Spiering Runway 17

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Spiering Runway 35

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 4

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 5

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 6

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 7

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 8

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 9

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 10

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 11

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 12

0 minutes of yellow glare
0 minutes of green glare

Results for: UPV1

Receptor	Green Glare (min)	Yellow Glare (min)
Carmean Runway 09	0	0
Carmean Runway 270	0	0
Our Domain Runway 210	0	0
Ridgely Runway 12	0	0
Ridgely Runway 30	0	0
Spiering Runway 17	0	0
Spiering Runway 35	0	0
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0

Flight Path: Carmean Runway 09

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Carmean Runway 270

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Our Domain Runway 210

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Ridgely Runway 12

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Ridgely Runway 30

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Spiering Runway 17

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Spiering Runway 35

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 4

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 5

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 6

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 7

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 8

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 9

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 10

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 11

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 12

0 minutes of yellow glare
0 minutes of green glare

Results for: UPV2

Receptor	Green Glare (min)	Yellow Glare (min)
Carmean Runway 09	0	0
Carmean Runway 270	0	0
Our Domain Runway 210	0	0
Ridgely Runway 12	0	0
Ridgely Runway 30	0	0
Spiering Runway 17	0	0
Spiering Runway 35	0	0
OP 1	0	0
OP 2	0	0

Receptor	Green Glare (min)	Yellow Glare (min)
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0

Flight Path: Carmean Runway 09

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Carmean Runway 270

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Our Domain Runway 210

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Ridgely Runway 12

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Ridgely Runway 30

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Spiering Runway 17

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Spiering Runway 35

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 4

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 5

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 6

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 7

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 8

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 9

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 10

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 11

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 12

0 minutes of yellow glare
0 minutes of green glare

Results for: UPV3

Receptor	Green Glare (min)	Yellow Glare (min)
Carmean Runway 09	0	0
Carmean Runway 270	0	0
Our Domain Runway 210	0	0
Ridgely Runway 12	0	0
Ridgely Runway 30	0	0
Spiering Runway 17	0	0
Spiering Runway 35	0	0
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0

Flight Path: Carmean Runway 09

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Carmean Runway 270

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Our Domain Runway 210

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Ridgely Runway 12

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Ridgely Runway 30

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Spiering Runway 17

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Spiering Runway 35

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 4

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 5

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 6

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 7

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 8

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 9

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 10

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 11

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 12

0 minutes of yellow glare
0 minutes of green glare

Results for: UPV4

Receptor	Green Glare (min)	Yellow Glare (min)
Carmean Runway 09	0	0
Carmean Runway 270	0	0
Our Domain Runway 210	0	0
Ridgely Runway 12	0	0
Ridgely Runway 30	0	0

Receptor	Green Glare (min)	Yellow Glare (min)
Spiering Runway 17	0	0
Spiering Runway 35	0	0
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0

Flight Path: Carmean Runway 09

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Carmean Runway 270

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Our Domain Runway 210

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Ridgely Runway 12

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Ridgely Runway 30

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Spiering Runway 17

0 minutes of yellow glare
0 minutes of green glare

Flight Path: Spiering Runway 35

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 4

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 5

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 6

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 7

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 8

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 9

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 10

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 11

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 12

0 minutes of yellow glare
0 minutes of green glare

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions.
The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual values may differ.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.