Project Number: 043-002	**Calculations by:** SMO
Project Name: Christina Estates	**Date:** 12/9/2025
Project Address: North Attleboro	**Checked by:** SMO
Client: Forge Building Lot 15	**Checked Date:** 12/9/2025

Independence ENGINEERING LLC

STORMWATER MANAGEMENT STANDARD 3 - RECHARGE VOLUME

	HYDROLOGIC SOIL GROUP				TOTAL
	A	B	C	D	
IMPERVIOUS AREA (S.F.)	0	1,584	0	0	**1584**
INCHES OF RUNOFF TO BE RECHARGED	0.60	0.35	0.25	0.10	
REQUIRED RECHARGE VOLUME (FT³)	0	46	0	0	**46**

CAPTURE AREA ADJUSTMENT - ADJUSTED MINIMUM REQUIRED RECHARGE VOLUME

65% OF IMPERVIOUS AREA	1030	SF	A MINIMUM OF 65% OF IMPERVIOUS AREA MUST BE DIRECTED TO SITE RECHARGE BMPS
TOTAL IMPERVIOUS SITE AREA DIRECTED TO RECHARGE BMP	2061	SF 130.1%	CALCULATED PERCENTAGE OF TOTAL IMPERVIOUS AREA
RATIO OF TOTAL IMPERVIOUS AREA / IMPERVIOUS AREA DIRECTED TO RECHARGE	0.77		CALCULATED RATIO IS APPLIED TO REQUIRE RECHARGE VOLUME TO DETERMINE ADJUSTED VOLUME
ADJUSTED REQUIRED RECHARGE VOLUME	**36**	CF	RATIO OF IMPERVIOUS AREA x REQUIRED RECHARGE VOLUME
PROPOSED RECHARGE VOLUME	**0**	CF	PER HYDROCAD CALCULATIONS FOR 2-YEAR STORM

DRAWDOWN IN 72 HOURS CALCULATION

A = BOTTOM AREA OF PROPOSED LEACHING STRUCTURE
Rv = RECHARGE VOLUME
K= SATURATED HYDRAULIC CONDUCTIVITY (RAWLS RATE) =
VALUE IS BASED ON B HYDRAULIC SOIL GROUP   0.52   INCHES/HOUR

Subsurface Infiltration Facility South

A= 73 SF
Rv= 46 CF
K= 0.52 INCHES/HOUR

DRAWDOWN TIME $T = \dfrac{Rv}{K \times A}$ = **14.5** HOURS TO EMPTY THE RECHARGE BMP

+/-72 HOURS, SO DRAWDOWN IS OK

CULTEC Residential DRAINAGE CALCULATOR

Date:	December 9, 2025

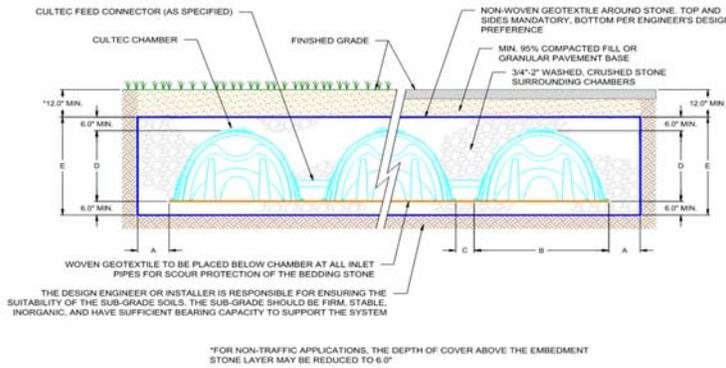| PROJECT INFORMATION	
Project Name:	Christina Estates
City:	North Attleboro
State / Province:	MA
Country:	USA

Instructions:

Step 1: Enter Area of Impervious Cover in "Drainage Area" Cell

Step 2: Enter Required Depth of Rainfall in "Rainfall Depth" Cell. Use NOAA's National Weather Service Precipitation Frequency Data Server (PFDS) Link to Rainfall Data Map if Required

Step 3: Reference Output Table to Determine Number of Chambers and System Area Required for Each Available Chamber Model

System Input Parameters

Drainage Area	1584	ft^2
Rainfall Depth	0.35	in
Storage Required	46	ft^3

Lookup Rainfall Data HERE

Typical System Cross-Section Detail

Specification Table

REF		Contactor 100HD	Recharger 180HD	Recharger 330XLHD
REF	Bare Chamber Volume	1.87ft^3/ft 14.00 ft^3/unit 105 gal	3.45ft^3/ft 21.81 ft^3/unit 163 gal	7.46ft^3/ft 52.21 ft^3/unit 391 gal
A	Stone Border Width (in)	12	12	12
B	Chamber Width (in)	36	36	52
C	Row Spacing (in)	6	6	6
D	Chamber Height (in)	12	20	30
E	Effective Depth (in)	24	32	42
	Chamber Length (ft)	8	7.33	8.5

System Output Table

Storage Required	46	ft^3

Chamber Model (choose one)	No. of Chambers Required units	Minimum Installed Storage per Unit ft^3	Storage Volume Provided ft^3	Minimum Required Area ft^2
Contactor 100HD	2	32.00	64	60
or				
Recharger 180HD	2	40.00	80	50
or				
Recharger 330XLHD	1	84.00	84	37

>>More information on residential drainage.

Call CULTEC for cost estimates and system design.

Find a CULTEC Rep near you

This calculator program is for estimation purposes only and should not take the place of a comprehensive engineering design.

System calculations do not include materials required conventional pipe manifolds.

The successful application and use of this software product is dependent on the application of skilled engineering judgment supplied by the user and/or their consultant.

The user of this software must select input values suitable to describe their specific engineering situation.

The information presented in the computer output is for review, interpretation, application, and approval by a qualified engineer who must assume full responsibility for verifying that all output is appropriate and correct.

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Use of this program constitutes acceptance of this liability agreement by the user.

Reconfiguring the bed layout may effect actual storage provided.

Contact CULTEC Technical Services at CT-tech@cultec.com. Or call 1-800-428-5832 or 203-775-4416 for further assistance.

Email Technical Services

CULTEC
878 Federal Road
Brookfield, CT 06804

Phone: 203-775-4416
Fax: 203-775-1462
www.cultec.com

CULTEC Residential System Calculator v.082024

Project Number: 043-002
Project Name: Christina Estates
Project Address: North Attleboro
Client: Forge Building
Lot 25 & 26

Calculations by: SMO
Date: 12/9/2025
Checked by: SMO
Checked Date: 12/9/2025

Independence
ENGINEERING LLC

STORMWATER MANAGEMENT STANDARD 3 - RECHARGE VOLUME

	HYDROLOGIC SOIL GROUP				TOTAL
	A	B	C	D	
IMPERVIOUS AREA (S.F.)	0	1,905	0	0	**1905**
INCHES OF RUNOFF TO BE RECHARGED	0.60	0.35	0.25	0.10	
REQUIRED RECHARGE VOLUME (FT³)	0	56	0	0	**56**

CAPTURE AREA ADJUSTMENT - ADJUSTED MINIMUM REQUIRED RECHARGE VOLUME

65% OF IMPERVIOUS AREA	1238	SF	A MINIMUM OF 65% OF IMPERVIOUS AREA MUST BE DIRECTED TO SITE RECHARGE BMPS
TOTAL IMPERVIOUS SITE AREA DIRECTED TO RECHARGE BMP	2061	SF	108.2% CALCULATED PERCENTAGE OF TOTAL IMPERVIOUS AREA
RATIO OF TOTAL IMPERVIOUS AREA / IMPERVIOUS AREA DIRECTED TO RECHARGE	0.92		CALCULATED RATIO IS APPLIED TO REQUIRE RECHARGE VOLUME TO DETERMINE ADJUSTED VOLUME
ADJUSTED REQUIRED RECHARGE VOLUME	**51**	CF	RATIO OF IMPERVIOUS AREA x REQUIRED RECHARGE VOLUME
PROPOSED RECHARGE VOLUME	**0**	CF	PER HYDROCAD CALCULATIONS FOR 2-YEAR STORM

DRAWDOWN IN 72 HOURS CALCULATION

A = BOTTOM AREA OF PROPOSED LEACHING STRUCTURE
Rv = RECHARGE VOLUME
K = SATURATED HYDRAULIC CONDUCTIVITY (RAWLS RATE) =
VALUE IS BASED ON B HYDRAULIC SOIL GROUP   0.52   INCHES/HOUR

Subsurface Infiltration Facility South

$$A= \quad 73 \text{ SF}$$
$$Rv= \quad 56 \text{ CF}$$
$$K= \quad 0.52 \text{ INCHES/HOUR}$$

DRAWDOWN TIME $T = \dfrac{Rv}{K \times A}$ = **17.6** HOURS TO EMPTY THE RECHARGE BMP
+/-72 HOURS, SO DRAWDOWN IS OK

Date:	December 9, 2025

PROJECT INFORMATION

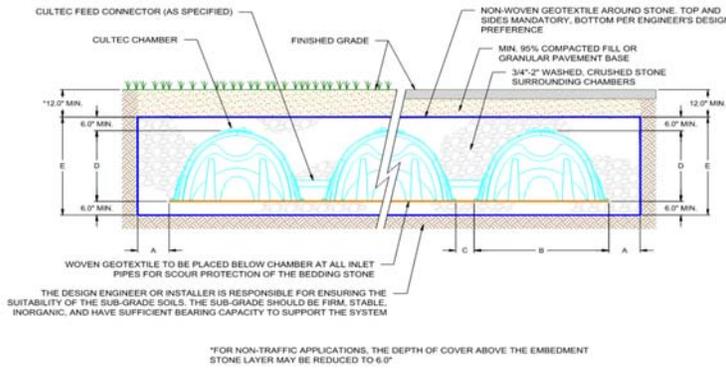|	
Project Name:	Christina Estates
City:	North Attleboro
State / Province:	MA
Country:	USA

Instructions:

Step 1: Enter Area of Impervious Cover in "Drainage Area" Cell

Step 2: Enter Required Depth of Rainfall in "Rainfall Depth" Cell. Use NOAA's National Weather Service Precipitation Frequency Data Server (PFDS) Link to Rainfall Data Map if Required

Step 3: Reference Output Table to Determine Number of Chambers and System Area Required for Each Available Chamber Model

System Input Parameters

Drainage Area	1905	ft^2	
Rainfall Depth	0.35	in	Lookup Rainfall Data HERE
Storage Required	**56**	ft^3	

Typical System Cross-Section Detail

Specification Table

REF		Contactor 100HD	Recharger 180HD	Recharger 330XLHD
REF	Bare Chamber Volume	1.87ft^3/ft 14.00 ft^3/unit 105 gal	3.45ft^3/ft 21.81 ft^3/unit 163 gal	7.46ft^3/ft 52.21 ft^3/unit 391 gal
A	Stone Border Width (in)	12	12	12
B	Chamber Width (in)	36	36	52
C	Row Spacing (in)	6	6	6
D	Chamber Height (in)	12	20	30
E	Effective Depth (in)	24	32	42
	Chamber Length (ft)	8	7.33	8.5

System Output Table

Storage Required	56	ft^3

Chamber Model (choose one)	No. of Chambers Required units	Minimum Installed Storage per Unit ft^3	Storage Volume Provided ft^3	Minimum Required Area ft^2
Contactor 100HD	2	32.00	64	60
or				
Recharger 180HD	2	40.00	80	50
or				
Recharger 330XLHD	1	84.00	84	37

>>More information on residential drainage.
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CULTEC Residential System Calculator v.082024

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A A A

Area of Interest (AOI) | Soil Map | Soil Data Explorer | Download Soils Data | Shopping Cart (Free)

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Map Unit Legend

Bristol County, Massachusetts, Northern Part (MA602)

Bristol County, Massachusetts, Northern Part (MA602)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	1.1	16.2%
73A	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	0.5	7.0%
305B	Paxton fine sandy loam, 3 to 8 percent slopes	0.0	0.2%
706C	Charlton-Rock outcrop-Paxton complex, 3 to 15 percent slopes	5.0	76.6%
Totals for Area of		**6.6**	**100.0%**

Soil Map

Scale | (not to scale)

0 ———————— 90 ft

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

Bristol County, Massachusetts, Northern Part

73A—Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony

Map Unit Setting
National map unit symbol: 2w695
Elevation: 0 to 1,580 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition
Whitman, extremely stony, and similar soils: 81 percent
Minor components: 19 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Whitman, Extremely Stony

Setting
Landform: Hills, ground moraines, depressions, drainageways, drumlins
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile
Oi - 0 to 1 inches: peat
A - 1 to 10 inches: fine sandy loam
Bg - 10 to 17 inches: gravelly fine sandy loam
Cdg - 17 to 61 inches: fine sandy loam

Properties and qualities
Slope: 0 to 3 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 7 to 38 inches to densic material
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.0 inches)

USDA **Natural Resources**
      Conservation Service
Web Soil Survey
National Cooperative Soil Survey
12/9/2025
Page 1 of 2

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY041MA - Very Wet Till Depressions
Hydric soil rating: Yes

Minor Components

Ridgebury, extremely stony
Percent of map unit: 10 percent
Landform: Hills, ground moraines, depressions, drainageways, drumlins
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro
Percent of map unit: 5 percent
Landform: Outwash deltas, depressions, drainageways, outwash terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea
Percent of map unit: 3 percent
Landform: Bogs, marshes, swamps
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Woodbridge, extremely stony
Percent of map unit: 1 percent
Landform: Hills, ground moraines, drumlins
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Data Source Information

Soil Survey Area: Bristol County, Massachusetts, Northern Part
Survey Area Data: Version 18, Sep 5, 2025

Bristol County, Massachusetts, Northern Part

706C—Charlton-Rock outcrop-Paxton complex, 3 to 15 percent slopes

Map Unit Setting
National map unit symbol: 2x1k5
Elevation: 0 to 340 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition
Charlton, extremely stony, and similar soils: 35 percent
Rock outcrop: 25 percent
Paxton, extremely stony, and similar soils: 20 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Charlton, Extremely Stony

Setting
Landform: Hills, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile
Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 4 inches: fine sandy loam
Bw - 4 to 27 inches: gravelly fine sandy loam
C - 27 to 65 inches: gravelly fine sandy loam

Properties and qualities
Slope: 3 to 15 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Description of Rock Outcrop

Setting

Landform: Hills, ridges
Parent material: Igneous and metamorphic rock

Typical profile

R - 0 to 79 inches: bedrock

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Paxton, Extremely Stony

Setting

Landform: Hills, ground moraines, drumlins
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 10 inches: fine sandy loam
Bw1 - 10 to 17 inches: fine sandy loam
Bw2 - 17 to 28 inches: fine sandy loam
Cd - 28 to 67 inches: gravelly fine sandy loam

Properties and qualities

Slope: 3 to 15 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 20 to 43 inches to densic material
Drainage class: Well drained
Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Montauk, extremely stony

Percent of map unit: 7 percent
Landform: Recessionial moraines, hills, ground moraines, drumlins
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Woodbridge, extremely stony

Percent of map unit: 5 percent
Landform: Hills, ground moraines, drumlins
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Gloucester, extremely stony

Percent of map unit: 4 percent
Landform: Ground moraines
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Ridgebury, extremely stony

Percent of map unit: 4 percent
Landform: Hills, ground moraines, depressions, drainageways, drumlins
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Concave

Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Bristol County, Massachusetts, Northern Part
Survey Area Data: Version 18, Sep 5, 2025

Attention must be given to ensure consistency in units. In particular, the Target Depth Factors must be converted to feet.

NRCS HYDROLOGIC SOIL TYPE	APPROX. SOIL TEXTURE	TARGET DEPTH FACTOR (F)
A	sand	**0.6-inch**
B	loam	**0.35-inch**
C	silty loam	**0.25-inch**
D	clay	**0.1-inch**

Table 2.3.2: Recharge Target Depth by Hydrologic Soil Group

When a site contains multiple Hydrologic Soil Groups, determine the *Required Recharge Volume* for each impervious area by Hydrologic Soil Group and then add the volumes together.

Example: Assume a ten (10) acre site. 5.0 acres are proposed to be developed for a retail use. A section of the entrance roadway is to be bridged over a stream that is classified as land under water. As such, the bridging is subject to the Wetlands Protection Act Regulations, and the Stormwater Management Standards apply to stormwater runoff from all proposed roads, parking areas, and rooftops. Of the 5.0 acres proposed to be developed, 2 acres of impervious surfaces are proposed atop Hydrologic Soil Group (HSG) "A" soils, 1 acre of impervious surfaces atop HSG "B" soil, 1.5 acres of impervious surfaces atop HSG "C" soil, and 0.5 acres are proposed to be landscaped area. The remaining 5.0 acres, located on HSG "A" soil, are proposed to remain forested. Determine the *Required Recharge Volume*.

Solution: The *Required Recharge Volume* is determined only for the impervious surfaces. The 5.0-acre forested area and the 0.5-acre landscaped area are not impervious areas. Although converted from forest, landscaped area is pervious area for purposes of Standard 3. Use *Equation (1)* to determine the *Required Recharge Volume* for each Hydrologic Soil Group covered by impervious area. Add together the *Required Recharge Volumes* determined for each HSG.

Rv = F x impervious area

Rv = [(F$_{HSG "A"}$) (Area$_1$)] + [(F$_{HSG "B"}$) (Area$_2$)] + [(F$_{HSG "C"}$)(Area$_3$)] + [(F$_{HSG "D"}$)(Area$_4$)] **Equation (2)**

Rv = [(0.6-in/12)(2 acres)] + [(0.35-in/12)(1 acre)] + [(0.25-in/12)(1.5 acres)] + [(0.1-in/12)(0 acres)]

Rv = 0.1605 acre-feet

Rv = 0.1605 acre-feet x 43560 square feet/acre-feet = 6,991 cubic feet or *258.9 cubic yards*

Type III 24-hr Rainfall=1.29"

Pond 2P: Infiltration Trench
Hydrograph
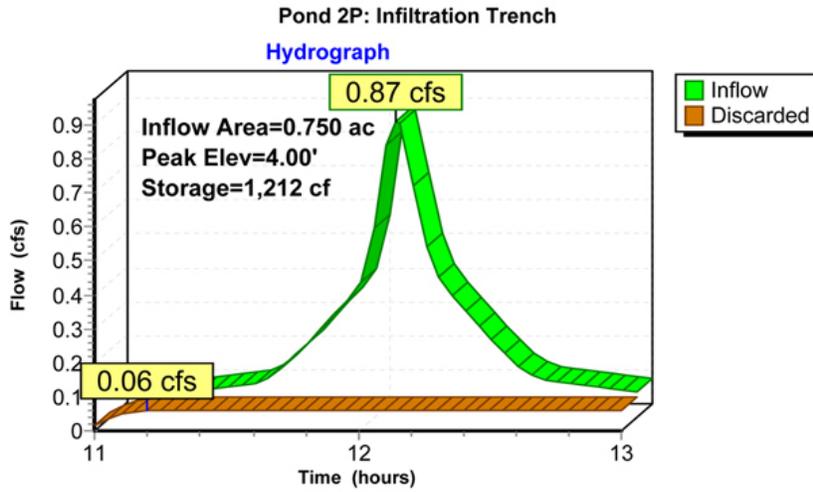
Table 2.3.3. 1982 Rawls Rates[18]

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

---

[18] Rawls, Brakensiek and Saxton, 1982