

GUIDANCE FOR THE PERMITTING OF SOLAR ENERGY SYSTEMS ON NEW JERSEY LANDFILLS

New Jersey Department of Environmental Protection
Division of Sustainable Waste Management

Update February 2024

Guidance for the Permitting of Solar Energy Systems on Landfills in New Jersey

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A. Introduction

New Jersey's [2019 Energy Master Plan](#) outlines the main strategies necessary to reach the goals of 100% clean energy and 80% emissions reductions from 2006 levels by 2050. Among these strategies is the acceleration of deployment of renewable energy, including solar.

Properly closed landfills may be suitable locations for solar energy systems. As of February 2020, solar installations have been completed on over 30 landfills with another 15 projects under construction or applications under review. In addition to providing a source of renewable energy, the installation of solar energy projects on landfills can offset the costs of closure and post-closure care and provide long-term revenues for landfill owners.

This guidance provides information about the process for obtaining approval to install solar energy projects on closed sanitary landfills under New Jersey's Solid Waste Regulations, N.J.A.C. 7:26 et seq., and other Department programs. This guidance describes the approvals that are necessary from the DEP's Division of Sustainable Waste Management (DSWM) and provides a list of the permits or approvals from other programs in the Department and other agencies that may be required. It also describes some of the special issues that must be addressed when placing solar energy systems on sanitary landfills.

To find information about the location of landfills in New Jersey, visit the DSWM's Landfill Database website at: <http://www.nj.gov/dep/dshw/lrm/landfill.htm>.

B. Process Overview

The process for obtaining approval from the Department and constructing landfill solar projects will generally follow this path, depending on site-specific situations:

1. Permit Readiness Checklist: The Permit Readiness Checklist and initial GeoWeb site suitability review are provided by the Department's Office of Permitting and Project Navigation (OPPN). The applicant completes the Readiness Checklist. See section C below.
2. Pre-application meeting: A pre-application meeting provides an opportunity early in the planning process for the applicant to meet with Department representatives, discuss the project and proposed schedule, and determine what will be required to obtain the appropriate permit approvals for the project. See section C below. For projects within the New Jersey Pinelands Area, inclusion of Pinelands staff at the pre-application meeting is advisable.
3. Landfill Assessment: The applicant will have to perform an assessment of the landfill and its surroundings to determine the environmental controls, maintenance, and monitoring necessary for closure and post-closure care. When existing documentation is not available to conduct the assessment, the applicant shall conduct an investigation sufficient to obtain the information required to complete the assessment. If a physical investigation of the landfill is needed to complete the assessment, e.g. soil borings, test pits, well installation, the applicant must obtain a Minor Disruption Approval pursuant to N.J.A.C. 7:26-2A.8(j). See section D below. A habitat assessment as discussed in F.6 should be included as part of the landfill assessment.

4. Approval for Construction Under New Jersey's Solid Waste Rules

Generally, applications for construction of solar energy systems on landfills under New Jersey's Solid Waste Rules will be processed by the Bureau of Solid Waste Permitting in the DSWM. Under certain circumstances, if the landfill is also required to comply with the Department's Site Remediation Rules, N.J.A.C. 7:26C and E, applications for Solid Waste approvals may be processed by the Department's Office of Brownfield and Community Revitalization in the Site Remediation Program. Depending on the specific regulatory circumstances of the landfill, approval of the project may take a variety of forms:

- a. **Landfill Closure and Post-Closure Plan:** If the landfill has not been verified as properly closed, the owner must prepare and submit for approval a Closure and Post-Closure Plan in accordance with N.J.A.C. 7:26-2A.9. A proposal to install the solar energy system may be included in the plan initially, or the owner may implement the approved closure plan and apply for modification of the plan for the solar energy project at a later date. See section E below for more information.
 - b. **Closure and Post-Closure Plan Modification:** If a Closure and Post-Closure Plan has already been approved and closure implemented to the satisfaction of the Department, then the owner will be required to apply for a modification of the Plan that addresses installation of the solar energy system and any changes or modifications to previously installed environmental control systems under the original Closure and Post-Closure Plan Approval. (N.J.A.C. 7:26-2A.9(d)6)
 - c. **Sanitary Landfill Major Disruption Approval:** Under certain limited circumstances, the Department may approve the installation of a solar energy system on a properly closed landfill through a Sanitary Landfill Major Disruption Approval in accordance with N.J.A.C. 7:26-2A.8(j). Such circumstances include projects located at landfills that have completed their post-closure care period or landfills that had been previously properly closed under the EPA's Superfund Program where no Closure and Post-Closure Plan Approval was previously issued.
 - d. **Solid Waste Facility Permit Modification:** The DSWM may approve the installation of a solar energy system on a properly closed portion of an operating landfill by modifying the landfill's Solid Waste Facility Permit.
5. Construction: After obtaining all required permits/approvals, the applicant may start construction of the proposed solar project. In accordance with N.J.A.C. 7:26-2A.9(c)4, a New Jersey licensed professional engineer (NJPE) must oversee the construction activities at the landfill.
6. Post-construction Submissions: After completion of the project, the owner must submit an as-built report and certification, including engineering drawings, signed and sealed by a NJPE to the DSWM.

C. Permit Coordination

A solar landfill project may require a number of Department permits or approvals. For the applicant's convenience, the OPPN offers a "one-stop" coordination process to assist the applicant. This office was established to improve service to permit applicants through better communication, coordination, and identification of problematic issues early in the permitting process. The OPPN will work with the applicant to help identify any site impediments or fatal flaws via a GeoWeb review as well as any DEP permits and approvals necessary to complete the project. The OPPN will establish a permitting team of representatives from applicable Department programs that may be involved in permitting or approving the solar project and coordinate a pre-application meeting between those DEP programs and the applicant. This process assists the applicant in determining if a development plan is advanced enough to be ready to submit permit applications, establishing contact with a full Departmental permitting team, and maintaining consistent contact throughout the permitting process.

To initiate the permit coordination process, an applicant must electronically submit a Permit Readiness Checklist to the OPPN prior to a pre-application meeting to ensure that all appropriate programs are present. The permit readiness checklist is located at the website: <https://dep.nj.gov/oppn/>.

If you have any questions concerning the permit coordination process, please contact OPPN at (609) 292-3600.

All permit/approval applications should be submitted directly to each program in the Department, or to agencies outside the Department as appropriate, after discussion and coordination through meetings with the OPPN.

D. Landfill Assessment

The owner of the site or other applicant must perform an assessment of the landfill and its surroundings. The purpose of the assessment is to determine the types and extent of closure requirements needed for the landfill. The assessment should use available records along with a physical investigation of the site to determine the current condition and potential impact of the landfill. The assessment should address, but not be limited to, the following:

- topography, geology, and hydrology of the area,
- surrounding land use,
- identification of nearby human and ecological receptors and environmentally sensitive areas, including a habitat assessment,
- site access routes,
- existing and future use of the site,
- current and prior owners and operators of the landfill,
- time period the landfill was used for disposal,
- characterization of the types of waste disposed,
- vertical and horizontal extent of waste,
- existing environmental controls and their condition and effectiveness,

- chemical characteristics of all environmental media, including soil, leachate, groundwater and surface water, and
- landfill gas generation rates and migration data.

If a physical investigation of the site e.g., soil boring/well drilling/decommissioning/test pits, is necessary, then the applicant shall obtain a Minor Disruption Approval pursuant to N.J.A.C. 7:26- 2A.8(j) from the Department. The application to obtain a Minor Disruption Approval must be prepared and submitted pursuant to the requirements of Section 9 of the Department's Technical Manual for Sanitary Landfill Permits and Approvals which can be found at <https://www.nj.gov/dep/dshw/hwtf/permits/sanlanpa.pdf>.

E. Landfill Closure and Post-Closure Care

A sanitary landfill must be properly closed in accordance with the requirements of N.J.A.C. 7:26- 2A.9 prior to the installation of a solar energy system or other redevelopment. In most cases, this includes the preparation and Department-approval of a Closure and Post-Closure Plan, in accordance with N.J.A.C. 7:26-2A.9(e). Specific guidance on each provision of the Closure and Post-Closure Plan is included in the Department's Technical Manual for Sanitary Landfill Permits and Approvals. This technical manual is available at <https://www.nj.gov/dep/dshw/hwtf/permits/sanlanpa.pdf>.

Listed below are brief descriptions of the elements required in a Closure and Post-Closure Plan. The plan must include a narrative describing the design of each closure element and a justification/explanation how the design complies with the regulation. The plan must also include NJPE signed and sealed engineering drawings of the designed closure elements. Note that the Department may require additional closure and post-closure measures or waive one or more of the requirements based upon the Department's evaluation of specific health and/or environmental circumstances:

1. Solid Waste Facility Permit Application Form – The form is available at <http://www.nj.gov/dep/dshw/resource/forms.htm>. It should be completed and signed by the owner, agent and professional engineer.
2. Municipal Site Plan Approval - A copy of the application and the preliminary or final site plan approval issued by the municipality for the project pursuant to the Municipal Land Use Law. This requirement applies to non-public entities that undertake closure of a legacy landfill or any landfill owner or operator that is proposing to accept any material on a landfill that is already properly closed. See N.J.A.C. 7:26-2A.9(e)2.
3. Landfill Assessment - An assessment of the landfill and its surroundings to determine the environmental controls, maintenance, and monitoring necessary for closure and post-closure care as described earlier in this document. See N.J.A.C. 7:26-2A.9(e)3.
4. Soil Erosion and Sediment Control Plan (certified) - A SESC plan approved by the regional soil conservation district or a copy of the SESC plan application must be included in the closure plan.

5. Final Capping/Cover, Final Cover Vegetation, and Final Cover Maintenance –

Final Cover - The final cover system must completely isolate the landfilled waste from the surrounding environment. The system must be designed to minimize long term infiltration or percolation of liquid into the landfill throughout the closure and post-closure care period. The final cover design is required to meet the standards of N.J.A.C. 7:26-2A.7(i). However, in some cases where impacts to human health and the environment allow, the DSWM may approve final cover consisting of 2 feet of soil [18 inches of common soil overlain by a six-inch minimum erosion layer (topsoil)].

The final cover system must accommodate settlement throughout the closure and post-closure care period. An analysis of the long-term stability of the final slopes must be addressed pursuant to N.J.A.C. 7:26-2A.5(a)6. (N.J.A.C. 2A.7(i)4).

Final Cover Vegetation – Vegetation should be selected in accordance with the Standards for Soil Erosion and Sediment Control in New Jersey and Preliminary Suggested Plant List for New Jersey Grid Supply Solar Facilities (see Appendix A below).

Final Cover Maintenance – During the post-closure care period, the final cover must be inspected on a regular basis. Vegetation must be mowed and fertilized, limed and reseeded as needed to prevent erosion. Erosion, settlement, and damage to the final cover/capping system must be repaired. Mowing should be conducted between October 1 and March 31 to prevent take pursuant to N.J.S.A. 23:2A-1 to 23:2A-1:16, preferably during the month of February or March. Consideration should be given to putting these areas on a rotational mowing regime where one-half to one-third of the site is mowed/managed on a 2-3-year rotation and to providing bare patches of friable soil for the benefit of ground-nesting bees where compatible with landfill closure. The owner should attempt to limit activities to landfill maintenance and those required to maintain and/or enhance the suitability of the areas for gamebird, songbird and/or pollinator habitat, as identified in the site's Final Vegetation Cover component.

6. Maintenance of Side Slopes - addressed in a similar manner to item 5 above.

7. Stormwater Run-on/Run-off Control Design, Construction and Maintenance

According to Solid Waste Rules, the surface drainage should be designed to protect the sanitary landfill from run-on/run-off at a minimum peak discharge of a 24-hour, 25- year storm. The design requirements for surface drainage must be in accordance with N.J.A.C. 7:26-2A.7(g). It should be noted that other Programs in the Department may have more stringent requirements on stormwater management (see below for more information on stormwater requirements.)

Run-on/run-off controls, e.g. berms, dikes, downchutes, swales, and basins, must be inspected regularly during the post-closure care period. The structures must be maintained with adequate capacity, kept free of obstructions, and repaired as needed.

8. Groundwater Wells, Groundwater Monitoring and Maintenance

Landfills that accepted waste for disposal on or after January 1, 1982, must have a New Jersey Pollutant Discharge Elimination System (NJPDES) Permit and monitor according to NJPDES regulations at N.J.A.C.7:14A. A groundwater monitoring system must be designed and constructed in accordance with NJPDES regulations at N.J.A.C. 7:14A-6.

Landfills without NJPDES Permits may be required to perform groundwater monitoring in accordance with the requirements of the Closure and Post-Closure Plan Approval depending on the results of the landfill assessment.

Wells will have to be periodically inspected and replaced or redeveloped as needed.

9. Landfill Gas Venting and Evacuation System Design, Construction and Maintenance and Landfill Gas Monitoring

If necessary, a landfill venting system must be developed to prevent gas build up and migration laterally from the site to adjacent receptors such as residences or other structures. Gas venting systems must be designed and constructed in accordance with N.J.A.C. 7:26-2A.7(f). If installed, regular inspections and maintenance are required during the post-closure care period.

Regardless of whether a gas venting system is required, regular subsurface monitoring for migration of landfill gas will likely be required during the post-closure care period in accordance with N.J.A.C. 7:26-2A.8(h)9.

10. Leachate Collection/Control System, and Operation and Maintenance of the Leachate Collection System

If necessary, a leachate collection system must be designed and constructed in accordance with N.J.A.C. 7:26-2A.7(d). Details of all aspects of the operation and maintenance of the leachate collection system must be provided.

11. Facility Access Control and Maintenance of Access Control - Facility access controls, e.g. fencing and gates, must be designed and constructed in accordance with N.J.A.C. 7:26-2A.8(b)25. Access controls must be regularly inspected and repaired during the post-closure care period.

12. Conformance of the Site to the Surrounding Area – Provisions of a program to make the closed landfill aesthetically compatible with the surrounding area and maintenance of these provisions during the post-closure care period is required.

13. Hydrogen Sulfide Monitoring – A program for monitoring hydrogen sulfide must be included if specifically required by the DSWM in accordance with N.J.A.C. 7:26-2A.7(h)10. Such a system is only required by the DSWM if the landfill has a history of odor complaints related to suspected hydrogen sulfide emissions. The Department's

Division of Air Quality may have additional requirements regarding hydrogen sulfide monitoring at landfills.

14. Material Acceptance Protocol – A protocol setting forth the types, quantities, uses, and specifications of material proposed for acceptance subsequent to termination of solid waste disposal operations at the landfill and the procedures to be implemented by the owner/operator to accept and manage such material must be provided. See N.J.A.C. 7:26- 2A.9(e)4xx.
15. Inspections – The plan must provide for periodic inspections of the facility during the post-closure care period. Details of items required to be inspected, inspection form(s), and an inspection schedule should be included.
16. Schedule – A schedule for implementation of closure and post-closure is required.
17. Closure and Post-Closure Financial Plan

For landfills that accepted solid waste for disposal on or after January 1, 1982, a Financial Plan prepared in accordance with N.J.A.C. 7:26-2A.9(f) shall be included. The Financial Plan must set forth the costs and expenses and establish the means for meeting those costs and expenses associated with full implementation of the approved Closure and Post-Closure Plan.

For any legacy landfill or closed sanitary landfill facility that accepts recyclable material, contaminated soil, wastewater treatment residual material, or construction debris, a Financial Plan prepared in accordance with N.J.A.C. 7:26-2A.9(h) shall be included. This Financial Plan includes requirements for financial assurance for closure and post-closure care expenses and liability insurance.

A “legacy landfill” is a sanitary landfill that ceased operations prior to January 1, 1982, and received for disposal solid waste or waste material that was accepted for disposal prior to October 21, 1976, and that is included within the definition of hazardous waste adopted by the Federal government pursuant to the Resource Conservation and Recovery Act, 42 U.S.C. §§ 6921 et seq.

18. Plan Certification - A NJPE must prepare, sign, and seal the closure and post-closure plan per N.J.A.C. 7:26-2A.9(e)1.

F. Specific Issues Regarding Solar Energy Systems

Many issues may influence the integrity of the landfill and its properties when installing solar systems on a landfill site. Therefore, it is important to understand what properties of the landfill need to be addressed and understood before commencing with a solar system project located on a landfill.

1. Settlement – Landfills naturally settle over time due to physical, chemical, and biological changes taking place in the waste mass. Differential settlement can cause damage to the landfill cap and ponding which can increase infiltration of water into the landfill. This would

increase leachate generation and potentially cause leachate seeps and/or negatively impact groundwater quality. The weight of the solar installations and construction equipment could have an impact on landfill settlement. Also, settlement can damage the solar installations or adversely impact their efficiency. Therefore, the design of the capping/cover system, selection of the type of solar systems and its support system, and construction practices must consider measures to minimize settlement.

2. Side Slope Stability – Like settlement, side slope stability must be considered when selecting the type of solar installation, the design of the cover system and solar foundations that will be used in such locations. Snow, wind and ice loading should also be considered when designing solar installations on side slopes.
3. Stormwater/Run-off – Installation of solar systems on a landfill will change the way stormwater behaves and will likely increase the potential for erosion and increase the amount of runoff that will have to be managed to prevent flooding. Therefore, the design of the solar installations must consider measures to minimize erosion, and stormwater management structures must be designed for the expected higher flow.
4. Landfill Cover - For landfills with existing caps/cover systems, installation may impact the landfill cap and expose waste during construction. This can occur during clearing and grading, construction of solar system support systems and utility installation. The integrity of the cap must not be damaged during construction. The DSWM strongly recommends the use of ballasted racking systems and running conduit for electrical lines above the surface of the landfill. All construction activities must be conducted in compliance with the requirements for landfill disruptions found at N.J.A.C. 7:26-2A.8(j).
5. Routine Cap Maintenance - Simply due to their presence on the landfill, solar system installations will affect the way post-closure maintenance of closure systems are normally performed. The Closure and Post-Closure Plan must address how the system’s design and maintenance programs allow for vegetation management, erosion inspections and cover maintenance, inspection and maintenance of the gas and leachate collection systems, gas migration and surface monitoring, etc.
6. Habitat - The Solar Act of 2021 (P.L. 2021, c.169 (c.48:3-119)) outlines siting criteria for grid supply solar facilities, including the requirement to “minimize, as much as is practicable, potential adverse environmental impacts” (6.b.2) and include consideration of existing and prior land uses of the property, whether the property contains a contaminated site or landfill, any conservation or agricultural designations associated with the property, and other site-specific criteria (6.b.3). Furthermore, the Act (N.J.S.A. 13:1B-15.178) recognized the need for solar facilities to be compatible with habitat for gamebirds, songbirds, and pollinators.

Landfills provide important habitats for many species of grassland-dependent wildlife, including endangered and threatened grassland birds and pollinator insects, and may also be suitable locations for solar energy systems. Depending on the density of solar arrays and size and configurations of the area developed, installation of solar facilities on landfills that provide habitat for grassland-dependent wildlife may cause adverse impacts to populations

of endangered and threatened wildlife. When carefully planned, solar energy projects on landfills can minimize adverse impacts by maintaining/enhancing habitat for breeding populations of pollinators and endangered/threatened grassland birds.

Habitat Assessment

Because closed landfills provide habitat for wildlife, a Closure and Post-Closure Plan should contain a habitat assessment that includes vegetated cover/seed mixes and vegetation maintenance for wildlife. This assessment should address site-specific concerns and circumstances related to pollinators and grassland-dependent birds, including but not limited to the selection of vegetated cover that complies with erosion standards and enhances habitat for pollinators and birds, and the maintenance of the vegetation that avoids mowing between April 1 and September 30.

Because old landfills are closed to the public, inventories of bird and pollinator species have not been conducted and therefore do not show up in the Landscape Project mapping on GeoWeb or other database searches for presence of endangered and threatened species. These inventories should be conducted on landfills to determine potential impacts of solar installation on pollinator and bird species, particularly those listed as endangered and threatened.

The plan should include an overall assessment of existing (i.e., pre-development) habitat to determine the value of the current habitat for pollinators and grassland-dependent birds, determine any invasive plant issues, and assess overall site conditions. From that assessment, opportunities for potential gamebird/songbird and pollinator habitat creation and/or preservation should be identified.

Any areas that contain existing, suitable gamebird/songbird or pollinator habitat and remain outside of the footprint of proposed solar panels should be identified for preservation and/or enhancement and clearly identified in the Habitat Assessment. These areas should be marked on site and depicted/properly labeled on all construction plans to ensure these areas are not disturbed prior to or during construction. Mowing to maintain the habitat conditions should be assessed and included in the Final Cover Maintenance component of the Closure and Post-Closure Plan.

Non-forested upland areas outside of the footprint(s) of solar panel array(s) that do not contain suitable habitat may be used to create new suitable gamebird/songbird or pollinator habitat, provided consideration is given to the functions and values any such area may be presently serving for other wildlife. Generally, creation and/or maintenance of pollinator habitat in these areas should follow more general pollinator habitat management guidelines such as those afforded by Conservation Cover (327) for Pollinators: New Jersey Installation Guide and Fact Sheet (Xerces Society for Invertebrate Conservation, 2013). Key among such provisions is ensuring that all areas to be planted are free of weeds or dormant weed seeds.

Areas within the footprint of the proposed solar panel array(s) can be compatible habitat for pollinators but unlikely for nesting birds. Creation of pollinator habitat within the arrays

would generally occur after the installation of all proposed panels and infrastructure. The potential for these “sub-areas” within the footprint of facility infrastructure and/or associated maintenance requirements to facilitate or challenge the creation of pollinator habitat should be included in the Habitat Assessment. For example, the frequency and nature of activity necessary in the lanes between photovoltaic panels rows should be assessed to determine what vegetative condition is possible to maintain in these areas. Similarly, the area under the lowest panel edge may be subject to frequent and destructive mowing or maintenance requirements that reasonably preclude the establishment of habitat beneficial to game birds, songbirds or pollinators, whereas the area under the highest panel edge may facilitate pollinator vegetation growth, provided shading is not too severe. The Habitat Assessment should anticipate these micro-conditions, determine appropriate species of vegetation that will accommodate site constraints, and establish site preparation standards necessary to support the proposed post-development condition.

Where compatible with landfill closure requirements, care should be taken not to overly compact the upper 12” of soils in locations where the Habitat Assessment identifies areas within the footprint of solar arrays to facilitate pollinator habitat. Application of gravels, mulches, plastic liners or other impediments to vegetative growth or access to the soil horizons in these areas should also be avoided.

In some instances, the areas within and outside of the proposed footprint(s) of solar panel array(s) will not provide sufficient habitat to maintain existing populations of pollinators or breeding grassland birds, particularly areas-sensitive rare and declining birds such as bobolinks. In these cases, consideration should be given to the configuration and/or density of the solar arrays to retain sufficient breeding habitat reserves away from forest edges for these species. Some additional examples of ways to increase compatibility of solar development with pollinator and bird habitat include increasing the spacing between rows of solar panels to >10 feet and raising the minimum height of panels to >5 feet.

The Department will consider the use of new and/or innovative technologies for solar energy production that have been approved by a NJPE. The NJPE must sign and seal the Closure and Post-Closure Plan application as meeting the Department’s landfill closure regulatory requirements and providing for post-closure care remedies in the event of failure of any aspect of the solar facility as it relates to fulfilling the landfill closure requirements.

G. Other Permits/Approvals/Requirements

Other Divisions within the Department or agencies outside of the Department may require permits or approvals for solar projects on landfills. Some of the more common permits that may be required are listed below. Please note that this is not a complete list of the Department’s permits and approvals that may be necessary for specific projects with unique circumstances. Contact information is provided to obtain further information on the specific requirements of these permits or approvals.

1. Land Use Permits (Flood Hazard Area, Freshwater Wetlands, Coastal Wetlands, CAFRA, Waterfront Development, Highlands Preservation Area, and Tidelands permits/approvals):
For questions regarding specific permit requirements, please contact the Division of Land

Resource Protection by visiting its internet website at <https://dep.nj.gov/wlm/lrp/> or by telephone at (609) 777-0454.

2. Air Permits: Required for landfill gas venting systems, such as an Air Pollution Control Permit and Certificate, pursuant to N.J.A.C. 7:27-8.2(c)17. For questions regarding these permit requirements, please contact the Bureau of Stationary Sources by visiting its internet website at <https://dep.nj.gov/boss/> or by phone at (609)-292-6716.
3. Well Drilling Permits: Required for drilling, constructing, redeveloping, replacing and decommissioning wells (including but not limited to gas vent extraction wells), some soil borings, cathodic protection wells, dewatering well points, etc. placed within or outside of the landfilled area. For questions regarding these permit requirements, please contact the Division of Water Supply and Geoscience by visiting its internet website at <http://www.nj.gov/dep/watersupply/> or by phone at 609-984-6831.
4. New Jersey Pollutant Discharge Elimination System Permits (NJPDES):

Groundwater discharges: For questions regarding the permit requirements for landfills that are no longer operating, please contact the DSWM's Bureau of Solid Waste Permitting at 609-292-9880.

Surface water discharges: Approval may be necessary if a new or increased discharge to surface water will occur due to this project. Please contact the Bureau of Surface Water and Pretreatment Permitting at (609) 292-4860.
5. New Jersey Highlands Council: Approval is required for sites located in either the Highlands Preservation or Planning Area. For questions, please contact the Highlands Council Executive Director at New Jersey Highlands Council, 100 North Road (Route 513), Chester, N.J. 07930-2322, telephone: (908) 879-6737 and <http://www.highlands.state.nj.us/>.

Additional information on the Highlands Water Protection and Planning Act rules is available at <http://www.nj.gov/dep/highlands/>.
6. New Jersey Pinelands Commission: Approval is required for sites located in the New Jersey Pinelands Area. For questions regarding permit requirements, please contact the NJPC by visiting its internet website at www.NJ.gov/pinelands or by phone at (609) 894-7300.
7. Green Acres: For questions concerning any permit requirements, please contact the Green Acres Program by visiting its internet website at <https://www.nj.gov/dep/greenacres/> or by phone at (609) 984-0500.
8. Fish & Wildlife: For questions regarding permit requirements, please contact Fish and Wildlife's Office of Environmental Review at fwoer@dep.nj.gov.

9. Stormwater Requirements for Placement of Solar Projects on Landfills: Two different requirements are described below: the Construction Activity Stormwater General Permit (5G3) and the design and performance standard for runoff quantity.

Construction Activity Stormwater General Permit (5G3) - Construction activities that propose to disturb an acre or more of land must apply for a Construction Activity Stormwater General Permit (known as “5G3”). This permit can be accessed through the Bureau of NJPDES Stormwater Permitting and Water Quality Management E-Permitting System available at the website: <http://www.nj.gov/dep/online>. Guidance on filling out the permit is available at <http://www.state.nj.us/dep/dwq/5g3.htm> or by phone at 609-633-7021. The Bureau website can be found at <https://dep.nj.gov/njpdes-stormwater/>.

Stormwater Runoff Quantity and Control Requirements - The Department’s requirements for the minimum design and performance standards necessary to control the stormwater runoff quantity due to the impacts of solar project placement on landfills can be found at N.J.A.C. 7:8 et seq. The Bureau of NJPDES Stormwater Permitting and Water Quality Management is available at the websites listed above.

H. Division of Sustainable Waste Management Contact Information

For further information, please contact the Bureau of Solid Waste Permitting at (609) 292-9880. Additional information about the requirements for disruption, closure/post-closure plan and closure plan modifications approvals, is available in the BSWP’s Technical Manual for Sanitary Landfill Permits and Approvals. This manual is available at: <http://www.nj.gov/dep/dshw/resource/techman.htm>.

Correspondence should be addressed to:

Chief, Bureau of Solid Waste Permitting
New Jersey Department of Environmental Protection
Division of Sustainable Waste Management
Mail Code 401-02C
401 East State Street P.O. Box 420
Trenton, New Jersey 08625

I. Office of Brownfield and Community Revitalization Contact Information

For further information, please contact the Office at (609) 984-1790. Correspondence should be addressed to:

Manager, Office of Brownfield and Community Revitalization
New Jersey Department of Environmental Protection
401 East State Street
Mail Code 401-05K, P.O. Box 420
Trenton, New Jersey 08625-0420

J. Resources for Additional Information

New Jersey Department of Environmental Protection Solar Siting Analysis Update December 2017, <https://www.state.nj.us/dep/aqes/SSAFINAL.pdf>.

“Solar Power Installations on Closed Landfills: Technical and Regulatory Considerations,” September 2009. Prepared by: Gabriel Sampson, National Network of Environmental Management Studies Fellow, Bren School of Environmental Science and Management, University of California, Santa Barbara for the U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Office of Superfund Remediation and Technology Innovation, Washington, D.C.

www.epa.gov www.clu-in.org

<http://www.clu-in.org/download/studentpapers/Solar-Power-Installations-on-Closed-Landfills-Sampson.pdf>

New Jersey Department of Agriculture State Soil Conservation Committee (SSCC) - <http://www.state.nj.us/agriculture/divisions/anr/nrc/soil.html>

USDA Natural Resources Conservation Service (NRCS) - <https://www.nrcs.usda.gov/>

USFWS N.J. Field Office - <http://www.fws.gov/northeast/njfieldoffice/>

New Jersey Department of Environmental Protection, Division of Air Quality, Bureau of Stationary Sources - <https://dep.nj.gov/boss/>

New Jersey Department of Environmental Protection Brownfields - <http://www.nj.gov/dep/srp/brownfields/>

New Jersey Department of Environmental Protection Endangered and Threatened Species - <http://www.nj.gov/dep/fgw/tandespp.htm>

New Jersey Department of Environmental Protection Land Resource Protection - <https://dep.nj.gov/wlm/lrp/>

New Jersey Department of Environmental Protection Division of Sustainable Waste Management - <http://www.nj.gov/dep/dshw/>

New Jersey Department of Environmental Protection NJPDES Stormwater and Water Quality Management - <https://dep.nj.gov/njpdess-stormwater/>

New Jersey Department of Environmental Protection Division of Water Supply and Geoscience – <http://www.nj.gov/dep/watersupply>

New Jersey Department of Environmental Protection Division of Water Quality - <http://www.nj.gov/dep/dwq/>

Division of Water Quality's Surface Water and Pretreatment Permitting –
<http://www.nj.gov/dep/dwq/swp.htm>

New Jersey Highlands Council - <https://www.nj.gov/njhighlands/>

Guidance for the Highlands Water Protection and Planning Act –
<http://www.nj.gov/dep/highlands/>

New Jersey Pinelands Commission - <http://www.nj.gov/pinelands/>

Appendix A

Preliminary Suggested Plant List for New Jersey Grid Supply Solar Facilities

The plants on this list were selected in consideration of the following assumptions or goals:

1. Plantings to include as many native plant species as possible, with perhaps a few highly attractive naturalized species (e.g., Red Clover and White Clover) if needed to address plant height constraints and/or provide a long and continuous bloom season.
2. All species in the mix are fairly widely distributed in NJ and have no special habitat requirements (e.g., limestone, sandy soil), so will be suitable for most sites throughout the state. No species are classified as Endangered or Threatened.
3. Perimeter areas away from panels can be planted with taller species and utilize standard pollinator habitat management guidance.

Grasses

Native perennial grasses provide nesting areas for some bee species and serve as caterpillar host plants for many species of lepidoptera. They also provide nesting and foraging habitat beneficial for gamebirds, songbirds and other native wildlife species.

Common Name	Scientific Name
Little Bluestem	<i>Schizachyrium scoparium</i>
Broomsedge	<i>Andropogon virginicus</i>
Purpletop	<i>Tridens flavus</i>
Deertongue	<i>Dicanthelium clandestinum</i>
Sideoats Grama	<i>Bouteloua curtipendula</i>

Forbs

Broad-leaved perennial plants provide nectar, pollen, and other resources for pollinators, and some serve as host plants for lepidoptera (moth and butterfly) caterpillars. Tuell, et al. (2008) found that wild bees were most often collected or observed on forbs in the following families:

Asteraceae (Aster), Asclepiadaceae (Milkweed), Campanulaceae (Bluebell), Lamiaceae (Mint), Liliaceae (Lily), Rosaceae (Rose), and Scrophulariaceae

(Figwort). The most attractive individual species that occur in NJ were Shrubby Cinquefoil (*Potentilla fruticosa*: Rosaceae), Carpenter's Square (*Scrophularia marilandica*: Scrophulariaceae), Culver's Root (*Veronicastrum virginicum*: Scrophulariaceae), Yellow Giant Hyssop (*Agastache nepetoides*: Lamiaceae), Cup Plant (*Silphium perfoliatum*: Asteraceae), Great Blue Lobelia (*Lobelia siphilitica*: Campanulaceae), and Showy Goldenrod (*Solidago speciosa*: Asteraceae).

Fowler and Droege (2020) compiled records of native pollen-specialist bees (species that collect pollen from a limited number of plant species) captured or observed foraging on flowers of native host plants and made the following findings:

- The most recurrent host plant family among pollen specialist bee species was Asteraceae (59 bee spp.).
- The most recurrent host plant genera (N = ~100) associated with pollen specialist bee species were *Solidago* L. (39 spp.), *Helianthus* L. (35 spp.), *Symphotrichum* Nees (32 spp.), *Rudbeckia* L. (26 spp.), *Chrysopsis* (Nutt.) Elliott (19 spp.), [*Grindelia* Willd.](#) (18 spp.), [*Coreopsis* L.](#) (17 spp.), [*Heterotheca* Cass.](#) (16 spp.), [*Salix* L.](#) (14 spp.), [*Verbesina* L.](#) (14 spp.), [*Bidens* L.](#) (12 spp.), [*Pityopsis* Nutt.](#) (12 spp.), [*Cirsium* Mill.](#) (10 spp.), and [*Vaccinium* L.](#) (10 spp.).

The above findings, as well as our own extensive field experience, have been used to compile the recommended plant lists for solar farms in NJ. Common and scientific names are from the USDA PLANTS database: <https://plants.sc.egov.usda.gov>.

Most of the species listed can be expected to reach a height of 5 feet or less, particularly as they may be growing in partial or full shade rather than full sun. Those that normally grow taller, marked with an asterisk, could be planted in perimeter areas, where they will not shade the panels. In some situations, congeners can be used as replacements.

Bloom Time

We have not included the spring ephemeral species that occur mainly in forested habitats. Species are categorized as early-, mid-, or late-season blooming according to the beginning of their blooming period. Many species flower through two or more seasons. Flowering periods were obtained from Hough, Mary Y., 1983. *New Jersey Wild Plants*. Harmony Press, Harmony, NJ. Given climate change, some bloom times may have shifted earlier. Note that typical bloom times may be affected should a specific plant be propagated in less-than-ideal conditions, such as a site affording too much shade.

Below is a table identifying the plant species categorized by bloom time. Those that may grow as tall as 5' are marked with an asterisk.

Bloom Time	Common Name	Scientific Name	Species	Family
Early Season (April to early June)	Virginia Strawberry	<i>Fragaria virginiana</i>	Forbs	Rose - Rosaceae
	Golden Ragwort	<i>Packera aurea</i>	Forbs	Aster - Asteraceae
	Robin's Plantain	<i>Erigeron pulchellus</i>	Forbs	Aster - Asteraceae
	Sundial Lupine	<i>Lupinus perennis</i>	Forbs	Legume - Fabaceae
	Tower Rockcress	<i>Arabis glabra</i>	Forbs	Mustard - Brassicaceae
	Foxglove Beardtongue	<i>Penstemon digitalis</i>	Forbs	Figwort - Scrophulariaceae
	Gray Goldenrod	<i>So. nemoralis</i>	Forbs	Aster - Asteraceae
	Lanceleaf Tickseed	<i>Coreopsis lanceolata</i>	Forbs	Aster - Asteraceae
	Hairy Beardtongue	<i>P. hirsutus</i>	Forbs	Figwort - Scrophulariaceae
	Shrubby Cinquefoil	<i>Dasiphora fruticosa</i>	Forbs	Rose - Rosaceae
	Golden Zizia	<i>Zizia aurea</i>	Forbs	Carrot - Apiaceae
	Indian Hmp	<i>A. cannabinum</i>	Forbs	Dogbane - Apocynaceae
	Spreading Dogbane	<i>Apocynum androsaemifolium</i>	Forbs	Dogbane - Apocynaceae
	Common Selfheal	<i>Prunella vulgaris</i>	Forbs	Mint - Lamiaceae/Labiatae
Palespike Lobelia	<i>Lobelia spicata</i>	Forbs	Bluebell - Campanulaceae	

Mid-Season (mid-June to early August)	Blackeyed Susan	<i>Rudbeckia hirta</i>	Forbs	Aster- Asteraceae
	Common Milkweed*	<i>A. syriaca</i>	Forbs	Milkweed - Asclepiadaceae
	Butterfly Milkweed	<i>A. tuberosa</i>	Forbs	Milkweed - Asclepiadaceae
	Early Goldenrod	<i>Solidago juncea</i>	Forbs	Aster- Asteraceae
	Narrowleaf Mountainmint	<i>Pycnanthemum tenuifolium</i>	Forbs	Mint - Lamiaceae/Labiatae
	Wild Basil	<i>Clinipodium vulgare</i>	Forbs	Mint - Lamiaceae/Labiatae
	Culver's Root*	<i>Veronicastrum virginicum</i>	Forbs	Figwort - Scrophulariaceae
	Pasture Thistle	<i>Cirsium pumilum</i>	Forbs	Aster- Asteraceae
	Smooth Oxeye*	<i>Heliopsis helianthoides</i>	Forbs	Aster- Asteraceae
	Small Yellow Wild Indigo	<i>Baptisia tinctoria</i>	Forbs	Legume - Fabaceae
	Smooth Phlox	<i>Phlox glaberrima interior</i>	Forbs	Phlox - Polemoniaceae
	Woodland Sunflower*	<i>Helianthus divaricatus</i>	Forbs	Aster- Asteraceae
	Swamp Milkweed	<i>Asclepias incarnata</i>	Forbs	Milkweed - Asclepiadaceae
	Wild Bergamot	<i>Monarda fistulosa</i>	Forbs	Mint - Lamiaceae/Labiatae
	Hoary Mountainmint	<i>P. incanum</i>	Forbs	Mint - Lamiaceae/Labiatae
	Carpenter's Square*	<i>Scrophularia marilandica</i>	Forbs	Figwort - Scrophulariaceae
	Aniscented Goldenrod	<i>So. odora</i>	Forbs	Aster- Asteraceae
	Slenderleaf False	<i>Agalinis tenuifolia</i>	Forbs	Bluebell -

	Foxglove			Campanulaceae
	Flat-top Goldentop	<i>Euthamia graminifolia</i>	Forbs	Aster- Asteraceae
	Dense Blazing Star	<i>Liatris spicata</i>	Forbs	Aster- Asteraceae
	Purplehead Sneezeweed	<i>Helenium flexuosum</i>	Forbs	Aster- Asteraceae
	Cup Plant*	<i>Silphium perfoliatum</i>	Forbs	Aster- Asteraceae
	New York Ironweed	<i>Vernonia noveboracensis</i>	Forbs	Aster- Asteraceae
	Wingstem*	<i>Verbesina alternifolia</i>	Forbs	Aster- Asteraceae
	Spanish Needles	<i>Bidens bipinnata</i>	Forbs	Aster- Asteraceae
	Partridge Pea	<i>Chamaecrista fasciculata</i>	Forbs	Legume - Fabaceae
	Great Blue Lobelia	<i>L. siphilitica</i>	Forbs	Bluebell - Campanulaceae
	Frost Aster*	<i>S. pilosum</i>	Forbs	Aster- Asteraceae
	Spotted Joe Pye Weed*	<i>Eutrochium maculatum</i>	Forbs	Aster- Asteraceae
	New England Aster*	<i>S. novae-angliae</i>	Forbs	Aster- Asteraceae
Late-Season (mid- August to frost)	Paleleaf Woodland Sunflower*	<i>H. strumosus</i>	Forbs	Aster- Asteraceae
	Smooth Blue Aster	<i>Symphotrichum laevis</i>	Forbs	Aster- Asteraceae
	Calico Aster	<i>S. lateriflorum</i>	Forbs	Aster- Asteraceae
	Lateflowering Thoroughwort	<i>Eupatorium serotinum</i>	Forbs	Aster- Asteraceae
	Roundhead Lespedeza	<i>Lespedeza capitata</i>	Forbs	Legume - Fabaceae
	Devil's Beggartick	<i>Bidens frondosa</i>	Forbs	Aster- Asteraceae

*Indicates those species that typically grow to at least 5 feet in height