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Wetlands Program Policy 17-1: Photovoltaic System Solar Array Review

Effective Date: 9-23-2017
DWW Policy 08-1 (BWR/WWP 17-1)
Program Applicability: All Boston and Regional BWR Programs, Municipal Conservation Commissions, and developers of solar photovoltaic systems.
Supersedes Policy: None

Approved by: Lealdon Langley, Director - Wetlands and Waterways Program

PURPOSE: This policy sets forth the Department's approach for reviewing ground-mounted solar photovoltaic systems relative to wetland jurisdiction.

STATUTORY AND REGULATORY BACKGROUND:

MGL c. 131, s. 40: Wetlands Protection Act ("Act") and 310 CMR 10.00.

MGL c. 21, s. 27: Massachusetts Water Quality Certification regulations, 314 CMR 9.00.

MGL c. 40A, s. 3: Massachusetts Zoning law states that no zoning ordinance or by-law shall prohibit or unreasonably regulate solar energy systems except where necessary to protect public health, safety, or welfare.

Green Communities Act ("GCA"): Acts of 2008 Chapter 169 promotes adoption of new policies to encourage investment in renewable energy and boost energy efficiency; provides grants to municipalities; works with the Clean Energy Center and others to site projects; develops policy on emerging renewable energy issues; and encourages solar projects development on closed landfills and other brownfields. The GCA is designed to expand the ability of municipalities, residential customers, and businesses to produce

electricity on their own premises; and to facilitate commercialization of and growth in large-scale energy sources that produce little or no greenhouse gas emissions.

SITING PHOTOVOLTAIC SYSTEMS:

The Massachusetts Department of Environmental Protection (MassDEP) strongly encourages the use of upland properties for locating ground-mounted photovoltaic systems (PVS). Placement of PVSs within jurisdictional wetlands is highly discouraged. Placement of PVSs within wetland buffer zones may be permissible with proper oversight of the issues discussed in this policy and proper authorization through the permitting process of the Wetland Protection Act. Wetlands impacted by PVS projects may also be subject to Sections 401 and 404 of the federal Clean Water Act. Large wooded parcels of land, historically, which have been difficult to develop in the past due to steep topography, shallow bedrock, or poor percolation rates, are often targeted for conversion to solar, development of such sites present unique challenges. Clearing, stumping, and grading of large sloped areas require special measures and attention to control changes in site hydrology and associated erosion impacts during construction. In addition, conversion of forests to PVS arrays is less beneficial for greenhouse gas reduction than converting disturbed areas to PVSs.

STANDARDS OF REVIEW:

PVSs contemplated for locations in resource areas are subject to all regulatory performance standards. Alterations to resource areas include direct impacts associated with constructing PVS arrays as well as indirect wetland alterations resulting from either decreased sunlight from panel shading or increased solar exposure from the selective cutting of tree canopies. For purposes of this policy, use of the term "panels" includes "integrated panels (or tables)" which consist of a number of individual panels joined and manufactured as a single unit. The regulatory standard for all wetland resource areas requires the avoidance and minimization of project impacts, 310 CMR 10.55(4)(b). The regulatory standard for Bordering Vegetated Wetlands (BVW) is "shall not destroy or otherwise impair …" MassDEP has determined that placing solar arrays over BVW will result in an impairment that is prohibited or requires mitigation in accordance with 310 CMR 10.55(4). Despite the discretionary allowance for BVW impacts afforded by 10.55(4)(b), direct and indirect BVW alterations require mitigation in the same general area of the water body or reach of the waterway as the lost area. Where the proposed BVW replacement is located in upland on the project locus, suitable upland locations need to be considered as a primary alternative for locating PVSs, which would avoid wetland resources impacts all together. As part of an alternatives analysis, the guiding presumption is that any on-site potential upland available for mitigation should be considered for use in constructing PVSs. As such, the Applicant must demonstrate why that the placement of solar arrays within BVW is not avoidable. The amount of alteration proposed must be based upon the areal extent of resource areas proposed to be altered, based on the canopy area of trees projected to reach shading height throughout the life of the project, not the basal area of trees and shrubs to be removed or pruned within resource areas. See Appendix A.

Proposals to locate panels within other resource areas, for example Riverfront Area or Bordering Land Subject to Flooding should be evaluated as to whether the placement is avoidable and whether the placement would meet the performance standards for the resource area. In resource areas, consideration should also be given to impacts to wetland resource areas adjacent to, and within, PVSs anticipated from long-term vegetation controls for site maintenance. Project proponents should evaluate the extent of anticipated future vegetation management impacts that may require the filing of a subsequent Notice of Intent.

Certain components of PVS projects may qualify as a Limited Project per 310 CMR 10.53(3). PVS components include: new access roadways 10.53(3)(e); construction, operation, or maintenance of public utility electric distribution or transmission lines 10.53(3)(d); or the improvement, repair and/or replacement of an existing access roadway needed to transport equipment to a renewable energy project site 10.53(3)(t).

The following information is required as part of the Notice of Intent (NOI) to demonstrate avoidance, minimization and mitigation:

1. Avoid: An analysis of alternatives which avoids resource area alterations must be conducted which includes, but is not limited to:
   - An alternatives analysis that considers available upland locations for PVS arrays and other project components on the subject parcel.
   - A review of alternative interconnection locations and types available to the solar facility for connecting the solar PV system to the electric grid (e.g. overhead vs. underground connections and various routes).
   - A discussion as to how the size of the PVS array can be reduced though elimination of some panels, the use of fewer, more efficient, panels that generate a greater amount of electricity, or reducing the spacing between panels/tables, for example, while maintaining project viability.

2. Minimize: If it remains necessary to remove vegetation to reduce or eliminate shading and achieve the preferred PVS project, the amount of alteration proposed must be minimized. To demonstrate that project impacts are minimized, the applicant must:

   - Provide an analysis that evaluates the use of high efficiency panels (e.g. panels that track the sun) and locating panels in a manner that reduces the need for future vegetation management and wetland alteration;
   - Evaluate the extent to which selective canopy alteration (e.g. pollarding) is feasible to prevent shading of the PVS versus clear-cutting;
   - Evaluate the use of specialized tree clearing equipment from upland locations to reduce wetland alteration for selective tree removal;
   - Describe how access roads, wetland crossings, and work in the buffer zone will minimize erosion or sedimentation.

- Demonstrate that ancillary structures related to construction of a solar installation or transmission of power in wetland resource areas are using best design and management practices; if fencing is proposed, the fence shall be at least 6-inches off the ground to provide for wildlife passage for the length of the fence.
- Apply the principles of Environmentally Sensitive Site Design and Low Impact Development (LID) Techniques (310 CMR 10.04) in the design and monitoring of stormwater controls (during both construction and post-construction).

3. Mitigate: Following all efforts to minimize impacts, the applicant must demonstrate that mitigation measures are provided that:

- assure alterations proposed to wetland resource area BVW will be mitigated pursuant to the requirements of 310 CMR 10.00 and 314 CMR 9.00 (i.e. the mitigation area corresponds to the areal extent of resource areas altered, including the canopy area of trees and shrubs to be removed or pruned within resource areas);
- monitoring plans are designed to evaluate mitigation success;
- to the extent practicable, native soils are undisturbed, or in the cases where topsoil is removed, a minimum of six inches of native topsoil, or a comparable compost-mulch mix, is replaced to facilitate plant growth and adequate vegetation coverage to control stormwater runoff.
- post-construction tree and shrub maintenance plans related to avoiding future shading of panels are developed; and
- use of seed mixes and plantings are comprised of species native or naturalized to Massachusetts. (Note that any future vegetation management, beyond that authorized or conditioned in the project Order of Conditions will require the filing of a separate Notice of Intent or Request for Determination of Applicability).

4. Stormwater Management

The Stormwater Management Standards contained at 310 CMR 10.05(6)(k) apply to PVS projects. The stormwater standards include: attenuation of peak rates of runoff caused by land development (310 CMR 10.05(6)(k)2), provision of recharge (310 CMR 10.05(6)(k)3), control of Total Suspended Solids (TSS) from impervious surfaces (excluding solar panels) (310 CMR 10.05(6)(k)4), and the provision of adequate erosion and sedimentation controls (310 CMR 10.05(6)(k)8).

Solar projects within the Buffer Zone or other jurisdictional area should endeavor to utilize Low Impact Development techniques and will receive credit for Environmentally Sensitive Site Design when LID is incorporated pursuant to the "Minimum Criteria for Credit" from Volume 3, Chapter 1 of the Massachusetts Stormwater Handbook.

DEP recommends the measures below to control the peak runoff rate, provide recharge, and treat TSS, provided the following are also met (note: the Applicant may provide documentation

for consideration demonstrating that the peak rate of runoff, recharge, and TSS treatment requirements are still met in cases where the factors below are not met):

- slopes on which the PVS arrays are placed are not greater than 3:1 (18^{o} or 33.5% slope), naturally or as graded;
- an erosion control plan is developed and implemented which prevents direct discharges to wetlands and which grade the project site to avoid or minimize channelized stormwater flow from the Buffer Zone directly into wetland resource areas;
- land disturbance and grading is conducted in a phased and selective manner (i.e. avoid, if possible, or minimize clearing the entire site at one time in order to minimize soil mobilization and the amount of soil exposure at any one time to reduce construction period runoff), or other appropriate construction best management practices are incorporated to preclude construction period runoff/erosion. Provide temporary land stabilization measures for all disturbed surfaces such as mulching until permanent native vegetative cover is established, and utilize temporary sedimentation basins as appropriate;
- construction and post-construction phase stormwater management plans include sub-catchments under the PVS arrays which include stormwater BMPs such as infiltration trenches, water bar/log bars, and natural vegetative cover consisting solely of native grass and plant species (note: the extent of stormwater BMPs required will depend largely on the existing cover type as compared to the proposed cover type. In some instances, BMPs may not be necessary, where the proposed cover type represents an improvement over existing conditions);
- top soil is preserved or supplemented sufficient to maintain vegetation cover;
- solar panel rows are spaced in a manner to allow sunlight penetration sufficient to support vegetation between the solar panel rows;
- where panel rows follow the slope (i.e. the panel arrays are constructed down, rather than across, a slope) provide intermittent gaps between adjacent panels sufficient to accommodate anticipated runoff so that runoff occurs from individual panels rather than from the length of the entire array;
- panel drip edges (or leading edge of panels) are no greater than 10-feet above the ground surface;
- no conveyances or outfalls are constructed; and.
- no work is proposed in a buffer zone of Resource Areas that borders a Critical Area, as defined at 314 CMR 9.02, or in the estimated habitat identified on the most recent Estimated Habitat Map of State Listed Rare Species prepared by the Natural Heritage and Endangered Species Program.

PVS array designs which do not qualify for LID credits shall demonstrate compliance with the Stormwater Management Standards specified at 310 CMR 10.05(6)(k)1-10, except that no stormwater recharge or TSS treatment shall be required when the ground surface under, and adjacent to, the PVS arrays consists of gravel/crushed stone or is planted and maintained with

native vegetative cover sufficient to provide adequate infiltration and eliminate surface water runoff. For peak rate attenuation, the runoff curve number computations shall be reflective of the final land cover type being proposed below the panels and between the rows of panels. Further, the land cover type must accurately reflect the existing condition in the stormwater calculations; Applicants are cautioned to appropriately evaluate the existing land cover type to avoid post-construction issues arising from stormwater runoff. An erosion and sedimentation control plan is required to be submitted as part of the NOI review pursuant to 310 CMR 10.05(6)(b) and 10.05(6)(k)8. Provision of perimeter controls alone is not sufficient to meet 310 CMR 10.05(6)(b) and 10.05(6)(k)8. In addition to perimeter controls, the plan must demonstrate land disturbance will be minimized at any one time, or that other appropriate measures are implemented, to prevent erosion to resource areas.

When calculations show an increase in peak flow, MassDEP recommends that re-engineering be conducted to include construction of retention basins or grading modifications (such as terracing or berms), infiltration trenches, bioengineering techniques, non-structural practices (e.g. establishment of a suitably sized and graded buffer area between the panels and vegetated wetlands or land under water) to mitigate the peak flows.

5. Accessory Structures

Access roads, parking areas, and rooftops of buildings or structures associated with a PVS arrays are fully subject to the Stormwater Management Standards specified at 310 CMR 10.05(6)(k). The selected Runoff Curve Number must be from the U. S. Natural Resources Conservation Service WinTR55 Land Use Details list for roads, parking, or rooftops depending on proposed surface and Hydrologic Soil Group.

_____ September 22, 2017

Lealdon Langley
Director
Wetlands and Waterways Program

Appendix A

Sample Template for Estimating Tree Clearing Impacts

Diameter of Tree at Breast Height (DBH) (inches)	Number of Trees of this DBH	Estimated Tree Basal Area Alteration (square feet)(1)	Estimated Tree Canopy Alteration (square feet)(2)	Total Wetland Alteration (square feet) (3)
4	1	0.09	133.3	133.3
5	1	0.14	133.3	133.4
6	1	0.20	133.3	133.4
7	1	0.27	133.3	133.5
8	2	0.70	266.5	267.2
9	2	0.88	266.5	267.4
10	2	1.09	266.5	267.6
11	2	1.32	266.5	267.8
12	2	1.57	266.5	268.1
13	2	1.84	266.5	268.3
14	2	2.14	266.5	268.6
15	2	2.45	266.5	269.0
16	2	2.79	266.5	269.3
17	2	3.15	266.5	269.7
18	2	3.53	266.5	270.0
19	2	3.94	266.5	270.4
20	2	4.36	266.5	270.9
22	1	2.64	133.3	135.9
23	1	2.88	133.3	136.1
24	1	3.14	133.3	136.4
25	2	6.81	266.5	273.3
30	1	4.91	133.3	138.2
Totals	**36**	**50.83**	**4797.00**	**4847.83**

Table Notes:

(1) Spreadsheet Formula: =((3.14/4)*((A2/12)^2))*B2

(2) Spreadsheet formula =205*B2*0.65. Tree canopy estimates should be determined in the field based on an assessment of the average drip line radius associated with the trees proposed to be selectively cut. In this example, if the average tree line drip radius of the trees proposed to be selectively removed is approximately 10 feet per tree (diameter 20 feet per tree), this translates to an approximate total canopy area of approximately 315 square feet per tree ($A = \pi r_2$). Then, based on visual observations made in the field, estimate the total percent cover of the tree layer to be altered by the selective tree removal using the methodology prescribed in MassDEP's BVW Delineation Handbook. For example, if the total estimated percent cover is 65% this would result in a refined canopy area impact estimate of approximately 205 s.f per tree (0.65 x 315 s.f.). Percent cover is the percent of the ground surface that would be covered if the foliage from a particular species or layer were projected onto the ground, ignoring small gaps between the leaves and branches. This methodology assumes the understory and shrub/sapling layers remain substantially intact and undisturbed as a result of selective tree removal, with mechanized equipment operating in the adjoining uplands and reaching into the wetlands or work is otherwise conducted by hand operated equipment (chainsaws, etc). This methodology does not apply to clear cuts or equipment operating in wetlands on construction mats that would disturb the surface of the wetland and understory vegetation.

(3) Total wetland alteration estimate includes the estimated basal area and percentage of tree canopy to be removed. This impact estimate is limited to the selective tree removal and does not take into account other wetland impacts that might be associated with a particular project.