

North Sturbridge Road
Charlton, MA

Ground-Mounted Solar Photovoltaic Installation

July 2018

NOTICE OF INTENT



BETA

1 Springfield Street
Suite 4
Chicopee, MA 01013
413.331.5326
www.BETA-Inc.com

Ground-Mounted Solar Photovoltaic Installation
North Sturbridge Road
Charlton, Massachusetts

NOTICE OF INTENT

Prepared by: BETA Group, Inc.
1 Springfield Street, Suite 4
Chicopee, MA 01013

Prepared for: Sunpin Solar Development, LLC
1901 Main Street, Suite 150
Irvine, CA 92614

July 2018

North Sturbridge Road
Charlton, Massachusetts

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North Sturbridge Road
Charlton, Massachusetts

NOI Forms - WPA Form 3



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

Charlton

City/Town

Important:

When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



Note:
Before completing this form consult your local Conservation Commission regarding any municipal bylaw or ordinance.

A. General Information

1. Project Location (**Note:** electronic filers will click on button to locate project site):

0 North Sturbridge Road

a. Street Address

Charlton

b. City/Town

01507

c. Zip Code

Latitude and Longitude:

14

f. Assessors Map/Plat Number

42.173307

d. Latitude

-72.021431

e. Longitude

7 and 11.1

g. Parcel /Lot Number

2. Applicant:

Marsel

a. First Name

Kamberaj

b. Last Name

Sunpin Solar Development, LLC

c. Organization

3 Corporate Park, Suite 168

d. Street Address

Irvine

e. City/Town

CA

f. State

92606

g. Zip Code

201-774-7996

h. Phone Number

i. Fax Number

mkamberaj@sunpinsolar.us

j. Email Address

3. Property owner (required if different from applicant):

Check if more than one owner

Pamela

a. First Name

Blackadar

b. Last Name

c. Organization

4421 S. Atlantic Ave, Unit A1

d. Street Address

Ponce Inlet

e. City/Town

FL

f. State

32127

g. Zip Code

386-383-5904

h. Phone Number

i. Fax Number

PBlackadar@cfl.rr.com

j. Email address

4. Representative (if any):

Danny

a. First Name

Rebelo

b. Last Name

BETA Group, Inc.

c. Company

1 Springfield Street

d. Street Address

Chicopee

e. City/Town

MA

f. State

01013

g. Zip Code

413-331-5326

h. Phone Number

i. Fax Number

drebelo@beta-inc.com

j. Email address

5. Total WPA Fee Paid (from NOI Wetland Fee Transmittal Form):

\$1,050.00

a. Total Fee Paid

\$512.50

b. State Fee Paid

\$537.50

c. City/Town Fee Paid



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A. General Information (continued)

6. General Project Description:

Clearing of vegetation and installation of Large-scale Ground-mounted Solor Photovoltaic facility on 10.9-acres of an approximately 31.364-acres property.

7a. Project Type Checklist: (Limited Project Types see Section A. 7b.)

- 1. Single Family Home
- 2. Residential Subdivision
- 3. Commercial/Industrial
- 4. Dock/Pier
- 5. Utilities
- 6. Coastal engineering Structure
- 7. Agriculture (e.g., cranberries, forestry)
- 8. Transportation
- 9. Other

7b. Is any portion of the proposed activity eligible to be treated as a limited project (including Ecological Restoration Limited Project) subject to 310 CMR 10.24 (coastal) or 310 CMR 10.53 (inland)?

1. Yes No If yes, describe which limited project applies to this project. (See 310 CMR 10.24 and 10.53 for a complete list and description of limited project types)

2. Limited Project Type

If the proposed activity is eligible to be treated as an Ecological Restoration Limited Project (310 CMR10.24(8), 310 CMR 10.53(4)), complete and attach Appendix A: Ecological Restoration Limited Project Checklist and Signed Certification.

8. Property recorded at the Registry of Deeds for:

Worcester

a. County

49768 & 49768

c. Book

b. Certificate # (if registered land)

246 and 249

d. Page Number

B. Buffer Zone & Resource Area Impacts (temporary & permanent)

- 1. Buffer Zone Only – Check if the project is located only in the Buffer Zone of a Bordering Vegetated Wetland, Inland Bank, or Coastal Resource Area.
- 2. Inland Resource Areas (see 310 CMR 10.54-10.58; if not applicable, go to Section B.3, Coastal Resource Areas).

Check all that apply below. Attach narrative and any supporting documentation describing how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location.



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B. Buffer Zone & Resource Area Impacts (temporary & permanent) (cont'd)

For all projects affecting other Resource Areas, please attach a narrative explaining how the resource area was delineated.

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
a. <input type="checkbox"/> Bank	1. linear feet	2. linear feet
b. <input type="checkbox"/> Bordering Vegetated Wetland	1. square feet	2. square feet
c. <input type="checkbox"/> Land Under Waterbodies and Waterways	1. square feet	2. square feet
	3. cubic yards dredged	

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
d. <input type="checkbox"/> Bordering Land Subject to Flooding	1. square feet	2. square feet
	3. cubic feet of flood storage lost	4. cubic feet replaced
e. <input type="checkbox"/> Isolated Land Subject to Flooding	1. square feet	
	2. cubic feet of flood storage lost	3. cubic feet replaced
f. <input type="checkbox"/> Riverfront Area	1. Name of Waterway (if available) - specify coastal or inland	

2. Width of Riverfront Area (check one):

- 25 ft. - Designated Densely Developed Areas only
- 100 ft. - New agricultural projects only
- 200 ft. - All other projects

3. Total area of Riverfront Area on the site of the proposed project: _____ square feet

4. Proposed alteration of the Riverfront Area:

a. total square feet	b. square feet within 100 ft.	c. square feet between 100 ft. and 200 ft.
----------------------	-------------------------------	--

5. Has an alternatives analysis been done and is it attached to this NOI? Yes No

6. Was the lot where the activity is proposed created prior to August 1, 1996? Yes No

3. Coastal Resource Areas: (See 310 CMR 10.25-10.35)

Note: for coastal riverfront areas, please complete **Section B.2.f.** above.



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B. Buffer Zone & Resource Area Impacts (temporary & permanent) (cont'd)

Check all that apply below. Attach narrative and supporting documentation describing how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location.

Online Users:
 Include your document transaction number (provided on your receipt page) with all supplementary information you submit to the Department.

<u>Resource Area</u>	<u>Size of Proposed Alteration</u>	<u>Proposed Replacement (if any)</u>
a. <input type="checkbox"/> Designated Port Areas	Indicate size under Land Under the Ocean, below	
b. <input type="checkbox"/> Land Under the Ocean	_____	
	1. square feet	

	2. cubic yards dredged	
c. <input type="checkbox"/> Barrier Beach	Indicate size under Coastal Beaches and/or Coastal Dunes below	
d. <input type="checkbox"/> Coastal Beaches	_____	_____
	1. square feet	2. cubic yards beach nourishment
e. <input type="checkbox"/> Coastal Dunes	_____	_____
	1. square feet	2. cubic yards dune nourishment
	<u>Size of Proposed Alteration</u>	
	<u>Proposed Replacement (if any)</u>	
f. <input type="checkbox"/> Coastal Banks	_____	
	1. linear feet	
g. <input type="checkbox"/> Rocky Intertidal Shores	_____	
	1. square feet	
h. <input type="checkbox"/> Salt Marshes	_____	_____
	1. square feet	2. sq ft restoration, rehab., creation
i. <input type="checkbox"/> Land Under Salt Ponds	_____	
	1. square feet	

	2. cubic yards dredged	
j. <input type="checkbox"/> Land Containing Shellfish	_____	
	1. square feet	
k. <input type="checkbox"/> Fish Runs	Indicate size under Coastal Banks, inland Bank, Land Under the Ocean, and/or inland Land Under Waterbodies and Waterways, above	

	1. cubic yards dredged	
l. <input type="checkbox"/> Land Subject to Coastal Storm Flowage	_____	
	1. square feet	
4. <input type="checkbox"/> Restoration/Enhancement	If the project is for the purpose of restoring or enhancing a wetland resource area in addition to the square footage that has been entered in Section B.2.b or B.3.h above, please enter the additional amount here.	
	_____	_____
	a. square feet of BVW	b. square feet of Salt Marsh
5. <input type="checkbox"/> Project Involves Stream Crossings		
	_____	_____
	a. number of new stream crossings	b. number of replacement stream crossings



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C. Other Applicable Standards and Requirements

- This is a proposal for an Ecological Restoration Limited Project. Skip Section C and complete Appendix A: Ecological Restoration Limited Project Checklists – Required Actions (310 CMR 10.11).

Streamlined Massachusetts Endangered Species Act/Wetlands Protection Act Review

- Is any portion of the proposed project located in **Estimated Habitat of Rare Wildlife** as indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetland Wildlife published by the Natural Heritage and Endangered Species Program (NHESP)? To view habitat maps, see the *Massachusetts Natural Heritage Atlas* or go to http://maps.massgis.state.ma.us/PRI_EST_HAB/viewer.htm.

a. Yes No **If yes, include proof of mailing or hand delivery of NOI to:**

**Natural Heritage and Endangered Species Program
Division of Fisheries and Wildlife
1 Rabbit Hill Road
Westborough, MA 01581**

2017 _____
b. Date of map

If yes, the project is also subject to Massachusetts Endangered Species Act (MESA) review (321 CMR 10.18). To qualify for a streamlined, 30-day, MESA/Wetlands Protection Act review, please complete Section C.1.c, and include requested materials with this Notice of Intent (NOI); *OR* complete Section C.2.f, if applicable. *If MESA supplemental information is not included with the NOI, by completing Section 1 of this form, the NHESP will require a separate MESA filing which may take up to 90 days to review (unless noted exceptions in Section 2 apply, see below).*

c. Submit Supplemental Information for Endangered Species Review*

- Percentage/acreage of property to be altered:
 - (a) within wetland Resource Area _____ percentage/acreage
 - (b) outside Resource Area _____ percentage/acreage
- Assessor's Map or right-of-way plan of site

- Project plans for entire project site, including wetland resource areas and areas outside of wetlands jurisdiction, showing existing and proposed conditions, existing and proposed tree/vegetation clearing line, and clearly demarcated limits of work**
 - (a) Project description (including description of impacts outside of wetland resource area & buffer zone)
 - (b) Photographs representative of the site

* Some projects **not** in Estimated Habitat may be located in Priority Habitat, and require NHESP review (see <http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/regulatory-review/>). Priority Habitat includes habitat for state-listed plants and strictly upland species not protected by the Wetlands Protection Act.

** MESA projects may not be segmented (321 CMR 10.16). The applicant must disclose full development plans even if such plans are not required as part of the Notice of Intent process.



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C. Other Applicable Standards and Requirements (cont'd)

- (c) MESA filing fee (fee information available at http://www.mass.gov/dfwele/dfw/nhosp/regulatory_review/mesa/mesa_fee_schedule.htm). Make check payable to “Commonwealth of Massachusetts - NHESP” and **mail to NHESP** at above address

Projects altering 10 or more acres of land, also submit:

- (d) Vegetation cover type map of site
- (e) Project plans showing Priority & Estimated Habitat boundaries
- (f) OR Check One of the Following
1. Project is exempt from MESA review.
Attach applicant letter indicating which MESA exemption applies. (See 321 CMR 10.14, http://www.mass.gov/dfwele/dfw/nhosp/regulatory_review/mesa/mesa_exemptions.htm; the NOI must still be sent to NHESP if the project is within estimated habitat pursuant to 310 CMR 10.37 and 10.59.)
 2. Separate MESA review ongoing. _____ a. NHESP Tracking # _____ b. Date submitted to NHESP
 3. Separate MESA review completed.
Include copy of NHESP “no Take” determination or valid Conservation & Management Permit with approved plan.
3. For coastal projects only, is any portion of the proposed project located below the mean high water line or in a fish run?
- a. Not applicable – project is in inland resource area only b. Yes No

If yes, include proof of mailing, hand delivery, or electronic delivery of NOI to either:

South Shore - Cohasset to Rhode Island border, and the Cape & Islands:

Division of Marine Fisheries -
Southeast Marine Fisheries Station
Attn: Environmental Reviewer
836 South Rodney French Blvd.
New Bedford, MA 02744
Email: DMF.EnvReview-South@state.ma.us

North Shore - Hull to New Hampshire border:

Division of Marine Fisheries -
North Shore Office
Attn: Environmental Reviewer
30 Emerson Avenue
Gloucester, MA 01930
Email: DMF.EnvReview-North@state.ma.us

Also if yes, the project may require a Chapter 91 license. For coastal towns in the Northeast Region, please contact MassDEP’s Boston Office. For coastal towns in the Southeast Region, please contact MassDEP’s Southeast Regional Office.



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Online Users:
Include your document transaction number (provided on your receipt page) with all supplementary information you submit to the Department.

C. Other Applicable Standards and Requirements (cont'd)

4. Is any portion of the proposed project within an Area of Critical Environmental Concern (ACEC)?
 a. Yes No If yes, provide name of ACEC (see instructions to WPA Form 3 or MassDEP Website for ACEC locations). **Note:** electronic filers click on Website.
 b. ACEC
5. Is any portion of the proposed project within an area designated as an Outstanding Resource Water (ORW) as designated in the Massachusetts Surface Water Quality Standards, 314 CMR 4.00?
 a. Yes No
6. Is any portion of the site subject to a Wetlands Restriction Order under the Inland Wetlands Restriction Act (M.G.L. c. 131, § 40A) or the Coastal Wetlands Restriction Act (M.G.L. c. 130, § 105)?
 a. Yes No
7. Is this project subject to provisions of the MassDEP Stormwater Management Standards?
 a. Yes. Attach a copy of the Stormwater Report as required by the Stormwater Management Standards per 310 CMR 10.05(6)(k)-(q) and check if:
 1. Applying for Low Impact Development (LID) site design credits (as described in Stormwater Management Handbook Vol. 2, Chapter 3)
 2. A portion of the site constitutes redevelopment
 3. Proprietary BMPs are included in the Stormwater Management System.
 b. No. Check why the project is exempt:
 1. Single-family house
 2. Emergency road repair
 3. Small Residential Subdivision (less than or equal to 4 single-family houses or less than equal to 4 units in multi-family housing project) with no discharge to Critical Areas.

D. Additional Information

- This is a proposal for an Ecological Restoration Limited Project. Skip Section D and complete Appendix A: Ecological Restoration Notice of Intent – Minimum Required Documents (310 CMR 10.12).

Applicants must include the following with this Notice of Intent (NOI). See instructions for details.

Online Users: Attach the document transaction number (provided on your receipt page) for any of the following information you submit to the Department.

1. USGS or other map of the area (along with a narrative description, if necessary) containing sufficient information for the Conservation Commission and the Department to locate the site. (Electronic filers may omit this item.)
2. Plans identifying the location of proposed activities (including activities proposed to serve as a Bordering Vegetated Wetland [BVW] replication area or other mitigating measure) relative to the boundaries of each affected resource area.



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D. Additional Information (cont'd)

3. Identify the method for BWV and other resource area boundary delineations (MassDEP BWV Field Data Form(s), Determination of Applicability, Order of Resource Area Delineation, etc.), and attach documentation of the methodology.

4. List the titles and dates for all plans and other materials submitted with this NOI.

See Drawing List in Table of Contents

a. Plan Title

BETA Group, Inc.

Danny P. Rebelo, PE

b. Prepared By

c. Signed and Stamped by

8/1/2018

d. Final Revision Date

e. Scale

f. Additional Plan or Document Title

g. Date

5. If there is more than one property owner, please attach a list of these property owners not listed on this form.

6. Attach proof of mailing for Natural Heritage and Endangered Species Program, if needed.

7. Attach proof of mailing for Massachusetts Division of Marine Fisheries, if needed.

8. Attach NOI Wetland Fee Transmittal Form

9. Attach Stormwater Report, if needed.

E. Fees

1. Fee Exempt: No filing fee shall be assessed for projects of any city, town, county, or district of the Commonwealth, federally recognized Indian tribe housing authority, municipal housing authority, or the Massachusetts Bay Transportation Authority.

Applicants must submit the following information (in addition to pages 1 and 2 of the NOI Wetland Fee Transmittal Form) to confirm fee payment:

90631

7/23/2018

2. Municipal Check Number

3. Check date

90630

7/23/2018

4. State Check Number

5. Check date

BETA Group, Inc.

6. Payor name on check: First Name

7. Payor name on check: Last Name



Massachusetts Department of Environmental Protection
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F. Signatures and Submittal Requirements

I hereby certify under the penalties of perjury that the foregoing Notice of Intent and accompanying plans, documents, and supporting data are true and complete to the best of my knowledge. I understand that the Conservation Commission will place notification of this Notice in a local newspaper at the expense of the applicant in accordance with the wetlands regulations, 310 CMR 10.05(5)(a).

I further certify under penalties of perjury that all abutters were notified of this application, pursuant to the requirements of M.G.L. c. 131, § 40. Notice must be made by Certificate of Mailing or in writing by hand delivery or certified mail (return receipt requested) to all abutters within 100 feet of the property line of the project location.

Wendy Kennedy

7/31/2018

1. Signature of Applicant

2. Date

Wendy Kennedy

068000 Wetland
07/29/18 12:53PM EDT
G28E-DP18-CASH-DDSZ

3. Signature of Property Owner (if different)

4. Date

Doug P. Peltola

8/1/18

5. Signature of Representative (if any)

6. Date

For Conservation Commission:

Two copies of the completed Notice of Intent (Form 3), including supporting plans and documents, two copies of the NOI Wetland Fee Transmittal Form, and the city/town fee payment, to the Conservation Commission by certified mail or hand delivery.

For MassDEP:

One copy of the completed Notice of Intent (Form 3), including supporting plans and documents, one copy of the NOI Wetland Fee Transmittal Form, and a **copy** of the state fee payment to the MassDEP Regional Office (see Instructions) by certified mail or hand delivery.

Other:

If the applicant has checked the "yes" box in any part of Section C, Item 3, above, refer to that section and the Instructions for additional submittal requirements.

The original and copies must be sent simultaneously. Failure by the applicant to send copies in a timely manner may result in dismissal of the Notice of Intent.



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Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A. Applicant Information

1. Location of Project:

<u>0 North Sturbridge Road</u>	<u>Charlton</u>
a. Street Address	b. City/Town
<u>90630, 90631</u>	<u>\$1,050</u>
c. Check number	d. Fee amount

2. Applicant Mailing Address:

<u>Marsel</u>	<u>Kamberaj</u>	
a. First Name	b. Last Name	
<u>Sunpin Solar Development, LLC</u>		
c. Organization		
<u>3 Corporate Park, Suite 168</u>		
d. Mailing Address		
<u>Irvine</u>	<u>CA</u>	<u>92606</u>
e. City/Town	f. State	g. Zip Code
<u>201-774-7996</u>	<u>mkamberaj@sunpinsolar.us</u>	
h. Phone Number	i. Fax Number	j. Email Address

3. Property Owner (if different):

<u>Pamela</u>	<u>Blackadar</u>	
a. First Name	b. Last Name	
<u></u>		
c. Organization		
<u>4421 S. Atlantic Ave, Unit A1</u>		
d. Mailing Address		
<u>Ponce Inlet</u>	<u>FL</u>	<u>32127</u>
e. City/Town	f. State	g. Zip Code
<u>386-383-5904</u>	<u>PBlackadar@cfl.rr.com</u>	
h. Phone Number	i. Fax Number	j. Email Address

B. Fees

Fee should be calculated using the following process & worksheet. **Please see Instructions before filling out worksheet.**

Step 1/Type of Activity: Describe each type of activity that will occur in wetland resource area and buffer zone.

Step 2/Number of Activities: Identify the number of each type of activity.

Step 3/Individual Activity Fee: Identify each activity fee from the six project categories listed in the instructions.

Step 4/Subtotal Activity Fee: Multiply the number of activities (identified in Step 2) times the fee per category (identified in Step 3) to reach a subtotal fee amount. Note: If any of these activities are in a Riverfront Area in addition to another Resource Area or the Buffer Zone, the fee per activity should be multiplied by 1.5 and then added to the subtotal amount.

Step 5/Total Project Fee: Determine the total project fee by adding the subtotal amounts from Step 4.

Step 6/Fee Payments: To calculate the state share of the fee, divide the total fee in half and subtract \$12.50. To calculate the city/town share of the fee, divide the total fee in half and add \$12.50.

To calculate filing fees, refer to the category fee list and examples in the instructions for filling out WPA Form 3 (Notice of Intent).



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B. Fees (continued)

Step 1/Type of Activity	Step 2/Number of Activities	Step 3/Individual Activity Fee	Step 4/Subtotal Activity Fee
3c.) road construction not crossing or driveway	1	\$1,050	\$1,050
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
Step 5/Total Project Fee:			<u>\$1,050.00</u>

Step 6/Fee Payments:

Total Project Fee:	<u>\$1,050.00</u>
State share of filing Fee:	<u>\$512.50</u>
City/Town share of filing Fee:	<u>\$537.50</u>
	a. Total Fee from Step 5
	b. 1/2 Total Fee less \$12.50
	c. 1/2 Total Fee plus \$12.50

C. Submittal Requirements

- a.) Complete pages 1 and 2 and send with a check or money order for the state share of the fee, payable to the Commonwealth of Massachusetts.

Department of Environmental Protection
 Box 4062
 Boston, MA 02211

- b.) **To the Conservation Commission:** Send the Notice of Intent or Abbreviated Notice of Intent; a **copy** of this form; and the city/town fee payment.

To MassDEP Regional Office (see Instructions): Send a copy of the Notice of Intent or Abbreviated Notice of Intent; a **copy** of this form; and a **copy** of the state fee payment. (E-filers of Notices of Intent may submit these electronically.)

North Sturbridge Road
Charlton, Massachusetts

Notice of Intent Narrative

1.0 NOTICE OF INTENT NARRATIVE

On behalf of Sunpin Solar Development, LLC, BETA Group, Inc. (BETA) has prepared this Notice of Intent (NOI) for a proposed Large-Scale Ground-Mounted Solar Photovoltaic Installation (LSGMSPI) on a forested property on North Sturbridge Road in Charlton, Massachusetts. This NOI has been prepared under the provisions of the Massachusetts Wetlands Protection Act (WPA).

Copies of the Certified Abutters List and Abutter Notification Letter are provided in Appendix C.

1.1 SITE DESCRIPTION

The Subject Property is located south of North Sturbridge Road between the residential addresses of 285 and 279 in Charlton, Massachusetts. The 2,930 kilowatt DC solar array installation is proposed on a 10.89 acre portion (the "Site") of the larger 31.364-acre property (the "Property"). A majority of the proposed work associated with the installation of the LGMSPi will take place outside of the jurisdictional buffer zones and resource areas. Work proposed in the outer 50-ft range of the 100-ft Buffer Zone includes clearing of vegetation, site preparation and grading and a gravel driveway. Work proposed outside of the 100-ft Buffer Zone includes clearing of vegetation, site preparation and grading, installation of solar arrays, installation of the security fence, and construction of stormwater management facilities.

The site is currently undeveloped, wooded land which contains some wetland buffer area. The land immediately west and north of the Property are single-family residential homes. To the south and east of the Property is undeveloped woodland.

According to the Massachusetts Cultural Resource Information System (MACRIS), there are no historical resources located on the Property. Additionally, the proposed work is not anticipated to involve activities that would adversely impact potential historic resources.

A NHESP Priority Habitat of Rare Species is located to the north of the Site behind Doane Hill, classified as PH 1039 according to MassGIS. Sections of Protected Open Space (Chapter 61, 61A, 61B) abut the property to the west, south and east. None of the Site is located within the FEMA 100-year Floodplain. Groundwater at the Site is inferred to flow in roughly a southwesterly direction towards McKinstry Brook.

Freshwater wetlands surround the Site to the west, south, and east. These bordering vegetated wetlands (BVW) generally border either side of McKinstry Brook along its banks and its tributary. McKinstry Brook is an intermittent stream that flows from the north of the Site and meanders along the northwest corner of the site. Wetland delineation and flagging were completed in May of 2018 by Wetland Consultants, Inc. of East Longmeadow, MA and is attached as Appendix A.

A site plan, showing the topography of the property, wetlands and associated buffer zones, riverfront areas is provided as Drawing 2.

The Commonwealth of Massachusetts does not identify the intermittent portion of the McKinstry Brook in the MassDEP 2014 Integrated List of Water Map

1.2 PROPOSED CONDITIONS

The Project consists of the installation of a Large-Scale Ground-Mounted Solar Photovoltaic System (LGMSPi) and the associated site work to clear and prepare the ground surface. The installation of a

gravel road is located partially within the outer 50-ft range of the 100-ft Buffer Zone, however, no structures are proposed to be constructed within the inner 50-ft range of the 100-ft Buffer Zone.

The LGMSPI will encompass approximately 10.89-acres (fenced area) and will connect to the electrical grid at North Sturbridge Road. The solar array has been laid out such that significant grading is not anticipated to be necessary to accommodate the project. Formal stormwater management areas (basins) are proposed to mitigate impacts generated by the Project.

The access drive is a proposed 18-ft wide driveway composed of a gravel surface. The access driveway connects to North Sturbridge Road at the northern boundary of the Property.

Anticipated erosion controls will include silt fencing and straw wattles. Stormwater controls are anticipated to include basins with associated outlet devices, infiltration basins, grassed and rip-rap lines swales, and stone check dams. Refer to the Stormwater Management Report in Appendix D for more information regarding stormwater management.

The proposed construction sequence is provided below:

- Ø Contractor shall have the limit of all erosion control barriers staked prior to any construction activities.
- Ø Erosion control and stone construction entrance shall be installed and inspected prior to initiated earthwork.
- Ø All greater than 3:1 slopes shall be stabilized with an erosion control.
- Ø Install the solar panel support posts and racks.
- Ø Install the solar panels and electrical conduits.
- Ø Loam and seed all disturbed areas as construction progresses.
- Ø Provide ongoing maintenance of disturbed areas until disturbed areas are 100% stabilized.
- Ø Construction sequence may vary to minimize disturbance on-site and all erosion controls will be maintained until full stabilization.
- Ø Vegetation control on the Site shall be mechanical only and no pesticides or other chemical products shall be used.

Refer to Post-Development Conditions of the Stormwater Management Report included in Appendix D of this NOI for information on existing and proposed hydrology and compliance with DEP Stormwater Management Policy.

1.3 BORDERING VEGETATED WETLANDS

Freshwater wetlands are located to the northwest and east of the Site. Additional areas of bordering vegetated wetlands (BVW) were identified in the field and flagged by Wetland Consultants, Inc. of East Longmeadow, MA in May 2018. As depicted on Drawing 2, a portion of the proposed Project is located within the 100-ft Buffer Zone of the BVW.

1.4 BUFFER ZONES

According to the MassDEP's Wetlands Protection Act Regulations, 310 CMR 10.00, a Buffer Zone extends 100-ft horizontally outward from the boundaries of the BVW.

As depicted on Drawing 2, proposed activities to be conducted within this Buffer Zone include site preparation and grading, clearing of vegetation and construction of portions of a gravel driveway.

1.5 RIVERFRONT AREAS

In accordance with the MassDEP's Wetlands Protection Act Regulations, 310 CMR 10.00, a Riverfront Area (RFA) is defined as the area of land between a river's mean annual high water line and a parallel line measured horizontally outward 200-ft. Pursuant to the criteria for identifying perennial streams under the rivers Protection Act, there were no perennial streams identified on the U.S. Geological Survey (USGS) Map within 200-ft of the subject site. See Drawing 2.

1.6 WORK IN WETLAND RESOURCE AREAS

1.6.1 BORDERING VEGETATED WETLANDS

No work is proposed within BVW resource areas located on the Property.

1.6.2 BUFFER ZONES

Activities proposed within the 100-ft buffer zone to the adjacent BVW include site preparation and grading, clearing of vegetation, and construction of portions of a gravel driveway. All work will be within the outer 50-ft range of the buffer zone. Impacts will be minimized to the furthest extent practicable.

1.7 MITIGATION OF IMPACTS TO WETLAND RESOURCE AREAS

Impacts have been minimized to the extent practicable with consideration of the area of solar array needed in order to make the Project economically viable.

Mitigation proposed for work within the buffer zones includes utilization of New England Conservation/Wildlife Seed mix on disturbed areas within the inner 50-ft buffer zone.

1.8 INTERESTS OF THE MASSACHUSETTS WETLANDS PROTECTION ACT

1.8.1 PROTECTION OF PUBLIC AND PRIVATE WATER SUPPLY AND GROUND WATER SUPPLY

The Site is not located within a Zone II or III Wellhead Protection Area (IWPA), or Zone A of a public water supply, or within a Medium Yield Aquifer, and no private wells or Areas of Critical Concern are located within 500-ft.

The proposed work is not anticipated to impact the water quality of the surrounding area as there are no impervious surfaces associated with the Project and the Project will not generate pollutants. Anticipated runoff is proposed to be collected in swales and stormwater basins, allowing for the gradual infiltration into the ground. Therefore, the public and private water supply and groundwater supply protection interests of the Act will be upheld.

1.8.2 LAND SUBJECT TO FLOODING

The Property is not located in a FEMA Flood Area. As indicated on Figure 2, the Property is not located in an area of Special Flood Hazard located in a 100-year floodplain.

1.8.3 STORM DAMAGE PREVENTION

The proposed stormwater management system is anticipated to mitigate runoff from the proposed area to be cleared, allowing for the collection and gradual infiltration of the stormwater into the ground. Therefore, the flood control and storm damage prevention interests of the Act will be maintained. See Stormwater Management Report in Appendix D.

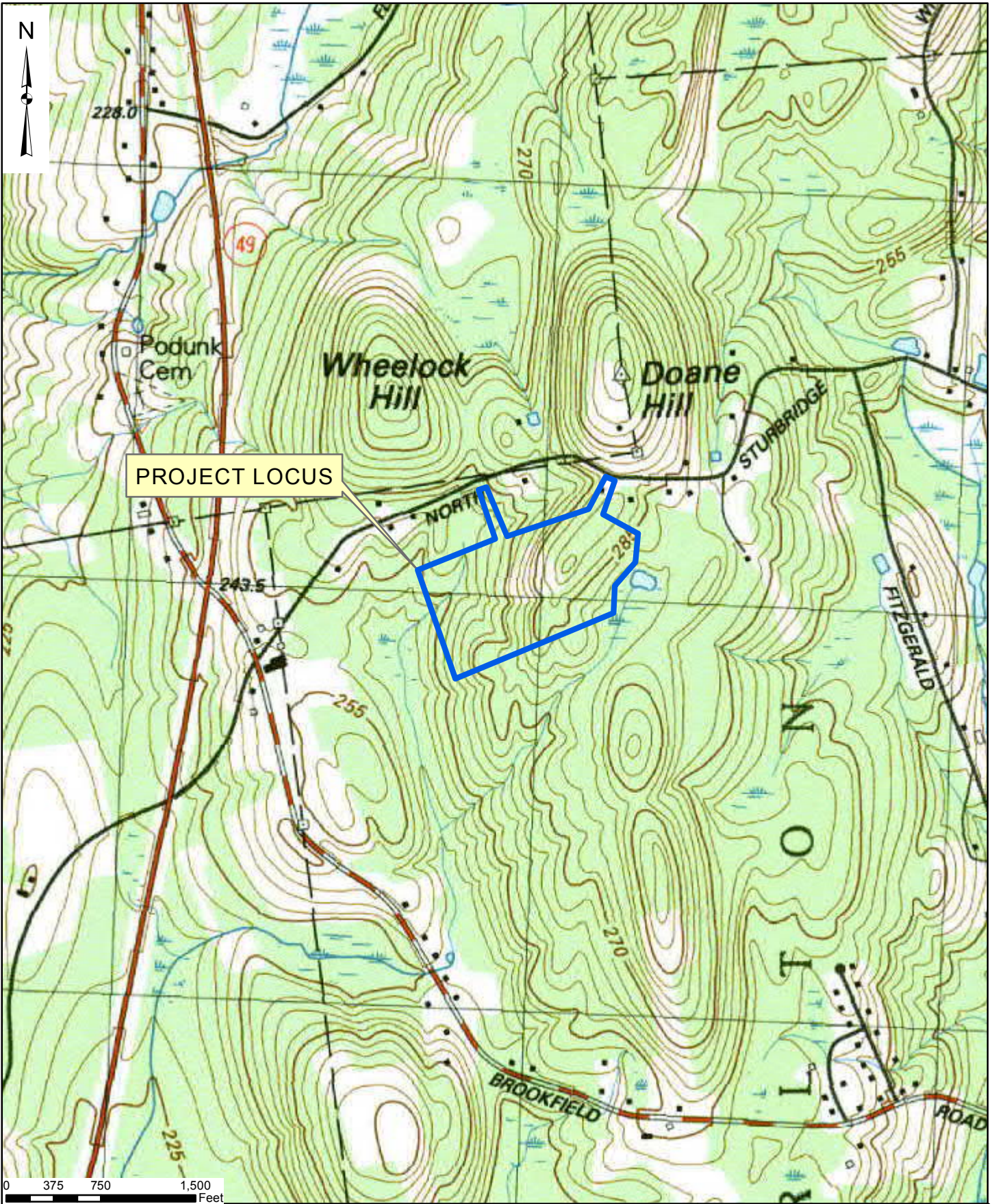
1.8.4 PREVENTION OF POLLUTION

Erosion control measures, including silt fencing and straw wattles will be installed prior to any soil disturbance. Regular maintenance of these measures will be conducted. The proposed solar array will not generate pollutants and there will be no use of pesticides or other chemicals products for vegetation control. The Site will be in compliance with the Standards of the DEP Stormwater Management Policy. Therefore, the pollution interest of the Act and Bylaw will be upheld.

1.8.5 PROTECTION OF FISHERIES, SHELLFISHERIES AND WILDLIFE HABITAT

BETA has also reviewed the most recent NHESP maps online at the Massachusetts Office of Geographic Information Systems (MassGIS) website. According to this data, the Property is not located within an Estimated Habitat of Rare Wildlife. Therefore, the fisheries, shellfisheries and wildlife habitat interests of the Act will be protected.

FIGURES



North Sturbridge Road Solar Facility
263 North Sturbridge Road
Charlton, MA

Figure 1
Site Locus Map

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources or local sites. The community map responsible should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where Base Flood Elevations (BFEs) and/or Floodways have been determined, users are encouraged to consult the Flood Profile and Floodway Data and/or Summary of Flooded Elevations reports contained within the Flood Insurance Study (FIS) Report that accompanies this FIRM. Users should be aware that RPLs shown on this FIRM represent modeled Antiflood Elevation. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Additionally, flood elevation data presented in the FIS Report should be plotted in conjunction with the FIRM for purposes of determining actual floodplain management.

Coastal Data Flood Elevations shown on this map apply only in areas of 10 1/2 foot National Vertical Datum at Mean High Water (MHW) of the 1980s. Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Flooded Elevations table in the Flood Insurance Study Report for the jurisdiction. Elevations shown in the Summary of Flooded Elevations table should be used for construction project floodplain management purposes when they are higher than the elevations shown on this FIRM.

Elevations of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic computations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study Report for the jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures. Refer to Section 2.A "Flood Protection Measures" of the Flood Insurance Study Report for information on flood control structures for the jurisdiction.

The projection used in the preparation of this map was Massachusetts State Plane Mercator Zone 18 (1983 zone 2003). The horizontal datum was NAD 83. GRS 1980 spheroid. Differences in station, azimuth, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences at map boundaries across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1980. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversions between the National Geodetic Vertical Datum of 1980 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov>, or contact the National Geodetic Survey at its following address:

NGS Information Service:
 NGA, 11852025
 National Geodetic Survey
 STOP 5, 60502
 1215 East-West Highway
 Silver Spring, Maryland 20910-1292
 (301) 713-5740

To obtain current elevation, declination, and/or station information for bench marks shown on this map, please contact the Information Geomatics Branch of the National Geodetic Survey at (201) 713-3332, or visit its website at <http://www.ngs.noaa.gov>.

Aerial map information shown on this FIRM was derived from digital orthorectified base map that was provided by digital terrain by Massachusetts Geographic Information Systems (MapGIS). Orthoregistry was produced at a scale of 1:5,000. Aerial photography is dated April 2005.

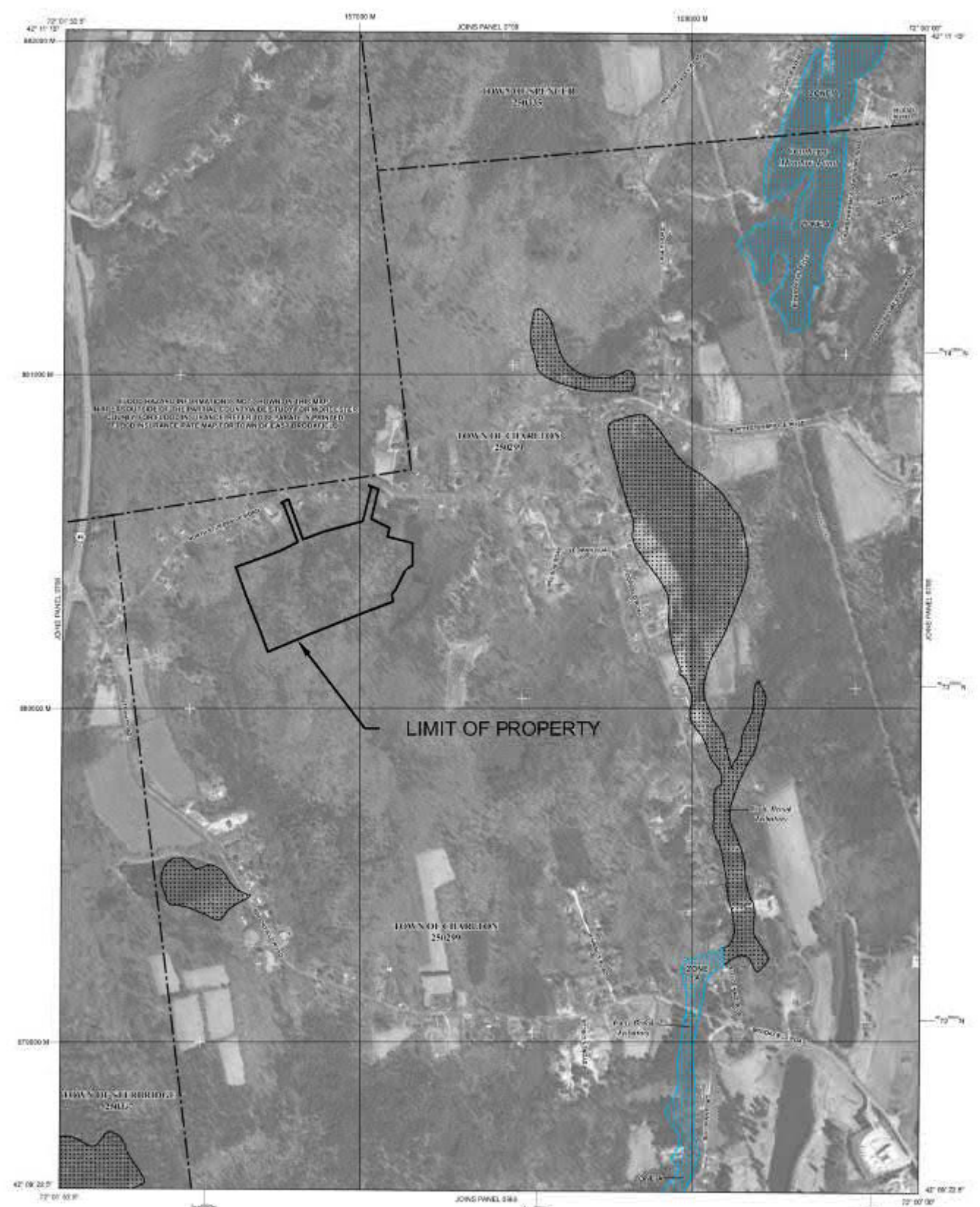
The profile lines shown on this map represent the hydraulic modeling features that match the flood profiles in the FIS report. As a result of improved topographic data, the profile elevations on some cross sections may deviate slightly from the channel centerline or occur outside the DFHA.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes in administrative or jurisdictional boundaries may have occurred since this map was published, map users should contact appropriate governmental officials to verify current corporate and jurisdictional boundaries.

Please refer to the separately printed Map Index for an overview map of the county showing the layout of map panels, community map regulatory addresses, and a listing of Communities at Risk containing National Flood Insurance Program status for each community as well as a listing of the panels in which each community is located.

For information on available products associated with this FIRM visit the Map Service Center (MSC) website at www.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have questions about this map, how to order products, or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange (FMIX) at 1-877-FEMA-MAP (1-877-364-6271) or visit the FEMA website at <http://www.fema.gov>.



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO REGULATIONS OF THE 1% ANNUAL CHANCE FLOOD
 The 1% Annual Chance Flood (100 year flood) area shown on the base map is the area that has a 1% chance of being exceeded or exceeded in any given year. The Special Flood Hazard Areas (SFHA) shown on this map are based on the 1% Annual Chance Flood. Areas of Special Flood Hazard include Zone A, AE, AO, AH, and X. The 1% Annual Chance Flood is the water surface elevation of the 1% Annual Chance Flood.

- ZONE A** Special Flood Hazard Area subject to regulation
- ZONE AE** Special Flood Hazard Area subject to regulation
- ZONE AO** Flood hazard due to storm surge (Zone AO) subject to regulation
- ZONE AH** Flood hazard due to storm surge (Zone AH) subject to regulation
- ZONE X** Flood hazard due to storm surge (Zone X) subject to regulation

FLOODWAY AREAS IN ZONE AE
 The boundary between a floodway and an adjacent floodway area that must be kept free of encroachment to maintain the 1% Annual Chance Flood. The Floodway boundary encloses a floodway.

OTHER FLOOD AREAS
ZONE 1 Area of 1% Annual Chance Flood, water of 1% Annual Chance Flood with average depth of one foot (1 foot in water depth area) and less than 1 foot in water depth. Areas not included in the 1% Annual Chance Flood.
ZONE 2 Area determined to be subject to 1% Annual Chance Flood.
ZONE 3 Area in which flood hazard is not shown, but possible.

CRITICAL BARRIER REGULATED SYSTEM (CBRS) AREAS

CHESAPEAKE PROTECTED AREAS (CPA)
 CPA areas and lines are normally water bodies or adjacent to Special Flood Hazard Areas. CPA areas and lines are normally water bodies or adjacent to Special Flood Hazard Areas.

1% Annual Chance Flood
 1% Annual Chance Flood Boundary
 Floodway boundary
 500 Year Flood
 Ditch and V-Line boundary
 Levee boundary
 Special Flood Hazard Area Zone and boundary showing Special Flood Hazard Area of 1% Annual Chance Flood, Floodway, or Floodway boundary
 Floodway boundary for 500 Year Flood
 500 Year Flood boundary for 500 Year Flood
 Base Flood Elevation (BFE) shown within zone, elevation in feet
 Base Flood Elevation (BFE) shown within zone, elevation in feet

Referenced to the North American Vertical Datum of 1980
A Cross section line
B Section line
C Causeway
D Bridge
E Channel
F Unimproved road/bridge structure in the North American Vertical Datum of 1980 and 100 year flood
100 Year Flood
 100 Year Flood Boundary
 100 Year Flood Boundary
 100 Year Flood Boundary
100 Year Flood
 100 Year Flood Boundary
 100 Year Flood Boundary
 100 Year Flood Boundary

MAP INFORMATION
 Date of Publication: 07/04/11
 Effective Date: 07/04/11
 Issued by: FEMA
 Project Number: 1366-99-0000

NOT TO SCALE

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0787E

FIRM
 FLOOD INSURANCE RATE MAP
 WORCESTER COUNTY,
 MASSACHUSETTS
 (ALL JURISDICTIONS)

PANEL 787 OF 1075
 (SEE MAP INDEX FOR FIRM PANEL LAYOUT)

COMMUNITY

COMMUNITY	NUMBER	DATE	SCALE
North Sturbridge	2507C	07/04/11	1:50,000
North Sturbridge	2507D	07/04/11	1:50,000
North Sturbridge	2507E	07/04/11	1:50,000
North Sturbridge	2507F	07/04/11	1:50,000

NOTES TO USER: The Map Number shown above should be used when placing map orders. The Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
2507C0787E
EFFECTIVE DATE
JULY 4, 2011
 Federal Emergency Management Agency



North Sturbridge Road Solar Facility
 263 North Sturbridge Road
 Charlton, MA

Figure No. 2
FEMA FIRM Map

APPENDIX A – WETLAND RESOURCE AREAS DELINEATION REPORT

WETLAND RESOURCE AREA DELINEATION

**NORTH STURBRIDGE ROAD
Map 14 – Parcel 7
CHARLTON, MASSACHUSETTS**

Prepared for:

**Mr. Christopher Nolan
BETA Group, Inc.
One Springfield Street
Chicopee, MA 01013**

Prepared by:

**Wetland Consultants, Inc.
123 Orchard Road
East Longmeadow, MA 01028**

WCI Job Number 18-013

May 9, 2018

WETLAND RESOURCE AREAS

**North Sturbridge Road
Map 14 - Parcel 7
Charlton, MA.
May 8, 2018**

INTRODUCTION:

At the request of BETA Group, Inc. Wetland Consultants, Inc. (WCI) identified and delineated wetland resource areas relative to the Massachusetts Wetland Protection Act (WPA) within 100-feet of the above referenced site in Charlton, MA. The resource areas delineated on April 27 and May 2, 2018 by WCI and field located by Sherman & Frydryk, LLC are described below.

SITE DESCRIPTION:

The site consists of a ±31-acre parcel of land with two (2) access points off of the southerly side of North Sturbridge Road in Charlton, MA and is located approximately 2,000-feet east of Putnam Road in Sturbridge, MA. The site consists of an undeveloped, forested hillside with two (2) wetland systems, which are located within the northwesterly and southeasterly portions of the site. Both of the wetland systems are headwaters to the southerly flowing Mckinstry Brook. The topography on the site generally slopes moderately from east to west dropping in elevation 20-feet across the site. See **Figures 1 & 2** and the site photographs.

WETLAND DELINEATION CRITERIA:

Prior to conducting a resource area delineation, available soil, topographic, aerial, habitat and flood plain maps were reviewed. The delineation incorporated the fifty-percent or more of hydrophytic vegetation and indicators of hydrology criterion cited in the WPA as well as the methods cited in the manuals, *Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetlands Protection Act* and the *1987 Corps of Engineers Wetlands Delineation Manual*. The wetland resource areas described below were characterized by vegetation, soils, topography, and evidence of hydrology.

Multiple hand soil borings were conducted along the bordering vegetated wetland (BVW) line to substantiate the delineation, and data collected and recorded for four (4) of the borings. The soil samples and their profiles were analyzed for redoximorphic features and other indicators of hydrology utilizing the Munsell Soil Color Chart and methods cited in the manual "*Field Indicators for Identifying Hydric Soils in New England version 3 April 2004*". Pink flags labeled SB1 – SB4 were placed in the field to identify the location of the recorded borings. See attached soil boring data sheets in **Appendix B**.

BVWs are areas that contain fifty-percent or more of hydrophytic vegetation and indicators of hydrology and are hydraulically connected to, or border on a Pond, Bank of a stream, or another BVW. BVWs are jurisdictional under the WPA and contain a 100-foot buffer zone.

BVW Description

W95 – W143. The W-Series Wetland flags delineate the southerly edge of a BVW associated with a westerly flowing intermittent stream located south of residences along North Sturbridge Road. The BVW receives hydrology from surficial runoff of the surrounding land and supports the growth of the following hydrophytes and upland vegetative species: Sensitive Fern - *Onoclea sensibilis*, Cinnamon Fern – *Osmunda cinnamomea*, Sphagnum Moss – *Sphagnum sp.*, Tussock Sedge – *Carex stricta*, Indian Pokeweed – *Veratrum viride*, Gold Thread – *Coptis trifolia*, Witch Hazel – *Hammemalis virginiana*, Spice Bush – *Lindera benzoin*, Mountain Laurel – *Kalmia latifolia*, Yellow Birch – *Betula alleganiensis*, Red Maple – *Acer rubrum*, American Beech – *Fagus grandifolia*, Eastern Hemlock – *Tsuga canadensis*, and Red oak – *Quercus rubrus*. The banks of the intermittent stream were not separately delineated because they fell within the BVW boundaries.

X100 - X115. The X-Series Wetland flags delineate the northwesterly boundaries of a large seasonally inundated BVW associated with an intermittent stream flowing southwesterly out of it. The BVW boundaries were clearly defined by an abrupt change in topography, which correlated well with changes in vegetation and hydrology. Due to the defined change between hydrophytic and non-hydrophytic vegetation the X-Series Wetland did not require soil or vegetative data confirmation. The vegetation within the area consisted primarily of Sensitive Fern – *Onoclea sensibilis*, Sphagnum Moss – *Sphagnum sp.*, Cinnamon Fern – *Osmunda cinnamomea*, Gold Thread – *Coptis trifolia*, Witch Hazel – *Hammemalis virginiana*, Highbush Blueberry – *Vaccinium corymbosum*, Winterberry – *Ilex verticulatta*, Spice Bush – *Lindera benzoin*, Mountain Laurel – *Kalmia latifolia*, Red Maple – *Acer rubrum*, Yellow Birch – *Betula alleganiensis*, and Eastern Hemlock – *Tsuga canadensis*.

RIVERFRONT RESOURCE AREA DELINEATION CRITERIA:

Pursuant to the criteria for identifying perennial streams under the Rivers Protection Act, there were no perennial streams identified on the U.S. Geological Survey (USGS) Map within 200-feet of the subject site. See **Figure 1**.

SOIL:

The MassGis Data cites the Natural Resources Conservation Service SSURGO – certified soils for the site as Charlton fine sandy loam 15 – 35 percent slopes, extremely stony and Chatfield – Hollis – Rock outcrop complex 3 to 15 percent slopes.

ENDANGERED SPECIES

According to the Massachusetts Natural Heritage and Endangered Species Program (NHESP) data layers as viewed on Oliver, a GIS website, there are no areas of the site within estimated and priority habitat. **Figure 1** shows the area map as observed with the NHESP data layers.

FLOOD PLAIN

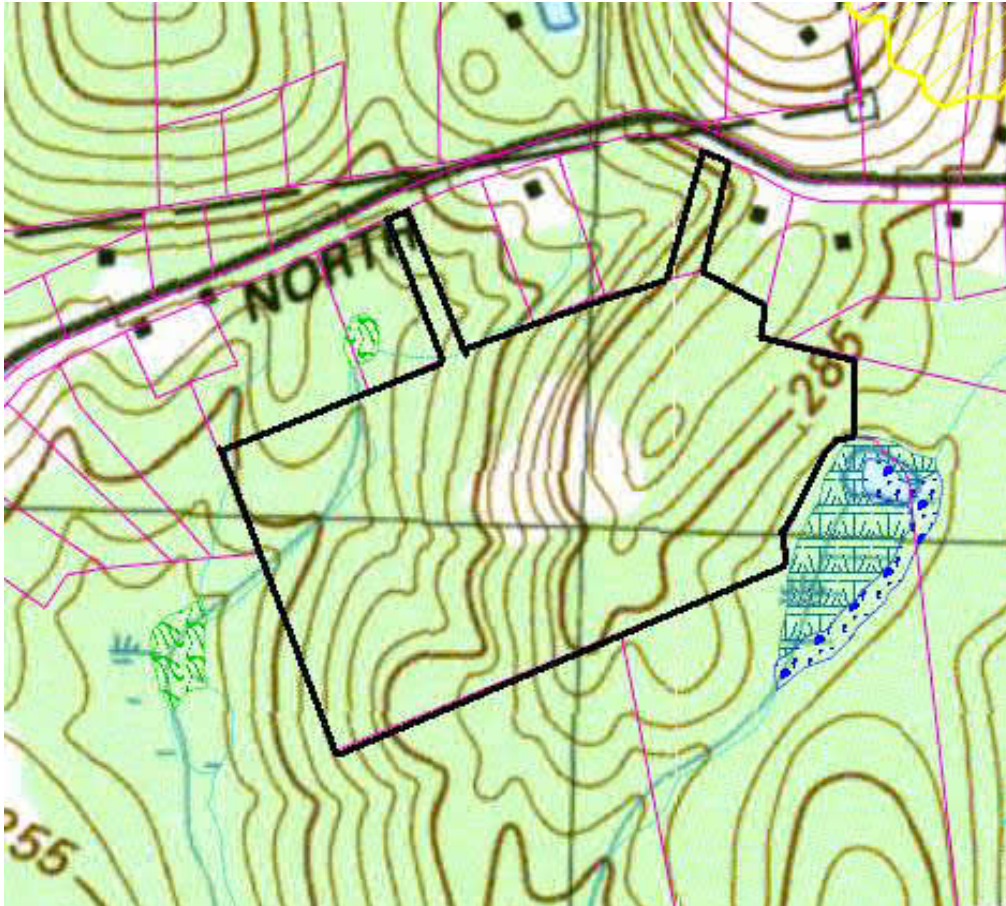
There are no areas on-site within FEMA's delineation of the 100-year flood zone, which is also known as Bordering Land Subject to Flooding (BLSF). BLSF falls under the jurisdiction of the WPA. See **Figure 3**.

REGULATORY REVIEW

Should work be proposed within the Bordering Vegetated Wetland or its buffer zone, Bank Resource or its buffer zone, or Land Under Waterbodies and Waterways a permit from the Charlton Conservation Commission, and the MA Department of Environmental Protection must be obtained prior to the start of any work.

FIGURES

WETLAND CONSULTANTS, INC.
123 Orchard Road
East Longmeadow, MA 01028



**NHESP 2017 Priority and Estimated Habitat, Certified Vernal Pool and MADEP
Wetland Data Layers overlain on USGS Topographic Map.**

**North Sturbridge Road
Charlton, MA**

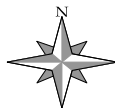


Figure 1

Job # 18-013

WETLAND CONSULTANTS, INC.
123 Orchard Road
East Longmeadow, MA 01028



MAGIS 2015 Colored Orthophotograph

North Sturbridge Road
Charlton, MA

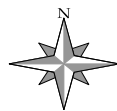
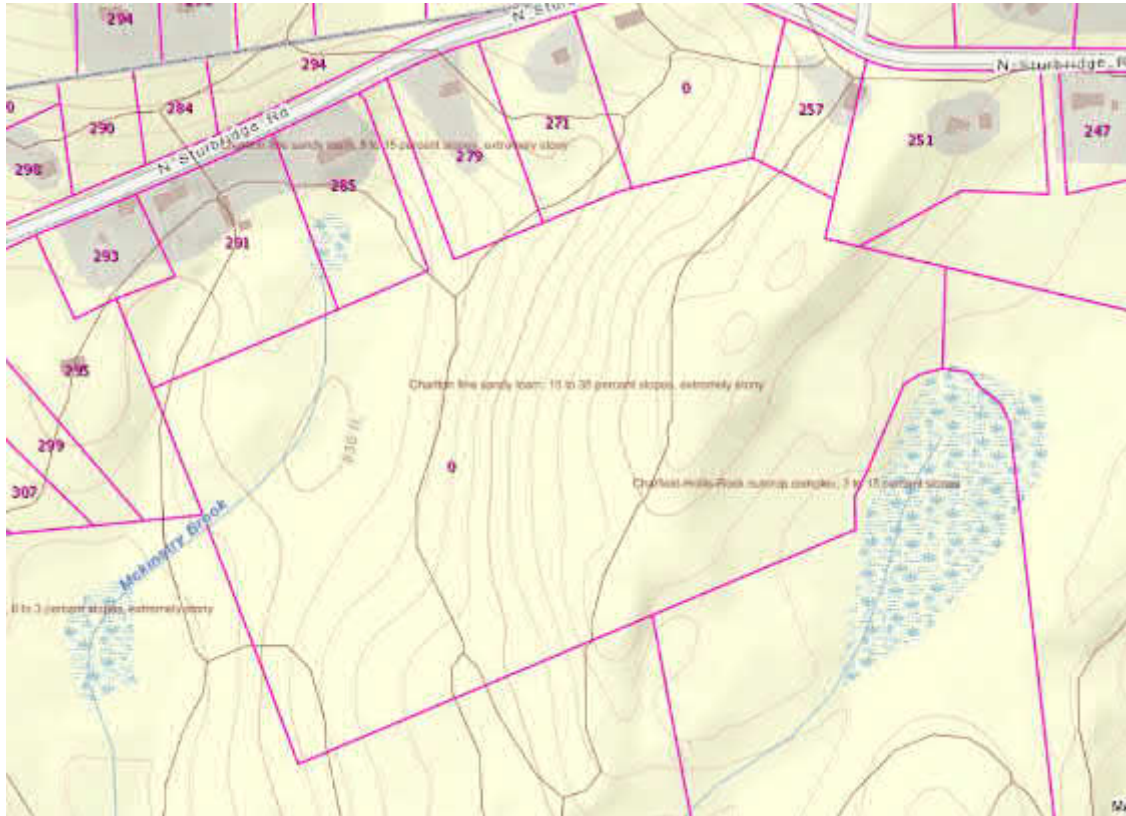


Figure 2

Job # 18-013

WETLAND CONSULTANTS, INC.
123 Orchard Road
East Longmeadow, MA 01028



Scale NA
MassGIS Data – Certified Soils
Natural Resource Conservation Service

North Sturbridge Road
Charlton, MA



Figure 3

Soil Map
Job #18-013

WETLAND CONSULTANTS, INC.
123 Orchard Road
East Longmeadow, MA 01028



MassGIS – FEMA National Flood hazard Layers

North Sturbridge Road
Charlton, MA



Figure 4

Flood Map
Job # 18-013

APPENDIX A

Site Photographs

Site Photographs – North Sturbridge Road Charlton, MA

4/27/18



Upland Area of the Subject Site



W-Series Wetland



X-Series Wetland



X-Series Wetland

Site Photographs – North Sturbridge Road Charlton, MA

4/27/18



Soil Boring SB-1 - Hydric



Soil Boring SB-2 - Non-Hydric



Soil Boring SB-3 - Hydric



Soil Boring SB-4 – Non-Hydric

APPENDIX B

Data Sheets

Section II. Indicators of Hydrology
North Sturbridge Road Property, Charlton, MA
4/27/18

Hydric Soil Interpretation **SB1 below W106**

1. Soil Survey

Is there a published soil survey for this site? Yes No

Title/date: MassGIS: Natural Resources
Conservation Service

Soil type mapped: Charlton FSL & Chatfield- Hollis
Rock Outcrop Complex

Hydric soil inclusions: Yes

Are field observations consistent with soil survey? Yes No

Remarks:

2. Soil Description

Horizon	Depth	Matrix Color	Masses Color
A	0" – 3"	10yr 2/2	sl - no redox
B	3" – 7"	10yr 4/3	sl – 5% 10yr 4/6
	7" – 18"	10yr 4/3	sl – 20% 10yr 5/6 5% 7.5yr 4/6 2% 10yr 4/2

Remarks:

Vegetation observed within the area consisted primarily of sphagnum moss, Indian pokeweed, tussock sedge, marsh marigold, gold thread, unknown grasses, princess pine, wintergreen, spicebush, witch hazel, eastern hemlock, red maple, beech and yellow birch.

Other

Conclusion: Is soil hydric? Yes No

Other Indicators of Hydrology: (check all that apply and describe)

<input type="checkbox"/>	Site inundated: _____
<input checked="" type="checkbox"/>	Depth to free water in observation hole: <u>6"</u>
<input type="checkbox"/>	Depth to soil saturation in observation hole: _____
<input type="checkbox"/>	Water marks: _____
<input type="checkbox"/>	Drift lines: _____
<input type="checkbox"/>	Sediment deposits: _____
<input type="checkbox"/>	Drainage patterns in BVW: _____
<input type="checkbox"/>	Oxidized rhizospheres: _____
<input type="checkbox"/>	Water-stained leaves: _____
<input type="checkbox"/>	Recorded data (stream, lake, or tidal gauge; aerial photo; other): _____

Other: _____

Vegetation and Hydrology Conclusion		
	Yes	No
Number of wetland indicator plants \geq number of non-wetland indicator plants	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Wetland hydrology present:		
hydric soil present	<input checked="" type="checkbox"/>	<input type="checkbox"/>
other indicators of hydrology present	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Sample location is in a BVW	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Submit this form with the Request for Determination of Applicability or Notice of Intent.

Section II. Indicators of Hydrology
North Sturbridge Road Property, Charlton, MA
4/27/18

Hydric Soil Interpretation **SB2 above W106**

3. Soil Survey

Is there a published soil survey for this site? Yes No

Title/date: MassGIS: Natural Resources
Conservation Service

Soil type mapped: Charlton FSL & Chatfield- Hollis
Rock Outcrop Complex

Hydric soil inclusions: Yes

Are field observations consistent with soil survey? Yes No

Remarks:

4. Soil Description

Horizon	Depth	Matrix Color	Masses Color
A	0" – 6"	10yr 2/2	sl - no redox
B	6" – 11"	10yr 4/4	sl – 3% 10yr 4/6
	11" – 19"	2.5y 4/3	sl – 5% 10yr 4/6 No depletions

Remarks:

Vegetation observed within the area consisted primarily of eastern hemlock and yellow birch.

Other

Conclusion: Is soil hydric? Yes No

Other Indicators of Hydrology: (check all that apply and describe)

<input type="checkbox"/>	Site inundated: _____
<input checked="" type="checkbox"/>	Depth to free water in observation hole: <u>12"</u>
<input type="checkbox"/>	Depth to soil saturation in observation hole: _____
<input type="checkbox"/>	Water marks: _____
<input type="checkbox"/>	Drift lines: _____
<input type="checkbox"/>	Sediment deposits: _____
<input type="checkbox"/>	Drainage patterns in BVW: _____
<input type="checkbox"/>	Oxidized rhizospheres: _____
<input type="checkbox"/>	Water-stained leaves: _____
<input type="checkbox"/>	Recorded data (stream, lake, or tidal gauge; aerial photo; other): _____

Other: _____

Vegetation and Hydrology Conclusion		
	Yes	No
Number of wetland indicator plants \geq number of non-wetland indicator plants	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Wetland hydrology present:		
hydric soil present	<input type="checkbox"/>	<input checked="" type="checkbox"/>
other indicators of hydrology present	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Sample location is in a BVW	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Submit this form with the Request for Determination of Applicability or Notice of Intent.

Section II. Indicators of Hydrology
North Sturbridge Road Property, Charlton, MA
4/27/18

Hydric Soil Interpretation **SB3 below W120**

5. Soil Survey

Is there a published soil survey for this site? Yes No
 Title/date: MassGIS: Natural Resources
Conservation Service
 Soil type mapped: Charlton FSL & Chatfield- Hollis
Rock Outcrop Complex
 Hydric soil inclusions: Yes

Are field observations consistent with soil survey? Yes No

Remarks:

6. Soil Description

Horizon	Depth	Matrix Color	Masses Color
A	0" – 9"	10yr 2/2	sil - no redox
B	9" – 18"	2.5y 5/2	ssi – 5% 10yr 4/6

Remarks:

Vegetation observed within the area consisted primarily of sphagnum moss, gold thread, witch hazel, red maple and cinnamon fern.

Other

Conclusion: Is soil hydric? Yes No

Other Indicators of Hydrology: (check all that apply and describe)

<input type="checkbox"/>	Site inundated: _____
<input checked="" type="checkbox"/>	Depth to free water in observation hole: <u>6"</u>
<input type="checkbox"/>	Depth to soil saturation in observation hole: _____
<input type="checkbox"/>	Water marks: _____
<input type="checkbox"/>	Drift lines: _____
<input type="checkbox"/>	Sediment deposits: _____
<input type="checkbox"/>	Drainage patterns in BVW: _____
<input type="checkbox"/>	Oxidized rhizospheres: _____
<input type="checkbox"/>	Water-stained leaves: _____
<input type="checkbox"/>	Recorded data (stream, lake, or tidal gauge; aerial photo; other): _____

Other: _____

Vegetation and Hydrology Conclusion		
	Yes	No
Number of wetland indicator plants \geq number of non-wetland indicator plants	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Wetland hydrology present:		
hydric soil present	<input checked="" type="checkbox"/>	<input type="checkbox"/>
other indicators of hydrology present	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Sample location is in a BVW	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Submit this form with the Request for Determination of Applicability or Notice of Intent.

Section II. Indicators of Hydrology
North Sturbridge Road Property, Charlton, MA
4/27/18

Hydric Soil Interpretation **SB4 above W120**

7. Soil Survey

Is there a published soil survey for this site? Yes No
 Title/date: MassGIS: Natural Resources Conservation Service
 Soil type mapped: Charlton FSL & Chatfield- Hollis Rock Outcrop Complex
 Hydric soil inclusions: Yes

Are field observations consistent with soil survey? Yes No

Remarks:

8. Soil Description

Horizon	Depth	Matrix Color	Masses Color
A	0" – 10"	10yr 3/1	sl - no redox
B	10" – 15"	10yr 3/3	sl – no redox
	15" – 18"	10yr 3/4	sl – no redox

Remarks:

Vegetation observed within the area consisted primarily of witch hazel, red maple and cinnamon fern.

Other

Conclusion: Is soil hydric? Yes No

Other Indicators of Hydrology: (check all that apply and describe)

Site inundated: _____
 Depth to free water in observation hole: _____
 Depth to soil saturation in observation hole: _____
 Water marks: _____
 Drift lines: _____
 Sediment deposits: _____
 Drainage patterns in BVW: _____
 Oxidized rhizospheres: _____
 Water-stained leaves: _____
 Recorded data (stream, lake, or tidal gauge; aerial photo; other): _____

Other: _____

Vegetation and Hydrology Conclusion		
	Yes	No
Number of wetland indicator plants \geq number of non-wetland indicator plants	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Wetland hydrology present:		
hydric soil present	<input type="checkbox"/>	<input checked="" type="checkbox"/>
other indicators of hydrology present	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Sample location is in a BVW	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Submit this form with the Request for Determination of Applicability or Notice of Intent.

APPENDIX B – LIST OF PROPERTY OWNERS



LIST OF PROPERTY OWNERS FOR 0 NORTH STURBRIDGE ROAD (14-B-7 and 14B-11.1)

Pamela Blackadar
4421 South Atlantic Ave, Unit A1,
Ponce Inlet, FL 32127
386-383-5904
PBlackadar@cfl.rr.com

Davis W. Stockman
7010 Trenton Rd
Barneveld, NY 13304
315-264-7904
dwstock@roadrunner.com

John H. Stockman
272 North Sturbridge Rd,
East Brookfield, MA 01515
508-248-6823
(No Email)

O:\5900s\5989 - Sunpin Solar - Charlton\Engineering\Permitting\NOI\appendix\appendix_B_list_of_property_owners.docx

APPENDIX C – ABUTTER NOTIFICATION

Town of Charlton Abutters List

Certified 07-18-18
Jessie Davis
Page 1 of 1

Subject Parcel ID: **14-B-7 100 ft.**

Subject Property Location:

ParcelID	Location	Owner	Co-Owner	Mailing Address	City	State	Zip
14-B-1	N STURBRIDGE RD	KASZOWSKI KENNETH P	ROBERT J JR + BRIAN	53 STURBRIDGE RD	CHARLTON	MA	01507
14-B-10	271 N STURBRIDGE RD	BARTSCH WILLIAM D JR (9/12)		271 N STURBRIDGE RD	CHARLTON	MA	01507
14-B-11	267 N STURBRIDGE RD	MILLER RORY D (1/1/5)	SMITH PATTI C J/T	267 N STURBRIDGE RD	CHARLTON	MA	01507
14-B-12	257 N STURBRIDGE RD	WIELGORECKI MARIUSZ (6/04)	WIELGORECKI BEATA T/E	257 N STURBRIDGE RD	CHARLTON	MA	01507
14-B-13	251 N STURBRIDGE RD	GOULD MARY A	RICHARD J	251 N STURBRIDGE RD	CHARLTON	MA	01507
14-B-16	N STURBRIDGE RD	SMITH ANDREW D (3/14)	SMITH KARA A T/E	241 N STURBRIDGE RD	CHARLTON	MA	01507
14-B-19	FITZGERALD RD	LEGEND DEVELOPMENT LLC (6/02		92 FITZGERALD RD	CHARLTON	MA	01507
14-B-22	295 N STURBRIDGE RD	WU XUANFU (5/12)		295 N STURBRIDGE RD	CHARLTON	MA	01507
14-B-21	241 N STURBRIDGE RD	SMITH ANDREW D (3/14)	SMITH KARA A T/E	241 N STURBRIDGE RD	CHARLTON	MA	01507
14-B-7	N STURBRIDGE RD	BLACKADAR PAMELA	STOCKMAN J. H., STOCKMA	4421 S. ATLANTIC AVE UNIT	PONCE INLET	FL	32127
14-B-8	285 N STURBRIDGE RD	DILLENBACK ROBERT C (9/15)		285 N STURBRIDGE RD	CHARLTON	MA	01507
14-B-9	279 N STURBRIDGE RD	LAPORTA BRIAN N (8/10)	LAPORTA ROBIN R T/E	279 N STURBRIDGE RD	CHARLTON	MA	01507

Parcel Count: **12**

End of Report

Abutters Report

=====
Total of 7 parcels found
Total of 7 abutters found

1-A-1
STOCKMAN JOHN HARLAN
272 N STURBRIDGE RD
CHARLTON
MA
01507

1-A-2
REEVE GEORGE E
PO BOX 648
EAST BROOKFIELD
MA
01515

14-B-11
MILLER RORY D (11/15)
267 N STURBRIDGE RD
CHARLTON
MA
01507

14-B-11.1
BLACKADAR PAMELA
4421 S. ATLANTIC AVE UNIT A1
PONCE INLET
FL
32127

14-B-11.2
J DUBOIS CONTRACTING LLC (6/14)
36 CRANBERRY MEADOW RD
CHARLTON
MA
01507

14-B-12
WIELGORECKI MARIUSZ (6/04)
257 N STURBRIDGE RD
CHARLTON
MA
01507

14-B-7
BLACKADAR PAMELA
4421 S. ATLANTIC AVE UNIT A1
PONCE INLET
FL
32127

100 #.

14-B-11.1

7-24-18

Assessors
Certificate
J. E. Linn

AFFIDAVIT OF SERVICE

Under the Massachusetts Wetlands Protection Act

I, Danny P. Rebelo, PE, hereby certify under the pains and penalties of perjury that on August 2, 2018 I gave notification to abutters in compliance with the second paragraph of Massachusetts General Laws Chapter 131, Section 40, and the DEP Guide to Abutter Notification dated April 8, 1994 in connection with the following matter:

North Sturbridge Road Solar Facility

A Notice of Intent filed under the Massachusetts Wetlands Protection Act by:

Marsel Kamberaj, Sunpin Solar Development, LLC

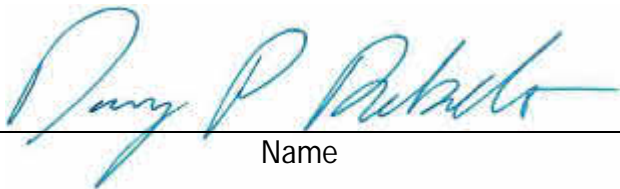
With the Town of Charlton Conservation Commission on August 1, 2018.

For property located at:

Zero North Sturbridge Road, Charlton, Massachusetts

Shown on Assessors Map # 14 Block # B Lot# 7, Map #14 Block #B Lot # 11.1.

The forms of the notification, and a list of the abutters to whom it was given and their addresses, are attached to this Affidavit of Service.


Name

August 1, 2018

Date

Notification to Abutters under the Massachusetts Wetland Protection Act

In accordance with the second paragraph of Massachusetts General Laws Chapter 131, Section 40, and Framingham Wetlands Protection Bylaw (Section 18) you are hereby notified of the following:

The name of the applicant is Sunpin Solar Development, LLC. The applicant has filed a Notice of Intent with the Conservation Commission for the Town of Charlton, MA for North Sturbridge Road Solar Facility.

The address of the lot where the activity is proposed is _0 North Sturbridge Road_ (Lots 14-B-7, 14-B-11.1).

Copies of the application may be examined at the Town of Charlton Conservation Commission, 37 Main Street, Charlton, MA 01507 between the hours of 7:30 AM and 5:00 PM Monday through Thursday (except on Wednesdays with meeting nights for which the hours will be between 11:00 AM and 5:00 PM).

Copies of the application may be obtained from the applicant or their representative by contacting Danny P. Rebelo, BETA Group, Inc., One Springfield Street, Suite 4, Chicopee, MA 02062, (413) 331-5326 between the hours of _8:30 AM_ and _5:00 PM_ on the following days of the week Monday - Friday.

The hearing will be held in the Charlton Municipal Offices at 37 Main Street, Conservation Commission Office, Charlton, MA 01507 on _August 15, 2018_ at _7:00 PM_.

Additional information regarding the public hearing may be obtained from the Town of Charlton Conservation Commission, 37 Main Street, Charlton, MA 01507 by calling 508-248-2247 between the hours of 7:30 AM and 5:00 PM Monday through Friday. Notice of the public hearing, including its date, time and place, will be published at least five (5) days in advance in the *Stonebridge Press*. Notice of the public hearing, including its date, time and place, will be posted in the Charlton Municipal Offices not less than forty-eight (48) hours in advance.

NOTE: You also may contact the nearest Department of Environmental Protection Regional Office for more information about this application or the MA Wetlands Protection Act. To contact the DEP, call the Central Regional Office at 508-792-7621.

APPENDIX D – STORMWATER REPORT

North Sturbridge Road
Solar Facility
Charlton, Massachusetts
August 1, 2018

Stormwater Management Report



1 Springfield Street
Suite 4
Chicopee, MA 01013
413.331.5326
www.BETA-Inc.com

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FIGURES

FIGURE 1: SITE LOCUS

APPENDICIES

A: EXISTING CONDITIONS CALCULATION

B: PROPOSED CONDITIONS CALCULATION

C: CONSTRUCTION PERIOD POLLUTION PREVENTION AND SEDIMENT AND EROSION CONTROL PLAN

D: LONG TERM OPERATION AND MAINTENANCE PLAN

E: SOILS DATA

F: SUPPLEMENTAL CALCULATIONS

G: WATERSHED PLANS

H: PRELIMINARY DRAINAGE AND GRADING PLANS AND STORMWATER DETAILS



Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the [Massachusetts Stormwater Handbook](#). The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.¹ This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8²
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

¹ The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

² For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.



Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



Signature and Date

Danny P. Rebelo

8/1/18

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

- New development
- Redevelopment
- Mix of New Development and Redevelopment



Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- No disturbance to any Wetland Resource Areas
- Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- Reduced Impervious Area (Redevelopment Only)
- Minimizing disturbance to existing trees and shrubs
- LID Site Design Credit Requested:
 - Credit 1
 - Credit 2
 - Credit 3
- Use of "country drainage" versus curb and gutter conveyance and pipe
- Bioretention Cells (includes Rain Gardens)
- Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- Treebox Filter
- Water Quality Swale
- Grass Channel
- Green Roof
- Other (describe): _____

Standard 1: No New Untreated Discharges

- No new untreated discharges
- Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.



Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

- Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.
- Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.
- Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

- Soil Analysis provided.
- Required Recharge Volume calculation provided.
- Required Recharge volume reduced through use of the LID site Design Credits.
- Sizing the infiltration, BMPs is based on the following method: Check the method used.
 - Static
 - Simple Dynamic
 - Dynamic Field¹
- Runoff from all impervious areas at the site discharging to the infiltration BMP.
- Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.
- Recharge BMPs have been sized to infiltrate the Required Recharge Volume.
- Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:
 - Site is comprised solely of C and D soils and/or bedrock at the land surface
 - M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
 - Solid Waste Landfill pursuant to 310 CMR 19.000
 - Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.
- Calculations showing that the infiltration BMPs will drain in 72 hours are provided.
- Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

¹ 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.



Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

- The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.
- Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
 - Provisions for storing materials and waste products inside or under cover;
 - Vehicle washing controls;
 - Requirements for routine inspections and maintenance of stormwater BMPs;
 - Spill prevention and response plans;
 - Provisions for maintenance of lawns, gardens, and other landscaped areas;
 - Requirements for storage and use of fertilizers, herbicides, and pesticides;
 - Pet waste management provisions;
 - Provisions for operation and management of septic systems;
 - Provisions for solid waste management;
 - Snow disposal and plowing plans relative to Wetland Resource Areas;
 - Winter Road Salt and/or Sand Use and Storage restrictions;
 - Street sweeping schedules;
 - Provisions for prevention of illicit discharges to the stormwater management system;
 - Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
 - Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
 - List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.
- A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.
 - Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:
 - is within the Zone II or Interim Wellhead Protection Area
 - is near or to other critical areas
 - is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
 - involves runoff from land uses with higher potential pollutant loads.
 - The Required Water Quality Volume is reduced through use of the LID site Design Credits.
 - Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.



Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

- The BMP is sized (and calculations provided) based on:
 - The ½" or 1" Water Quality Volume or
 - The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.
- The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.
- A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

- The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.
- The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted **prior to** the discharge of stormwater to the post-construction stormwater BMPs.
- The NPDES Multi-Sector General Permit does **not** cover the land use.
- LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.
- All exposure has been eliminated.
- All exposure has **not** been eliminated and all BMPs selected are on MassDEP LUHPPL list.
- The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

- The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.
- Critical areas and BMPs are identified in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

- The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:
 - Limited Project
 - Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
 - Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
 - Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
 - Bike Path and/or Foot Path
 - Redevelopment Project
 - Redevelopment portion of mix of new and redevelopment.
- Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.
- The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- . Narrative;
 - . Construction Period Operation and Maintenance Plan;
 - . Names of Persons or Entity Responsible for Plan Compliance;
 - . Construction Period Pollution Prevention Measures;
 - . Erosion and Sedimentation Control Plan Drawings;
 - . Detail drawings and specifications for erosion control BMPs, including sizing calculations;
 - . Vegetation Planning;
 - . Site Development Plan;
 - . Construction Sequencing Plan;
 - . Sequencing of Erosion and Sedimentation Controls;
 - . Operation and Maintenance of Erosion and Sedimentation Controls;
 - . Inspection Schedule;
 - . Maintenance Schedule;
 - . Inspection and Maintenance Log Form.
- A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

- The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has **not** been included in the Stormwater Report but will be submitted **before** land disturbance begins.
- The project is **not** covered by a NPDES Construction General Permit.
- The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.
- The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

- The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:
 - Name of the stormwater management system owners;
 - Party responsible for operation and maintenance;
 - Schedule for implementation of routine and non-routine maintenance tasks;
 - Plan showing the location of all stormwater BMPs maintenance access areas;
 - Description and delineation of public safety features;
 - Estimated operation and maintenance budget; and
 - Operation and Maintenance Log Form.
- The responsible party is **not** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:
 - A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
 - A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

- The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;
- An Illicit Discharge Compliance Statement is attached;
- NO Illicit Discharge Compliance Statement is attached but will be submitted **prior to** the discharge of any stormwater to post-construction BMPs.

Stormwater Management Report

North Sturbridge Road Solar Facility – Charlton, Massachusetts

OBJECTIVE OF CALCULATIONS

The calculations contained in this report are an analysis of the site hydrology and stormwater runoff for both the Existing Conditions and Proposed Conditions Cases. The project is considered a new development and the objective of this analysis is to demonstrate that measures have been implemented to fully comply with the Town of Charlton Stormwater requirements and Massachusetts Stormwater Management Standards. Analysis of the Existing and Proposed Conditions is included for the two, ten, twenty five, fifty, and one hundred year rainfall events.

CALCULATION METHODS AND ASSUMPTIONS

Stormwater runoff is analyzed using the following:

- “HydroCADä Stormwater Modeling System,” by Applied Microcomputer Systems based upon SCS Technical Releases No. 55 and 20 for generating hydraulic calculations including peak flows and runoff volumes

EQUATIONS AND SOURCES OF DATA USED

- 24-Hour Rainfall data (Technical Paper 40)
 - 2 yr = 3.00 in. 10 yr = 4.60 in. 25 yr = 5.30 in. 50 yr. = 6.00 in 100 yr = 6.50 in.
- Soils information from the Natural Resources Conservation Service (NRCS) website and field investigations performed by O’Reilly, Talbot & Okun, Associates, Inc. (OTO) of Springfield, MA on May 17, 2018.

POINTS OF ANALYSIS

Stormwater runoff rates and volumes from the project area were analyzed at three Points of Analysis (POA) and correspond to the following:

- POA1 – Offsite to the east, into an area of vegetated wetlands.
- POA2 – Offsite to the southwest into an area of vegetated wetlands.
- POA3 – Offsite to the west, representing the northwestern sub-watershed.

EXISTING CONDITION DESCRIPTION

The project site encompasses a currently undeveloped site located along North Sturbridge Road in Charlton, Massachusetts (the “Site”). The Charlton Assessor’s Office identifies the Site as Lots 14-B-7 and 14-B-11.1.

The existing Site is located along the south side of North Sturbridge Road a short distance east of the Charlton/Sturbridge town line and south of the East Brookfield/Charlton town line(refer to Figure 1: Site Locus). The area within and around the Site is zoned as Agricultural, with primarily undeveloped wooded areas in the vicinity of the Site as well as several low density residential properties.

Stormwater Management Report

North Sturbridge Road Solar Facility – Charlton, Massachusetts

The project area includes an undeveloped 31.934-acre lot. The entirety of the Site is predominantly woodlands with a light underbrush, with an area of vegetated wetlands present in the northwest corner of the property.

Topography at the Site generally slopes to the west and east from a hill located on the east side of the property. Topography along the sides of this hill are generally between 15% and 35%, with shallower slopes to the west near the wetlands. Separate sections of wetlands are present to both the east and west of the property, with the wetlands to the east located approximately 100 ft from the property line. Both of these wetland areas appear to connect to McKinstry Brook to the South. Refer to the watershed plans for existing topography.

Natural Resources Conservation Service soil maps indicate soils in the project area are generally Charlton Fien Sandy Loam and extremely stony or Chatfield-Hollis-Rock outcrop complex. The central area of the Site is listed as Hydrologic Soil Group (HSG) A, bounded to the east and west by areas of HSG B. A soils analysis was conducted by OTO to determine the quality and infiltration capacity of the onsite soils. Based on this study, soils are primarily comprised of fine to coarse sand with varying amount of gravel, cobbles, and boulders. OTO noted that several bedrock outcroppings were observed near the surface throughout the Site. Infiltration rates were highly varied, with very high rates observed in some locations and negligible infiltration at others. Due to the unreliable nature of the observed rates, this report assumes a K value of 0.52 in/hr and 1.02 in/hr based on a soil textural classification as fine sandy loam for HSG B and HSG A soil, respectively. Refer to Appendix E for a copy of the Hydraulic Conductivity Report and NRCS soil maps.

PROPOSED CONDITION DESCRIPTION WITH MITIGATION

This project proposes the installation of a 2.93 MW Solar Facility. Facility components and associated work will take place outside of the wetland areas and their associated buffer zones, with the exception of the gravel access road which crosses through the 100-foot wetland buffer. The array has been primarily positioned towards the top of the hill, and the surrounding area is to be cleared of trees to allow sufficient sunlight to reach the proposed solar array. A gravel access road will provide access to the array from North Sturbridge Road to be used primarily for maintenance.

The footprint of the array will be surrounded by a chain-link perimeter fence. The area within this fence will be re-vegetated with grass and wildflowers. The area between the perimeter fence and the clearing limits will be allowed to regrow naturally and will only be maintained occasionally to prevent tall vegetation from interfering with the solar panels. No grubbing will be performed in this area. Proposed impervious areas will be limited to the paved access road apron and the small pads beneath transformers and inverters. These areas encompass less than 0.20% of the Site. Changes to site topography will be limited to

Stormwater Management Report

North Sturbridge Road Solar Facility – Charlton, Massachusetts

grading for the proposed gravel access road, transformer pads, grassed swales, and infiltration basins.

Stormwater management will be accomplished through the re-vegetation of developed areas to emulate pre-development cover types and the installation of three infiltration basins throughout the Site. These basins have been designed to capture, store, and infiltrate the increased runoff volume resulting from the proposed development, as well as to mitigate stormwater peak discharge rates to below pre-development conditions. Each of the basins has been designed with an emergency spillway, a minimum of 1' freeboard, and to drain within 72 hours for the 100 year storm event.

Runoff is further managed in the western watershed through the use of a grass lined swale, which runs along the upper portion of the hill. As topography in the northwestern portion of the watershed is generally unsuitable for a basin of sufficient size and configuration, the swale has been designed to divert sufficient runoff to a flat area in the southwestern portion of the watershed. To characterize the effects of this swale, the western watershed has been divided into the northwest and southwest sub-watersheds, with peak discharge rates and runoff volumes being reduced compared to pre-development conditions for each area.

To prevent sedimentation on North Sturbridge Road and the surrounding wetlands, a series of 1' deep grassed swales will be installed along the downgradient side of the gravel access road. These swales are designed to run parallel to the natural topography of the Site, and intended to capture sediment while causing minimal interference to drainage patterns.

See Appendix G for figures showing the pre- and post- development site conditions and Appendices A and B for copies of the pre- and post-development HydroCAD calculations. Additional calculations used for the design are provided as Appendix F. Preliminary Drainage and Grading Plans as well as Stormwater Details are included in Appendix H.

Stormwater Management Report

North Sturbridge Road Solar Facility – Charlton, Massachusetts

SUMMARY OF RESULTS

<u>Peak Rate of Runoff</u>		Flow (cubic feet per second)									
		2 Year Storm		10 Year Storm		25 Year Storm		50 Year Storm		100 Year Storm	
Outlet To:		Exist	Prop	Exist	Prop	Exist	Prop	Exist	Prop	Exist	Prop
POA1	Off-Site: East	0.29	0.28	2.40	1.49	3.85	2.18	5.51	2.92	6.78	3.48
POA2	Off-Site: West	0.00	0.00	0.07	0.06	0.23	0.22	0.61	0.57	0.97	0.90
POA3	Off-Site: West	0.00	0.00	0.12	0.09	0.31	0.24	0.86	0.67	1.45	1.13
Project Total:		0.29	0.28	2.59	1.64	4.39	2.64	6.98	4.16	9.20	5.51

<u>Runoff Volume</u>		Volume (acre-feet)									
		2 Year Storm		10 Year Storm		25 Year Storm		50 Year Storm		100 Year Storm	
Outlet To:		Exist	Prop	Exist	Prop	Exist	Prop	Exist	Prop	Exist	Prop
POA1	Off-Site: East	0.080	0.048	0.325	0.156	0.468	0.215	0.627	0.279	0.749	0.328
POA2	Off-Site: West	0.000	0.000	0.046	0.038	0.095	0.080	0.161	0.135	0.216	0.181
POA3	Off-Site: West	0.000	0.000	0.077	0.058	0.173	0.131	0.300	0.227	0.409	0.310
Project Total:		0.080	0.048	0.448	0.252	0.736	0.426	1.088	0.641	1.374	0.819

COMMENTS AND CONCLUSIONS

As a result of the proposed mitigation measures, peak flows will be reduced, and runoff will be controlled. The provided analysis has demonstrated that there will be no adverse impacts as a result of the project. As such, the proposed stormwater management Best Management Practices have been designed to fully meet the Town of Charlton Stormwater requirements and the DEP's Stormwater Management Policy. A summary of compliance with the ten Stormwater Management Standards has been provided.

Stormwater Management Report
North Sturbridge Road Solar Facility – Charlton, Massachusetts

SUMMARY OF COMPLIANCE WITH THE TEN STORMWATER MANAGEMENT STANDARDS

Sunpin Solar Development, LLC is proposing the installation of a 2.93 MW solar facility in Charlton, MA. The following summary has been prepared to illustrate the project's conformance with MassDEP's Stormwater Management Standards.

LID Measures:

Low Impact Development (LID) techniques on the project site are limited due to the presence of resource areas and lack of infiltration on the Site. The development incorporates country drainage, and no disturbances to wetland resource areas are proposed. No wetlands, flood zones, or wellhead protection areas will be adversely impacted as a result of the project.

Standard 1: No New Untreated Discharges

No new untreated discharges to wetlands are created as part of this project. – project complies.

Standard 2: Peak Rate Attenuation

The proposed design incorporates infiltration basins to capture, store, and manage the release of runoff as a result of changes to existing cover types. A net decrease in peak runoff rate is anticipated as part of the project. – project complies.

Standard 3: Recharge

A portion of the stormwater runoff from the project area will be directed to the infiltration basins throughout the Site. The basins have been designed to infiltrate a recharge volume in excess of that required for the Site. In addition, the western basins will be capable of fully attenuating (e.g. no discharge) up to the 2-year storm event (3.00") – project complies.

Standard 4: Water Quality

Proposed impervious areas are limited to the transformer pads and the paved apron. Sedimentation will also occur to a lesser extent from the proposed gravel access road. TSS Removal is provided in the form of country drainage and the infiltration basins, which have been designed to infiltrate a water quality volume in excess of that required for the Site. In addition, grassed swales will be installed along the downgradient side of the gravel roadway to capture sediment as well as to provide pretreatment for the infiltration basins. – project complies.

Standard 5: Land Uses with Higher Potential Pollutant Loads (LUHPPLs)

The project does not propose Land Uses with Higher Potential Pollutant Loads – not applicable.

Stormwater Management Report

North Sturbridge Road Solar Facility – Charlton, Massachusetts

Standard 6: Critical Areas

The project will not result in any new direct stormwater discharges to critical area – not applicable.

Standard 7: Redevelopment

The project is a new development and has been designed to fully comply with the Stormwater Management Standards – not applicable.

Standard 8: Construction Period Pollution Prevention and Erosion and Sediment Control

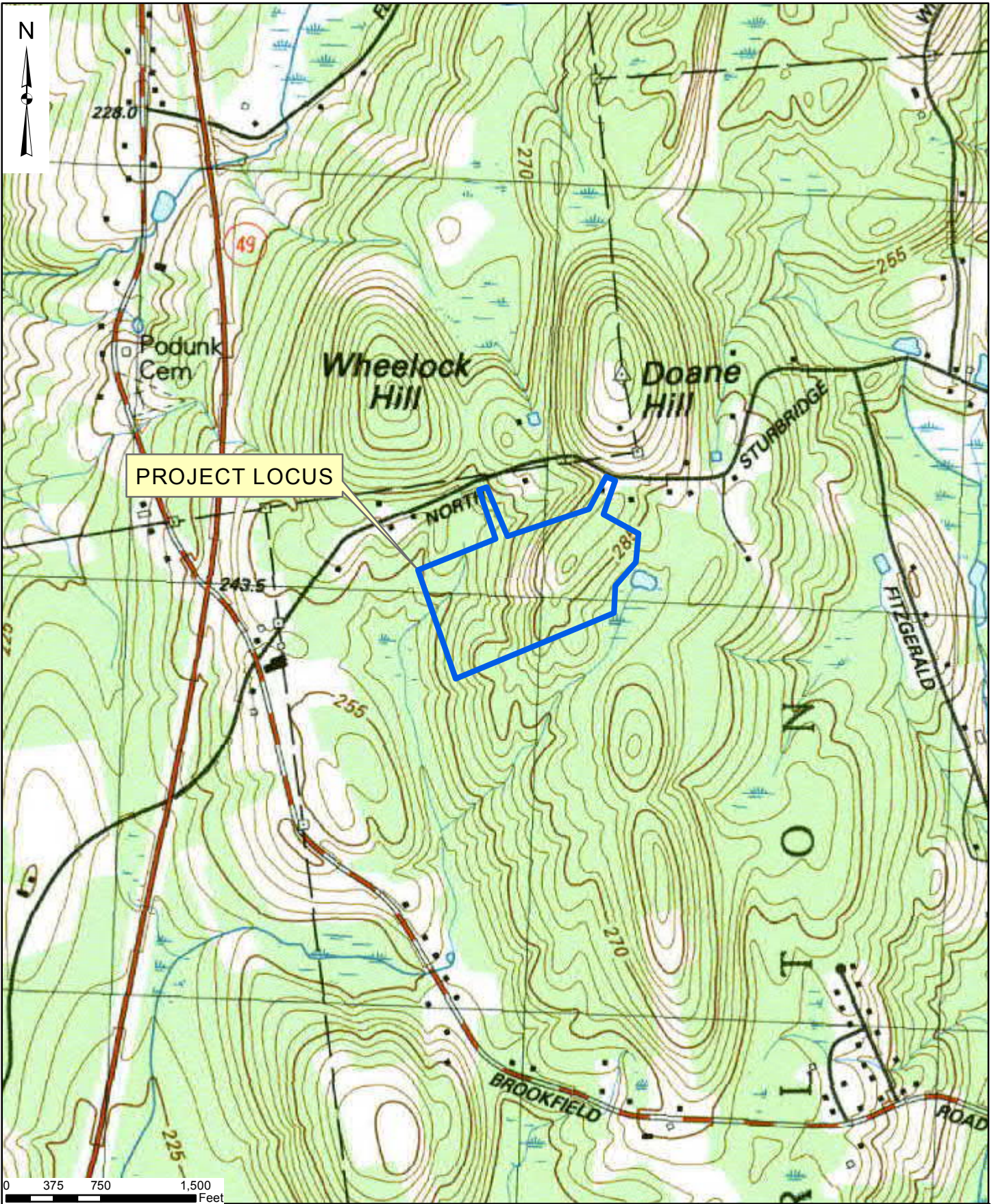
The project will disturb greater than one acre and will require the development of a Stormwater Pollution Prevention Plan (SWPPP) prior to construction. Basic erosion controls consisting of straw wattles, silt fence, and temporary sediment basins shall be depicted on the design plans.

Standard 9: Long Term Operation and Maintenance Plan

Operations and Maintenance of Stormwater management systems will be the responsibility of Sunpin Solar Development, LLC. Therefore, inspection and maintenance of infiltration basins and grassed swales will be in accordance with the attached Operation and Maintenance Plan.

Standard 10: Prohibition of Illicit Discharges

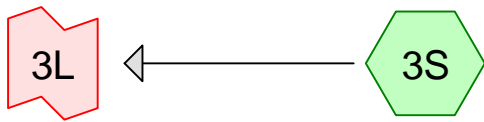
There are currently no known non-stormwater illicit discharges within the project limits and new discharges are prohibited.



North Sturbridge Road Solar Facility
263 North Sturbridge Road
Charlton, MA

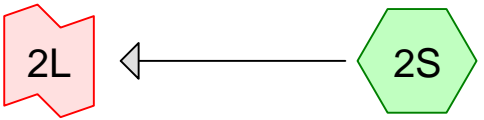
Figure 1
Site Locus Map

APPENDIX A – EXISTING CONDITIONS CALCULATION



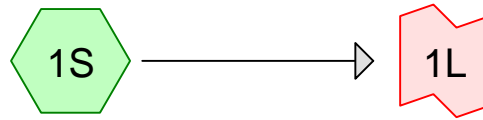
POA3 - West Run-off
(Wetlands)

EX-DA-3 - Northwest
Sub-watershed



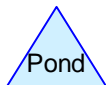
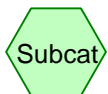
POA2 - West Run-off
(Wetlands)

EX-DA-2 - West
Sub-Watershed



EX-DA-1 - East
Watershed

POA1 - East Run-off
(Wetlands)



CharltonSolar Existing Conditions

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Type III 24-hr 2-Year Rainfall=3.00"

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Summary for Subcatchment 1S: EX-DA-1 - East Watershed

Runoff = 0.29 cfs @ 12.55 hrs, Volume= 0.080 af, Depth= 0.19"

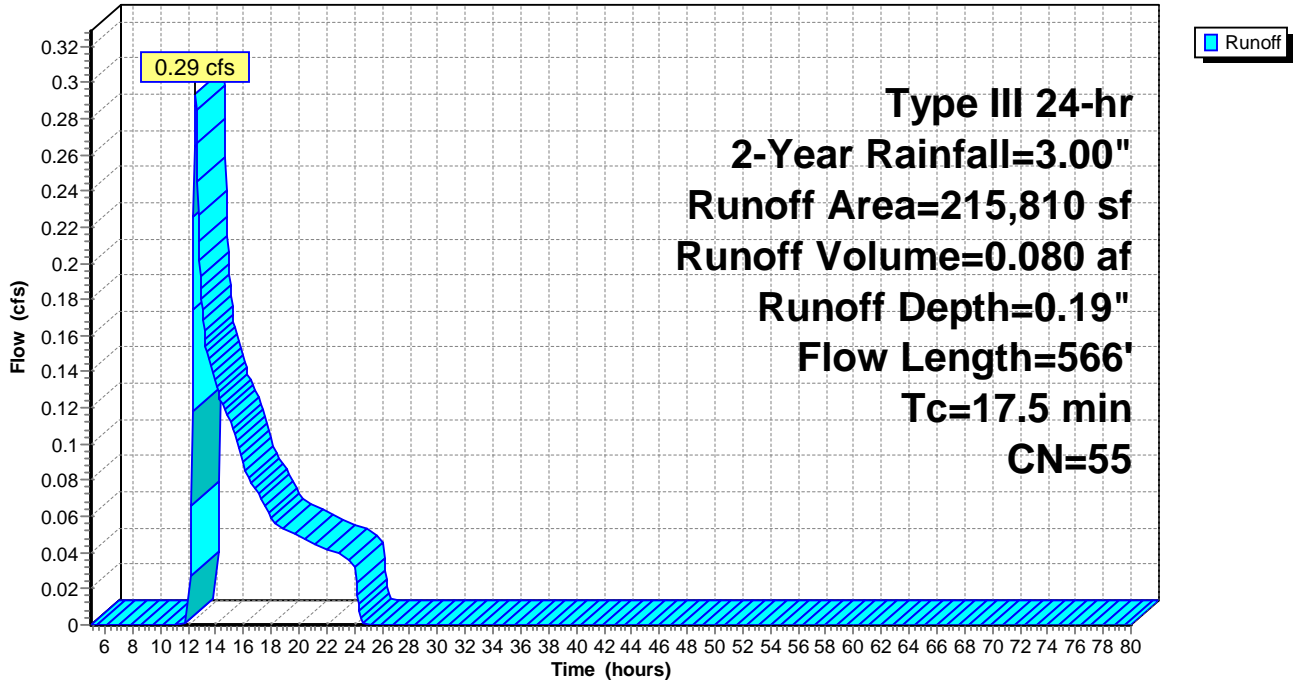
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
215,810	55	Woods, Good, HSG B
215,810		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.0276	0.07		Sheet Flow, Sheet Flow 1 Woods: Light underbrush n= 0.400 P2= 3.00"
0.8	74	0.1045	1.62		Shallow Concentrated Flow, Shallow Conc. 1 Woodland Kv= 5.0 fps
0.7	88	0.1806	2.12		Shallow Concentrated Flow, Shallow Conc. 2 Woodland Kv= 5.0 fps
0.3	18	0.0556	1.18		Shallow Concentrated Flow, Shallow Conc. 3 Woodland Kv= 5.0 fps
0.1	9	0.1833	2.14		Shallow Concentrated Flow, Shallow Conc. 4 Woodland Kv= 5.0 fps
1.5	104	0.0532	1.15		Shallow Concentrated Flow, Shallow Conc. 5 Woodland Kv= 5.0 fps
2.9	223	0.0656	1.28		Shallow Concentrated Flow, Shallow Conc. 6 Woodland Kv= 5.0 fps
17.5	566	Total			

Subcatchment 1S: EX-DA-1 - East Watershed

Hydrograph



CharltonSolar Existing Conditions

Type III 24-hr 2-Year Rainfall=3.00"

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Summary for Subcatchment 2S: EX-DA-2 - West Sub-Watershed

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

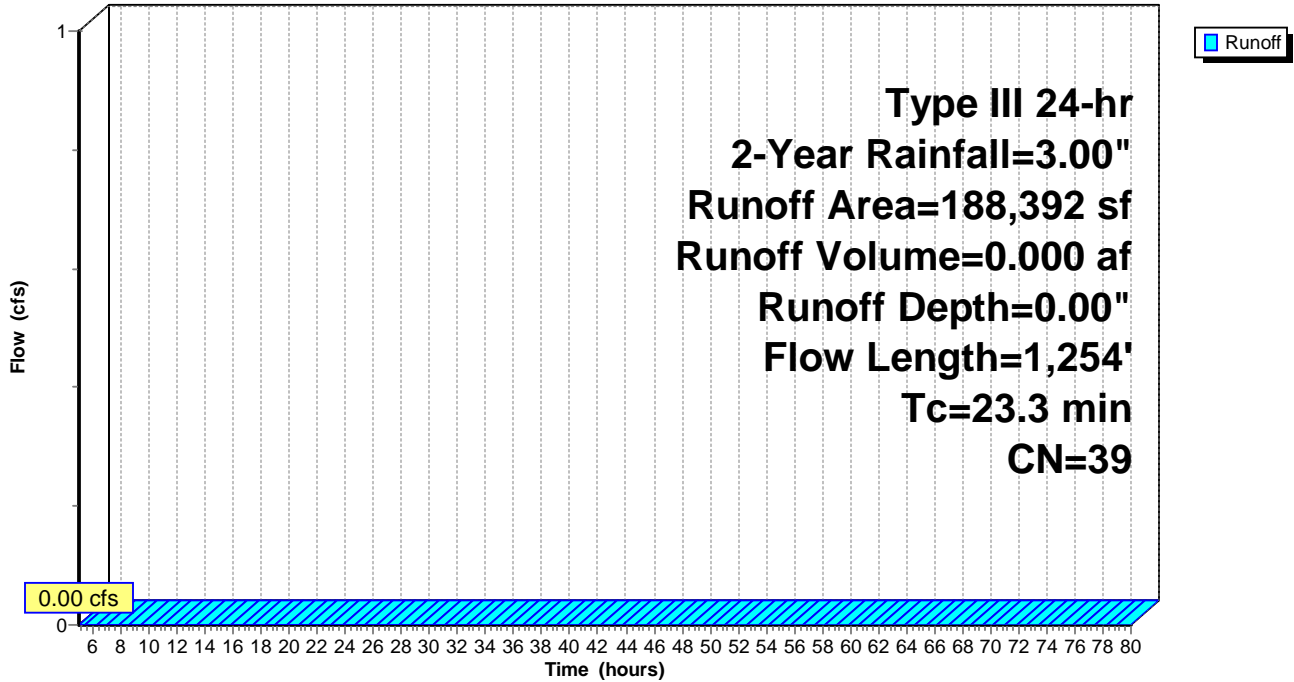
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
117,520	30	Woods, Good, HSG A
70,872	55	Woods, Good, HSG B
188,392	39	Weighted Average
188,392		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	50	0.0620	0.10		Sheet Flow, Sheet Flow 1 Woods: Light underbrush n= 0.400 P2= 3.00"
1.6	155	0.1023	1.60		Shallow Concentrated Flow, Shallow Conc. 1 Woodland Kv= 5.0 fps
2.1	119	0.0372	0.96		Shallow Concentrated Flow, Shallow Conc. 2 Woodland Kv= 5.0 fps
2.0	284	0.2238	2.37		Shallow Concentrated Flow, Shallow Conc. 3 Woodland Kv= 5.0 fps
3.8	322	0.0805	1.42		Shallow Concentrated Flow, Shallow Conc. 4 Woodland Kv= 5.0 fps
5.7	324	0.0359	0.95		Shallow Concentrated Flow, Shallow Conc. 5 Woodland Kv= 5.0 fps
23.3	1,254	Total			

Subcatchment 2S: EX-DA-2 - West Sub-Watershed

Hydrograph



CharltonSolar Existing Conditions

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Type III 24-hr 2-Year Rainfall=3.00"

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Summary for Subcatchment 3S: EX-DA-3 - Northwest Sub-watershed

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

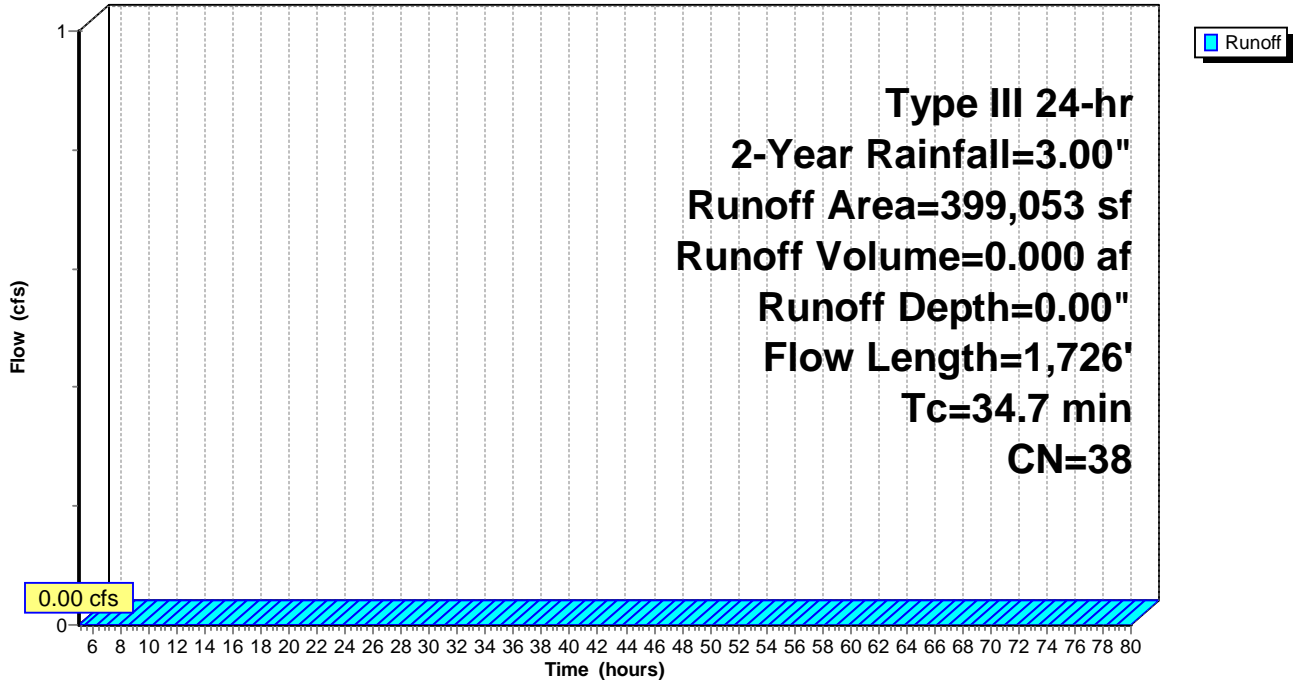
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
275,758	30	Woods, Good, HSG A
114,477	55	Woods, Good, HSG B
4,576	70	Woods, Good, HSG C
998	30	Meadow, non-grazed, HSG A
3,244	71	Meadow, non-grazed, HSG C
399,053	38	Weighted Average
399,053		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.1228	0.14		Sheet Flow, Sheet Flow
					Woods: Light underbrush n= 0.400 P2= 3.00"
2.2	234	0.1293	1.80		Shallow Concentrated Flow, Shallow Conc. 1
					Woodland Kv= 5.0 fps
0.8	76	0.1007	1.59		Shallow Concentrated Flow, Shallow Conc. 2
					Woodland Kv= 5.0 fps
2.0	191	0.1005	1.59		Shallow Concentrated Flow, Shallow Conc. 3
					Woodland Kv= 5.0 fps
2.6	163	0.0443	1.05		Shallow Concentrated Flow, Shallow Conc. 4
					Woodland Kv= 5.0 fps
1.5	114	0.0656	1.28		Shallow Concentrated Flow, Shallow Conc. 5
					Woodland Kv= 5.0 fps
3.4	331	0.1026	1.60		Shallow Concentrated Flow, Shallow Conc. 6
					Woodland Kv= 5.0 fps
6.2	261	0.0195	0.70		Shallow Concentrated Flow, Shallow Conc. 7
					Woodland Kv= 5.0 fps
3.2	153	0.0250	0.79		Shallow Concentrated Flow, Shallow Conc. 8
					Woodland Kv= 5.0 fps
6.6	153	0.0059	0.38		Shallow Concentrated Flow, Shallow Conc. 9
					Woodland Kv= 5.0 fps
34.7	1,726	Total			

Subcatchment 3S: EX-DA-3 - Northwest Sub-watershed

Hydrograph



CharltonSolar Existing Conditions

Type III 24-hr 10-Year Rainfall=4.60"

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Summary for Subcatchment 1S: EX-DA-1 - East Watershed

Runoff = 2.40 cfs @ 12.31 hrs, Volume= 0.325 af, Depth= 0.79"

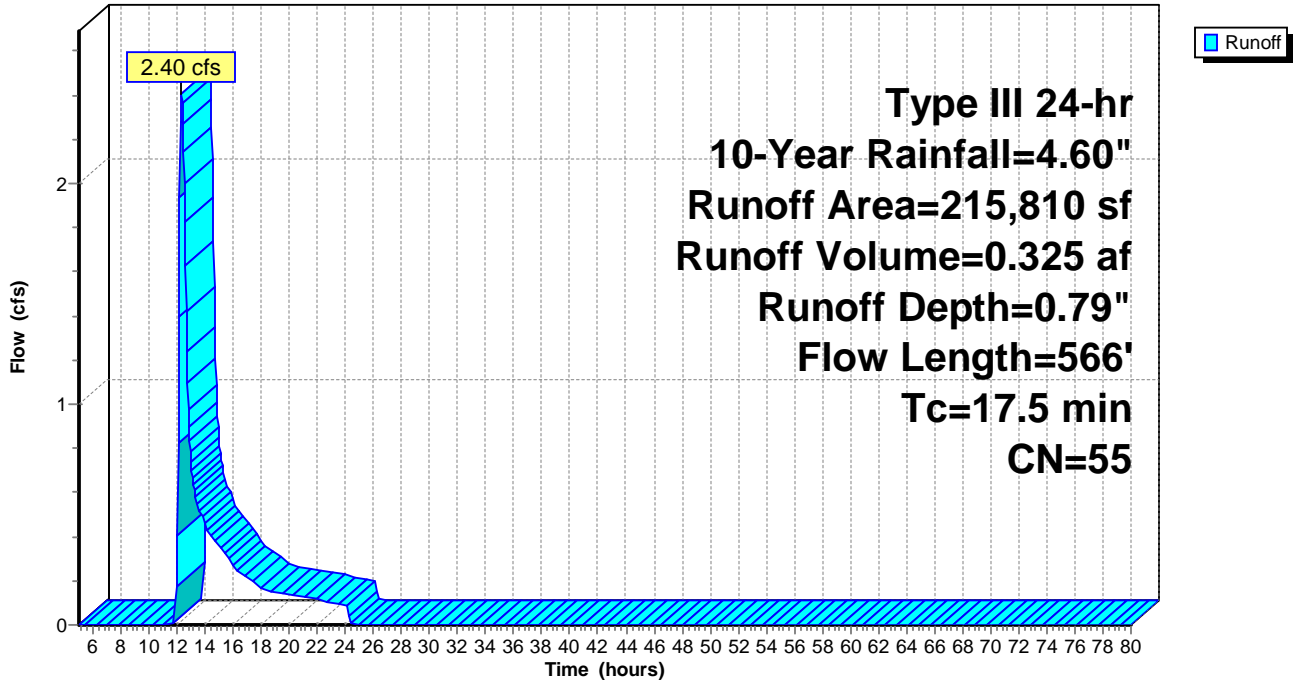
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.60"

Area (sf)	CN	Description
215,810	55	Woods, Good, HSG B
215,810		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.0276	0.07		Sheet Flow, Sheet Flow 1 Woods: Light underbrush n= 0.400 P2= 3.00"
0.8	74	0.1045	1.62		Shallow Concentrated Flow, Shallow Conc. 1 Woodland Kv= 5.0 fps
0.7	88	0.1806	2.12		Shallow Concentrated Flow, Shallow Conc. 2 Woodland Kv= 5.0 fps
0.3	18	0.0556	1.18		Shallow Concentrated Flow, Shallow Conc. 3 Woodland Kv= 5.0 fps
0.1	9	0.1833	2.14		Shallow Concentrated Flow, Shallow Conc. 4 Woodland Kv= 5.0 fps
1.5	104	0.0532	1.15		Shallow Concentrated Flow, Shallow Conc. 5 Woodland Kv= 5.0 fps
2.9	223	0.0656	1.28		Shallow Concentrated Flow, Shallow Conc. 6 Woodland Kv= 5.0 fps
17.5	566	Total			

Subcatchment 1S: EX-DA-1 - East Watershed

Hydrograph



CharltonSolar Existing Conditions

Type III 24-hr 10-Year Rainfall=4.60"

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Summary for Subcatchment 2S: EX-DA-2 - West Sub-Watershed

Runoff = 0.07 cfs @ 14.83 hrs, Volume= 0.046 af, Depth= 0.13"

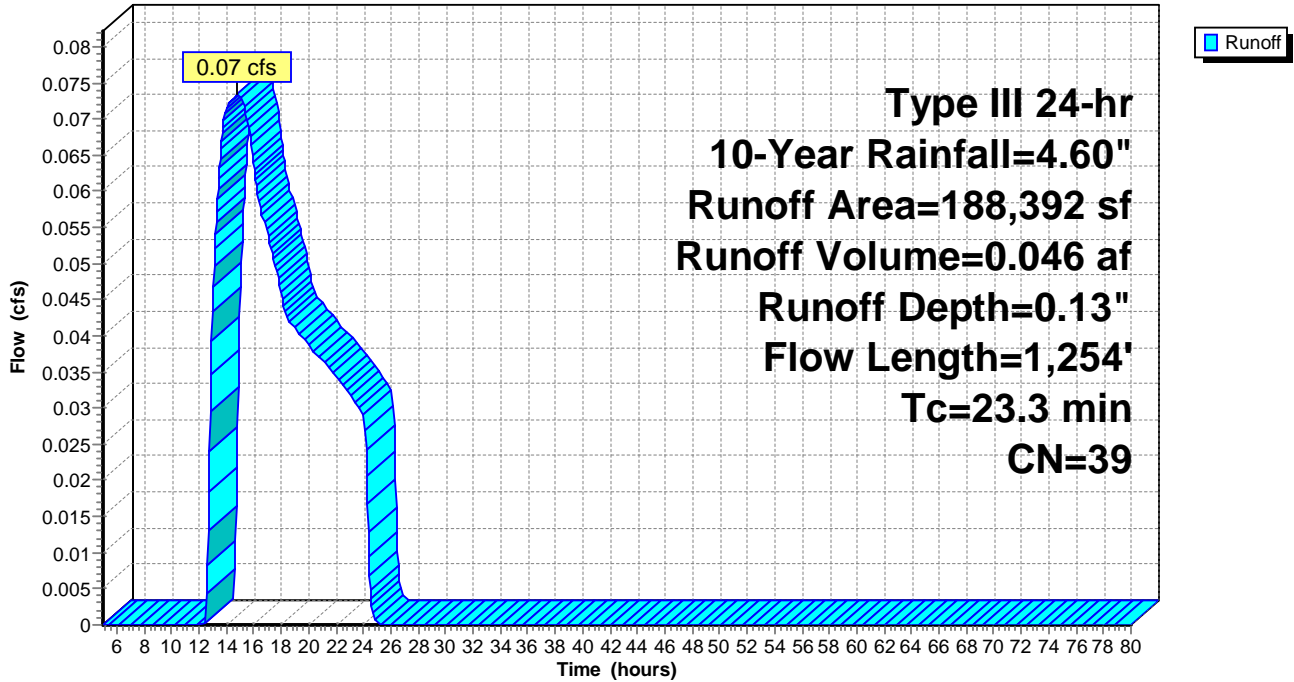
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Rainfall=4.60"

Area (sf)	CN	Description
117,520	30	Woods, Good, HSG A
70,872	55	Woods, Good, HSG B
188,392	39	Weighted Average
188,392		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	50	0.0620	0.10		Sheet Flow, Sheet Flow 1 Woods: Light underbrush n= 0.400 P2= 3.00"
1.6	155	0.1023	1.60		Shallow Concentrated Flow, Shallow Conc. 1 Woodland Kv= 5.0 fps
2.1	119	0.0372	0.96		Shallow Concentrated Flow, Shallow Conc. 2 Woodland Kv= 5.0 fps
2.0	284	0.2238	2.37		Shallow Concentrated Flow, Shallow Conc. 3 Woodland Kv= 5.0 fps
3.8	322	0.0805	1.42		Shallow Concentrated Flow, Shallow Conc. 4 Woodland Kv= 5.0 fps
5.7	324	0.0359	0.95		Shallow Concentrated Flow, Shallow Conc. 5 Woodland Kv= 5.0 fps
23.3	1,254	Total			

Subcatchment 2S: EX-DA-2 - West Sub-Watershed

Hydrograph



CharltonSolar Existing Conditions

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Type III 24-hr 10-Year Rainfall=4.60"

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Summary for Subcatchment 3S: EX-DA-3 - Northwest Sub-watershed

Runoff = 0.12 cfs @ 15.29 hrs, Volume= 0.077 af, Depth= 0.10"

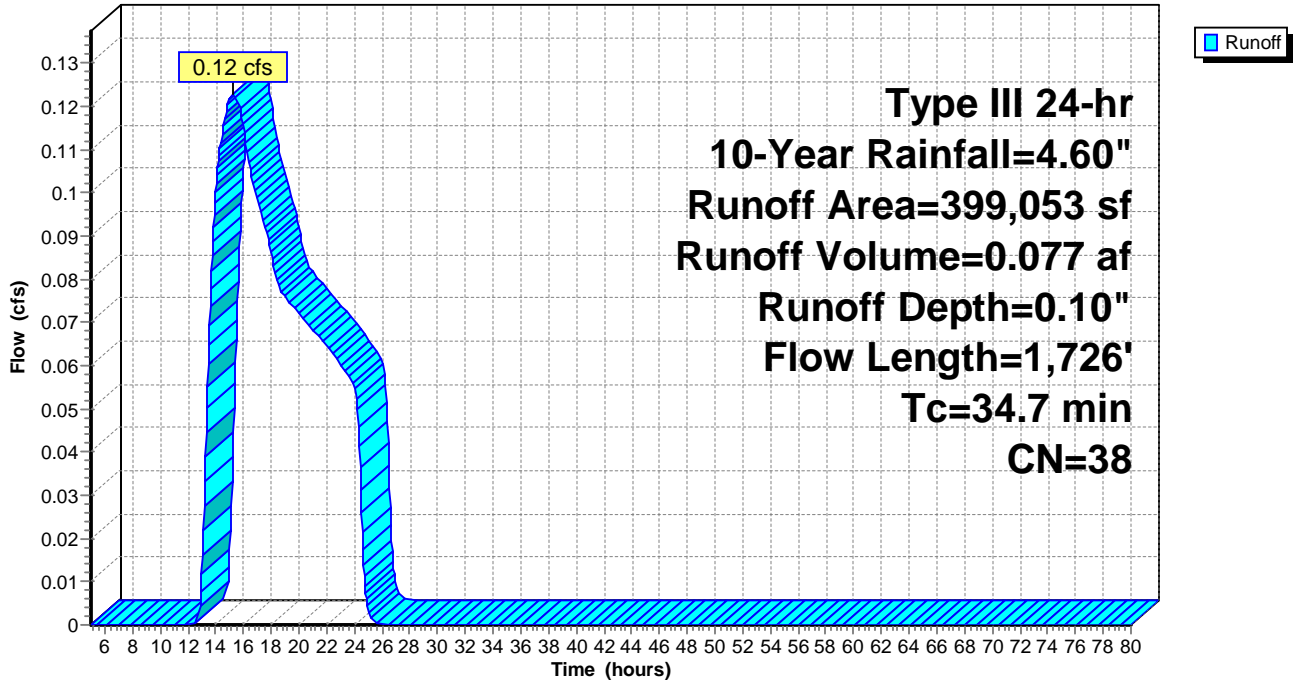
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.60"

Area (sf)	CN	Description
275,758	30	Woods, Good, HSG A
114,477	55	Woods, Good, HSG B
4,576	70	Woods, Good, HSG C
998	30	Meadow, non-grazed, HSG A
3,244	71	Meadow, non-grazed, HSG C
399,053	38	Weighted Average
399,053		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.1228	0.14		Sheet Flow, Sheet Flow
					Woods: Light underbrush n= 0.400 P2= 3.00"
2.2	234	0.1293	1.80		Shallow Concentrated Flow, Shallow Conc. 1
					Woodland Kv= 5.0 fps
0.8	76	0.1007	1.59		Shallow Concentrated Flow, Shallow Conc. 2
					Woodland Kv= 5.0 fps
2.0	191	0.1005	1.59		Shallow Concentrated Flow, Shallow Conc. 3
					Woodland Kv= 5.0 fps
2.6	163	0.0443	1.05		Shallow Concentrated Flow, Shallow Conc. 4
					Woodland Kv= 5.0 fps
1.5	114	0.0656	1.28		Shallow Concentrated Flow, Shallow Conc. 5
					Woodland Kv= 5.0 fps
3.4	331	0.1026	1.60		Shallow Concentrated Flow, Shallow Conc. 6
					Woodland Kv= 5.0 fps
6.2	261	0.0195	0.70		Shallow Concentrated Flow, Shallow Conc. 7
					Woodland Kv= 5.0 fps
3.2	153	0.0250	0.79		Shallow Concentrated Flow, Shallow Conc. 8
					Woodland Kv= 5.0 fps
6.6	153	0.0059	0.38		Shallow Concentrated Flow, Shallow Conc. 9
					Woodland Kv= 5.0 fps
34.7	1,726	Total			

Subcatchment 3S: EX-DA-3 - Northwest Sub-watershed

Hydrograph



CharltonSolar Existing Conditions

Prepared by BETA Group Inc.

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Type III 24-hr 25-Year Rainfall=5.30"

Printed 7/31/2018

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Summary for Subcatchment 1S: EX-DA-1 - East Watershed

Runoff = 3.85 cfs @ 12.29 hrs, Volume= 0.468 af, Depth= 1.13"

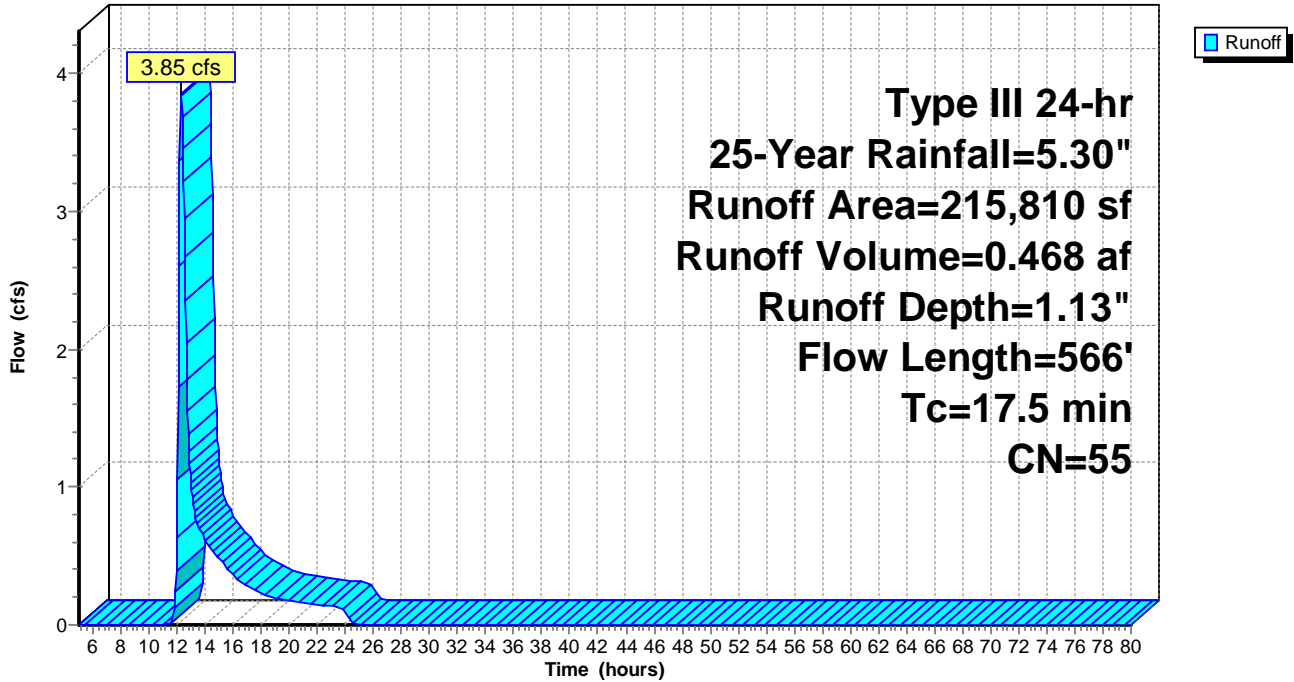
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
215,810	55	Woods, Good, HSG B
215,810		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.0276	0.07		Sheet Flow, Sheet Flow 1 Woods: Light underbrush n= 0.400 P2= 3.00"
0.8	74	0.1045	1.62		Shallow Concentrated Flow, Shallow Conc. 1 Woodland Kv= 5.0 fps
0.7	88	0.1806	2.12		Shallow Concentrated Flow, Shallow Conc. 2 Woodland Kv= 5.0 fps
0.3	18	0.0556	1.18		Shallow Concentrated Flow, Shallow Conc. 3 Woodland Kv= 5.0 fps
0.1	9	0.1833	2.14		Shallow Concentrated Flow, Shallow Conc. 4 Woodland Kv= 5.0 fps
1.5	104	0.0532	1.15		Shallow Concentrated Flow, Shallow Conc. 5 Woodland Kv= 5.0 fps
2.9	223	0.0656	1.28		Shallow Concentrated Flow, Shallow Conc. 6 Woodland Kv= 5.0 fps
17.5	566	Total			

Subcatchment 1S: EX-DA-1 - East Watershed

Hydrograph



CharltonSolar Existing Conditions

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Type III 24-hr 25-Year Rainfall=5.30"

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Summary for Subcatchment 2S: EX-DA-2 - West Sub-Watershed

Runoff = 0.23 cfs @ 12.71 hrs, Volume= 0.095 af, Depth= 0.26"

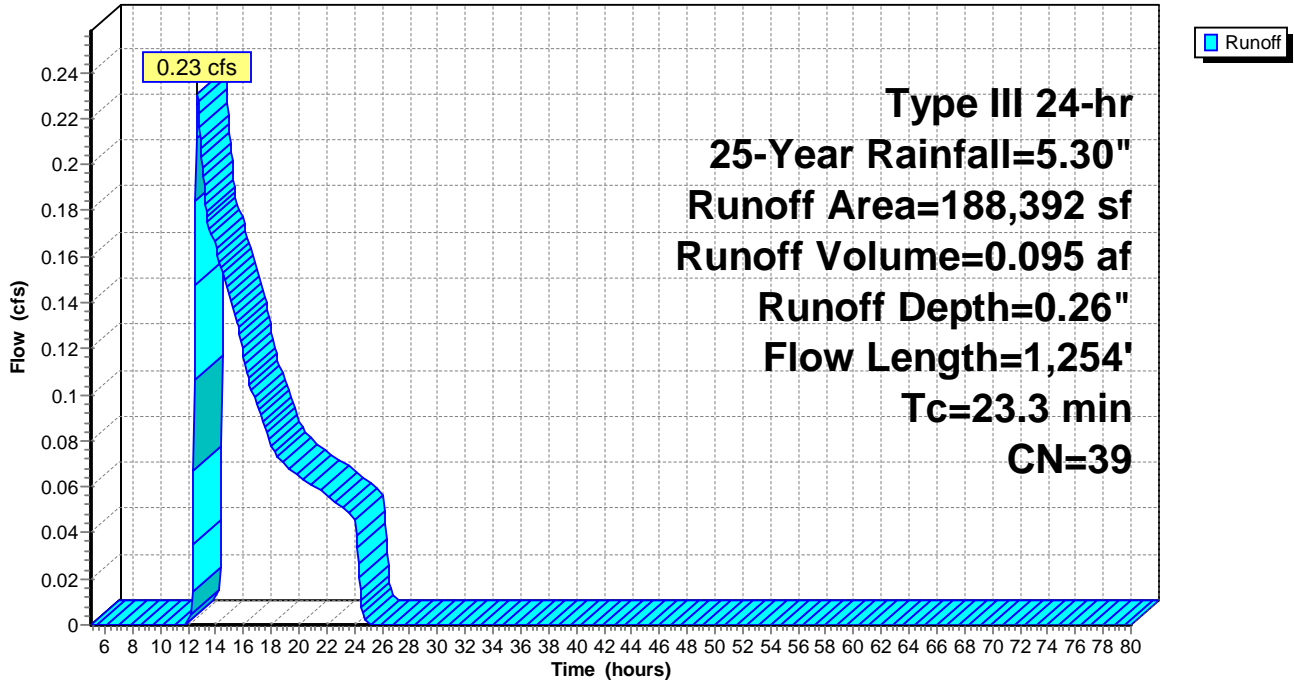
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
117,520	30	Woods, Good, HSG A
70,872	55	Woods, Good, HSG B
188,392	39	Weighted Average
188,392		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	50	0.0620	0.10		Sheet Flow, Sheet Flow 1 Woods: Light underbrush n= 0.400 P2= 3.00"
1.6	155	0.1023	1.60		Shallow Concentrated Flow, Shallow Conc. 1 Woodland Kv= 5.0 fps
2.1	119	0.0372	0.96		Shallow Concentrated Flow, Shallow Conc. 2 Woodland Kv= 5.0 fps
2.0	284	0.2238	2.37		Shallow Concentrated Flow, Shallow Conc. 3 Woodland Kv= 5.0 fps
3.8	322	0.0805	1.42		Shallow Concentrated Flow, Shallow Conc. 4 Woodland Kv= 5.0 fps
5.7	324	0.0359	0.95		Shallow Concentrated Flow, Shallow Conc. 5 Woodland Kv= 5.0 fps
23.3	1,254	Total			

Subcatchment 2S: EX-DA-2 - West Sub-Watershed

Hydrograph



CharltonSolar Existing Conditions

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Type III 24-hr 25-Year Rainfall=5.30"

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Summary for Subcatchment 3S: EX-DA-3 - Northwest Sub-watershed

Runoff = 0.31 cfs @ 13.19 hrs, Volume= 0.173 af, Depth= 0.23"

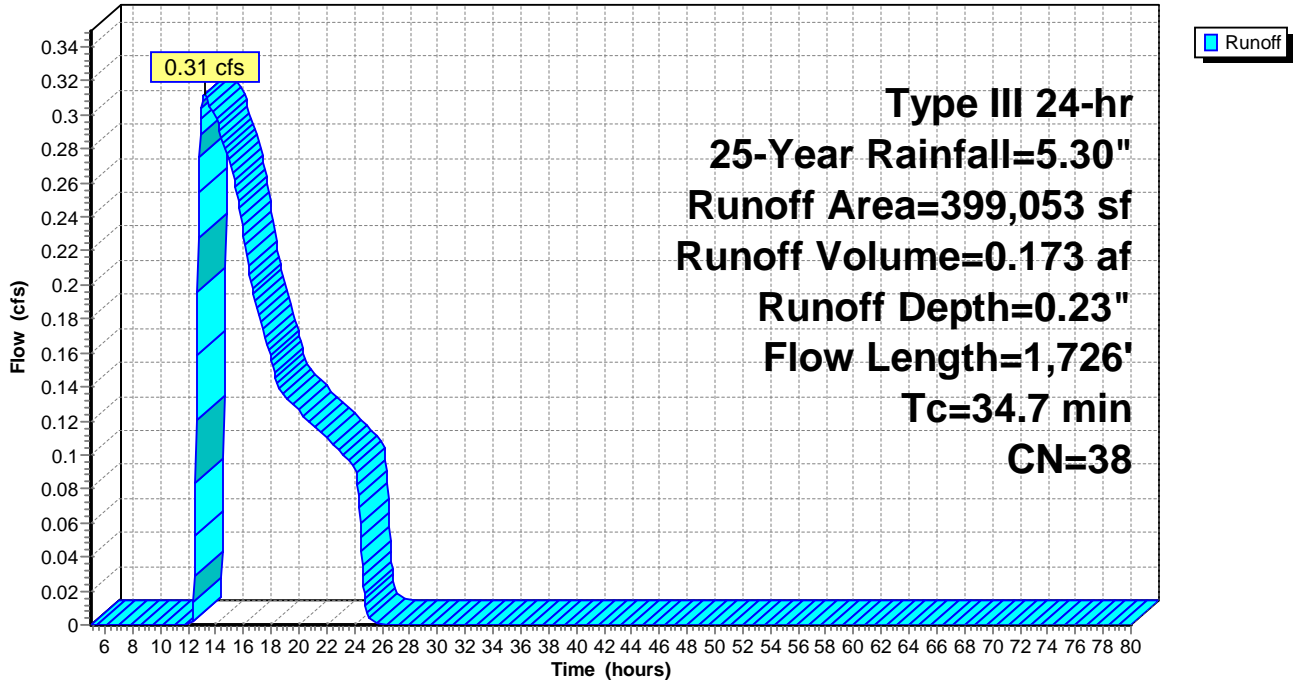
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
275,758	30	Woods, Good, HSG A
114,477	55	Woods, Good, HSG B
4,576	70	Woods, Good, HSG C
998	30	Meadow, non-grazed, HSG A
3,244	71	Meadow, non-grazed, HSG C
399,053	38	Weighted Average
399,053		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.1228	0.14		Sheet Flow, Sheet Flow
					Woods: Light underbrush n= 0.400 P2= 3.00"
2.2	234	0.1293	1.80		Shallow Concentrated Flow, Shallow Conc. 1
					Woodland Kv= 5.0 fps
0.8	76	0.1007	1.59		Shallow Concentrated Flow, Shallow Conc. 2
					Woodland Kv= 5.0 fps
2.0	191	0.1005	1.59		Shallow Concentrated Flow, Shallow Conc. 3
					Woodland Kv= 5.0 fps
2.6	163	0.0443	1.05		Shallow Concentrated Flow, Shallow Conc. 4
					Woodland Kv= 5.0 fps
1.5	114	0.0656	1.28		Shallow Concentrated Flow, Shallow Conc. 5
					Woodland Kv= 5.0 fps
3.4	331	0.1026	1.60		Shallow Concentrated Flow, Shallow Conc. 6
					Woodland Kv= 5.0 fps
6.2	261	0.0195	0.70		Shallow Concentrated Flow, Shallow Conc. 7
					Woodland Kv= 5.0 fps
3.2	153	0.0250	0.79		Shallow Concentrated Flow, Shallow Conc. 8
					Woodland Kv= 5.0 fps
6.6	153	0.0059	0.38		Shallow Concentrated Flow, Shallow Conc. 9
					Woodland Kv= 5.0 fps
34.7	1,726	Total			

Subcatchment 3S: EX-DA-3 - Northwest Sub-watershed

Hydrograph



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Type III 24-hr 50-Year Rainfall=6.00"

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Summary for Subcatchment 1S: EX-DA-1 - East Watershed

Runoff = 5.51 cfs @ 12.27 hrs, Volume= 0.627 af, Depth= 1.52"

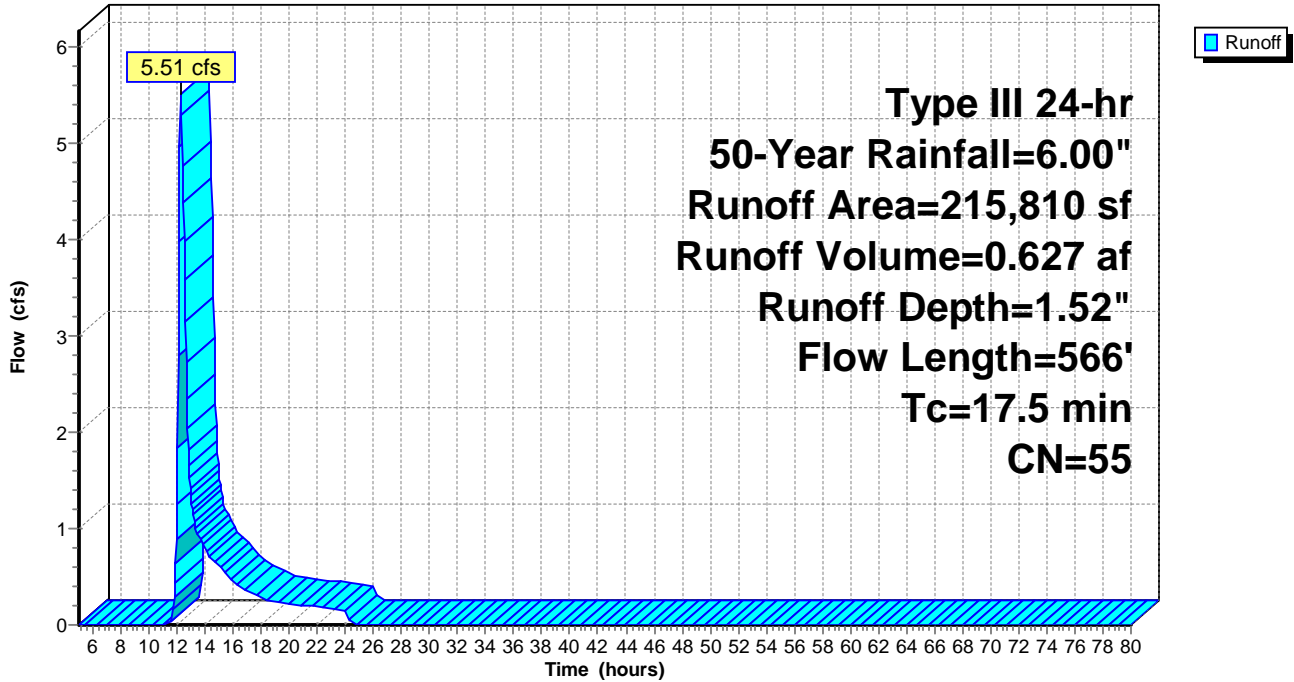
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.00"

Area (sf)	CN	Description
215,810	55	Woods, Good, HSG B
215,810		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.0276	0.07		Sheet Flow, Sheet Flow 1
					Woods: Light underbrush n= 0.400 P2= 3.00"
0.8	74	0.1045	1.62		Shallow Concentrated Flow, Shallow Conc. 1
					Woodland Kv= 5.0 fps
0.7	88	0.1806	2.12		Shallow Concentrated Flow, Shallow Conc. 2
					Woodland Kv= 5.0 fps
0.3	18	0.0556	1.18		Shallow Concentrated Flow, Shallow Conc. 3
					Woodland Kv= 5.0 fps
0.1	9	0.1833	2.14		Shallow Concentrated Flow, Shallow Conc. 4
					Woodland Kv= 5.0 fps
1.5	104	0.0532	1.15		Shallow Concentrated Flow, Shallow Conc. 5
					Woodland Kv= 5.0 fps
2.9	223	0.0656	1.28		Shallow Concentrated Flow, Shallow Conc. 6
					Woodland Kv= 5.0 fps
17.5	566	Total			

Subcatchment 1S: EX-DA-1 - East Watershed

Hydrograph



CharltonSolar Existing Conditions

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Type III 24-hr 50-Year Rainfall=6.00"

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Summary for Subcatchment 2S: EX-DA-2 - West Sub-Watershed

Runoff = 0.61 cfs @ 12.60 hrs, Volume= 0.161 af, Depth= 0.45"

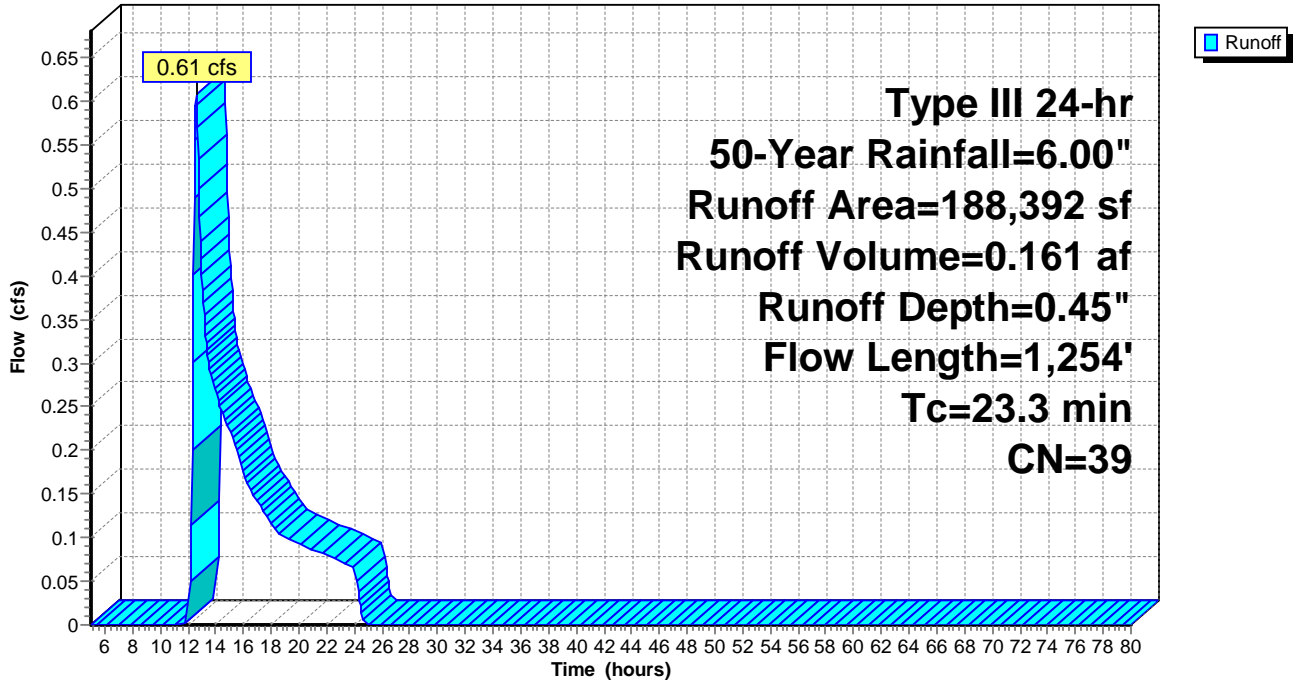
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.00"

Area (sf)	CN	Description
117,520	30	Woods, Good, HSG A
70,872	55	Woods, Good, HSG B
188,392	39	Weighted Average
188,392		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	50	0.0620	0.10		Sheet Flow, Sheet Flow 1 Woods: Light underbrush n= 0.400 P2= 3.00"
1.6	155	0.1023	1.60		Shallow Concentrated Flow, Shallow Conc. 1 Woodland Kv= 5.0 fps
2.1	119	0.0372	0.96		Shallow Concentrated Flow, Shallow Conc. 2 Woodland Kv= 5.0 fps
2.0	284	0.2238	2.37		Shallow Concentrated Flow, Shallow Conc. 3 Woodland Kv= 5.0 fps
3.8	322	0.0805	1.42		Shallow Concentrated Flow, Shallow Conc. 4 Woodland Kv= 5.0 fps
5.7	324	0.0359	0.95		Shallow Concentrated Flow, Shallow Conc. 5 Woodland Kv= 5.0 fps
23.3	1,254	Total			

Subcatchment 2S: EX-DA-2 - West Sub-Watershed

Hydrograph



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Type III 24-hr 50-Year Rainfall=6.00"

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Summary for Subcatchment 3S: EX-DA-3 - Northwest Sub-watershed

Runoff = 0.86 cfs @ 12.81 hrs, Volume= 0.300 af, Depth= 0.39"

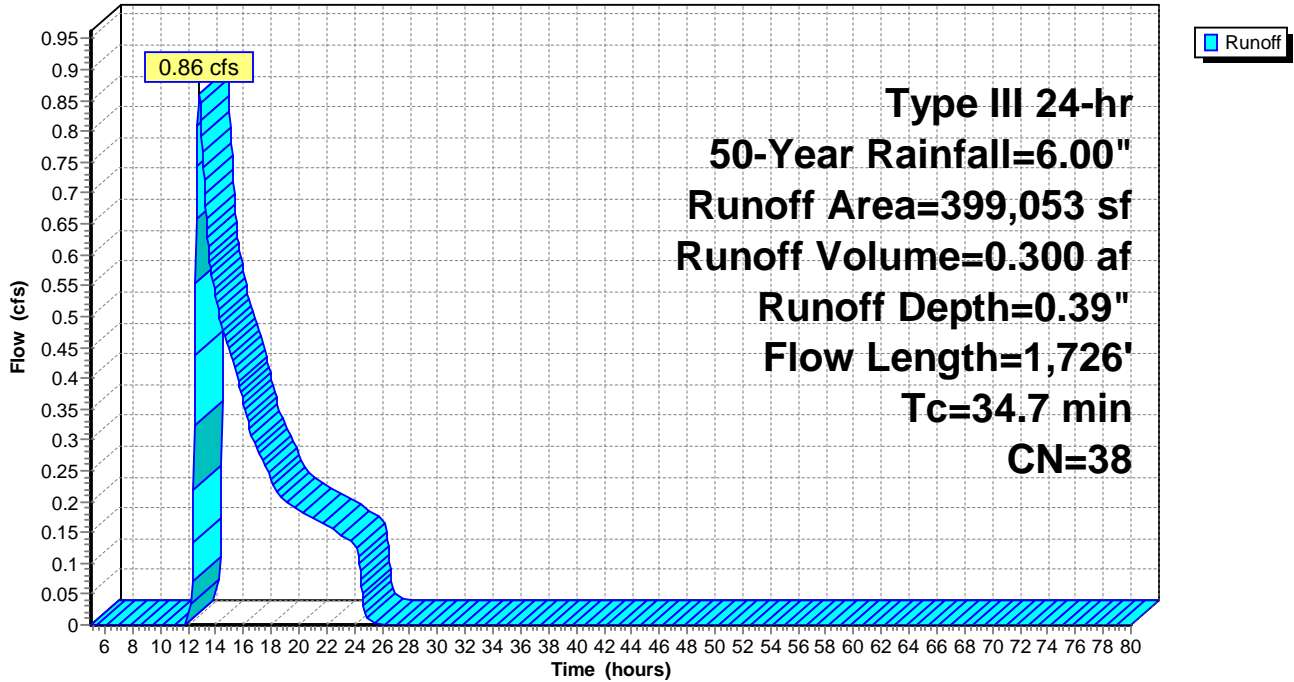
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.00"

Area (sf)	CN	Description
275,758	30	Woods, Good, HSG A
114,477	55	Woods, Good, HSG B
4,576	70	Woods, Good, HSG C
998	30	Meadow, non-grazed, HSG A
3,244	71	Meadow, non-grazed, HSG C
399,053	38	Weighted Average
399,053		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.1228	0.14		Sheet Flow, Sheet Flow
					Woods: Light underbrush n= 0.400 P2= 3.00"
2.2	234	0.1293	1.80		Shallow Concentrated Flow, Shallow Conc. 1
					Woodland Kv= 5.0 fps
0.8	76	0.1007	1.59		Shallow Concentrated Flow, Shallow Conc. 2
					Woodland Kv= 5.0 fps
2.0	191	0.1005	1.59		Shallow Concentrated Flow, Shallow Conc. 3
					Woodland Kv= 5.0 fps
2.6	163	0.0443	1.05		Shallow Concentrated Flow, Shallow Conc. 4
					Woodland Kv= 5.0 fps
1.5	114	0.0656	1.28		Shallow Concentrated Flow, Shallow Conc. 5
					Woodland Kv= 5.0 fps
3.4	331	0.1026	1.60		Shallow Concentrated Flow, Shallow Conc. 6
					Woodland Kv= 5.0 fps
6.2	261	0.0195	0.70		Shallow Concentrated Flow, Shallow Conc. 7
					Woodland Kv= 5.0 fps
3.2	153	0.0250	0.79		Shallow Concentrated Flow, Shallow Conc. 8
					Woodland Kv= 5.0 fps
6.6	153	0.0059	0.38		Shallow Concentrated Flow, Shallow Conc. 9
					Woodland Kv= 5.0 fps
34.7	1,726	Total			

Subcatchment 3S: EX-DA-3 - Northwest Sub-watershed

Hydrograph



CharltonSolar Existing Conditions

Type III 24-hr 100-Year Rainfall=6.50"

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Summary for Subcatchment 1S: EX-DA-1 - East Watershed

Runoff = 6.78 cfs @ 12.27 hrs, Volume= 0.749 af, Depth= 1.81"

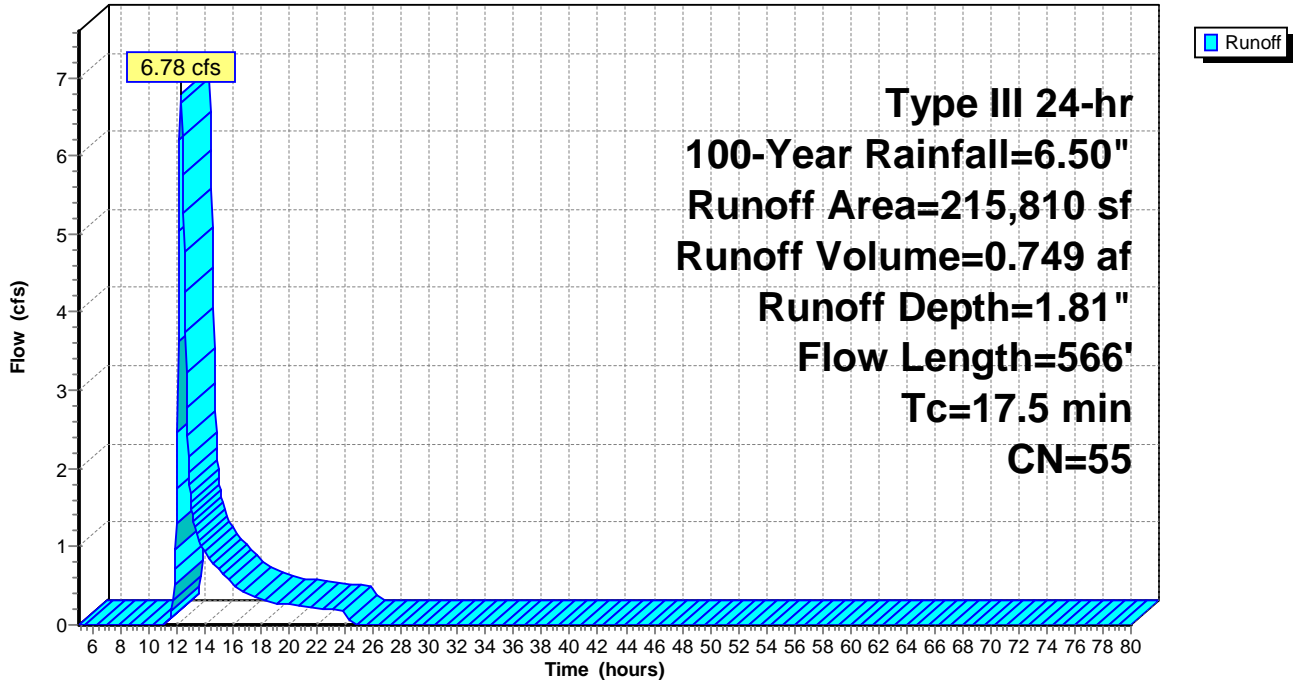
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
215,810	55	Woods, Good, HSG B
215,810		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.0276	0.07		Sheet Flow, Sheet Flow 1
					Woods: Light underbrush n= 0.400 P2= 3.00"
0.8	74	0.1045	1.62		Shallow Concentrated Flow, Shallow Conc. 1
					Woodland Kv= 5.0 fps
0.7	88	0.1806	2.12		Shallow Concentrated Flow, Shallow Conc. 2
					Woodland Kv= 5.0 fps
0.3	18	0.0556	1.18		Shallow Concentrated Flow, Shallow Conc. 3
					Woodland Kv= 5.0 fps
0.1	9	0.1833	2.14		Shallow Concentrated Flow, Shallow Conc. 4
					Woodland Kv= 5.0 fps
1.5	104	0.0532	1.15		Shallow Concentrated Flow, Shallow Conc. 5
					Woodland Kv= 5.0 fps
2.9	223	0.0656	1.28		Shallow Concentrated Flow, Shallow Conc. 6
					Woodland Kv= 5.0 fps
17.5	566	Total			

Subcatchment 1S: EX-DA-1 - East Watershed

Hydrograph



CharltonSolar Existing Conditions

Type III 24-hr 100-Year Rainfall=6.50"

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Summary for Subcatchment 2S: EX-DA-2 - West Sub-Watershed

Runoff = 0.97 cfs @ 12.56 hrs, Volume= 0.216 af, Depth= 0.60"

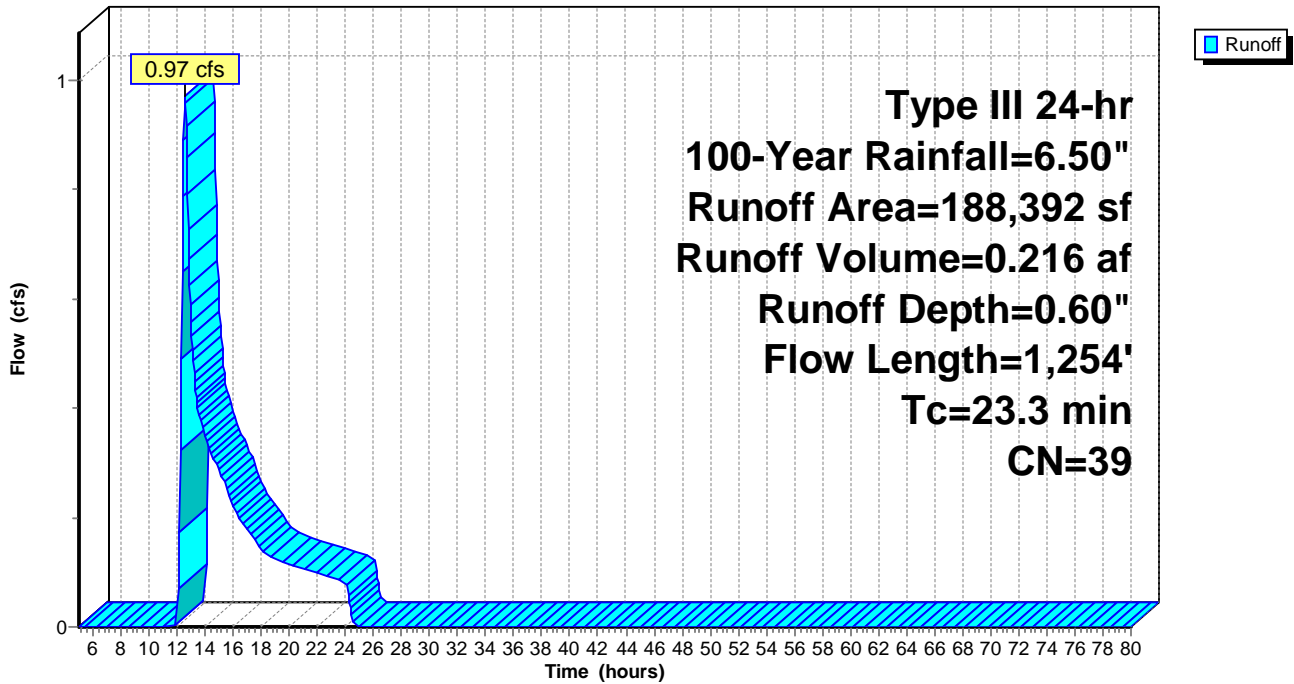
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
117,520	30	Woods, Good, HSG A
70,872	55	Woods, Good, HSG B
188,392	39	Weighted Average
188,392		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	50	0.0620	0.10		Sheet Flow, Sheet Flow 1 Woods: Light underbrush n= 0.400 P2= 3.00"
1.6	155	0.1023	1.60		Shallow Concentrated Flow, Shallow Conc. 1 Woodland Kv= 5.0 fps
2.1	119	0.0372	0.96		Shallow Concentrated Flow, Shallow Conc. 2 Woodland Kv= 5.0 fps
2.0	284	0.2238	2.37		Shallow Concentrated Flow, Shallow Conc. 3 Woodland Kv= 5.0 fps
3.8	322	0.0805	1.42		Shallow Concentrated Flow, Shallow Conc. 4 Woodland Kv= 5.0 fps
5.7	324	0.0359	0.95		Shallow Concentrated Flow, Shallow Conc. 5 Woodland Kv= 5.0 fps
23.3	1,254	Total			

Subcatchment 2S: EX-DA-2 - West Sub-Watershed

Hydrograph



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Type III 24-hr 100-Year Rainfall=6.50"

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Summary for Subcatchment 3S: EX-DA-3 - Northwest Sub-watershed

Runoff = 1.45 cfs @ 12.75 hrs, Volume= 0.409 af, Depth= 0.54"

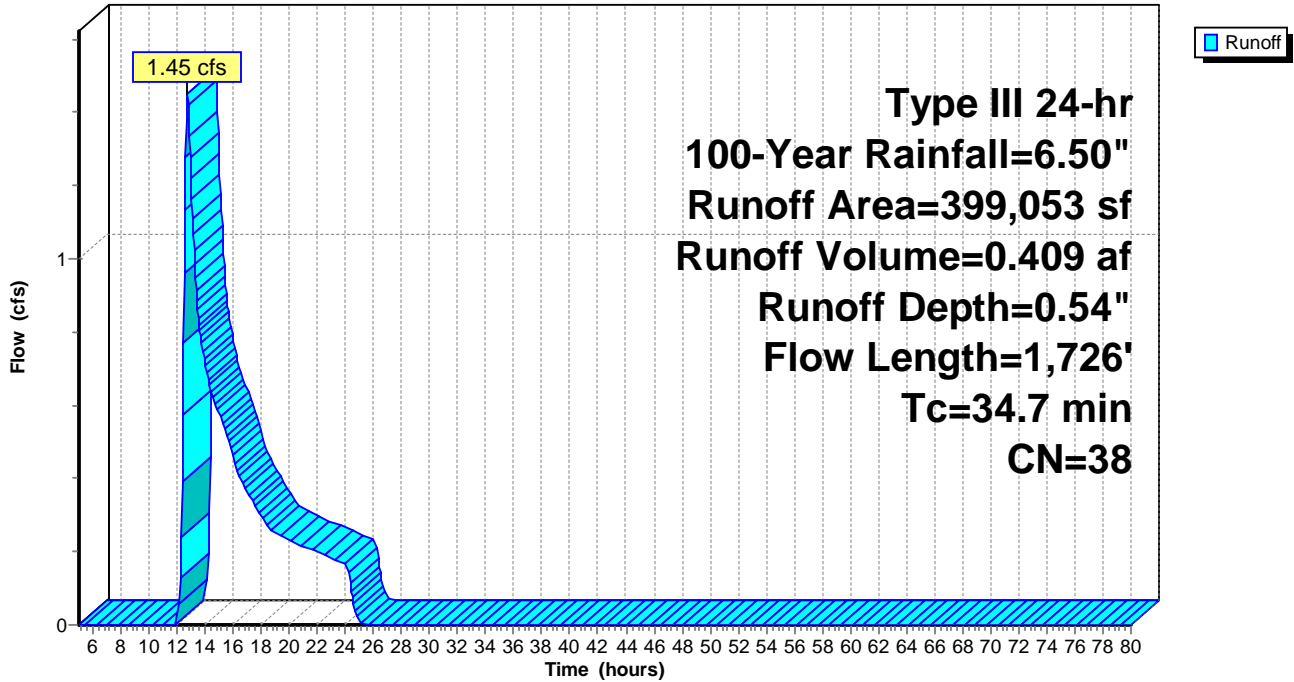
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
275,758	30	Woods, Good, HSG A
114,477	55	Woods, Good, HSG B
4,576	70	Woods, Good, HSG C
998	30	Meadow, non-grazed, HSG A
3,244	71	Meadow, non-grazed, HSG C
399,053	38	Weighted Average
399,053		100.00% Pervious Area

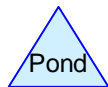
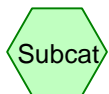
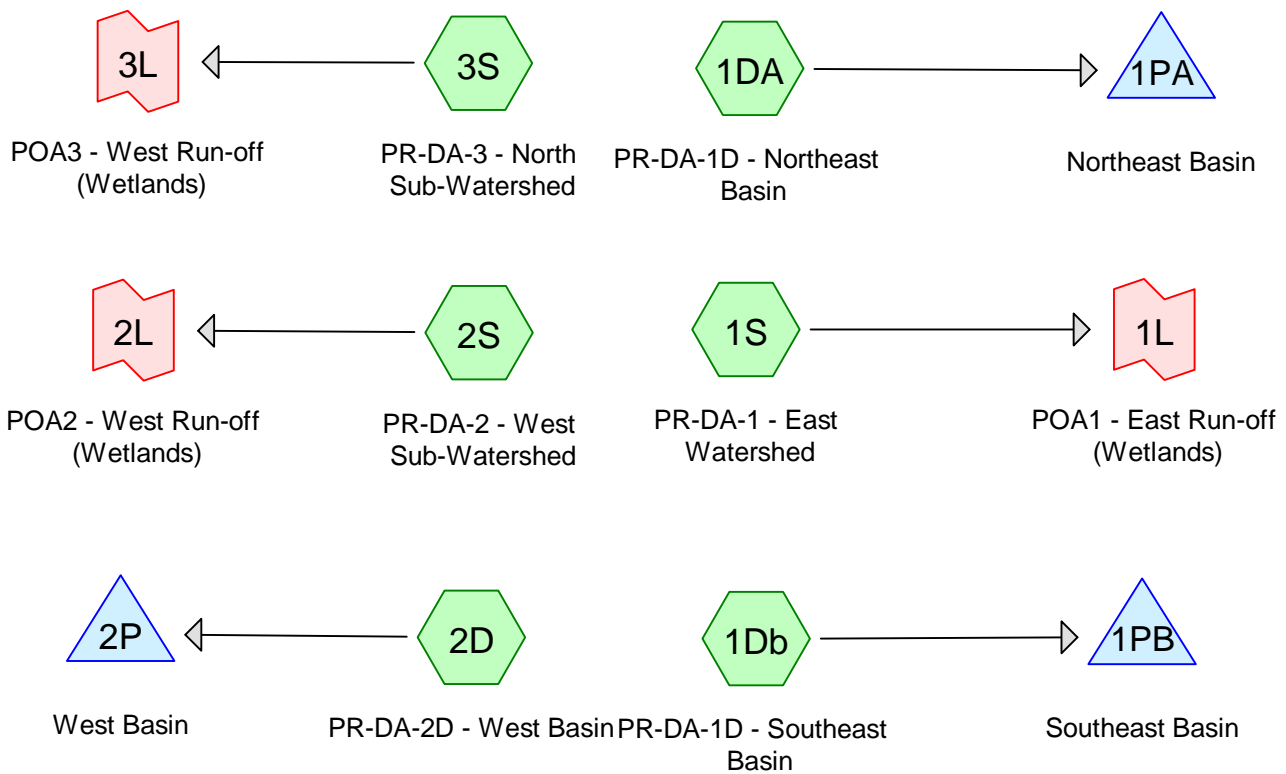
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.1228	0.14		Sheet Flow, Sheet Flow
					Woods: Light underbrush n= 0.400 P2= 3.00"
2.2	234	0.1293	1.80		Shallow Concentrated Flow, Shallow Conc. 1
					Woodland Kv= 5.0 fps
0.8	76	0.1007	1.59		Shallow Concentrated Flow, Shallow Conc. 2
					Woodland Kv= 5.0 fps
2.0	191	0.1005	1.59		Shallow Concentrated Flow, Shallow Conc. 3
					Woodland Kv= 5.0 fps
2.6	163	0.0443	1.05		Shallow Concentrated Flow, Shallow Conc. 4
					Woodland Kv= 5.0 fps
1.5	114	0.0656	1.28		Shallow Concentrated Flow, Shallow Conc. 5
					Woodland Kv= 5.0 fps
3.4	331	0.1026	1.60		Shallow Concentrated Flow, Shallow Conc. 6
					Woodland Kv= 5.0 fps
6.2	261	0.0195	0.70		Shallow Concentrated Flow, Shallow Conc. 7
					Woodland Kv= 5.0 fps
3.2	153	0.0250	0.79		Shallow Concentrated Flow, Shallow Conc. 8
					Woodland Kv= 5.0 fps
6.6	153	0.0059	0.38		Shallow Concentrated Flow, Shallow Conc. 9
					Woodland Kv= 5.0 fps
34.7	1,726	Total			

Subcatchment 3S: EX-DA-3 - Northwest Sub-watershed

Hydrograph



APPENDIX B – PROPOSED CONDITIONS CALCULATION



Routing Diagram for CharltonSolar Proposed Conditions
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CharltonSolar Proposed Conditions

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Type III 24-hr 2-Year Rainfall=3.00"

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Page 2

Summary for Subcatchment 1DA: PR-DA-1D - Northeast Basin

Runoff = 0.26 cfs @ 12.20 hrs, Volume= 0.041 af, Depth= 0.33"

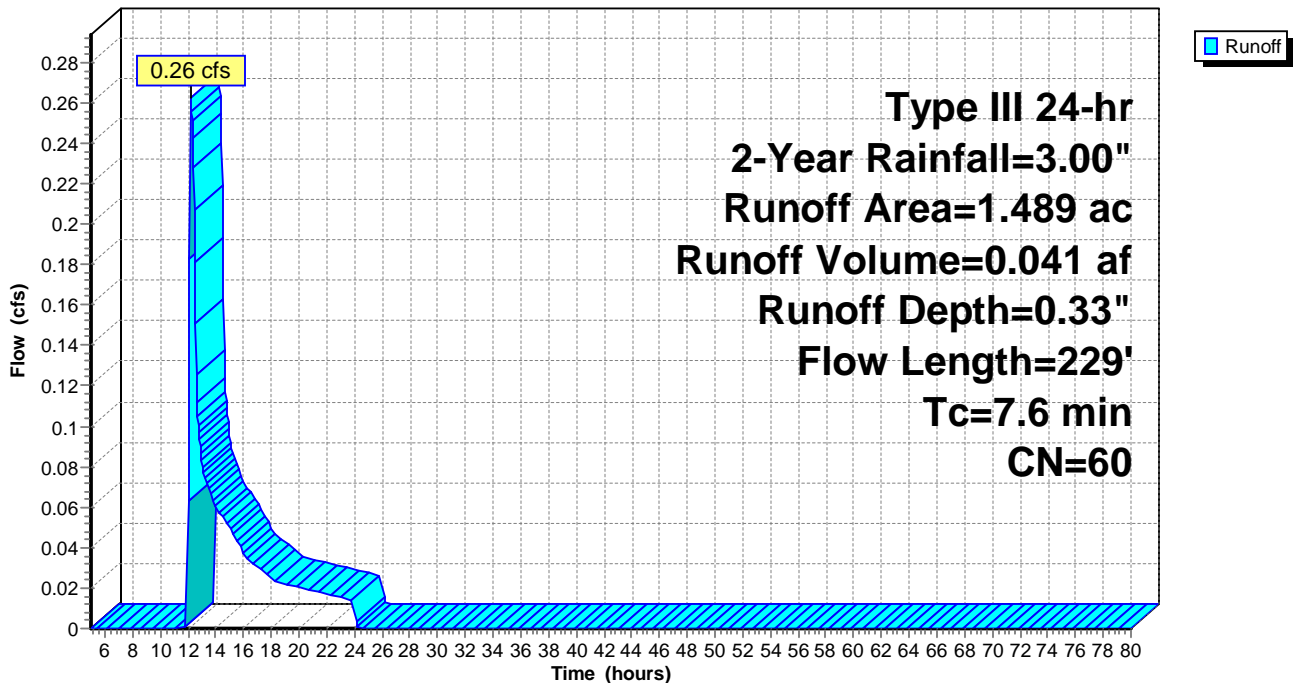
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (ac)	CN	Description
1.359	58	Meadow, non-grazed, HSG B
0.130	85	Gravel roads, HSG B
1.489	60	Weighted Average
1.489		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	50	0.0378	0.13		Sheet Flow, Sheet Flow 1 Grass: Dense n= 0.240 P2= 3.00"
0.5	84	0.1524	2.73		Shallow Concentrated Flow, Shallow Conc. 1 Short Grass Pasture Kv= 7.0 fps
0.3	55	0.2042	3.16		Shallow Concentrated Flow, Shallow Conc. 2 Short Grass Pasture Kv= 7.0 fps
0.1	26	0.0335	2.95		Shallow Concentrated Flow, Shallow Conc. 3 Unpaved Kv= 16.1 fps
0.1	14	0.2114	2.30		Shallow Concentrated Flow, Shallow Conc. 4 Woodland Kv= 5.0 fps
7.6	229	Total			

Subcatchment 1DA: PR-DA-1D - Northeast Basin

Hydrograph



CharltonSolar Proposed Conditions

Type III 24-hr 2-Year Rainfall=3.00"

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Summary for Subcatchment 1Db: PR-DA-1D - Southeast Basin

Runoff = 0.30 cfs @ 12.24 hrs, Volume= 0.050 af, Depth= 0.33"

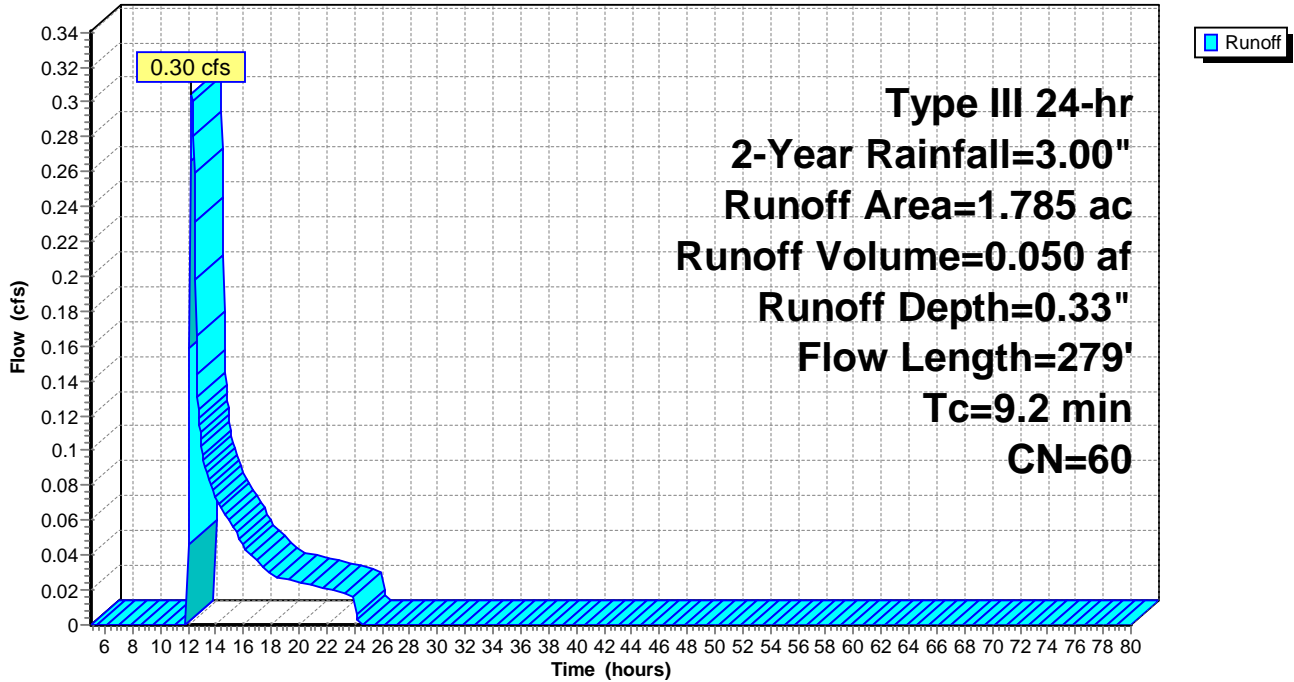
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.00"

Area (ac)	CN	Description
1.629	58	Meadow, non-grazed, HSG B
0.156	85	Gravel roads, HSG B
1.785	60	Weighted Average
1.785		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	50	0.0292	0.11		Sheet Flow, Sheet Flow 1 Grass: Dense n= 0.240 P2= 3.00"
0.5	78	0.1623	2.82		Shallow Concentrated Flow, Shallow Conc. 1 Short Grass Pasture Kv= 7.0 fps
0.2	48	0.2594	3.57		Shallow Concentrated Flow, Shallow Conc. 2 Short Grass Pasture Kv= 7.0 fps
0.5	38	0.0384	1.37		Shallow Concentrated Flow, Shallow Conc. 3 Short Grass Pasture Kv= 7.0 fps
0.3	18	0.0033	0.92		Shallow Concentrated Flow, Shallow Conc. 4 Unpaved Kv= 16.1 fps
0.1	10	0.0860	2.05		Shallow Concentrated Flow, Shallow Conc. 5 Short Grass Pasture Kv= 7.0 fps
0.3	37	0.1289	1.80		Shallow Concentrated Flow, Shallow Conc. 6 Woodland Kv= 5.0 fps
9.2	279	Total			

Subcatchment 1Db: PR-DA-1D - Southeast Basin

Hydrograph



CharltonSolar Proposed Conditions

Type III 24-hr 2-Year Rainfall=3.00"

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Summary for Subcatchment 1S: PR-DA-1 - East Watershed

Runoff = 0.28 cfs @ 12.35 hrs, Volume= 0.048 af, Depth= 0.33"

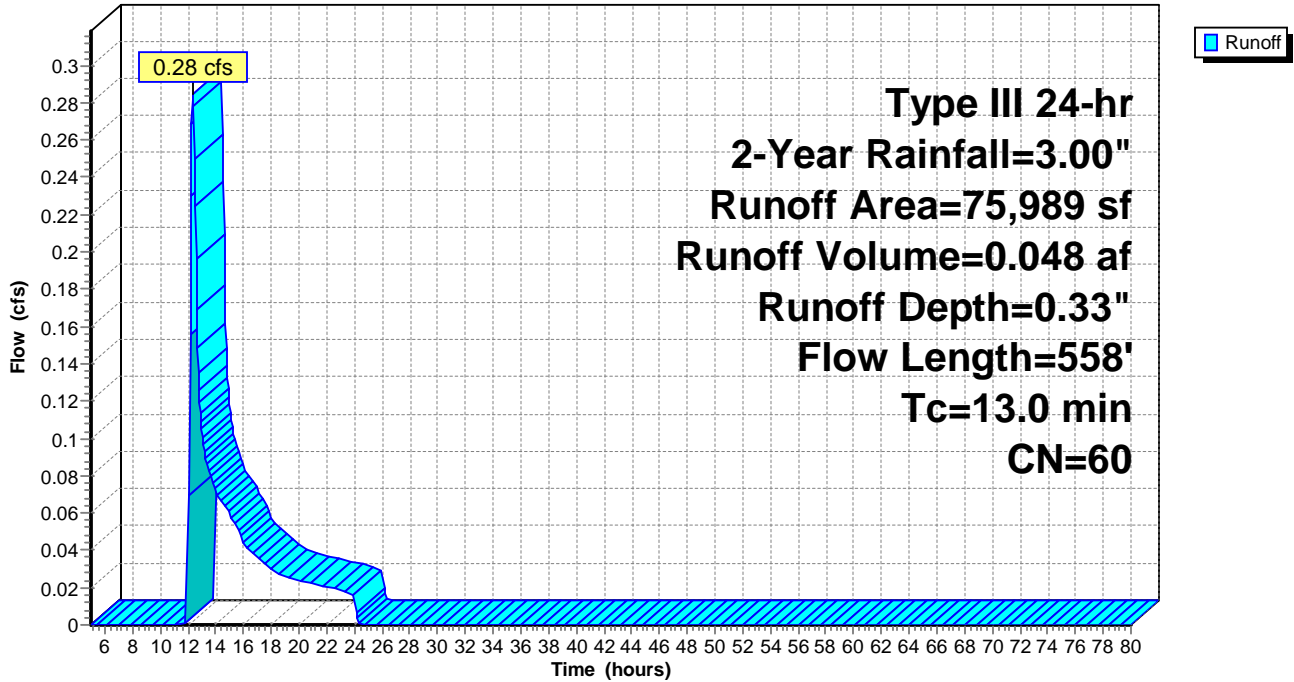
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
70,152	58	Meadow, non-grazed, HSG B
5,837	85	Gravel roads, HSG B
75,989	60	Weighted Average
75,989		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0276	0.11		Sheet Flow, Sheet Flow 1 Grass: Dense n= 0.240 P2= 3.00"
0.6	75	0.1045	2.26		Shallow Concentrated Flow, Shallow Conc. 1 Short Grass Pasture Kv= 7.0 fps
0.5	84	0.1892	3.04		Shallow Concentrated Flow, Shallow Conc. 2 Short Grass Pasture Kv= 7.0 fps
0.1	18	0.0556	3.80		Shallow Concentrated Flow, Shallow Conc. 3 Unpaved Kv= 16.1 fps
0.1	9	0.1833	3.00		Shallow Concentrated Flow, Shallow Conc. 4 Short Grass Pasture Kv= 7.0 fps
1.4	99	0.0557	1.18		Shallow Concentrated Flow, Shallow Conc. 5 Woodland Kv= 5.0 fps
2.9	223	0.0656	1.28		Shallow Concentrated Flow, Shallow Conc. 6 Woodland Kv= 5.0 fps
13.0	558	Total			

Subcatchment 1S: PR-DA-1 - East Watershed

Hydrograph



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Type III 24-hr 2-Year Rainfall=3.00"

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Summary for Subcatchment 2D: PR-DA-2D - West Basin

Runoff = 0.02 cfs @ 15.27 hrs, Volume= 0.011 af, Depth= 0.05"

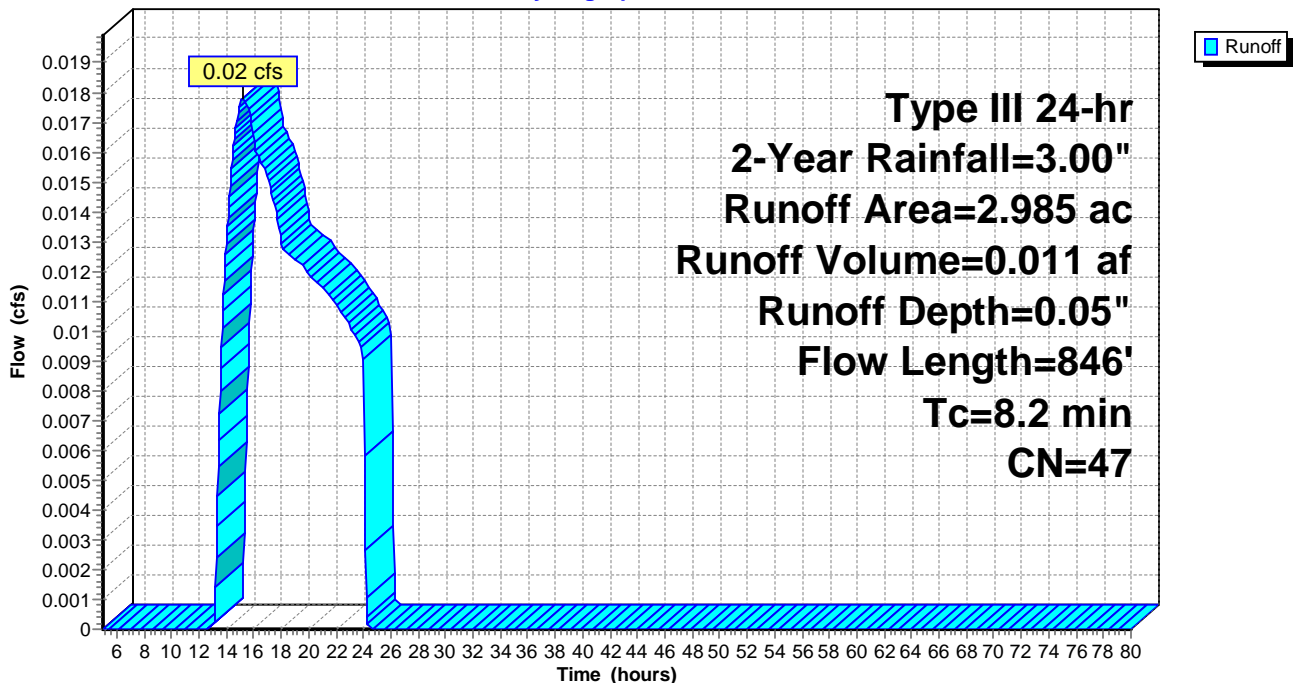
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (ac)	CN	Description
1.223	30	Meadow, non-grazed, HSG A
1.705	58	Meadow, non-grazed, HSG B
0.057	85	Gravel roads, HSG B
2.985	47	Weighted Average
2.985		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	50	0.1198	0.20		Sheet Flow, Sheet Flow 1 Grass: Dense n= 0.240 P2= 3.00"
0.3	52	0.1373	2.59		Shallow Concentrated Flow, Shallow Conc. 1 Short Grass Pasture Kv= 7.0 fps
3.3	690	0.0080	3.49	3.49	Channel Flow, Grassed Swale Area= 1.0 sf Perim= 2.0' r= 0.50' n= 0.024
0.5	54	0.1481	1.92		Shallow Concentrated Flow, Shallow Conc. 2 Woodland Kv= 5.0 fps
8.2	846	Total			

Subcatchment 2D: PR-DA-2D - West Basin

Hydrograph



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Type III 24-hr 2-Year Rainfall=3.00"

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Summary for Subcatchment 2S: PR-DA-2 - West Sub-Watershed

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

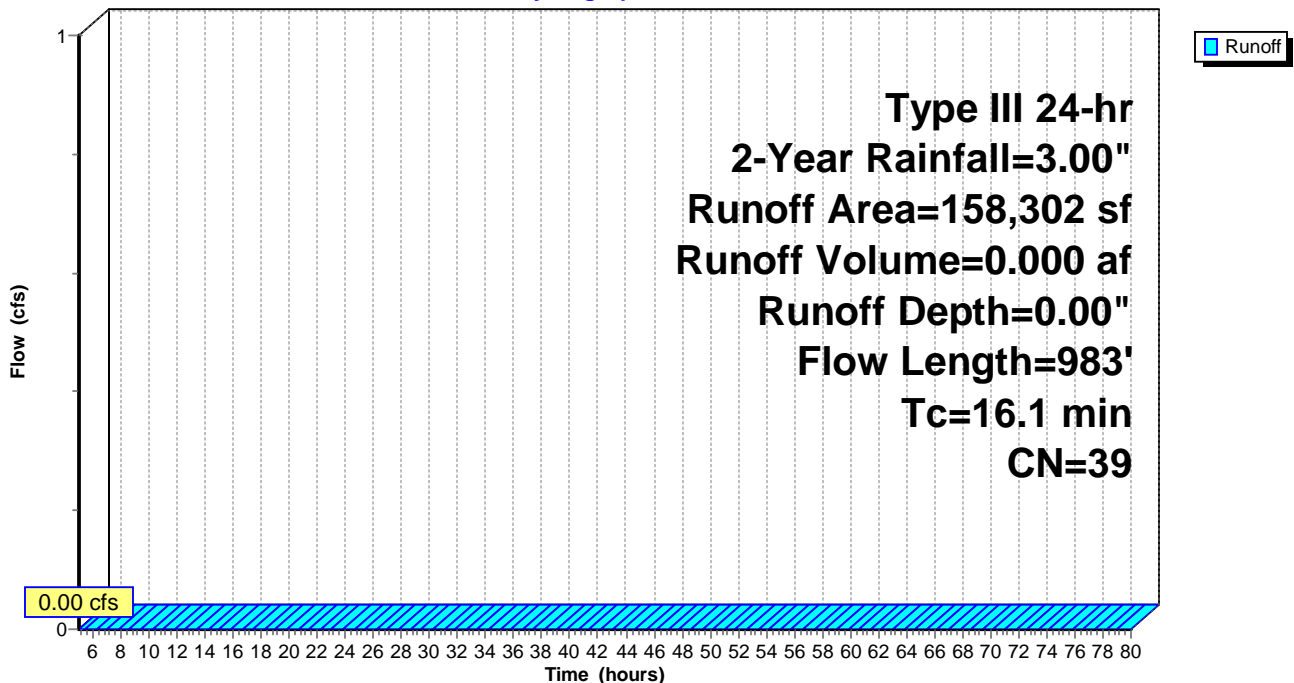
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
107,315	30	Meadow, non-grazed, HSG A
50,987	58	Meadow, non-grazed, HSG B
0	85	Gravel roads, HSG B
158,302	39	Weighted Average
158,302		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0900	0.18		Sheet Flow, Sheet Flow 1 Grass: Dense n= 0.240 P2= 3.00"
2.0	287	0.2228	2.36		Shallow Concentrated Flow, Shallow Conc. 1 Woodland Kv= 5.0 fps
3.8	322	0.0805	1.42		Shallow Concentrated Flow, Shallow Conc. 2 Woodland Kv= 5.0 fps
5.7	324	0.0359	0.95		Shallow Concentrated Flow, Shallow Conc. 3 Woodland Kv= 5.0 fps
16.1	983	Total			

Subcatchment 2S: PR-DA-2 - West Sub-Watershed

Hydrograph



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Type III 24-hr 2-Year Rainfall=3.00"

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Summary for Subcatchment 3S: PR-DA-3 - North Sub-Watershed

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
230,309	30	Meadow, non-grazed, HSG A
45,634	58	Meadow, non-grazed, HSG B
5,641	71	Meadow, non-grazed, HSG C
8,626	76	Gravel roads, HSG A
9,641	85	Gravel roads, HSG B
2,188	89	Gravel roads, HSG C
302,039	38	Weighted Average
302,039		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	50	0.1228	0.20		Sheet Flow, Sheet Flow
					Grass: Dense n= 0.240 P2= 3.00"
1.5	234	0.1293	2.52		Shallow Concentrated Flow, Shallow Conc. 1
					Short Grass Pasture Kv= 7.0 fps
0.8	76	0.1007	1.59		Shallow Concentrated Flow, Shallow Conc. 2
					Woodland Kv= 5.0 fps
2.0	191	0.1005	1.59		Shallow Concentrated Flow, Shallow Conc. 3
					Woodland Kv= 5.0 fps
2.6	163	0.0443	1.05		Shallow Concentrated Flow, Shallow Conc. 4
					Woodland Kv= 5.0 fps
1.5	114	0.0656	1.28		Shallow Concentrated Flow, Shallow Conc. 5
					Woodland Kv= 5.0 fps
3.4	331	0.1026	1.60		Shallow Concentrated Flow, Shallow Conc. 6
					Woodland Kv= 5.0 fps
6.2	261	0.0195	0.70		Shallow Concentrated Flow, Shallow Conc. 7
					Woodland Kv= 5.0 fps
3.2	153	0.0250	0.79		Shallow Concentrated Flow, Shallow Conc. 8
					Woodland Kv= 5.0 fps
6.6	153	0.0059	0.38		Shallow Concentrated Flow, Shallow Conc. 9
					Woodland Kv= 5.0 fps
31.9	1,726	Total			

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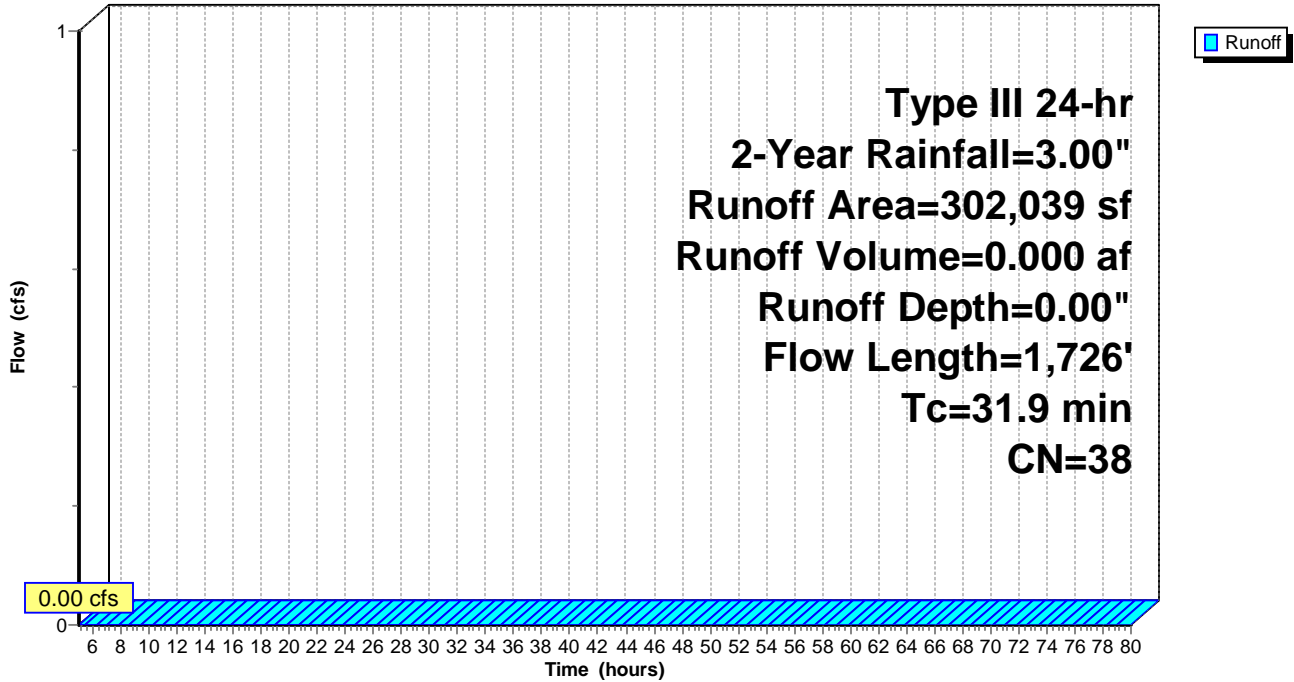
Type III 24-hr 2-Year Rainfall=3.00"

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Subcatchment 3S: PR-DA-3 - North Sub-Watershed

Hydrograph



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Type III 24-hr 2-Year Rainfall=3.00"

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Summary for Pond 1PA: Northeast Basin

Inflow Area = 1.489 ac, 0.00% Impervious, Inflow Depth = 0.33" for 2-Year event
Inflow = 0.26 cfs @ 12.20 hrs, Volume= 0.041 af
Outflow = 0.05 cfs @ 15.21 hrs, Volume= 0.041 af, Atten= 82%, Lag= 180.7 min
Discarded = 0.05 cfs @ 15.21 hrs, Volume= 0.041 af

Routing by Stor-Ind method, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Peak Elev= 926.14' @ 15.21 hrs Surf.Area= 3,808 sf Storage= 528 cf

Plug-Flow detention time= 121.5 min calculated for 0.041 af (100% of inflow)
Center-of-Mass det. time= 121.3 min (1,052.7 - 931.4)

Volume	Invert	Avail.Storage	Storage Description
#1	926.00'	9,516 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
926.00	3,654	0	0
927.00	4,744	4,199	4,199
928.00	5,890	5,317	9,516

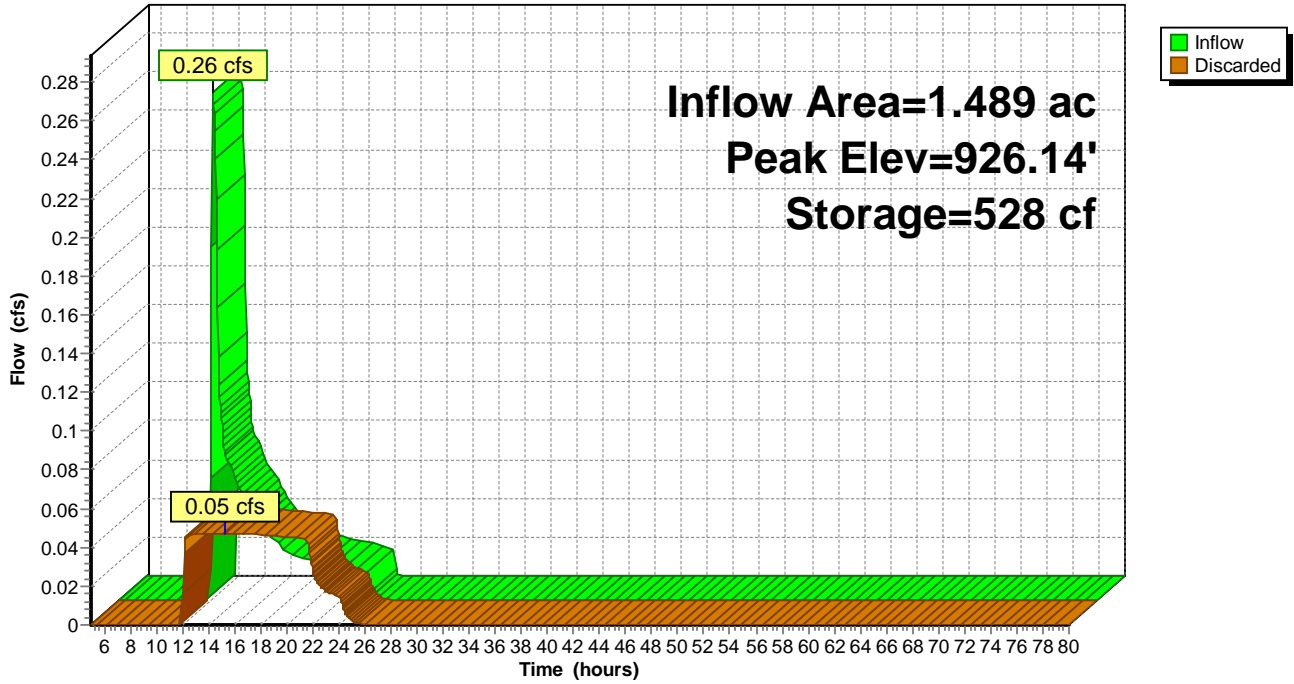
Device	Routing	Invert	Outlet Devices
#1	Discarded	926.00'	0.520 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 922.00'

Discarded OutFlow Max=0.05 cfs @ 15.21 hrs HW=926.14' (Free Discharge)

↑**1=Exfiltration** (Controls 0.05 cfs)

Pond 1PA: Northeast Basin

Hydrograph



CharltonSolar Proposed Conditions

Type III 24-hr 2-Year Rainfall=3.00"

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Summary for Pond 1PB: Southeast Basin

Inflow Area = 1.785 ac, 0.00% Impervious, Inflow Depth = 0.33" for 2-Year event
 Inflow = 0.30 cfs @ 12.24 hrs, Volume= 0.050 af
 Outflow = 0.11 cfs @ 12.95 hrs, Volume= 0.050 af, Atten= 65%, Lag= 42.2 min
 Discarded = 0.11 cfs @ 12.95 hrs, Volume= 0.050 af

Routing by Stor-Ind method, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
 Peak Elev= 919.04' @ 12.95 hrs Surf.Area= 8,777 sf Storage= 336 cf

Plug-Flow detention time= 26.7 min calculated for 0.050 af (100% of inflow)
 Center-of-Mass det. time= 26.8 min (959.6 - 932.9)

Volume	Invert	Avail.Storage	Storage Description
#1	919.00'	9,613 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

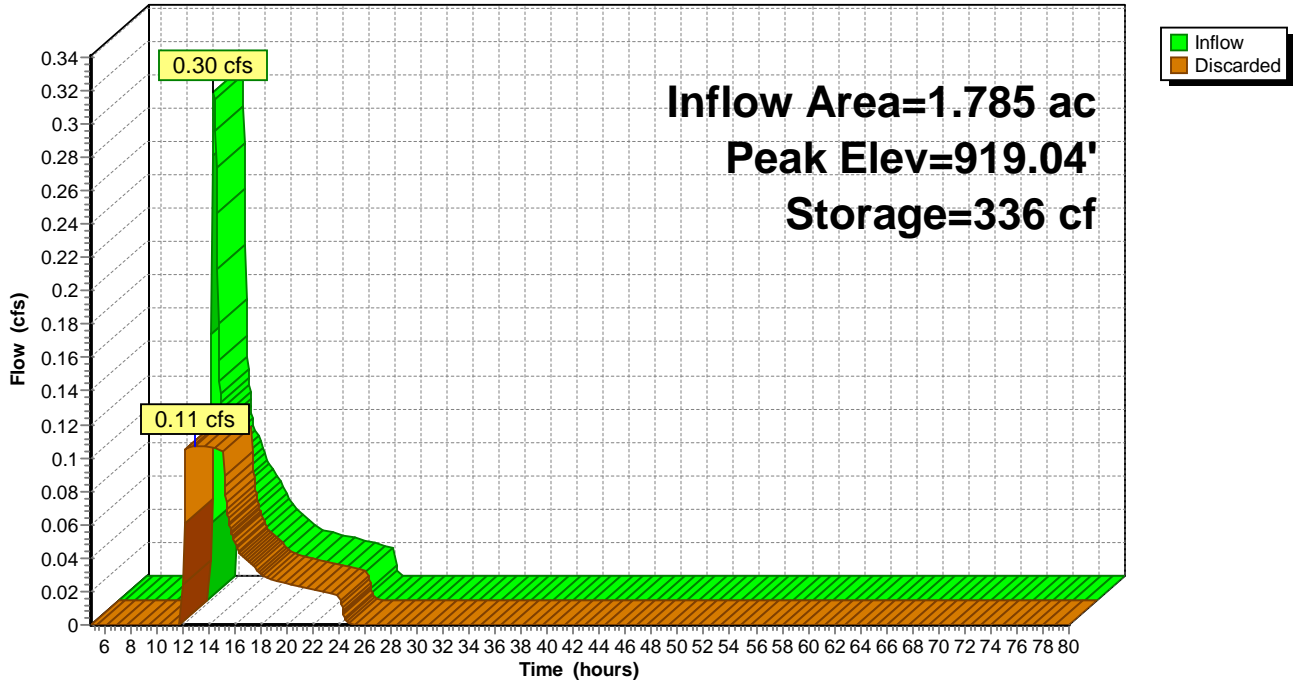
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
919.00	8,707	0	0
920.00	10,518	9,613	9,613

Device	Routing	Invert	Outlet Devices
#1	Discarded	919.00'	0.520 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 915.00'

Discarded OutFlow Max=0.11 cfs @ 12.95 hrs HW=919.04' (Free Discharge)
 ↑1=Exfiltration (Controls 0.11 cfs)

Pond 1PB: Southeast Basin

Hydrograph



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Type III 24-hr 2-Year Rainfall=3.00"

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Summary for Pond 2P: West Basin

Inflow Area = 2.985 ac, 0.00% Impervious, Inflow Depth = 0.05" for 2-Year event
 Inflow = 0.02 cfs @ 15.27 hrs, Volume= 0.011 af
 Outflow = 0.02 cfs @ 15.39 hrs, Volume= 0.011 af, Atten= 0%, Lag= 7.5 min
 Discarded = 0.02 cfs @ 15.39 hrs, Volume= 0.011 af

Routing by Stor-Ind method, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 928.00' @ 15.39 hrs Surf.Area= 5,826 sf Storage= 8 cf

Plug-Flow detention time= 7.6 min calculated for 0.011 af (100% of inflow)
 Center-of-Mass det. time= 7.6 min (1,106.4 - 1,098.8)

Volume	Invert	Avail.Storage	Storage Description
#1	928.00'	6,280 cf	Custom Stage Data (Prismatic) Listed below

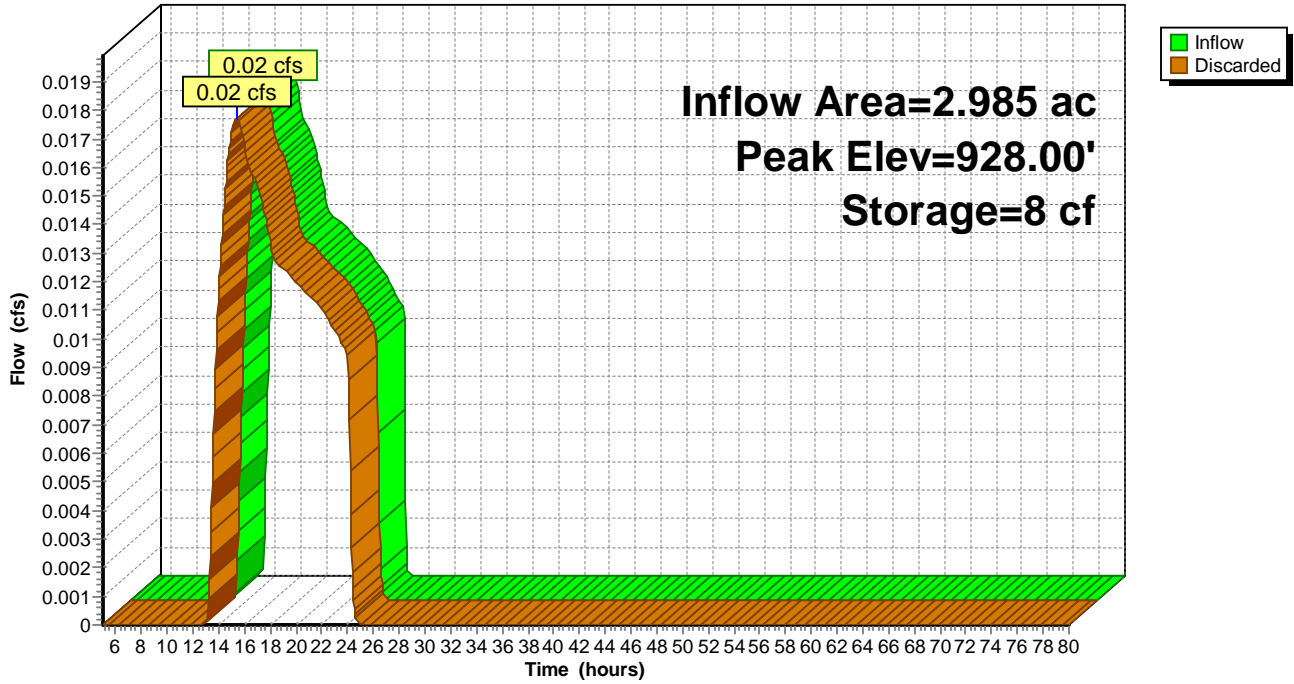
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
928.00	5,825	0	0
929.00	6,735	6,280	6,280

Device	Routing	Invert	Outlet Devices
#1	Discarded	928.00'	1.020 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 924.00'

Discarded OutFlow Max=0.14 cfs @ 15.39 hrs HW=928.00' (Free Discharge)
 ↑**1=Exfiltration** (Controls 0.14 cfs)

Pond 2P: West Basin

Hydrograph



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Type III 24-hr 10-Year Rainfall=4.60"

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Summary for Subcatchment 1DA: PR-DA-1D - Northeast Basin

Runoff = 1.48 cfs @ 12.13 hrs, Volume= 0.133 af, Depth= 1.07"

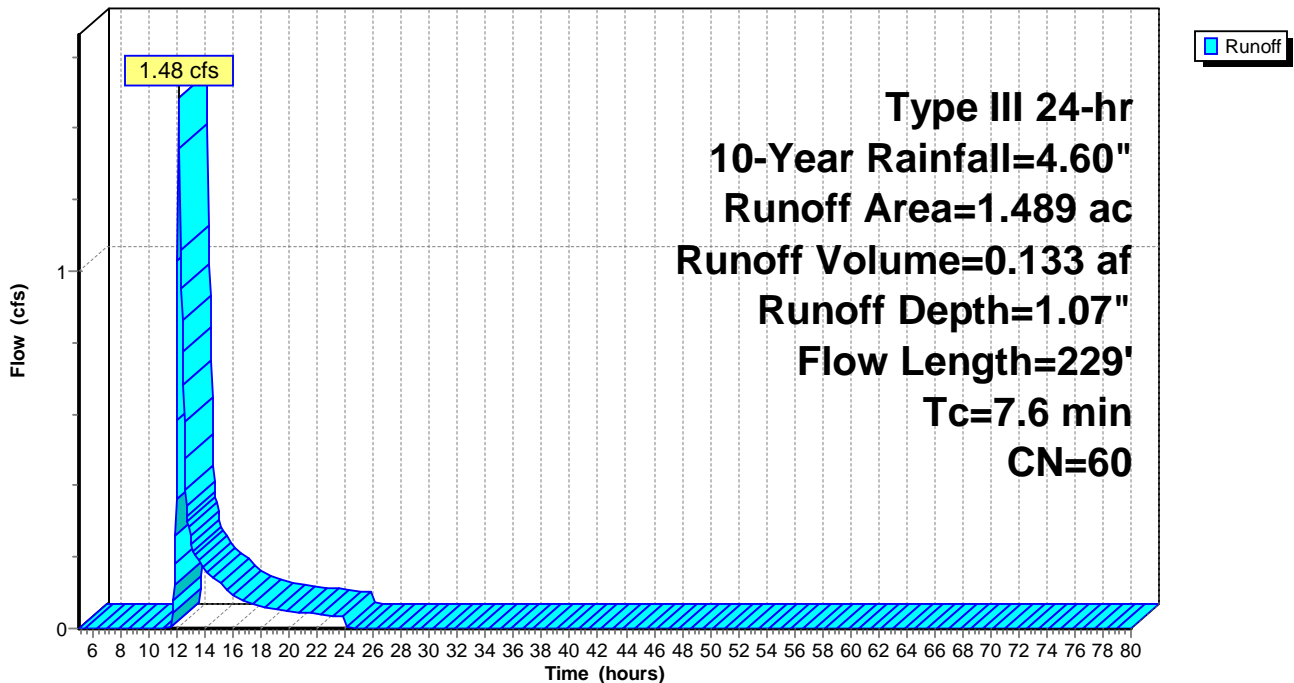
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.60"

Area (ac)	CN	Description
1.359	58	Meadow, non-grazed, HSG B
0.130	85	Gravel roads, HSG B
1.489	60	Weighted Average
1.489		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	50	0.0378	0.13		Sheet Flow, Sheet Flow 1 Grass: Dense n= 0.240 P2= 3.00"
0.5	84	0.1524	2.73		Shallow Concentrated Flow, Shallow Conc. 1 Short Grass Pasture Kv= 7.0 fps
0.3	55	0.2042	3.16		Shallow Concentrated Flow, Shallow Conc. 2 Short Grass Pasture Kv= 7.0 fps
0.1	26	0.0335	2.95		Shallow Concentrated Flow, Shallow Conc. 3 Unpaved Kv= 16.1 fps
0.1	14	0.2114	2.30		Shallow Concentrated Flow, Shallow Conc. 4 Woodland Kv= 5.0 fps
7.6	229	Total			

Subcatchment 1DA: PR-DA-1D - Northeast Basin

Hydrograph



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Type III 24-hr 10-Year Rainfall=4.60"

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Summary for Subcatchment 1Db: PR-DA-1D - Southeast Basin

Runoff = 1.71 cfs @ 12.15 hrs, Volume= 0.160 af, Depth= 1.07"

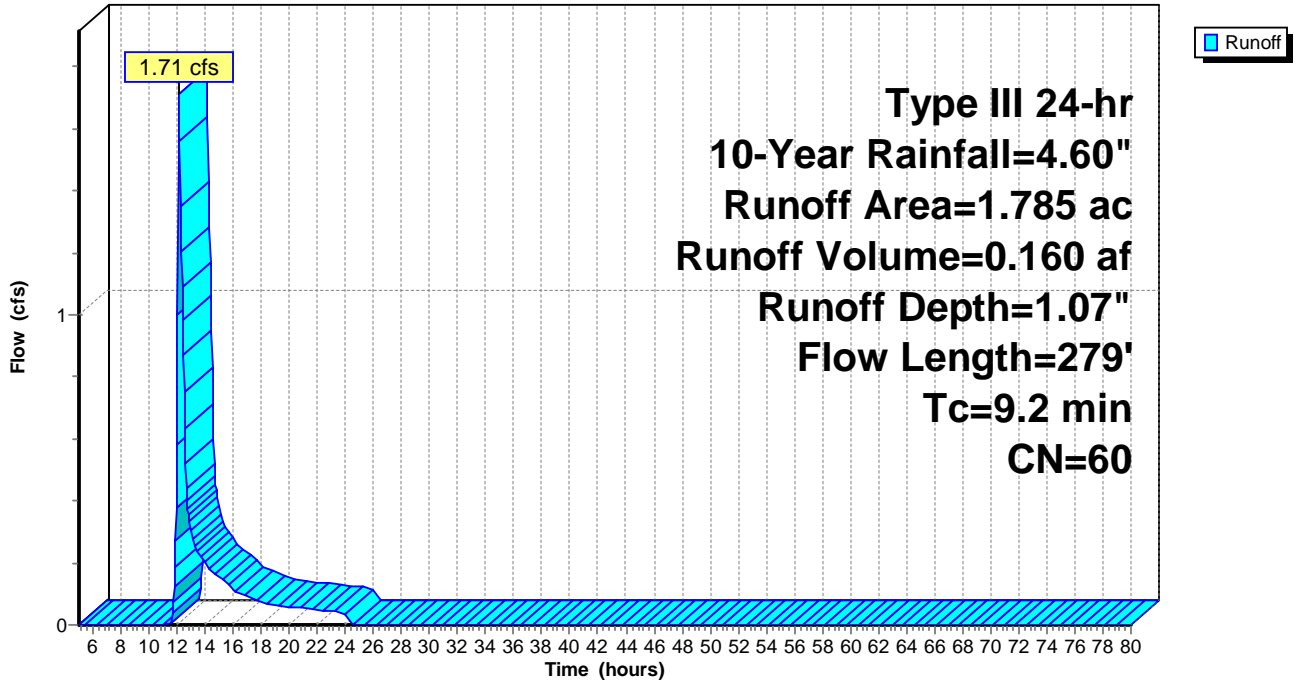
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Rainfall=4.60"

Area (ac)	CN	Description
1.629	58	Meadow, non-grazed, HSG B
0.156	85	Gravel roads, HSG B
1.785	60	Weighted Average
1.785		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	50	0.0292	0.11		Sheet Flow, Sheet Flow 1 Grass: Dense n= 0.240 P2= 3.00"
0.5	78	0.1623	2.82		Shallow Concentrated Flow, Shallow Conc. 1 Short Grass Pasture Kv= 7.0 fps
0.2	48	0.2594	3.57		Shallow Concentrated Flow, Shallow Conc. 2 Short Grass Pasture Kv= 7.0 fps
0.5	38	0.0384	1.37		Shallow Concentrated Flow, Shallow Conc. 3 Short Grass Pasture Kv= 7.0 fps
0.3	18	0.0033	0.92		Shallow Concentrated Flow, Shallow Conc. 4 Unpaved Kv= 16.1 fps
0.1	10	0.0860	2.05		Shallow Concentrated Flow, Shallow Conc. 5 Short Grass Pasture Kv= 7.0 fps
0.3	37	0.1289	1.80		Shallow Concentrated Flow, Shallow Conc. 6 Woodland Kv= 5.0 fps
9.2	279	Total			

Subcatchment 1Db: PR-DA-1D - Southeast Basin

Hydrograph



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Type III 24-hr 10-Year Rainfall=4.60"

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Summary for Subcatchment 1S: PR-DA-1 - East Watershed

Runoff = 1.49 cfs @ 12.21 hrs, Volume= 0.156 af, Depth= 1.07"

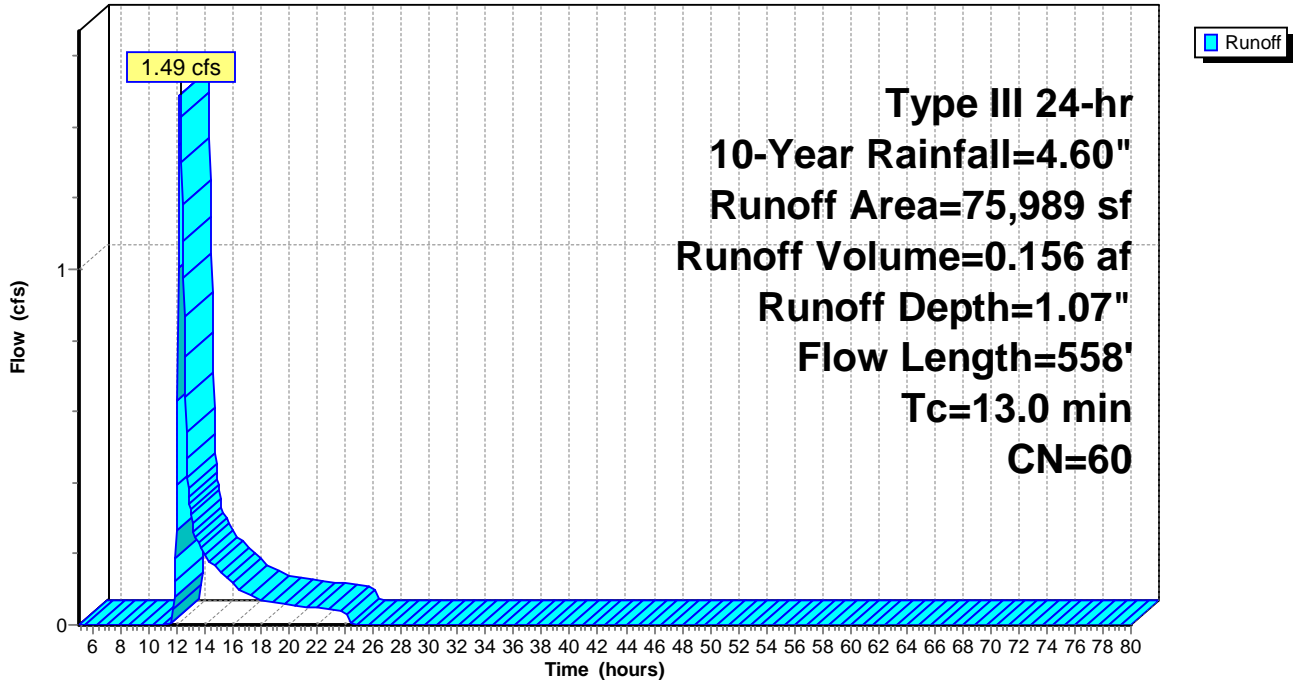
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.60"

Area (sf)	CN	Description
70,152	58	Meadow, non-grazed, HSG B
5,837	85	Gravel roads, HSG B
75,989	60	Weighted Average
75,989		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0276	0.11		Sheet Flow, Sheet Flow 1 Grass: Dense n= 0.240 P2= 3.00"
0.6	75	0.1045	2.26		Shallow Concentrated Flow, Shallow Conc. 1 Short Grass Pasture Kv= 7.0 fps
0.5	84	0.1892	3.04		Shallow Concentrated Flow, Shallow Conc. 2 Short Grass Pasture Kv= 7.0 fps
0.1	18	0.0556	3.80		Shallow Concentrated Flow, Shallow Conc. 3 Unpaved Kv= 16.1 fps
0.1	9	0.1833	3.00		Shallow Concentrated Flow, Shallow Conc. 4 Short Grass Pasture Kv= 7.0 fps
1.4	99	0.0557	1.18		Shallow Concentrated Flow, Shallow Conc. 5 Woodland Kv= 5.0 fps
2.9	223	0.0656	1.28		Shallow Concentrated Flow, Shallow Conc. 6 Woodland Kv= 5.0 fps
13.0	558	Total			

Subcatchment 1S: PR-DA-1 - East Watershed

Hydrograph



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Type III 24-hr 10-Year Rainfall=4.60"

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Summary for Subcatchment 2D: PR-DA-2D - West Basin

Runoff = 0.53 cfs @ 12.34 hrs, Volume= 0.100 af, Depth= 0.40"

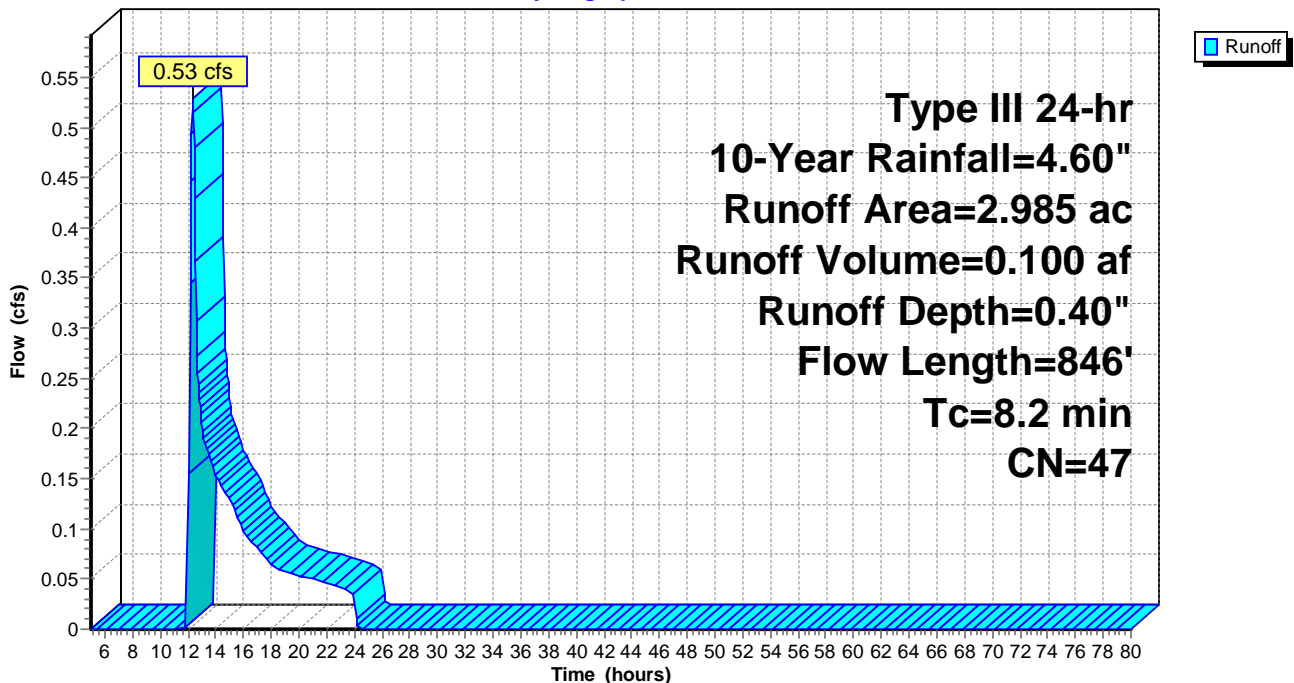
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.60"

Area (ac)	CN	Description
1.223	30	Meadow, non-grazed, HSG A
1.705	58	Meadow, non-grazed, HSG B
0.057	85	Gravel roads, HSG B
2.985	47	Weighted Average
2.985		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	50	0.1198	0.20		Sheet Flow, Sheet Flow 1 Grass: Dense n= 0.240 P2= 3.00"
0.3	52	0.1373	2.59		Shallow Concentrated Flow, Shallow Conc. 1 Short Grass Pasture Kv= 7.0 fps
3.3	690	0.0080	3.49	3.49	Channel Flow, Grassed Swale Area= 1.0 sf Perim= 2.0' r= 0.50' n= 0.024
0.5	54	0.1481	1.92		Shallow Concentrated Flow, Shallow Conc. 2 Woodland Kv= 5.0 fps
8.2	846	Total			

Subcatchment 2D: PR-DA-2D - West Basin

Hydrograph



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Type III 24-hr 10-Year Rainfall=4.60"

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Summary for Subcatchment 2S: PR-DA-2 - West Sub-Watershed

Runoff = 0.06 cfs @ 14.72 hrs, Volume= 0.038 af, Depth= 0.13"

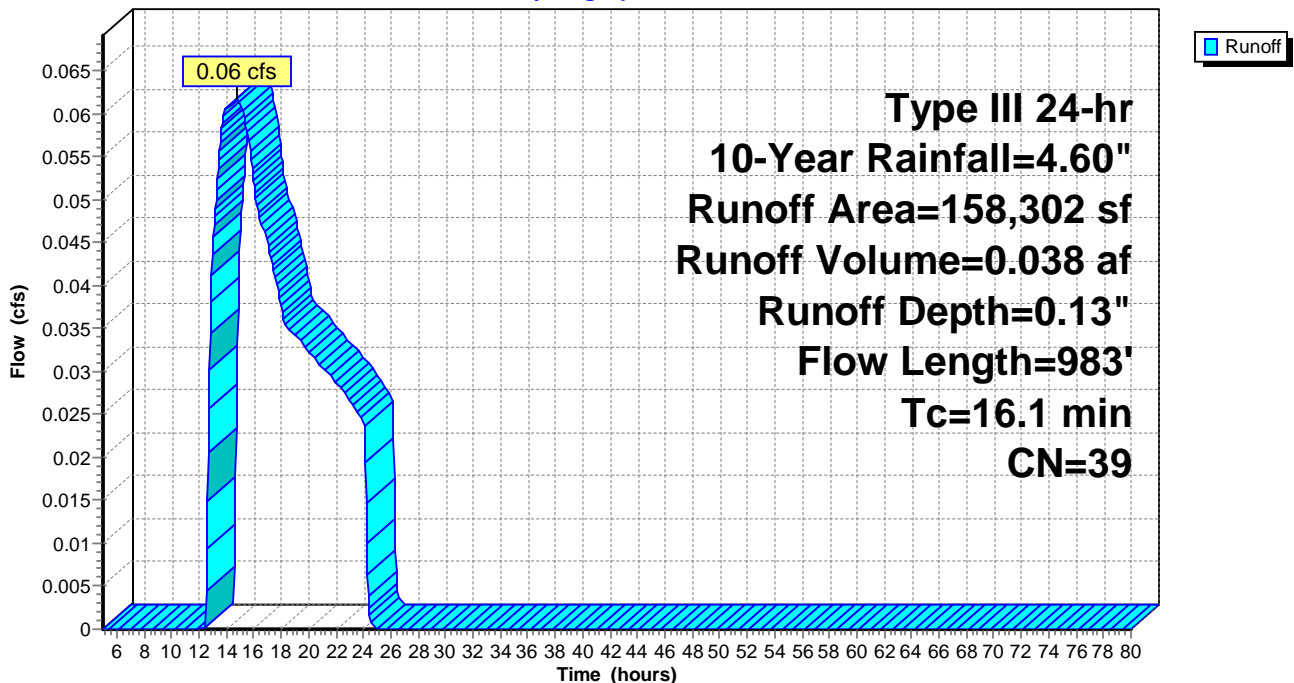
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.60"

Area (sf)	CN	Description
107,315	30	Meadow, non-grazed, HSG A
50,987	58	Meadow, non-grazed, HSG B
0	85	Gravel roads, HSG B
158,302	39	Weighted Average
158,302		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0900	0.18		Sheet Flow, Sheet Flow 1 Grass: Dense n= 0.240 P2= 3.00"
2.0	287	0.2228	2.36		Shallow Concentrated Flow, Shallow Conc. 1 Woodland Kv= 5.0 fps
3.8	322	0.0805	1.42		Shallow Concentrated Flow, Shallow Conc. 2 Woodland Kv= 5.0 fps
5.7	324	0.0359	0.95		Shallow Concentrated Flow, Shallow Conc. 3 Woodland Kv= 5.0 fps
16.1	983	Total			

Subcatchment 2S: PR-DA-2 - West Sub-Watershed

Hydrograph



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Type III 24-hr 10-Year Rainfall=4.60"

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Summary for Subcatchment 3S: PR-DA-3 - North Sub-Watershed

Runoff = 0.09 cfs @ 15.21 hrs, Volume= 0.058 af, Depth= 0.10"

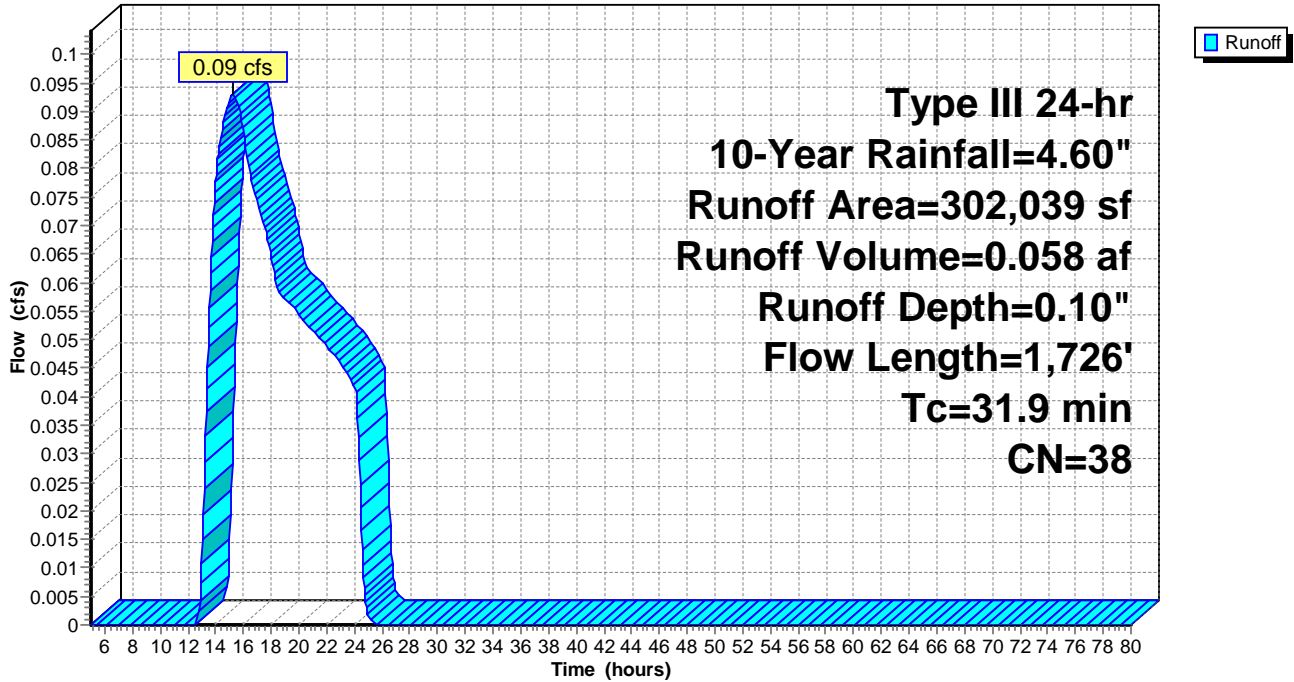
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.60"

Area (sf)	CN	Description
230,309	30	Meadow, non-grazed, HSG A
45,634	58	Meadow, non-grazed, HSG B
5,641	71	Meadow, non-grazed, HSG C
8,626	76	Gravel roads, HSG A
9,641	85	Gravel roads, HSG B
2,188	89	Gravel roads, HSG C
302,039	38	Weighted Average
302,039		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	50	0.1228	0.20		Sheet Flow, Sheet Flow
					Grass: Dense n= 0.240 P2= 3.00"
1.5	234	0.1293	2.52		Shallow Concentrated Flow, Shallow Conc. 1
					Short Grass Pasture Kv= 7.0 fps
0.8	76	0.1007	1.59		Shallow Concentrated Flow, Shallow Conc. 2
					Woodland Kv= 5.0 fps
2.0	191	0.1005	1.59		Shallow Concentrated Flow, Shallow Conc. 3
					Woodland Kv= 5.0 fps
2.6	163	0.0443	1.05		Shallow Concentrated Flow, Shallow Conc. 4
					Woodland Kv= 5.0 fps
1.5	114	0.0656	1.28		Shallow Concentrated Flow, Shallow Conc. 5
					Woodland Kv= 5.0 fps
3.4	331	0.1026	1.60		Shallow Concentrated Flow, Shallow Conc. 6
					Woodland Kv= 5.0 fps
6.2	261	0.0195	0.70		Shallow Concentrated Flow, Shallow Conc. 7
					Woodland Kv= 5.0 fps
3.2	153	0.0250	0.79		Shallow Concentrated Flow, Shallow Conc. 8
					Woodland Kv= 5.0 fps
6.6	153	0.0059	0.38		Shallow Concentrated Flow, Shallow Conc. 9
					Woodland Kv= 5.0 fps
31.9	1,726	Total			

Subcatchment 3S: PR-DA-3 - North Sub-Watershed

Hydrograph



CharltonSolar Proposed Conditions

Type III 24-hr 10-Year Rainfall=4.60"

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Summary for Pond 1PA: Northeast Basin

Inflow Area = 1.489 ac, 0.00% Impervious, Inflow Depth = 1.07" for 10-Year event
 Inflow = 1.48 cfs @ 12.13 hrs, Volume= 0.133 af
 Outflow = 0.07 cfs @ 17.64 hrs, Volume= 0.133 af, Atten= 96%, Lag= 330.7 min
 Discarded = 0.07 cfs @ 17.64 hrs, Volume= 0.133 af

Routing by Stor-Ind method, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
 Peak Elev= 926.84' @ 17.64 hrs Surf.Area= 4,569 sf Storage= 3,452 cf

Plug-Flow detention time= 621.1 min calculated for 0.133 af (100% of inflow)
 Center-of-Mass det. time= 620.9 min (1,504.3 - 883.4)

Volume	Invert	Avail.Storage	Storage Description
#1	926.00'	9,516 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

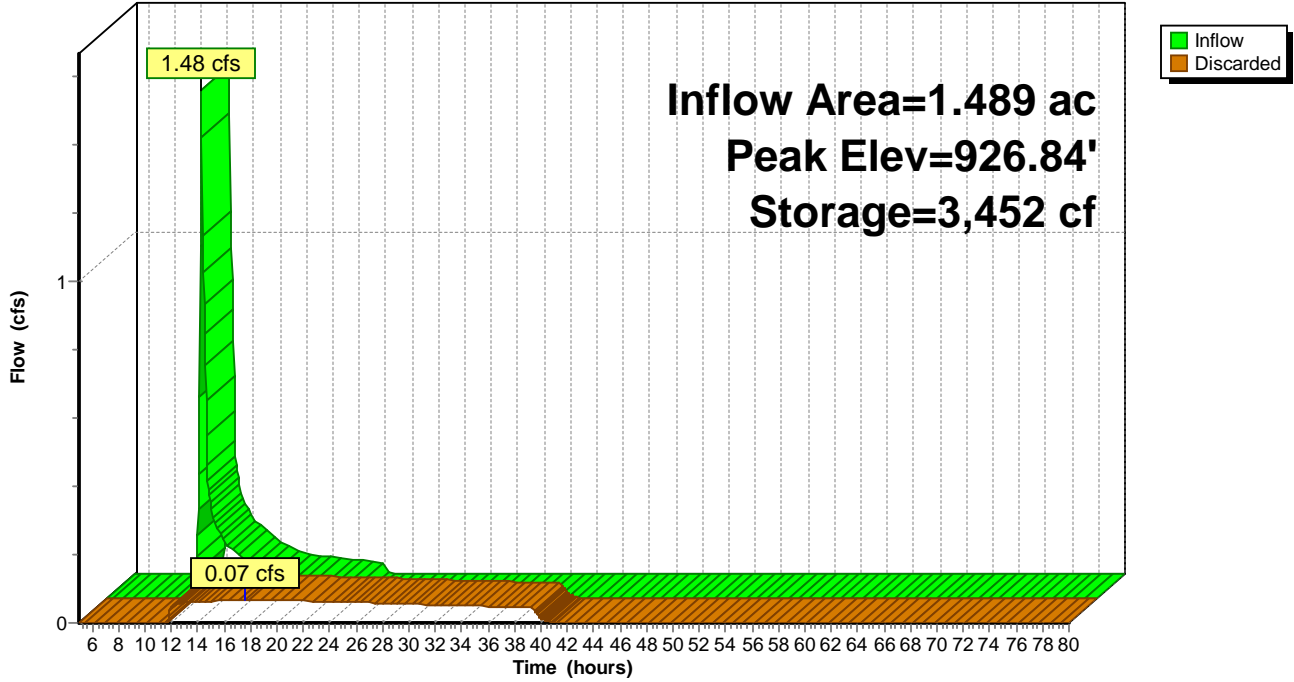
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
926.00	3,654	0	0
927.00	4,744	4,199	4,199
928.00	5,890	5,317	9,516

Device	Routing	Invert	Outlet Devices
#1	Discarded	926.00'	0.520 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 922.00'

Discarded OutFlow Max=0.07 cfs @ 17.64 hrs HW=926.84' (Free Discharge)
 ↑1=Exfiltration (Controls 0.07 cfs)

Pond 1PA: Northeast Basin

Hydrograph



CharltonSolar Proposed Conditions

Type III 24-hr 10-Year Rainfall=4.60"

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Summary for Pond 1PB: Southeast Basin

Inflow Area = 1.785 ac, 0.00% Impervious, Inflow Depth = 1.07" for 10-Year event
 Inflow = 1.71 cfs @ 12.15 hrs, Volume= 0.160 af
 Outflow = 0.12 cfs @ 15.79 hrs, Volume= 0.160 af, Atten= 93%, Lag= 218.0 min
 Discarded = 0.12 cfs @ 15.79 hrs, Volume= 0.160 af

Routing by Stor-Ind method, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
 Peak Elev= 919.37' @ 15.79 hrs Surf.Area= 9,374 sf Storage= 3,328 cf

Plug-Flow detention time= 312.1 min calculated for 0.160 af (100% of inflow)
 Center-of-Mass det. time= 312.0 min (1,196.9 - 884.9)

Volume	Invert	Avail.Storage	Storage Description
#1	919.00'	9,613 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

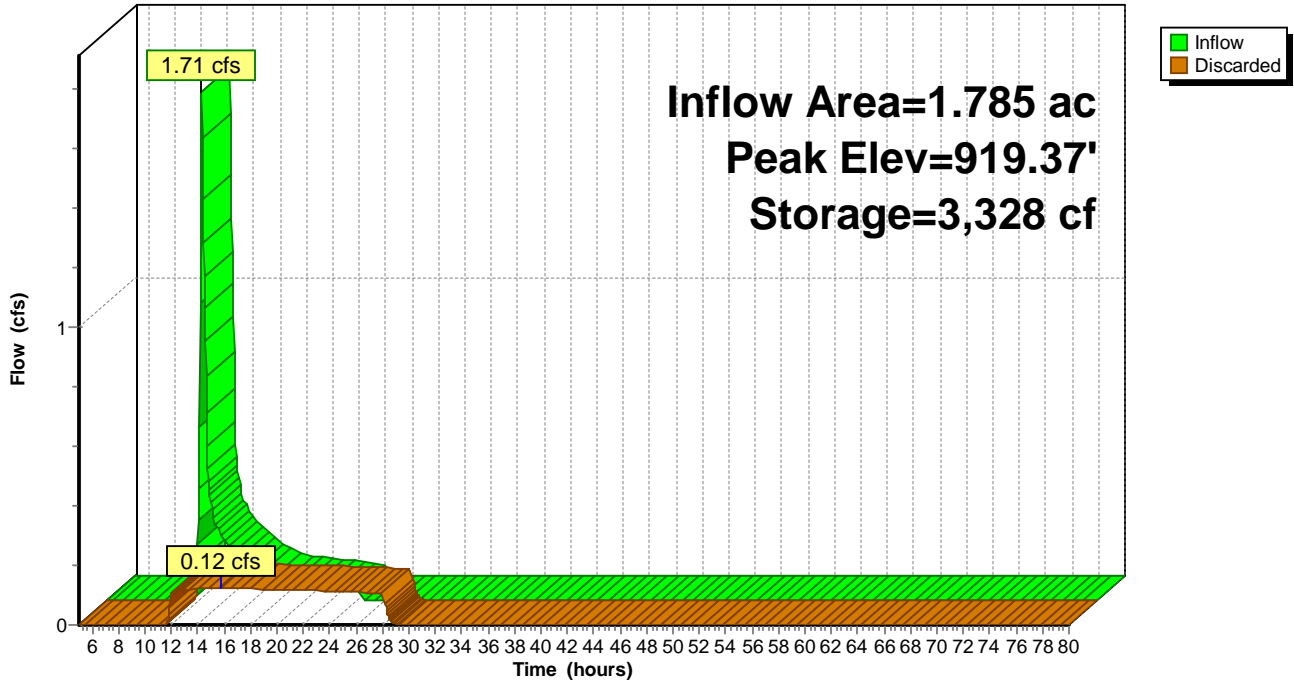
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
919.00	8,707	0	0
920.00	10,518	9,613	9,613

Device	Routing	Invert	Outlet Devices
#1	Discarded	919.00'	0.520 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 915.00'

Discarded OutFlow Max=0.12 cfs @ 15.79 hrs HW=919.37' (Free Discharge)
 ↑**1=Exfiltration** (Controls 0.12 cfs)

Pond 1PB: Southeast Basin

Hydrograph



CharltonSolar Proposed Conditions

Type III 24-hr 10-Year Rainfall=4.60"

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Summary for Pond 2P: West Basin

Inflow Area = 2.985 ac, 0.00% Impervious, Inflow Depth = 0.40" for 10-Year event
 Inflow = 0.53 cfs @ 12.34 hrs, Volume= 0.100 af
 Outflow = 0.14 cfs @ 14.30 hrs, Volume= 0.100 af, Atten= 73%, Lag= 117.7 min
 Discarded = 0.14 cfs @ 14.30 hrs, Volume= 0.100 af

Routing by Stor-Ind method, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 928.13' @ 14.30 hrs Surf.Area= 5,943 sf Storage= 817 cf

Plug-Flow detention time= 54.1 min calculated for 0.100 af (100% of inflow)
 Center-of-Mass det. time= 54.0 min (1,003.0 - 949.0)

Volume	Invert	Avail.Storage	Storage Description
#1	928.00'	6,280 cf	Custom Stage Data (Prismatic) Listed below

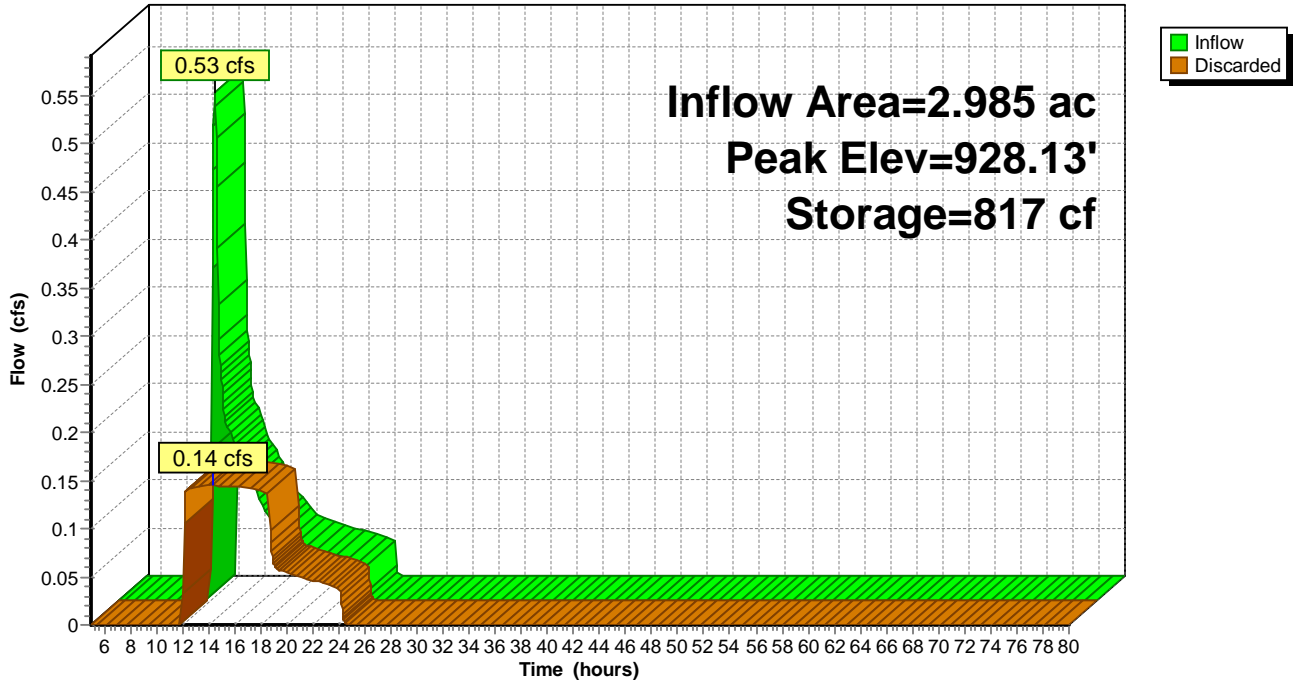
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
928.00	5,825	0	0
929.00	6,735	6,280	6,280

Device	Routing	Invert	Outlet Devices
#1	Discarded	928.00'	1.020 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 924.00'

Discarded OutFlow Max=0.14 cfs @ 14.30 hrs HW=928.13' (Free Discharge)
 ↑**1=Exfiltration** (Controls 0.14 cfs)

Pond 2P: West Basin

Hydrograph



CharltonSolar Proposed Conditions

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Type III 24-hr 25-Year Rainfall=5.30"

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Summary for Subcatchment 1DA: PR-DA-1D - Northeast Basin

Runoff = 2.20 cfs @ 12.12 hrs, Volume= 0.184 af, Depth= 1.48"

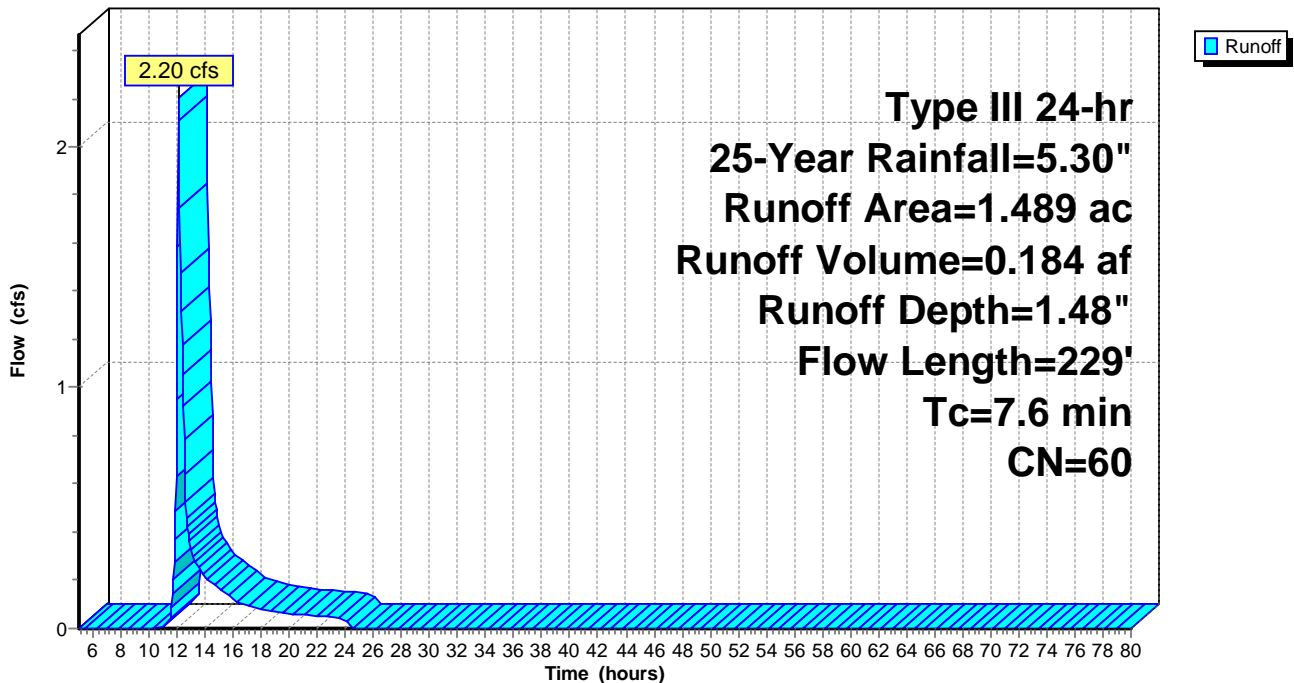
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (ac)	CN	Description
1.359	58	Meadow, non-grazed, HSG B
0.130	85	Gravel roads, HSG B
1.489	60	Weighted Average
1.489		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	50	0.0378	0.13		Sheet Flow, Sheet Flow 1 Grass: Dense n= 0.240 P2= 3.00"
0.5	84	0.1524	2.73		Shallow Concentrated Flow, Shallow Conc. 1 Short Grass Pasture Kv= 7.0 fps
0.3	55	0.2042	3.16		Shallow Concentrated Flow, Shallow Conc. 2 Short Grass Pasture Kv= 7.0 fps
0.1	26	0.0335	2.95		Shallow Concentrated Flow, Shallow Conc. 3 Unpaved Kv= 16.1 fps
0.1	14	0.2114	2.30		Shallow Concentrated Flow, Shallow Conc. 4 Woodland Kv= 5.0 fps
7.6	229	Total			

Subcatchment 1DA: PR-DA-1D - Northeast Basin

Hydrograph



CharltonSolar Proposed Conditions

Type III 24-hr 25-Year Rainfall=5.30"

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Summary for Subcatchment 1Db: PR-DA-1D - Southeast Basin

Runoff = 2.49 cfs @ 12.15 hrs, Volume= 0.220 af, Depth= 1.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25-Year Rainfall=5.30"

Area (ac)	CN	Description
1.629	58	Meadow, non-grazed, HSG B
0.156	85	Gravel roads, HSG B
1.785	60	Weighted Average
1.785		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	50	0.0292	0.11		Sheet Flow, Sheet Flow 1 Grass: Dense n= 0.240 P2= 3.00"
0.5	78	0.1623	2.82		Shallow Concentrated Flow, Shallow Conc. 1 Short Grass Pasture Kv= 7.0 fps
0.2	48	0.2594	3.57		Shallow Concentrated Flow, Shallow Conc. 2 Short Grass Pasture Kv= 7.0 fps
0.5	38	0.0384	1.37		Shallow Concentrated Flow, Shallow Conc. 3 Short Grass Pasture Kv= 7.0 fps
0.3	18	0.0033	0.92		Shallow Concentrated Flow, Shallow Conc. 4 Unpaved Kv= 16.1 fps
0.1	10	0.0860	2.05		Shallow Concentrated Flow, Shallow Conc. 5 Short Grass Pasture Kv= 7.0 fps
0.3	37	0.1289	1.80		Shallow Concentrated Flow, Shallow Conc. 6 Woodland Kv= 5.0 fps
9.2	279	Total			

CharltonSolar Proposed Conditions

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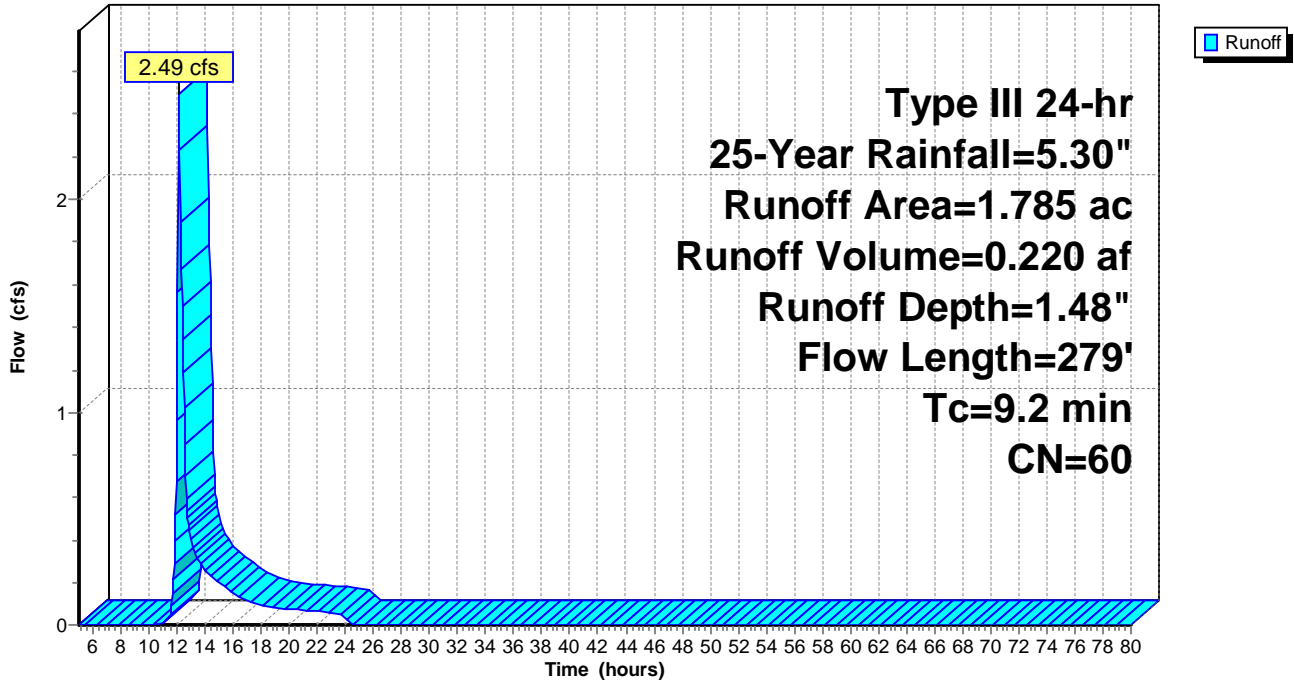
Type III 24-hr 25-Year Rainfall=5.30"

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Subcatchment 1Db: PR-DA-1D - Southeast Basin

Hydrograph



CharltonSolar Proposed Conditions

Type III 24-hr 25-Year Rainfall=5.30"

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Summary for Subcatchment 1S: PR-DA-1 - East Watershed

Runoff = 2.18 cfs @ 12.20 hrs, Volume= 0.215 af, Depth= 1.48"

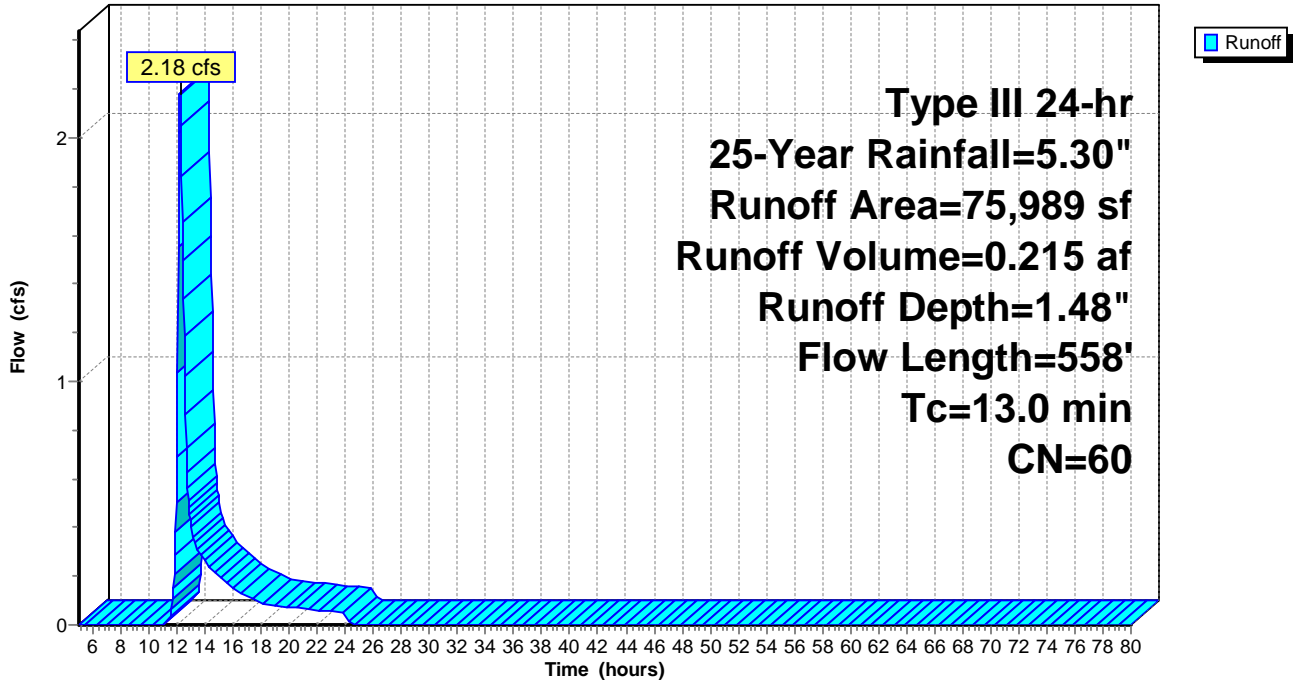
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
70,152	58	Meadow, non-grazed, HSG B
5,837	85	Gravel roads, HSG B
75,989	60	Weighted Average
75,989		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0276	0.11		Sheet Flow, Sheet Flow 1 Grass: Dense n= 0.240 P2= 3.00"
0.6	75	0.1045	2.26		Shallow Concentrated Flow, Shallow Conc. 1 Short Grass Pasture Kv= 7.0 fps
0.5	84	0.1892	3.04		Shallow Concentrated Flow, Shallow Conc. 2 Short Grass Pasture Kv= 7.0 fps
0.1	18	0.0556	3.80		Shallow Concentrated Flow, Shallow Conc. 3 Unpaved Kv= 16.1 fps
0.1	9	0.1833	3.00		Shallow Concentrated Flow, Shallow Conc. 4 Short Grass Pasture Kv= 7.0 fps
1.4	99	0.0557	1.18		Shallow Concentrated Flow, Shallow Conc. 5 Woodland Kv= 5.0 fps
2.9	223	0.0656	1.28		Shallow Concentrated Flow, Shallow Conc. 6 Woodland Kv= 5.0 fps
13.0	558	Total			

Subcatchment 1S: PR-DA-1 - East Watershed

Hydrograph



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Type III 24-hr 25-Year Rainfall=5.30"

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Summary for Subcatchment 2D: PR-DA-2D - West Basin

Runoff = 1.11 cfs @ 12.18 hrs, Volume= 0.161 af, Depth= 0.65"

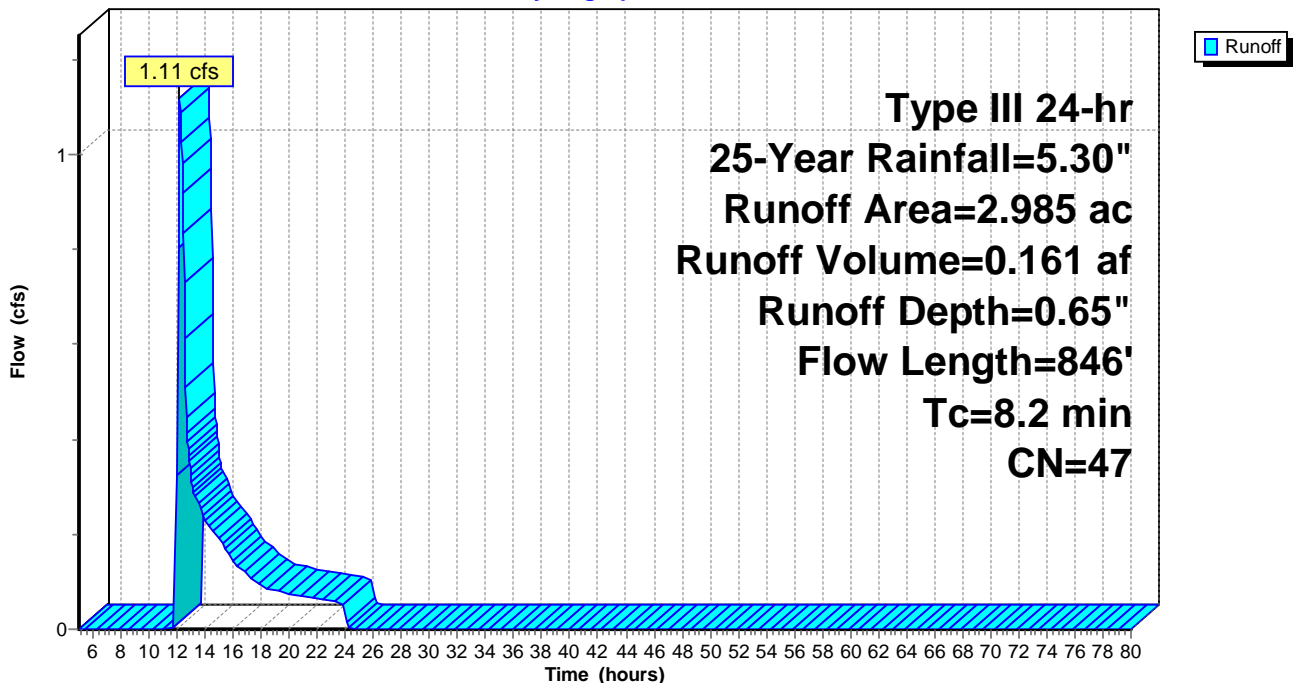
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (ac)	CN	Description
1.223	30	Meadow, non-grazed, HSG A
1.705	58	Meadow, non-grazed, HSG B
0.057	85	Gravel roads, HSG B
2.985	47	Weighted Average
2.985		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	50	0.1198	0.20		Sheet Flow, Sheet Flow 1 Grass: Dense n= 0.240 P2= 3.00"
0.3	52	0.1373	2.59		Shallow Concentrated Flow, Shallow Conc. 1 Short Grass Pasture Kv= 7.0 fps
3.3	690	0.0080	3.49	3.49	Channel Flow, Grassed Swale Area= 1.0 sf Perim= 2.0' r= 0.50' n= 0.024
0.5	54	0.1481	1.92		Shallow Concentrated Flow, Shallow Conc. 2 Woodland Kv= 5.0 fps
8.2	846	Total			

Subcatchment 2D: PR-DA-2D - West Basin

Hydrograph



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Type III 24-hr 25-Year Rainfall=5.30"

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Summary for Subcatchment 2S: PR-DA-2 - West Sub-Watershed

Runoff = 0.22 cfs @ 12.58 hrs, Volume= 0.080 af, Depth= 0.26"

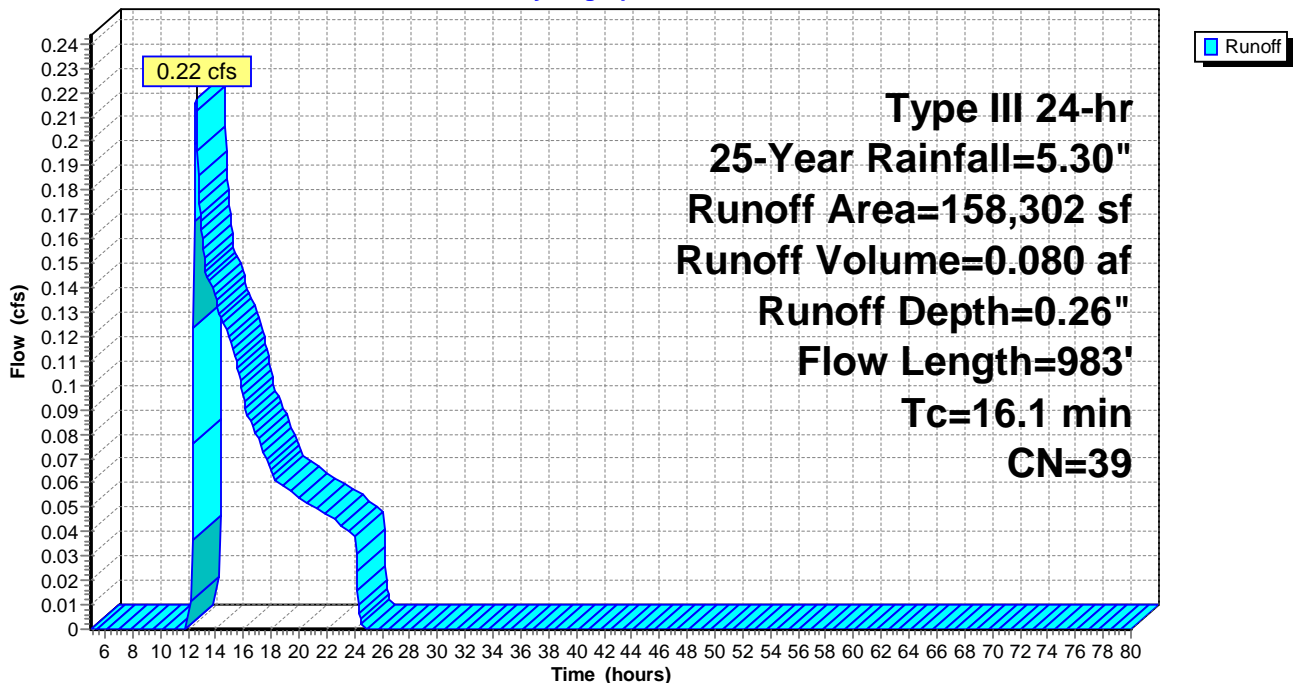
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
107,315	30	Meadow, non-grazed, HSG A
50,987	58	Meadow, non-grazed, HSG B
0	85	Gravel roads, HSG B
158,302	39	Weighted Average
158,302		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0900	0.18		Sheet Flow, Sheet Flow 1 Grass: Dense n= 0.240 P2= 3.00"
2.0	287	0.2228	2.36		Shallow Concentrated Flow, Shallow Conc. 1 Woodland Kv= 5.0 fps
3.8	322	0.0805	1.42		Shallow Concentrated Flow, Shallow Conc. 2 Woodland Kv= 5.0 fps
5.7	324	0.0359	0.95		Shallow Concentrated Flow, Shallow Conc. 3 Woodland Kv= 5.0 fps
16.1	983	Total			

Subcatchment 2S: PR-DA-2 - West Sub-Watershed

Hydrograph



CharltonSolar Proposed Conditions

Type III 24-hr 25-Year Rainfall=5.30"

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Summary for Subcatchment 3S: PR-DA-3 - North Sub-Watershed

Runoff = 0.24 cfs @ 13.13 hrs, Volume= 0.131 af, Depth= 0.23"

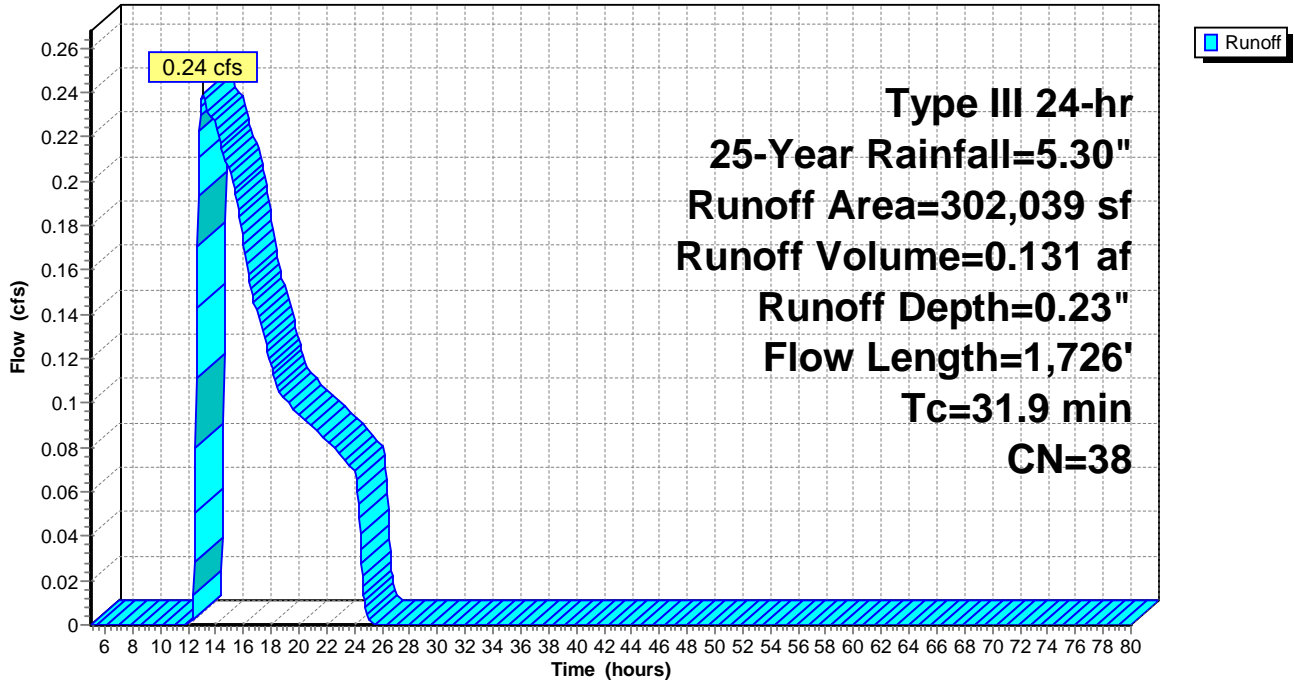
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
230,309	30	Meadow, non-grazed, HSG A
45,634	58	Meadow, non-grazed, HSG B
5,641	71	Meadow, non-grazed, HSG C
8,626	76	Gravel roads, HSG A
9,641	85	Gravel roads, HSG B
2,188	89	Gravel roads, HSG C
302,039	38	Weighted Average
302,039		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	50	0.1228	0.20		Sheet Flow, Sheet Flow
					Grass: Dense n= 0.240 P2= 3.00"
1.5	234	0.1293	2.52		Shallow Concentrated Flow, Shallow Conc. 1
					Short Grass Pasture Kv= 7.0 fps
0.8	76	0.1007	1.59		Shallow Concentrated Flow, Shallow Conc. 2
					Woodland Kv= 5.0 fps
2.0	191	0.1005	1.59		Shallow Concentrated Flow, Shallow Conc. 3
					Woodland Kv= 5.0 fps
2.6	163	0.0443	1.05		Shallow Concentrated Flow, Shallow Conc. 4
					Woodland Kv= 5.0 fps
1.5	114	0.0656	1.28		Shallow Concentrated Flow, Shallow Conc. 5
					Woodland Kv= 5.0 fps
3.4	331	0.1026	1.60		Shallow Concentrated Flow, Shallow Conc. 6
					Woodland Kv= 5.0 fps
6.2	261	0.0195	0.70		Shallow Concentrated Flow, Shallow Conc. 7
					Woodland Kv= 5.0 fps
3.2	153	0.0250	0.79		Shallow Concentrated Flow, Shallow Conc. 8
					Woodland Kv= 5.0 fps
6.6	153	0.0059	0.38		Shallow Concentrated Flow, Shallow Conc. 9
					Woodland Kv= 5.0 fps
31.9	1,726	Total			

Subcatchment 3S: PR-DA-3 - North Sub-Watershed

Hydrograph



CharltonSolar Proposed Conditions

Type III 24-hr 25-Year Rainfall=5.30"

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Summary for Pond 1PA: Northeast Basin

Inflow Area = 1.489 ac, 0.00% Impervious, Inflow Depth = 1.48" for 25-Year event
 Inflow = 2.20 cfs @ 12.12 hrs, Volume= 0.184 af
 Outflow = 0.08 cfs @ 18.05 hrs, Volume= 0.184 af, Atten= 97%, Lag= 355.5 min
 Discarded = 0.08 cfs @ 18.05 hrs, Volume= 0.184 af

Routing by Stor-Ind method, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
 Peak Elev= 927.20' @ 18.05 hrs Surf.Area= 4,969 sf Storage= 5,151 cf

Plug-Flow detention time= 804.2 min calculated for 0.183 af (100% of inflow)
 Center-of-Mass det. time= 804.6 min (1,677.3 - 872.6)

Volume	Invert	Avail.Storage	Storage Description
#1	926.00'	9,516 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

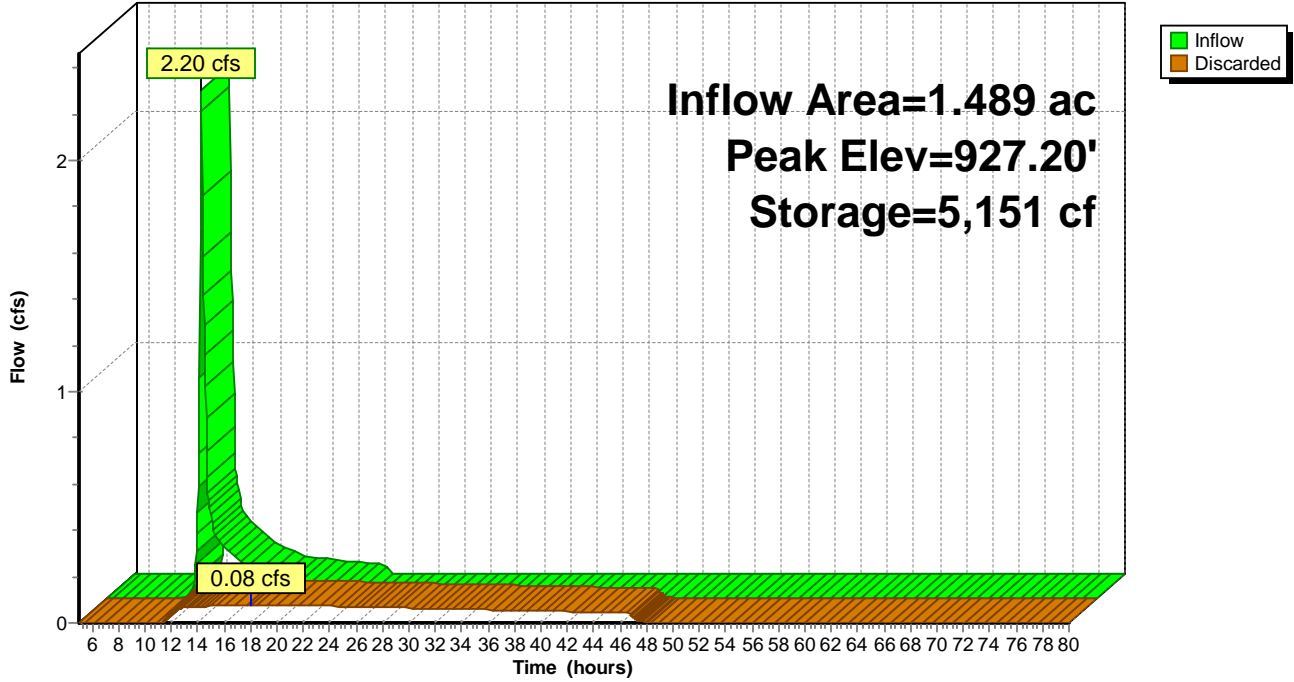
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
926.00	3,654	0	0
927.00	4,744	4,199	4,199
928.00	5,890	5,317	9,516

Device	Routing	Invert	Outlet Devices
#1	Discarded	926.00'	0.520 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 922.00'

Discarded OutFlow Max=0.08 cfs @ 18.05 hrs HW=927.20' (Free Discharge)
 ↑**1=Exfiltration** (Controls 0.08 cfs)

Pond 1PA: Northeast Basin

Hydrograph



CharltonSolar Proposed Conditions

Type III 24-hr 25-Year Rainfall=5.30"

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Summary for Pond 1PB: Southeast Basin

Inflow Area = 1.785 ac, 0.00% Impervious, Inflow Depth = 1.48" for 25-Year event
 Inflow = 2.49 cfs @ 12.15 hrs, Volume= 0.220 af
 Outflow = 0.13 cfs @ 16.37 hrs, Volume= 0.220 af, Atten= 95%, Lag= 253.5 min
 Discarded = 0.13 cfs @ 16.37 hrs, Volume= 0.220 af

Routing by Stor-Ind method, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
 Peak Elev= 919.57' @ 16.37 hrs Surf.Area= 9,738 sf Storage= 5,249 cf

Plug-Flow detention time= 453.9 min calculated for 0.220 af (100% of inflow)
 Center-of-Mass det. time= 453.9 min (1,328.1 - 874.1)

Volume	Invert	Avail.Storage	Storage Description
#1	919.00'	9,613 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

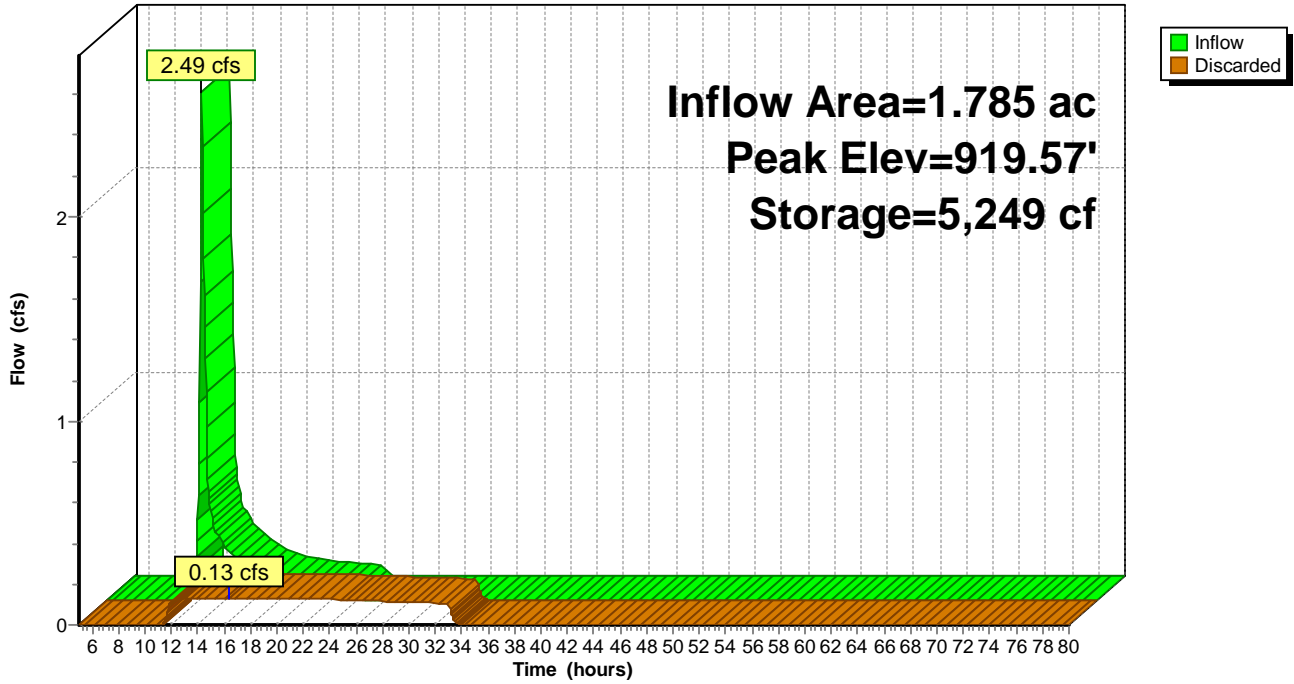
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
919.00	8,707	0	0
920.00	10,518	9,613	9,613

Device	Routing	Invert	Outlet Devices
#1	Discarded	919.00'	0.520 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 915.00'

Discarded OutFlow Max=0.13 cfs @ 16.37 hrs HW=919.57' (Free Discharge)
 ↑1=Exfiltration (Controls 0.13 cfs)

Pond 1PB: Southeast Basin

Hydrograph



CharltonSolar Proposed Conditions

Type III 24-hr 25-Year Rainfall=5.30"

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Summary for Pond 2P: West Basin

Inflow Area = 2.985 ac, 0.00% Impervious, Inflow Depth = 0.65" for 25-Year event
 Inflow = 1.11 cfs @ 12.18 hrs, Volume= 0.161 af
 Outflow = 0.16 cfs @ 15.64 hrs, Volume= 0.161 af, Atten= 86%, Lag= 207.5 min
 Discarded = 0.16 cfs @ 15.64 hrs, Volume= 0.161 af

Routing by Stor-Ind method, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 928.39' @ 15.64 hrs Surf.Area= 6,178 sf Storage= 2,437 cf

Plug-Flow detention time= 175.5 min calculated for 0.161 af (100% of inflow)
 Center-of-Mass det. time= 175.3 min (1,100.7 - 925.4)

Volume	Invert	Avail.Storage	Storage Description
#1	928.00'	6,280 cf	Custom Stage Data (Prismatic) Listed below

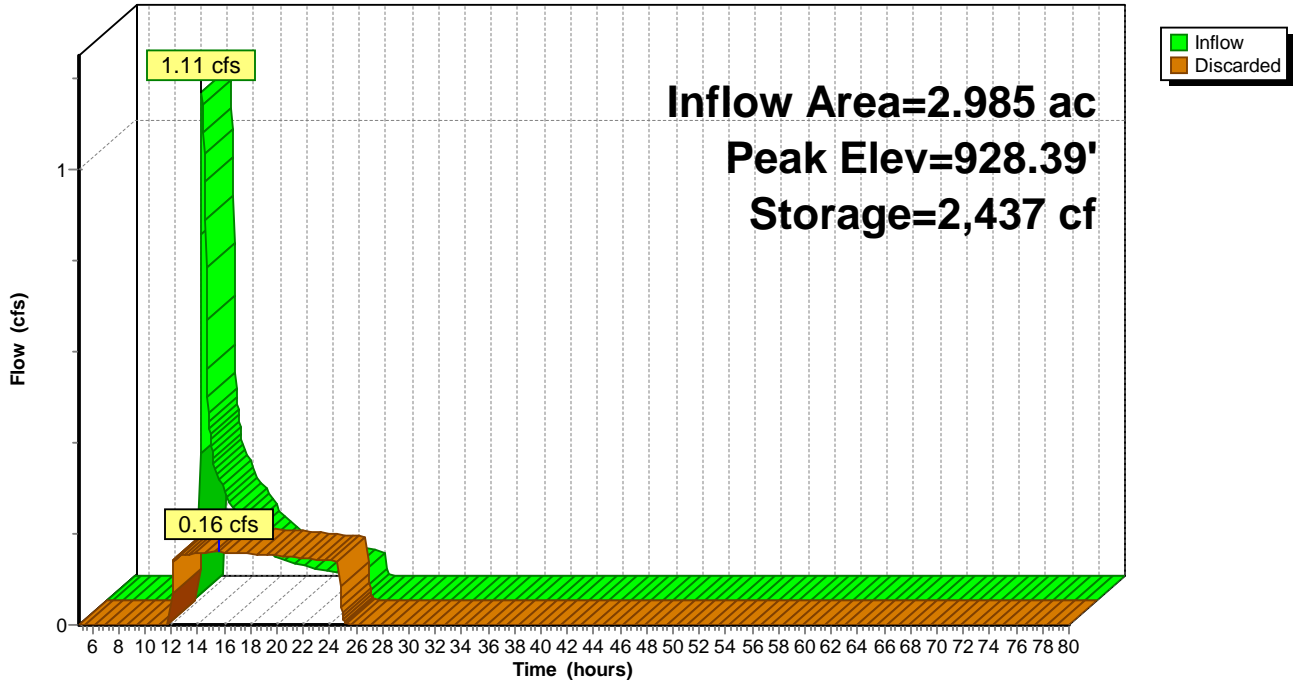
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
928.00	5,825	0	0
929.00	6,735	6,280	6,280

Device	Routing	Invert	Outlet Devices
#1	Discarded	928.00'	1.020 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 924.00'

Discarded OutFlow Max=0.16 cfs @ 15.64 hrs HW=928.39' (Free Discharge)
 ↑1=Exfiltration (Controls 0.16 cfs)

Pond 2P: West Basin

Hydrograph



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Type III 24-hr 50-Year Rainfall=6.00"

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Summary for Subcatchment 1DA: PR-DA-1D - Northeast Basin

Runoff = 2.95 cfs @ 12.12 hrs, Volume= 0.238 af, Depth= 1.92"

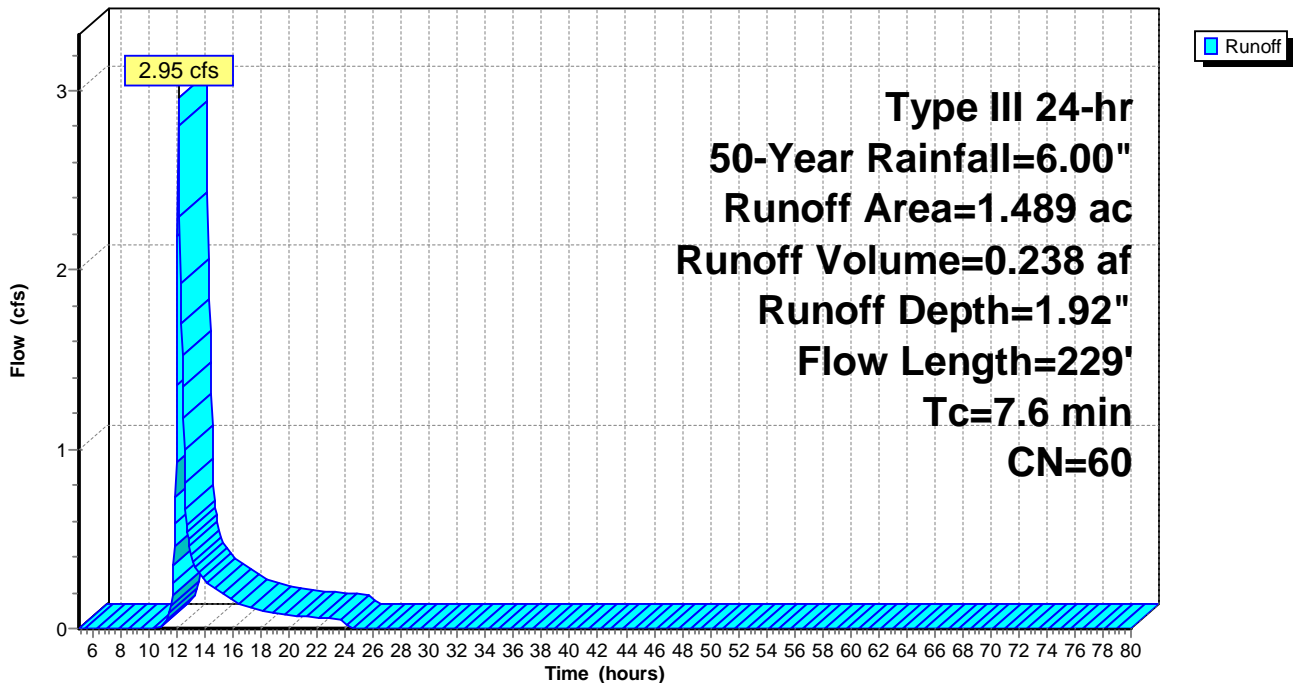
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.00"

Area (ac)	CN	Description
1.359	58	Meadow, non-grazed, HSG B
0.130	85	Gravel roads, HSG B
1.489	60	Weighted Average
1.489		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	50	0.0378	0.13		Sheet Flow, Sheet Flow 1 Grass: Dense n= 0.240 P2= 3.00"
0.5	84	0.1524	2.73		Shallow Concentrated Flow, Shallow Conc. 1 Short Grass Pasture Kv= 7.0 fps
0.3	55	0.2042	3.16		Shallow Concentrated Flow, Shallow Conc. 2 Short Grass Pasture Kv= 7.0 fps
0.1	26	0.0335	2.95		Shallow Concentrated Flow, Shallow Conc. 3 Unpaved Kv= 16.1 fps
0.1	14	0.2114	2.30		Shallow Concentrated Flow, Shallow Conc. 4 Woodland Kv= 5.0 fps
7.6	229	Total			

Subcatchment 1DA: PR-DA-1D - Northeast Basin

Hydrograph



CharltonSolar Proposed Conditions

Type III 24-hr 50-Year Rainfall=6.00"

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Summary for Subcatchment 1Db: PR-DA-1D - Southeast Basin

Runoff = 3.35 cfs @ 12.14 hrs, Volume= 0.286 af, Depth= 1.92"

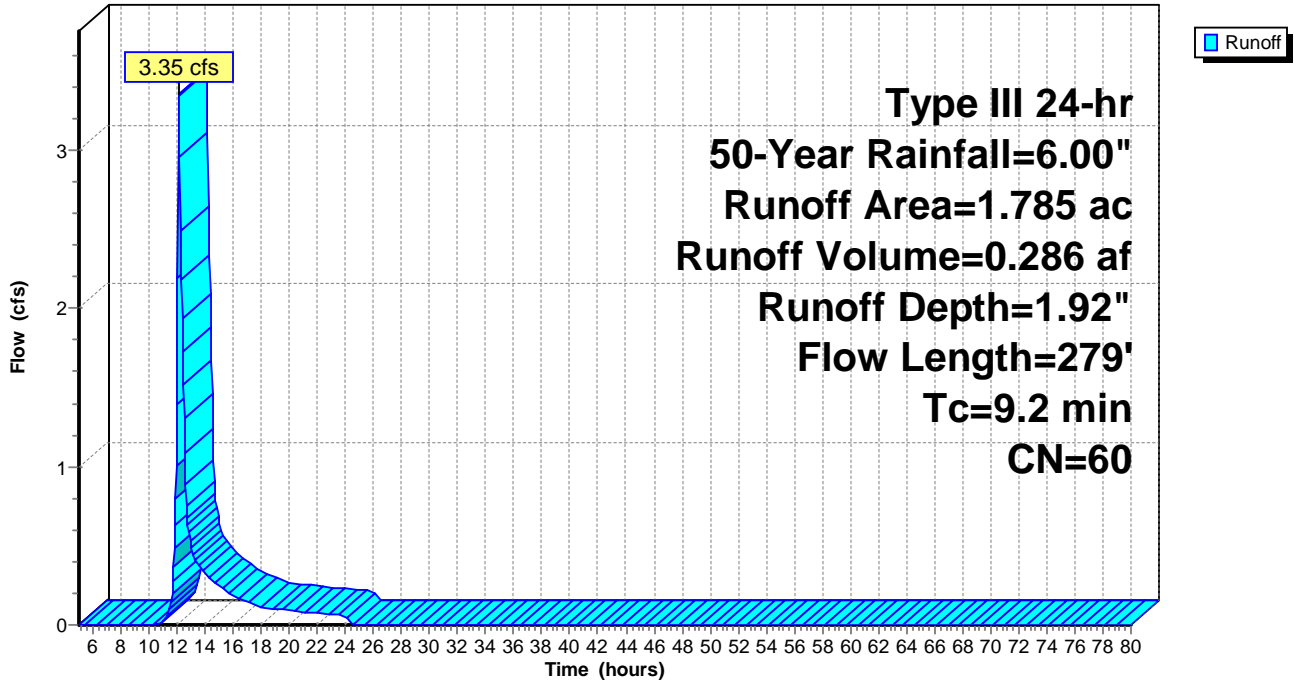
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
 Type III 24-hr 50-Year Rainfall=6.00"

Area (ac)	CN	Description
1.629	58	Meadow, non-grazed, HSG B
0.156	85	Gravel roads, HSG B
1.785	60	Weighted Average
1.785		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	50	0.0292	0.11		Sheet Flow, Sheet Flow 1 Grass: Dense n= 0.240 P2= 3.00"
0.5	78	0.1623	2.82		Shallow Concentrated Flow, Shallow Conc. 1 Short Grass Pasture Kv= 7.0 fps
0.2	48	0.2594	3.57		Shallow Concentrated Flow, Shallow Conc. 2 Short Grass Pasture Kv= 7.0 fps
0.5	38	0.0384	1.37		Shallow Concentrated Flow, Shallow Conc. 3 Short Grass Pasture Kv= 7.0 fps
0.3	18	0.0033	0.92		Shallow Concentrated Flow, Shallow Conc. 4 Unpaved Kv= 16.1 fps
0.1	10	0.0860	2.05		Shallow Concentrated Flow, Shallow Conc. 5 Short Grass Pasture Kv= 7.0 fps
0.3	37	0.1289	1.80		Shallow Concentrated Flow, Shallow Conc. 6 Woodland Kv= 5.0 fps
9.2	279	Total			

Subcatchment 1Db: PR-DA-1D - Southeast Basin

Hydrograph



CharltonSolar Proposed Conditions

Type III 24-hr 50-Year Rainfall=6.00"

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Summary for Subcatchment 1S: PR-DA-1 - East Watershed

Runoff = 2.92 cfs @ 12.20 hrs, Volume= 0.279 af, Depth= 1.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.00"

Area (sf)	CN	Description
70,152	58	Meadow, non-grazed, HSG B
5,837	85	Gravel roads, HSG B
75,989	60	Weighted Average
75,989		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0276	0.11		Sheet Flow, Sheet Flow 1 Grass: Dense n= 0.240 P2= 3.00"
0.6	75	0.1045	2.26		Shallow Concentrated Flow, Shallow Conc. 1 Short Grass Pasture Kv= 7.0 fps
0.5	84	0.1892	3.04		Shallow Concentrated Flow, Shallow Conc. 2 Short Grass Pasture Kv= 7.0 fps
0.1	18	0.0556	3.80		Shallow Concentrated Flow, Shallow Conc. 3 Unpaved Kv= 16.1 fps
0.1	9	0.1833	3.00		Shallow Concentrated Flow, Shallow Conc. 4 Short Grass Pasture Kv= 7.0 fps
1.4	99	0.0557	1.18		Shallow Concentrated Flow, Shallow Conc. 5 Woodland Kv= 5.0 fps
2.9	223	0.0656	1.28		Shallow Concentrated Flow, Shallow Conc. 6 Woodland Kv= 5.0 fps
13.0	558	Total			

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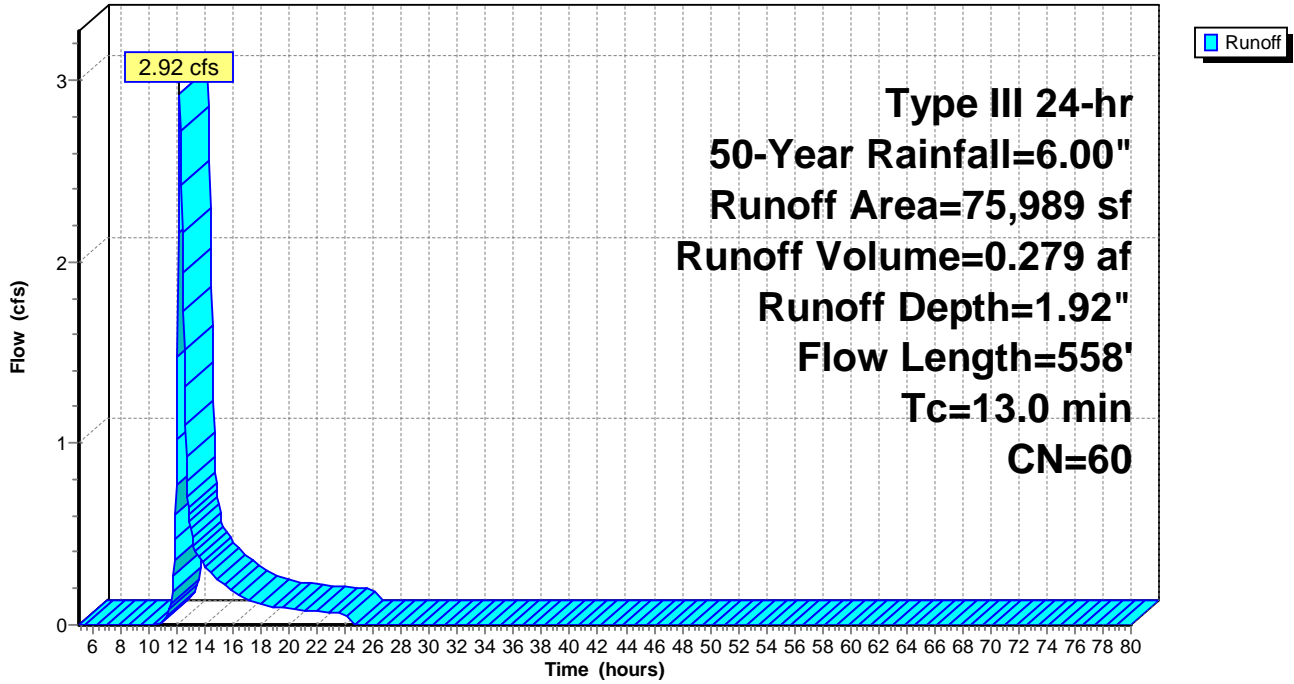
Type III 24-hr 50-Year Rainfall=6.00"

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Subcatchment 1S: PR-DA-1 - East Watershed

Hydrograph



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Type III 24-hr 50-Year Rainfall=6.00"

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Summary for Subcatchment 2D: PR-DA-2D - West Basin

Runoff = 2.05 cfs @ 12.16 hrs, Volume= 0.232 af, Depth= 0.93"

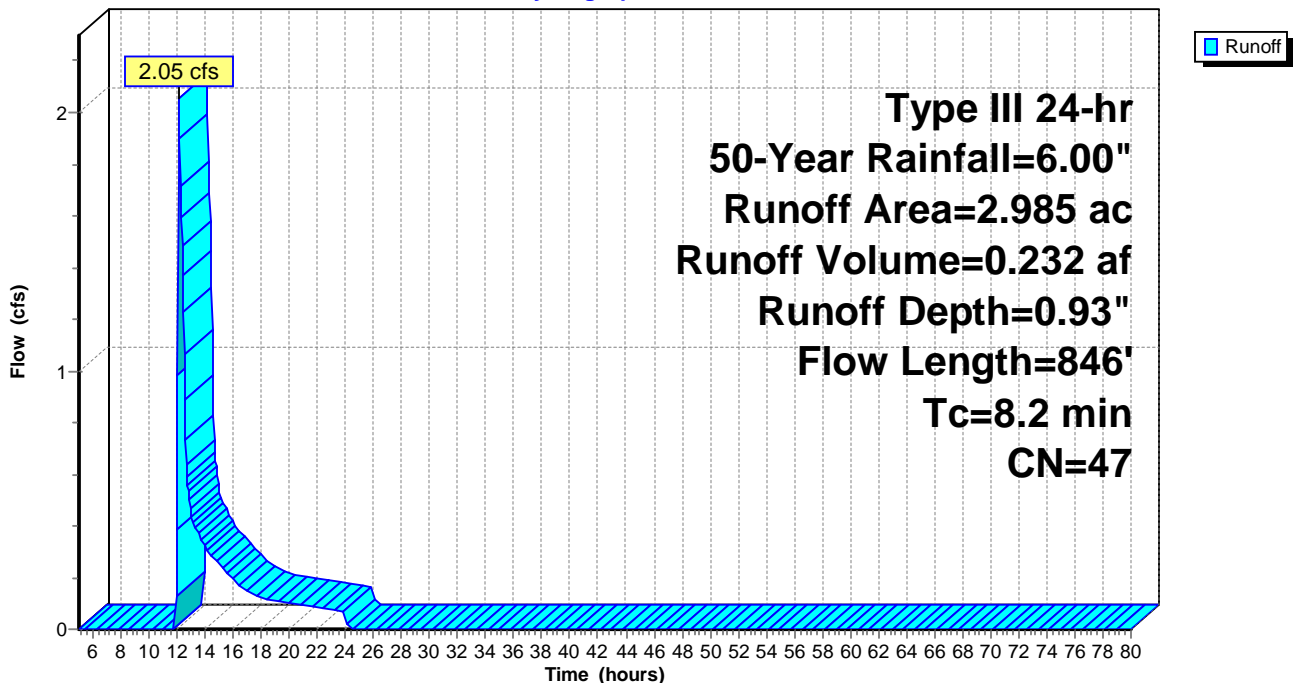
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.00"

Area (ac)	CN	Description
1.223	30	Meadow, non-grazed, HSG A
1.705	58	Meadow, non-grazed, HSG B
0.057	85	Gravel roads, HSG B
2.985	47	Weighted Average
2.985		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	50	0.1198	0.20		Sheet Flow, Sheet Flow 1 Grass: Dense n= 0.240 P2= 3.00"
0.3	52	0.1373	2.59		Shallow Concentrated Flow, Shallow Conc. 1 Short Grass Pasture Kv= 7.0 fps
3.3	690	0.0080	3.49	3.49	Channel Flow, Grassed Swale Area= 1.0 sf Perim= 2.0' r= 0.50' n= 0.024
0.5	54	0.1481	1.92		Shallow Concentrated Flow, Shallow Conc. 2 Woodland Kv= 5.0 fps
8.2	846	Total			

Subcatchment 2D: PR-DA-2D - West Basin

Hydrograph



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Type III 24-hr 50-Year Rainfall=6.00"

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Summary for Subcatchment 2S: PR-DA-2 - West Sub-Watershed

Runoff = 0.57 cfs @ 12.50 hrs, Volume= 0.135 af, Depth= 0.45"

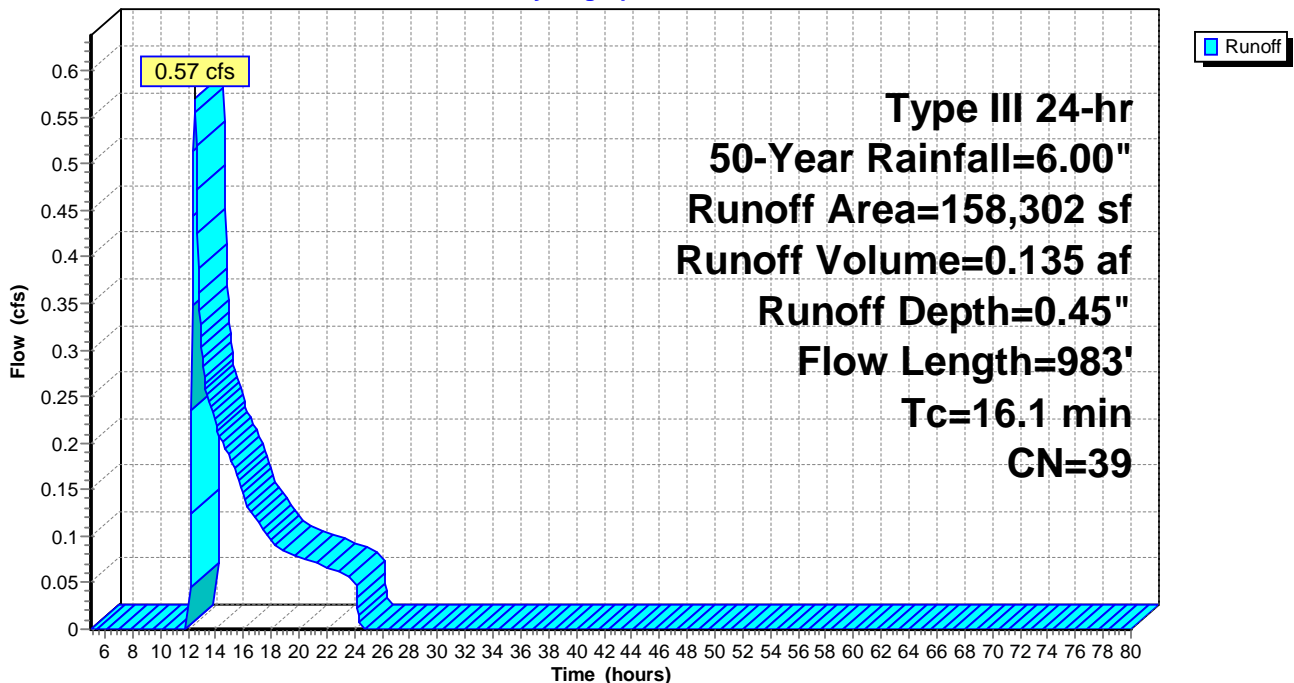
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.00"

Area (sf)	CN	Description
107,315	30	Meadow, non-grazed, HSG A
50,987	58	Meadow, non-grazed, HSG B
0	85	Gravel roads, HSG B
158,302	39	Weighted Average
158,302		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0900	0.18		Sheet Flow, Sheet Flow 1 Grass: Dense n= 0.240 P2= 3.00"
2.0	287	0.2228	2.36		Shallow Concentrated Flow, Shallow Conc. 1 Woodland Kv= 5.0 fps
3.8	322	0.0805	1.42		Shallow Concentrated Flow, Shallow Conc. 2 Woodland Kv= 5.0 fps
5.7	324	0.0359	0.95		Shallow Concentrated Flow, Shallow Conc. 3 Woodland Kv= 5.0 fps
16.1	983	Total			

Subcatchment 2S: PR-DA-2 - West Sub-Watershed

Hydrograph



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Type III 24-hr 50-Year Rainfall=6.00"

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Summary for Subcatchment 3S: PR-DA-3 - North Sub-Watershed

Runoff = 0.67 cfs @ 12.77 hrs, Volume= 0.227 af, Depth= 0.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=6.00"

Area (sf)	CN	Description
230,309	30	Meadow, non-grazed, HSG A
45,634	58	Meadow, non-grazed, HSG B
5,641	71	Meadow, non-grazed, HSG C
8,626	76	Gravel roads, HSG A
9,641	85	Gravel roads, HSG B
2,188	89	Gravel roads, HSG C
302,039	38	Weighted Average
302,039		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	50	0.1228	0.20		Sheet Flow, Sheet Flow
					Grass: Dense n= 0.240 P2= 3.00"
1.5	234	0.1293	2.52		Shallow Concentrated Flow, Shallow Conc. 1
					Short Grass Pasture Kv= 7.0 fps
0.8	76	0.1007	1.59		Shallow Concentrated Flow, Shallow Conc. 2
					Woodland Kv= 5.0 fps
2.0	191	0.1005	1.59		Shallow Concentrated Flow, Shallow Conc. 3
					Woodland Kv= 5.0 fps
2.6	163	0.0443	1.05		Shallow Concentrated Flow, Shallow Conc. 4
					Woodland Kv= 5.0 fps
1.5	114	0.0656	1.28		Shallow Concentrated Flow, Shallow Conc. 5
					Woodland Kv= 5.0 fps
3.4	331	0.1026	1.60		Shallow Concentrated Flow, Shallow Conc. 6
					Woodland Kv= 5.0 fps
6.2	261	0.0195	0.70		Shallow Concentrated Flow, Shallow Conc. 7
					Woodland Kv= 5.0 fps
3.2	153	0.0250	0.79		Shallow Concentrated Flow, Shallow Conc. 8
					Woodland Kv= 5.0 fps
6.6	153	0.0059	0.38		Shallow Concentrated Flow, Shallow Conc. 9
					Woodland Kv= 5.0 fps
31.9	1,726	Total			

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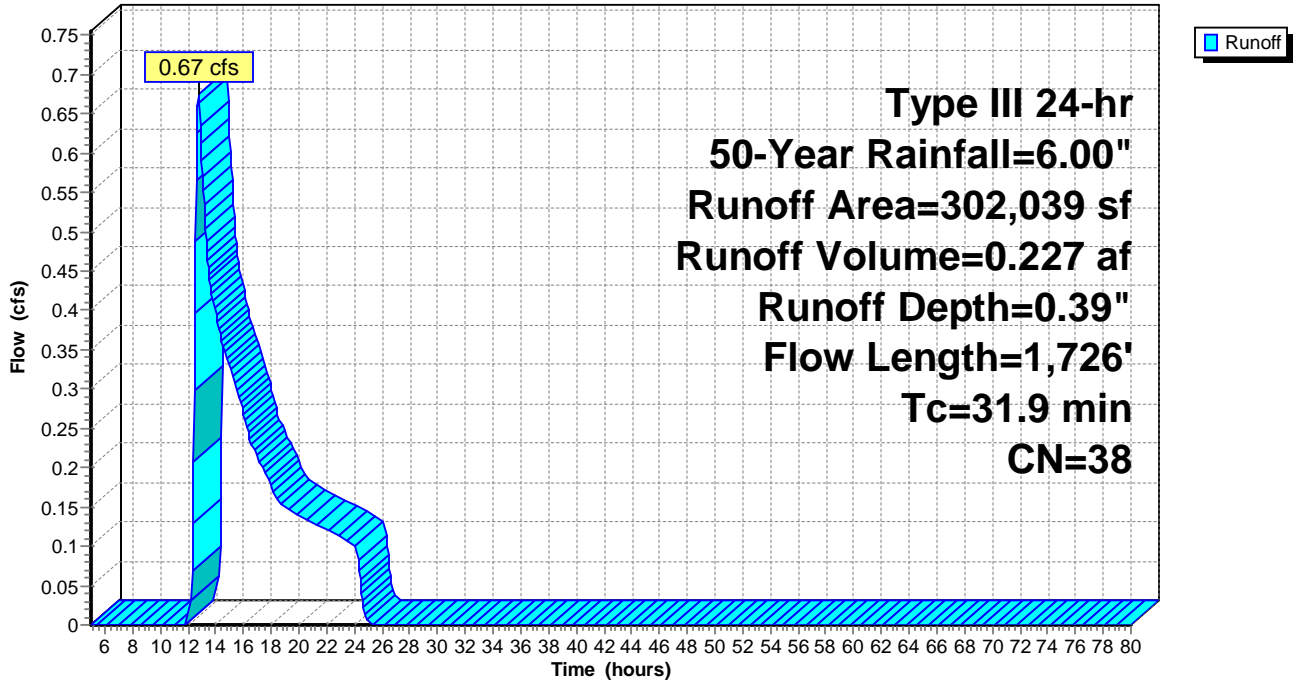
Type III 24-hr 50-Year Rainfall=6.00"

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Subcatchment 3S: PR-DA-3 - North Sub-Watershed

Hydrograph



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Type III 24-hr 50-Year Rainfall=6.00"

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Summary for Pond 1PA: Northeast Basin

Inflow Area = 1.489 ac, 0.00% Impervious, Inflow Depth = 1.92" for 50-Year event
 Inflow = 2.95 cfs @ 12.12 hrs, Volume= 0.238 af
 Outflow = 0.09 cfs @ 18.75 hrs, Volume= 0.238 af, Atten= 97%, Lag= 397.7 min
 Discarded = 0.09 cfs @ 18.75 hrs, Volume= 0.238 af

Routing by Stor-Ind method, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
 Peak Elev= 927.56' @ 18.75 hrs Surf.Area= 5,383 sf Storage= 7,023 cf

Plug-Flow detention time= 965.4 min calculated for 0.238 af (100% of inflow)
 Center-of-Mass det. time= 966.0 min (1,830.4 - 864.3)

Volume	Invert	Avail.Storage	Storage Description
#1	926.00'	9,516 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

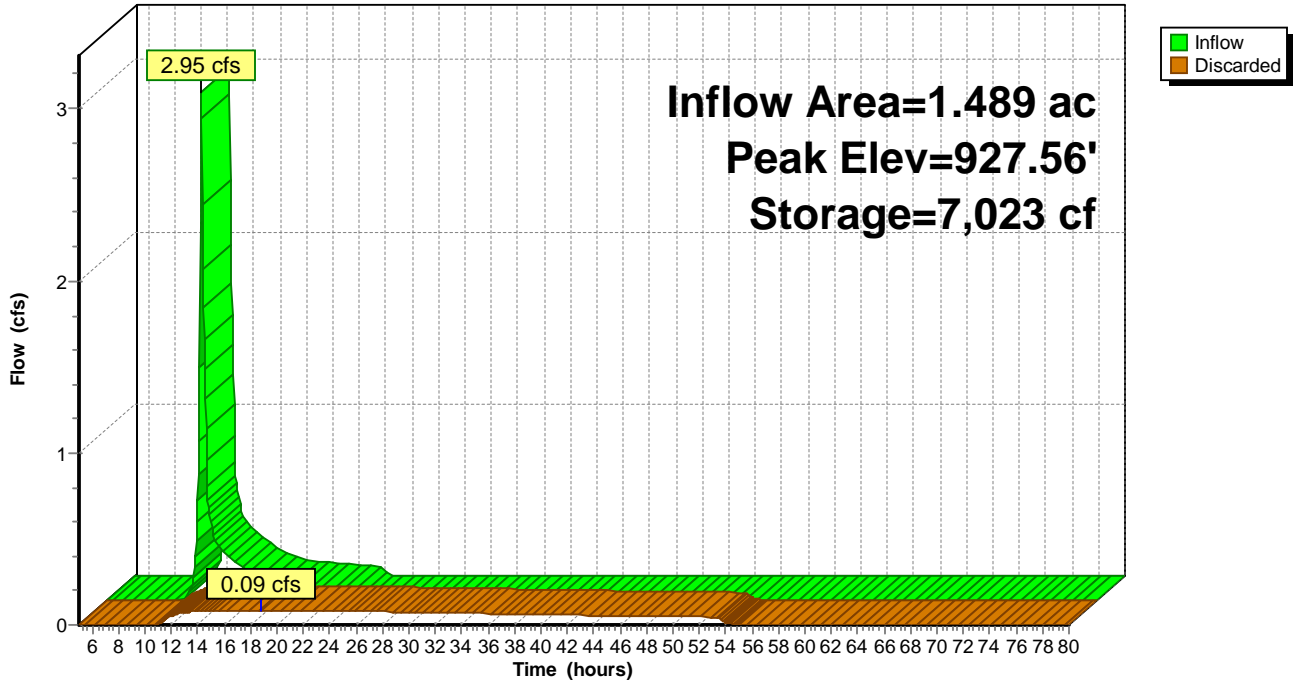
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
926.00	3,654	0	0
927.00	4,744	4,199	4,199
928.00	5,890	5,317	9,516

Device	Routing	Invert	Outlet Devices
#1	Discarded	926.00'	0.520 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 922.00'

Discarded OutFlow Max=0.09 cfs @ 18.75 hrs HW=927.56' (Free Discharge)
 ↑**1=Exfiltration** (Controls 0.09 cfs)

Pond 1PA: Northeast Basin

Hydrograph



CharltonSolar Proposed Conditions

Type III 24-hr 50-Year Rainfall=6.00"

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Summary for Pond 1PB: Southeast Basin

Inflow Area = 1.785 ac, 0.00% Impervious, Inflow Depth = 1.92" for 50-Year event
 Inflow = 3.35 cfs @ 12.14 hrs, Volume= 0.286 af
 Outflow = 0.14 cfs @ 17.02 hrs, Volume= 0.286 af, Atten= 96%, Lag= 292.4 min
 Discarded = 0.14 cfs @ 17.02 hrs, Volume= 0.286 af

Routing by Stor-Ind method, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
 Peak Elev= 919.79' @ 17.02 hrs Surf.Area= 10,130 sf Storage= 7,399 cf

Plug-Flow detention time= 585.9 min calculated for 0.286 af (100% of inflow)
 Center-of-Mass det. time= 585.8 min (1,451.6 - 865.8)

Volume	Invert	Avail.Storage	Storage Description
#1	919.00'	9,613 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

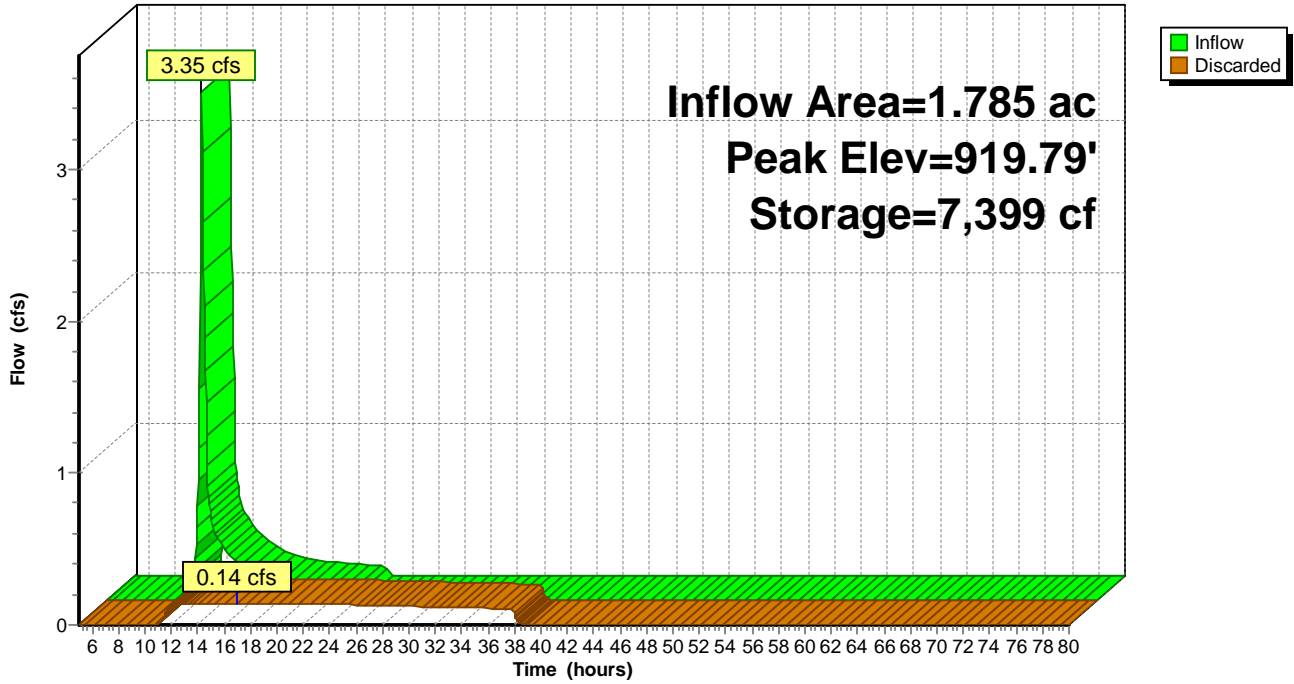
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
919.00	8,707	0	0
920.00	10,518	9,613	9,613

Device	Routing	Invert	Outlet Devices
#1	Discarded	919.00'	0.520 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 915.00'

Discarded OutFlow Max=0.14 cfs @ 17.02 hrs HW=919.79' (Free Discharge)
 ↑1=Exfiltration (Controls 0.14 cfs)

Pond 1PB: Southeast Basin

Hydrograph



CharltonSolar Proposed Conditions

Type III 24-hr 50-Year Rainfall=6.00"

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Summary for Pond 2P: West Basin

Inflow Area = 2.985 ac, 0.00% Impervious, Inflow Depth = 0.93" for 50-Year event
 Inflow = 2.05 cfs @ 12.16 hrs, Volume= 0.232 af
 Outflow = 0.18 cfs @ 16.15 hrs, Volume= 0.232 af, Atten= 91%, Lag= 239.6 min
 Discarded = 0.18 cfs @ 16.15 hrs, Volume= 0.232 af

Routing by Stor-Ind method, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 928.72' @ 16.15 hrs Surf.Area= 6,481 sf Storage= 4,529 cf

Plug-Flow detention time= 304.1 min calculated for 0.232 af (100% of inflow)
 Center-of-Mass det. time= 304.0 min (1,213.3 - 909.3)

Volume	Invert	Avail.Storage	Storage Description
#1	928.00'	6,280 cf	Custom Stage Data (Prismatic) Listed below

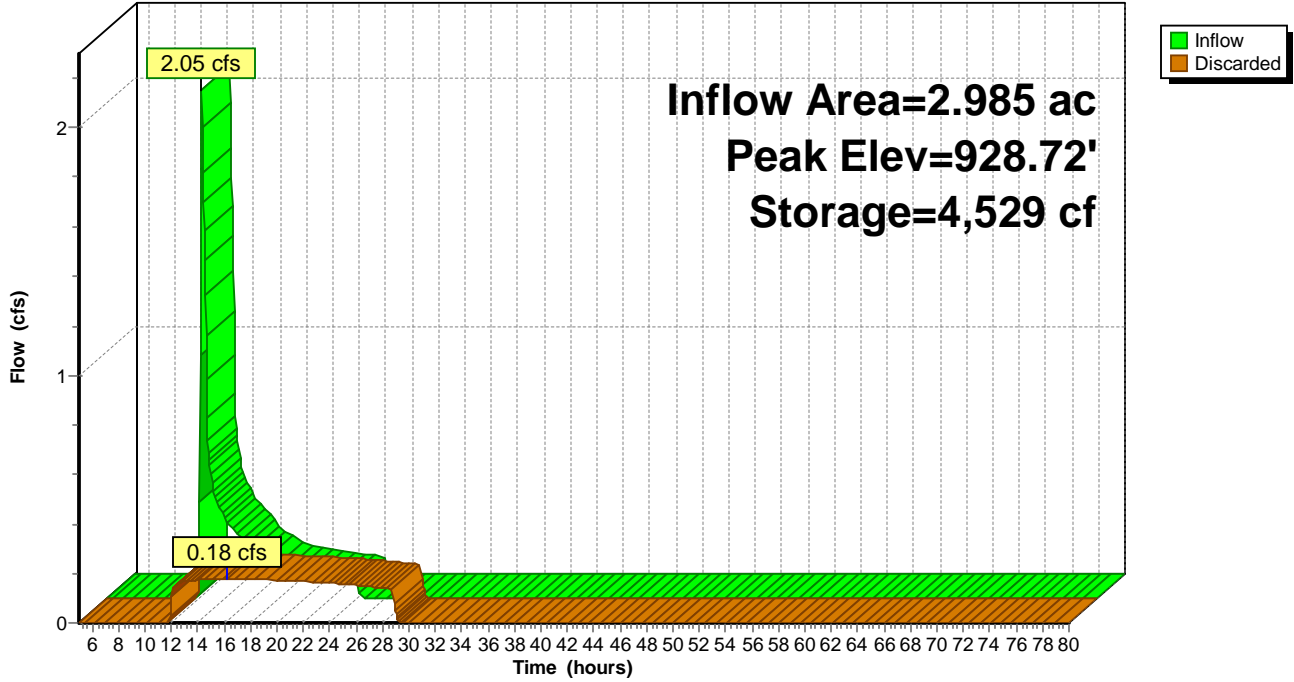
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
928.00	5,825	0	0
929.00	6,735	6,280	6,280

Device	Routing	Invert	Outlet Devices
#1	Discarded	928.00'	1.020 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 924.00'

Discarded OutFlow Max=0.18 cfs @ 16.15 hrs HW=928.72' (Free Discharge)
 ↑**1=Exfiltration** (Controls 0.18 cfs)

Pond 2P: West Basin

Hydrograph



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Type III 24-hr 100-Year Rainfall=6.50"

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Summary for Subcatchment 1DA: PR-DA-1D - Northeast Basin

Runoff = 3.52 cfs @ 12.12 hrs, Volume= 0.280 af, Depth= 2.26"

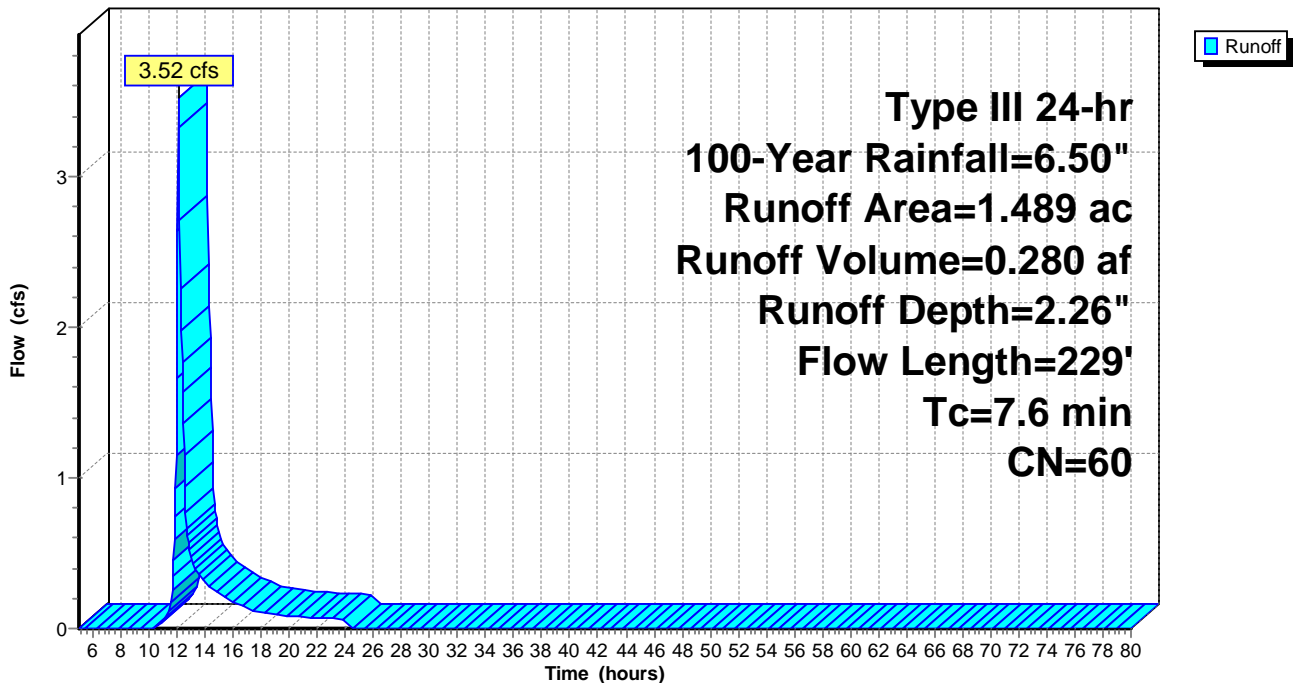
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (ac)	CN	Description
1.359	58	Meadow, non-grazed, HSG B
0.130	85	Gravel roads, HSG B
1.489	60	Weighted Average
1.489		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	50	0.0378	0.13		Sheet Flow, Sheet Flow 1 Grass: Dense n= 0.240 P2= 3.00"
0.5	84	0.1524	2.73		Shallow Concentrated Flow, Shallow Conc. 1 Short Grass Pasture Kv= 7.0 fps
0.3	55	0.2042	3.16		Shallow Concentrated Flow, Shallow Conc. 2 Short Grass Pasture Kv= 7.0 fps
0.1	26	0.0335	2.95		Shallow Concentrated Flow, Shallow Conc. 3 Unpaved Kv= 16.1 fps
0.1	14	0.2114	2.30		Shallow Concentrated Flow, Shallow Conc. 4 Woodland Kv= 5.0 fps
7.6	229	Total			

Subcatchment 1DA: PR-DA-1D - Northeast Basin

Hydrograph



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Type III 24-hr 100-Year Rainfall=6.50"

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Summary for Subcatchment 1Db: PR-DA-1D - Southeast Basin

Runoff = 3.99 cfs @ 12.14 hrs, Volume= 0.336 af, Depth= 2.26"

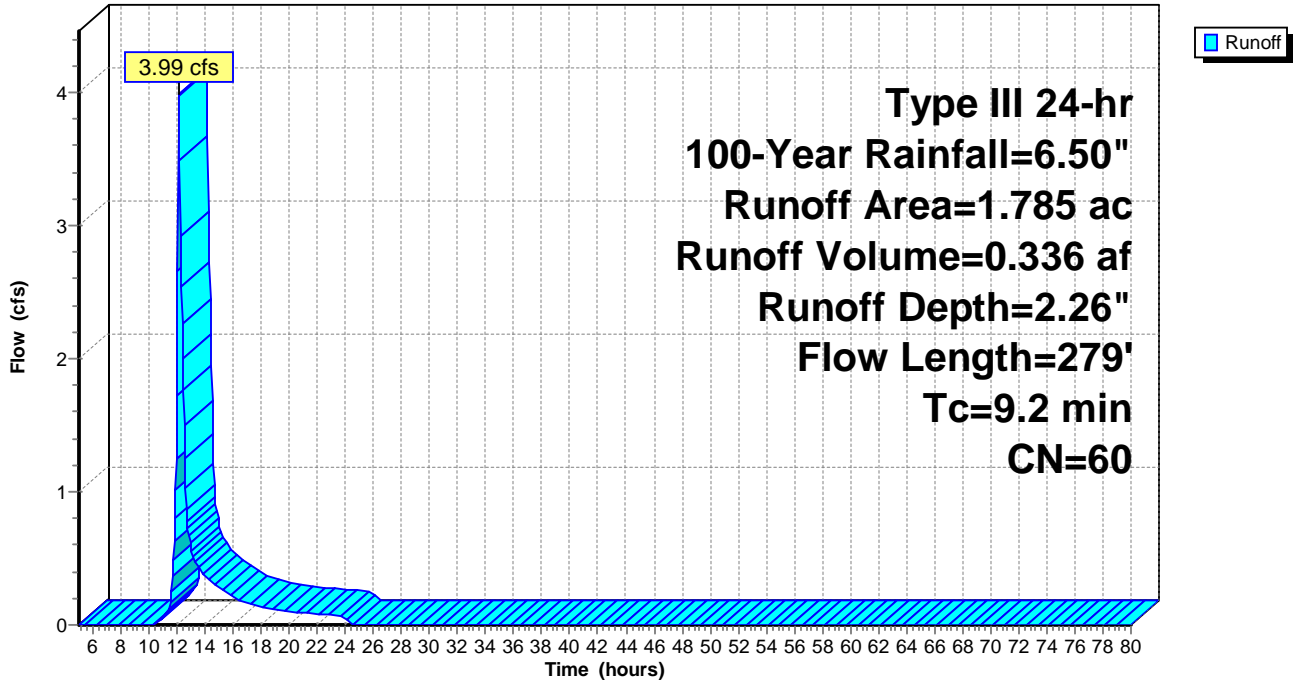
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-Year Rainfall=6.50"

Area (ac)	CN	Description
1.629	58	Meadow, non-grazed, HSG B
0.156	85	Gravel roads, HSG B
1.785	60	Weighted Average
1.785		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	50	0.0292	0.11		Sheet Flow, Sheet Flow 1 Grass: Dense n= 0.240 P2= 3.00"
0.5	78	0.1623	2.82		Shallow Concentrated Flow, Shallow Conc. 1 Short Grass Pasture Kv= 7.0 fps
0.2	48	0.2594	3.57		Shallow Concentrated Flow, Shallow Conc. 2 Short Grass Pasture Kv= 7.0 fps
0.5	38	0.0384	1.37		Shallow Concentrated Flow, Shallow Conc. 3 Short Grass Pasture Kv= 7.0 fps
0.3	18	0.0033	0.92		Shallow Concentrated Flow, Shallow Conc. 4 Unpaved Kv= 16.1 fps
0.1	10	0.0860	2.05		Shallow Concentrated Flow, Shallow Conc. 5 Short Grass Pasture Kv= 7.0 fps
0.3	37	0.1289	1.80		Shallow Concentrated Flow, Shallow Conc. 6 Woodland Kv= 5.0 fps
9.2	279	Total			

Subcatchment 1Db: PR-DA-1D - Southeast Basin

Hydrograph



CharltonSolar Proposed Conditions

Type III 24-hr 100-Year Rainfall=6.50"

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Summary for Subcatchment 1S: PR-DA-1 - East Watershed

Runoff = 3.48 cfs @ 12.20 hrs, Volume= 0.328 af, Depth= 2.26"

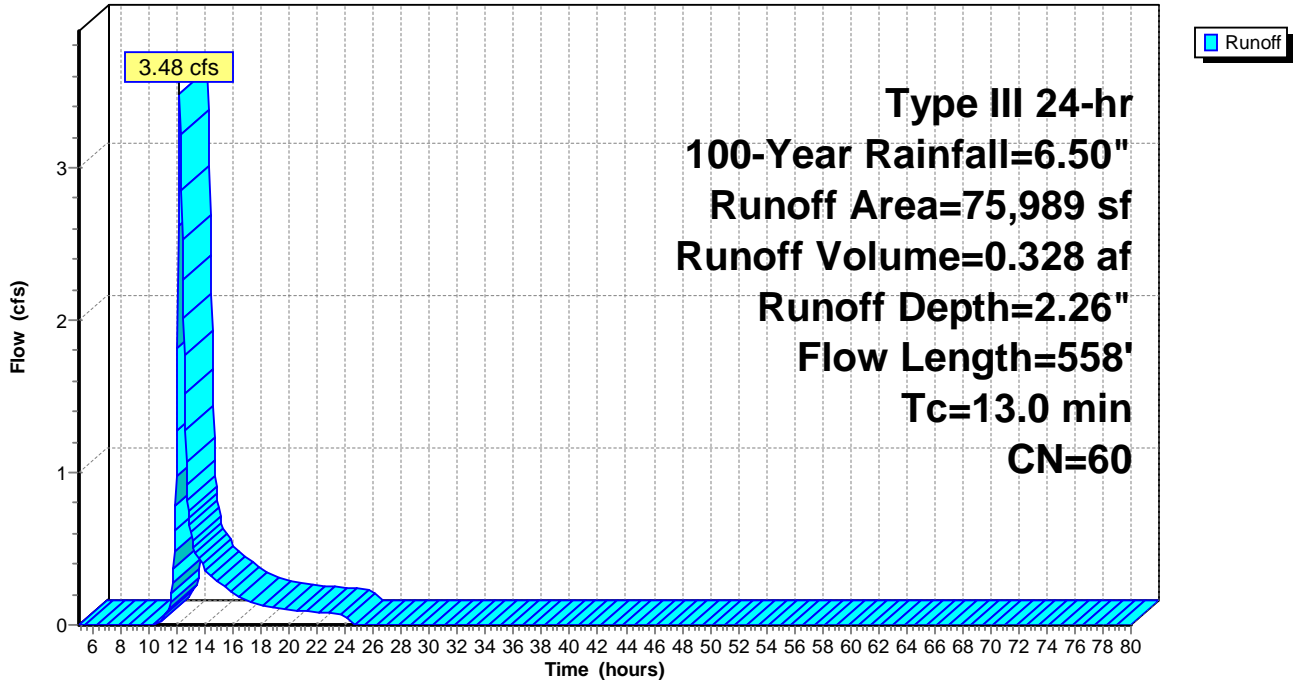
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
70,152	58	Meadow, non-grazed, HSG B
5,837	85	Gravel roads, HSG B
75,989	60	Weighted Average
75,989		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0276	0.11		Sheet Flow, Sheet Flow 1 Grass: Dense n= 0.240 P2= 3.00"
0.6	75	0.1045	2.26		Shallow Concentrated Flow, Shallow Conc. 1 Short Grass Pasture Kv= 7.0 fps
0.5	84	0.1892	3.04		Shallow Concentrated Flow, Shallow Conc. 2 Short Grass Pasture Kv= 7.0 fps
0.1	18	0.0556	3.80		Shallow Concentrated Flow, Shallow Conc. 3 Unpaved Kv= 16.1 fps
0.1	9	0.1833	3.00		Shallow Concentrated Flow, Shallow Conc. 4 Short Grass Pasture Kv= 7.0 fps
1.4	99	0.0557	1.18		Shallow Concentrated Flow, Shallow Conc. 5 Woodland Kv= 5.0 fps
2.9	223	0.0656	1.28		Shallow Concentrated Flow, Shallow Conc. 6 Woodland Kv= 5.0 fps
13.0	558	Total			

Subcatchment 1S: PR-DA-1 - East Watershed

Hydrograph



CharltonSolar Proposed Conditions

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Type III 24-hr 100-Year Rainfall=6.50"

Printed 7/31/2018

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Summary for Subcatchment 2D: PR-DA-2D - West Basin

Runoff = 2.80 cfs @ 12.15 hrs, Volume= 0.289 af, Depth= 1.16"

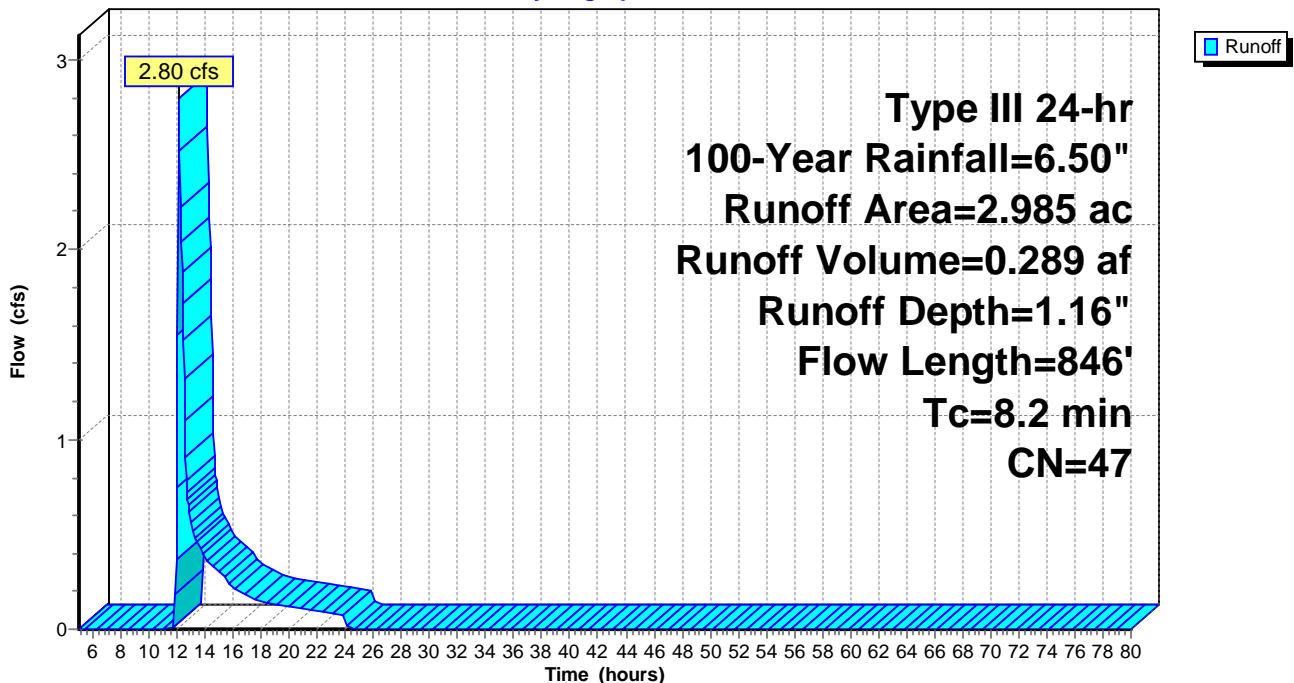
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (ac)	CN	Description
1.223	30	Meadow, non-grazed, HSG A
1.705	58	Meadow, non-grazed, HSG B
0.057	85	Gravel roads, HSG B
2.985	47	Weighted Average
2.985		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	50	0.1198	0.20		Sheet Flow, Sheet Flow 1 Grass: Dense n= 0.240 P2= 3.00"
0.3	52	0.1373	2.59		Shallow Concentrated Flow, Shallow Conc. 1 Short Grass Pasture Kv= 7.0 fps
3.3	690	0.0080	3.49	3.49	Channel Flow, Grassed Swale Area= 1.0 sf Perim= 2.0' r= 0.50' n= 0.024
0.5	54	0.1481	1.92		Shallow Concentrated Flow, Shallow Conc. 2 Woodland Kv= 5.0 fps
8.2	846	Total			

Subcatchment 2D: PR-DA-2D - West Basin

Hydrograph



CharltonSolar Proposed Conditions

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Type III 24-hr 100-Year Rainfall=6.50"

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Summary for Subcatchment 2S: PR-DA-2 - West Sub-Watershed

Runoff = 0.90 cfs @ 12.45 hrs, Volume= 0.181 af, Depth= 0.60"

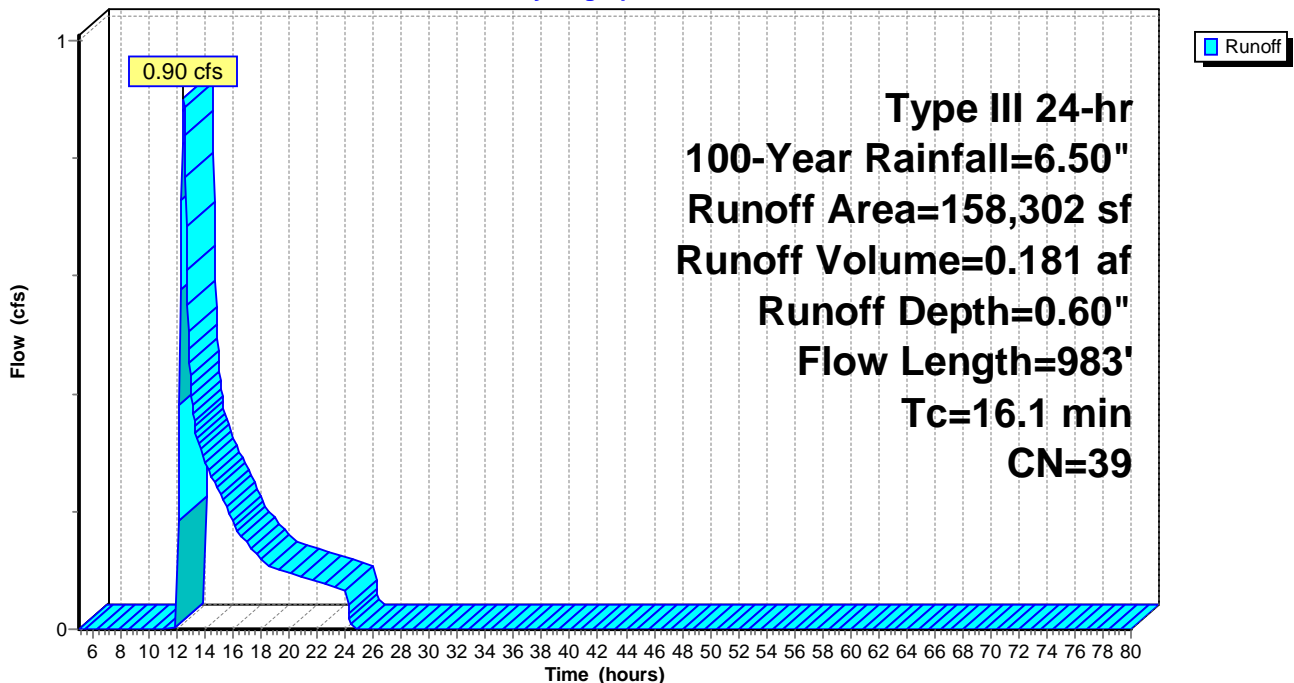
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
107,315	30	Meadow, non-grazed, HSG A
50,987	58	Meadow, non-grazed, HSG B
0	85	Gravel roads, HSG B
158,302	39	Weighted Average
158,302		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0900	0.18		Sheet Flow, Sheet Flow 1 Grass: Dense n= 0.240 P2= 3.00"
2.0	287	0.2228	2.36		Shallow Concentrated Flow, Shallow Conc. 1 Woodland Kv= 5.0 fps
3.8	322	0.0805	1.42		Shallow Concentrated Flow, Shallow Conc. 2 Woodland Kv= 5.0 fps
5.7	324	0.0359	0.95		Shallow Concentrated Flow, Shallow Conc. 3 Woodland Kv= 5.0 fps
16.1	983	Total			

Subcatchment 2S: PR-DA-2 - West Sub-Watershed

Hydrograph



CharltonSolar Proposed Conditions

Type III 24-hr 100-Year Rainfall=6.50"

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Summary for Subcatchment 3S: PR-DA-3 - North Sub-Watershed

Runoff = 1.13 cfs @ 12.70 hrs, Volume= 0.310 af, Depth= 0.54"

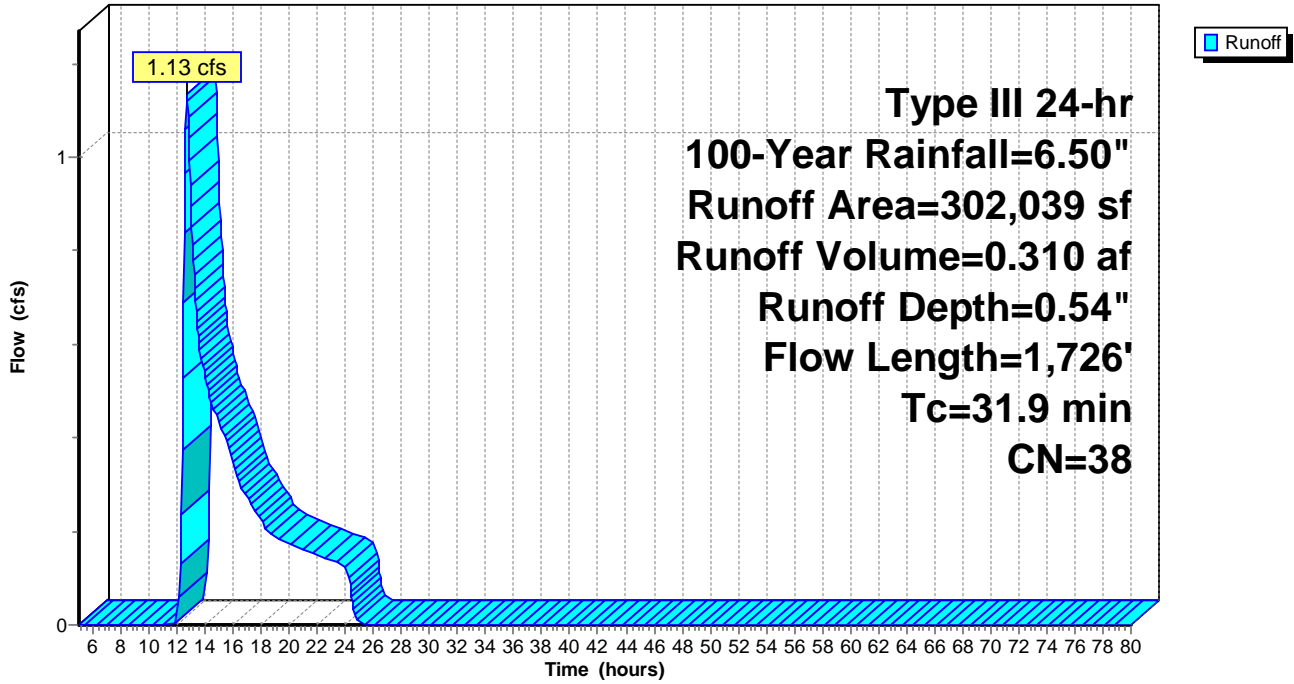
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
230,309	30	Meadow, non-grazed, HSG A
45,634	58	Meadow, non-grazed, HSG B
5,641	71	Meadow, non-grazed, HSG C
8,626	76	Gravel roads, HSG A
9,641	85	Gravel roads, HSG B
2,188	89	Gravel roads, HSG C
302,039	38	Weighted Average
302,039		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	50	0.1228	0.20		Sheet Flow, Sheet Flow
					Grass: Dense n= 0.240 P2= 3.00"
1.5	234	0.1293	2.52		Shallow Concentrated Flow, Shallow Conc. 1
					Short Grass Pasture Kv= 7.0 fps
0.8	76	0.1007	1.59		Shallow Concentrated Flow, Shallow Conc. 2
					Woodland Kv= 5.0 fps
2.0	191	0.1005	1.59		Shallow Concentrated Flow, Shallow Conc. 3
					Woodland Kv= 5.0 fps
2.6	163	0.0443	1.05		Shallow Concentrated Flow, Shallow Conc. 4
					Woodland Kv= 5.0 fps
1.5	114	0.0656	1.28		Shallow Concentrated Flow, Shallow Conc. 5
					Woodland Kv= 5.0 fps
3.4	331	0.1026	1.60		Shallow Concentrated Flow, Shallow Conc. 6
					Woodland Kv= 5.0 fps
6.2	261	0.0195	0.70		Shallow Concentrated Flow, Shallow Conc. 7
					Woodland Kv= 5.0 fps
3.2	153	0.0250	0.79		Shallow Concentrated Flow, Shallow Conc. 8
					Woodland Kv= 5.0 fps
6.6	153	0.0059	0.38		Shallow Concentrated Flow, Shallow Conc. 9
					Woodland Kv= 5.0 fps
31.9	1,726	Total			

Subcatchment 3S: PR-DA-3 - North Sub-Watershed

Hydrograph



CharltonSolar Proposed Conditions

Type III 24-hr 100-Year Rainfall=6.50"

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Summary for Pond 1PA: Northeast Basin

Inflow Area = 1.489 ac, 0.00% Impervious, Inflow Depth = 2.26" for 100-Year event
 Inflow = 3.52 cfs @ 12.12 hrs, Volume= 0.280 af
 Outflow = 0.09 cfs @ 19.18 hrs, Volume= 0.280 af, Atten= 97%, Lag= 423.9 min
 Discarded = 0.09 cfs @ 19.18 hrs, Volume= 0.280 af

Routing by Stor-Ind method, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
 Peak Elev= 927.82' @ 19.18 hrs Surf.Area= 5,680 sf Storage= 8,457 cf

Plug-Flow detention time= 1,070.1 min calculated for 0.280 af (100% of inflow)
 Center-of-Mass det. time= 1,070.8 min (1,930.1 - 859.4)

Volume	Invert	Avail.Storage	Storage Description
#1	926.00'	9,516 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
926.00	3,654	0	0
927.00	4,744	4,199	4,199
928.00	5,890	5,317	9,516

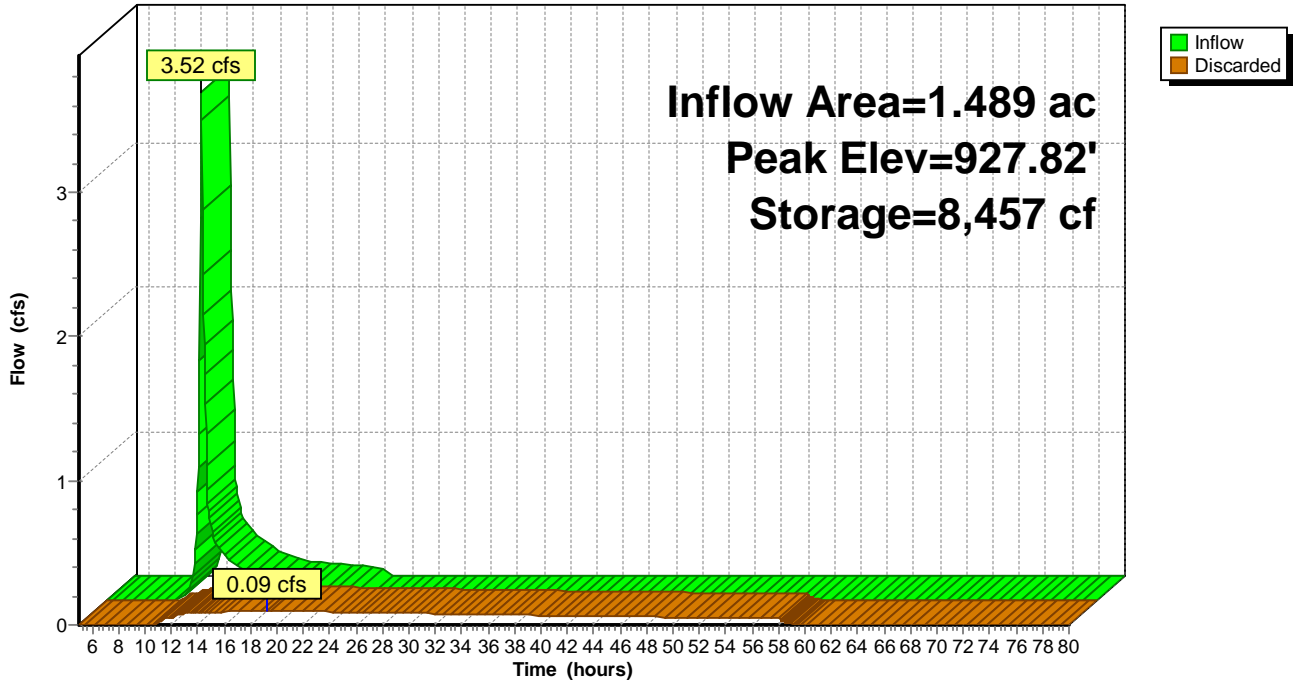
Device	Routing	Invert	Outlet Devices
#1	Discarded	926.00'	0.520 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 922.00'

Discarded OutFlow Max=0.09 cfs @ 19.18 hrs HW=927.82' (Free Discharge)

↑**1=Exfiltration** (Controls 0.09 cfs)

Pond 1PA: Northeast Basin

Hydrograph



CharltonSolar Proposed Conditions

Type III 24-hr 100-Year Rainfall=6.50"

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Summary for Pond 1PB: Southeast Basin

Inflow Area = 1.785 ac, 0.00% Impervious, Inflow Depth = 2.26" for 100-Year event
 Inflow = 3.99 cfs @ 12.14 hrs, Volume= 0.336 af
 Outflow = 0.15 cfs @ 17.33 hrs, Volume= 0.336 af, Atten= 96%, Lag= 311.4 min
 Discarded = 0.15 cfs @ 17.33 hrs, Volume= 0.336 af

Routing by Stor-Ind method, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs
 Peak Elev= 919.95' @ 17.33 hrs Surf.Area= 10,421 sf Storage= 9,052 cf

Plug-Flow detention time= 673.9 min calculated for 0.335 af (100% of inflow)
 Center-of-Mass det. time= 674.2 min (1,535.0 - 860.8)

Volume	Invert	Avail.Storage	Storage Description
#1	919.00'	9,613 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

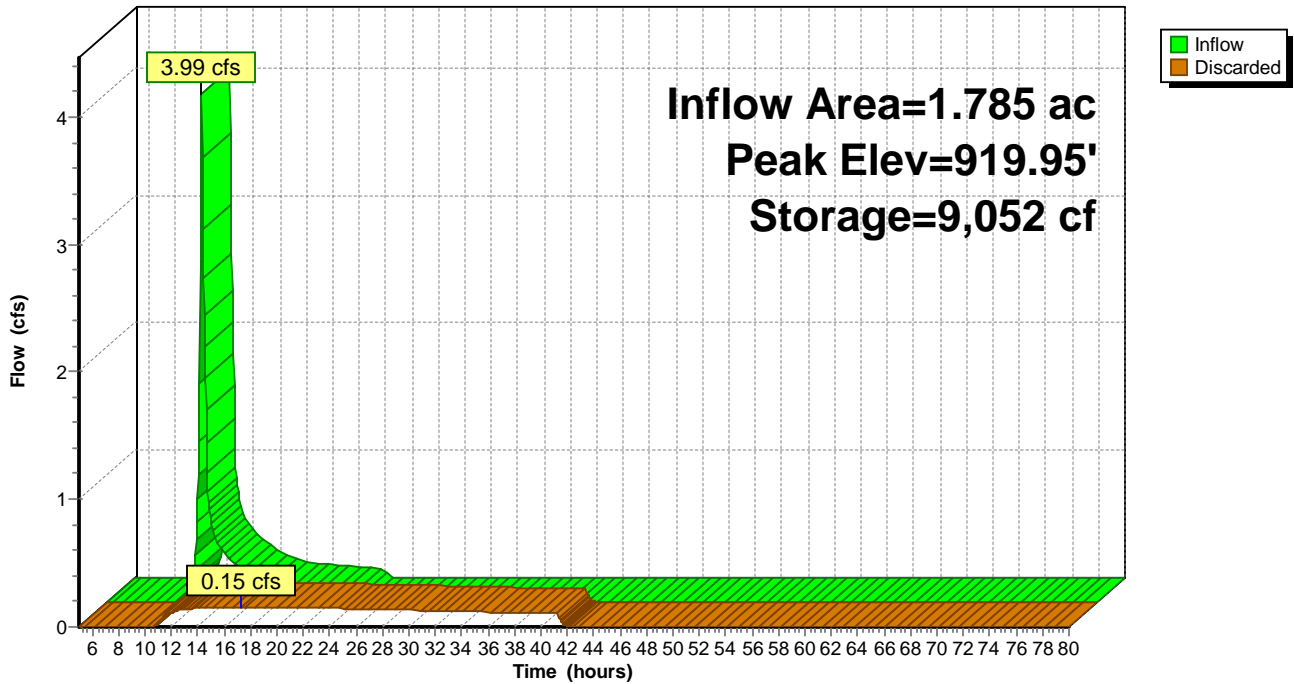
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
919.00	8,707	0	0
920.00	10,518	9,613	9,613

Device	Routing	Invert	Outlet Devices
#1	Discarded	919.00'	0.520 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 915.00'

Discarded OutFlow Max=0.15 cfs @ 17.33 hrs HW=919.95' (Free Discharge)
 ↑**1=Exfiltration** (Controls 0.15 cfs)

Pond 1PB: Southeast Basin

Hydrograph



CharltonSolar Proposed Conditions

Type III 24-hr 100-Year Rainfall=6.50"

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Summary for Pond 2P: West Basin

Inflow Area = 2.985 ac, 0.00% Impervious, Inflow Depth = 1.16" for 100-Year event
 Inflow = 2.80 cfs @ 12.15 hrs, Volume= 0.289 af
 Outflow = 0.20 cfs @ 16.61 hrs, Volume= 0.289 af, Atten= 93%, Lag= 267.7 min
 Discarded = 0.20 cfs @ 16.61 hrs, Volume= 0.289 af

Routing by Stor-Ind method, Time Span= 5.00-80.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 928.99' @ 16.61 hrs Surf.Area= 6,729 sf Storage= 6,241 cf

Plug-Flow detention time= 386.4 min calculated for 0.289 af (100% of inflow)
 Center-of-Mass det. time= 386.5 min (1,287.0 - 900.5)

Volume	Invert	Avail.Storage	Storage Description
#1	928.00'	6,280 cf	Custom Stage Data (Prismatic) Listed below

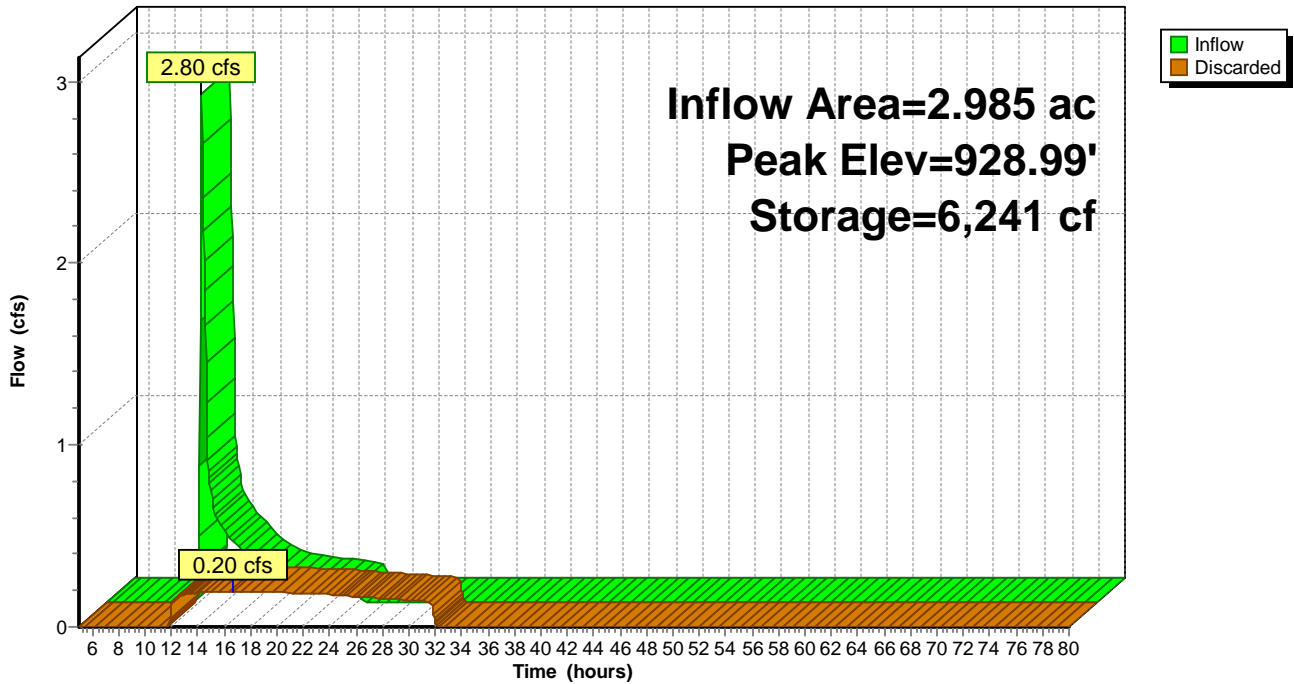
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
928.00	5,825	0	0
929.00	6,735	6,280	6,280

Device	Routing	Invert	Outlet Devices
#1	Discarded	928.00'	1.020 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 924.00'

Discarded OutFlow Max=0.20 cfs @ 16.61 hrs HW=928.99' (Free Discharge)
 ↑**1=Exfiltration** (Controls 0.20 cfs)

Pond 2P: West Basin

Hydrograph



***APPENDIX C – CONSTRUCTION PERIOD
POLLUTION PREVENTION AND EROSION
AND SEDIMENTATION CONTROL PLAN***

Introduction

The anticipated area of disturbance as a result of this project is greater than one acre; therefore, filing a notice of intent with EPA and development of a Stormwater Pollution Prevention Plan (SWPPP) is required. The following plan provides general guidance for the prevention of pollution and erosion and sedimentation during construction.

Potential Erosion and Sedimentation

Portions of the project involve soil disturbance; therefore, site preparation, scheduling, and construction practices need to be carefully planned to prevent construction debris and erosion from adversely impacting downstream resources. Although it is not always possible to avoid all impacts the following guidelines shall be followed:

- Minimize land disturbance area and soil exposure to stormwater and wind erosion.
- Minimize time that area is disturbed.
- Avoid routing stormwater runoff or dewatering flows through disturbed areas.
- Inspect and maintain erosion controls until all soils are stabilized.
- Maintain good housekeeping practices.
- Stabilize disturbed soils as soon as possible to limit exposure.

Erosion and Sedimentation Plan

This Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan have been prepared in accordance with the Department of Environmental Protection's Massachusetts Erosion and Sedimentation Guidelines for Urban and Suburban Areas.

Pre-Construction and Site Preparation

- Contractor shall install all erosion control barrier in accordance with the construction documents prior to commencing any land disturbance activity.
- Inspect and maintain erosion controls until all soils are stabilized.
- Monitor weather reports daily and stabilize/prepare site if storm event in excess of the 2-year storm is expected.

Inspection and Maintenance of Erosion Controls during Construction

Inspect erosion controls weekly and after every storm event until all soils are stabilized.

- Erosion Control Barrier: Check for sedimentation accumulation, removing sediments when they reach excessive volumes (approximately 1/3 the height of the barrier). Also remove sediments when runoff ponds for 24 or more hours to prevent potential mosquito breeding habitat. Restake/replace wattles and silt fence as necessary to maintain their effectiveness.
- Stabilized Construction Entrance: Check to observe overall integrity and effectiveness of crushed stone entrance. Reshape pad as needed for drainage and runoff control, and top dress with clean stone if needed. Remove tracked-out

sediment by the end of each work day.

- Temporary Earthen Swales & Filter Swales: Check for erosion in the vicinity of and along the perimeter of the channels. Reshape swale as needed for proper sloping and drainage control. Observe integrity of stone check dams, and remove accumulated sediment behind the dams when the height exceeds approximately one-third the height of the dam.
- Sediment Basins: Remove sediment from the basins when the accumulated height exceeds one-half the height of the basin or swale.

Good Housekeeping

- Avoid stockpiling of soil within 100 feet of wetland resources and wellhead protection areas. If necessary, provide sufficient erosion controls to prevent migration of sediments.
- Minimize hazardous materials stored on site. All materials stored on site shall be stored in original containers and sealed.
- Refuel construction equipment off-site.
- Any spills of hazardous materials shall be reported, contained, and removed in accordance with local, State, and Federal regulations.

Plans

See proposed construction drawings for locations of all proposed erosion and sedimentation controls.

Potential Construction Site Pollutants

Pollutant-Generating Activity	Pollutants or Pollutant Constituents (that could be discharged if exposed to stormwater)	Location on Site (or reference SWPPP site map where this is shown)
Equipment Re-fueling	Diesel Fuel, Gasoline	Laydown Area
Leaking or Broken Hydraulic Lines	Hydraulic Oil	Building Work Areas and Laydown Area
Minor Equipment Maintenance	Diesel Fuel, Gasoline, Hydraulic Oil, Motor Oil, Anti-Freeze	Laydown Area
Applying Fertilizer	Nitrogen, Phosphorous	Newly Seeded Areas
Portable Sanitary Toilets	Bacteria, Parasites and Viruses	Laydown Area
Vehicle Accident	Diesel Fuel, Gasoline	Entire Site
Trash Containers/Dumpsters	Paper, Plastic, and Food Waste	Laydown Area



***APPENDIX D – LONG TERM OPERATION
AND MAINTENANCE PLAN***

Long Term Operation & Maintenance Plan
Stormwater Management Systems
North Sturbridge Road Solar Facility - Charlton, MA

This stormwater management system (SWMS) operations and maintenance plan has been prepared in accordance with the Massachusetts Department of Environmental Protection's Stormwater Management Standards.

General Information

Project Name: North Sturbridge Road Solar Facility

Project Type: Site Development

Address: North Sturbridge Road, Charlton MA

SWMS Owner: Sunpin Solar Development, LLC
3 Corporate Park, Suite 150
Irvine, CA 92614

Responsible Party: Sunpin Solar Development, LLC

Contact: Marsel Kamberaj, Sunpin Solar Development, LLC

It shall be the responsibility of the Owner to provide a revised plan to the Town of Charlton indicating any change of ownership or responsible party.

BMP Inspection and Maintenance Procedures

Effectiveness of Best Management Practices (BMPs) is maximized when properly maintained. The following inspections schedule and maintenance required of BMPs for this project (see attached plan) shall be as outlined and documented below.

- Infiltration Basin
 - Remove accumulated sediment, trash, debris, leaves, and grass clippings.
 - Mow the buffer area, side slopes, and basin bottom.
 - Rake basin floor and remove tree or other plant seedlings before they become established.
 - Check for ponding within basin.
 - Check for erosion along basin slopes.
 - Inspect to ensure proper functioning.
 - Check for erosion along overflow riprap apron.



Long Term Operation & Maintenance Plan
Stormwater Management Systems
North Sturbridge Road Solar Facility - Charlton, MA

- Grassed Swale
 - Remove accumulated sediment, trash, debris, leaves, and grass clippings.
 - Mow the side slopes and basin bottom.
 - Remove tree or other plant seedlings before they become established.
 - Check for erosion in vicinity of swale.

Public Safety and Features

1. Provide police detail for extended occupation of roadway if traffic dictates.
2. All excavations and entry into closed structures will be completed in accordance with OSHA requirements.

Approximate Maintenance Budget

Inspection and maintenance for this site is estimated as follows.

1. Inspections	\$500
2. Mowing	\$1,500
3. Infiltration Basin	\$4,050
Annual Total:	\$6,050

Long Term Operation & Maintenance Plan
 Stormwater Management Systems
 North Sturbridge Road Solar Facility - Charlton, MA

BMP Inspection and Maintenance Documentation Form

Inspection No.: _____ Date: _____ Weather: _____

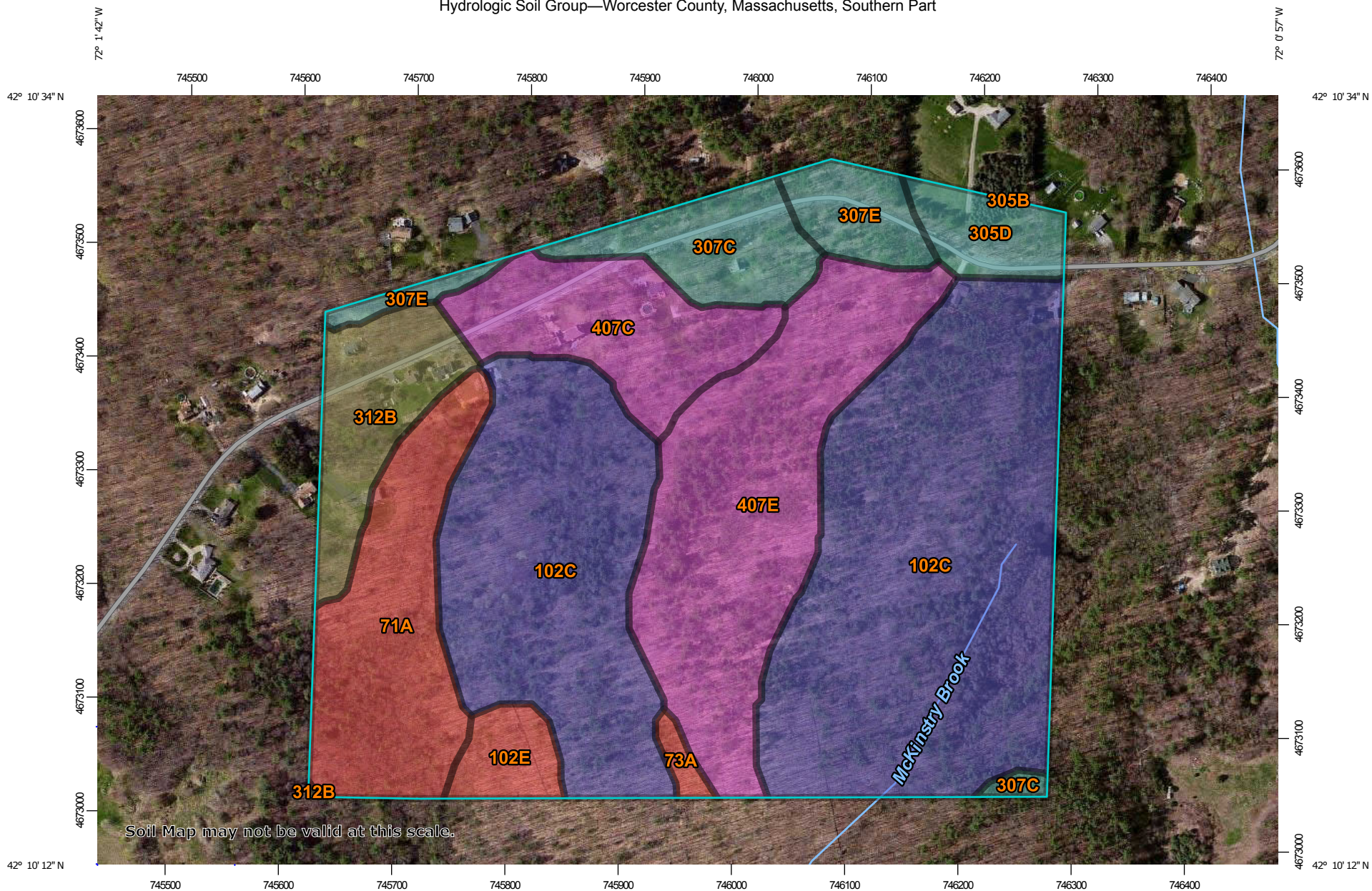
Date & Amount of Last Precipitation Event: _____

Inspector Name: _____ Inspection Signature: _____

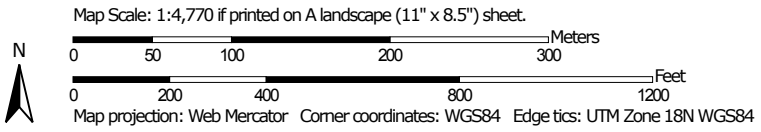
BMP	Condition/Stability	Comment & Recommendations	Date Corrected
Infiltration Basin			
Emergency Spillway			
Grassed Swales			
Other			
Additional Comments			

APPENDIX E – SOILS DATA

Hydrologic Soil Group—Worcester County, Massachusetts, Southern Part




Soil Map may not be valid at this scale.



MAP LEGEND

Area of Interest (AOI)









 Area of Interest (AOI)

Soils

Soil Rating Polygons





 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Lines

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Points





 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available


Water Features

 Streams and Canals

Transportation

 Rails
 Interstate Highways
 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

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:
 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: Worcester County, Massachusetts, Southern Part
 Survey Area Data: Version 10, Oct 6, 2017

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

Date(s) aerial images were photographed: Apr 9, 2011—May 12, 2011

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
71A	Ridgebury fine sandy loam, 0 to 3 percent slopes, extremely stony	D	8.5	10.4%
73A	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	D	0.5	0.6%
102C	Chatfield-Hollis-Rock outcrop complex, 0 to 15 percent slopes	B	37.6	45.7%
102E	Chatfield-Hollis-Rock outcrop complex, 15 to 35 percent slopes	D	1.7	2.1%
305B	Paxton fine sandy loam, 3 to 8 percent slopes	C	0.0	0.0%
305D	Paxton fine sandy loam, 15 to 25 percent slopes	C	2.2	2.7%
307C	Paxton fine sandy loam, 8 to 15 percent slopes, extremely stony	C	4.0	4.9%
307E	Paxton fine sandy loam, 15 to 35 percent slopes, extremely stony	C	2.9	3.5%
312B	Woodbridge fine sandy loam, 0 to 8 percent slopes, extremely stony	C/D	4.5	5.5%
407C	Charlton fine sandy loam, 8 to 15 percent slopes, extremely stony	A	6.3	7.6%
407E	Charlton fine sandy loam, 15 to 35 percent slopes, extremely stony	A	14.0	17.1%
Totals for Area of Interest			82.2	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



J2463-12-01
June 1, 2018

BETA Group, Inc.
One Springfield Street
Chicopee, Massachusetts 01013
Attn: Chris Nolan

Re: Stormwater Design Recommendations
Sunpin Solar Charlton Facility
North Sturbridge Road
Charlton, MA

Dear Mr. Nolan:

O'Reilly Talbot & Okun Associates, Inc. (OTO) is pleased to provide this letter report summarizing our investigations for the design of underground stormwater infiltration systems, associated with the proposed solar facility to be located off North Sturbridge Road, Charlton, Massachusetts. This report is subject to the attached limitations.

SUBSURFACE EXPLORATIONS

Subsurface explorations consisted of four test pits (TP-1 through TP-4), which were performed on May 17, 2018. The test pits were performed in the proposed stormwater infiltration areas, as identified by others. The test pits were performed using a Caterpillar 420-D backhoe/loader, equipped with a ½ yard bucket. The test pits extended to a depth of approximately between 1.5 and 7 feet below ground surface. Four infiltration tests (hydraulic conductivity) were performed within the test pits (IF-1 through IF-4) at depths between 1 foot and 2.75 feet. An OTO geotechnical engineer logged the test pits and performed the hydraulic conductivity tests. The test pit logs are attached. The test pit locations are shown on the attached Site sketch.

SUBSURFACE CONDITIONS

The ground surface at each test pit location was covered with approximately three to six inches of brush and decaying organic material (leaves, branches), followed by approximately six inches of topsoil. The topsoil generally consisted of fine sand, with little amounts of silt, and trace organics (roots). Numerous large boulders (greater than 3 feet in diameter) and several bedrock outcroppings could be observed at the surface across the Site. Bedrock was encountered at or near the ground surface in test pits TP-1A, TP-3A and TP-4.

The surficial layer was underlain by native, orange-brown, fine to coarse sand with little to some amounts of silt, and varying amounts of gravel, cobbles and boulders. Each of the test pits were extended to refusal upon large boulders and/or bedrock at a depth of between 0.5 and 7 feet. No groundwater, obvious indications of a seasonal high groundwater table, or indications of a saturated soil condition were observed within the test pits.

HYDRAULIC CONDUCTIVITY TESTING RESULTS

In-Situ hydraulic conductivity (or permeability) testing was performed in each of the test pits (TP-1 through TP-4), to aid in the design of the stormwater control disposal system. The test and results are described below.

The test was performed using a constant head methodology, via a Guelph permeameter. The Guelph permeameter allows the rate of water recharge into an unsaturated soil to be measured while a constant water head is maintained. The permeability test was performed by auguring a shallow hole into the soil at the base of the test pit, adding water to the apparatus, and then recording the change in the rate of water flow from a reservoir over time. These data were then used to estimate the coefficient of permeability or hydraulic conductivity.

The tests were performed at a depth of approximately 1 to 2.75 feet below ground surface. The soil encountered at the test interval consisted of fine to coarse sand with little to some amounts silt and varying amounts of gravel, cobbles and boulders. The saturated hydraulic conductivity (K) values determined by these tests are presented in Table 1.

Table 1
Hydraulic Conductivity Test Results

Infiltration Test/Test Pit	Test Depth (feet)	Refusal Depth (feet)	Soil Conditions	K Value (feet/day)
IF-1/TP-1	2.75	4.5	Fine to coarse sand, some boulders and cobbles, some gravel, little silt	< 0.02
IF-2/TP-2	2.5	7.0 (Large boulders from 3-7 feet)	Fine sand, little to some silt, little fine gravel, little medium to coarse sand	3.60
IF-3/TP-3	2.50	4.5	Fine sand, little silt, little fine gravel, little medium to coarse sand	24.00
IF-4/TP-4	1.00	1.5	Fine sand, little silt, little fine gravel, little medium to coarse sand	< 0.02
Note: No infiltration observed in TP-1 and TP-4. The infiltration rates varied significantly at each location.				

Based upon the results of these tests, we recommend that the field conditions be verified during installation of the stormwater structures, to ensure that actual conditions are similar to those observed during these investigations and assumed for design. If conditions are different than those observed, OTO should be contracted to review conditions. Soil

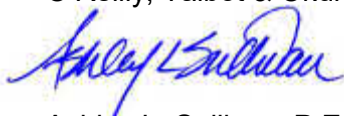
conditions did not vary significantly at each location (silt content, depth to groundwater, and refusal depth). The variability in the infiltration rates may be due to the density of the soils.

ADDITIONAL CONSIDERATIONS

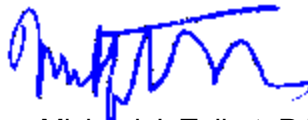
Solar panel foundation systems include ground screws, driven piles (such as a steel H pile), and/or surface mounted, ballast systems. Typically, these systems are designed by the supplier in general accordance with the manufacturer's guidelines and specifications. The ground screw or pile system designer and installer should note that numerous cobbles and boulders, along with shallow bedrock is present in the near surface soils. We recommend that the foundation installer evaluate their ability to install the proposed system and the ability of the piles or ground screws to resist anticipated loads (in both compression and tension) should shallow refusal be encountered.

We appreciated the opportunity to be of service on this project. If you have any questions, please contact the undersigned.

Sincerely yours
O'Reilly, Talbot & Okun Associates, Inc.



Ashley L. Sullivan, P.E.
Associate

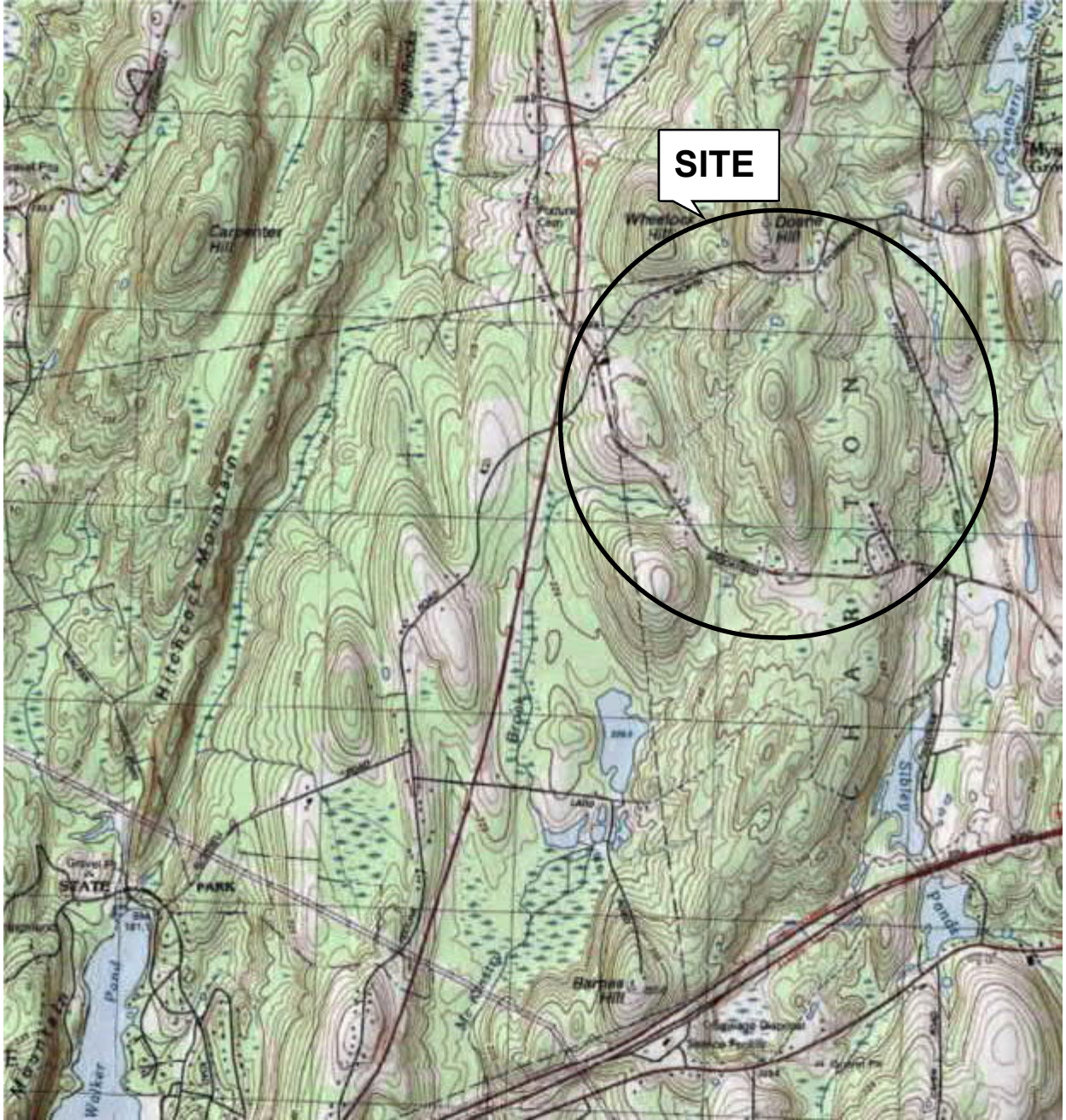


Michael J. Talbot, P.E.
Principal

Attachments: Limitations, Site Locus, Site Sketch, Test Pit Logs, Photographs

LIMITATIONS

1. The observations presented in this report were made under the conditions described herein. The conclusions presented in this report were based solely upon the services described in the report and not on scientific tasks or procedures beyond the scope of the project or the time and budgetary constraints imposed by the client. The work described in this report was carried out in accordance with the Statement of Terms and Conditions attached to our proposal.
2. The analysis and recommendations submitted in this report are based in part upon the data obtained from widely spaced subsurface explorations. The nature and extent of variations between these explorations may not become evident until construction. If variations then appear evident, it may be necessary to reevaluate the recommendations of this report.
3. The generalized soil profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretations of widely spaced explorations and samples; actual soil transitions are probably more erratic. For specific information, refer to the boring logs.
4. In the event that any changes in the nature, design or location of the proposed structures are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing by O'Reilly, Talbot & Okun Associates Inc. It is recommended that we be retained to provide a general review of final plans and specifications.
5. Our report was prepared for the exclusive benefit of our client. Reliance upon the report and its conclusions is not made to third parties or future property owners.



Topographic Map Quadrant: Warren E, MA
©2016 National Geographic Partners

Map Current as of: 1997



293 Bridge Street, Suite 500
Springfield, Massachusetts 01103

Phone: 413-788-6222
www.oto-env.com

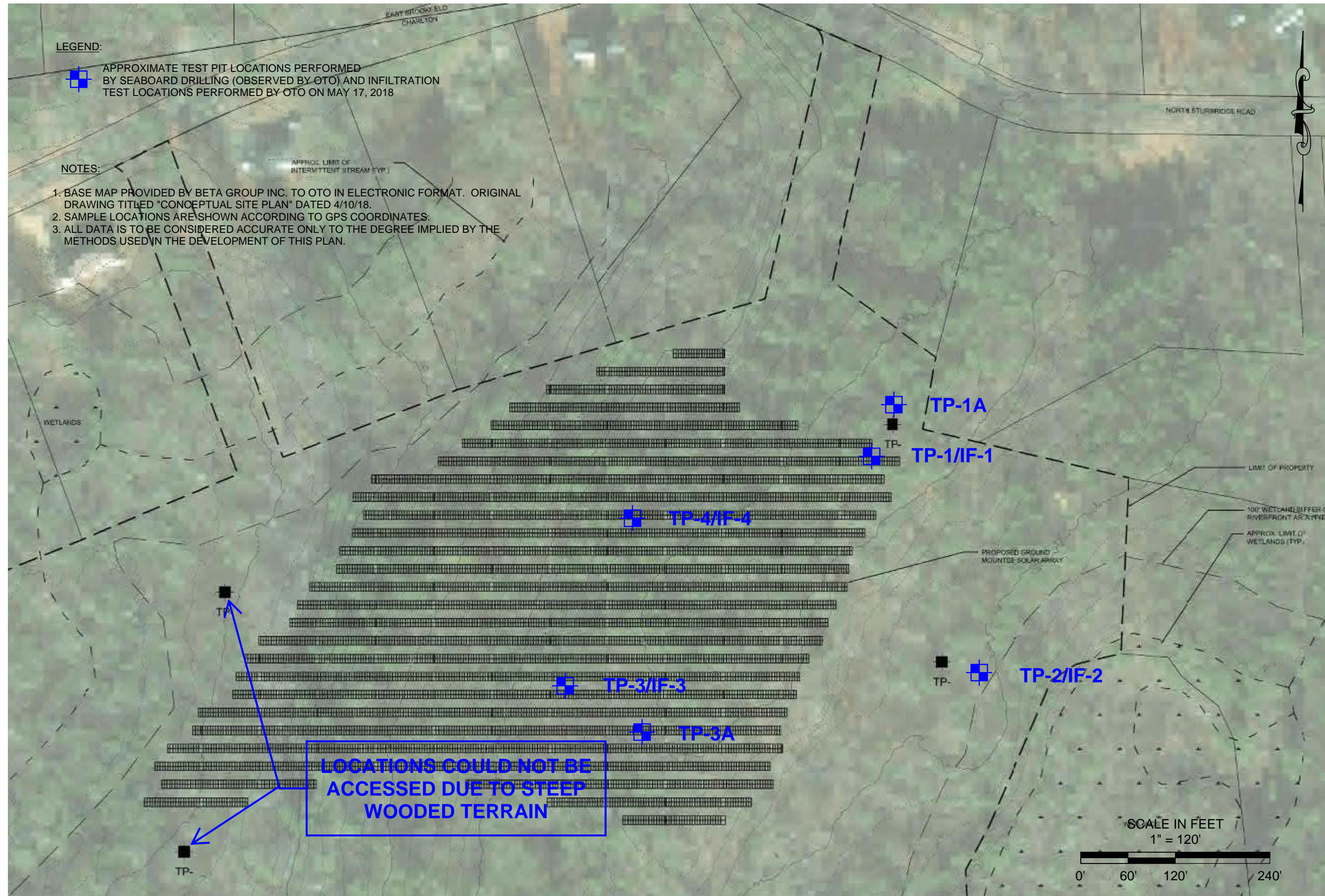
North Sturbridge Road
Charlton, MA

PROJECT NUMBER
J2463-12-01

SITE LOCUS

MAY 24, 2018

Figure 1



Designed By: MJN
 Drawn By: MJN
 Checked By: ALS
 Date: 05/24/2018
 Revised Date:

NORTH STURBRIDGE ROAD
 CHARLTON, MASSACHUSETTS
SITE SKETCH

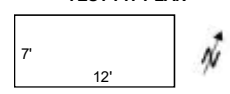
PROJECT NO.
J2463-12-01

FIGURE NO.
2

LOG OF TEST PIT TP-1

PROJECT	Sunpin Charlton	CONTRACTOR	Seaboard
JOB NO.	2463-12-01	DATE	5/17/2018
LOCATION	Charlton, MA	WEATHER	Sunny 70's
TEST PIT LOCATION	NE portion of site	START TIME	8:45
		FINISH TIME	9:30
		OTO STAFF	MN
		OPERATOR	Tanker
		BACKHOE	CAT 420D
		CAPACITY (cy)	1/2
		GS ELEV. (ft)	
		FINAL DEPTH (ft)	4.5

DEPTH (ft)	SOIL DESCRIPTION	EXCAV. EFFORT	BOULDERS/ COBBLES		REMARKS
			COUNT	SIZE	
0'	6" Dark brown, fine SAND, little silt, trace (-) organics (roots), damp	E			
1'					
2'					
3'	Orange brown, fine to coarse SAND, some boulders and cobbles, some gravel, little silt, damp.	M	Numerous	3"-18"	
4'					
5'	Bedrock End of Exploration at 4.5' upon likely Bedrock	V			
6'					
7'					
8'					
9'					
10'					
11'					

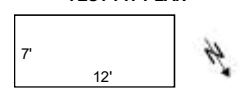
TEST PIT PLAN 	EXCAVATION EFFORT EasyE ModerateM DifficultD Very DifficultV	BOULDER/COBBLE CLASS <table border="0"> <tr> <td>Type</td> <td>Size</td> </tr> <tr> <td>Cobble</td> <td>3" - 6"</td> </tr> <tr> <td>Small</td> <td>6" - 18"</td> </tr> <tr> <td>Medium</td> <td>18" - 36"</td> </tr> <tr> <td>Large</td> <td>36" and Larger</td> </tr> </table>	Type	Size	Cobble	3" - 6"	Small	6" - 18"	Medium	18" - 36"	Large	36" and Larger	PROPORTIONS USED <table border="0"> <tr> <td>Term</td> <td>Relative Quantity</td> </tr> <tr> <td>and</td> <td>35% - 50%</td> </tr> <tr> <td>some</td> <td>20% - 35%</td> </tr> <tr> <td>little</td> <td>10% - 20%</td> </tr> <tr> <td>trace</td> <td>10% or less</td> </tr> </table>	Term	Relative Quantity	and	35% - 50%	some	20% - 35%	little	10% - 20%	trace	10% or less	GROUNDWATER CONDITIONS GW Depth (ft): NE GW Elevation (ft): Elapsed Time (min):
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Term	Relative Quantity																							
and	35% - 50%																							
some	20% - 35%																							
little	10% - 20%																							
trace	10% or less																							

Remarks: 1. Bedrock encountered at approximately 6" BGS in initial test pit (TP-1A) offset approximately 20' southeast. 2. Infiltration test run adjacent to test pit.	PROJECT NO. 2463-12-01
	LOG OF TEST PIT TP-1

LOG OF TEST PIT TP-2

PROJECT	Sunpin Charlton	CONTRACTOR	Seaboard
JOB NO.	2463-12-01	OPERATOR	Tanker
LOCATION	Charlton, MA	BACKHOE	CAT 420D
TEST PIT LOCATION	SE portion of site	START TIME	9:45
		FINISH TIME	10:30
		OTO STAFF	MN
		CAPACITY (cy)	1/2
		GS ELEV. (ft)	
		FINAL DEPTH (ft)	4.5

DEPTH (ft)	SOIL DESCRIPTION	EXCAV. EFFORT	BOULDERS/ COBBLES		REMARKS
			COUNT	SIZE	
0'	6" Dark brown, fine SAND, little silt, trace (-) organics (roots), damp	E			
1'					
2'	Orange brown gray, fine SAND, little to some silt, little fine gravel, little medium coarse sand, damp.	M	Numerous	3"-18"	
3'					
4'					
5'	Large (1'-4' dia) angular boulders.	D			
6'					
7'	End of Exploration at approximately 7' upon difficult excavation.	VD			
8'					
9'					
10'					
11'					

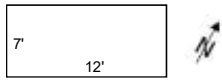
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Term	Relative Quantity																							
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some	20% - 35%																							
little	10% - 20%																							
trace	10% or less																							

Remarks: 1. Infiltration test run adjacent to test pit.	PROJECT NO. 2463-12-01
	LOG OF TEST PIT TP-2

LOG OF TEST PIT TP-

PROJECT	Sunpin Charlton	CONTRACTOR	Seaboard
JOB NO.	2463-12-01	DATE	5/17/2018
LOCATION	Charlton, MA	WEATHER	Sunny 70's
TEST PIT LOCATION	SW portion of the site	START TIME	11:45
		FINISH TIME	12:30
		OTO STAFF	MN
		OPERATOR	Tanker
		BACKHOE	CAT 420D
		CAPACITY (cy)	1/2
		GS ELEV. (ft)	
		FINAL DEPTH (ft)	4.5

DEPTH (ft)	SOIL DESCRIPTION	EXCAV. EFFORT	BOULDERS/ COBBLES		REMARKS
			COUNT	SIZE	
0'	6" Dark brown, fine SAND, little silt, trace (-) organics (roots), damp	E			
1'					
2'					
3'	Brown, fine SAND, little silt, little fine gravel, little medium to coarse sand, damp. Numerous large boulders, 1"-2" dia	M D			
4'					
5'	End of Exploration at approximately 4.5' upon boulder/rock.	VD			
6'					
7'					
8'					
9'					
10'					
11'					

TEST PIT PLAN 	EXCAVATION EFFORT EasyE ModerateM DifficultD Very DifficultV	BOULDER/COBBLE CLASS <table border="0"> <tr> <td>Type</td> <td>Size</td> </tr> <tr> <td>Cobble</td> <td>3" - 6"</td> </tr> <tr> <td>Small</td> <td>6" - 18"</td> </tr> <tr> <td>Medium</td> <td>18" - 36"</td> </tr> <tr> <td>Large</td> <td>36" and Larger</td> </tr> </table>	Type	Size	Cobble	3" - 6"	Small	6" - 18"	Medium	18" - 36"	Large	36" and Larger	PROPORTIONS USED <table border="0"> <tr> <td>Term</td> <td>Relative Quantity</td> </tr> <tr> <td>and</td> <td>35% - 50%</td> </tr> <tr> <td>some</td> <td>20% - 35%</td> </tr> <tr> <td>little</td> <td>10% - 20%</td> </tr> <tr> <td>trace</td> <td>10% or less</td> </tr> </table>	Term	Relative Quantity	and	35% - 50%	some	20% - 35%	little	10% - 20%	trace	10% or less	GROUNDWATER CONDITIONS GW Depth (ft): NE GW Elevation (ft): Elapsed Time (min):
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Large	36" and Larger																							
Term	Relative Quantity																							
and	35% - 50%																							
some	20% - 35%																							
little	10% - 20%																							
trace	10% or less																							

Remarks: 1. Bedrock encountered near ground surface in initial test pit (TP-3A), offset approximately 30' west. 2. Infiltration test run adjacent to test pit.	PROJECT NO. 2463-12-01
	LOG OF TEST PIT TP-



LOG OF TEST PIT TP-4

PROJECT	Sunpin Charlton	CONTRACTOR	Seaboard
JOB NO.	2463-12-01	OPERATOR	Tanker
LOCATION	Charlton, MA	BACKHOE	CAT 420D
TEST PIT LOCATION	NW portion of site	START TIME	12:45
		FINISH TIME	1:30
		OTO STAFF	MN
		CAPACITY (cy)	1/2
		GS ELEV. (ft)	
		FINAL DEPTH (ft)	4.5

DEPTH (ft)	SOIL DESCRIPTION	EXCAV. EFFORT	BOULDERS/ COBBLES		REMARKS
			COUNT	SIZE	
0'	6" Dark brown, fine SAND, little silt, trace (-) organics (roots), damp	E			
1'	Brown, fine SAND, little silt, little fine gravel, little medium to coarse sand, damp.	M			
2'	End of Exploration upon bedrock/boulders at approximatey 1.5'	VD			
3'					
4'					
5'					
6'					
7'					
8'					
9'					
10'					
11'					

TEST PIT PLAN 	EXCAVATION EFFORT EasyE ModerateM DifficultD Very DifficultV	BOULDER/COBBLE CLASS <table border="0"> <tr> <td>Type</td> <td>Size</td> </tr> <tr> <td>Cobble</td> <td>3" - 6"</td> </tr> <tr> <td>Small</td> <td>6" - 18"</td> </tr> <tr> <td>Medium</td> <td>18" - 36"</td> </tr> <tr> <td>Large</td> <td>36" and Larger</td> </tr> </table>	Type	Size	Cobble	3" - 6"	Small	6" - 18"	Medium	18" - 36"	Large	36" and Larger	PROPORTIONS USED <table border="0"> <tr> <td>Term</td> <td>Relative Quantity</td> </tr> <tr> <td>and</td> <td>35% - 50%</td> </tr> <tr> <td>some</td> <td>20% - 35%</td> </tr> <tr> <td>little</td> <td>10% - 20%</td> </tr> <tr> <td>trace</td> <td>10% or less</td> </tr> </table>	Term	Relative Quantity	and	35% - 50%	some	20% - 35%	little	10% - 20%	trace	10% or less	GROUNDWATER CONDITIONS GW Depth (ft): NE GW Elevation (ft): Elapsed Time (min):
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Remarks: 1. Infiltration test run adjacent to test pit.	PROJECT NO. 2463-12-01
	LOG OF TEST PIT TP-4



Test Pit 1A – Shallow Refusal



Test Pit 1



Test Pit 1 – Spoils



Test Pit 2



Test Pit 2 - Boulders



Test Pit 2 – Spoils



Test Pit 3A – Shallow Refusal



Test Pit 3A – Shallow Refusal



Test Pit 3



Test Pit 3 – Spoils



Test Pit 4



Test Pit 4 - Spoils

APPENDIX F – SUPPLEMENTAL CALCULATIONS



Impervious Area = **2,782** sq. ft.

Required Recharge Volume

Recharge Volume (R_V) Required = Impervious Area x Runoff Depth (from HSG)

$$R_V^* = 1,845 \text{ sf.} \times 0.35 \text{ in} \times 0.08 \text{ ft/in} = 53.8125 \text{ cu. ft.}$$

Total R_V Required = 54 cu. ft.

Required Water Quality Volume

Water Quality Volume (WQ_V) Required = Impervious Area x Runoff Depth (Excluding roof area)

$$WQ_V \text{ (All Areas)} = 1,845 \text{ sf.} \times 1.0 \text{ in} \times 0.08 \text{ ft/in} = 153.8 \text{ cu. ft.}$$

Subtotal WQ_V Required = 154 cu. ft.

Provided Recharge & Water Quality Volume**

Infiltration Basin: West	5867	CF
Infiltration Basin: Northeast	8923	CF
Infiltration Basin: Southeast	9304	CF

Total = 24,094 cu. ft. > R_V Req'd = 54 cu. ft. & WQ_V Req'd = 154 cu. ft. **OK**

* Hydrologic Soil Goup (HSG) B obtained by NRCS Soil Maps

**Storage volumes provided are for the 100 year storm event

Time to Empty - BMP Drawdown Time

$$T_D \text{ (Drawdown Time)} = R_V / (K)(A_S)$$

West Basin Volume: 5867 CF

$$A_S = \text{Surface Area} = 6645 \text{ sq. ft.}$$

$$T_D = 5867 \text{ cf.} / 0.54 \text{ ft/day} \times 0.0417 \text{ day/hr} \times 6645 \text{ sq. ft.} = \underline{\underline{39.2 \text{ hrs OK}}}$$

Northeast Basin Volume: 8923 CF

$$A_S = \text{Surface Area} = 5890 \text{ sq. ft.}$$

$$T_D = 8923 \text{ cf.} / 0.54 \text{ ft/day} \times 0.0417 \text{ day/hr} \times 5890 \text{ sq. ft.} = \underline{\underline{67.3 \text{ hrs OK}}}$$

Southeast Basin Volume: 9304 CF

$$A_S = \text{Surface Area} = 10518 \text{ sq. ft.}$$

$$T_D = 9304 \text{ cf.} / 0.54 \text{ ft/day} \times 0.0417 \text{ day/hr} \times 10518 \text{ sq. ft.} = \underline{\underline{39.3 \text{ hrs OK}}}$$

Mannings Formula

$$Q = VA = (1.49/n)(A)(r_H)^{2/3}(S)^{1/2}$$

n = roughness coefficient

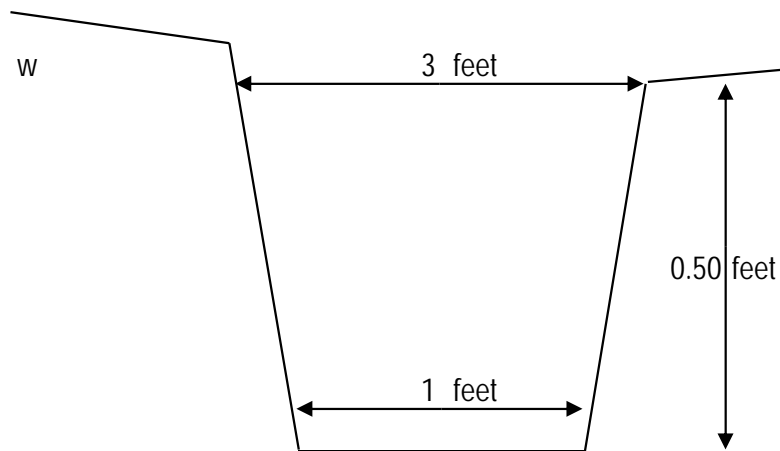
A = cross section area

S = slope

r_H = hydraulic radius = A/P

P = wetted perimeter

North Diversion Swale



Find Capacity of Swale

$$Q=VA=(1.49/n)(A)(r_H)^{2/3}(S)^{1/2}$$

n = 0.024

A = h x w

1.00 sf

P = 2 x (h+w)=

2.00 ft

r_H = 0.50 sf.

S = 0.019 ft/ft

Q = 5.39 cfs

Required: 2.19

V = 5.39 ft/s

Mannings Formula

$$Q = VA = (1.49/n)(A)(r_H)^{2/3}(S)^{1/2}$$

n = roughness coefficient

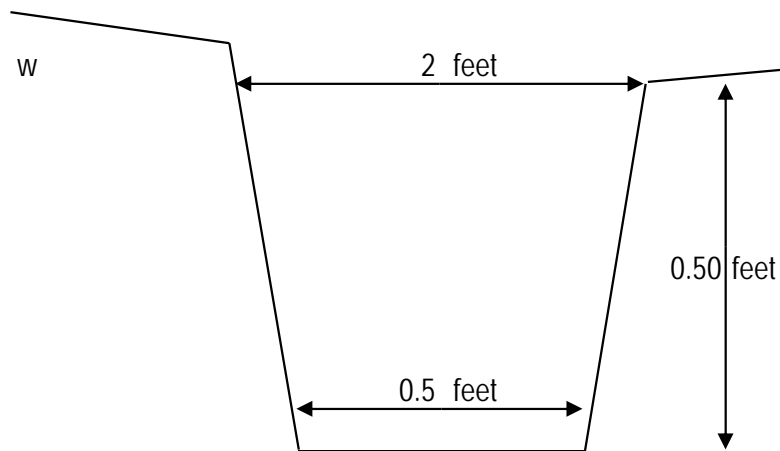
A = cross section area

S = slope

r_H = hydraulic radius = A/P

P = wetted perimeter

South Diversion Swale



Find Capacity of Swale

$$Q = VA = (1.49/n)(A)(r_H)^{2/3}(S)^{1/2}$$

n = 0.024

A = h x w

0.63 sf

P = 2 x (h+w)=

1.50 ft

r_H = 0.42 sf.

S = 0.0054 ft/ft

Q = 1.59 cfs

Required: 0.48

V = 2.55 ft/s

Hydraulic Analysis Report

Project Data

Project Title: Spencer Solar Facility
Designer: Stephen Borgatti
Project Date: Tuesday, February 06, 2018
Project Units: U.S. Customary Units
Notes:

Channel Analysis: North Grassed Swale Outlet- 100-year

Notes:

Input Parameters

Channel Type: Trapezoidal
Side Slope 1 (Z1): 4.0000 ft/ft
Side Slope 2 (Z2): 4.0000 ft/ft
Channel Width: 1.0000 ft
Longitudinal Slope: 0.0190 ft/ft
Manning's n: 0.0581
Flow: 1.9000 cfs

Result Parameters

Depth: 0.4557 ft
Area of Flow: 1.2861 ft²
Wetted Perimeter: 4.7574 ft
Hydraulic Radius: 0.2703 ft
Average Velocity: 1.4773 ft/s
Top Width: 4.6452 ft
Froude Number: 0.4948
Critical Depth: 0.3222 ft
Critical Velocity: 2.5761 ft/s
Critical Slope: 0.0857 ft/ft
Critical Top Width: 3.58 ft
Calculated Max Shear Stress: 0.5402 lb/ft²
Calculated Avg Shear Stress: 0.3205 lb/ft²

Channel Lining Analysis: Channel Lining Design Analysis - North Swale

Notes:

Lining Input Parameters

Channel Lining Type: Riprap, Cobble, or Gravel

D50: 0.15 ft

Riprap Specific Weight: 165 lb/ft³

Water Specific Weight: 62.4 lb/ft³

Riprap Shape is Angular

Safety Factor: 1

Calculated Safety Factor: 1.00016

Lining Results

Angle of Repose: 39.7 degrees

Relative Flow Depth: 1.84581

Manning's n method: Blodgett

Manning's n: 0.058075

Channel Bottom Shear Results

V*: 0.527984

Reynold's Number: 6507.61

Shield's Parameter: 0.047

shear stress on channel bottom: 0.54022 lb/ft²

Permissible shear stress for channel bottom: 0.72333 lb/ft²

channel bottom is stable

Stable D50: 0.112045 ft

Channel Side Shear Results

K1: 0.934

K2: 0.925113

Kb: 0

shear stress on side of channel: 0.54022 lb/ft²

Permissible shear stress for side of channel: 0.669162 lb/ft²

Stable Side D50: 0.113122 lb/ft²

side of channel is stable

Channel Lining Stability Results

the channel is stable

Channel Summary

Name of Selected Channel: North Grassed Swale Outlet- 100-year

Channel Analysis: South Grassed Swale Outlet - 100-year

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width: 0.5000 ft

Longitudinal Slope: 0.0054 ft/ft

Manning's n: 0.0589

Flow: 0.4400 cfs

Result Parameters

Depth: 0.4393 ft

Area of Flow: 0.6057 ft²

Wetted Perimeter: 2.4648 ft

Hydraulic Radius: 0.2457 ft

Average Velocity: 0.7264 ft/s

Top Width: 2.2574 ft

Froude Number: 0.2471

Critical Depth: 0.2163 ft

Critical Velocity: 2.1809 ft/s

Critical Slope: 0.1054 ft/ft

Critical Top Width: 1.37 ft

Calculated Max Shear Stress: 0.1480 lb/ft²

Calculated Avg Shear Stress: 0.0828 lb/ft²

Channel Lining Analysis: Channel Lining Design Analysis - South Swale

Notes:

Lining Input Parameters

Channel Lining Type: Riprap, Cobble, or Gravel

D50: 0.15 ft

Riprap Specific Weight: 165 lb/ft³

Water Specific Weight: 62.4 lb/ft³

Riprap Shape is Angular

Safety Factor: 1

Calculated Safety Factor: 1.00016

Lining Results

Angle of Repose: 39.7 degrees

Relative Flow Depth: 1.78885

Manning's n method: Blodgett

Manning's n: 0.0589241

Channel Bottom Shear Results

V*: 0.276393

Reynold's Number: 3406.65

Shield's Parameter: 0.047

shear stress on channel bottom: 0.148041 lb/ft²

Permissible shear stress for channel bottom: 0.72333 lb/ft²

channel bottom is stable

Stable D50: 0.0307047 ft

Channel Side Shear Results

K1: 0.802

K2: 0.714026

Kb: 0

shear stress on side of channel: 0.148041 lb/ft²

Permissible shear stress for side of channel: 0.516476 lb/ft²

Stable Side D50: 0.0344877 lb/ft²

side of channel is stable

Channel Lining Stability Results

the channel is stable

Channel Summary

Name of Selected Channel: South Grassed Swale Outlet - 100-year

RIPRAP SIZING CALCULATIONS

Project: North Sturbridge Road Solar Facility
 Town: Charlton, MA

Date: 7/31/2018
 Revised: 8/2/2018
 Job No. 5989
 Calc. by: SLB

$$D_{50} = 0.2D [Q / (g)^{1/2} D^{2.5}]^{4/3} [D / Tw]$$

D = Diameter, ft.

g = Accel. of gravity, 32.2 f.p.s.

Q = Discharge rate, c.f.s.

D50 = Riprap size, ft. (minimum)

Tw = Tailwater Depth, ft. (Unknown Tw = 0.4 x D)

Class	D ₅₀ (in.)	Apron Length	Apron Depth
1	5	4D	3.5D ₅₀
2	6	4D	3.3D ₅₀
3	10	5D	2.4D ₅₀

Width(at apron end) = 3D+(2/3)L

Note: Formulas taken from HEC No. 14; Publication No. FHWA-NHI-06-086 July 2006

NORTH GRASSED SWALE OUTLET

D = 3 ft
 Q100YR = 1.9 cfs
 Tw = 1.2 ft
 D50 = 0.15 ft Calculated via Hydraulic Toolbox
 1.80 in
 RIPRAP CLASS = 1

L = 12 ft (minimum)
 DEPTH = 6.30 in (minimum)
 W = 17.00 ft (minimum)

SOUTH GRASSED SWALE OUTLET

D = 2 ft
 Q100YR = 0.44 cfs
 Tw = 0.8 ft
 D50 = 0.15 ft Calculated via Hydraulic Toolbox
 1.80 in
 RIPRAP CLASS = 1

L = 8 ft (minimum)
 DEPTH = 6.30 in (minimum)
 W = 11.33 ft (minimum)

APPENDIX G – WATERSHED PLANS

Prepared by:



Prepared for:



NORTH STURBRIDGE ROAD SOLAR FACILITY

North Sturbridge Road
Charlton, MA

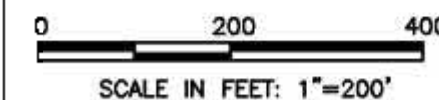
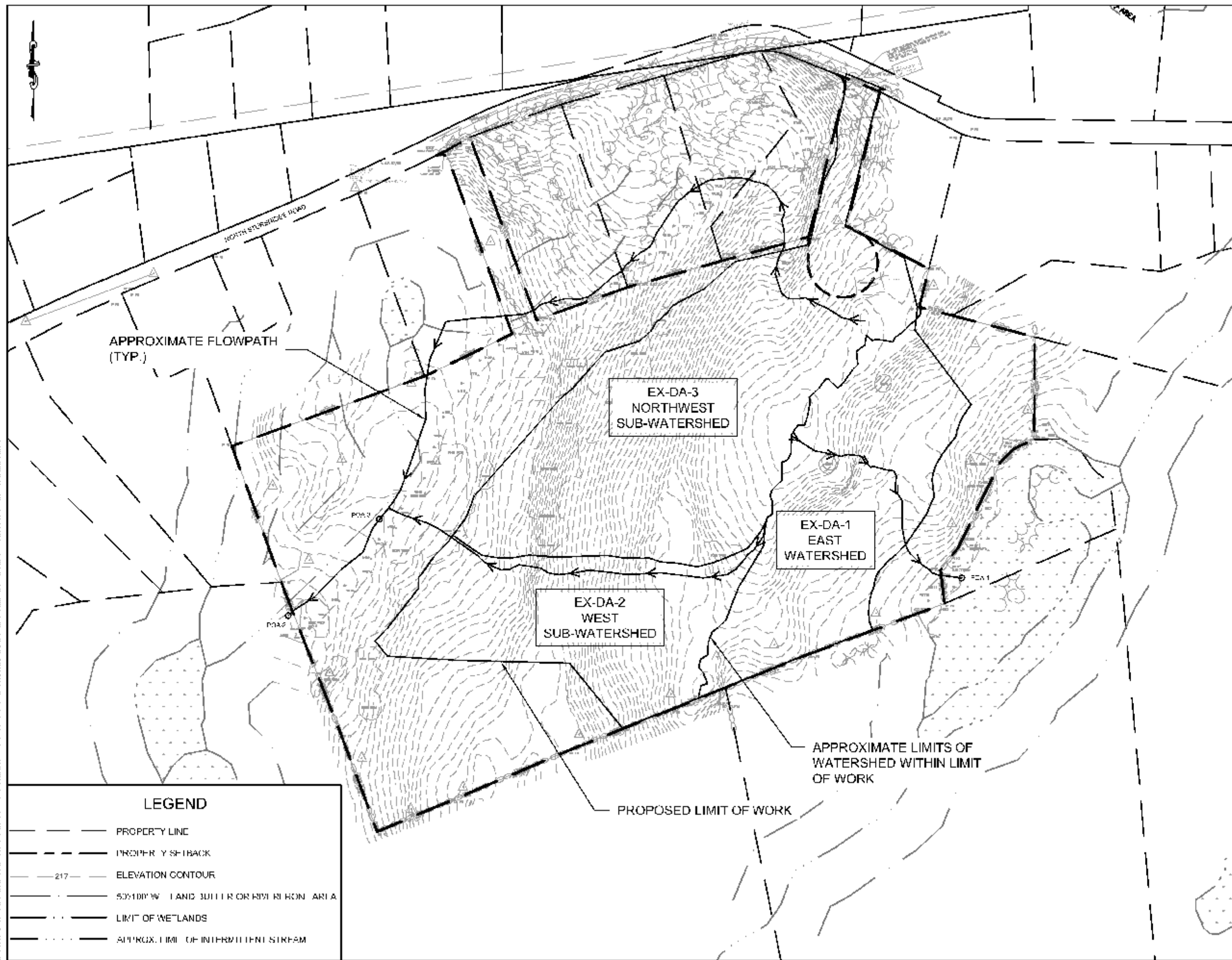


Figure No. 1

Existing Conditions

ISSUE DATE: 8/1/2018



APPROXIMATE FLOWPATH
(TYP.)

EX-DA-3
NORTHWEST
SUB-WATERSHED

EX-DA-1
EAST
WATERSHED

EX-DA-2
WEST
SUB-WATERSHED

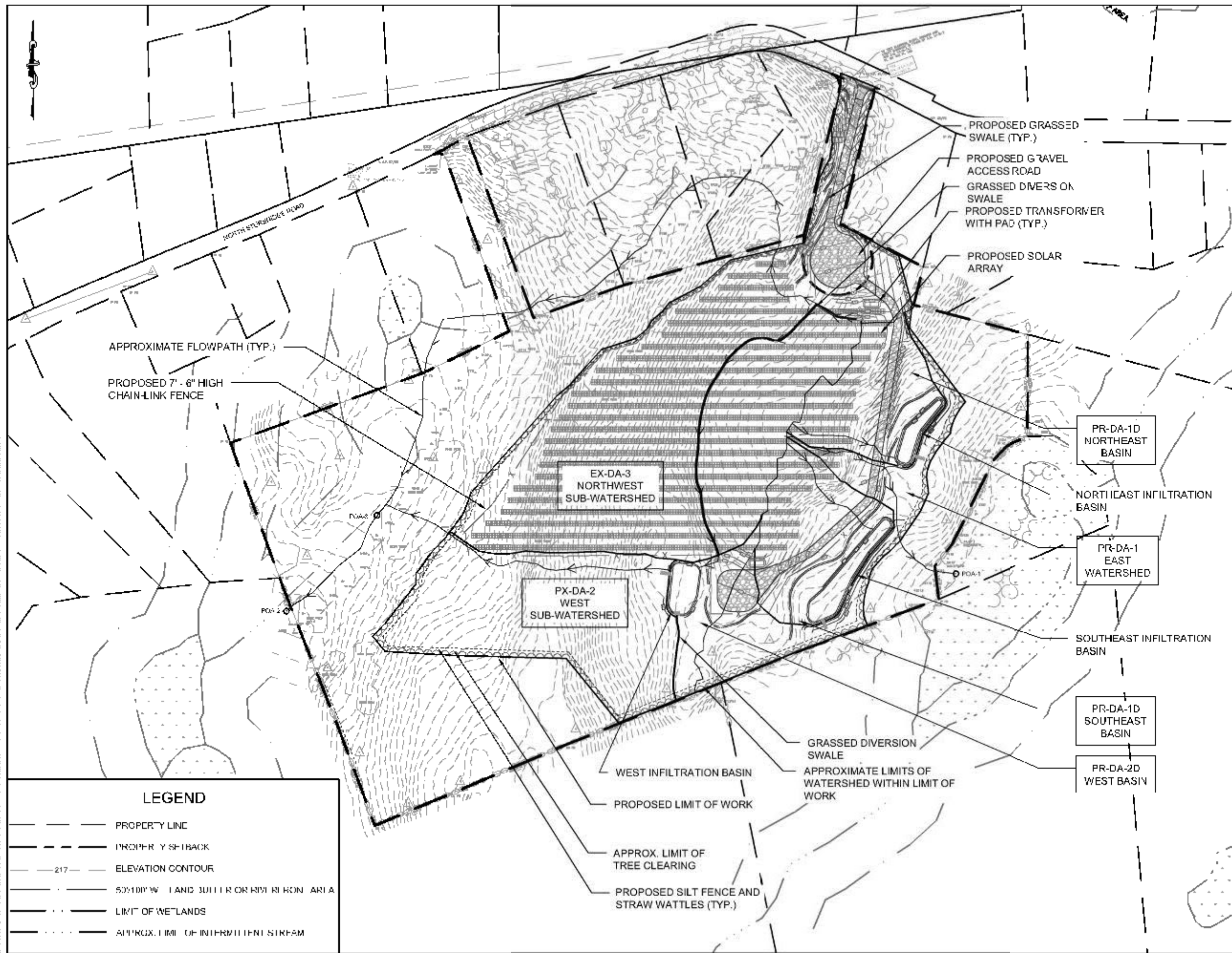
APPROXIMATE LIMITS OF
WATERSHED WITHIN LIMIT
OF WORK

PROPOSED LIMIT OF WORK

LEGEND

- — — — — PROPERTY LINE
- - - - - PROPERTY SETBACK
- 217 - - - ELEVATION CONTOUR
- - - - - 50:100' WETLAND BUFFER OR RIVER/RIBBON AREA
- - - - - LIMIT OF WETLANDS
- - - - - APPROX. LIMIT OF INTERMITTENT STREAM

D:\Projects\2018\18-0001\18-0001.dwg



Prepared by:

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Prepared for:

 Securing a brighter future through solar

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North Sturbridge Road
 Charlton, MA

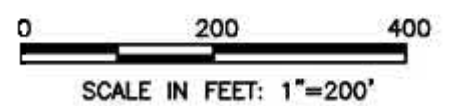








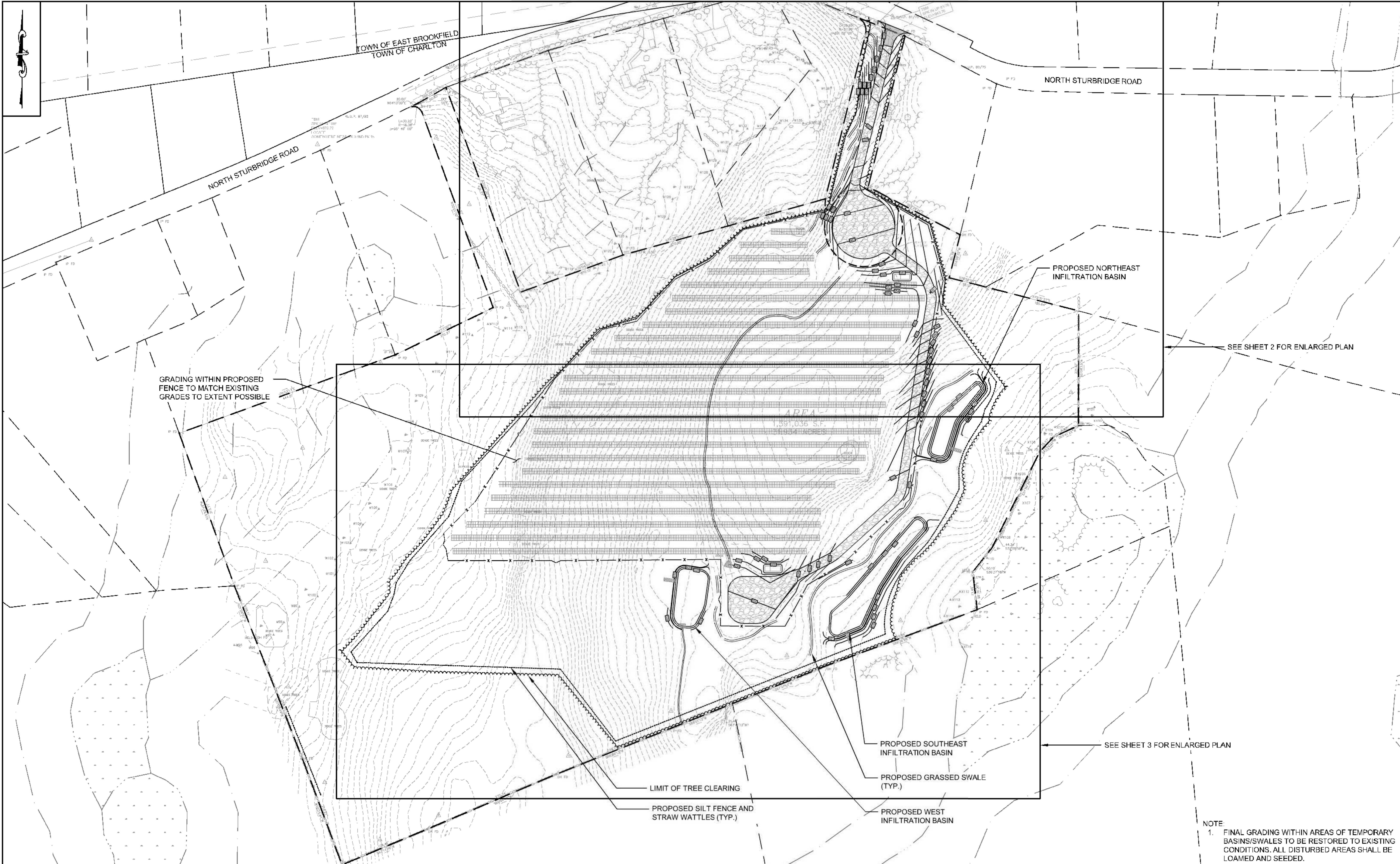
Figure No. 2
Proposed Conditions

ISSUE DATE: 8/1/2018

LEGEND	
	PROPERTY LINE
	PROPERTY SETBACK
	ELEVATION CONTOUR
	50:100' WETLAND BUFFER OR RIVER/RIBBON AREA
	LIMIT OF WETLANDS
	APPROX. LIMIT OF INTERMITTENT STREAM

APPENDIX H – PRELIMINARY PLANS

8/1/2018 9:02 AM 0:\690556889 - SUNPIN SOLAR - CHARLTON\DRAWING FILES\NORTH STURBRIDGE ROAD\PLANS\NORTH STURBRIDGE ROAD\PLANS\NORTH STURBRIDGE ROAD\GRADES\GRADES.DWG (BETA STB BW STB)



GRADING WITHIN PROPOSED FENCE TO MATCH EXISTING GRADES TO EXTENT POSSIBLE

SEE SHEET 2 FOR ENLARGED PLAN

SEE SHEET 3 FOR ENLARGED PLAN

NOTE:
 1. FINAL GRADING WITHIN AREAS OF TEMPORARY BASINS/SWALES TO BE RESTORED TO EXISTING CONDITIONS. ALL DISTURBED AREAS SHALL BE LOAMED AND SEEDDED.

NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

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DESIGNED BY:	SLB/DJR
CHECKED BY:	DJR

PREPARED BY



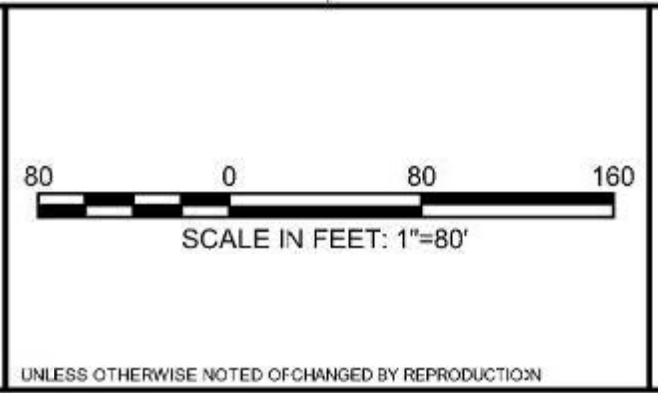
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**NORTH STURBRIDGE ROAD SOLAR FACILITY
 PRELIMINARY GRADING AND
 DRAINAGE PLAN**

NORTH STURBRIDGE ROAD
 CHARLTON, MA

BETA JOB NO.	5989
ISSUE DATE	8/1/2018
SHEET NO.	1

8/12/2018 9:05 AM 0:16:00 56889 - SUNPIN SOLAR - CHARLTON DRAINAGE PLAN NORTH STURBRIDGE ROAD PRELIMINARY GRADING AND DRAINAGE PLAN (BETA STB B/W STB)



PROPOSED 0.5' DEEP, 3' WIDE GRASSED SWALE FOR DIVERSION OF RUNOFF TO WEST INFILTRATION BASIN (TYP.)

PROPOSED STONE CHECK DAM (TYP.)

GRADING WITHIN PROPOSED FENCE TO MATCH EXISTING GRADES TO EXTENT POSSIBLE

PROPOSED 0.5' DEEP GRASSED SWALE ALONG DOWNGRADIENT SIDE OF ACCESS ROAD (TYP.)

LIMIT OF TREE CLEARING

PROPOSED SILT FENCE AND STRAW WATTLES (TYP.)

PROPOSED NORTHEAST INFILTRATION BASIN

NOTE:
1. FINAL GRADING WITHIN AREAS OF TEMPORARY BASINS/SWALES TO BE RESTORED TO EXISTING CONDITIONS. ALL DISTURBED AREAS SHALL BE LOAMED AND SEEDDED.

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SLB/DJR

CHECKED BY:
DJR

PREPARED BY



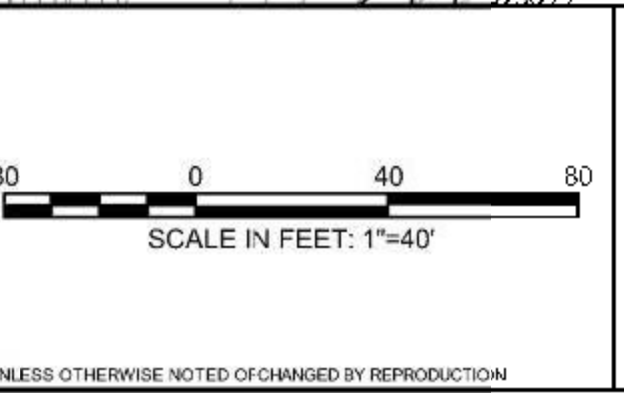
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NORTH STURBRIDGE ROAD SOLAR FACILITY

PRELIMINARY GRADING AND DRAINAGE PLAN ENLARGED

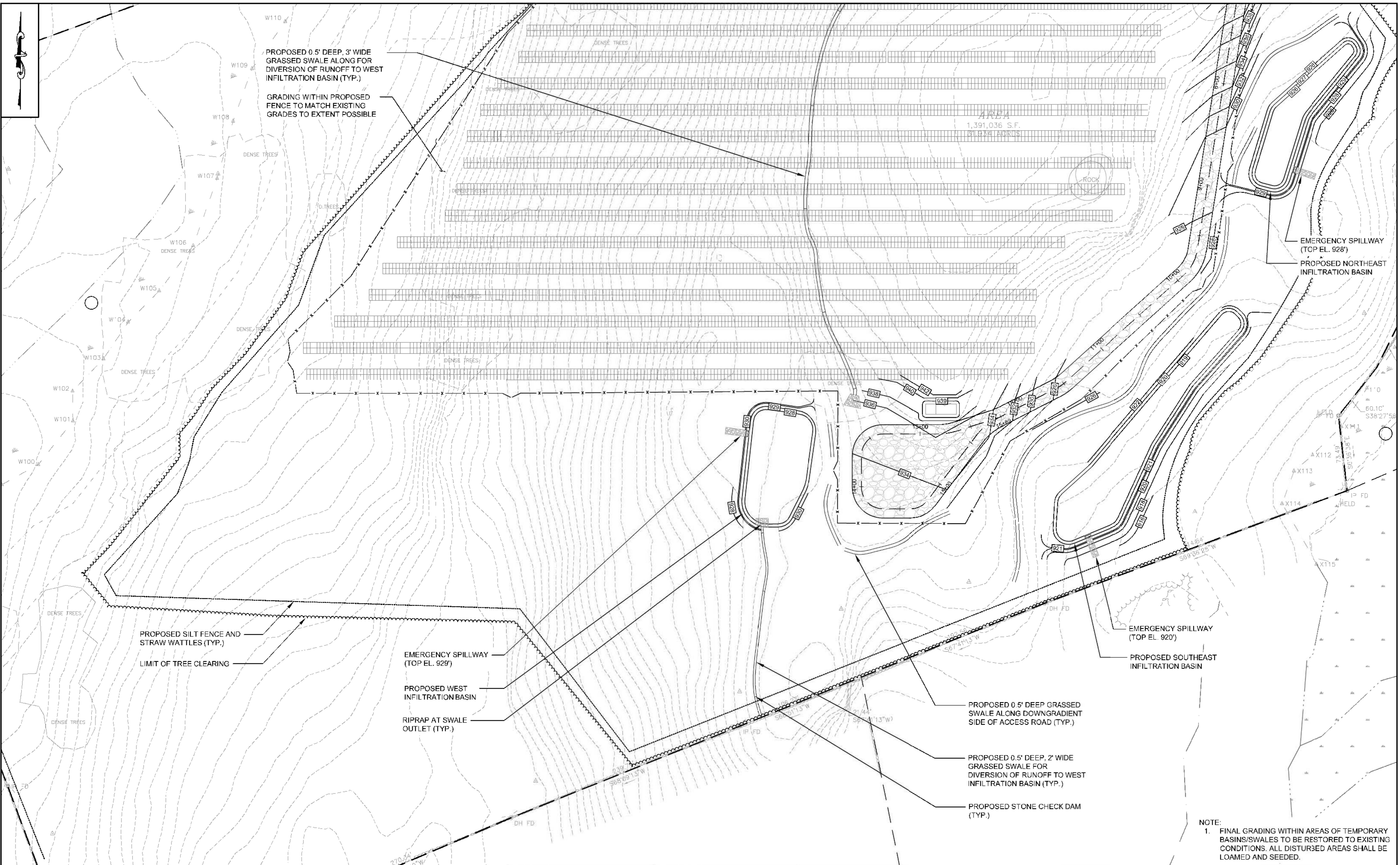
NORTH STURBRIDGE ROAD
CHARLTON, MA

BETA JOB NO. 5989

ISSUE DATE 8/12/2018

SHEET NO. 2

8/1/2018 9:07 AM 0:16:00:5689 - SUNPIN SOLAR - CHARLTON DRAINAGE PLAN NORTH STURBRIDGE ROAD PLANNING NORTH STURBRIDGE ROAD SOLAR FACILITY DRAINAGE GRADING DWG (BETA STB BW STB)



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SLB/DJR

CHECKED BY:
DJR

EMERGENCY SPILLWAY (TOP EL. 929')

PROPOSED WEST INFILTRATION BASIN

RIPRAP AT SWALE OUTLET (TYP.)

PREPARED BY



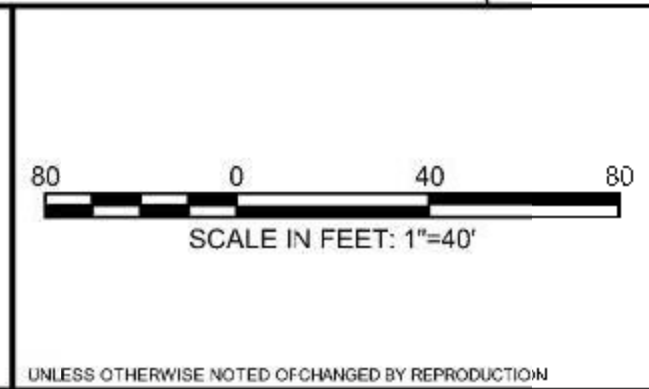
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**NORTH STURBRIDGE ROAD SOLAR FACILITY
PRELIMINARY GRADING AND
DRAINAGE PLAN ENLARGED**

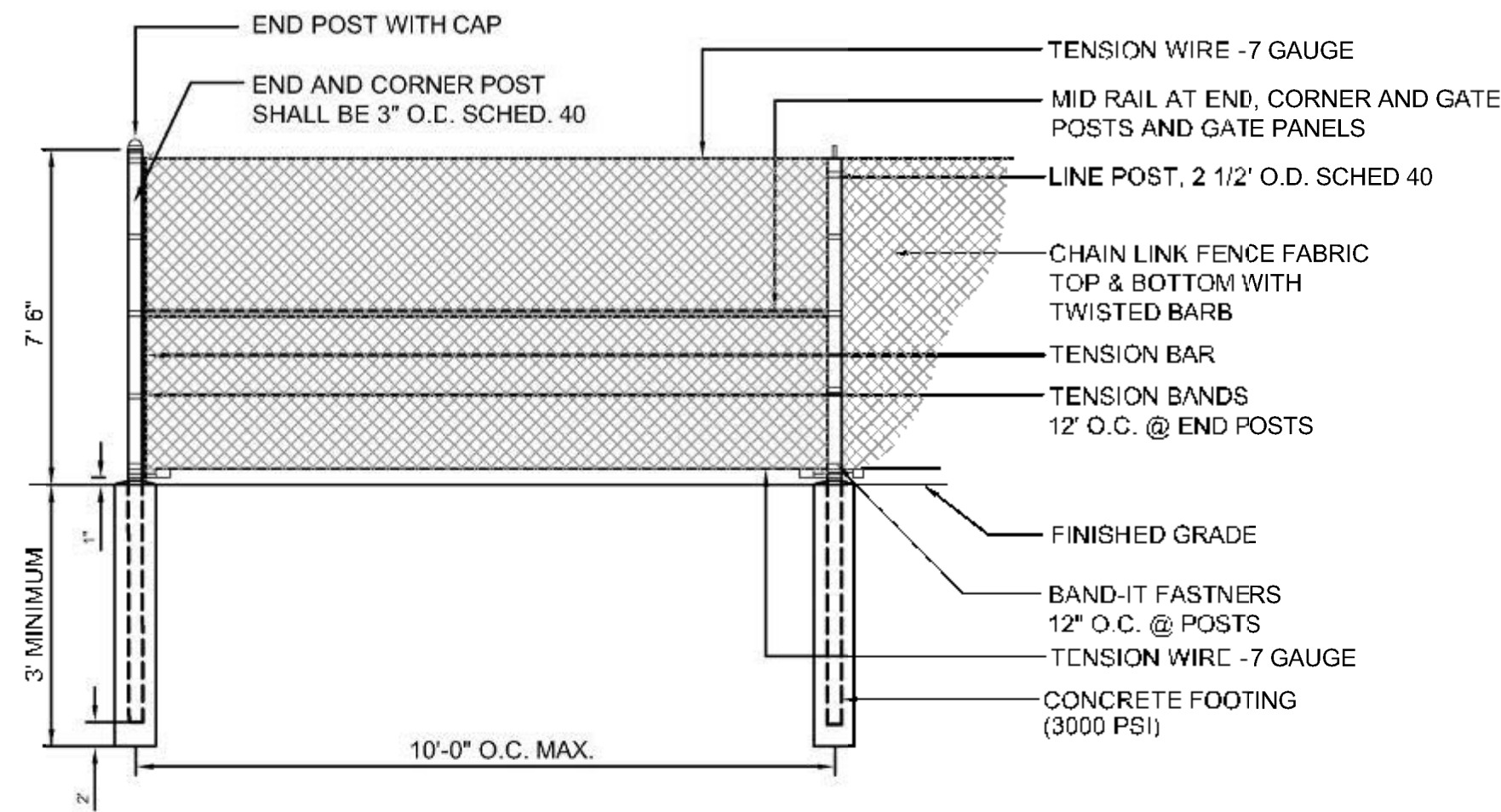
NORTH STURBRIDGE ROAD
CHARLTON, MA

BETA JOB NO. 5989

ISSUE DATE 8/1/2018

SHEET NO. 3

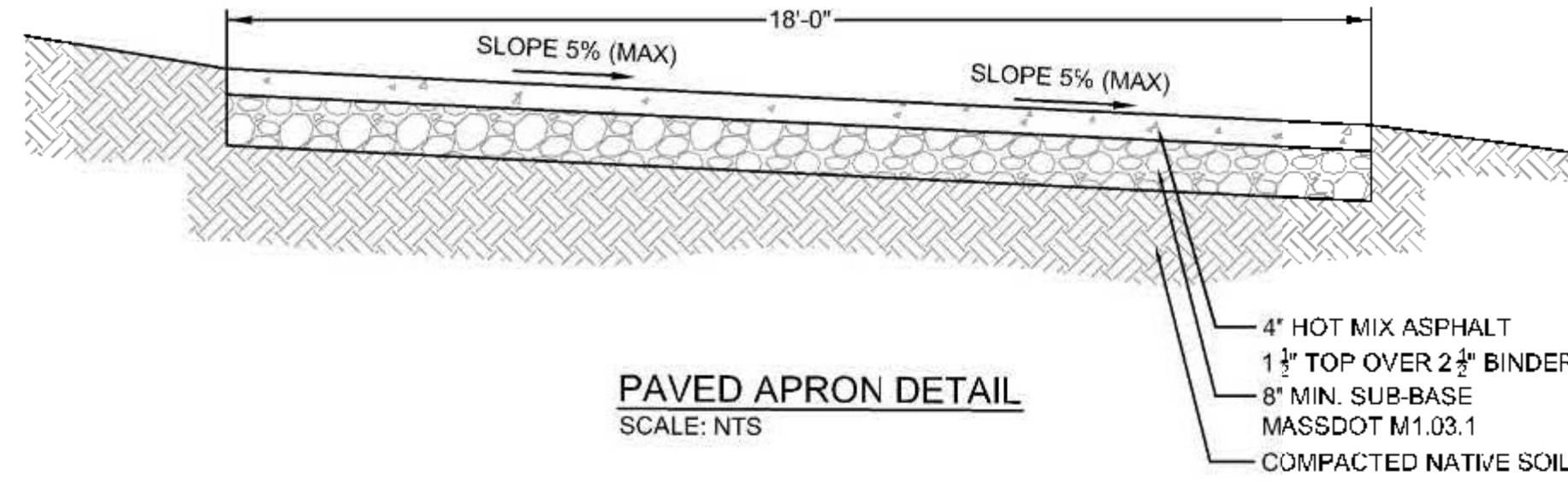
NOTE:
1. FINAL GRADING WITHIN AREAS OF TEMPORARY BASINS/SWALES TO BE RESTORED TO EXISTING CONDITIONS. ALL DISTURBED AREAS SHALL BE LOAMED AND SEEDDED.



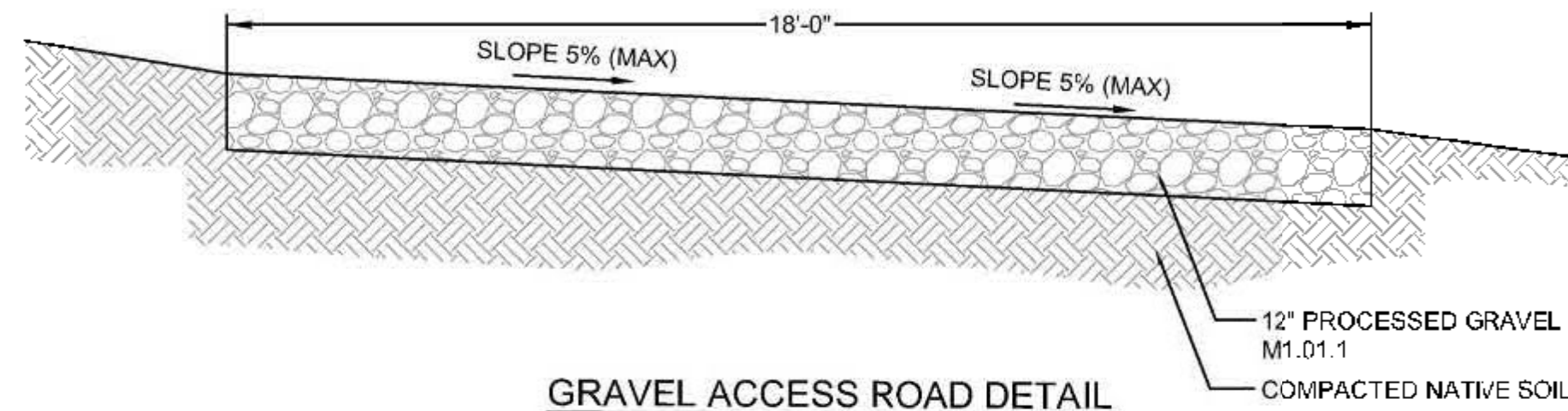
CHAIN LINK FENCE DETAIL
SCALE: NTS

NOTES:

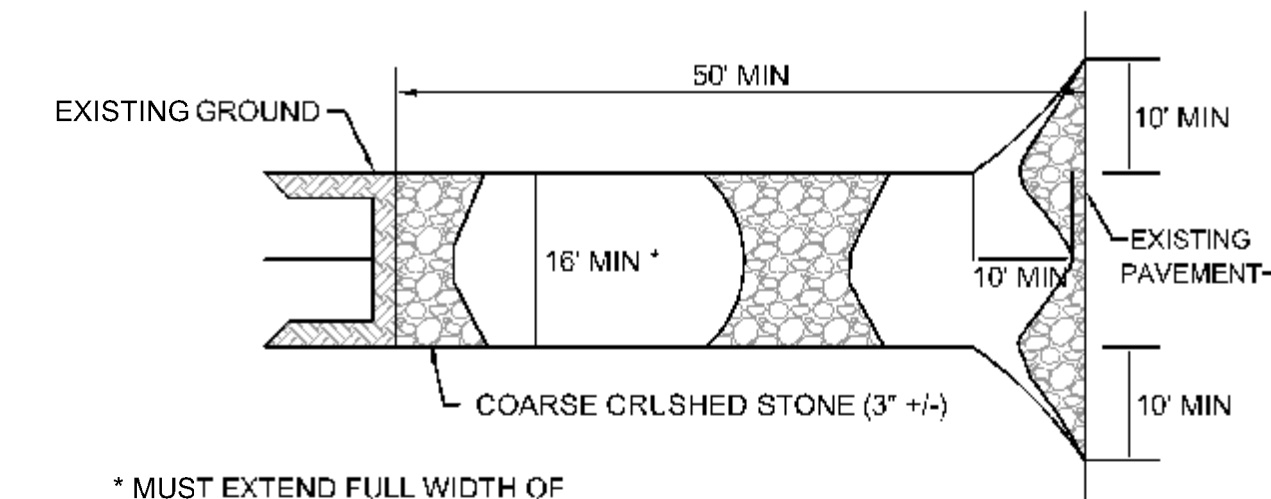
- FENCE LINE ALONG SOUTHERN SIDE OF ARRAY TO BE VINYL COATED. ALL HARDWARE FITTINGS AND MISCELLANEOUS MATERIALS SHALL BE GALVANIZED AND VINYL COATED. COLOR TO MATCH FABRIC, AS SPECIFIED. NUTS AND BOLTS SHALL BE THERMAL COATED, COLOR TO MATCH FABRIC, AS SPECIFIED.
- FENCE TO BE INSTALLED 6" OFF GROUND TO ALLOW MIGRATION OF WILDLIFE INTO AND OUT OF THE SOLAR FACILITY.



PAVED APRON DETAIL
SCALE: NTS

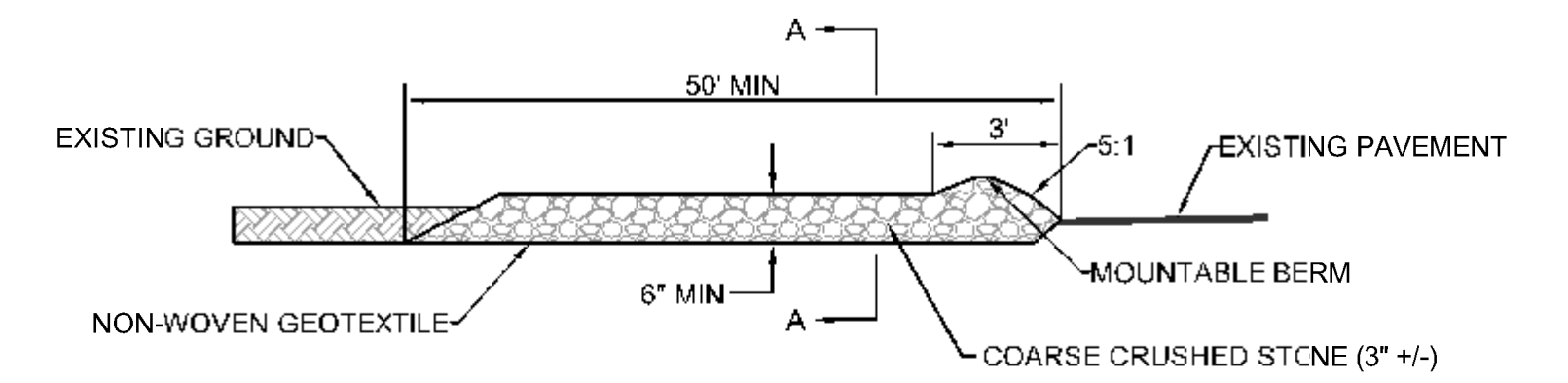


GRAVEL ACCESS ROAD DETAIL
SCALE: NTS

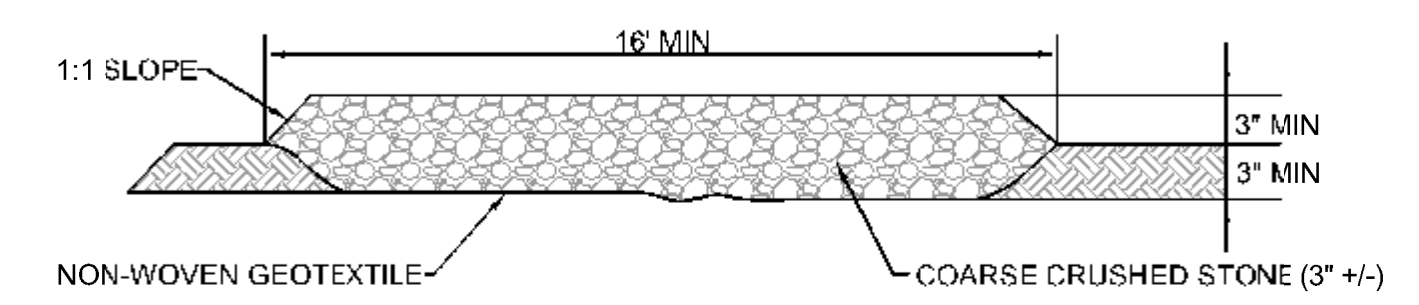


* MUST EXTEND FULL WIDTH OF INGRESS AND EGRESS OPERATION

PLAN VIEW
N.T.S.



SIDE ELEVATION
N.T.S.



SECTION A-A
N.T.S.

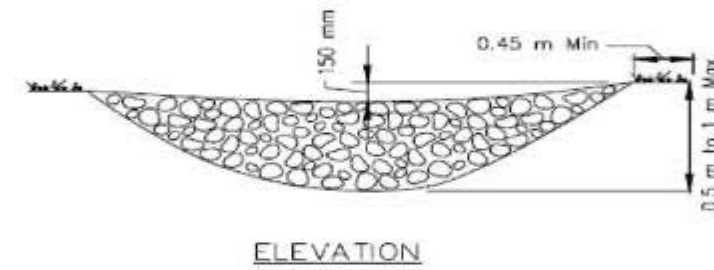
STABILIZED CONSTRUCTION ENTRANCE
SCALE: NTS

TEMPORARY CONSTRUCTION ENTRANCE NOTES

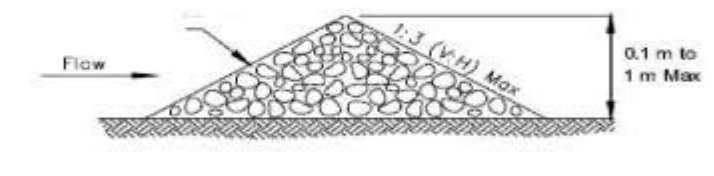
- REMOVE ALL VEGETATION AND OTHER UNSUITABLE MATERIAL FROM THE FOUNDATION AREA. GRADE, AND CROWN FOR POSITIVE DRAINAGE.
- IF SLOPE TOWARDS THE PUBLIC ROAD EXCEEDS 2%, CONSTRUCT A 6- TO 8-INCH RIDGE WITH 3H:1V SIDE SLOPES ACROSS THE FOUNDATION APPROXIMATELY 15 FEET FROM THE EDGE OF THE PUBLIC ROAD TO DIVERT RUNOFF FROM IT.
- INSTALL PIPE UNDER THE ENTRANCE IF NEEDED TO MAINTAIN DRAINAGE DITCHES ALONG PUBLIC ROADS.
- PLACE STONE TO DIMENSIONS AND GRADE AS SHOWN ON PLANS. LEAVE SURFACE SLOPED FOR DRAINAGE.

MAINTENANCE

- RESHAPE PAD AS NEEDED FOR DRAINAGE AND RUNOFF CONTROL.
- TOP DRESS WITH CLEAN STONE AS NEEDED.

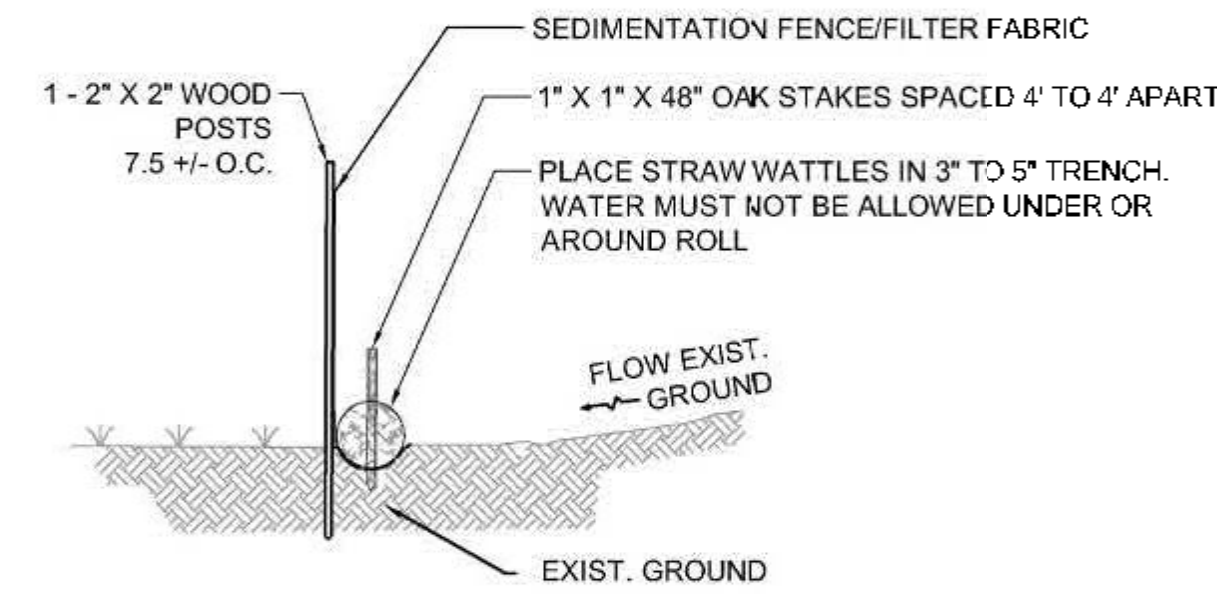


ELEVATION

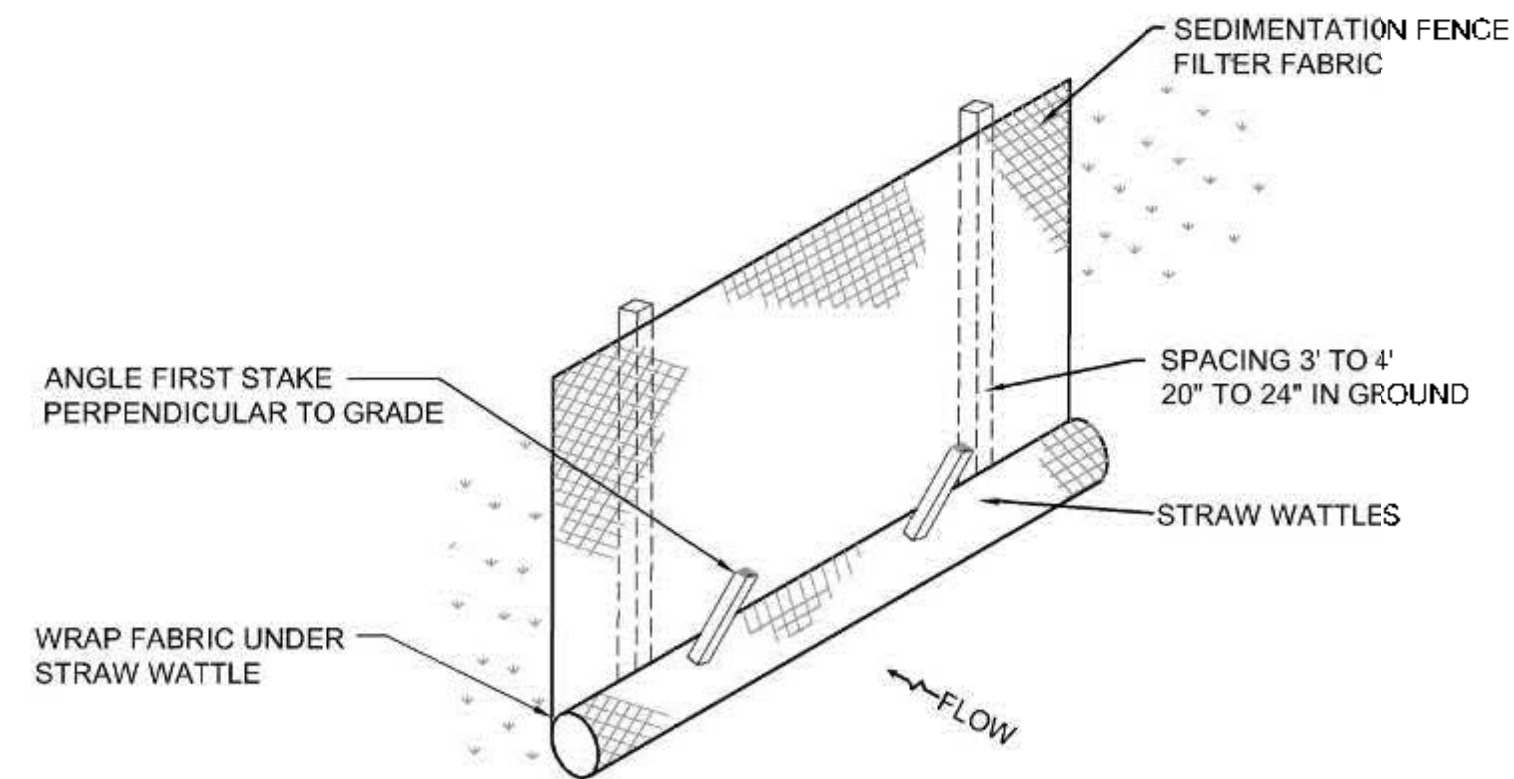


TYPICAL ROCK CHECK DAM SECTION

STONE CHECK DAM DETAIL
SCALE: NTS

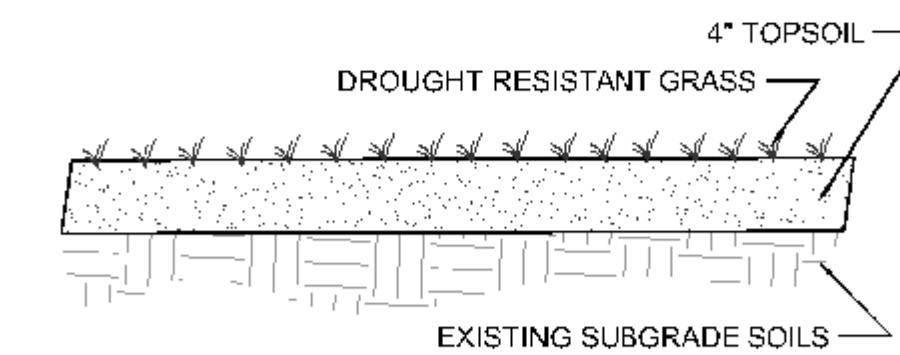


EMBEDDING DETAIL

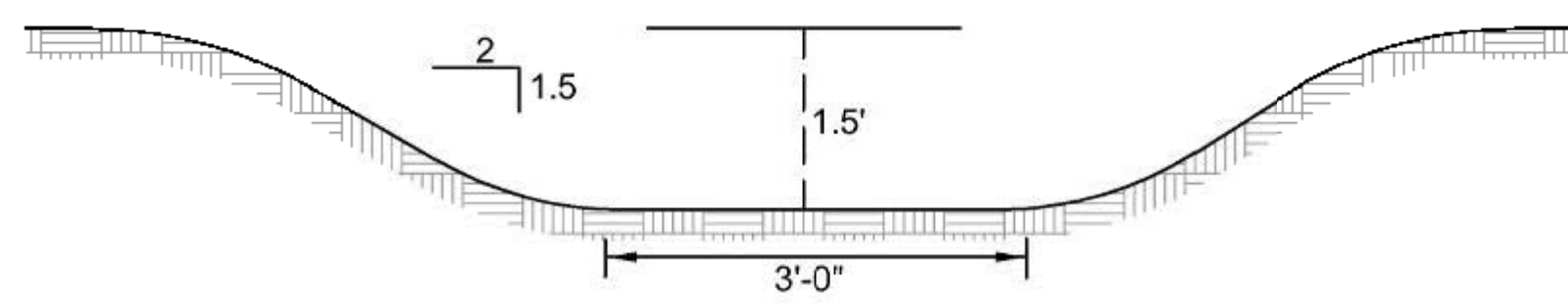


ANCHORING DETAIL

EROSION CONTROL BARRIER DETAIL
SCALE: NTS



GROUND COVER DETAIL
SCALE: NTS



TEMPORARY EARTHEN SWALE DETAIL
SCALE: NTS

NOTES:

- INSTALL STONE CHECK DAMS WITHIN SWALE 15 FEET FROM OUTFALL AND AS SHOWN ON SHEET 4, APPROX. EVERY 100 FEET.

8/1/2018 9:27 AM 0:16:00:56889 - SUNPIN SOLAR - CHARLTON DRAWING FILES/NORTH STURBRIDGE ROAD/PLANS/NORTH STURBRIDGE ROAD SOLAR FACILITY DETAILS.DWG (BETA, STB, BW, STB)

NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

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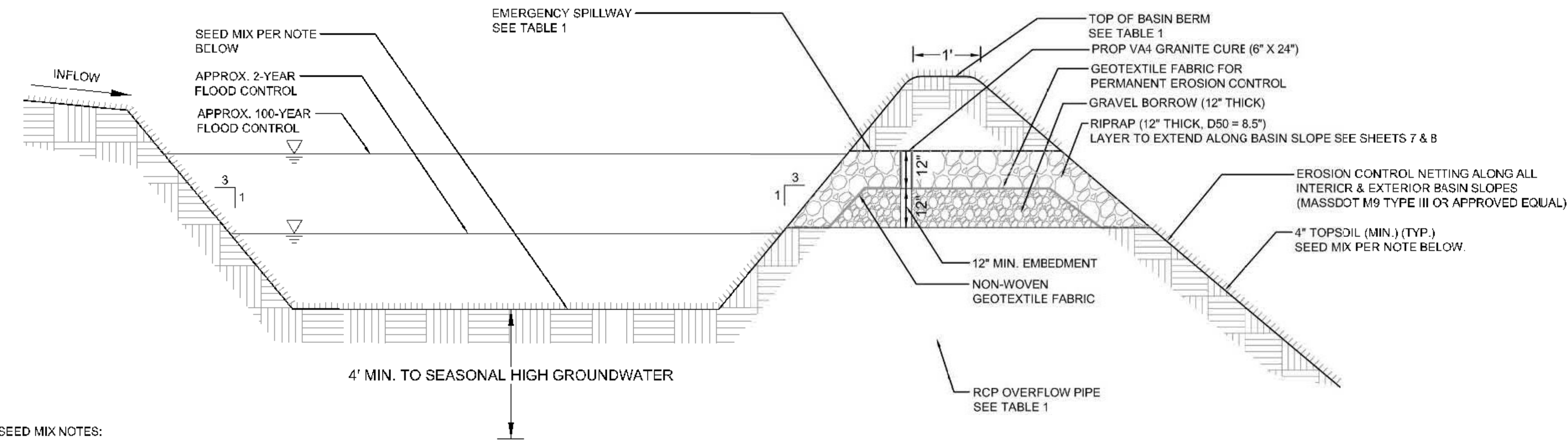
NONE

NORTH STURBRIDGE ROAD SOLAR FACILITY

PRELIMINARY DETAILS I

NORTH STURBRIDGE ROAD
CHARLTON, MA

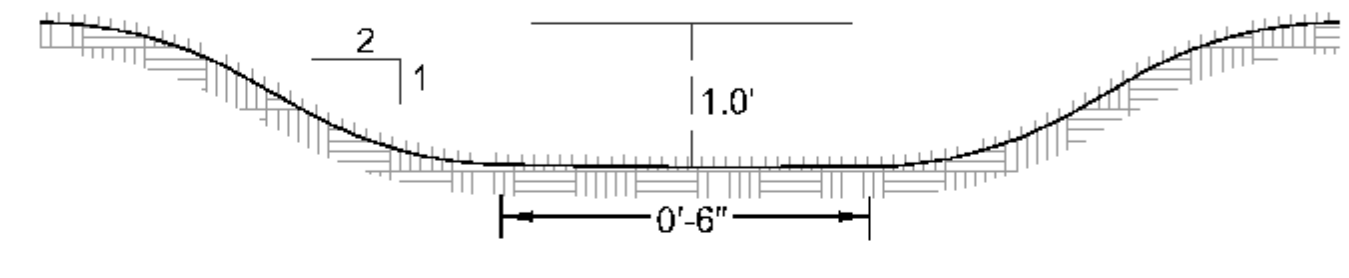
BETA JOB NO.	5989
ISSUE DATE	8/1/2018
SHEET NO.	4



	WEST	NORTHEAST	SOUTHEAST
BOTTOM OF BASIN EL.	928.00'	926.00'	919.00'
TOP OF BASIN BERM EL.	931.00'	929.00'	922.00'
EMERGENCY SPILLWAY EL.	930.00'	928.00'	921.00'

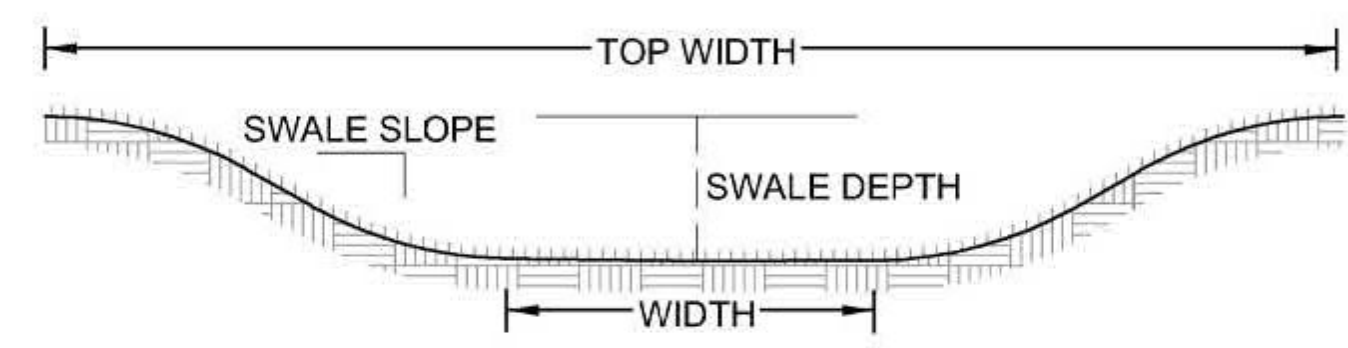
- SEED MIX NOTES:
1. SEED SHALL BE CONSERVATION WILDLIFE MIX AS PRODUCED BY NEW ENGLAND WETLAND PLANTS, INC, AMHERST MA OR APPROVED EQUIVALENT.
 2. APPLY SEED AT A RATE OF 1 LB/1,750 S.F. OR 25 LBS / ACRE.
 3. FERTILIZER SHALL NOT BE USED.

DETENTION POND DETAIL
SCALE: NTS



GRASSED SWALE DETAIL
SCALE: NTS

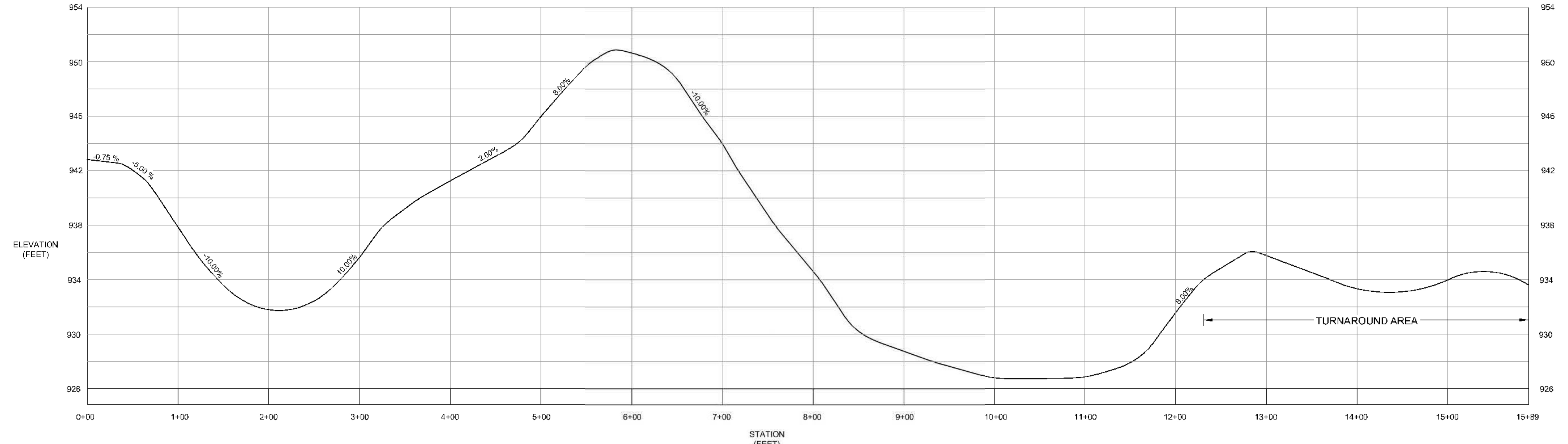
- NOTES:
1. ACTUAL SITE TOPOGRAPHY MAY VARY FROM THAT SHOWN ON THE PLANS. GRASSED SWALES SHALL BE INSTALLED PARALLEL TO SITE CONTOURS AND PERPENDICULAR TO DIRECTION OF FLOW AS DETERMINED DURING CONSTRUCTION.



DIVERSION SWALE DETAIL
SCALE: NTS

- NOTES:
1. SEE TABLE 2 FOR DESIGN PARAMETERS
 2. INSTALL STONE CHECK DAMS ALONG SWALE 15 FEET FROM OUTFALL AND APPROX. EVERY 100' AS DEPICTED ON SITE PLANS.

	NORTH	SOUTH
BOTTOM WIDTH	1'	0.5'
TOP WIDTH	3'	1'
DEPTH	0.5'	0.5'
SIDE SLOPE (H:V)	4:1	3:2



GRAVEL ACCESS ROAD PROFILE
HORIZONTAL SCALE: 1" = 60'
VERTICAL SCALE: 1" = 4'

8/1/2018 9:31 AM O:\69005\6989 - SUNPIN SOLAR - CHARLTON\DRAWING FILES\NORTH STURBRIDGE ROAD\PLANS\NORTH STURBRIDGE ROAD SOLAR FACILITY\DETAILS.DWG (BETA, STE, BW, STD)

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NONE

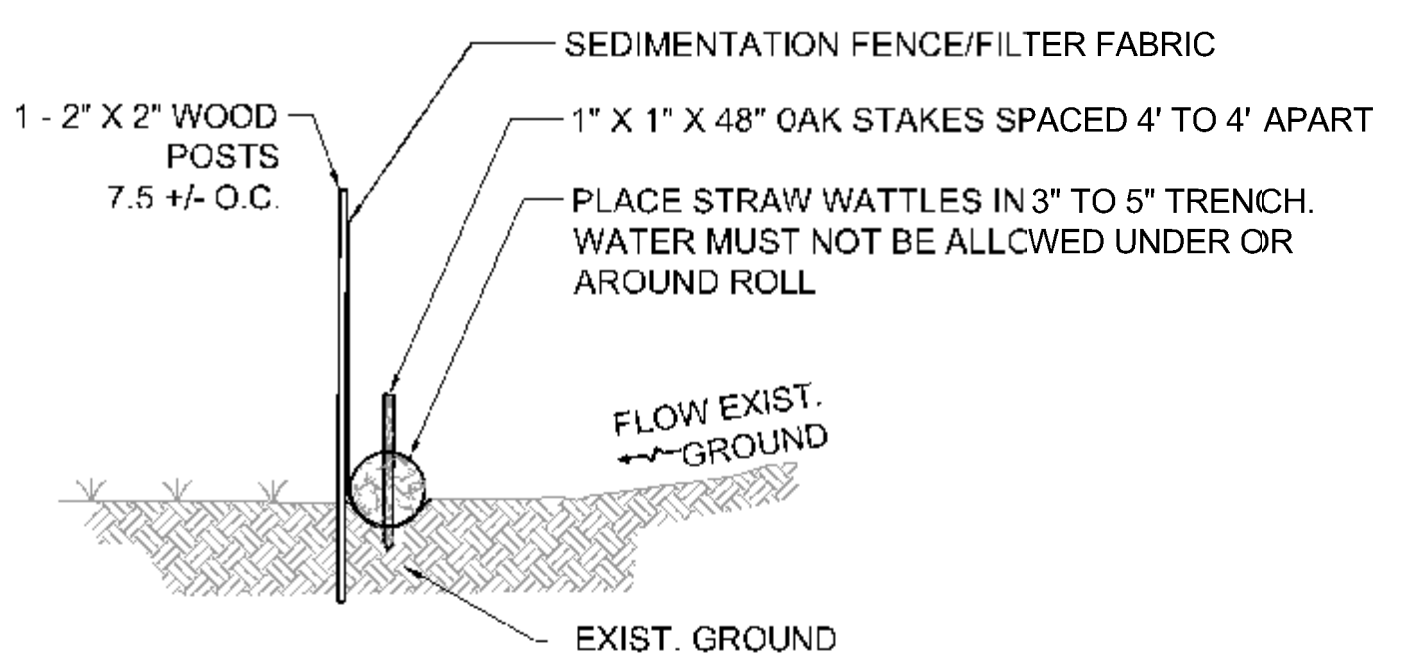
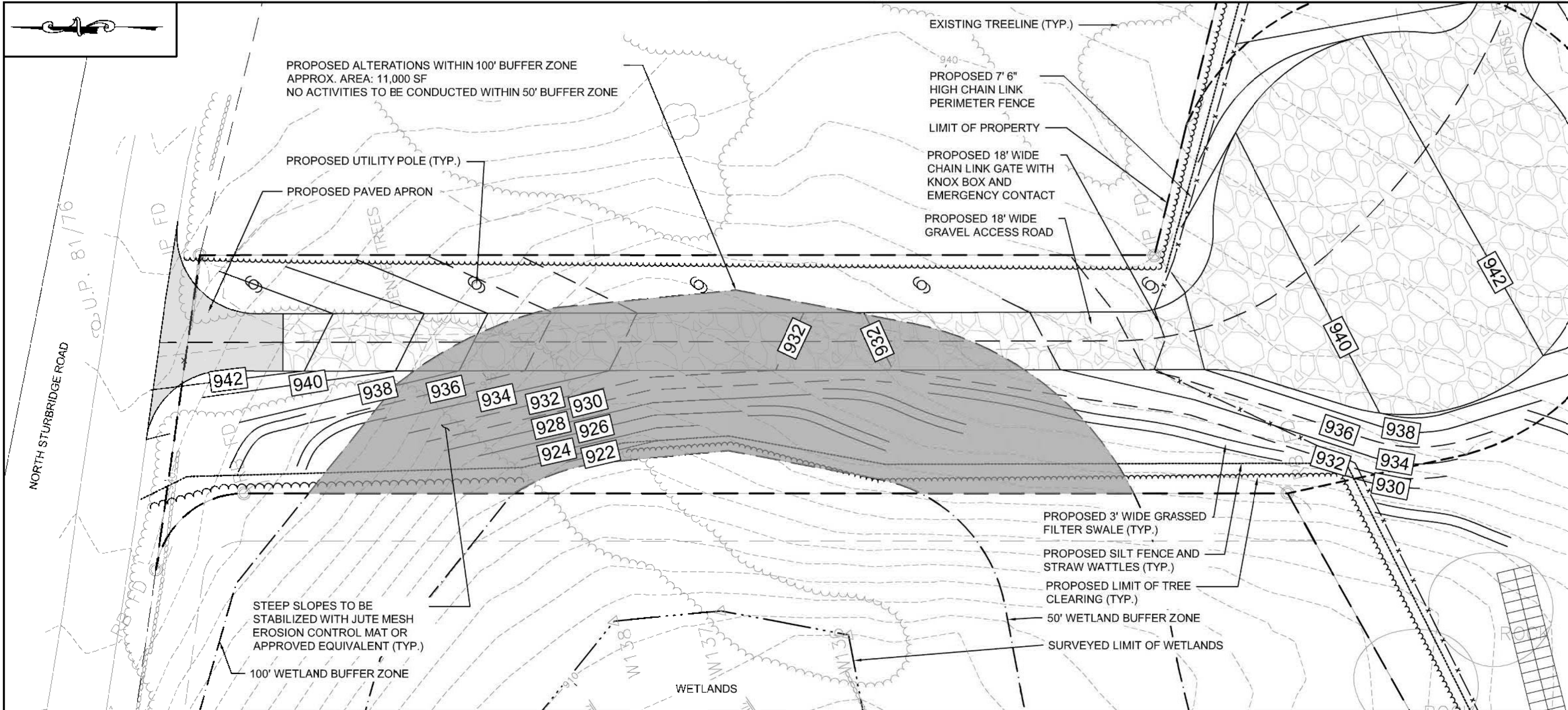
NORTH STURBRIDGE ROAD SOLAR FACILITY
PRELIMINARY DETAILS II
NORTH STURBRIDGE ROAD
CHARLTON, MA

BETA JOB NO. 5989
ISSUE DATE 8/1/2018
SHEET NO. 5

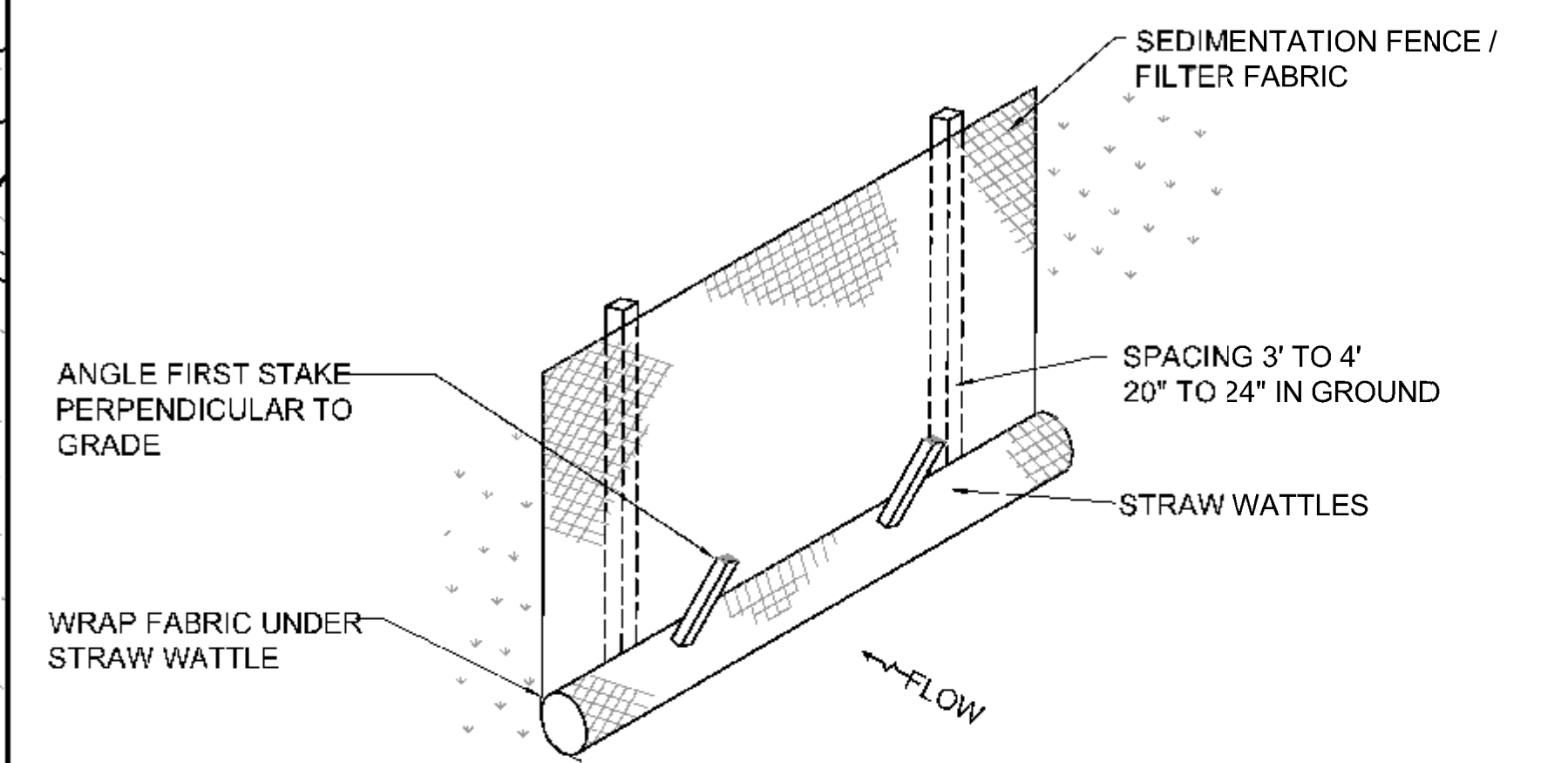


BETA

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Chicopee, MA 01013
413.331.5326
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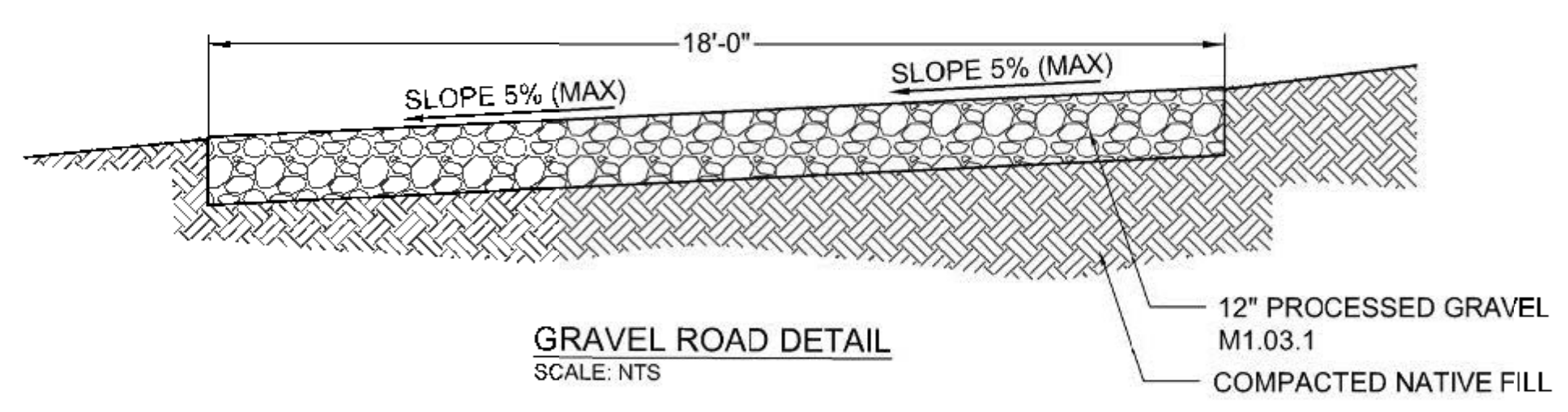


EMBEDDING DETAIL

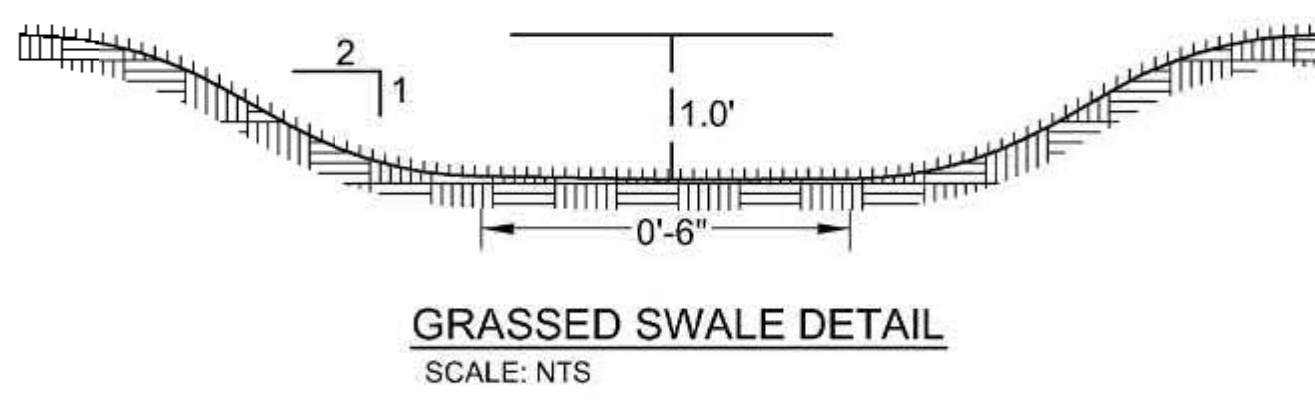


ANCHORING DETAIL

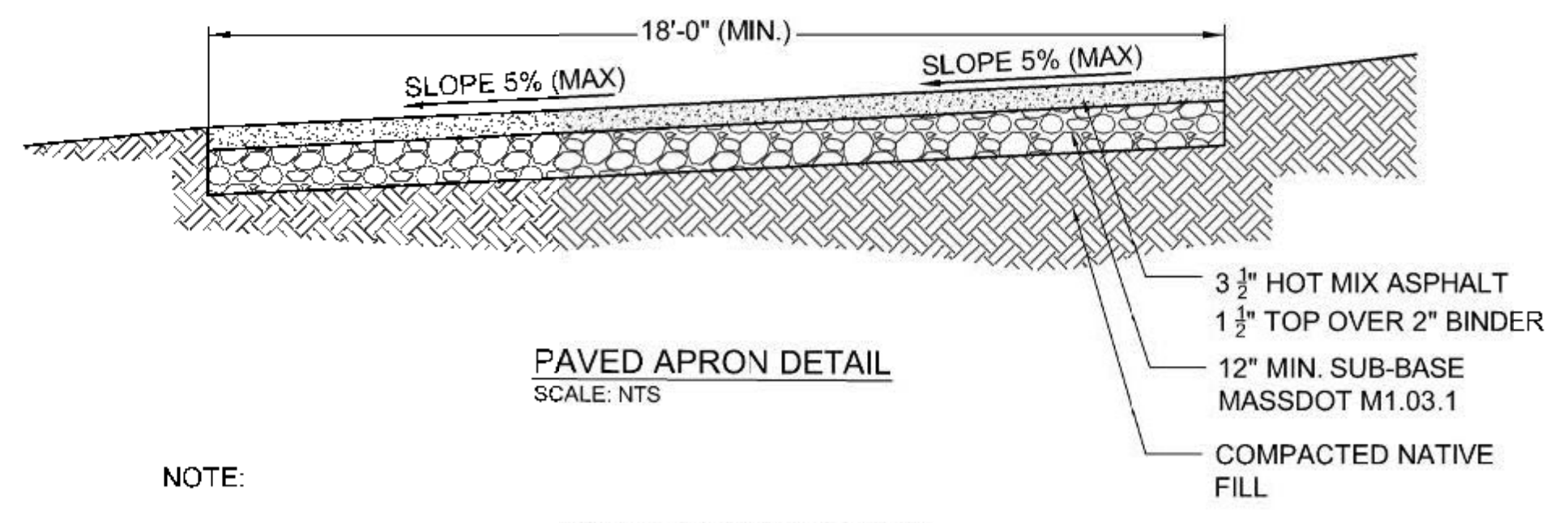
EROSION CONTROL BARRIER DETAIL
SCALE: NTS



GRAVEL ROAD DETAIL
SCALE: NTS

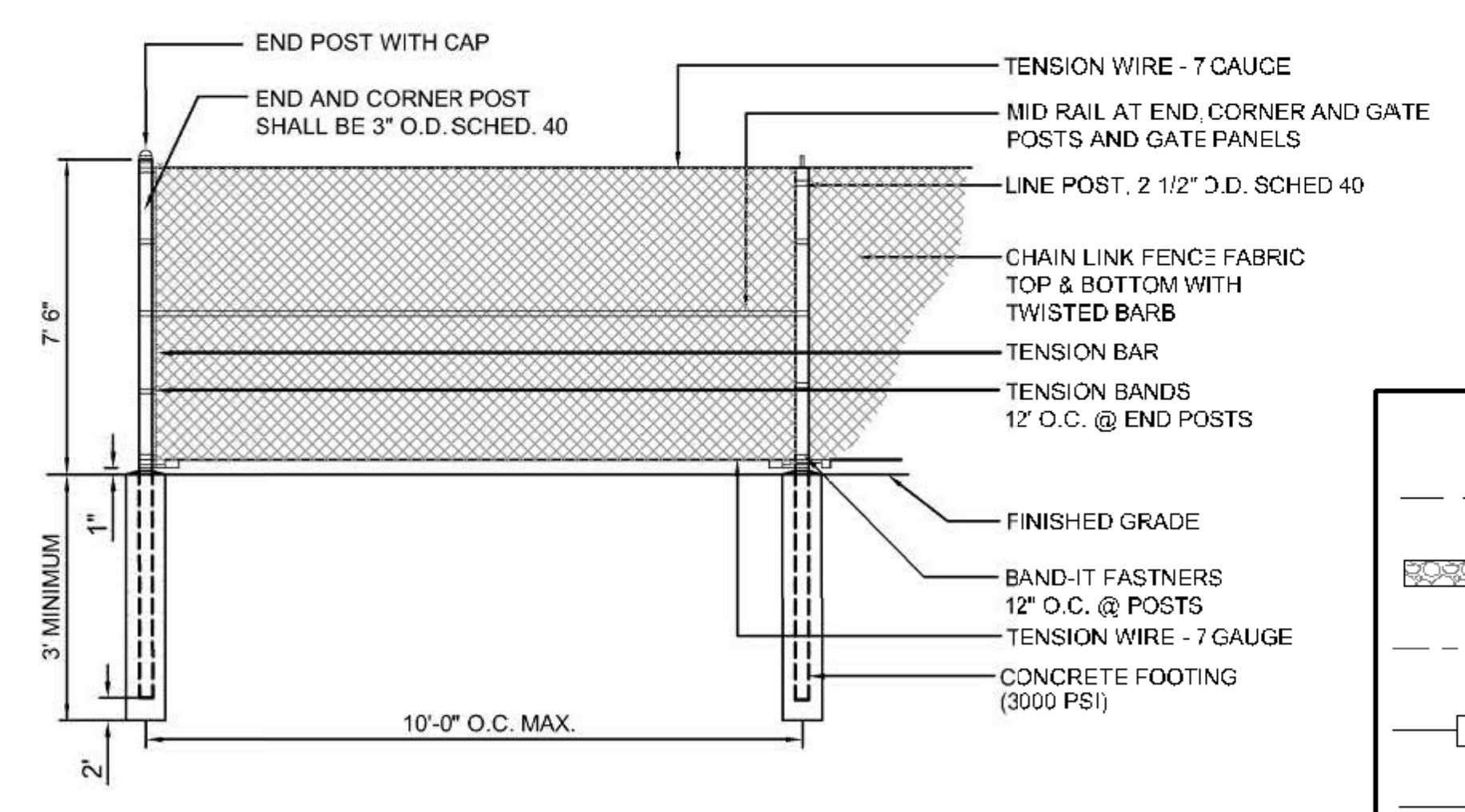


GRASSED SWALE DETAIL
SCALE: NTS



PAVED APRON DETAIL
SCALE: NTS

NOTE:
ALL SOFT OR SPONGY MATERIAL BELOW THE SUBGRADE SHALL BE REMOVED AND REPLACED WITH GRAVEL BORROW CONFORMING WITH MASSDOT SPEC M 1.02.0 TYPE A CONTAINING NO STONES OVER SIX (6) INCHES IN DIAMETER.



CHAIN LINK FENCE DETAIL
SCALE: NTS

NOTES:
1. FENCELINE ALONG SOUTHERN SIDE OF ARRAY TO BE VINYL COATED. ALL HARDWARE FITTINGS AND MISCELLANEOUS MATERIALS SHALL BE GALVANIZED AND VINYL COATED, COLOR TO MATCH FABRIC, AS SPECIFIED. NUTS AND BOLTS SHALL BE THERMAL COATED, COLOR TO MATCH FABRIC, AS SPECIFIED.
2. FENCE TO BE INSTALLED 6" OFF GROUND TO ALLOW MIGRATION OF WILDLIFE INTO AND OUT OF THE SOLAR FACILITY.

NOTES:
1. ENGINEER WILL PROVIDE A STORMWATER POLLUTION PREVENTION PLAN (SWPPP) TO OBTAIN A NPDES CONSTRUCTION GENERAL PERMIT (CGP) PRIOR TO THE CONTRACTOR COMMENCING WORK.

LEGEND

- PROPERTY LINE
- 217 --- EXISTING ELEVATION CONTOUR
- [217] PROPOSED ELEVATION CONTOUR
- ESTIMATED 50'/100' WETLAND BUFFER ZONE OR RIVERFRONT AREA
- APPROXIMATE LIMIT OF INTERMITTENT STREAM
- LIMIT OF PROTECTED WETLANDS
- ESTIMATED & PRIORITY RARE WILDLIFE HABITAT LIMITS
- ▲ WETLAND FLAG
- EXISTING/PROPOSED TREELINE (AS NOTED)
- EXISTING STONE WALL

FOR PERMITTING

NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

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DESIGNED BY: SLB/DPR
CHECKED BY: DPR

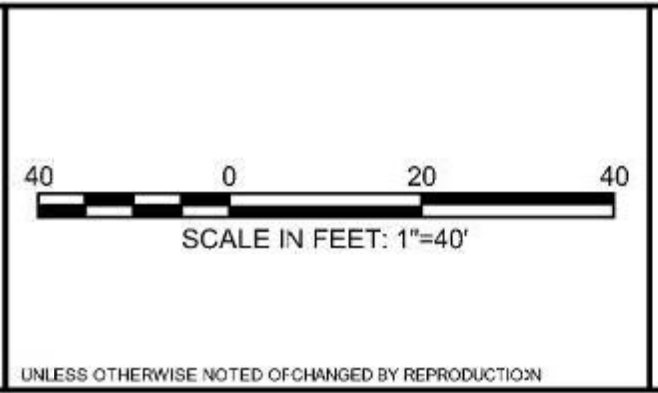
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NORTH STURBRIDGE ROAD SOLAR FACILITY

ALTERATION AREA PLAN

NORTH STURBRIDGE ROAD
CHARLTON, MA

BETA JOB NO.	5989
ISSUE DATE	8/1/2018
DRAWING NO.	3

8/1/2018 8:57 AM C:\BETA\DRAWING FILES\NORTH STURBRIDGE ROAD\PLANS\NORTH STURBRIDGE ROAD\ROADSOLAR\FACILITY\FIGURES\DWG (BETA) STB 81V STB.DWG