Addendum - 1
Stormwater Management Report

for:

Large Scale Ground Mounted Solar Photovoltaic Installation

2394 Main Poland Road
Conway, MA 01581

Project Proponent:

Nexamp, LLC

101 Summer Street, 2nd Floor
Boston, MA 02110

Original Report December 2018
Revised: March 2019

Michael J. Scott, P.E.

WDA DESIGN GROUP

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PURPOSE

Revised hydrologic calculations have been performed in response to peer review comments as part of the Site Plan Review and Notice of Intent applications for a proposed ground mounted solar array project at Main Poland Road in Conway, Massachusetts. This report addresses drainage, hydrology and stormwater management comments received from Tighe & Bond and the Town of Conway Planning Board as well as comments made during the Conservation Commission hearings. Stormwater calculations for existing conditions reference the original Stormwater Management Report dated December 2018 as the existing hydrologic analysis remains valid. The calculations were performed to design stormwater collection and attenuation facilities for the site and to demonstrate that the project will meet the standards of the Town of Conway and the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Regulations.

The revisions made in this report are as follows:

a) the overall scope/scale of the project has been reduced, resulting in a smaller disturbed area in order to maintain a greater natural buffer to wetlands and provide a larger setback and buffer to neighboring lots.

b) the post development times of concentration (Tc) have been reevaluated to reflect proper cover types of the proposed conditions. Areas of meadow inside the fence are evaluated as "dense grass", areas of brush to be cleared with stumps remaining are evaluated as "forest with heavy litter".

c) trap rock check dams have been added to the existing drainage channel in the eastern drainage area (PDA-200) to increase times of concentration as well as mitigate existing runoff concerns.

d) for proposed drainage area (PDA-200) the original time of concentration path was analyzed with revised cover types, which resulted in a large increase in the Tc. An alternate Tc path for PDA-200 is used in this Addendum as it provides an analysis more closely resembling the other areas of proposed disturbance, is closer to the Tc for existing site conditions and is therefore more conservative value than that of the original Tc path.

e) The detention basin has been slightly enlarged to mitigate the peak flows and provide one-foot of free board.

STORMWATER MANAGEMENT STANDARDS

STANDARD #2 – PEAK RATE ATTENUATION.

ANALYSIS SUMMARY

In order to assess the impact of the proposed development on peak runoff rates onto down-gradient properties, hydrologic calculations were performed for each of three (3) design storms at the design point(s). The calculations refer to runoff quantities at the final design point(s), the western property line (DP-1), the eastern property line (DP-2), and the wetland system to the south of the property (DP-3).

Calculations of peak runoff rates for existing and proposed site conditions are included and summarized in Table I for comparison of peak runoff rates for the design point for the three (3) design storms. A proposed hydrology plan is provided showing the various sub-watersheds draining to the proposed stormwater management facilities. Stormwater runoff from the overland areas not tributary to the stormwater management facilities will drain by sheet flow or shallow concentrated flow along the existing flow patterns to the design point.

Table I demonstrates that the proposed stormwater management system will be effective in limiting peak rates of runoff from the subject property to approximate pre-development levels.

TABLE I: EXISTING AND PROPOSED PEAK RUNOFF

DRAINAGE AREA	DESIGN STORM EVENT / PEAK RUNOFF (cfs)		
	2-Year	10-Year	100-Year
Existing (DP-1)	0.5	8.3	35.2
Proposed (DP-1)	0.4	8.2	35.0
Existing (DP-2)	0.4	6.1	25.2
Proposed (DP-2)	0.4	6.1	25.1
Existing (DP-3)	0.6	3.6	10.5
Proposed (DP-3)	0.6	3.6	10.5

TABLE II: EXISTING AND PROPOSED RUNOFF VOLUMES

DRAINAGE AREA	DESIGN STORM EVENT / VOLUME (acre-feet)		
	2-Year	10-Year	100-Year
Existing (DP-1)	0.31	1.76	5.09
Proposed (DP-1)	0.28	1.76	5.19
Existing (DP-2)	0.18	0.87	2.37
Proposed (DP-2)	0.18	0.87	2.37
Existing (DP-3)	0.12	0.42	1.00
Proposed (DP-3)	0.12	0.42	1.00

TABLE III: MAXIMUM WATER ELEVATION

STORMWATER FACILITY	100-YEAR STORM EVENT WATER ELEVATION	TOP / BERM ELEVATION
Detention Basin (DB-100)	1239.4	1240.5

PROPOSED HYDROLOGY

REMAINDER OF PROPERTY NOT STUDIED

DP-2
EAST

MAIN POLAND ROAD

PDA-200

PDA-100

PDA-101

PDA-300

DP-1
WEST

SOUTH ASHFIELD ROAD

DP-3
WETLANDS

TITLE: EXISTING HYDROLOGY PLAN
2394 Main Poland Road
Conway, MA

OWNER: ROBERT & SARAH MEWMAN
2394 Main Poland Road
Conway, MA

APPLICANT: Nexamp, LLC
101 Summer Street, 2nd Floor
Boston, MA

DATE: December 2018
DRAWN BY: TBS
JOB NO.: 1212
FILE NO.: 1212350
REV. NO.: ADD-1
REV. DATE: 3/14/2019

0 250 500 750

PREPARED BY:

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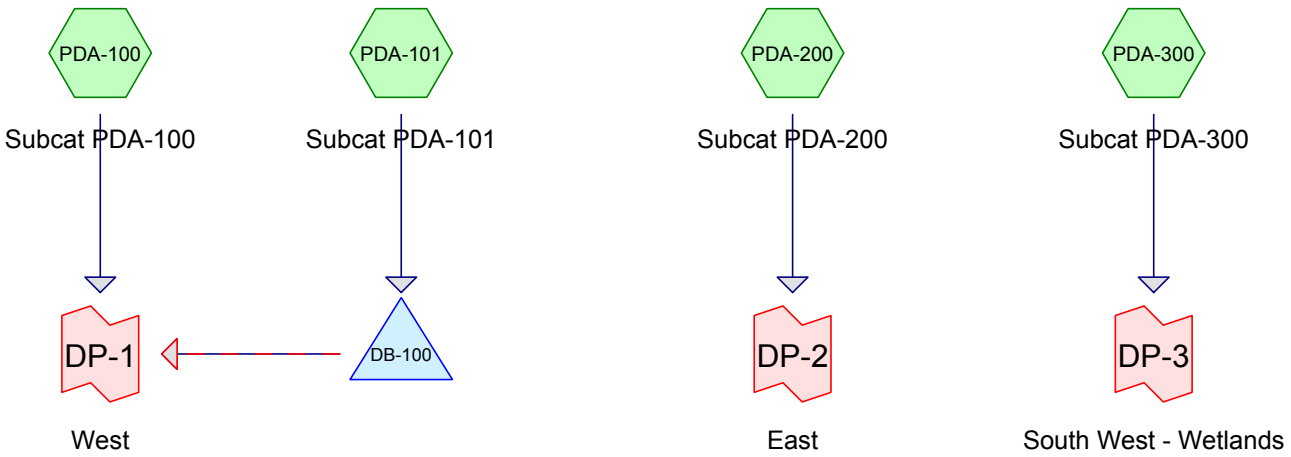

Subcat Reach Pond Link

Routing Diagram for 1212 - Proposed-Addendum
Prepared by Microsoft

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
40,989	30	Brush, Good, HSG A (PDA-100, PDA-200)
176,018	48	Brush, Good, HSG B (PDA-100, PDA-101, PDA-200)
15,261	96	Gravel surface, HSG A (PDA-100, PDA-101)
42,542	96	Gravel surface, HSG B (PDA-100, PDA-101, PDA-200, PDA-300)
655,736	30	Meadow, non-grazed, HSG A (PDA-100, PDA-101, PDA-200)
521,049	58	Meadow, non-grazed, HSG B (PDA-100, PDA-101, PDA-200)
3,320	98	Roofs, HSG B (PDA-200, PDA-300)
71,960	30	Woods, Good, HSG A (PDA-100, PDA-200)
1,155,301	55	Woods, Good, HSG B (PDA-100, PDA-101, PDA-200, PDA-300)
90,219	77	Woods, Good, HSG D (PDA-100)
2,772,396	**50**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
783,947	HSG A	PDA-100, PDA-101, PDA-200
1,898,230	HSG B	PDA-100, PDA-101, PDA-200, PDA-300
0	HSG C	
90,219	HSG D	PDA-100
0	Other	
2,772,396		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatc Number
40,989	176,018	0	0	0	217,007	Brush, Good	
15,261	42,542	0	0	0	57,803	Gravel surface	
655,736	521,049	0	0	0	1,176,785	Meadow, non-grazed	
0	3,320	0	0	0	3,320	Roofs	
71,960	1,155,301	0	90,219	0	1,317,481	Woods, Good	
783,947	**1,898,230**	**0**	**90,219**	**0**	**2,772,396**	**TOTAL AREA**	

Time span=0.00-96.00 hrs, dt=0.05 hrs, 1921 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PDA-100: Subcat PDA-100 Runoff Area=1,606,717 sf 0.00% Impervious Runoff Depth=0.09"
Flow Length=1,057' Tc=21.3 min CN=48 Runoff=0.4 cfs 12,048 cf

Subcatchment PDA-101: Subcat PDA-101 Runoff Area=176,192 sf 0.00% Impervious Runoff Depth=0.28"
Flow Length=712' Tc=24.4 min CN=56 Runoff=0.4 cfs 4,105 cf

Subcatchment PDA-200: Subcat PDA-200 Runoff Area=742,322 sf 0.26% Impervious Runoff Depth=0.13"
Flow Length=583' Tc=9.8 min CN=50 Runoff=0.4 cfs 7,953 cf

Subcatchment PDA-300: Subcat PDA-300 Runoff Area=247,166 sf 0.57% Impervious Runoff Depth=0.25"
Tc=12.5 min CN=55 Runoff=0.6 cfs 5,167 cf

Pond DB-100: Peak Elev=1,237.67' Storage=4,105 cf Inflow=0.4 cfs 4,105 cf
Primary=0.0 cfs 0 cf Secondary=0.0 cfs 0 cf Outflow=0.0 cfs 0 cf

Link DP-1: West Inflow=0.4 cfs 12,048 cf
Primary=0.4 cfs 12,048 cf

Link DP-2: East Inflow=0.4 cfs 7,953 cf
Primary=0.4 cfs 7,953 cf

Link DP-3: South West - Wetlands Inflow=0.6 cfs 5,167 cf
Primary=0.6 cfs 5,167 cf

Total Runoff Area = 2,772,396 sf Runoff Volume = 29,274 cf Average Runoff Depth = 0.13"
99.88% Pervious = 2,769,076 sf 0.12% Impervious = 3,320 sf

Summary for Subcatchment PDA-100: Subcat PDA-100

Runoff = 0.4 cfs @ 14.78 hrs, Volume= 12,048 cf, Depth= 0.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.20"

Area (sf)	CN	Description
20,453	30	Brush, Good, HSG A
82,293	48	Brush, Good, HSG B
14,322	96	Gravel surface, HSG A
5,275	96	Gravel surface, HSG B
514,769	30	Meadow, non-grazed, HSG A
319,568	58	Meadow, non-grazed, HSG B
38,176	30	Woods, Good, HSG A
521,641	55	Woods, Good, HSG B
90,219	77	Woods, Good, HSG D
1,606,717	48	Weighted Average
1,606,717		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.20"
8.7	644	0.0310	1.23		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.2	40	0.0500	0.56		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
5.2	323	0.0430	1.04		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
21.3	1,057	Total			

Summary for Subcatchment PDA-101: Subcat PDA-101

Runoff = 0.4 cfs @ 12.58 hrs, Volume= 4,105 cf, Depth= 0.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.20"

Area (sf)	CN	Description
40,166	48	Brush, Good, HSG B
939	96	Gravel surface, HSG A
11,393	96	Gravel surface, HSG B
14,471	30	Meadow, non-grazed, HSG A
105,266	58	Meadow, non-grazed, HSG B
3,957	55	Woods, Good, HSG B
176,192	56	Weighted Average
176,192		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.20"
3.0	234	0.0340	1.29		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.9	163	0.0250	0.40		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.4	118	0.0760	1.38		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.3	147	0.1770	1.05		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
24.4	712	Total			

Summary for Subcatchment PDA-200: Subcat PDA-200

Runoff = 0.4 cfs @ 12.54 hrs, Volume= 7,953 cf, Depth= 0.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.20"

Area (sf)	CN	Description
20,536	30	Brush, Good, HSG A
53,559	48	Brush, Good, HSG B
25,138	96	Gravel surface, HSG B
126,497	30	Meadow, non-grazed, HSG A
96,214	58	Meadow, non-grazed, HSG B
1,919	98	Roofs, HSG B
33,784	30	Woods, Good, HSG A
384,673	55	Woods, Good, HSG B
742,322	50	Weighted Average
740,403		99.74% Pervious Area
1,919		0.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.0800	0.18		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.20"
1.6	208	0.1000	2.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.0	127	0.1730	1.04		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.5	198	0.1890	2.17		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
9.8	583	Total			

Summary for Subcatchment PDA-300: Subcat PDA-300

Runoff = 0.6 cfs @ 12.44 hrs, Volume= 5,167 cf, Depth= 0.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.20"

Area (sf)	CN	Description
735	96	Gravel surface, HSG B
1,401	98	Roofs, HSG B
245,029	55	Woods, Good, HSG B
247,166	55	Weighted Average
245,765		99.43% Pervious Area
1,401		0.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5					**Direct Entry,**

Summary for Pond DB-100:

Inflow Area = 176,192 sf, 0.00% Impervious, Inflow Depth = 0.28" for 2-year event
Inflow = 0.4 cfs @ 12.58 hrs, Volume= 4,105 cf
Outflow = 0.0 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf
Secondary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 1,237.67' @ 25.45 hrs Surf.Area= 3,083 sf Storage= 4,105 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	1,236.00'	13,773 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,236.00	1,835	0	0
1,238.00	3,330	5,165	5,165
1,240.00	5,278	8,608	13,773

Device	Routing	Invert	Outlet Devices
#1	Primary	1,236.00'	**12.0" Round Culvert** L= 45.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,236.00' / 1,235.00' S= 0.0222 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	1,238.30'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	1,238.50'	**10.0" Vert. Orifice/Grate** C= 0.600
#4	Secondary	1,239.90'	**10.0' long x 8.0' breadth Broad-Crested Rectangular Weir**

Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50
Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=1,236.00' (Free Discharge)
└**1=Culvert** (Controls 0.0 cfs)
  ├**2=Orifice/Grate** (Controls 0.0 cfs)
  └**3=Orifice/Grate** (Controls 0.0 cfs)

Secondary OutFlow Max=0.0 cfs @ 0.00 hrs HW=1,236.00' (Free Discharge)
└**4=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Summary for Link DP-1: West

Inflow Area = 1,782,909 sf, 0.00% Impervious, Inflow Depth = 0.08" for 2-year event
Inflow = 0.4 cfs @ 14.78 hrs, Volume= 12,048 cf
Primary = 0.4 cfs @ 14.78 hrs, Volume= 12,048 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Summary for Link DP-2: East

Inflow Area = 742,322 sf, 0.26% Impervious, Inflow Depth = 0.13" for 2-year event
Inflow = 0.4 cfs @ 12.54 hrs, Volume= 7,953 cf
Primary = 0.4 cfs @ 12.54 hrs, Volume= 7,953 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Summary for Link DP-3: South West - Wetlands

Inflow Area = 247,166 sf, 0.57% Impervious, Inflow Depth = 0.25" for 2-year event
Inflow = 0.6 cfs @ 12.44 hrs, Volume= 5,167 cf
Primary = 0.6 cfs @ 12.44 hrs, Volume= 5,167 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Time span=0.00-96.00 hrs, dt=0.05 hrs, 1921 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PDA-100: Subcat PDA-100 Runoff Area=1,606,717 sf 0.00% Impervious Runoff Depth=0.51"
Flow Length=1,057' Tc=21.3 min CN=48 Runoff=8.2 cfs 68,946 cf

Subcatchment PDA-101: Subcat PDA-101 Runoff Area=176,192 sf 0.00% Impervious Runoff Depth=0.94"
Flow Length=712' Tc=24.4 min CN=56 Runoff=2.2 cfs 13,806 cf

Subcatchment PDA-200: Subcat PDA-200 Runoff Area=742,322 sf 0.26% Impervious Runoff Depth=0.61"
Flow Length=583' Tc=9.8 min CN=50 Runoff=6.1 cfs 37,889 cf

Subcatchment PDA-300: Subcat PDA-300 Runoff Area=247,166 sf 0.57% Impervious Runoff Depth=0.88"
Tc=12.5 min CN=55 Runoff=3.6 cfs 18,170 cf

Pond DB-100: Peak Elev=1,238.63' Storage=7,459 cf Inflow=2.2 cfs 13,806 cf
Primary=0.3 cfs 7,596 cf Secondary=0.0 cfs 0 cf Outflow=0.3 cfs 7,596 cf

Link DP-1: West Inflow=8.2 cfs 76,542 cf
Primary=8.2 cfs 76,542 cf

Link DP-2: East Inflow=6.1 cfs 37,889 cf
Primary=6.1 cfs 37,889 cf

Link DP-3: South West - Wetlands Inflow=3.6 cfs 18,170 cf
Primary=3.6 cfs 18,170 cf

Total Runoff Area = 2,772,396 sf Runoff Volume = 138,811 cf Average Runoff Depth = 0.60"
99.88% Pervious = 2,769,076 sf 0.12% Impervious = 3,320 sf

Summary for Subcatchment PDA-100: Subcat PDA-100

Runoff = 8.2 cfs @ 12.49 hrs, Volume= 68,946 cf, Depth= 0.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.80"

Area (sf)	CN	Description
20,453	30	Brush, Good, HSG A
82,293	48	Brush, Good, HSG B
14,322	96	Gravel surface, HSG A
5,275	96	Gravel surface, HSG B
514,769	30	Meadow, non-grazed, HSG A
319,568	58	Meadow, non-grazed, HSG B
38,176	30	Woods, Good, HSG A
521,641	55	Woods, Good, HSG B
90,219	77	Woods, Good, HSG D
1,606,717	48	Weighted Average
1,606,717		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.20"
8.7	644	0.0310	1.23		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.2	40	0.0500	0.56		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
5.2	323	0.0430	1.04		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
21.3	1,057	Total			

Summary for Subcatchment PDA-101: Subcat PDA-101

Runoff = 2.2 cfs @ 12.42 hrs, Volume= 13,806 cf, Depth= 0.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.80"

Area (sf)	CN	Description
40,166	48	Brush, Good, HSG B
939	96	Gravel surface, HSG A
11,393	96	Gravel surface, HSG B
14,471	30	Meadow, non-grazed, HSG A
105,266	58	Meadow, non-grazed, HSG B
3,957	55	Woods, Good, HSG B
176,192	56	Weighted Average
176,192		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.20"
3.0	234	0.0340	1.29		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.9	163	0.0250	0.40		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.4	118	0.0760	1.38		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.3	147	0.1770	1.05		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
24.4	712	Total			

Summary for Subcatchment PDA-200: Subcat PDA-200

Runoff = 6.1 cfs @ 12.21 hrs, Volume= 37,889 cf, Depth= 0.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.80"

Area (sf)	CN	Description
20,536	30	Brush, Good, HSG A
53,559	48	Brush, Good, HSG B
25,138	96	Gravel surface, HSG B
126,497	30	Meadow, non-grazed, HSG A
96,214	58	Meadow, non-grazed, HSG B
1,919	98	Roofs, HSG B
33,784	30	Woods, Good, HSG A
384,673	55	Woods, Good, HSG B
742,322	50	Weighted Average
740,403		99.74% Pervious Area
1,919		0.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.0800	0.18		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.20"
1.6	208	0.1000	2.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.0	127	0.1730	1.04		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.5	198	0.1890	2.17		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
9.8	583	Total			

Summary for Subcatchment PDA-300: Subcat PDA-300

Runoff = 3.6 cfs @ 12.22 hrs, Volume= 18,170 cf, Depth= 0.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.80"

Area (sf)	CN	Description
735	96	Gravel surface, HSG B
1,401	98	Roofs, HSG B
245,029	55	Woods, Good, HSG B
247,166	55	Weighted Average
245,765		99.43% Pervious Area
1,401		0.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5					**Direct Entry,**

Summary for Pond DB-100:

Inflow Area = 176,192 sf, 0.00% Impervious, Inflow Depth = 0.94" for 10-year event
Inflow = 2.2 cfs @ 12.42 hrs, Volume= 13,806 cf
Outflow = 0.3 cfs @ 15.07 hrs, Volume= 7,596 cf, Atten= 85%, Lag= 159.1 min
Primary = 0.3 cfs @ 15.07 hrs, Volume= 7,596 cf
Secondary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 1,238.63' @ 15.07 hrs Surf.Area= 3,944 sf Storage= 7,459 cf

Plug-Flow detention time= 365.5 min calculated for 7,592 cf (55% of inflow)
Center-of-Mass det. time= 228.8 min (1,138.6 - 909.7)

Volume	Invert	Avail.Storage	Storage Description
#1	1,236.00'	13,773 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,236.00	1,835	0	0
1,238.00	3,330	5,165	5,165
1,240.00	5,278	8,608	13,773

Device	Routing	Invert	Outlet Devices
#1	Primary	1,236.00'	**12.0" Round Culvert** L= 45.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,236.00' / 1,235.00' S= 0.0222 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	1,238.30'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	1,238.50'	**10.0" Vert. Orifice/Grate** C= 0.600
#4	Secondary	1,239.90'	**10.0' long x 8.0' breadth Broad-Crested Rectangular Weir**

Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50
Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=0.3 cfs @ 15.07 hrs HW=1,238.63' (Free Discharge)
└**1=Culvert** (Passes 0.3 cfs of 5.5 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.3 cfs @ 1.96 fps)
  └**3=Orifice/Grate** (Orifice Controls 0.1 cfs @ 1.23 fps)

Secondary OutFlow Max=0.0 cfs @ 0.00 hrs HW=1,236.00' (Free Discharge)
└**4=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Summary for Link DP-1: West

Inflow Area = 1,782,909 sf, 0.00% Impervious, Inflow Depth = 0.52" for 10-year event
Inflow = 8.2 cfs @ 12.49 hrs, Volume= 76,542 cf
Primary = 8.2 cfs @ 12.49 hrs, Volume= 76,542 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Summary for Link DP-2: East

Inflow Area = 742,322 sf, 0.26% Impervious, Inflow Depth = 0.61" for 10-year event
Inflow = 6.1 cfs @ 12.21 hrs, Volume= 37,889 cf
Primary = 6.1 cfs @ 12.21 hrs, Volume= 37,889 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Summary for Link DP-3: South West - Wetlands

Inflow Area = 247,166 sf, 0.57% Impervious, Inflow Depth = 0.88" for 10-year event
Inflow = 3.6 cfs @ 12.22 hrs, Volume= 18,170 cf
Primary = 3.6 cfs @ 12.22 hrs, Volume= 18,170 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Time span=0.00-96.00 hrs, dt=0.05 hrs, 1921 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PDA-100: Subcat PDA-100 Runoff Area=1,606,717 sf 0.00% Impervious Runoff Depth=1.49"
Flow Length=1,057' Tc=21.3 min CN=48 Runoff=35.0 cfs 199,653 cf

Subcatchment PDA-101: Subcat PDA-101 Runoff Area=176,192 sf 0.00% Impervious Runoff Depth=2.22"
Flow Length=712' Tc=24.4 min CN=56 Runoff=6.1 cfs 32,568 cf

Subcatchment PDA-200: Subcat PDA-200 Runoff Area=742,322 sf 0.26% Impervious Runoff Depth=1.67"
Flow Length=583' Tc=9.8 min CN=50 Runoff=25.1 cfs 103,100 cf

Subcatchment PDA-300: Subcat PDA-300 Runoff Area=247,166 sf 0.57% Impervious Runoff Depth=2.12"
Tc=12.5 min CN=55 Runoff=10.5 cfs 43,745 cf

Pond DB-100: Peak Elev=1,239.40' Storage=10,764 cf Inflow=6.1 cfs 32,568 cf
Primary=2.7 cfs 26,358 cf Secondary=0.0 cfs 0 cf Outflow=2.7 cfs 26,358 cf

Link DP-1: West Inflow=35.0 cfs 226,011 cf
Primary=35.0 cfs 226,011 cf

Link DP-2: East Inflow=25.1 cfs 103,100 cf
Primary=25.1 cfs 103,100 cf

Link DP-3: South West - Wetlands Inflow=10.5 cfs 43,745 cf
Primary=10.5 cfs 43,745 cf

Total Runoff Area = 2,772,396 sf Runoff Volume = 379,066 cf Average Runoff Depth = 1.64"
99.88% Pervious = 2,769,076 sf 0.12% Impervious = 3,320 sf

Summary for Subcatchment PDA-100: Subcat PDA-100

Runoff = 35.0 cfs @ 12.36 hrs, Volume= 199,653 cf, Depth= 1.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.00"

Area (sf)	CN	Description
20,453	30	Brush, Good, HSG A
82,293	48	Brush, Good, HSG B
14,322	96	Gravel surface, HSG A
5,275	96	Gravel surface, HSG B
514,769	30	Meadow, non-grazed, HSG A
319,568	58	Meadow, non-grazed, HSG B
38,176	30	Woods, Good, HSG A
521,641	55	Woods, Good, HSG B
90,219	77	Woods, Good, HSG D
1,606,717	48	Weighted Average
1,606,717		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.20"
8.7	644	0.0310	1.23		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.2	40	0.0500	0.56		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
5.2	323	0.0430	1.04		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
21.3	1,057	Total			

Summary for Subcatchment PDA-101: Subcat PDA-101

Runoff = 6.1 cfs @ 12.37 hrs, Volume= 32,568 cf, Depth= 2.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.00"

Area (sf)	CN	Description
40,166	48	Brush, Good, HSG B
939	96	Gravel surface, HSG A
11,393	96	Gravel surface, HSG B
14,471	30	Meadow, non-grazed, HSG A
105,266	58	Meadow, non-grazed, HSG B
3,957	55	Woods, Good, HSG B
176,192	56	Weighted Average
176,192		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.20"
3.0	234	0.0340	1.29		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.9	163	0.0250	0.40		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.4	118	0.0760	1.38		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.3	147	0.1770	1.05		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
24.4	712	Total			

Summary for Subcatchment PDA-200: Subcat PDA-200

Runoff = 25.1 cfs @ 12.16 hrs, Volume= 103,100 cf, Depth= 1.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.00"

Area (sf)	CN	Description
20,536	30	Brush, Good, HSG A
53,559	48	Brush, Good, HSG B
25,138	96	Gravel surface, HSG B
126,497	30	Meadow, non-grazed, HSG A
96,214	58	Meadow, non-grazed, HSG B
1,919	98	Roofs, HSG B
33,784	30	Woods, Good, HSG A
384,673	55	Woods, Good, HSG B
742,322	50	Weighted Average
740,403		99.74% Pervious Area
1,919		0.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.0800	0.18		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.20"
1.6	208	0.1000	2.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.0	127	0.1730	1.04		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.5	198	0.1890	2.17		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
9.8	583	Total			

Summary for Subcatchment PDA-300: Subcat PDA-300

Runoff = 10.5 cfs @ 12.19 hrs, Volume= 43,745 cf, Depth= 2.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.00"

Area (sf)	CN	Description
735	96	Gravel surface, HSG B
1,401	98	Roofs, HSG B
245,029	55	Woods, Good, HSG B
247,166	55	Weighted Average
245,765		99.43% Pervious Area
1,401		0.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5					**Direct Entry,**

Summary for Pond DB-100:

Inflow Area = 176,192 sf, 0.00% Impervious, Inflow Depth = 2.22" for 100-year event
Inflow = 6.1 cfs @ 12.37 hrs, Volume= 32,568 cf
Outflow = 2.7 cfs @ 12.83 hrs, Volume= 26,358 cf, Atten= 56%, Lag= 27.4 min
Primary = 2.7 cfs @ 12.83 hrs, Volume= 26,358 cf
Secondary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Peak Elev= 1,239.40' @ 12.83 hrs Surf.Area= 4,690 sf Storage= 10,764 cf

Plug-Flow detention time= 165.1 min calculated for 26,345 cf (81% of inflow)
Center-of-Mass det. time= 87.5 min (968.1 - 880.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,236.00'	13,773 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,236.00	1,835	0	0
1,238.00	3,330	5,165	5,165
1,240.00	5,278	8,608	13,773

Device	Routing	Invert	Outlet Devices
#1	Primary	1,236.00'	**12.0" Round Culvert** L= 45.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,236.00' / 1,235.00' S= 0.0222 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	1,238.30'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	1,238.50'	**10.0" Vert. Orifice/Grate** C= 0.600
#4	Secondary	1,239.90'	**10.0' long x 8.0' breadth Broad-Crested Rectangular Weir**

Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50
Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=2.7 cfs @ 12.83 hrs HW=1,239.39' (Free Discharge)
└**1=Culvert** (Passes 2.7 cfs of 6.4 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.9 cfs @ 4.43 fps)
  └**3=Orifice/Grate** (Orifice Controls 1.8 cfs @ 3.33 fps)

Secondary OutFlow Max=0.0 cfs @ 0.00 hrs HW=1,236.00' (Free Discharge)
└**4=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Summary for Link DP-1: West

Inflow Area = 1,782,909 sf, 0.00% Impervious, Inflow Depth = 1.52" for 100-year event
Inflow = 35.0 cfs @ 12.36 hrs, Volume= 226,011 cf
Primary = 35.0 cfs @ 12.36 hrs, Volume= 226,011 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Summary for Link DP-2: East

Inflow Area = 742,322 sf, 0.26% Impervious, Inflow Depth = 1.67" for 100-year event
Inflow = 25.1 cfs @ 12.16 hrs, Volume= 103,100 cf
Primary = 25.1 cfs @ 12.16 hrs, Volume= 103,100 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs

Summary for Link DP-3: South West - Wetlands

Inflow Area = 247,166 sf, 0.57% Impervious, Inflow Depth = 2.12" for 100-year event
Inflow = 10.5 cfs @ 12.19 hrs, Volume= 43,745 cf
Primary = 10.5 cfs @ 12.19 hrs, Volume= 43,745 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs