

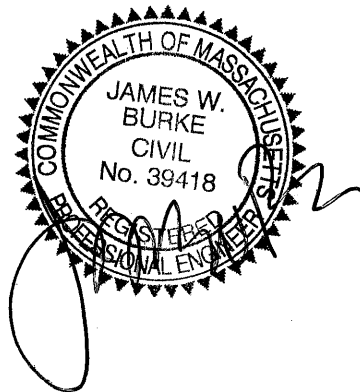
Engineering Report
for a
Existing Nursery and Landscape Business
In
Milton, Massachusetts

Prepared by:

DeCelle-Burke and Associates, Inc.
1266 Furnace Brook Parkway, Unit 401
Quincy, MA 02169

Prepared for:

Thayer Nursery
270 Hillside Street
Milton, MA 02186



February 25, 2015

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SECTION 1

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PROJECT NARRATIVE

Existing Conditions

The project locus, 270 Hillside Street in Milton, Massachusetts is a 5.4 acre parcel of land located in the Residence A zoning district. The parcel is improved with two (2) single family dwellings, a 2-1/2 story shop building, a greenhouse and several large barns and sheds. The lot is accessed from Forest Street from a single curb cut that services a gravel parking area. The property abuts Hillside Street to the west, and Forest Street to the south. Residential properties abut the locus to the north and east.

The buildings are serviced by public water, private sewer, and overhead power and communications from the Hillside Street and Forest Street public layouts. No existing site drainage was found servicing the site. The site drains overland uncontrolled into abutting streets and private properties. The site topography ranges from a high elevation of 196 at the southeast corner to a low of 182 along the north eastern property boundary. The elevations are based on the North American Vertical Datum of 1988 (NAVD). The site is not in any FEMA mapped flood zone.

The primary use of the property is as a tree nursery and landscaping business. Operations on the property include but are not limited to tree planting and transplanting, transportation and storage of landscape materials such as mulch and stone dust, transportation of hardscape materials such as pave stone and concrete block, and the sale and storage of kiln dried firewood. The nursery also stocks Christmas trees and wreaths for seasonal sales.

Site soils for the parcel are defined by the Natural Resources Conservation Service (NRCS) as Woodbridge, a fine sandy loam. These soils are defined as moderately well drained sloping soils on top of hills, on the side slope and on toe slopes of uplands.

Proposed Conditions

The existing business operations on the site are being realigned to minimize visual, auditory and fugitive dust impacts to abutting properties. Hours of operation and rules regarding operations on site will be outlined under separate cover.

Fences outfitted with sound attenuating material will be installed along the property lines with residential abutters as shown on the site plans. These fences combined with new vegetative plantings will provide visual, noise and dust reduction to the maximum extent practicable.

To help mitigate runoff from leaving the site a drainage trench has been installed along the southeasterly property line. This trench will convey runoff to two leach pits that were installed behind the existing barn. Overland flow from the site will follow existing flow paths. Limited regrading to the site is proposed. The overland flow will flow to a new catch basin connected to a twelve (12) unit Cultec recharge system located in the northerly nursery stock area. The Cultecs will capture and recharge site runoff not captured by the trench. A ten (10) inch PVC overflow will connect the proposed catch basin to a catch basin in the Hillside Street Public layout.

Stormwater Management

Thayer Nursery proposes to comply with Massachusetts Stormwater Management Policy by installing twelve Cultec chambers. The chambers will recharge the stormwater runoff generated by the buildings and parking areas. Calculations are attached that provide the hydraulic performance model of the chambers for the 2, 10, 25 & 100-year storm event. The infiltration chambers exceed the required water quality storage volume and eliminates any suspended solids contaminated runoff generated from this area.

Stormwater Runoff Comparison Chart for Pre- and Post-Construction

2-Year Storm (3.2")			
Existing Conditions		Proposed Conditions	
Area Description	Flow (CFS)	Area Description	Flow (CFS)
Flow off-site	8.70	Flow off-site	8.55

10-Year Storm (4.7")			
Existing Conditions		Proposed Conditions	
Area Description	Flow (CFS)	Area Description	Flow (CFS)
Flow off-site	16.52	Flow off-site	14.84

25-Year Storm (5.6")			
Existing Conditions		Proposed Conditions	
Area Description	Flow (CFS)	Area Description	Flow (CFS)
Flow off-site	21.43	Flow off-site	18.30

100-Year Storm (7.0")			
Existing Conditions		Proposed Conditions	
Area Description	Flow (CFS)	Area Description	Flow (CFS)
Flow off-site	29.38	Flow off-site	25.02

Section 2

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Supporting Maps

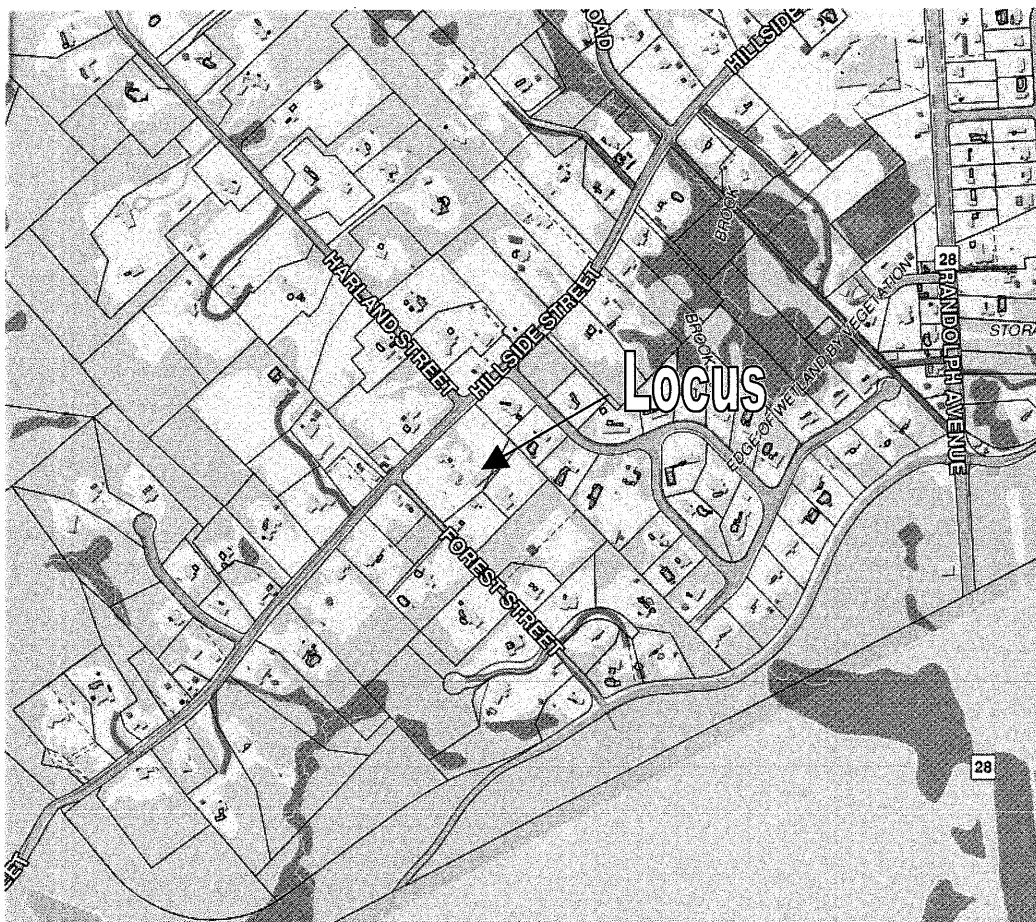
Assessor's Map

USGS Map

FEMA Panel

Soils Map

NHESP Map



Map N Block 12 Lots 1A, 1B & 1C

DATE:
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TITLE:

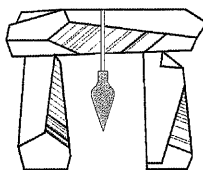
ASSESSORS MAP

SCALE:
NOT TO SCALE

PREPARED FOR:

**Thayer Nursery
270 Hillside Street
Milton, MA**

DeCELLE



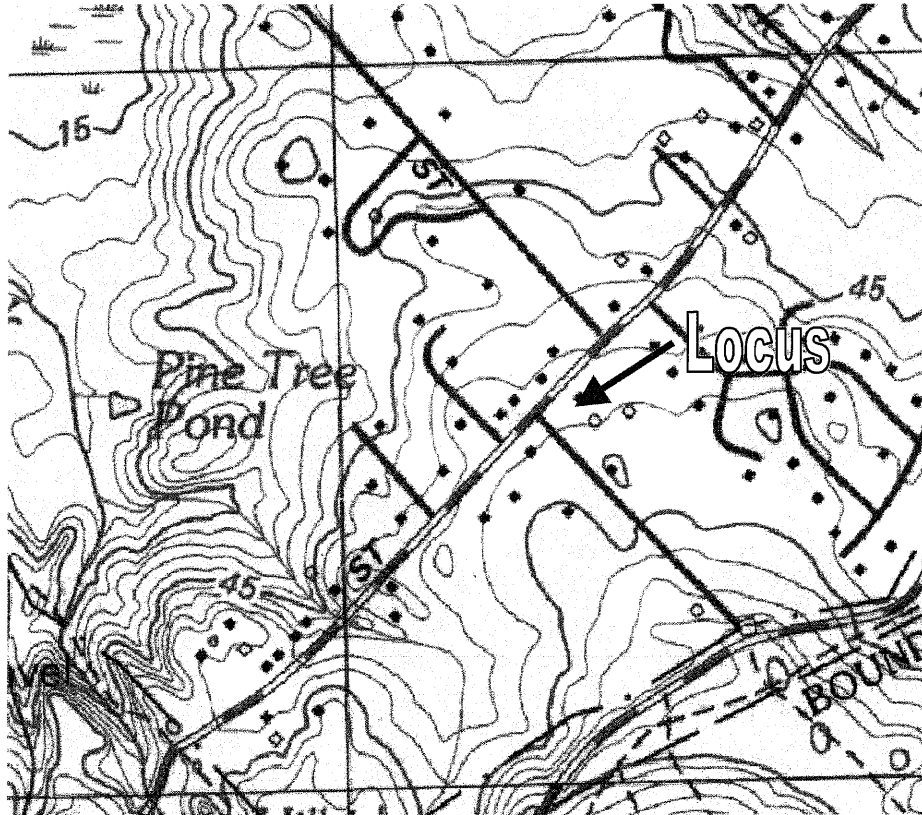
BURKE

& Associates, Inc.

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PROJECT TITLE:

**Thayer Nursery
270 Hillside Street
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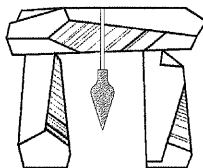
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USGS MAP

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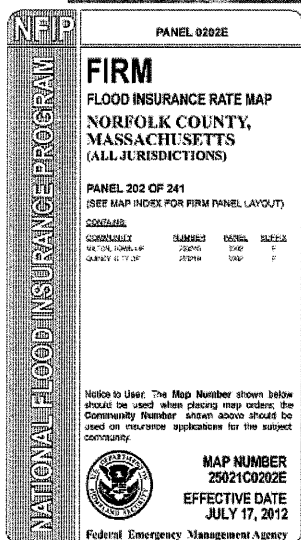
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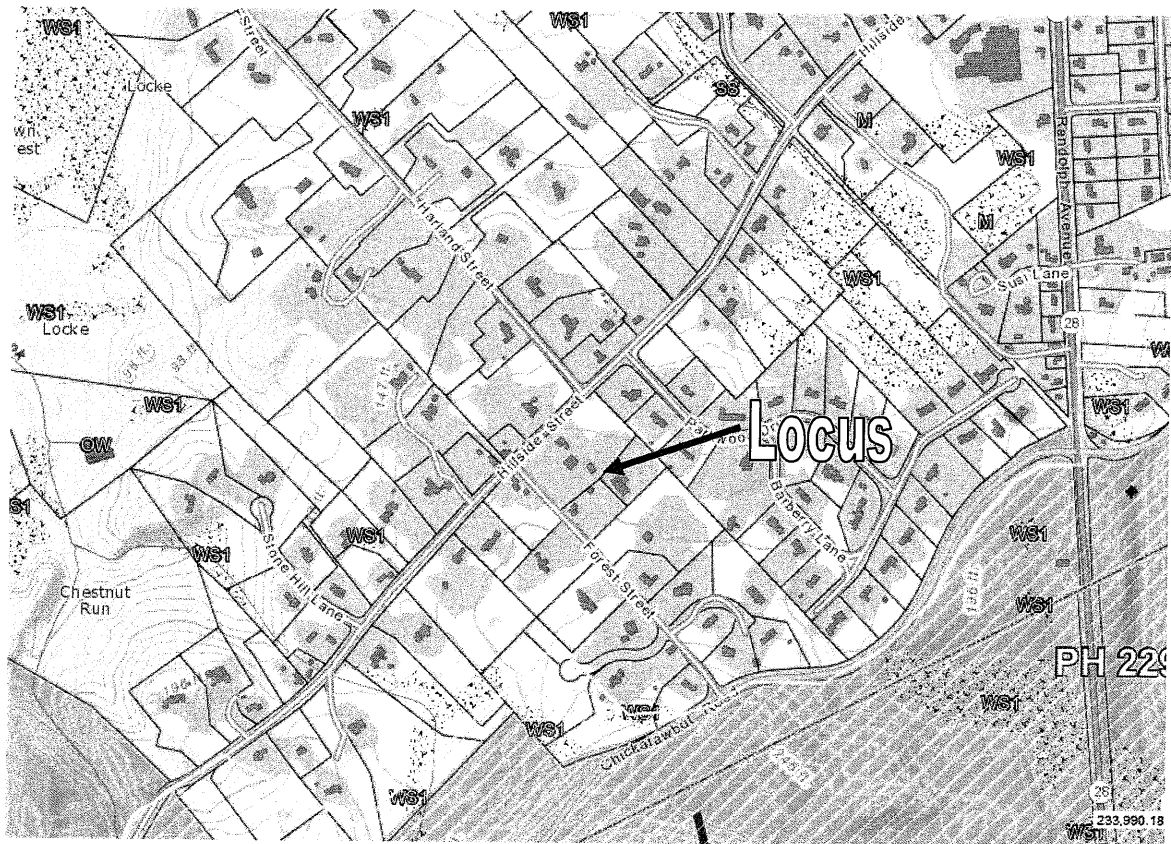
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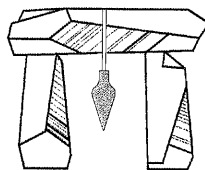
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NHESP MAP

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Section 3 – Stormwater Operation & Maintenance Plan

Structural Operations

Catch Basin

The catch basin was installed to remove trash, debris, sediment and a percentage of grease and oil from stormwater. Oil and grease will float on the surface of the pooled water and be trapped by an inverted elbow. To ensure maximum capacity and efficiency, the sumps will be cleaned when half of the available capacity of the deep sump has been used or at a minimum of once per year. The Manager shall inspect the manhole sumps at least twice per year. The Manager shall hire a contractor in good standing in the Commonwealth of Massachusetts with experience in cleaning stormwater sumps with a vacuum truck. All sediment and water retrieved from the tanks shall be disposed of by the hired company off-site in a legal manner. The Manager shall provide a written inspection report of which an example form is attached.

Underground Cultec Chambers

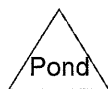
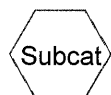
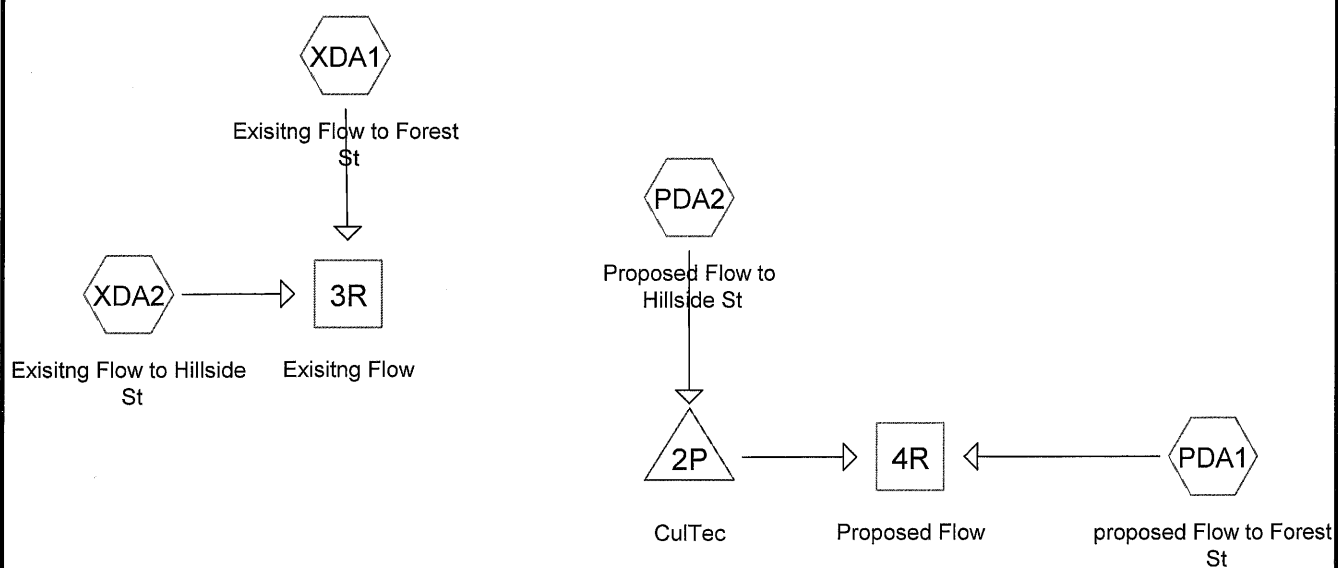
The underground Cultec chambers were installed to recharge stormwater runoff from the roof of the building. The benefit of this structural stormwater BMP is that the roof runoff does not generate sediment and the chambers shall remain effective for a long period of time. Inspection ports brought to grade are ineffective given the location of the chambers under a residential slab floor. Overflow ports at the building can be observed to determine the effectiveness of the chambers. The Site Manager shall inspect the chambers overflows during large storm events to determine the effectiveness.

Site Management

The site shall be inspected on a quarterly basis for rutting, potholes, broken berms, depressions eroded areas and any other site damage caused by vehicular or human activity. The landscaped areas shall be raked as necessary to maintain a their grade. Grassed areas shall be raked out and seeded as needed to maintain an even vegetated surface. The Manager shall hire a contractor in good standing in the Commonwealth of Massachusetts with experience in paving to repair any potholes, broken berms or other damaged paved area. The Manager shall hire a landscaper in good standing in the Commonwealth of Massachusetts with experience in re-vegetating eroded areas.

Record Keeping

Records of the inspections and maintenance for the Non-Structural and Structural Operations performed or organized by Manager for the property shall be up to date and available for review and inspection. An example record keeping sheet is attached.



Routing Diagram for Thayer Nursery

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Thayer Nursery

Prepared by DeCelle-Burke & Associates

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Type III 24-hr Rainfall=3.20"

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Page 2

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond 2P: CulTec

Peak Elev=180.87' Storage=1,323 cf Inflow=6.10 cfs 0.405 af
Discarded=0.00 cfs 0.002 af Primary=6.03 cfs 0.396 af Outflow=6.03 cfs 0.398 af

Reach 3R: Existing Flow

Inflow=8.70 cfs 0.576 af
Outflow=8.70 cfs 0.576 af

Reach 4R: Proposed Flow

Inflow=8.55 cfs 0.568 af
Outflow=8.55 cfs 0.568 af

Subcatchment PDA1: proposed Flow to

Runoff Area=62,948 sf 2.81% Impervious Runoff Depth>1.43"
Tc=5.0 min CN=82 Runoff=2.60 cfs 0.172 af

Subcatchment PDA2: Proposed Flow to

Runoff Area=171,578 sf 13.26% Impervious Runoff Depth>1.23"
Tc=5.0 min CN=79 Runoff=6.10 cfs 0.405 af

Subcatchment XDA1: Existing Flow to

Runoff Area=62,948 sf 2.81% Impervious Runoff Depth>1.43"
Tc=5.0 min CN=82 Runoff=2.60 cfs 0.172 af

Subcatchment XDA2: Existing Flow to

Runoff Area=171,578 sf 15.03% Impervious Runoff Depth>1.23"
Tc=5.0 min CN=79 Runoff=6.10 cfs 0.405 af

Total Runoff Area = 10.768 ac Runoff Volume = 1.153 af Average Runoff Depth = 1.28"
88.90% Pervious = 9.573 ac 11.10% Impervious = 1.195 ac

Summary for Pond 2P: CulTec

Inflow Area = 3.939 ac, 13.26% Impervious, Inflow Depth > 1.23"
 Inflow = 6.10 cfs @ 12.08 hrs, Volume= 0.405 af
 Outflow = 6.03 cfs @ 12.11 hrs, Volume= 0.398 af, Atten= 1%, Lag= 1.5 min
 Discarded = 0.00 cfs @ 12.11 hrs, Volume= 0.002 af
 Primary = 6.03 cfs @ 12.11 hrs, Volume= 0.396 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 180.87' @ 12.11 hrs Surf.Area= 603 sf Storage= 1,323 cf

Plug-Flow detention time= 12.1 min calculated for 0.397 af (98% of inflow)
 Center-of-Mass det. time= 6.1 min (811.5 - 805.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	175.00'	593 cf	7.00'W x 86.17'L x 3.67'H Field A 2,212 cf Overall - 730 cf Embedded = 1,481 cf x 40.0% Voids
#2A	175.50'	730 cf	Cultec R-V8HD x 12 Inside #1 Effective Size= 55.2"W x 32.0"H => 8.68 sf x 7.50'L = 65.1 cf Overall Size= 60.0"W x 32.0"H x 8.00'L with 0.50' Overlap Row Length Adjustment= -5.83' x 8.68 sf x 1 rows
#3	181.00'	9,249 cf	Custom Stage Data (Prismatic) Listed below
		10,572 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
181.00	1,500	0	0
182.00	16,998	9,249	9,249

Device	Routing	Invert	Outlet Devices
#1	Primary	175.60'	10.0" Round Culvert L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 175.60' / 175.60' S= 0.0000 ' Cc= 0.900 n= 0.009 PVC, smooth interior, Flow Area= 0.55 sf
#2	Discarded	175.00'	0.170 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 0.00'
#3	Primary	180.80'	12.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.00 cfs @ 12.11 hrs HW=180.61' (Free Discharge)
 ↳ **2=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=5.62 cfs @ 12.11 hrs HW=180.60' (Free Discharge)
 ↳ **1=Culvert** (Inlet Controls 5.62 cfs @ 10.31 fps)
 ↳ **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Reach 3R: Existing Flow

Inflow Area = 5.384 ac, 11.75% Impervious, Inflow Depth > 1.28"
 Inflow = 8.70 cfs @ 12.08 hrs, Volume= 0.576 af
 Outflow = 8.70 cfs @ 12.08 hrs, Volume= 0.576 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Reach 4R: Proposed Flow

Inflow Area = 5.384 ac, 10.45% Impervious, Inflow Depth > 1.27"
 Inflow = 8.55 cfs @ 12.10 hrs, Volume= 0.568 af
 Outflow = 8.55 cfs @ 12.10 hrs, Volume= 0.568 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Subcatchment PDA1: proposed Flow to Forest St

Runoff = 2.60 cfs @ 12.08 hrs, Volume= 0.172 af, Depth> 1.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr Rainfall=3.20"

Area (sf)	CN	Description
1,464	98	Roofs, HSG B
13,311	75	Small grain, straight row, Good, HSG B
10,817	75	Small grain, straight row, Good, HSG B
7,539	61	>75% Grass cover, Good, HSG B
302	98	Paved parking, HSG B
21,106	96	Gravel surface, HSG B
8,409	79	<50% Grass cover, Poor, HSG B
62,948	82	Weighted Average
61,182		97.19% Pervious Area
1,766		2.81% Impervious Area

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

Summary for Subcatchment PDA2: Proposed Flow to Hillside St

Runoff = 6.10 cfs @ 12.08 hrs, Volume= 0.405 af, Depth> 1.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr Rainfall=3.20"

Thayer Nursery

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Type III 24-hr Rainfall=3.20"

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Area (sf)	CN	Description
1,837	98	Roofs, HSG B
2,518	98	Roofs, HSG B
6,197	98	Roofs, HSG B
4,999	98	Roofs, HSG B
4,215	98	Paved parking, HSG B
2,554	98	Paved parking, HSG B
19,494	61	>75% Grass cover, Good, HSG B
3,111	61	>75% Grass cover, Good, HSG B
7,334	73	Small grain, contoured, Good, HSG B
31,891	73	Small grain, contoured, Good, HSG B
2,900	79	<50% Grass cover, Poor, HSG B
5,021	60	Woods, Fair, HSG B
426	98	Unconnected pavement, HSG B
79,081	82	Dirt roads, HSG B
171,578	79	Weighted Average
148,832		86.74% Pervious Area
22,746		13.26% Impervious Area
426		1.87% Unconnected

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

Summary for Subcatchment XDA1: Existing Flow to Forest St

Runoff = 2.60 cfs @ 12.08 hrs, Volume= 0.172 af, Depth> 1.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.20"

Area (sf)	CN	Description
1,464	98	Roofs, HSG B
13,311	75	Small grain, straight row, Good, HSG B
10,817	75	Small grain, straight row, Good, HSG B
7,539	61	>75% Grass cover, Good, HSG B
302	98	Paved parking, HSG B
21,106	96	Gravel surface, HSG B
8,409	79	<50% Grass cover, Poor, HSG B
62,948	82	Weighted Average
61,182		97.19% Pervious Area
1,766		2.81% Impervious Area

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

Summary for Subcatchment XDA2: Existing Flow to Hillside St

Runoff = 6.10 cfs @ 12.08 hrs, Volume= 0.405 af, Depth> 1.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=3.20"

Area (sf)	CN	Description
1,837	98	Roofs, HSG B
2,518	98	Roofs, HSG B
6,197	98	Roofs, HSG B
4,999	98	Roofs, HSG B
4,215	98	Paved parking, HSG B
5,594	98	Paved parking, HSG B
19,494	61	>75% Grass cover, Good, HSG B
3,111	61	>75% Grass cover, Good, HSG B
5,687	73	Small grain, contoured, Good, HSG B
30,498	73	Small grain, contoured, Good, HSG B
2,900	79	<50% Grass cover, Poor, HSG B
5,021	60	Woods, Fair, HSG B
426	98	Unconnected pavement, HSG B
79,081	82	Dirt roads, HSG B
171,578	79	Weighted Average
145,792		84.97% Pervious Area
25,786		15.03% Impervious Area
426		1.65% Unconnected

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

Thayer Nursery

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Type III 24-hr Rainfall=4.70"

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Page 1

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond 2P: CulTecPeak Elev=181.05' Storage=1,825 cf Inflow=11.77 cfs 0.779 af
Discarded=0.01 cfs 0.002 af Primary=10.29 cfs 0.769 af Outflow=10.30 cfs 0.771 af**Reach 3R: Existing Flow**Inflow=16.52 cfs 1.095 af
Outflow=16.52 cfs 1.095 af**Reach 4R: Proposed Flow**Inflow=14.84 cfs 1.086 af
Outflow=14.84 cfs 1.086 af**Subcatchment PDA1: proposed Flow to**Runoff Area=62,948 sf 2.81% Impervious Runoff Depth>2.63"
Tc=5.0 min CN=82 Runoff=4.76 cfs 0.317 af**Subcatchment PDA2: Proposed Flow to**Runoff Area=171,578 sf 13.26% Impervious Runoff Depth>2.37"
Tc=5.0 min CN=79 Runoff=11.77 cfs 0.779 af**Subcatchment XDA1: Existing Flow to**Runoff Area=62,948 sf 2.81% Impervious Runoff Depth>2.63"
Tc=5.0 min CN=82 Runoff=4.76 cfs 0.317 af**Subcatchment XDA2: Existing Flow to**Runoff Area=171,578 sf 15.03% Impervious Runoff Depth>2.37"
Tc=5.0 min CN=79 Runoff=11.77 cfs 0.779 af**Total Runoff Area = 10.768 ac Runoff Volume = 2.191 af Average Runoff Depth = 2.44"**
88.90% Pervious = 9.573 ac 11.10% Impervious = 1.195 ac

Summary for Pond 2P: CulTec

Inflow Area = 3.939 ac, 13.26% Impervious, Inflow Depth > 2.37"
 Inflow = 11.77 cfs @ 12.08 hrs, Volume= 0.779 af
 Outflow = 10.30 cfs @ 12.12 hrs, Volume= 0.771 af, Atten= 12%, Lag= 2.6 min
 Discarded = 0.01 cfs @ 12.12 hrs, Volume= 0.002 af
 Primary = 10.29 cfs @ 12.12 hrs, Volume= 0.769 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 181.05' @ 12.12 hrs Surf.Area= 2,945 sf Storage= 1,825 cf

Plug-Flow detention time= 8.6 min calculated for 0.771 af (99% of inflow)
 Center-of-Mass det. time= 4.9 min (795.6 - 790.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	175.00'	593 cf	7.00'W x 86.17'L x 3.67'H Field A 2,212 cf Overall - 730 cf Embedded = 1,481 cf x 40.0% Voids
#2A	175.50'	730 cf	Cultec R-V8HD x 12 Inside #1 Effective Size= 55.2"W x 32.0"H => 8.68 sf x 7.50'L = 65.1 cf Overall Size= 60.0"W x 32.0"H x 8.00'L with 0.50' Overlap Row Length Adjustment= -5.83' x 8.68 sf x 1 rows
#3	181.00'	9,249 cf	Custom Stage Data (Prismatic) Listed below
		10,572 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
181.00	1,500	0	0
182.00	16,998	9,249	9,249

Device	Routing	Invert	Outlet Devices
#1	Primary	175.60'	10.0" Round Culvert L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 175.60' / 175.60' S= 0.0000 '/' Cc= 0.900 n= 0.009 PVC, smooth interior, Flow Area= 0.55 sf
#2	Discarded	175.00'	0.170 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 0.00'
#3	Primary	180.80'	12.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.01 cfs @ 12.12 hrs HW=181.05' (Free Discharge)
 ↳2=Exfiltration (Controls 0.01 cfs)

Primary OutFlow Max=10.14 cfs @ 12.12 hrs HW=181.05' (Free Discharge)
 ↳1=Culvert (Inlet Controls 5.89 cfs @ 10.80 fps)
 ↳3=Broad-Crested Rectangular Weir (Weir Controls 4.25 cfs @ 1.42 fps)

Thayer Nursery

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Type III 24-hr Rainfall=4.70"

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Summary for Reach 3R: Existing Flow

Inflow Area = 5.384 ac, 11.75% Impervious, Inflow Depth > 2.44"
 Inflow = 16.52 cfs @ 12.08 hrs, Volume= 1.095 af
 Outflow = 16.52 cfs @ 12.08 hrs, Volume= 1.095 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Reach 4R: Proposed Flow

Inflow Area = 5.384 ac, 10.45% Impervious, Inflow Depth > 2.42"
 Inflow = 14.84 cfs @ 12.10 hrs, Volume= 1.086 af
 Outflow = 14.84 cfs @ 12.10 hrs, Volume= 1.086 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Subcatchment PDA1: proposed Flow to Forest St

Runoff = 4.76 cfs @ 12.08 hrs, Volume= 0.317 af, Depth> 2.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr Rainfall=4.70"

Area (sf)	CN	Description
1,464	98	Roofs, HSG B
13,311	75	Small grain, straight row, Good, HSG B
10,817	75	Small grain, straight row, Good, HSG B
7,539	61	>75% Grass cover, Good, HSG B
302	98	Paved parking, HSG B
21,106	96	Gravel surface, HSG B
8,409	79	<50% Grass cover, Poor, HSG B
62,948	82	Weighted Average
61,182		97.19% Pervious Area
1,766		2.81% Impervious Area

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

Summary for Subcatchment PDA2: Proposed Flow to Hillside St

Runoff = 11.77 cfs @ 12.08 hrs, Volume= 0.779 af, Depth> 2.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr Rainfall=4.70"

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Type III 24-hr Rainfall=4.70"

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Area (sf)	CN	Description
1,837	98	Roofs, HSG B
2,518	98	Roofs, HSG B
6,197	98	Roofs, HSG B
4,999	98	Roofs, HSG B
4,215	98	Paved parking, HSG B
2,554	98	Paved parking, HSG B
19,494	61	>75% Grass cover, Good, HSG B
3,111	61	>75% Grass cover, Good, HSG B
7,334	73	Small grain, contoured, Good, HSG B
31,891	73	Small grain, contoured, Good, HSG B
2,900	79	<50% Grass cover, Poor, HSG B
5,021	60	Woods, Fair, HSG B
426	98	Unconnected pavement, HSG B
79,081	82	Dirt roads, HSG B
171,578	79	Weighted Average
148,832		86.74% Pervious Area
22,746		13.26% Impervious Area
426		1.87% Unconnected

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

Summary for Subcatchment XDA1: Existing Flow to Forest St

Runoff = 4.76 cfs @ 12.08 hrs, Volume= 0.317 af, Depth> 2.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=4.70"

Area (sf)	CN	Description
1,464	98	Roofs, HSG B
13,311	75	Small grain, straight row, Good, HSG B
10,817	75	Small grain, straight row, Good, HSG B
7,539	61	>75% Grass cover, Good, HSG B
302	98	Paved parking, HSG B
21,106	96	Gravel surface, HSG B
8,409	79	<50% Grass cover, Poor, HSG B
62,948	82	Weighted Average
61,182		97.19% Pervious Area
1,766		2.81% Impervious Area

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

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Type III 24-hr Rainfall=4.70"

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Summary for Subcatchment XDA2: Existing Flow to Hillside St

Runoff = 11.77 cfs @ 12.08 hrs, Volume= 0.779 af, Depth> 2.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Type III 24-hr Rainfall=4.70"

Area (sf)	CN	Description
1,837	98	Roofs, HSG B
2,518	98	Roofs, HSG B
6,197	98	Roofs, HSG B
4,999	98	Roofs, HSG B
4,215	98	Paved parking, HSG B
5,594	98	Paved parking, HSG B
19,494	61	>75% Grass cover, Good, HSG B
3,111	61	>75% Grass cover, Good, HSG B
5,687	73	Small grain, contoured, Good, HSG B
30,498	73	Small grain, contoured, Good, HSG B
2,900	79	<50% Grass cover, Poor, HSG B
5,021	60	Woods, Fair, HSG B
426	98	Unconnected pavement, HSG B
79,081	82	Dirt roads, HSG B
171,578	79	Weighted Average
145,792		84.97% Pervious Area
25,786		15.03% Impervious Area
426		1.65% Unconnected

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

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Type III 24-hr Rainfall=5.60"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond 2P: CulTec

Peak Elev=181.14' Storage=2,594 cf Inflow=15.34 cfs 1.021 af
Discarded=0.02 cfs 0.003 af Primary=12.75 cfs 1.011 af Outflow=12.77 cfs 1.013 af

Reach 3R: Existing Flow

Inflow=21.43 cfs 1.430 af
Outflow=21.43 cfs 1.430 af

Reach 4R: Proposed Flow

Inflow=18.30 cfs 1.420 af
Outflow=18.30 cfs 1.420 af

Subcatchment PDA1: proposed Flow to

Runoff Area=62,948 sf 2.81% Impervious Runoff Depth>3.40"
Tc=5.0 min CN=82 Runoff=6.13 cfs 0.409 af

Subcatchment PDA2: Proposed Flow to

Runoff Area=171,578 sf 13.26% Impervious Runoff Depth>3.11"
Tc=5.0 min CN=79 Runoff=15.34 cfs 1.021 af

Subcatchment XDA1: Existing Flow to

Runoff Area=62,948 sf 2.81% Impervious Runoff Depth>3.40"
Tc=5.0 min CN=82 Runoff=6.13 cfs 0.409 af

Subcatchment XDA2: Existing Flow to

Runoff Area=171,578 sf 15.03% Impervious Runoff Depth>3.11"
Tc=5.0 min CN=79 Runoff=15.34 cfs 1.021 af

Total Runoff Area = 10.768 ac Runoff Volume = 2.860 af Average Runoff Depth = 3.19"
88.90% Pervious = 9.573 ac 11.10% Impervious = 1.195 ac

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Type III 24-hr Rainfall=5.60"

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Summary for Pond 2P: CulTec

Inflow Area = 3.939 ac, 13.26% Impervious, Inflow Depth > 3.11"
 Inflow = 15.34 cfs @ 12.08 hrs, Volume= 1.021 af
 Outflow = 12.77 cfs @ 12.13 hrs, Volume= 1.013 af, Atten= 17%, Lag= 3.4 min
 Discarded = 0.02 cfs @ 12.13 hrs, Volume= 0.003 af
 Primary = 12.75 cfs @ 12.13 hrs, Volume= 1.011 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 181.14' @ 12.13 hrs Surf.Area= 4,233 sf Storage= 2,594 cf

Plug-Flow detention time= 7.5 min calculated for 1.010 af (99% of inflow)
 Center-of-Mass det. time= 4.6 min (789.0 - 784.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	175.00'	593 cf	7.00'W x 86.17'L x 3.67'H Field A 2,212 cf Overall - 730 cf Embedded = 1,481 cf x 40.0% Voids
#2A	175.50'	730 cf	Cultec R-V8HD x 12 Inside #1 Effective Size= 55.2"W x 32.0"H => 8.68 sf x 7.50'L = 65.1 cf Overall Size= 60.0"W x 32.0"H x 8.00'L with 0.50' Overlap Row Length Adjustment= -5.83' x 8.68 sf x 1 rows
#3	181.00'	9,249 cf	Custom Stage Data (Prismatic) Listed below
		10,572 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
181.00	1,500	0	0
182.00	16,998	9,249	9,249

Device	Routing	Invert	Outlet Devices
#1	Primary	175.60'	10.0" Round Culvert L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 175.60' / 175.60' S= 0.0000 ' /' Cc= 0.900 n= 0.009 PVC, smooth interior, Flow Area= 0.55 sf
#2	Discarded	175.00'	0.170 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 0.00'
#3	Primary	180.80'	12.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.02 cfs @ 12.13 hrs HW=181.13' (Free Discharge)

↑ **2=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=12.54 cfs @ 12.13 hrs HW=181.13' (Free Discharge)

↑ **1=Culvert** (Inlet Controls 5.94 cfs @ 10.89 fps)

↑ **3=Broad-Crested Rectangular Weir** (Weir Controls 6.60 cfs @ 1.66 fps)

Summary for Reach 3R: Existing Flow

Inflow Area = 5.384 ac, 11.75% Impervious, Inflow Depth > 3.19"
 Inflow = 21.43 cfs @ 12.08 hrs, Volume= 1.430 af
 Outflow = 21.43 cfs @ 12.08 hrs, Volume= 1.430 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Reach 4R: Proposed Flow

Inflow Area = 5.384 ac, 10.45% Impervious, Inflow Depth > 3.16"
 Inflow = 18.30 cfs @ 12.11 hrs, Volume= 1.420 af
 Outflow = 18.30 cfs @ 12.11 hrs, Volume= 1.420 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Subcatchment PDA1: proposed Flow to Forest St

Runoff = 6.13 cfs @ 12.07 hrs, Volume= 0.409 af, Depth> 3.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr Rainfall=5.60"

Area (sf)	CN	Description
1,464	98	Roofs, HSG B
13,311	75	Small grain, straight row, Good, HSG B
10,817	75	Small grain, straight row, Good, HSG B
7,539	61	>75% Grass cover, Good, HSG B
302	98	Paved parking, HSG B
21,106	96	Gravel surface, HSG B
8,409	79	<50% Grass cover, Poor, HSG B
62,948	82	Weighted Average
61,182		97.19% Pervious Area
1,766		2.81% Impervious Area

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

Summary for Subcatchment PDA2: Proposed Flow to Hillside St

Runoff = 15.34 cfs @ 12.08 hrs, Volume= 1.021 af, Depth> 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr Rainfall=5.60"

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Type III 24-hr Rainfall=5.60"

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Area (sf)	CN	Description
1,837	98	Roofs, HSG B
2,518	98	Roofs, HSG B
6,197	98	Roofs, HSG B
4,999	98	Roofs, HSG B
4,215	98	Paved parking, HSG B
2,554	98	Paved parking, HSG B
19,494	61	>75% Grass cover, Good, HSG B
3,111	61	>75% Grass cover, Good, HSG B
7,334	73	Small grain, contoured, Good, HSG B
31,891	73	Small grain, contoured, Good, HSG B
2,900	79	<50% Grass cover, Poor, HSG B
5,021	60	Woods, Fair, HSG B
426	98	Unconnected pavement, HSG B
79,081	82	Dirt roads, HSG B
171,578	79	Weighted Average
148,832		86.74% Pervious Area
22,746		13.26% Impervious Area
426		1.87% Unconnected

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

Summary for Subcatchment XDA1: Existing Flow to Forest St

Runoff = 6.13 cfs @ 12.07 hrs, Volume= 0.409 af, Depth> 3.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=5.60"

Area (sf)	CN	Description
1,464	98	Roofs, HSG B
13,311	75	Small grain, straight row, Good, HSG B
10,817	75	Small grain, straight row, Good, HSG B
7,539	61	>75% Grass cover, Good, HSG B
302	98	Paved parking, HSG B
21,106	96	Gravel surface, HSG B
8,409	79	<50% Grass cover, Poor, HSG B
62,948	82	Weighted Average
61,182		97.19% Pervious Area
1,766		2.81% Impervious Area

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

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Type III 24-hr Rainfall=5.60"

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Summary for Subcatchment XDA2: Existing Flow to Hillside St

Runoff = 15.34 cfs @ 12.08 hrs, Volume= 1.021 af, Depth> 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=5.60"

Area (sf)	CN	Description
1,837	98	Roofs, HSG B
2,518	98	Roofs, HSG B
6,197	98	Roofs, HSG B
4,999	98	Roofs, HSG B
4,215	98	Paved parking, HSG B
5,594	98	Paved parking, HSG B
19,494	61	>75% Grass cover, Good, HSG B
3,111	61	>75% Grass cover, Good, HSG B
5,687	73	Small grain, contoured, Good, HSG B
30,498	73	Small grain, contoured, Good, HSG B
2,900	79	<50% Grass cover, Poor, HSG B
5,021	60	Woods, Fair, HSG B
426	98	Unconnected pavement, HSG B
79,081	82	Dirt roads, HSG B
171,578	79	Weighted Average
145,792		84.97% Pervious Area
25,786		15.03% Impervious Area
426		1.65% Unconnected

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

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Type III 24-hr Rainfall=7.00"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond 2P: CulTec

Peak Elev=181.27' Storage=3,826 cf Inflow=21.13 cfs 1.413 af
Discarded=0.02 cfs 0.003 af Primary=17.57 cfs 1.402 af Outflow=17.60 cfs 1.405 af

Reach 3R: Existing Flow

Inflow=29.38 cfs 1.971 af
Outflow=29.38 cfs 1.971 af

Reach 4R: Proposed Flow

Inflow=25.02 cfs 1.960 af
Outflow=25.02 cfs 1.960 af

Subcatchment PDA1: proposed Flow to

Runoff Area=62,948 sf 2.81% Impervious Runoff Depth>4.63"
Tc=5.0 min CN=82 Runoff=8.24 cfs 0.558 af

Subcatchment PDA2: Proposed Flow to

Runoff Area=171,578 sf 13.26% Impervious Runoff Depth>4.31"
Tc=5.0 min CN=79 Runoff=21.13 cfs 1.413 af

Subcatchment XDA1: Existing Flow to

Runoff Area=62,948 sf 2.81% Impervious Runoff Depth>4.63"
Tc=5.0 min CN=82 Runoff=8.24 cfs 0.558 af

Subcatchment XDA2: Existing Flow to

Runoff Area=171,578 sf 15.03% Impervious Runoff Depth>4.31"
Tc=5.0 min CN=79 Runoff=21.13 cfs 1.413 af

Total Runoff Area = 10.768 ac Runoff Volume = 3.942 af Average Runoff Depth = 4.39"
88.90% Pervious = 9.573 ac 11.10% Impervious = 1.195 ac

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Type III 24-hr Rainfall=7.00"

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Summary for Pond 2P: CulTec

Inflow Area = 3.939 ac, 13.26% Impervious, Inflow Depth > 4.31"
 Inflow = 21.13 cfs @ 12.07 hrs, Volume= 1.413 af
 Outflow = 17.60 cfs @ 12.13 hrs, Volume= 1.405 af, Atten= 17%, Lag= 3.4 min
 Discarded = 0.02 cfs @ 12.13 hrs, Volume= 0.003 af
 Primary = 17.57 cfs @ 12.13 hrs, Volume= 1.402 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 181.27' @ 12.13 hrs Surf.Area= 6,297 sf Storage= 3,826 cf

Plug-Flow detention time= 6.6 min calculated for 1.405 af (99% of inflow)
 Center-of-Mass det. time= 4.3 min (781.1 - 776.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	175.00'	593 cf	7.00'W x 86.17'L x 3.67'H Field A 2,212 cf Overall - 730 cf Embedded = 1,481 cf x 40.0% Voids
#2A	175.50'	730 cf	Cultec R-V8HD x 12 Inside #1 Effective Size= 55.2"W x 32.0"H => 8.68 sf x 7.50'L = 65.1 cf Overall Size= 60.0"W x 32.0"H x 8.00'L with 0.50' Overlap Row Length Adjustment= -5.83' x 8.68 sf x 1 rows
#3	181.00'	9,249 cf	Custom Stage Data (Prismatic) Listed below
		10,572 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
181.00	1,500	0	0
182.00	16,998	9,249	9,249

Device	Routing	Invert	Outlet Devices
#1	Primary	175.60'	10.0" Round Culvert L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 175.60' / 175.60' S= 0.0000 ' / Cc= 0.900 n= 0.009 PVC, smooth interior, Flow Area= 0.55 sf
#2	Discarded	175.00'	0.170 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 0.00'
#3	Primary	180.80'	12.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.02 cfs @ 12.13 hrs HW=181.26' (Free Discharge)
 ↳ **2=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=17.23 cfs @ 12.13 hrs HW=181.26' (Free Discharge)
 ↳ **1=Culvert** (Inlet Controls 6.01 cfs @ 11.03 fps)
 ↳ **3=Broad-Crested Rectangular Weir** (Weir Controls 11.22 cfs @ 2.02 fps)

Summary for Reach 3R: Existing Flow

Inflow Area = 5.384 ac, 11.75% Impervious, Inflow Depth > 4.39"
 Inflow = 29.38 cfs @ 12.07 hrs, Volume= 1.971 af
 Outflow = 29.38 cfs @ 12.07 hrs, Volume= 1.971 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Reach 4R: Proposed Flow

Inflow Area = 5.384 ac, 10.45% Impervious, Inflow Depth > 4.37"
 Inflow = 25.02 cfs @ 12.11 hrs, Volume= 1.960 af
 Outflow = 25.02 cfs @ 12.11 hrs, Volume= 1.960 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Subcatchment PDA1: proposed Flow to Forest St

Runoff = 8.24 cfs @ 12.07 hrs, Volume= 0.558 af, Depth> 4.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr Rainfall=7.00"

Area (sf)	CN	Description
1,464	98	Roofs, HSG B
13,311	75	Small grain, straight row, Good, HSG B
10,817	75	Small grain, straight row, Good, HSG B
7,539	61	>75% Grass cover, Good, HSG B
302	98	Paved parking, HSG B
21,106	96	Gravel surface, HSG B
8,409	79	<50% Grass cover, Poor, HSG B
62,948	82	Weighted Average
61,182		97.19% Pervious Area
1,766		2.81% Impervious Area

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

Summary for Subcatchment PDA2: Proposed Flow to Hillside St

Runoff = 21.13 cfs @ 12.07 hrs, Volume= 1.413 af, Depth> 4.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr Rainfall=7.00"

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Type III 24-hr Rainfall=7.00"

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Area (sf)	CN	Description
1,837	98	Roofs, HSG B
2,518	98	Roofs, HSG B
6,197	98	Roofs, HSG B
4,999	98	Roofs, HSG B
4,215	98	Paved parking, HSG B
2,554	98	Paved parking, HSG B
19,494	61	>75% Grass cover, Good, HSG B
3,111	61	>75% Grass cover, Good, HSG B
7,334	73	Small grain, contoured, Good, HSG B
31,891	73	Small grain, contoured, Good, HSG B
2,900	79	<50% Grass cover, Poor, HSG B
5,021	60	Woods, Fair, HSG B
426	98	Unconnected pavement, HSG B
79,081	82	Dirt roads, HSG B
171,578	79	Weighted Average
148,832		86.74% Pervious Area
22,746		13.26% Impervious Area
426		1.87% Unconnected

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

Summary for Subcatchment XDA1: Existing Flow to Forest St

Runoff = 8.24 cfs @ 12.07 hrs, Volume= 0.558 af, Depth> 4.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=7.00"

Area (sf)	CN	Description
1,464	98	Roofs, HSG B
13,311	75	Small grain, straight row, Good, HSG B
10,817	75	Small grain, straight row, Good, HSG B
7,539	61	>75% Grass cover, Good, HSG B
302	98	Paved parking, HSG B
21,106	96	Gravel surface, HSG B
8,409	79	<50% Grass cover, Poor, HSG B
62,948	82	Weighted Average
61,182		97.19% Pervious Area
1,766		2.81% Impervious Area

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

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Type III 24-hr Rainfall=7.00"

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Summary for Subcatchment XDA2: Existing Flow to Hillside St

Runoff = 21.13 cfs @ 12.07 hrs, Volume= 1.413 af, Depth> 4.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Rainfall=7.00"

Area (sf)	CN	Description
1,837	98	Roofs, HSG B
2,518	98	Roofs, HSG B
6,197	98	Roofs, HSG B
4,999	98	Roofs, HSG B
4,215	98	Paved parking, HSG B
5,594	98	Paved parking, HSG B
19,494	61	>75% Grass cover, Good, HSG B
3,111	61	>75% Grass cover, Good, HSG B
5,687	73	Small grain, contoured, Good, HSG B
30,498	73	Small grain, contoured, Good, HSG B
2,900	79	<50% Grass cover, Poor, HSG B
5,021	60	Woods, Fair, HSG B
426	98	Unconnected pavement, HSG B
79,081	82	Dirt roads, HSG B
171,578	79	Weighted Average
145,792		84.97% Pervious Area
25,786		15.03% Impervious Area
426		1.65% Unconnected

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