
DRAINAGE REPORT

Sullivan Solar Farm

Rear of 1005 North Street

Suffield, CT

March 30, 2015

Prepared for:

*Lodestar Energy, LLC
3 Ellsworth Place, Suite 122
Avon, CT 06001*



Project No. 2014-115

Prepared by:

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I. INTRODUCTION

A. Project Summary

Lodestar Energy LLC is proposing the construction of a 2.0 MW AC solar photovoltaic facility at the rear of the Sullivan Farm at 1005 North Street in Suffield, Connecticut. The project will include clearing and grubbing, grading, construction of access roads, layout and placement of foundation systems, racking, and solar PV panels, installation of utility pads and associated electrical equipment, installation of electrical conduit, conduit supports, electrical poles, and overhead wire, and security fencing. The access road will be constructed to accommodate emergency vehicles and fire trucks.

B. Existing Conditions

The project site includes the western 28.1 acres of a 51.3 acre parcel owned by Kevin and Krist Sullivan at 1005 North Street in Suffield (the Sullivan Farm). The site is located approximately 1,350 feet west of North Street. It is accessible from the west side of North Street via an existing paved portion of driveway followed by approximately 1,200 feet of dirt farm road. The farm road is approximately 10 feet wide. As it approaches the site, the road crosses a culverted stream and bisects wetlands on both sides. The access road leads to an open agricultural field on the southern portion of the site.

The site contains two upland areas divided by an intermittent stream. The stream originates from a pond and associated wetland in the northwest corner of the site. From the pond, the stream flows easterly to a wetland on the east side of the site. The area to the north of the intermittent stream was formerly mined for gravel back in the 1950's and 1960's. The gravel operation has since ceased, and this area has become overgrown and wooded. The northern portion of the site is accessed from the southern portion of the site via a farm road over an existing culvert that conveys the intermittent stream.

The majority of the area to the southern portion of the project site is currently maintained in agriculture. This area is currently a hay field, but was formerly corn. Portions of the agricultural lot are characterized as wetland, but are still actively farmed. Wooded areas are present to the east, south and west of the field. A small isolated pond is located within the southeast corner of the agricultural field where the access road enters the field.

Runoff from the northern and eastern portions of the site currently sheet flows to the intermittent stream and surrounding wetlands that continue to flow into the larger wetland system east of the site on the remaining portion of the Sullivan Farm. This wetland ultimately discharges to the south via the culvert under the access road. Runoff from the southwestern corner of the property sheet flows into the wetland system across the southerly property line.

C. *Soils*

Based on a review of the USDA Soil Survey of Hartford County, several soil types are located at the site. Soil types are identified on the Soils Map in Appendix 1. Table 1 also summarizes the soil types below. The USDA Soil Survey defines groups of soils into Hydrologic Soil Groups (HSG) according to their runoff-producing characteristics. Soils are assigned to four groups (A, B, C, and D Groups). In group A, are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They typically are deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a hardpan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other nearly impervious material. The HSG classifications of site soils are summarized in Table 1. The HSG soil classifications within the proposed development area are also identified on the Drainage Area Maps in Appendix 2.

Table 1 – Site Soil Classifications

Map Unit #	Soil Type	HSG Classification
9	Scitico, Shaker & Maybid	D
25	Brancroft silt loam	C
28	Elmridge fine sandy loam	C
32	Haven & Enfield soils	B
36	Windsor loamy sand	A
37	Manchester gravelly sandy loam	A
40	Ludlow silt loam	C
82	Broadbrook silt loam	C
305	Udorthents-Pits complex, gravel	C

II. *STORMWATER RUNOFF ANALYSIS*

A. *Methodology*

Peak runoff flow rates on-site were determined for pre- and post-development conditions using Applied Microcomputer System's HydroCAD™ Stormwater Modeling System. This computer software employs the SCS Technical Release 55 and 20 (TR-55 & TR-20) methodology. The potential stormwater impacts were evaluated for the 2-yr, 10-yr, 25-yr, and 100-yr; Type III 24-hour storm events.

Based on the present and proposed drainage patterns at the site, two design points were selected for the analysis. Design point 1 is the wetland system to the east of the site where the northern and eastern portions of the site drain. Design point 2 is the wetland

system south of the site where the southwest portion of the site drains. The design points are shown on the Drainage Area Maps in Appendix 2.

B. Pre-Development Hydrology

The pre-development site was divided into two subcatchments associated with the two design points. The subcatchment (1) that discharges to design point 1 consists of 21.25 acres of woodland, agricultural field (modeled as row crop), gravel road and lawn areas. The subcatchment (2) that discharges to design point 2 consists of 6.61 acres of similar cover types. These subcatchments are shown on the attached Pre-Development Drainage Area Map in Appendix 2. Pre-development runoff characteristics for each of the subcatchments are provided in Appendix 3. A summary of the calculated peak flows is provided in Table 2.

C. Post Development Hydrology

The proposed development will result in the construction of approximately 12 acres of solar panels with surrounding gravel access roads. The natural drainage patterns, which consist of sheet flow to the surrounding wetlands, will be preserved. The proposed fixed panel solar arrays are installed on elevated racks that provide adequate height above the ground to promote vegetative growth and allow for infiltration. As a result, the areas containing the solar arrays can be considered pervious groundcover.

The design points selected for calculations of the pre-development condition are also used for the calculations of the post-development condition. The post development site was divided into two subcatchments associated with the two design points. Subcatchment 1 includes 19.82 acres that will discharge to design point 1. Subcatchment 2 includes 8.03 acres that will discharge to design point 2. The subcatchments are shown on the Post Development Drainage Area Map in Appendix 2. The post development subcatchment characteristics are summarized in the attached HydroCAD data sheets in Appendix 4.

Using the characteristics described above, the Post Development peak flow rates for the entire site were calculated for the design storms. Table 2 compares the pre-development peak flows with the post-development peak flows at the design points.

Table 1 – Summary of Peak Discharges

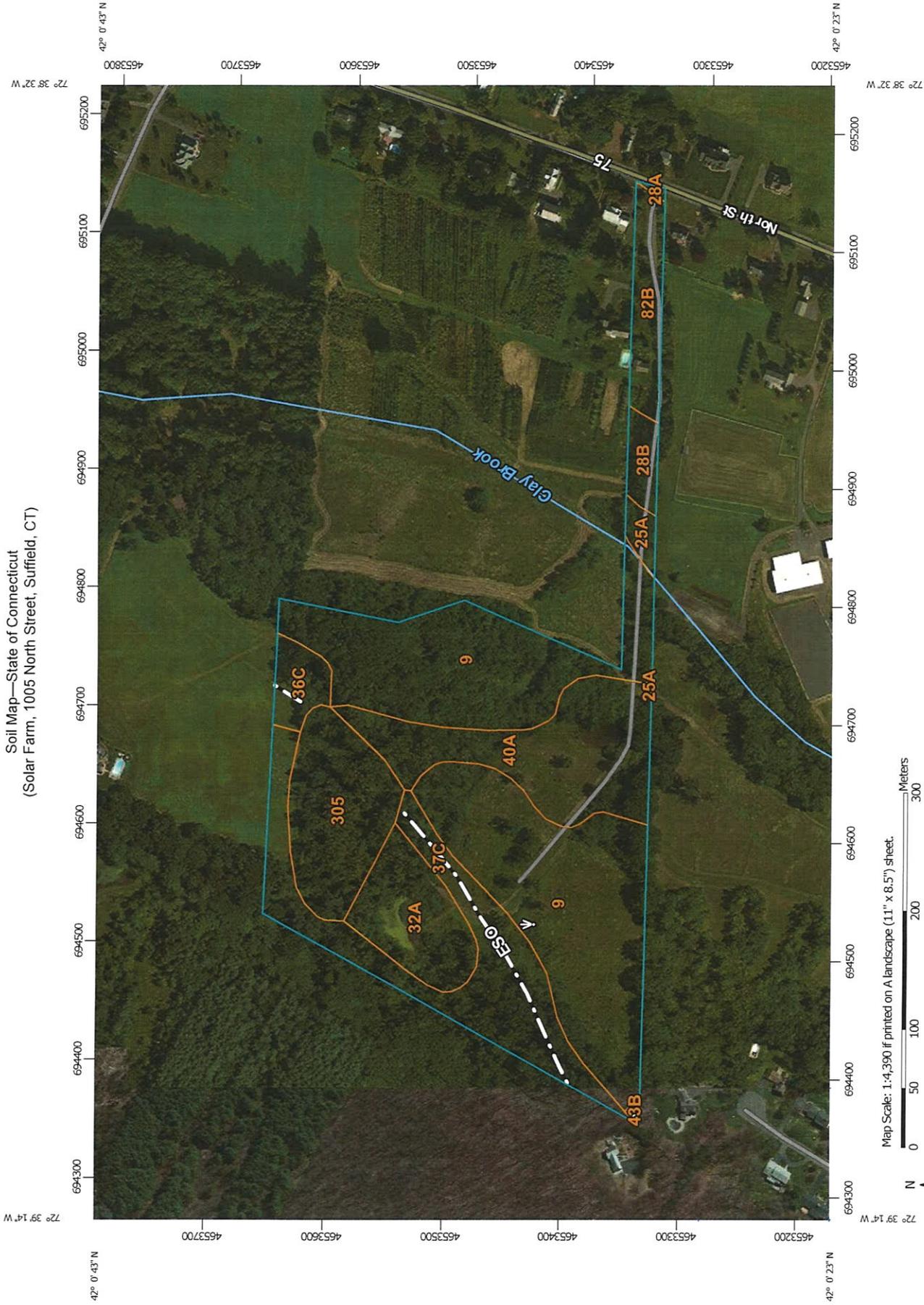
	2-Year	10-Year	25-Year	100-Year
Design Point #1				
Pre	14.1	29.5	38.5	54.7
Post	14.0	29.5	38.5	54.7
Design Point #2				
Pre	10.5	19.3	24.15	32.7o
Post	7.0	14.5	18.8	26.5

D. Conclusion

The proposed design and analysis indicates that the post development peak discharge from the site will be equal to or less than the pre-development peak discharge for all design storms. As a result, one can conclude that the proposed development will not have a negative impact on downstream properties.

Appendix 1:
SOILS INFORMATION

Soil Map—State of Connecticut
 (Solar Farm, 1005 North Street, Suffield, CT)



MAP LEGEND

	Area of Interest (AOI)		Spoil Area
	Soils		Stony Spot
	Soil Map Unit Polygons		Very Stony Spot
	Soil Map Unit Lines		Wet Spot
	Soil Map Unit Points		Other
	Special Point Features		Special Line Features
	Blowout		Streams and Canals
	Borrow Pit		Interstate Highways
	Clay Spot		US Routes
	Closed Depression		Major Roads
	Gravel Pit		Local Roads
	Gravelly Spot		Aerial Photography
	Landfill		
	Lava Flow		
	Marsh or swamp		
	Mine or Quarry		
	Miscellaneous Water		
	Perennial Water		
	Rock Outcrop		
	Saline Spot		
	Sandy Spot		
	Severely Eroded Spot		
	Sinkhole		
	Slide or Slip		
	Sodic Spot		

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: State of Connecticut
Survey Area Data: Version 13, Oct 28, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 28, 2011—Sep 9, 2013

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

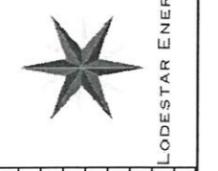
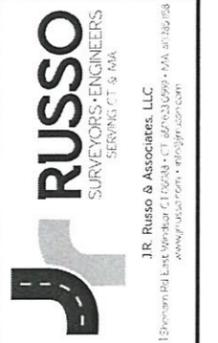
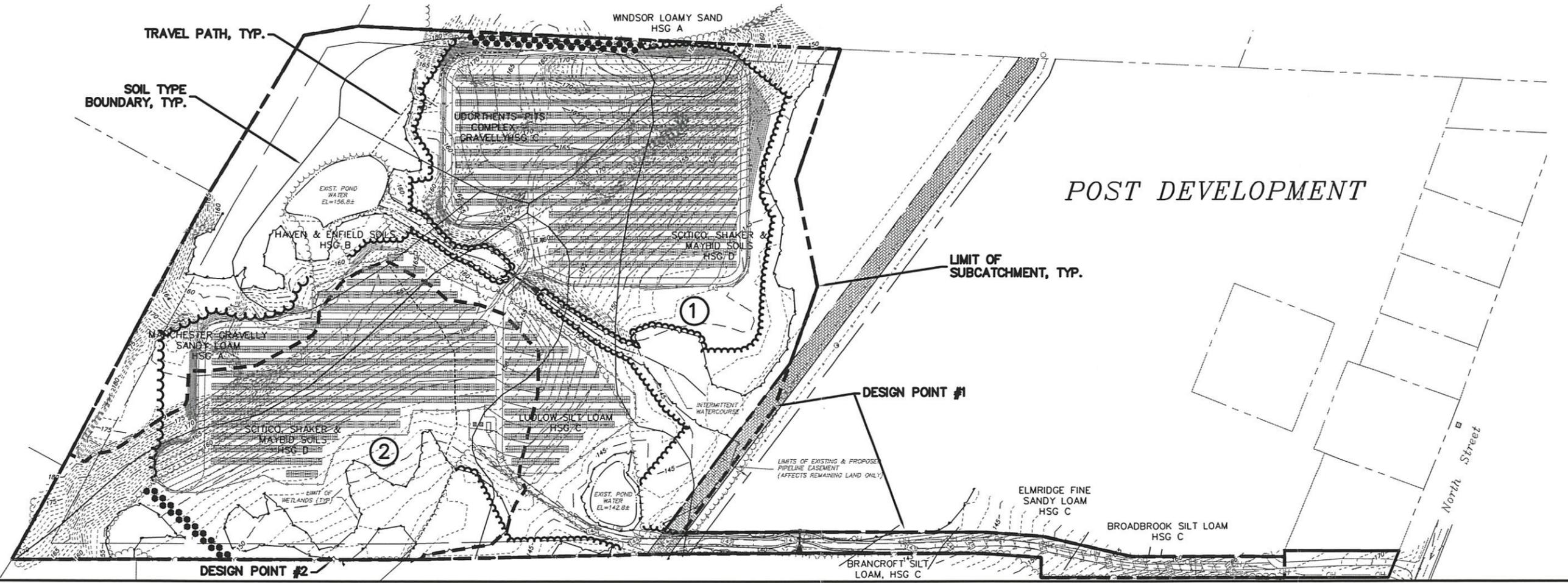
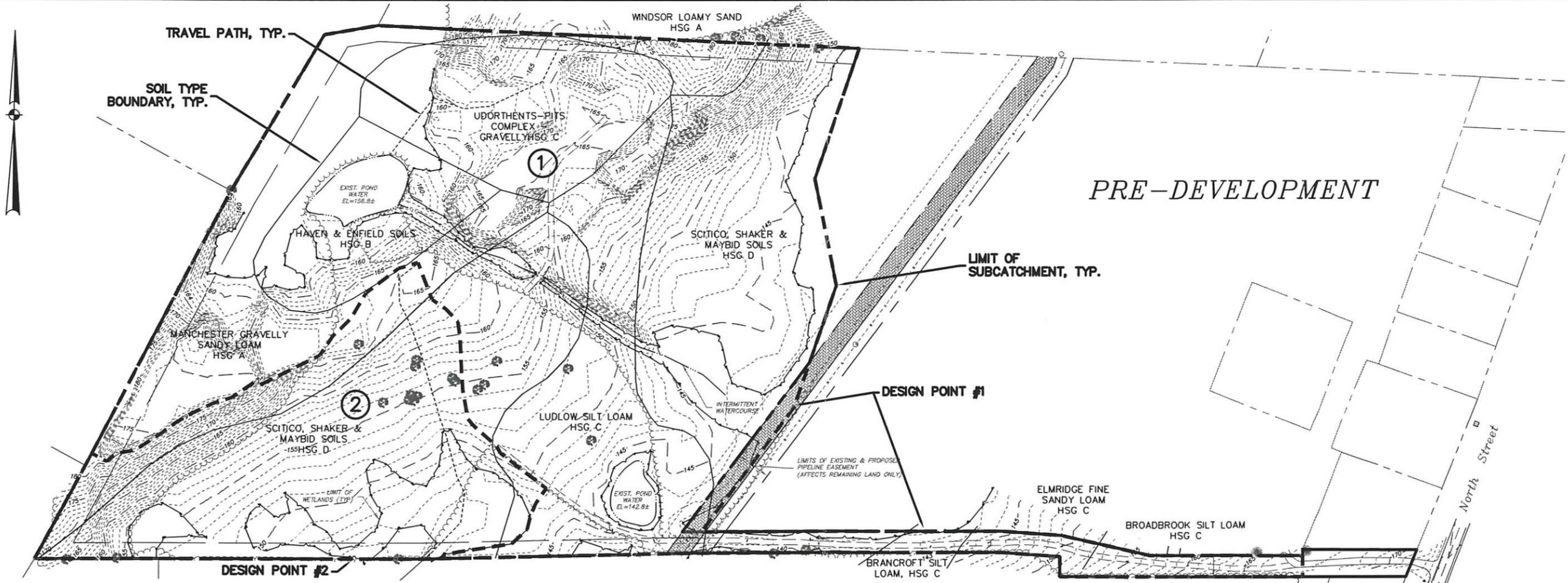
Map Unit Legend

State of Connecticut (CT600)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
9	Scitico, Shaker, and Maybid soils	12.5	42.9%
25A	Brancroft silt loam, 0 to 3 percent slopes	0.3	1.0%
28A	Elmridge fine sandy loam, 0 to 3 percent slopes	0.0	0.1%
28B	Elmridge fine sandy loam, 3 to 8 percent slopes	0.5	1.7%
32A	Haven and Enfield soils, 0 to 3 percent slopes	2.2	7.4%
36C	Windsor loamy sand, 8 to 15 percent slopes	0.7	2.4%
37C	Manchester gravelly sandy loam, 3 to 15 percent slopes	4.6	15.9%
40A	Ludlow silt loam, 0 to 3 percent slopes	4.2	14.3%
43B	Rainbow silt loam, 3 to 8 percent slopes	0.0	0.1%
82B	Broadbrook silt loam, 3 to 8 percent slopes	1.2	4.0%
305	Udorthents-Pits complex, gravelly	3.0	10.2%
Totals for Area of Interest		29.1	100.0%

HSG
D
C
C
C
C
B
A
A
A
C
C
C
C

Appendix 2:
FIGURES

S:\Acad\2014 Civil 3D\2014-115 Lodestar Energy\Russo Drawings\2014-115_SURV.dwg, 4/2/2015 12:21:35 PM, 1:2.1086



REVISIONS	
BY: RS	CHK: JEU

Sullivan Solar Farm
 Prepared For
Lodestar Energy, LLC
 Rear Land of 1005 North Street
 Suffield, Connecticut
 Map 39H Block 29 Lot 21 Zone: R-90

Drainage Area Maps
DATE 3-10-15
SCALE 1"=100'
JOB NUMBER 2014-115
SHEET 1 of 1

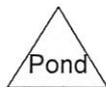
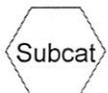
Appendix 3:
PRE-DEVELOPMENT ANALYSES



To South



To East



2014-115 Lodestar PRE

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PRE DEVELOPMENT
Type III 24-hr 2-yr Rainfall=3.20"

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Page 2

Summary for Subcatchment 1: To East

Runoff = 14.05 cfs @ 12.49 hrs, Volume= 1.937 af, Depth= 1.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-yr Rainfall=3.20"

Area (ac)	CN	Description
* 4.744	98	Wetland
* 0.432	96	Gravel Road
0.737	74	>75% Grass cover, Good, HSG C
0.148	80	>75% Grass cover, Good, HSG D
0.086	67	Row crops, straight row, Good, HSG A
0.402	78	Row crops, straight row, Good, HSG B
1.390	85	Row crops, straight row, Good, HSG C
1.058	89	Row crops, straight row, Good, HSG D
2.720	30	Woods, Good, HSG A
0.572	55	Woods, Good, HSG B
4.408	70	Woods, Good, HSG C
4.549	77	Woods, Good, HSG D
21.246	75	Weighted Average
16.502		77.67% Pervious Area
4.744		22.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	35	0.1100	0.19		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
14.5	115	0.0700	0.13		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
11.2	450	0.0180	0.67		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
4.3	850	0.0200	3.26	8.16	Trap/Vee/Rect Channel Flow, Bot.W=4.00' D=0.50' Z= 2.0 ' Top.W=6.00' n= 0.035
33.1	1,450	Total			

Summary for Subcatchment 2: To South

Runoff = 10.52 cfs @ 12.14 hrs, Volume= 0.848 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-yr Rainfall=3.20"

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Area (ac)	CN	Description
*	1.509	98 Wetland
	0.543	67 Row crops, straight row, Good, HSG A
	3.202	89 Row crops, straight row, Good, HSG D
	0.669	30 Woods, Good, HSG A
	0.081	70 Woods, Good, HSG C
	0.609	77 Woods, Good, HSG D
	6.613	82 Weighted Average
	5.104	77.18% Pervious Area
	1.509	22.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	150	0.0330	0.54		Sheet Flow, Fallow n= 0.050 P2= 3.20"
4.9	470	0.0320	1.61		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
9.5	620	Total			

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PRE DEVELOPMENT
Type III 24-hr 10-yr Rainfall=4.70"

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Page 4

Summary for Subcatchment 1: To East

Runoff = 29.52 cfs @ 12.47 hrs, Volume= 3.910 af, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-yr Rainfall=4.70"

Area (ac)	CN	Description
* 4.744	98	Wetland
* 0.432	96	Gravel Road
0.737	74	>75% Grass cover, Good, HSG C
0.148	80	>75% Grass cover, Good, HSG D
0.086	67	Row crops, straight row, Good, HSG A
0.402	78	Row crops, straight row, Good, HSG B
1.390	85	Row crops, straight row, Good, HSG C
1.058	89	Row crops, straight row, Good, HSG D
2.720	30	Woods, Good, HSG A
0.572	55	Woods, Good, HSG B
4.408	70	Woods, Good, HSG C
4.549	77	Woods, Good, HSG D
21.246	75	Weighted Average
16.502		77.67% Pervious Area
4.744		22.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	35	0.1100	0.19		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
14.5	115	0.0700	0.13		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
11.2	450	0.0180	0.67		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
4.3	850	0.0200	3.26	8.16	Trap/Vee/Rect Channel Flow, Bot.W=4.00' D=0.50' Z= 2.0 ' /' Top.W=6.00' n= 0.035
33.1	1,450	Total			

Summary for Subcatchment 2: To South

Runoff = 19.31 cfs @ 12.13 hrs, Volume= 1.550 af, Depth= 2.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-yr Rainfall=4.70"

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PRE DEVELOPMENT

Type III 24-hr 10-yr Rainfall=4.70"

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Page 5

Area (ac)	CN	Description
*	1.509	98 Wetland
	0.543	67 Row crops, straight row, Good, HSG A
	3.202	89 Row crops, straight row, Good, HSG D
	0.669	30 Woods, Good, HSG A
	0.081	70 Woods, Good, HSG C
	0.609	77 Woods, Good, HSG D
	6.613	82 Weighted Average
	5.104	77.18% Pervious Area
	1.509	22.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	150	0.0330	0.54		Sheet Flow, Fallow n= 0.050 P2= 3.20"
4.9	470	0.0320	1.61		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
9.5	620	Total			

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PRE DEVELOPMENT

Type III 24-hr 25-yr Rainfall=5.50"

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Page 6

Summary for Subcatchment 1: To East

Runoff = 38.47 cfs @ 12.47 hrs, Volume= 5.065 af, Depth= 2.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-yr Rainfall=5.50"

Area (ac)	CN	Description
* 4.744	98	Wetland
* 0.432	96	Gravel Road
0.737	74	>75% Grass cover, Good, HSG C
0.148	80	>75% Grass cover, Good, HSG D
0.086	67	Row crops, straight row, Good, HSG A
0.402	78	Row crops, straight row, Good, HSG B
1.390	85	Row crops, straight row, Good, HSG C
1.058	89	Row crops, straight row, Good, HSG D
2.720	30	Woods, Good, HSG A
0.572	55	Woods, Good, HSG B
4.408	70	Woods, Good, HSG C
4.549	77	Woods, Good, HSG D
21.246	75	Weighted Average
16.502		77.67% Pervious Area
4.744		22.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	35	0.1100	0.19		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
14.5	115	0.0700	0.13		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
11.2	450	0.0180	0.67		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
4.3	850	0.0200	3.26	8.16	Trap/Vee/Rect Channel Flow, Bot.W=4.00' D=0.50' Z= 2.0 '/' Top.W=6.00' n= 0.035
33.1	1,450	Total			

Summary for Subcatchment 2: To South

Runoff = 24.15 cfs @ 12.13 hrs, Volume= 1.945 af, Depth= 3.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-yr Rainfall=5.50"

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PRE DEVELOPMENT

Type III 24-hr 25-yr Rainfall=5.50"

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Page 7

Area (ac)	CN	Description
*	1.509	98 Wetland
	0.543	67 Row crops, straight row, Good, HSG A
	3.202	89 Row crops, straight row, Good, HSG D
	0.669	30 Woods, Good, HSG A
	0.081	70 Woods, Good, HSG C
	0.609	77 Woods, Good, HSG D
	6.613	82 Weighted Average
	5.104	77.18% Pervious Area
	1.509	22.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	150	0.0330	0.54		Sheet Flow, Fallow n= 0.050 P2= 3.20"
4.9	470	0.0320	1.61		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
9.5	620	Total			

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Summary for Subcatchment 1: To East

Runoff = 54.70 cfs @ 12.46 hrs, Volume= 7.191 af, Depth= 4.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-yr Rainfall=6.90"

Area (ac)	CN	Description
* 4.744	98	Wetland
* 0.432	96	Gravel Road
0.737	74	>75% Grass cover, Good, HSG C
0.148	80	>75% Grass cover, Good, HSG D
0.086	67	Row crops, straight row, Good, HSG A
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1.390	85	Row crops, straight row, Good, HSG C
1.058	89	Row crops, straight row, Good, HSG D
2.720	30	Woods, Good, HSG A
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4.408	70	Woods, Good, HSG C
4.549	77	Woods, Good, HSG D
21.246	75	Weighted Average
16.502		77.67% Pervious Area
4.744		22.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	35	0.1100	0.19		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
14.5	115	0.0700	0.13		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
11.2	450	0.0180	0.67		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
4.3	850	0.0200	3.26	8.16	Trap/Vee/Rect Channel Flow, Bot.W=4.00' D=0.50' Z= 2.0 ' /' Top.W=6.00' n= 0.035
33.1	1,450	Total			

Summary for Subcatchment 2: To South

Runoff = 32.69 cfs @ 12.13 hrs, Volume= 2.658 af, Depth= 4.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-yr Rainfall=6.90"

2014-115 Lodestar PRE

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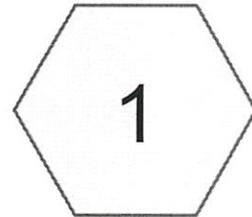
Area (ac)	CN	Description
*	1.509	98 Wetland
	0.543	67 Row crops, straight row, Good, HSG A
	3.202	89 Row crops, straight row, Good, HSG D
	0.669	30 Woods, Good, HSG A
	0.081	70 Woods, Good, HSG C
	0.609	77 Woods, Good, HSG D
	6.613	82 Weighted Average
	5.104	77.18% Pervious Area
	1.509	22.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	150	0.0330	0.54		Sheet Flow, Fallow n= 0.050 P2= 3.20"
4.9	470	0.0320	1.61		Shallow Concentrated Flow, Cultivated Straight Rows Kv= 9.0 fps
9.5	620	Total			

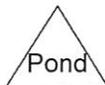
Appendix 4:
POST DEVELOPMENT ANALYSES



To South



To East



2014-115 Lodestar POST

Prepared by {enter your company name here}

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POST DEVELOPMENT
Type III 24-hr 2-yr Rainfall=3.20"

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Page 2

Summary for Subcatchment 1: To East

Runoff = 14.04 cfs @ 12.42 hrs, Volume= 1.806 af, Depth= 1.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-yr Rainfall=3.20"

Area (ac)	CN	Description
* 4.686	98	Wetland
* 0.945	96	Gravel Road
1.247	39	>75% Grass cover, Good, HSG A
0.493	61	>75% Grass cover, Good, HSG B
4.869	74	>75% Grass cover, Good, HSG C
3.745	80	>75% Grass cover, Good, HSG D
1.377	30	Woods, Good, HSG A
0.878	55	Woods, Good, HSG B
0.577	70	Woods, Good, HSG C
0.999	77	Woods, Good, HSG D
19.816	75	Weighted Average
15.130		76.35% Pervious Area
4.686		23.65% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	35	0.1100	0.19		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
14.5	115	0.0700	0.13		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
1.0	30	0.0100	0.50		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
1.9	265	0.0150	2.35	2.65	Trap/Vee/Rect Channel Flow, Bot.W=1.00' D=0.50' Z= 3.0 & 2.0 ' Top.W=3.50' n= 0.035
3.6	170	0.0250	0.79		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
4.3	850	0.0200	3.26	8.16	Trap/Vee/Rect Channel Flow, Bot.W=4.00' D=0.50' Z= 2.0 ' Top.W=6.00' n= 0.035
28.4	1,465	Total			

Summary for Subcatchment 2: To South

Runoff = 7.02 cfs @ 12.29 hrs, Volume= 0.771 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-yr Rainfall=3.20"

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POST DEVELOPMENT
Type III 24-hr 2-yr Rainfall=3.20"

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Page 3

Area (ac)	CN	Description
* 0.407	96	Gravel Road
* 1.509	98	Wetland
0.930	39	>75% Grass cover, Good, HSG A
0.044	61	>75% Grass cover, Good, HSG B
0.374	74	>75% Grass cover, Good, HSG C
3.870	80	>75% Grass cover, Good, HSG D
0.434	30	Woods, Good, HSG A
0.018	70	Woods, Good, HSG C
0.442	77	Woods, Good, HSG D
8.028	76	Weighted Average
6.519		81.20% Pervious Area
1.509		18.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.5	132	0.0400	0.16		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.3	18	0.0200	0.98		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.20"
6.1	455	0.0320	1.25		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
19.9	605	Total			

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POST DEVELOPMENT
Type III 24-hr 10-yr Rainfall=4.70"

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Page 4

Summary for Subcatchment 1: To East

Runoff = 29.54 cfs @ 12.40 hrs, Volume= 3.647 af, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-yr Rainfall=4.70"

Area (ac)	CN	Description
* 4.686	98	Wetland
* 0.945	96	Gravel Road
1.247	39	>75% Grass cover, Good, HSG A
0.493	61	>75% Grass cover, Good, HSG B
4.869	74	>75% Grass cover, Good, HSG C
3.745	80	>75% Grass cover, Good, HSG D
1.377	30	Woods, Good, HSG A
0.878	55	Woods, Good, HSG B
0.577	70	Woods, Good, HSG C
0.999	77	Woods, Good, HSG D
19.816	75	Weighted Average
15.130		76.35% Pervious Area
4.686		23.65% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	35	0.1100	0.19		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
14.5	115	0.0700	0.13		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
1.0	30	0.0100	0.50		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
1.9	265	0.0150	2.35	2.65	Trap/Vee/Rect Channel Flow, Bot.W=1.00' D=0.50' Z= 3.0 & 2.0 ' /' Top.W=3.50' n= 0.035
3.6	170	0.0250	0.79		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
4.3	850	0.0200	3.26	8.16	Trap/Vee/Rect Channel Flow, Bot.W=4.00' D=0.50' Z= 2.0 ' /' Top.W=6.00' n= 0.035
28.4	1,465	Total			

Summary for Subcatchment 2: To South

Runoff = 14.48 cfs @ 12.28 hrs, Volume= 1.532 af, Depth= 2.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-yr Rainfall=4.70"

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Area (ac)	CN	Description
* 0.407	96	Gravel Road
* 1.509	98	Wetland
0.930	39	>75% Grass cover, Good, HSG A
0.044	61	>75% Grass cover, Good, HSG B
0.374	74	>75% Grass cover, Good, HSG C
3.870	80	>75% Grass cover, Good, HSG D
0.434	30	Woods, Good, HSG A
0.018	70	Woods, Good, HSG C
0.442	77	Woods, Good, HSG D
8.028	76	Weighted Average
6.519		81.20% Pervious Area
1.509		18.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.5	132	0.0400	0.16		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.3	18	0.0200	0.98		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.20"
6.1	455	0.0320	1.25		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
19.9	605	Total			

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POST DEVELOPMENT
Type III 24-hr 25-yr Rainfall=5.50"

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Page 6

Summary for Subcatchment 1: To East

Runoff = 38.49 cfs @ 12.40 hrs, Volume= 4.724 af, Depth= 2.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-yr Rainfall=5.50"

Area (ac)	CN	Description
* 4.686	98	Wetland
* 0.945	96	Gravel Road
1.247	39	>75% Grass cover, Good, HSG A
0.493	61	>75% Grass cover, Good, HSG B
4.869	74	>75% Grass cover, Good, HSG C
3.745	80	>75% Grass cover, Good, HSG D
1.377	30	Woods, Good, HSG A
0.878	55	Woods, Good, HSG B
0.577	70	Woods, Good, HSG C
0.999	77	Woods, Good, HSG D
19.816	75	Weighted Average
15.130		76.35% Pervious Area
4.686		23.65% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	35	0.1100	0.19		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
14.5	115	0.0700	0.13		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
1.0	30	0.0100	0.50		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
1.9	265	0.0150	2.35	2.65	Trap/Vee/Rect Channel Flow, Bot.W=1.00' D=0.50' Z= 3.0 & 2.0 ' Top.W=3.50' n= 0.035
3.6	170	0.0250	0.79		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
4.3	850	0.0200	3.26	8.16	Trap/Vee/Rect Channel Flow, Bot.W=4.00' D=0.50' Z= 2.0 ' Top.W=6.00' n= 0.035
28.4	1,465	Total			

Summary for Subcatchment 2: To South

Runoff = 18.76 cfs @ 12.28 hrs, Volume= 1.976 af, Depth= 2.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-yr Rainfall=5.50"

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POST DEVELOPMENT
Type III 24-hr 25-yr Rainfall=5.50"

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Page 7

Area (ac)	CN	Description
* 0.407	96	Gravel Road
* 1.509	98	Wetland
0.930	39	>75% Grass cover, Good, HSG A
0.044	61	>75% Grass cover, Good, HSG B
0.374	74	>75% Grass cover, Good, HSG C
3.870	80	>75% Grass cover, Good, HSG D
0.434	30	Woods, Good, HSG A
0.018	70	Woods, Good, HSG C
0.442	77	Woods, Good, HSG D
8.028	76	Weighted Average
6.519		81.20% Pervious Area
1.509		18.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.5	132	0.0400	0.16		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.3	18	0.0200	0.98		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.20"
6.1	455	0.0320	1.25		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
19.9	605	Total			

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POST DEVELOPMENT
 Type III 24-hr 100-yr Rainfall=6.90"
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 Page 8

Summary for Subcatchment 1: To East

Runoff = 54.73 cfs @ 12.40 hrs, Volume= 6.707 af, Depth= 4.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.02 hrs
 Type III 24-hr 100-yr Rainfall=6.90"

Area (ac)	CN	Description
* 4.686	98	Wetland
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1.247	39	>75% Grass cover, Good, HSG A
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3.745	80	>75% Grass cover, Good, HSG D
1.377	30	Woods, Good, HSG A
0.878	55	Woods, Good, HSG B
0.577	70	Woods, Good, HSG C
0.999	77	Woods, Good, HSG D
19.816	75	Weighted Average
15.130		76.35% Pervious Area
4.686		23.65% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	35	0.1100	0.19		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
14.5	115	0.0700	0.13		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
1.0	30	0.0100	0.50		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
1.9	265	0.0150	2.35	2.65	Trap/Vee/Rect Channel Flow, Bot.W=1.00' D=0.50' Z= 3.0 & 2.0 ' Top.W=3.50' n= 0.035
3.6	170	0.0250	0.79		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
4.3	850	0.0200	3.26	8.16	Trap/Vee/Rect Channel Flow, Bot.W=4.00' D=0.50' Z= 2.0 ' Top.W=6.00' n= 0.035
28.4	1,465	Total			

Summary for Subcatchment 2: To South

Runoff = 26.49 cfs @ 12.27 hrs, Volume= 2.789 af, Depth= 4.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.02 hrs
 Type III 24-hr 100-yr Rainfall=6.90"

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Area (ac)	CN	Description
* 0.407	96	Gravel Road
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0.044	61	>75% Grass cover, Good, HSG B
0.374	74	>75% Grass cover, Good, HSG C
3.870	80	>75% Grass cover, Good, HSG D
0.434	30	Woods, Good, HSG A
0.018	70	Woods, Good, HSG C
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8.028	76	Weighted Average
6.519		81.20% Pervious Area
1.509		18.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.5	132	0.0400	0.16		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
0.3	18	0.0200	0.98		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.20"
6.1	455	0.0320	1.25		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
19.9	605	Total			