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Via Email: marlboroughplanning@marlboroughny.us, cbrand@marlboroughny.us

September 6, 2024

Town of Marlborough
Planning Board
21 Milton Turnpike, Suite 200
Milton, NY 12547

Attn: Chair Chris Brand

RE: ELP MARLBOROUGH SOLAR LLC
RUNOFF EROSIVE VELOCITY ANALYSIS
C&A #: 4996.26

Dear Chair Brand,

On behalf of the Applicant, ELP Marlborough Solar LLC, as requested by the Planning Board, and per previous correspondence with its review consultant, MHE Engineering, Crawford & Associates is providing this analysis of stormwater runoff velocities to identify any areas of concern for erosion.

Per MHE Engineering comment, the project area was analyzed where slopes ranging from 5%-10% and exceeding 10% coincide with where solar modules are proposed not completely parallel with grade contours. These locations were analyzed to ensure stormwater runoff does not exceed the NYSDEC threshold for erosive velocity. Each post-construction drainage area, DA-1P through DA-3P was analyzed in multiple locations to determine the worst-case scenario for each drainage area, and to determine whether the erosive runoff velocity would be exceeded within the installation area.

The flow paths analyzed were selected by identifying high elevation points within the project as start points, flow paths passing through areas corresponding to 5%-10% and greater than 10% slope thresholds, and termination points at the toe of the steepest slopes, where velocity would be highest. All flow paths analyzed began as sheet flow runoff from the proposed solar modules then transitioned to shallow concentrated flow at the end of the module. Slope, surface description (short grass cover), and length of flow path in these locations were input to HydroCAD, assuming post development conditions, to determine the time of concentration for the selected flow path. HydroCAD output of time, in minutes, for the runoff to flow through these sloped areas to the termination points was used to determine runoff velocity, providing a near instantaneous velocity calculation. See Tables 1-3 below for the results of the analysis. Note that each table includes the average runoff velocity following the originally derived Time of Concentration (TOC) path from the drainage analysis, along with the maximum calculated velocity for the worst-case scenario slopes ranging between 5%-10%, and greater than 10% for each drainage area. Further, the distance listed in the below tables does not correspond to the total length of the TOC path, but rather to the length of the TOC path in the noted slope range, and ultimately used in the velocity

calculation. See attached a drawing which overlays the slope analysis with the locations of analyzed points for the scenarios indicated in the tables.

Table 1: DA-1P Runoff Velocities				
Slope	Tc (minutes)	Distance (ft)	Calculated Velocity (ft/s)	NYSDEC Erosive Velocity Threshold (ft/s)
TOC-1	17.9	1,827	1.70	3.0
5-10%	1.1	140	2.12	4.0
>10%	1.1	155	2.35	3.0

Table 2: DA-2P Runoff Velocities				
Slope	Tc (minutes)	Distance (ft)	Velocity (ft/s)	NYSDEC Erosive Velocity Threshold (ft/s)
TOC-2	18.3	1,341	1.22	3.0
5-10%	0.4	53	2.21	4.0
>10%	0.4	75	3.13	3.0

Table 3: DA-3P Runoff Velocities				
Slope	Tc (minutes)	Distance (ft)	Velocity (ft/s)	NYSDEC Erosive Velocity Threshold (ft/s)
TOC-3	13.0	705	0.90	3.0
5-10%	0.4	49	2.04	4.0
>10%	0.4	62	2.58	3.0

According to the New York State Department of Environmental Conservation Stormwater Management Design Manual, July 31, 2024. Appendix G: Non-Erosive Velocities of Vegetated Channels, the maximum velocities for non-erosive flow allowed are between 2.5-5 ft/s depending on slopes and vegetative lining type. For slopes between 5-10%, the maximum velocity is 4 ft/s, and for slopes greater than 10%, the maximum velocity is 3 ft/s.

As shown in the results above, most analyzed points are below the maximum velocity thresholds. For the one which exceeds the threshold and other value approaching the threshold, it is important to recall that this analysis includes several conservative assumptions to provide the worst-case simulation of the post development conditions, including 100' or more of defined flow path, a short grass covered surface, an immediate transition from sheet flow to shallow concentrated flow when the water drips from the edge of the module, and the expected velocity at its absolute maximum. These assumptions are considered well conservative as the actual installed conditions will include lush grass vegetation to stabilize site soils, diffuse runoff, and limit shallow concentrated flow from occurring. Further, the runoff will not be at maximum velocity along the entire flow path, only at the toe of slope termination point. Therefore, it is anticipated that all actual runoff velocities will be below the calculated maximums, post-construction runoff flows on site will be considered non-erosive, and stormwater management features to further encourage sheet flow conditions will not be required for the installation.

We look forward to continuing coordination with the Planning Board during review of the application. If you have any questions, please do not hesitate to reach out via email at cknox@crawfordandassociates.com or by phone at 518-828-2700 x 1138.

Sincerely,
Crawford & Associates
Engineering & Land Surveying, P.C.

Christopher J. Knox, PE
Project Manager II

Cc: Chris Brand, Planning Board Chair (cbrand@marlboroughny.us)
Jen Flynn, Planning Board Secretary (marlboroughplanning@marlboroughny.us)

H:\WORK\4996.26 Marlborough\Corresp\Permitting\2024.09.06 Non-Erosive Runoff Velocities.docx

SITE PLAN NOTES:

1. BACKGROUND DRAWING & CONTOURS TAKEN FROM SURVEY TITLED "MAP OF A PORTION OF LANDS OF TRUNCALI PREPARED FOR ELP MARLBOROUGH SOLAR, LLC." BY CONTROL POINT ASSOCIATES INC. P.C. DATED 4/22/2024.
2. NWI POTENTIAL WETLAND BOUNDARIES DOWNLOADED FROM NATIONAL WETLANDS INVENTORY, ACCESSED NOVEMBER 2023.
3. FEMA NFHL CHECKED IN JANUARY 2024 AND NO FLOOD HAZARDS WERE IDENTIFIED WITHIN THE PROJECT AREA. PROJECT FALLS WITHIN FIRM PANEL #36111C0900F.
4. PROPOSED SOLAR FACILITY LAYOUT FROM DRAWING TITLED "PRELIMINARY PV SITE PLAN" PREPARED BY CS ENERGY DATED MARCH 2, 2023, AMMENDED BY C&A PER DEVELOPER INSTRUCTIONS.

BINGHAM ROAD

DP-1

DP-2

DP-3

DA-1P
51.09 ACRES

DA-2P
10.11 ACRES

DA-3P
4.84 ACRES

TOC-1

TOC-1 5-10% SLOPE ANALYSIS AREA

TOC-1 >10% SLOPE ANALYSIS AREA

TOC-1 >10%

TOC-1 5-10%

TOC-2

TOC-2 5-10% SLOPE ANALYSIS AREA

TOC-2 5-10%

TOC-2 >10% SLOPE ANALYSIS AREA

TOC-2 >10%

TOC-3

TOC-3 >10%

TOC-3 >10% SLOPE ANALYSIS AREA

TOC-3 5-10%

TOC-3 5-10% SLOPE ANALYSIS AREA

53.0'

75.0'

140.0'

155.0'

62.0'

49.0'

LEGEND

- EXISTING CONTOUR 2' INTERVAL
- 1210 EXISTING CONTOUR 10' INTERVAL
- PROPERTY LINE
- EXISTING/PROPOSED DRIVEWAY
- EXISTING/PROPOSED DRAINAGE AREAS
- EXISTING WATERBODY
- WETLAND BOUNDARY
- EXISTING/PROPOSED CONIFER TREE
- EXISTING/PROPOSED DECIDUOUS TREE
- TIME OF CONCENTRATION (TOC) PATH
- RUNOFF VELOCITY ANALYSIS TOC PATH
- WETLAND HATCH
- PERVIOUS DRIVE HATCH
- CONCRETE EQUIPMENT PAD HATCH
- EXISTING SLOPES 5-10%
- EXISTING SLOPES >10%
- PROPOSED GRASS FILTER STRIP

POST-DEVELOPMENT TOC PATHS

SCALE: 1"=100'

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft.

NAD 83
NY STATE PLANE EAST ZONE

DRAFT
NOT FOR
CONSTRUCTION

IT IS A VIOLATION OF THE NEW YORK STATE EDUCATION LAW FOR ANY PERSON TO ALTER THESE DOCUMENTS IN ANY WAY, UNLESS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER.

REV #	DESCRIPTION	DATE	BY

ELP MARLBOROUGH SOLAR
335 BINGHAM ROAD
TOWN OF MARLBOROUGH — ULSTER COUNTY, NY

EROSIVE VELOCITY ANALYSIS
POST-DEVELOPMENT TOC PATHS

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DATE	9/6/2024
SCALE	AS SHOWN
DRAWN BY:	TSB/DPB
DESIGNED BY:	TSB/DPB
CHECKED BY:	CJK
APPROVED BY:	CJK
X:\WORK\4996.26 Marlborough\DWG\Temp Drawings\2024-09-04 TOC paths.dwg	
C&A JOB#	4996.26
DRAWING:	FIG-3