

# **STORMWATER MANAGEMENT REPORT**

## **109 CREEPER HILL ROAD GRAFTON , MA**

*PREPARED BY:*

ASA ENGINEERING  
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April 26, 2021

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*1 Drainage Report*

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## **INTRODUCTION**

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The purpose of this drainage report is to provide a review of the stormwater runoff, both quality and quantity, as it pertains to the existing and proposed developed conditions. The report will show by means of narrative, calculations and exhibits that appropriate best management practices have been used to mitigate the impacts from the proposed redevelopment. The report will demonstrate that the proposed site development reduces the rate of runoff at the overall site runoff point during all storm events. Further, the report will show that the proposed stormwater management system complies with the ten stormwater standards as presented in the Massachusetts Department of Environmental Protection (MA DEP) Stormwater Management Regulations.

The proposed project consists of the construction of a 5810 square foot structure in place of an existing 1990 square foot abandoned structure (A net increase of 3,820 SF). This structure will be used as an addition to an existing food processing building adjacent to it. The existing foundation slab and abandoned building structure will be removed in order to provide area for the proposed building and proposed infiltration system. The existing truck path roadway within the site consist of gravel/stone cover, which as part of this project will be further stabilized by adding additional 3/4 in stone covering as means to provide erosion control during the project and as a permanent measure to keep the dust down and control erosion of the gravel roadway. The roof drain for the proposed building will be connected to an existing underground stone infiltration BMP. As part of this addition the existing BMP will be modified with installation of Cultec units (Recharge 330) to replace existing stone & pipe configuration to increase the storage capacity in an attempt to decrease peak runoff and to promote ground water recharge to maximum extent possible.

## **SITE LOCATION AND DESCRIPTION**

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The site is located at 109 Creeper Hill Road , in Grafton MA. The site is located within an industrial zone, which is currently used for food recycling operations. The proposed building will be used to implement the current operation and automation of the process.

Portion of the site also falls within the 200' buffer zone for the river front area located on the east side outside of the project construction limit. Generally, the property slopes from west to the east with a earth berm separating the main section of the site from the bordering wetland on the east side.

Based of the soil report that was obtained from the Natural Resources Conservation Service, formerly Soil Conservation Service, the majority of the site has been classified as Undorthents and cannot be accurately be classified, due to previous development in form of cut and fill of original materials, and requires field testing.

A copy of the NRCS Soil Map is provided in the Appendix of this report.

## **EXISTING DRAINAGE PATTERNS**

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To demonstrate compliance with the stormwater regulations, the existing drainage patterns were analyzed at “design points”. The design point was selected based visual observation of drainage patterns.

For the most part, surface runoff surface sheds towards the northeastern boundary of the site towards Creeple Hill Road. Since the site is for the majority of the area consists of gravel surfaces, runoff is limited and recharge levels are high .

The stormwater runoff model shows that the proposed development reduces the rate of runoff for each design point analyzed. This is accomplished by providing subsurface infiltration systems for the proposed building, in addition to the existing building adjacent to it .

The HydroCAD worksheets and hydrographs are included in the “HydroCAD Worksheets” Section of this report.

## **METHODOLOGY**

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The peak rate of runoff was determined using techniques and data found in the following:

1. Urban Hydrology for Small Watersheds – Technical Release 55 by the United States Department of Agriculture Soils Conservation Service, June 1986. Runoff curve numbers and 24-hour precipitation values were obtained from this reference.
2. HydroCAD<sup>®</sup> Stormwater Modeling System by HydroCAD Software Solutions LLC, version 8.50, 2007. The HydroCAD program was used to generate the runoff hydrographs for the watershed areas, to determine discharge/stage/storage characteristics for the infiltration systems, to perform drainage routing and to combine the results of the runoff hydrographs.
3. Soil Survey of Norfolk County Massachusetts, by United States Department of Agriculture, Natural Resources Conservation Service. Soil types and boundaries were obtained from this reference.

## STORMWATER MANAGEMENT STANDARDS

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The proposed project is designed to meet or exceed all of the Stormwater Management Standards as determined by MassDEP to the maximum extent practicable. A description of each standard and if it is met is below.

### Standard #1 – No New Untreated Discharges or Erosion:

Discharge points will remain unchanged from pre-construction to post-construction. No new discharges are created. Existing discharges off the site currently drain through well-established areas with vegetation and no signs of erosion. Being redirected into the proposed infiltration reservoir will mitigate proposed discharge from the proposed building.

### Standard #2 – Peak Rate Attenuation:

Calculations have been provided to show that the proposed redevelopment will not cause an increase in peak discharge rates, but it would help reducing it through limited storage provide in the proposed infiltration reservoir. Refer to the HydroCAD calculations provided within this report for detailed breakdowns of each study point.

### Standard #3 – Recharge to Groundwater:

The project meets this standard with the “post-development site increasing the annual recharge from the pre-development conditions. The proposed building is situated over an existing concrete slab. Also existing infiltration BMP will be retrofitted with 77 units of Cultec Recharge 330. This reservoir is to be used for the recharge of ground water from the existing roofs in addition to the new building. Currently under existing conditions, recharge is only attained stone and pipe system. Under proposed conditions, recharge is provided for the impervious areas being introduced based on the table below:

Hydrologic Group Volume to Recharge (x Total Impervious Area)	
Hydrologic Group	Volume to Recharge x Total Impervious Area
A	0.60 inches of runoff
B	0.35 inches of runoff
C	0.25 inches of runoff
D	0.10 inches of runoff

Using hydrological group A (note that the majority of existing soil type has been classified as Udorthents) The required recharge volume is given by the following equation:

$$R_v = F \times IA \text{ (Equation 1 Stormwater Handbook Volume 3)}$$

Where  $R_v$  = Required Recharge Volume,  $ft^3$   
 $F$  = Target Depth factor (Hydrologic Group A)  
 $IA$  = Impervious drainage area

For Watershed 5,810 square feet of proposed impervious surface (building) will be constructed.

$$\begin{aligned} R_v &= F \times IA \\ &= (0.60 \text{ inches})(12 \text{ inches/foot})(5810 \text{ square feet}) \\ &= 290.5 \text{ cubic feet} \end{aligned}$$

6,201 cubic feet of available storage is provided in the underground system.  
 (See HydroCAD worksheet)

Infiltration system is based on the Static Method of calculation as outlined in the Stormwater Management Handbook).

The system drawdown time is defined as:

$$\text{Time}_{\text{drawdown}} = R_v / (K)(\text{bottom area})$$

where  $R_v$  = Required Recharge Volume, ft<sup>3</sup>  
 $K$  = Saturated Hydraulic Conductivity (Rawls table)  
Bottom area = bottom area of recharge structure

with a bottom area of 47'x44'  
and  $K= 2.4$  in

$$\begin{aligned} &= 320 \text{ ft}^3 / (2.4* \text{ in/hour})(2068 \text{ s.f.})(1\text{ft}/12 \text{ in}) \\ &= 0.09\text{hours} (<72 \text{ hours drain time} = \text{ok}) \end{aligned}$$

\*2.4 inches per hour is a default for HSG "A" with Loamy Sand texture which had been established based on a soil evaluation conducted at infiltration field location in 2014.

A capture area adjustment is not required as all stormwater is treated through stormwater controls.

Therefore, this standard has been met.

#### **Standard 4 – Water Quality:**

The project is a redevelopment project. Stormwater water quality units are not proposed. The runoff directed towards the infiltration system is from the roof area and does not require treatment and therefore Standard 4 does not apply to this project.

#### **Standard 5 – Land Use with Higher Potential Pollutant Loads (LUHPPLs):**

The proposed project is not a Land Use with Higher Potential Pollutant Loads and therefore Standard 5 does not apply to this project.

#### **Standard 6 – Critical Areas**

The proposed project is not located in an area defined as a Critical Area and therefore Standard 6 does not apply to this project.

#### **Standard 7 – Redevelopments and Other Projects Subject to the Standards only to the Maximum Extent Practicable**

Standards are met to the maximum extent practicable as described in this section thereby meeting this Standard.

#### **Standard 8 – Construction Period Pollution Prevention & Erosion & Sediment Control**

An Erosion Control plan has been incorporated with the design plans. Also, due to limited area of disturbance the project does not require a Stormwater Pollution Prevention Plan under the EPA NPDES program.

#### **Standard 9 – Operations and Maintenance Plan**

Refer to the Operations and Maintenance Plan included in this report.

**Standard 10 – Prohibition of Illicit Discharges**

No illicit discharges exist on site. The storm water management system proposed shall not be connected to the wastewater management system and shall not be contaminated by contact with process wastes, raw materials, toxic pollutants, hazardous substances, oil, or grease per Massachusetts DEP Storm Water Standard 10. The Illicit discharge statement is included in the appendix of this report.



## 2 Operation & Maintenance Plan

## **OPERATION AND MAINTENANCE PLAN**

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In accordance with the standards set forth by the Stormwater Management Regulations issued by the Department of Environmental Protection (DEP), this report has prepared the following Operation and Maintenance (O&M) plan for the proposed stormwater management system at the 109 Creeper Hill Road site. This O&M plan addressed post construction pollution prevention and maintenance of stormwater systems.

This plan is broken into two major sections. The first section describes pollution prevention techniques to encourage source controls that prevent pollution. The second section is devoted to a post-development operation and maintenance plan of the stormwater management system. An operation and maintenance schedule has been included at the end of the report.

### Basic Information

Owner: Troiano trucking  
Address: 109 Creeper Hill  
City: Grafton, MA

### **Section 1 Pollution Prevention**

As a food recycling facility, the largest potential sources of pollution includes food packaging and normal maintenance truck fluids in this facility. It is anticipated that all of these materials will be stored and maintained inside specialized containers that are only access by trained personnel. However the following pollution prevention techniques are provided in the event that there is a spill outside the facility that may enter the stormwater management system.

#### ***Good House Keeping***

The following measures will be employed to control potential sources of contamination and prevent pollution at The Project property:

#### *Deicing*

To prevent increased pollutant concentrations in stormwater discharges, the amount of road salt applied will be controlled. Calibration devices for spreaders in trucks will be encouraged to contractors employed to plow the parking area. The amount of deicing materials used will be monitored with the goal of using only enough to make the roadway and parking areas safe.

#### *Snow Storage/Disposal*

Snow storage/disposal will be allowed in unused areas of the property away from storm drainage systems and wetland resource areas.

#### *Pavement Sweeping*

N/A.

#### *Fertilizer/Pesticide/Herbicide Application*

Applications of treatment materials will be used throughout the site. Their application adjacent to the stormwater systems will be limited. Slow release fertilizer will be used and applied in the minimum amounts recommended by the manufacturer. Once applied, the fertilizer will be worked into the soil to limit exposure to stormwater. Storage will be in a closed structure; and the contents of any partially used bags will be transferred to a sealable, plastic bin to avoid spills.

### Materials Management/Housekeeping Practices

The following product-specific practices will be followed on-site. Recommendations are provided for petroleum products, fertilizers, solvents, paints, and other hazardous substances, and concrete.

**Petroleum Products** – Routine maintenance of course equipment is anticipated. No chemicals, fluids or fuels from vehicles will be drained into the stormwater system. All fluids will be collected in appropriate containers and disposed of according to State regulations. Storage of diesel and unleaded fuel will be regulated by the State Fire Marshall and will be in an approved container. No petroleum-based or asphalt substances will be stored within 100 feet of a waterway.

**Solvents, Paints, and other Hazardous Substances** - All containers will be tightly sealed and stored indoors when not required for use. Excess materials will not be discharged to the storm sewer system, but will be properly disposed according to manufacturer's instructions or state and local regulations. Outside storage on the property will be prohibited.

### ***Spill Prevention and Control***

The Property Manager/Groundskeeper will be responsible for training of people in the proper handling and cleanup of spilled materials. No spilled hazardous materials or hazardous wastes will be allowed to come in contact with storm water discharges. If such contact occurs, the storm water discharge will be contained on site until appropriate measures in compliance with State and Federal regulations are taken to dispose of such contaminated storm water.

In order to minimize the potential for a spill of hazardous materials to come into contact with storm water, the following steps will be implemented:

1. All materials with hazardous properties (such as pesticides, petroleum products, fertilizers, detergents, construction chemicals, acids, paints, paint solvents, cleaning solvents, additives for soil stabilization, concrete curing compounds and additives, etc.) will be stored in a secure location, with their lids on, preferably under cover, when not in use.
2. The minimum practical quantity of all such materials will be kept on the site.
3. A spill control and containment kit (containing, for example, absorbent materials, acid neutralizing powder, brooms, dust pans, mops, rags, gloves, goggles, plastic and metal trash containers, etc.) will be provided at the maintenance area of the site.
4. Manufacturers recommended methods for spill cleanup will be clearly posted and site personnel will be trained regarding these procedures and the location of the information and cleanup supplies.

In the event of a spill, the following procedures should be followed:

1. All spills will be cleaned up immediately after discovery.

2. The spill area will be kept well ventilated and personnel will wear appropriate protective clothing to prevent injury from contact with the hazardous substances.
3. The Owner and Property Manager will be notified immediately.
4. Spills of toxic or hazardous materials will be reported to the appropriate federal, state, and/or local government agency, regardless of the size of the spill.
5. If the spilt material enters the drainage system, the catch basin or other structure acting as the inlet shall be cleaned via a vac truck as soon as possible and before the next rainfall event to the extent practicable.

The Property Manager will be the spill prevention and response coordinator. He will designate the individuals who will receive spill prevention and response training. These individuals will each become responsible for a particular phase of prevention and response. The names of these personnel will be posted in the material storage area and other applicable areas onsite.

### **Section 2 Stormwater Management System – Operation and Maintenance**

1. Paved Areas – N/A
2. Salt for de-icing during the winter months shall be limited to the minimum amount practicable. Sand containing the minimum amount of calcium chloride (or approved equivalent) needed for handling may be applied as part of the routine winter maintenance activities.
3. The Infiltration System: Inspect and maintain twice a year and after every rain event. Removal of all debris from the area and avoid storage of any material on or around the infiltration system.
4. All sediments removed from the infiltration systems shall be disposed of properly, and in accordance with applicable local and state regulations.
5. All vegetated areas on the site shall be stabilized and maintained to control erosion. Any disturbed areas shall be re-seeded as soon as practicable. Trash and debris should be removed on a regular basis.
6. Work within any drainage structures shall be performed in accordance with the latest OSHA regulations, and only by individuals with appropriate OSHA certification.

Maintenance Responsibilities - All post-construction maintenance activities shall be documented and kept on file for up to 3 years. Copies of said document shall be submitted to the Zoning Board of Appeals and the Town Engineer.



**Table B-1. Requirements for Determining Field Infiltration Rates**

Infiltration Design Method	NRCS Hydrologic Soil Groups			
	A	B	C	D
Static Method	Soil Textural Analysis	Soil Textural Analysis	Saturated Hydraulic Conductivity Testing	Infiltration Not Allowed
Simple Dynamic Method	Soil Textural Analysis	Soil Textural Analysis	Saturated Hydraulic Conductivity Testing	Infiltration Not Allowed
Dynamic Field Method	Saturated Hydraulic Conductivity Testing	Saturated Hydraulic Conductivity Testing	Saturated Hydraulic Conductivity Testing	Infiltration Not Allowed

**Table B-2. Default (Rawls) Infiltration Rates**

Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate Inches/Hour
Sand	A	8.27
Loamy Sand	A	2.41
Sandy Loam	B	1.02
Loam	B	0.52
Silt Loam	C	0.27
Sandy Clay Loam	C	0.17
Clay Loam	D	0.09
Silty Clay Loam	D	0.06
Sandy Clay	D	0.05
Silty Clay	D	0.04
Clay	D	0.02

Source: Rawls, Brakensiek and Saxton, 1982.

- The slowest of the Hydrologic Soil Groups determined to exist at the point where infiltration is proposed shall be used.
  - *Example:* Two samples are taken at a proposed infiltration bioretention system in the actual soil layer where recharge is proposed. One sample indicates sandy soils. The second sample indicates a sandy loam soil. The default infiltration rate used for the design analysis must use the sandy loam rate and not the sandy soil rate. Soils must not be composited for purposes of the soil textural analysis.
- When the “Dynamic Field” method is used to size the infiltration system (regardless of Hydrologic Soil Group) or infiltration is proposed within Hydrologic Soil Group C soils



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Map Unit Legend

Worcester County, Massachusetts, Southern Part (MA615)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
245B	Hinckley sandy loam, 3 to 8 percent slopes	1.7	16.9%
651	Udorthents, smoothed	8.2	83.1%
<b>Totals for Area of Interest</b>		<b>9.9</b>	<b>100.0%</b>

Scale (not to scale)



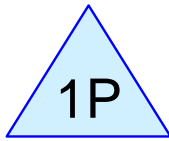
**Warning: Soil Map may not be valid at this scale.**

You have zoomed in beyond the scale at which the soil map for this area is intended to be used. Mapping of soils is done at a particular scale. The soil surveys that comprise your AOI were mapped at a design of map units and the level of detail shown in the resulting soil map are dependent on that map scale.

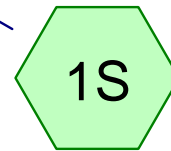
Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that have been shown at a more detailed scale.



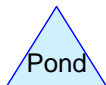
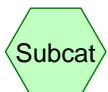




Cultec Recharge 330  
-Exfiltration



Post development



# Grafton-Toriano-post-develop2021

Prepared by {enter your company name here}

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## Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.133	98	Roof Propose (1S)
0.184	98	roof -Existing (1S)
0.184	98	roof -Exsiting (1S)
<b>0.501</b>		<b>TOTAL AREA</b>

# Grafton-Toriano-post-develop2021

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## Soil Listing (all nodes)

Area (acres)	Soil Goup	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
<b>0.501</b>	Other	1S
0.501		<b>TOTAL AREA</b>

**Grafton-Toriano-post-develop2021**

Type III 24-hr 2-YEAR EVENT Rainfall=3.10"

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Time span=0.00-33.00 hrs, dt=0.05 hrs, 661 points

Runoff by SCS TR-20 method, UH=SCS

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

**Subcatchment 1S: Post development**

Runoff Area=21,810 sf 100.00% Impervious Runoff Depth=2.87"

Flow Length=130' Tc=1.0 min CN=98 Runoff=1.68 cfs 0.120 af

**Pond 1P: Cultec Recharge 330 -Exfiltration**

Peak Elev=374.91' Storage=1,989 cf Inflow=1.68 cfs 0.120 af

Outflow=0.12 cfs 0.120 af

**Total Runoff Area = 0.501 ac Runoff Volume = 0.120 af Average Runoff Depth = 2.87"**  
**0.00% Pervious = 0.000 ac 100.00% Impervious = 0.501 ac**

**Summary for Subcatchment 1S: Post development**

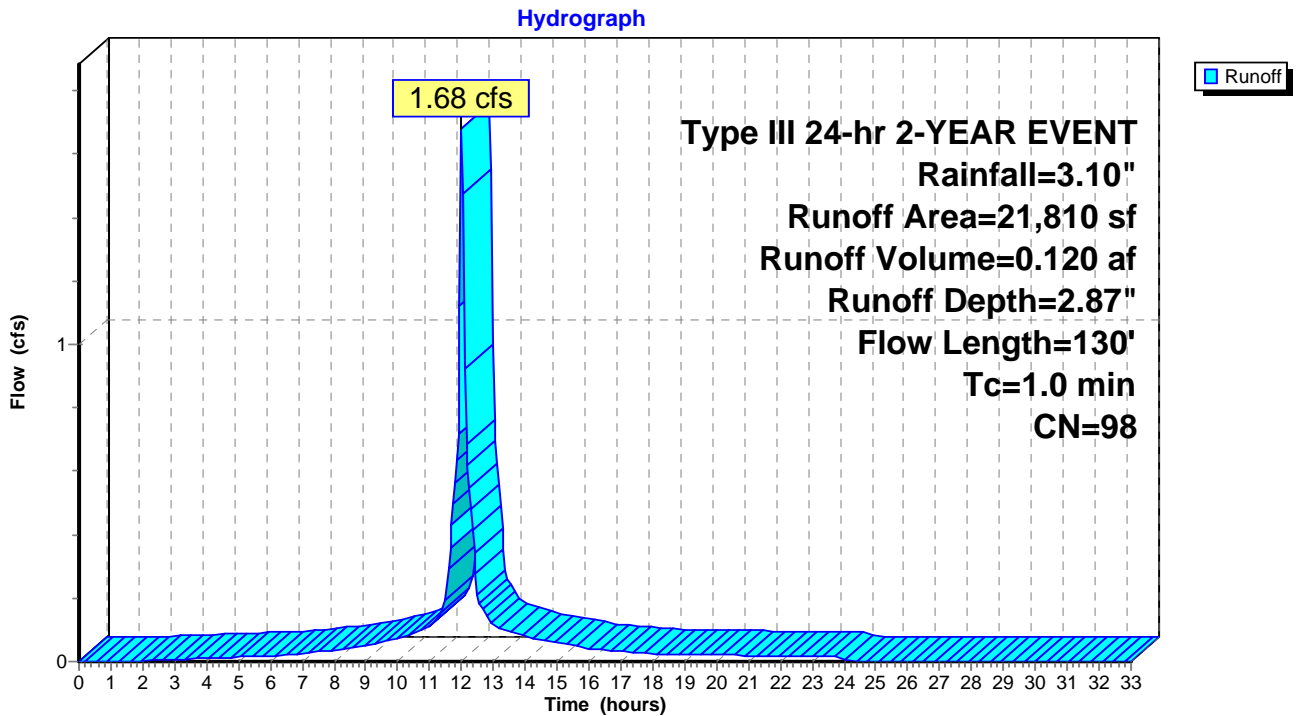
Runoff = 1.68 cfs @ 12.01 hrs, Volume= 0.120 af, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-33.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 2-YEAR EVENT Rainfall=3.10"

	Area (sf)	CN	Description
*	8,000	98	roof -Existing
*	8,000	98	roof -Exsiting
*	5,810	98	Roof Propose
	21,810	98	Weighted Average
	21,810		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	130		2.17		Direct Entry,

**Subcatchment 1S: Post development**



**Hydrograph for Subcatchment 1S: Post development**

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	26.50	3.10	2.87	0.00
0.50	0.02	0.00	0.00	27.00	3.10	2.87	0.00
1.00	0.03	0.00	0.00	27.50	3.10	2.87	0.00
1.50	0.05	0.00	0.00	28.00	3.10	2.87	0.00
2.00	0.06	0.00	0.00	28.50	3.10	2.87	0.00
2.50	0.08	0.01	0.00	29.00	3.10	2.87	0.00
3.00	0.10	0.01	0.01	29.50	3.10	2.87	0.00
3.50	0.11	0.02	0.01	30.00	3.10	2.87	0.00
4.00	0.13	0.03	0.01	30.50	3.10	2.87	0.00
4.50	0.15	0.04	0.01	31.00	3.10	2.87	0.00
5.00	0.18	0.05	0.01	31.50	3.10	2.87	0.00
5.50	0.20	0.07	0.02	32.00	3.10	2.87	0.00
6.00	0.22	0.09	0.02	32.50	3.10	2.87	0.00
6.50	0.25	0.11	0.02	33.00	3.10	2.87	0.00
7.00	0.28	0.13	0.03				
7.50	0.32	0.16	0.03				
8.00	0.35	0.19	0.03				
8.50	0.40	0.23	0.04				
9.00	0.45	0.27	0.05				
9.50	0.51	0.33	0.06				
10.00	0.59	0.40	0.07				
10.50	0.67	0.48	0.09				
11.00	0.77	0.57	0.11				
11.50	0.92	0.72	0.18				
12.00	1.55	1.33	<b>1.66</b>				
12.50	2.18	1.95	0.21				
13.00	2.32	2.10	0.12				
13.50	2.43	2.20	0.10				
14.00	2.51	2.28	0.08				
14.50	2.59	2.36	0.07				
15.00	2.65	2.42	0.06				
15.50	2.70	2.47	0.05				
16.00	2.75	2.52	0.04				
16.50	2.78	2.55	0.04				
17.00	2.82	2.59	0.03				
17.50	2.85	2.62	0.03				
18.00	2.88	2.65	0.03				
18.50	2.90	2.67	0.02				
19.00	2.92	2.69	0.02				
19.50	2.95	2.71	0.02				
20.00	2.97	2.74	0.02				
20.50	2.99	2.75	0.02				
21.00	3.01	2.77	0.02				
21.50	3.02	2.79	0.02				
22.00	3.04	2.81	0.02				
22.50	3.06	2.82	0.02				
23.00	3.07	2.84	0.02				
23.50	3.09	2.85	0.01				
24.00	<b>3.10</b>	<b>2.87</b>	0.01				
24.50	3.10	2.87	0.00				
25.00	3.10	2.87	0.00				
25.50	3.10	2.87	0.00				
26.00	3.10	2.87	0.00				

**Summary for Pond 1P: Cultec Recharge 330 -Exfiltration**

Inflow Area = 0.501 ac, 100.00% Impervious, Inflow Depth = 2.87" for 2-YEAR EVENT event  
 Inflow = 1.68 cfs @ 12.01 hrs, Volume= 0.120 af  
 Outflow = 0.12 cfs @ 12.98 hrs, Volume= 0.120 af, Atten= 93%, Lag= 58.1 min  
 Primary = 0.12 cfs @ 12.98 hrs, Volume= 0.120 af

Routing by Stor-Ind method, Time Span= 0.00-33.00 hrs, dt= 0.05 hrs  
 Peak Elev= 374.91' @ 12.98 hrs Surf.Area= 2,137 sf Storage= 1,989 cf

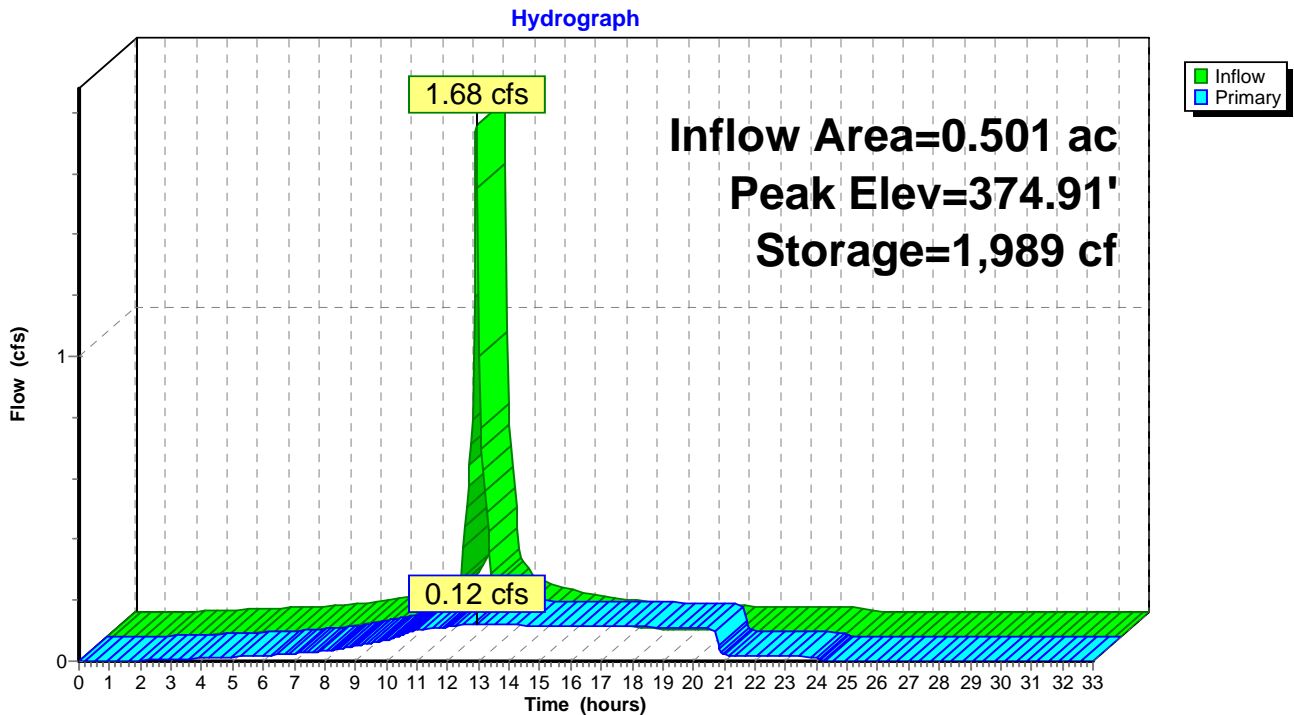
Plug-Flow detention time= 128.5 min calculated for 0.120 af (100% of inflow)  
 Center-of-Mass det. time= 128.4 min ( 880.8 - 752.4 )

Volume	Invert	Avail.Storage	Storage Description
#1	373.55'	2,615 cf	<b>44.00'W x 43.00'L x 4.40'H Prismatic Z=1.0</b> 10,123 cf Overall - 3,586 cf Embedded = 6,537 cf x 40.0% Voids
#2	374.11'	3,586 cf	<b>47.8"W x 30.0"H x 6.25'L Cultec R-330 x 77</b> Inside #1
		6,201 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	373.55'	<b>2.400 in/hr Exfiltration over Surface area</b>

**Primary OutFlow** Max=0.12 cfs @ 12.98 hrs HW=374.91' (Free Discharge)  
 ↳1=Exfiltration (Exfiltration Controls 0.12 cfs)

**Pond 1P: Cultec Recharge 330 -Exfiltration**



**Hydrograph for Pond 1P: Cultec Recharge 330 -Exfiltration**

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0	373.55	0.00
1.00	0.00	0	373.55	0.00
2.00	0.00	1	373.55	0.00
3.00	0.01	2	373.55	0.01
4.00	0.01	3	373.55	0.01
5.00	0.01	4	373.56	0.01
6.00	0.02	6	373.56	0.02
7.00	0.03	8	373.56	0.03
8.00	0.03	11	373.56	0.03
9.00	0.05	16	373.57	0.05
10.00	0.07	22	373.58	0.07
11.00	0.11	33	373.59	0.10
12.00	<b>1.66</b>	937	374.37	0.11
13.00	0.12	<b>1,989</b>	<b>374.91</b>	<b>0.12</b>
14.00	0.08	1,906	374.87	0.12
15.00	0.06	1,725	374.78	0.12
16.00	0.04	1,484	374.65	0.12
17.00	0.03	1,201	374.50	0.11
18.00	0.03	896	374.35	0.11
19.00	0.02	578	374.18	0.11
20.00	0.02	259	373.89	0.11
21.00	0.02	7	373.56	0.02
22.00	0.02	5	373.56	0.02
23.00	0.02	5	373.56	0.02
24.00	0.01	4	373.56	0.01
25.00	0.00	0	373.55	0.00
26.00	0.00	0	373.55	0.00
27.00	0.00	0	373.55	0.00
28.00	0.00	0	373.55	0.00
29.00	0.00	0	373.55	0.00
30.00	0.00	0	373.55	0.00
31.00	0.00	0	373.55	0.00
32.00	0.00	0	373.55	0.00
33.00	0.00	0	373.55	0.00



**Grafton-Toriano-post-develop2021**

Type III 24-hr 10-YEAR EVENT Rainfall=4.50"

Prepared by {enter your company name here}

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Time span=0.00-33.00 hrs, dt=0.05 hrs, 661 points

Runoff by SCS TR-20 method, UH=SCS

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

**Subcatchment 1S: Post development**

Runoff Area=21,810 sf 100.00% Impervious Runoff Depth=4.26"

Flow Length=130' Tc=1.0 min CN=98 Runoff=2.45 cfs 0.178 af

**Pond 1P: Cultec Recharge 330 -Exfiltration**

Peak Elev=375.66' Storage=3,393 cf Inflow=2.45 cfs 0.178 af

Outflow=0.13 cfs 0.178 af

**Total Runoff Area = 0.501 ac Runoff Volume = 0.178 af Average Runoff Depth = 4.26"**  
**0.00% Pervious = 0.000 ac 100.00% Impervious = 0.501 ac**

**Summary for Subcatchment 1S: Post development**

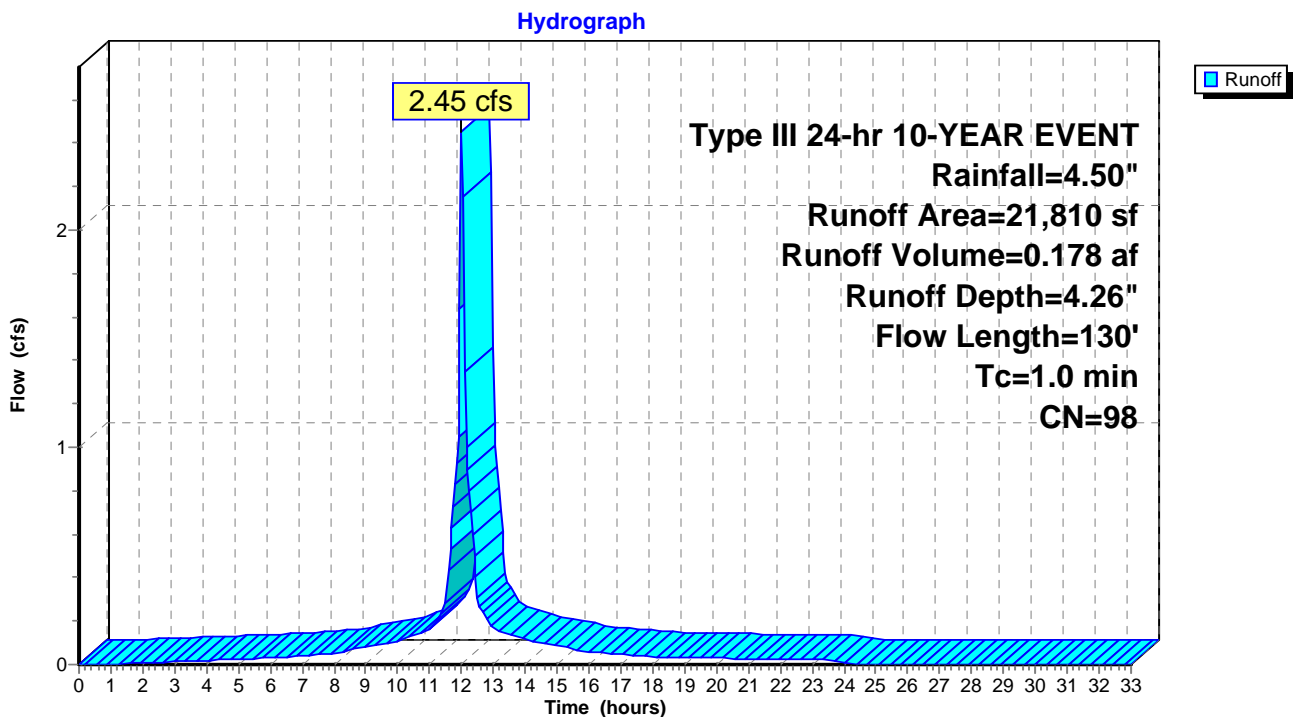
Runoff = 2.45 cfs @ 12.01 hrs, Volume= 0.178 af, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-33.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 10-YEAR EVENT Rainfall=4.50"

	Area (sf)	CN	Description
*	8,000	98	roof -Existing
*	8,000	98	roof -Exsiting
*	5,810	98	Roof Propose
	21,810	98	Weighted Average
	21,810		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	130		2.17		Direct Entry,

**Subcatchment 1S: Post development**



**Hydrograph for Subcatchment 1S: Post development**

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	26.50	4.50	4.26	0.00
0.50	0.02	0.00	0.00	27.00	4.50	4.26	0.00
1.00	0.04	0.00	0.00	27.50	4.50	4.26	0.00
1.50	0.07	0.00	0.00	28.00	4.50	4.26	0.00
2.00	0.09	0.01	0.01	28.50	4.50	4.26	0.00
2.50	0.11	0.02	0.01	29.00	4.50	4.26	0.00
3.00	0.14	0.03	0.01	29.50	4.50	4.26	0.00
3.50	0.17	0.05	0.02	30.00	4.50	4.26	0.00
4.00	0.19	0.07	0.02	30.50	4.50	4.26	0.00
4.50	0.22	0.09	0.02	31.00	4.50	4.26	0.00
5.00	0.26	0.11	0.03	31.50	4.50	4.26	0.00
5.50	0.29	0.14	0.03	32.00	4.50	4.26	0.00
6.00	0.32	0.16	0.03	32.50	4.50	4.26	0.00
6.50	0.36	0.20	0.04	33.00	4.50	4.26	0.00
7.00	0.41	0.24	0.04				
7.50	0.46	0.28	0.05				
8.00	0.51	0.33	0.05				
8.50	0.58	0.39	0.07				
9.00	0.66	0.46	0.08				
9.50	0.75	0.55	0.09				
10.00	0.85	0.65	0.11				
10.50	0.97	0.77	0.13				
11.00	1.13	0.91	0.16				
11.50	1.34	1.12	0.26				
12.00	2.25	2.02	<b>2.42</b>				
12.50	3.16	2.93	0.30				
13.00	3.37	3.14	0.17				
13.50	3.53	3.29	0.14				
14.00	3.65	3.42	0.11				
14.50	3.75	3.52	0.10				
15.00	3.84	3.61	0.09				
15.50	3.92	3.69	0.07				
16.00	3.99	3.75	0.06				
16.50	4.04	3.81	0.05				
17.00	4.09	3.86	0.05				
17.50	4.14	3.90	0.04				
18.00	4.18	3.94	0.04				
18.50	4.21	3.98	0.03				
19.00	4.24	4.01	0.03				
19.50	4.28	4.04	0.03				
20.00	4.31	4.07	0.03				
20.50	4.34	4.10	0.03				
21.00	4.36	4.13	0.03				
21.50	4.39	4.15	0.03				
22.00	4.41	4.18	0.02				
22.50	4.44	4.20	0.02				
23.00	4.46	4.22	0.02				
23.50	4.48	4.24	0.02				
24.00	<b>4.50</b>	<b>4.26</b>	0.02				
24.50	4.50	4.26	0.00				
25.00	4.50	4.26	0.00				
25.50	4.50	4.26	0.00				
26.00	4.50	4.26	0.00				

**Summary for Pond 1P: Cultec Recharge 330 -Exfiltration**

Inflow Area = 0.501 ac, 100.00% Impervious, Inflow Depth = 4.26" for 10-YEAR EVENT event  
 Inflow = 2.45 cfs @ 12.01 hrs, Volume= 0.178 af  
 Outflow = 0.13 cfs @ 13.73 hrs, Volume= 0.178 af, Atten= 95%, Lag= 103.1 min  
 Primary = 0.13 cfs @ 13.73 hrs, Volume= 0.178 af

Routing by Stor-Ind method, Time Span= 0.00-33.00 hrs, dt= 0.05 hrs  
 Peak Elev= 375.66' @ 13.73 hrs Surf.Area= 2,277 sf Storage= 3,393 cf

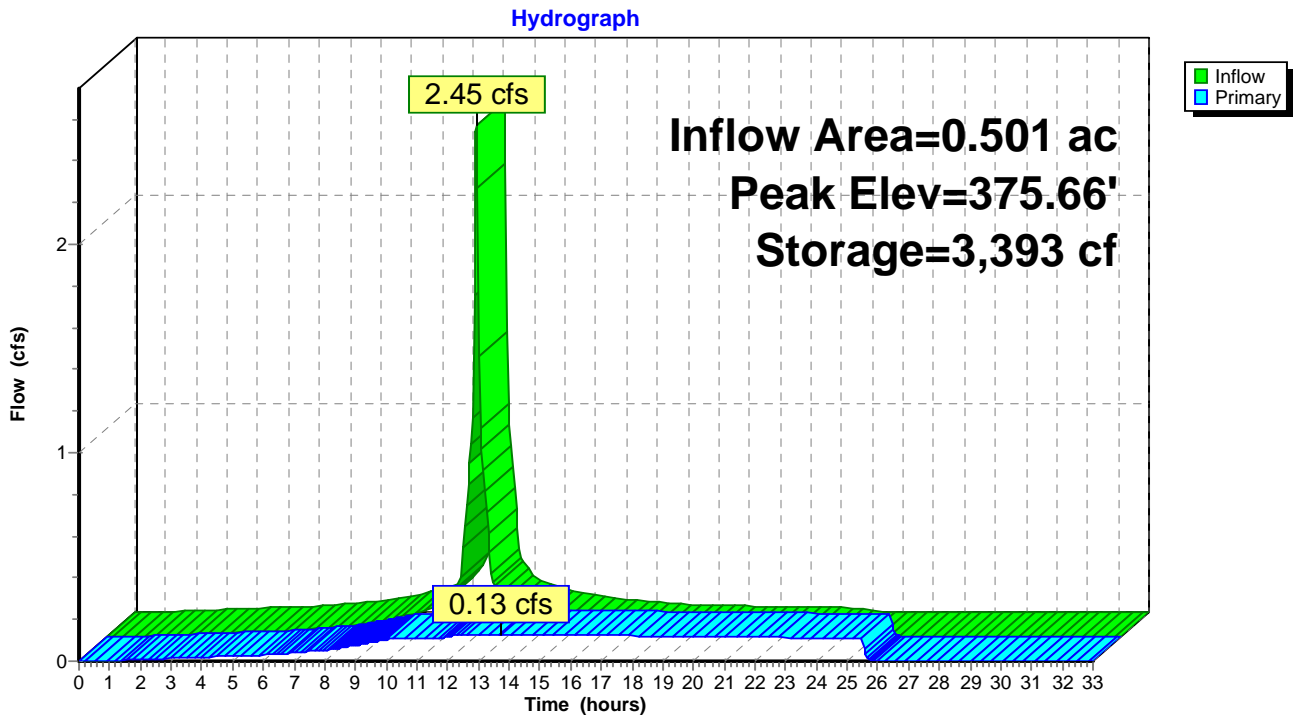
Plug-Flow detention time= 226.9 min calculated for 0.178 af (100% of inflow)  
 Center-of-Mass det. time= 226.7 min ( 971.9 - 745.2 )

Volume	Invert	Avail.Storage	Storage Description
#1	373.55'	2,615 cf	<b>44.00'W x 43.00'L x 4.40'H Prismatic Z=1.0</b> 10,123 cf Overall - 3,586 cf Embedded = 6,537 cf x 40.0% Voids
#2	374.11'	3,586 cf	<b>47.8"W x 30.0"H x 6.25'L Cultec R-330 x 77</b> Inside #1
		6,201 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	373.55'	<b>2.400 in/hr Exfiltration over Surface area</b>

**Primary OutFlow** Max=0.13 cfs @ 13.73 hrs HW=375.66' (Free Discharge)  
 ↳1=Exfiltration (Exfiltration Controls 0.13 cfs)

**Pond 1P: Cultec Recharge 330 -Exfiltration**



**Hydrograph for Pond 1P: Cultec Recharge 330 -Exfiltration**

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0	373.55	0.00
1.00	0.00	0	373.55	0.00
2.00	0.01	2	373.55	0.01
3.00	0.01	4	373.56	0.01
4.00	0.02	6	373.56	0.02
5.00	0.03	8	373.56	0.02
6.00	0.03	9	373.56	0.03
7.00	0.04	13	373.57	0.04
8.00	0.05	17	373.57	0.05
9.00	0.08	24	373.58	0.08
10.00	0.11	33	373.59	0.10
11.00	0.16	132	373.72	0.11
12.00	<b>2.42</b>	1,634	374.73	0.12
13.00	0.17	<b>3,340</b>	<b>375.63</b>	<b>0.13</b>
14.00	0.11	<b>3,386</b>	<b>375.66</b>	<b>0.13</b>
15.00	0.09	3,286	375.60	0.13
16.00	0.06	3,095	375.50	0.12
17.00	0.05	2,841	375.36	0.12
18.00	0.04	2,551	375.21	0.12
19.00	0.03	2,240	375.04	0.12
20.00	0.03	1,924	374.88	0.12
21.00	0.03	1,602	374.71	0.12
22.00	0.02	1,278	374.54	0.11
23.00	0.02	951	374.38	0.11
24.00	0.02	620	374.21	0.11
25.00	0.00	225	373.84	0.11
26.00	0.00	0	373.55	0.00
27.00	0.00	0	373.55	0.00
28.00	0.00	0	373.55	0.00
29.00	0.00	0	373.55	0.00
30.00	0.00	0	373.55	0.00
31.00	0.00	0	373.55	0.00
32.00	0.00	0	373.55	0.00
33.00	0.00	0	373.55	0.00

**Grafton-Toriano-post-develop2021**

Type III 24-hr 25-YEAR EVENT Rainfall=5.30"

Prepared by {enter your company name here}

Printed 4/26/2021

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Time span=0.00-33.00 hrs, dt=0.05 hrs, 661 points

Runoff by SCS TR-20 method, UH=SCS

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

**Subcatchment 1S: Post development**

Runoff Area=21,810 sf 100.00% Impervious Runoff Depth=5.06"

Flow Length=130' Tc=1.0 min CN=98 Runoff=2.90 cfs 0.211 af

**Pond 1P: Cultec Recharge 330 -Exfiltration**

Peak Elev=376.19' Storage=4,278 cf Inflow=2.90 cfs 0.211 af

Outflow=0.13 cfs 0.211 af

**Total Runoff Area = 0.501 ac Runoff Volume = 0.211 af Average Runoff Depth = 5.06"**  
**0.00% Pervious = 0.000 ac 100.00% Impervious = 0.501 ac**

**Summary for Subcatchment 1S: Post development**

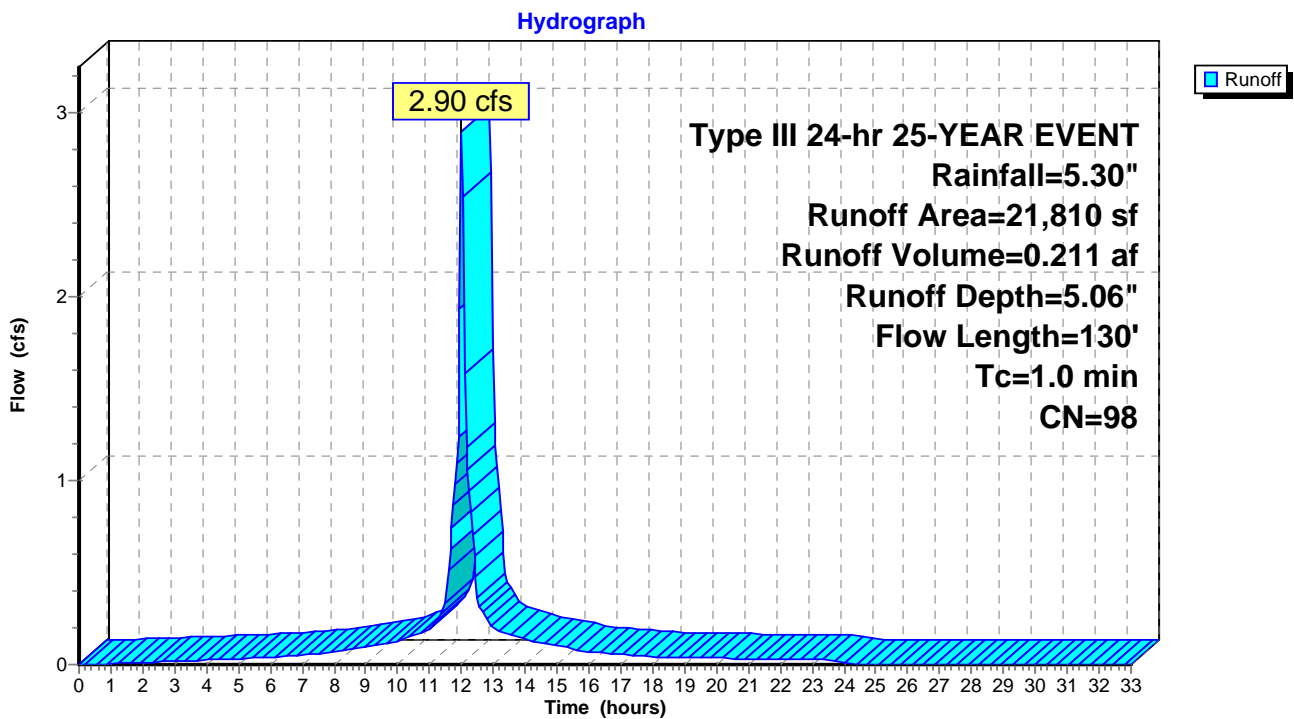
Runoff = 2.90 cfs @ 12.01 hrs, Volume= 0.211 af, Depth= 5.06"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-33.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 25-YEAR EVENT Rainfall=5.30"

	Area (sf)	CN	Description
*	8,000	98	roof -Existing
*	8,000	98	roof -Exsiting
*	5,810	98	Roof Propose
	21,810	98	Weighted Average
	21,810		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	130		2.17		Direct Entry,

**Subcatchment 1S: Post development**



**Hydrograph for Subcatchment 1S: Post development**

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	26.50	5.30	5.06	0.00
0.50	0.03	0.00	0.00	27.00	5.30	5.06	0.00
1.00	0.05	0.00	0.00	27.50	5.30	5.06	0.00
1.50	0.08	0.01	0.01	28.00	5.30	5.06	0.00
2.00	0.11	0.02	0.01	28.50	5.30	5.06	0.00
2.50	0.13	0.03	0.02	29.00	5.30	5.06	0.00
3.00	0.16	0.05	0.02	29.50	5.30	5.06	0.00
3.50	0.19	0.07	0.02	30.00	5.30	5.06	0.00
4.00	0.23	0.09	0.03	30.50	5.30	5.06	0.00
4.50	0.26	0.12	0.03	31.00	5.30	5.06	0.00
5.00	0.30	0.15	0.03	31.50	5.30	5.06	0.00
5.50	0.34	0.18	0.03	32.00	5.30	5.06	0.00
6.00	0.38	0.21	0.04	32.50	5.30	5.06	0.00
6.50	0.43	0.25	0.04	33.00	5.30	5.06	0.00
7.00	0.48	0.30	0.05				
7.50	0.54	0.35	0.06				
8.00	0.60	0.41	0.06				
8.50	0.68	0.49	0.08				
9.00	0.77	0.57	0.10				
9.50	0.88	0.67	0.11				
10.00	1.00	0.79	0.13				
10.50	1.15	0.93	0.16				
11.00	1.33	1.11	0.19				
11.50	1.58	1.36	0.31				
12.00	2.65	2.42	<b>2.86</b>				
12.50	3.72	3.49	0.36				
13.00	3.97	3.74	0.20				
13.50	4.15	3.92	0.16				
14.00	4.30	4.06	0.13				
14.50	4.42	4.18	0.12				
15.00	4.53	4.29	0.10				
15.50	4.62	4.38	0.09				
16.00	4.70	4.46	0.07				
16.50	4.76	4.52	0.06				
17.00	4.82	4.58	0.06				
17.50	4.87	4.64	0.05				
18.00	4.92	4.68	0.04				
18.50	4.96	4.72	0.04				
19.00	5.00	4.76	0.04				
19.50	5.04	4.80	0.04				
20.00	5.07	4.84	0.03				
20.50	5.11	4.87	0.03				
21.00	5.14	4.90	0.03				
21.50	5.17	4.93	0.03				
22.00	5.20	4.96	0.03				
22.50	5.23	4.99	0.03				
23.00	5.25	5.01	0.03				
23.50	5.28	5.04	0.02				
24.00	<b>5.30</b>	<b>5.06</b>	0.02				
24.50	5.30	5.06	0.00				
25.00	5.30	5.06	0.00				
25.50	5.30	5.06	0.00				
26.00	5.30	5.06	0.00				



**Summary for Pond 1P: Cultec Recharge 330 -Exfiltration**

Inflow Area = 0.501 ac, 100.00% Impervious, Inflow Depth = 5.06" for 25-YEAR EVENT event  
 Inflow = 2.90 cfs @ 12.01 hrs, Volume= 0.211 af  
 Outflow = 0.13 cfs @ 14.00 hrs, Volume= 0.211 af, Atten= 95%, Lag= 119.2 min  
 Primary = 0.13 cfs @ 14.00 hrs, Volume= 0.211 af

Routing by Stor-Ind method, Time Span= 0.00-33.00 hrs, dt= 0.05 hrs  
 Peak Elev= 376.19' @ 14.00 hrs Surf.Area= 2,379 sf Storage= 4,278 cf

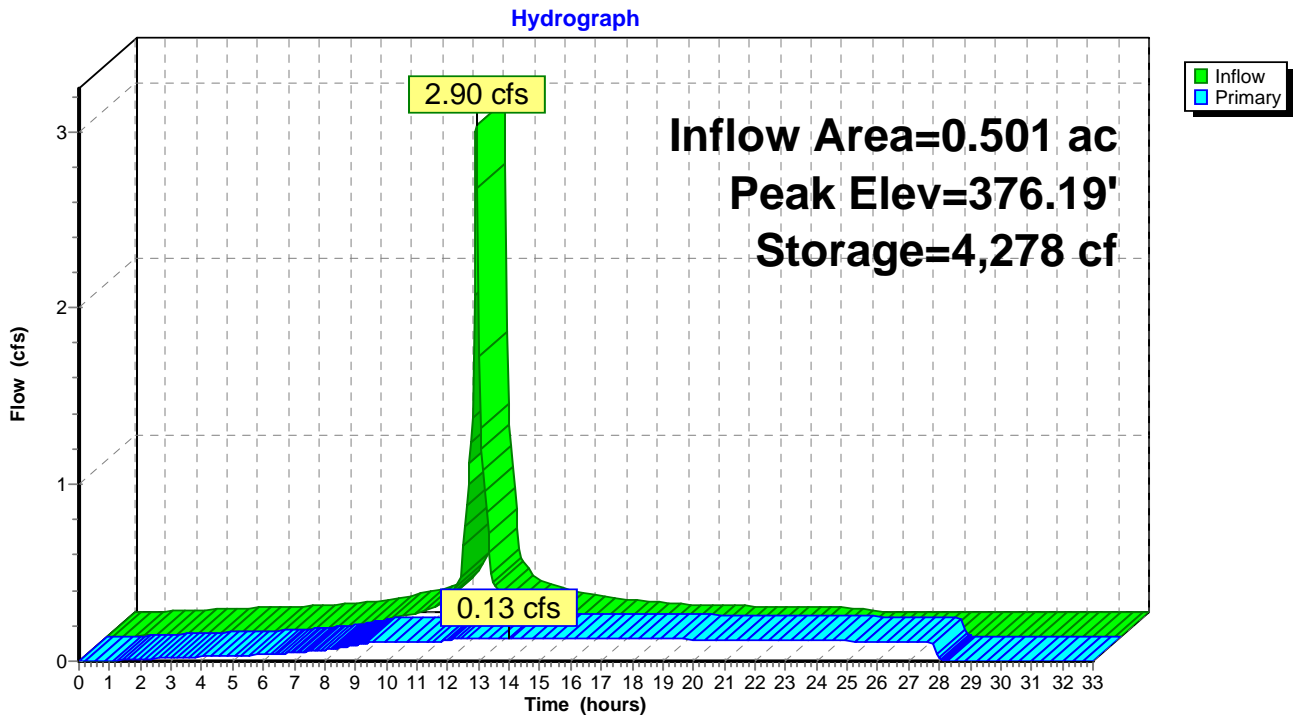
Plug-Flow detention time= 283.4 min calculated for 0.211 af (100% of inflow)  
 Center-of-Mass det. time= 283.3 min ( 1,025.8 - 742.4 )

Volume	Invert	Avail.Storage	Storage Description
#1	373.55'	2,615 cf	<b>44.00'W x 43.00'L x 4.40'H Prismatic Z=1.0</b> 10,123 cf Overall - 3,586 cf Embedded = 6,537 cf x 40.0% Voids
#2	374.11'	3,586 cf	<b>47.8"W x 30.0"H x 6.25'L Cultec R-330 x 77</b> Inside #1
		6,201 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	373.55'	<b>2.400 in/hr Exfiltration over Surface area</b>

**Primary OutFlow** Max=0.13 cfs @ 14.00 hrs HW=376.19' (Free Discharge)  
 ↳1=Exfiltration (Exfiltration Controls 0.13 cfs)

**Pond 1P: Cultec Recharge 330 -Exfiltration**



**Hydrograph for Pond 1P: Cultec Recharge 330 -Exfiltration**

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0	373.55	0.00
1.00	0.00	1	373.55	0.00
2.00	0.01	3	373.55	0.01
3.00	0.02	6	373.56	0.02
4.00	0.03	8	373.56	0.02
5.00	0.03	10	373.56	0.03
6.00	0.04	11	373.57	0.04
7.00	0.05	16	373.57	0.05
8.00	0.06	20	373.58	0.06
9.00	0.10	29	373.59	0.09
10.00	0.13	58	373.63	0.11
11.00	0.19	244	373.87	0.11
12.00	<b>2.86</b>	2,085	374.96	0.12
13.00	0.20	4,163	376.12	0.13
14.00	0.13	<b>4,278</b>	<b>376.19</b>	<b>0.13</b>
15.00	0.10	4,220	376.15	0.13
16.00	0.07	4,054	376.05	0.13
17.00	0.06	3,814	375.90	0.13
18.00	0.04	3,531	375.74	0.13
19.00	0.04	3,222	375.57	0.13
20.00	0.03	2,906	375.40	0.12
21.00	0.03	2,584	375.22	0.12
22.00	0.03	2,257	375.05	0.12
23.00	0.03	1,926	374.88	0.12
24.00	0.02	1,590	374.70	0.12
25.00	0.00	1,176	374.49	0.11
26.00	0.00	768	374.28	0.11
27.00	0.00	367	374.03	0.11
28.00	0.00	7	373.56	0.02
29.00	0.00	0	373.55	0.00
30.00	0.00	0	373.55	0.00
31.00	0.00	0	373.55	0.00
32.00	0.00	0	373.55	0.00
33.00	0.00	0	373.55	0.00

**Grafton-Toriano-post-develop2021**

Type III 24-hr 100-YEAR EVENT Rainfall=6.40"

Prepared by {enter your company name here}

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Time span=0.00-33.00 hrs, dt=0.05 hrs, 661 points

Runoff by SCS TR-20 method, UH=SCS

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

**Subcatchment 1S: Post development**

Runoff Area=21,810 sf 100.00% Impervious Runoff Depth=6.16"

Flow Length=130' Tc=1.0 min CN=98 Runoff=3.50 cfs 0.257 af

**Pond 1P: Cultec Recharge 330 -Exfiltration**

Peak Elev=377.33' Storage=5,536 cf Inflow=3.50 cfs 0.257 af

Outflow=0.14 cfs 0.257 af

**Total Runoff Area = 0.501 ac Runoff Volume = 0.257 af Average Runoff Depth = 6.16"**  
**0.00% Pervious = 0.000 ac 100.00% Impervious = 0.501 ac**

**Summary for Subcatchment 1S: Post development**

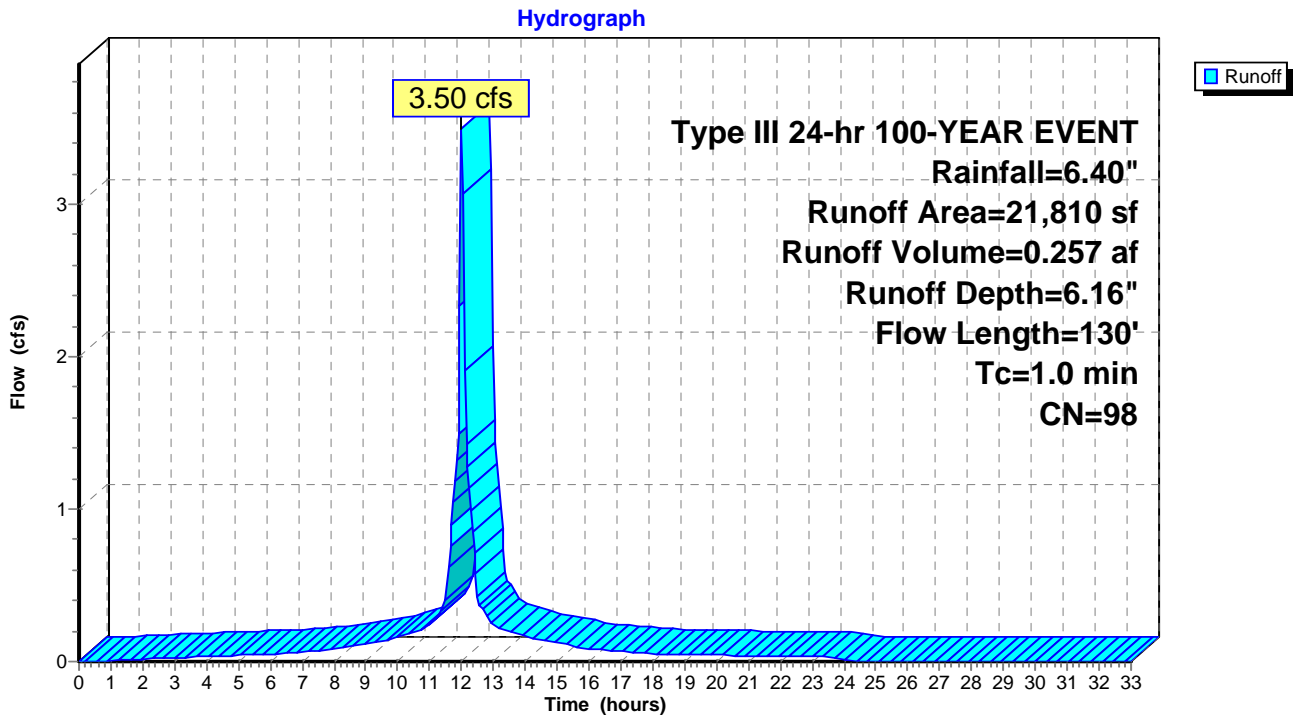
Runoff = 3.50 cfs @ 12.01 hrs, Volume= 0.257 af, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-33.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 100-YEAR EVENT Rainfall=6.40"

	Area (sf)	CN	Description
*	8,000	98	roof -Existing
*	8,000	98	roof -Exsiting
*	5,810	98	Roof Propose
	21,810	98	Weighted Average
	21,810		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	130		2.17		Direct Entry,

**Subcatchment 1S: Post development**



**Hydrograph for Subcatchment 1S: Post development**

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	26.50	6.40	6.16	0.00
0.50	0.03	0.00	0.00	27.00	6.40	6.16	0.00
1.00	0.06	0.00	0.01	27.50	6.40	6.16	0.00
1.50	0.10	0.01	0.01	28.00	6.40	6.16	0.00
2.00	0.13	0.03	0.02	28.50	6.40	6.16	0.00
2.50	0.16	0.04	0.02	29.00	6.40	6.16	0.00
3.00	0.20	0.07	0.03	29.50	6.40	6.16	0.00
3.50	0.23	0.09	0.03	30.00	6.40	6.16	0.00
4.00	0.28	0.13	0.03	30.50	6.40	6.16	0.00
4.50	0.32	0.16	0.04	31.00	6.40	6.16	0.00
5.00	0.36	0.20	0.04	31.50	6.40	6.16	0.00
5.50	0.41	0.24	0.04	32.00	6.40	6.16	0.00
6.00	0.46	0.28	0.05	32.50	6.40	6.16	0.00
6.50	0.52	0.33	0.05	33.00	6.40	6.16	0.00
7.00	0.58	0.39	0.06				
7.50	0.65	0.46	0.07				
8.00	0.73	0.53	0.08				
8.50	0.82	0.62	0.10				
9.00	0.93	0.73	0.12				
9.50	1.06	0.85	0.14				
10.00	1.21	1.00	0.15				
10.50	1.39	1.17	0.19				
11.00	1.60	1.38	0.23				
11.50	1.91	1.68	0.38				
12.00	3.20	2.97	<b>3.46</b>				
12.50	4.49	4.26	0.43				
13.00	4.80	4.56	0.24				
13.50	5.01	4.78	0.20				
14.00	5.19	4.95	0.16				
14.50	5.34	5.10	0.14				
15.00	5.47	5.23	0.12				
15.50	5.58	5.34	0.10				
16.00	5.67	5.43	0.08				
16.50	5.75	5.51	0.08				
17.00	5.82	5.58	0.07				
17.50	5.88	5.65	0.06				
18.00	5.94	5.70	0.05				
18.50	5.99	5.75	0.05				
19.00	6.04	5.80	0.05				
19.50	6.08	5.84	0.04				
20.00	6.12	5.89	0.04				
20.50	6.17	5.93	0.04				
21.00	6.20	5.97	0.04				
21.50	6.24	6.00	0.04				
22.00	6.28	6.04	0.03				
22.50	6.31	6.07	0.03				
23.00	6.34	6.10	0.03				
23.50	6.37	6.13	0.03				
24.00	<b>6.40</b>	<b>6.16</b>	0.02				
24.50	6.40	6.16	0.00				
25.00	6.40	6.16	0.00				
25.50	6.40	6.16	0.00				
26.00	6.40	6.16	0.00				

**Summary for Pond 1P: Cultec Recharge 330 -Exfiltration**

Inflow Area = 0.501 ac, 100.00% Impervious, Inflow Depth = 6.16" for 100-YEAR EVENT event  
 Inflow = 3.50 cfs @ 12.01 hrs, Volume= 0.257 af  
 Outflow = 0.14 cfs @ 14.37 hrs, Volume= 0.257 af, Atten= 96%, Lag= 141.7 min  
 Primary = 0.14 cfs @ 14.37 hrs, Volume= 0.257 af

Routing by Stor-Ind method, Time Span= 0.00-33.00 hrs, dt= 0.05 hrs  
 Peak Elev= 377.33' @ 14.37 hrs Surf.Area= 2,606 sf Storage= 5,536 cf

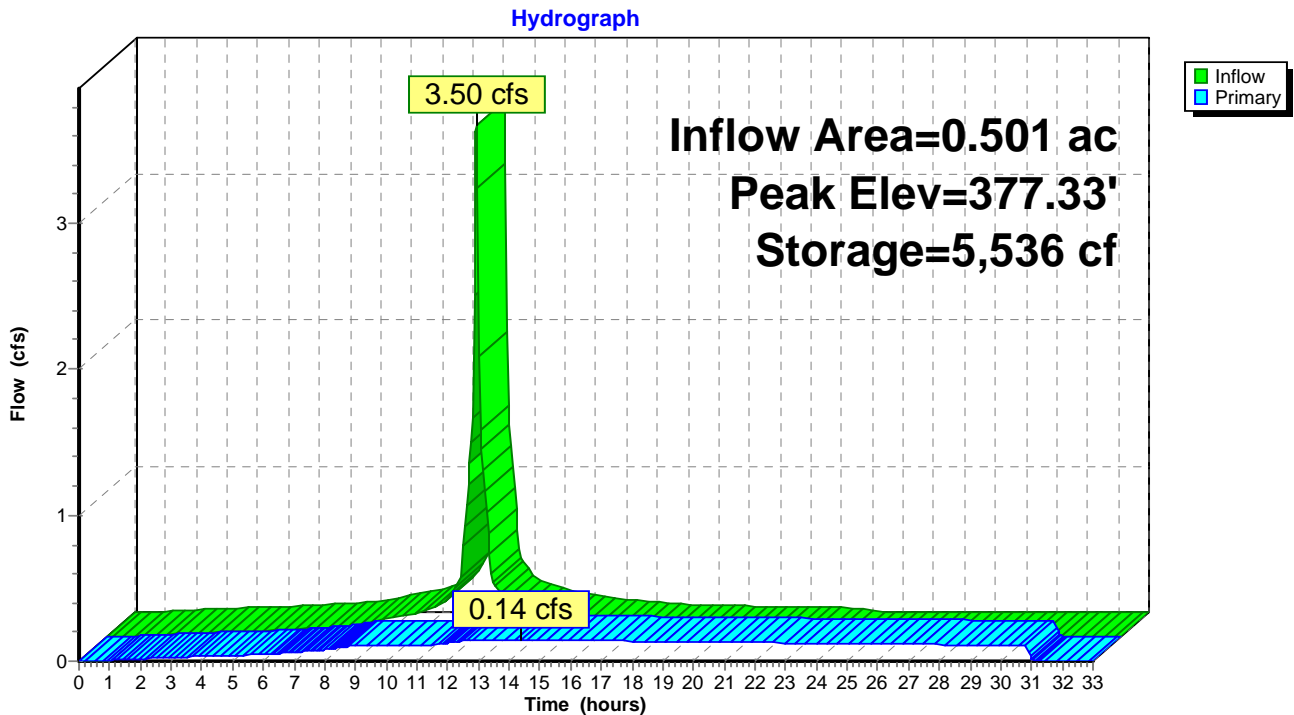
Plug-Flow detention time= 353.2 min calculated for 0.257 af (100% of inflow)  
 Center-of-Mass det. time= 353.1 min ( 1,092.7 - 739.6 )

Volume	Invert	Avail.Storage	Storage Description
#1	373.55'	2,615 cf	<b>44.00'W x 43.00'L x 4.40'H Prismatic Z=1.0</b> 10,123 cf Overall - 3,586 cf Embedded = 6,537 cf x 40.0% Voids
#2	374.11'	3,586 cf	<b>47.8"W x 30.0"H x 6.25'L Cultec R-330 x 77</b> Inside #1
		6,201 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	373.55'	<b>2.400 in/hr Exfiltration over Surface area</b>

**Primary OutFlow** Max=0.14 cfs @ 14.37 hrs HW=377.33' (Free Discharge)  
 ↳1=Exfiltration (Exfiltration Controls 0.14 cfs)

**Pond 1P: Cultec Recharge 330 -Exfiltration**



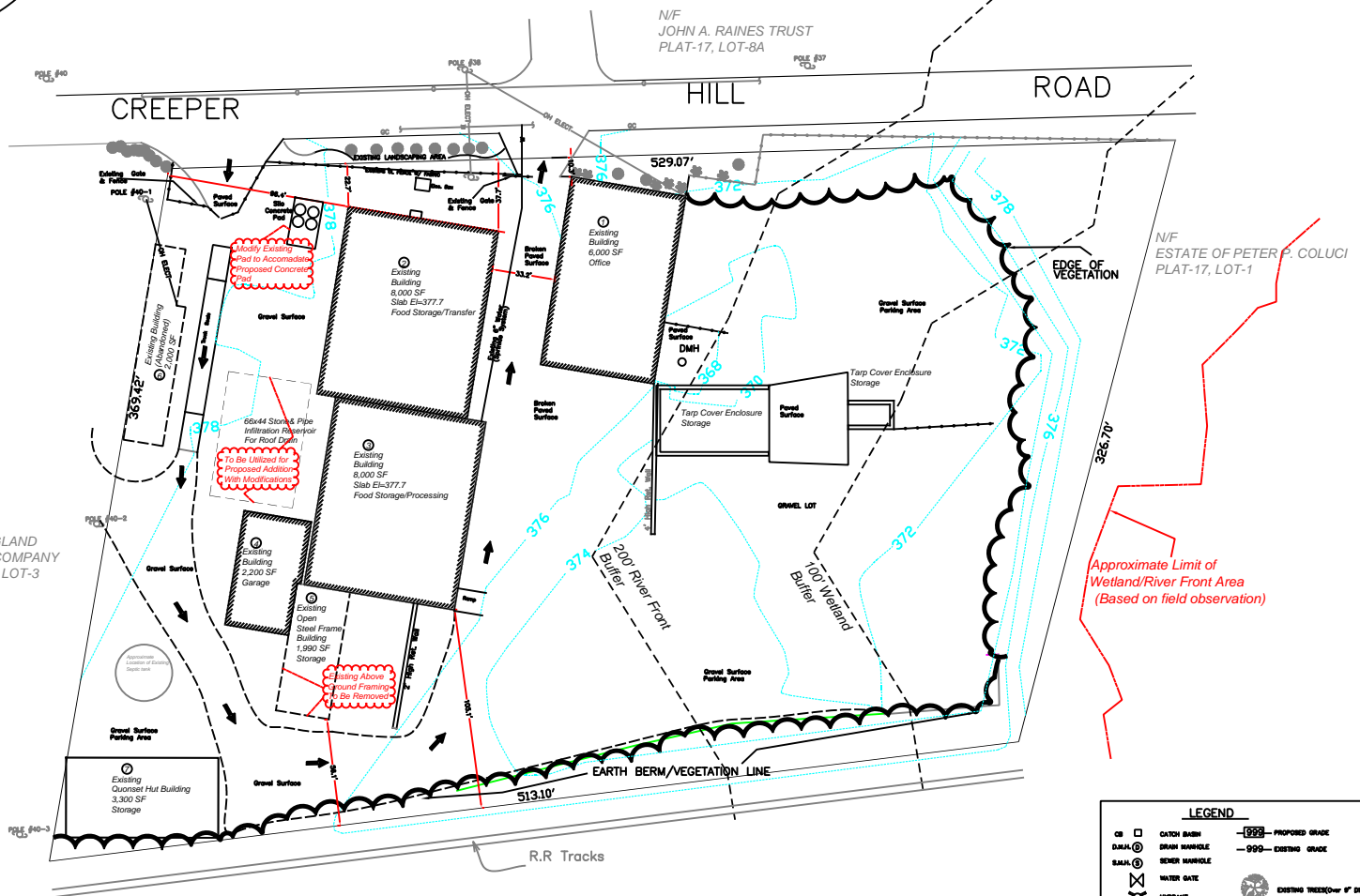
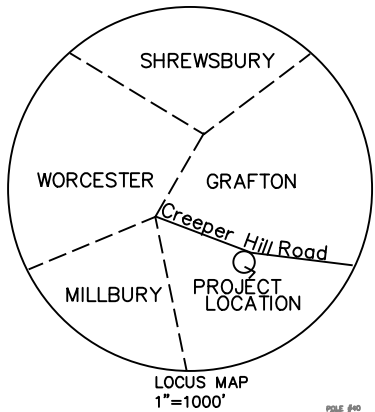
**Hydrograph for Pond 1P: Cultec Recharge 330 -Exfiltration**

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0	373.55	0.00
1.00	0.01	1	373.55	0.00
2.00	0.02	5	373.56	0.02
3.00	0.03	8	373.56	0.02
4.00	0.03	10	373.56	0.03
5.00	0.04	12	373.57	0.04
6.00	0.05	14	373.57	0.05
7.00	0.06	19	373.58	0.06
8.00	0.08	25	373.58	0.08
9.00	0.12	38	373.60	0.11
10.00	0.15	143	373.74	0.11
11.00	0.23	446	374.12	0.11
12.00	<b>3.46</b>	2,754	375.31	0.12
13.00	0.24	5,331	377.13	0.14
14.00	0.16	<b>5,526</b>	<b>377.32</b>	<b>0.14</b>
15.00	0.12	<b>5,510</b>	<b>377.30</b>	<b>0.14</b>
16.00	0.08	5,363	377.16	0.14
17.00	0.07	5,127	376.93	0.14
18.00	0.05	4,843	376.65	0.14
19.00	0.05	4,533	376.37	0.13
20.00	0.04	4,214	376.15	0.13
21.00	0.04	3,889	375.95	0.13
22.00	0.03	3,558	375.75	0.13
23.00	0.03	3,221	375.57	0.13
24.00	0.02	2,877	375.38	0.12
25.00	0.00	2,439	375.15	0.12
26.00	0.00	2,007	374.92	0.12
27.00	0.00	1,584	374.70	0.12
28.00	0.00	1,168	374.49	0.11
29.00	0.00	760	374.28	0.11
30.00	0.00	360	374.02	0.11
31.00	0.00	5	373.56	0.02
32.00	0.00	0	373.55	0.00
33.00	0.00	0	373.55	0.00

## *4 HydroCad worksheet*

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**GENERAL NOTES**

- 1-THE LOCATION OF THE PROPERTY LINES SHALL BE VERIFIED IN THE FIELD BY A REGISTERED LAND SURVEYOR BEFORE THE START OF ANY CONSTRUCTION ACTIVITIES.
- 2.THERE SHALL BE NO CONSTRUCTION ACTIVITIES UNTIL EROSION CONTROL MEASURES ARE IN PLACE
- 3.THE EROSION CONTROLS SHOULD BE MAINTAINED DURING THE CONSTRUCTION
- 4-EXISTING CONDITION PLAN AND LOCATION OF BUILDINGS ARE BASED ON A PLAN PREPARED BY ANDREWS SURVEY & ENGINEERING DATED 12/11/2001.

**LOT COVERAGE CALCULATION**

BUILDING COVERAGE	28,490 SF	GLEAD
PAVEMENT/OPEN PORE/SURFACE	12,000 SF	CS2
PARKING/GRASS SURFACE	157,500 SF	66,640
OPEN SPACE/GRASS	28,214 SF	GLEAD
<b>TOTAL</b>	<b>= 226,204 SF</b>	<b>=5.2 ACR.</b>

**ZONING: OFFICE/ LIGHT INDUSTRY (OLI)**

	REQUIRED	EXISTING
MIN. LOT AREA:	40,000 SF	53,247
MIN. LOT FRONTAGE:	120 FT	250 FT
MINIMUM FRONT YARD:	40 FT	10,30 FT
MINIMUM SIDE YARD:	35 FT	0 FT
MINIMUM REAR YARD:	35 FT	3 FT
MINIMUM BLD. COVERAGE:	40 %	12%

Deed Ref- BK- 19840 Pg-135 (ID 110.017.0-0000-0002.0)

Approximate Limit of Wetland/River Front Area (Based on field observation)

**REVISIONS**

NO.	DESCRIPTION	DATE

**EXISTING CONDITION PLAN**

FOR  
109 CREEPER HILL ROAD  
GRAFTON, MA

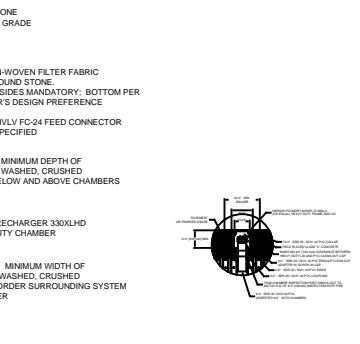
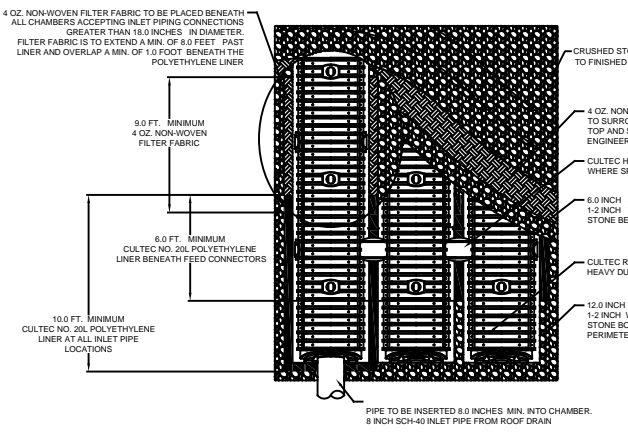
SCALE: AS NOTED DATE: 4/22/21

PREPARED BY: ASA ENGINEERING 715 MAIN STREET SHREWSBURY, MA 01789 377-8084 mcaur1100@yahoo.com  
PREPARED FOR: WASTE TO FEED INC.

**LEGEND**

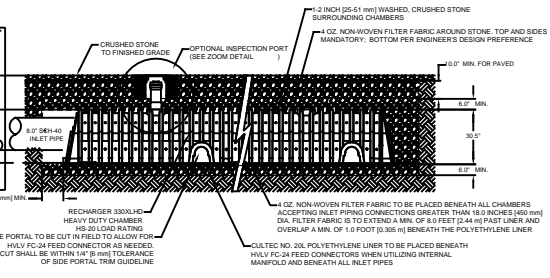
□	CATCH BASIN	---	PROPOSED GRADE
○	GRASS MANHOLE	---	EXISTING GRADE
○	SEWER MANHOLE	---	EXISTING GRADE
⊗	WATER GATE	⊗	EXISTING TREES (over 6" diam.)
⊗	HYDRANT	→	TRUCK TRAVEL PATH
-S-	SEWER LINE	+	WET LAND FLAG
+	WET LAND FLAG	◆	RIVER FRONT FLAG
-W-	WATER LINE	⊙	BUILDING NUMBER DEGRADATION

SCALE 1"=30'



**SCHEDULE OF ELEVATIONS**

FG	EL=378.0
T.O Chamber	EL=376.08
Invt. in	EL=374.11 (R.D.)
BOT Chamber	EL=374.11 (R.D.)



# CULTEC UNITS DETAIL

## GENERAL NOTES

- 1-THE LOCATION OF THE PROPERTY LINES SHALL BE SHOWN IN THE FIELD BY A REGISTERED LAND SURVEYOR BEFORE THE START OF ANY CONSTRUCTION ACTIVITIES.
- 2-THERE SHALL BE NO CONSTRUCTION ACTIVITIES UNTIL EROSION CONTROL MEASURES ARE IN PLACE.
- 3-THE EROSION CONTROLS SHOULD BE MAINTAINED DURING THE CONSTRUCTION.
- 4-EXISTING CONDITION PLAN AND LOCATION OF BUILDINGS SHOWN HEREON ARE APPROPRIATE BASED ON THE FIELD LOCATION OF ALL VISIBLE STRUCTURES SUCH AS GUTTER BASINS, MANHOLE WATER GATES, ETC. AND COMPLYING INFORMATION FROM PLANS SUPPLIED BY VARIOUS UTILITY COMPANIES AND THE GOVERNMENT AGENCIES IN ACCORDANCE WITH CHAPTER 82 SECTION 40 INCLUDING AMENDMENTS ALL CONTRACTORS SHOULD NOTIFY BY WRITING ALL THE UTILITY COMPANIES AND GOVERNMENT AGENCIES PRIOR TO ANY EXCAVATION OR CALL 1-888-344-7233.
- 5-SHOULD CONFLICTS OCCUR WITH EXISTING UTILITIES, CONTRACTOR SHALL STOP WORK IMMEDIATELY AND NOTIFY OWNERS REPRESENTATIVE FOR FIELD CHANGE.
- 6-THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND GRADES ON THE SITE AND IMMEDIATELY REPORT ANY DISCREPANCIES OR DEVIATIONS FROM THE PLANS TO THE DESIGNER. ALSO REPORT ANY CONDITION UNCOVERED IN THE WORK WHICH IS NOT REFLECTED WITHIN THE PLAN.
- 7-STRUCTURE PLANS IS NOT INCLUDED AS PART OF THIS PLAN AND SHALL BE INCLUDED UNDER SEPARATE SUBMISSION.
- 8-ALL ROOF DRAINS/GUTTERS SHALL BE DIRECTED TO THE PROPOSED UNDERGROUND INFILTRATION SYSTEM SHOWN WITH PVC SCHED 40 PIPES IN ACCORDANCE WITH TOWN OF GRAFTON REQUIREMENTS.
- 9-THE ENTIRE AREA WITHIN THE STREET LINES, AND BEYOND, AS NECESSARY FOR CONSTRUCTION PARTWORK, SHALL BE CLEARED OF ALL BRUSH, TREE ROOTS, STUMPS, BULDERS, AND OTHER OBSTRUCTIONARY MATTER.
- 10-THE SCOPE OF WORK FOR THIS PROJECT WILL NOT MODIFY OR CHANGE THE EXISTING GRADE FOR THE ENTIRE SITE.
- 11-TOPOGRAPHIC ELEVATIONS ARE BASED ON THE TOWN OF GRAFTON GIS MAP.
- 12-EROSION CONTROL MEASURES SHALL BE IN PLACE BEFORE THE CONSTRUCTION STARTS AND SHALL BE MAINTAINED DURING CONSTRUCTION UNTIL THE ENTIRE AREA FINAL COVER ESTABLISHES.
- 13-THE HEIGHT OF THE PROPOSED STORAGE SILOS AND BUILDING SHALL BE IN CONFORMANCE WITH THE REQUIREMENT OF TOWN OF GRAFTON BY LAWS.

## CONSTRUCTION NOTES

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- 2-THERE SHALL BE NO CONSTRUCTION ACTIVITIES UNTIL EROSION CONTROL MEASURES ARE IN PLACE.
- 3-THE EROSION CONTROLS SHOULD BE MAINTAINED DURING THE CONSTRUCTION.
- 4-EXISTING CONDITION PLAN AND LOCATION OF BUILDINGS SHOWN HEREON ARE APPROPRIATE BASED ON THE FIELD LOCATION OF ALL VISIBLE STRUCTURES SUCH AS GUTTER BASINS, MANHOLE WATER GATES, ETC. AND COMPLYING INFORMATION FROM PLANS SUPPLIED BY VARIOUS UTILITY COMPANIES AND THE GOVERNMENT AGENCIES IN ACCORDANCE WITH CHAPTER 82 SECTION 40 INCLUDING AMENDMENTS ALL CONTRACTORS SHOULD NOTIFY BY WRITING ALL THE UTILITY COMPANIES AND GOVERNMENT AGENCIES PRIOR TO ANY EXCAVATION OR CALL 1-888-344-7233.
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- 6-THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND GRADES ON THE SITE AND IMMEDIATELY REPORT ANY DISCREPANCIES OR DEVIATIONS FROM THE PLANS TO THE DESIGNER. ALSO REPORT ANY CONDITION UNCOVERED IN THE WORK WHICH IS NOT REFLECTED WITHIN THE PLAN.
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- 13-THE HEIGHT OF THE PROPOSED STORAGE SILOS AND BUILDING SHALL BE IN CONFORMANCE WITH THE REQUIREMENT OF TOWN OF GRAFTON BY LAWS.

**LIT COVERAGE CALCULATION**

BUILDING COVERAGE	35,887 SF	135.410
PAVEMENT/FOREPS SURFACED	12,000 SF	45.000
PARKING PERIPLUS SURFACED	15,771 SF	57.270
SPOT SPACE/GREEN SPACE	25,284 SF	92.624
<b>TOTAL =</b>	<b>88,942 SF</b>	<b>325.304</b> ACRES

## ZONING: OFFICE/ LIGHT INDUSTRY (OL)

MIN. LOT AREA:	REQUIRED	EXISTING	PROPOSED
130 ft	130 ft	130 ft	130 ft
MINIMUM FRONT YARD:	40 ft	10.50 ft	220 ft
MINIMUM SIDE YARD:	35 ft	0 ft	104.4 ft
MINIMUM REAR YARD:	35 ft	3 ft	38 ft
MAXIMUM BULK COVERAGE:	40 %	12%	15.4%

## PARKING REQUIREMENT:

EXISTING BUILDINGS =	AREA	REQUIRED
PROPOSED BUILDINGS =	35,887 SF	3,500 SF
<b>TOTAL =</b>	<b>30,010 SF</b>	
REQUIRED PARKING SPACES:	(29,827 SF) / 500 =	60
AVAILABLE PARKING SPACES:		71

## REVISIONS

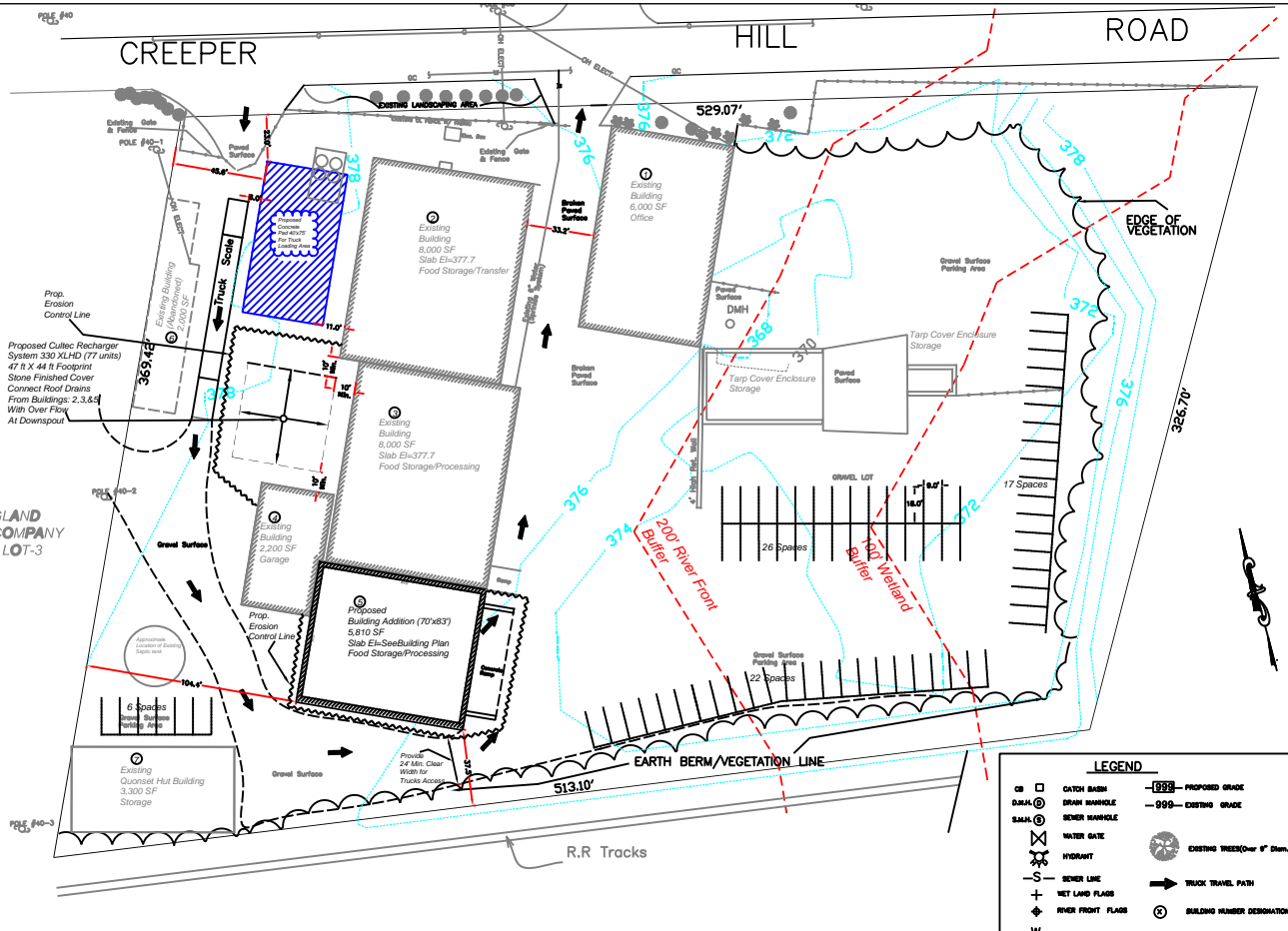
## PROPOSE BUILDING ADDITION SITE PLAN

FOR  
109 CREEPER HILL ROAD  
GRAFTON, MA

SCALE: AS NOTED DATE: 4/22/21

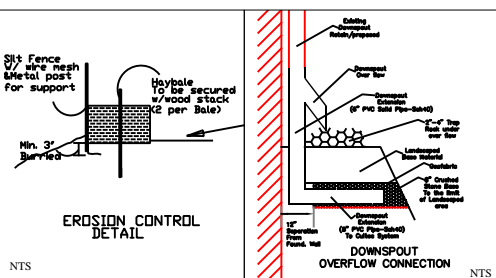
PREPARED BY: ASA ENGINEERING  
715 MAIN STREET  
SURREYSBURY, MA  
(978) 377-5084  
mcase1100@hobas.com

PREPARED FOR: WASTE TO FEED INC.



SCALE 1"=30'

**NOTE:**  
1-Hours of operations and the number of employees shall and shipping /receiving activities shall remain the same as current use and operation.  
2-No hazardous material will handled at this site.



- 1-EROSION CONTROLS MEASURES SHOULD BE IN PLACE BEFORE THE LAND DISTURBANCE , AND SHOULD NOT BE REMOVE UNTIL ALL CONSTRUCTION ACTIVITIES ARE COMPLETED.
- 2-THE EROSION CONTROLS SHOULD BE MAINTAIN ON A REGULAR BASES TO PREVENT ACCUMULATION OF SEDIMENTS .
- 3- TEMPORARY SEEDING OF ALL DISTURBED AREAS SHALL BE IMPLEMENTED DURING CONSTRUCTION SHUT DOWNS OF MORE THAN 5 DAYS.
- 4-THE ENTRANCE AND EXIT AREAS TO THE PROPOSED SITE SHOULD BE STABILIZE BY USING CRUSH STONE OR OTHER EFFECTIVE MEASURES.
- 5-SEDIMENTS WHICH ARE TRACKED INTO THE PUBLIC WAYS SHOULD BE REMOVED ON A DAILY BASES.
- 6-ALL DISTURBED AREAS SHALL BE MAINTAIN DURING THE STABILIZATION OF PERMANENT MEASURES