Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Saturday, 05 / 9 / 2020

Pond No. 1 - A1-2

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 118.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	118.00	14,200	0	0
2.89	120.89	20,100	49,312	49,312
2.90	120.90	62,300	393	49,705
3.00	121.00	72,800	6,748	56,452
4.00	122.00	77,177	74,970	131,423
6.89	124.89	90,900	242,577	374,000
6.90	124.90	105,100	979	374,979
7.00	125.00	119,400	11,216	386,195
10.49	128.49	140,400	452,811	839,006
10.50	128.50	162,000	1,511	840,517
11.00	129.00	167,400	82,338	922,855

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	Inactive	0.00	0.00
Span (in)	= 24.00	12.00	0.00	0.00
No. Barrels	= 1	2	0	0
Invert El. (ft)	= 116.20	122.00	0.00	0.00
Length (ft)	= 620.00	0.50	0.00	0.00
Slope (%)	= 2.00	0.00	0.00	n/a
N-Value	= .011	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.00	0.50	40.00	0.00
Crest El. (ft)	= 124.00	123.50	128.00	0.00
Weir Coeff.	= 3.33	3.33	2.60	3.33
Weir Type	= 1	Rect	Broad	---
Multi-Stage	= Yes	Yes	No	No

Exfil.(in/hr) = 1.500 (by Contour)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	118.00	0.00	0.00	---	---	0.00	0.00	0.00	---	0.000	---	0.000
2.89	49,312	120.89	13.65 ic	0.00	---	---	0.00	0.00	0.00	---	0.698	---	0.698
2.90	49,705	120.90	13.65 ic	0.00	---	---	0.00	0.00	0.00	---	2.163	---	2.163
3.00	56,452	121.00	13.65 ic	0.00	---	---	0.00	0.00	0.00	---	2.528	---	2.528
4.00	131,423	122.00	13.65 ic	0.00	---	---	0.00	0.00	0.00	---	2.680	---	2.680
6.89	374,000	124.89	30.69 ic	0.00	---	---	27.96	2.73	0.00	---	3.156	---	33.84
6.90	374,979	124.90	31.19 ic	0.00	---	---	28.43	2.76	0.00	---	3.649	---	34.84
7.00	386,195	125.00	36.36 ic	0.00	---	---	33.30	3.06	0.00	---	4.146	---	40.50
10.49	839,006	128.49	45.46 oc	0.00	---	---	43.03 s	2.42 s	35.67	---	4.875	---	86.00
10.50	840,517	128.50	45.47 oc	0.00	---	---	42.96 s	2.42 s	36.77	---	5.625	---	87.77
11.00	922,855	129.00	45.98 oc	0.00	---	---	43.51 s	2.42 s	104.00	---	5.812	---	155.74

STORMWATER POND DESIGN CRITERIA
Env-Wq 1508.03

Type/Node Name: **A1-3 Dry Extended Detention Pond with Micro Pool**

Enter the type of stormwater pond (e.g., Wet Pond) and the node name in the drainage analysis, if applicable

15.25	ac	A = Area draining to the practice	
10.97	ac	A_I = Impervious area draining to the practice	
0.72	decimal	I = percent impervious area draining to the practice, in decimal form	
0.70	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
10.64	ac-in	WQV= 1" x Rv x A	
38,607	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
3,861	cf	10% x WQV (check calc for sediment forebay and micropool volume)	
19,303	cf	50% x WQV (check calc for extended detention volume)	
23,000	cf	V_{SED} = sediment forebay volume	← ≥ 10%WQV
4,600	cf	V_{PP} = permanent pool volume (volume below the lowest invert of the outlet structure) Attach stage-storage table.	
yes	cf	Extended Detention?[1]	← ≤ 50% WQV
34,007		V_{ED} = Volume of Extended detention (if "yes is given in box above)	
131.75		E_{ED} = elevation of WQV if "yes" is given in box above[2]	
0.79	cfs	$2Q_{avg}$ = 2* V_{ED} / 24 hrs * (1hr / 3600 sec) (used to check against Q_{EDmax} below)	
0.42	cfs	Q_{EDmax} = discharge at the E_{ED} (attach stage-discharge table)	← <$2Q_{avg}$
44.98	hours	T_{ED} = drawdown time of extended detention = $2V_{ED}/Q_{EDmax}$	← ≥ 24-hrs
4.00	:1	Pond side slopes	← ≥3:1
129.00	ft	Elevation of seasonal high water table	
130.75	ft	Elevation of lowest pond outlet	
124.00	ft	Max floor = maximum elevation of pond bottom (ft)	
121.00	ft	Minimum floor (to maintain depth at less than 8')	← ≤ 8 ft
130.00	ft	Elevation of pond floor[3]	← ≤ Max floor and > Min floor
415.00	ft	Length of the flow path between the inlet and outlet at mid-depth	
125.00	ft	Average Width ([average of the top width + average bottom width]/2)	
3.32	:1	Length to Average Width ratio	← ≥ 3:1
Yes	Yes/No	The perimeter should be curvilinear.	
Yes	Yes/No	The inlet and outlet should be located as far apart as possible.	
No	Yes/No	Is there a manually-controlled drain to dewater the pond over a 24hr period?	
If no state why:		Small & Shallow perminate pond.	
Trash Rack over 4" low flow orifice		What mechanism is proposed to prevent the outlet structure from clogging (applicable for orifices/weirs with a dimension of <6")?	
133.89	ft	Peak elevation of the 50-year storm event	
135.00	ft	Berm elevation of the pond	
YES		50 peak elevation ≤ the berm elevation?	← yes

1. If the entire WQV is stored in the perm. pool, there is no extended det., and the following five lines do not apply.
2. This is the elevation of WQV if the hydrologic analysis is set up to include the permanent pool storage in the node description.
3. If the pond floor elevation is above the max floor elev., a hydrologic budget must be submitted to demonstrate that a minimum depth of 3 feet can be maintained. (First check whether a revised "lowest pond outlet" elev. will resolve the issue.)

Designer's Notes:

Average width = (34+34+218+218+100)/5 --> Multiple cross sections

Pond Report

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Pond No. 2 - A1-3

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 130.75 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	130.75	27,700	0	0
0.25	131.00	31,540	7,399	7,399
1.25	132.00	48,973	39,934	47,333
2.25	133.00	55,428	52,162	99,495
3.25	134.00	61,331	58,349	157,844
4.25	135.00	66,021	63,655	221,499

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	4.00	0.00	0.00
Span (in)	= 24.00	4.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 130.75	130.75	0.00	0.00
Length (ft)	= 470.00	0.50	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

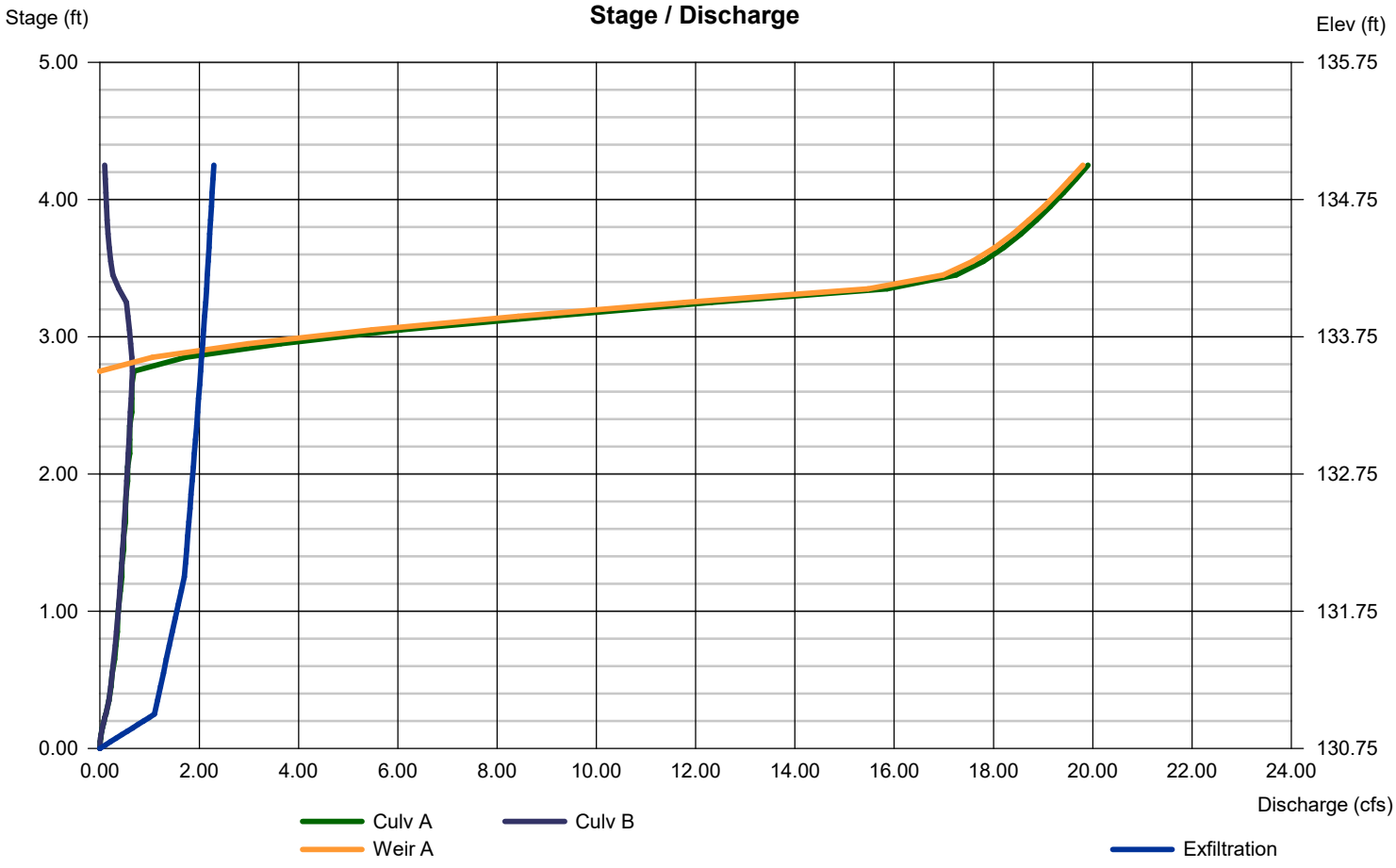
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.00	0.00	0.00	0.00
Crest El. (ft)	= 133.50	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 1.500 (by Contour)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



Pond Report

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Pond No. 2 - A1-3

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 130.75 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	130.75	27,700	0	0
0.25	131.00	31,540	7,399	7,399
1.25	132.00	48,973	39,934	47,333
2.25	133.00	55,428	52,162	99,495
3.25	134.00	61,331	58,349	157,844
4.25	135.00	66,021	63,655	221,499

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	4.00	0.00	0.00
Span (in)	= 24.00	4.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 130.75	130.75	0.00	0.00
Length (ft)	= 470.00	0.50	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.00	0.00	0.00	0.00
Crest El. (ft)	= 133.50	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 1.500 (by Contour)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	130.75	0.00	0.00	---	---	0.00	---	---	---	0.000	---	0.000
0.25	7,399	131.00	0.12 ic	0.12 ic	---	---	0.00	---	---	---	1.095	---	1.212
1.25	47,333	132.00	0.44 ic	0.42 ic	---	---	0.00	---	---	---	1.700	---	2.118
2.25	99,495	133.00	0.60 ic	0.59 ic	---	---	0.00	---	---	---	1.925	---	2.511
3.25	157,844	134.00	12.32 ic	0.53 ic	---	---	11.77	---	---	---	2.130	---	14.43
4.25	221,499	135.00	19.90 oc	0.10 ic	---	---	19.80 s	---	---	---	2.292	---	22.19

INFILTRATION PRACTICE CRITERIA
(Env-Wq 1508.06)

Type/Node Name: **A1-4 FOREBAY FEATURE ONLY to Infiltration Basin**

Enter the type of infiltration practice (e.g., basin, trench) and the node name in the drainage analysis, if applicable

Yes		Have you reviewed Env-Wq 1508.06(a) to ensure that infiltration is allowed?	
40.57	ac	A = Area draining to the practice	
28.33	ac	A_I = Impervious area draining to the practice	
0.70	decimal	I = percent impervious area draining to the practice, in decimal form	
0.68	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
27.53	ac-in	WQV= 1" x Rv x A	
99,918	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
24,979	cf	25% x WQV (check calc for sediment forebay volume)	
Sed. Forebay		Method of pretreatment? (not required for clean or roof runoff)	
29,250	cf	V_{SED} = sediment forebay volume, if used for pretreatment	← ≥ 25%WQV
N/A	cf	V = volume[1] (attach a stage-storage table)	← ≥ WQV
N/A	sf	A_{SA} = surface area of the bottom of the pond	
N/A	iph	$Ksat_{DESIGN}$ = design infiltration rate[2]	
-	hours	T_{DRAIN} = drain time = V / (A_{SA} * I_{DESIGN})	← ≤ 72-hrs
132.25	feet	E_{BTM} = elevation of the bottom of the basin	
129.00	feet	E_{SHWT} = elevation of SHWT (if none found, enter the lowest elevation of the test pit)	
130.00	feet	E_{ROCK} = elevation of bedrock (if none found, enter the lowest elevation of the test pit)	
3.25	feet	D_{SHWT} = separation from SHWT	← ≥ *[3]
2.3	feet	D_{ROCK} = separation from bedrock	← ≥ *[3]
	ft	D_{amend} = Depth of amended soil, if applicable due high infiltation rate	← ≥ 24"
	ft	D_T = depth of trench, if trench proposed	← 4 - 10 ft
	Yes/No	If a trench or underground system is proposed, observation well provided[4]	
		If a trench is proposed, material in trench	
On-site Soils		If a basin is proposed, basin floor material	
Yes	Yes/No	If a basin is proposed, the perimeter should be curvilinear, basin floor shall be flat.	
4.0	:1	If a basin is proposed, pond side slopes	← ≥3:1
137.31	ft	Peak elevation of the 10-year storm event (infiltration can be used in analysis)	
138.38	ft	Peak elevation of the 50-year storm event (infiltration can be used in analysis)	
139.50	ft	Elevation of the top of the practice (if a basin, this is the elevation of the berm)	
YES		10 peak elevation ≤ Elevation of the top of the trench?[5]	← yes
YES		If a basin is proposed, 50-year peak elevation ≤ Elevation of berm?	← yes

1. Volume below the lowest invert of the outlet structure and excludes forebay volume
2. $Ksat_{DESIGN}$ includes a factor of safety. See Env-Wq 1504.14 for requirements for determining the infiltr. rate
3. 1' separation if treatment not required; 4' for treatment in GPAs & WSIPAs; & 3' in all other areas.
4. Clean, washed well graded diameter of 1.5 to 3 inches above the in-situ soil.
5. If 50-year peak elevation exceeds top of trench, the overflow must be routed in HydroCAD as secondary discharge.

Designer's Notes:

This feature is used only for attenuation and to accomidate, ata a minimum, the 25% pre-tretment volume of the watershed before dischargeing stormwater to Infiltration basin B6-2 for treatment and groundwater recharge.

Pond Report

Pond No. 3 - A1-4

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 132.25 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	132.25	13,450	0	0
0.75	133.00	17,300	11,500	11,500
1.75	134.00	22,600	19,889	31,389
2.75	135.00	28,000	25,249	56,638
3.75	136.00	33,700	30,803	87,441
4.75	137.00	39,700	36,655	124,097
5.00	137.25	41,100	10,098	134,195
5.75	138.00	78,100	43,960	178,155
6.75	139.00	95,100	86,452	264,607
7.25	139.50	102,000	49,260	313,867

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 36.00	10.00	0.00	0.00
Span (in)	= 36.00	10.00	0.00	0.00
No. Barrels	= 1	4	0	0
Invert El. (ft)	= 131.25	134.00	0.00	0.00
Length (ft)	= 144.00	0.50	0.00	0.00
Slope (%)	= 1.73	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.00	0.00	0.00	0.00
Crest El. (ft)	= 135.25	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Contour)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	132.25	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.75	11,500	133.00	7.16 ic	0.00	---	---	0.00	---	---	---	---	---	0.000
1.75	31,389	134.00	7.16 ic	0.00	---	---	0.00	---	---	---	---	---	0.000
2.75	56,638	135.00	8.04 ic	8.02 ic	---	---	0.00	---	---	---	---	---	8.022
3.75	87,441	136.00	34.90 ic	13.22 ic	---	---	21.63	---	---	---	---	---	34.85
4.75	124,097	137.00	65.13 ic	8.05 ic	---	---	57.08 s	---	---	---	---	---	65.13
5.00	134,195	137.25	68.37 ic	7.15 ic	---	---	61.22 s	---	---	---	---	---	68.37
5.75	178,155	138.00	76.04 ic	5.33 ic	---	---	70.70 s	---	---	---	---	---	76.03
6.75	264,607	139.00	84.10 ic	3.97 ic	---	---	80.11 s	---	---	---	---	---	84.08
7.25	313,867	139.50	87.67 ic	3.53 ic	---	---	84.12 s	---	---	---	---	---	87.65

INFILTRATION PRACTICE CRITERIA
(Env-Wq 1508.06)

Type/Node Name: **A1-5 Infiltration Basin**

Enter the type of infiltration practice (e.g., basin, trench) and the node name in the drainage analysis, if applicable

Yes		Have you reviewed Env-Wq 1508.06(a) to ensure that infiltration is allowed?	
13.12	ac	A = Area draining to the practice	
9.11	ac	A_I = Impervious area draining to the practice	
0.69	decimal	I = percent impervious area draining to the practice, in decimal form	
0.67	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
8.86	ac-in	WQV= 1" x Rv x A	
32,144	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
8,036	cf	25% x WQV (check calc for sediment forebay volume)	
Sed. Forebay		Method of pretreatment? (not required for clean or roof runoff)	
11,544	cf	V_{SED} = sediment forebay volume, if used for pretreatment	← ≥ 25%WQV
57,995	cf	V = volume[1] (attach a stage-storage table)	← ≥ WQV
35,500	sf	A_{SA} = surface area of the bottom of the pond	
1.50	iph	$Ksat_{DESIGN}$ = design infiltration rate[2]	
7.2	hours	T_{DRAIN} = drain time = V / (A_{SA} * I_{DESIGN})	← ≤ 72-hrs
133.00	feet	E_{BTM} = elevation of the bottom of the basin	
130.00	feet	E_{SHWT} = elevation of SHWT (if none found, enter the lowest elevation of the test pit)	
123.00	feet	E_{ROCK} = elevation of bedrock (if none found, enter the lowest elevation of the test pit)	
3.00	feet	D_{SHWT} = separation from SHWT	← ≥ *[3]
10.0	feet	D_{ROCK} = separation from bedrock	← ≥ *[3]
	ft	D_{amend} = Depth of amended soil, if applicable due high infiltation rate	← ≥ 24"
	ft	D_T = depth of trench, if trench proposed	← 4 - 10 ft
	Yes/No	If a trench or underground system is proposed, observation well provided[4]	
		If a trench is proposed, material in trench	
On-site Soils		If a basin is proposed, basin floor material	
Yes	Yes/No	If a basin is proposed, the perimeter should be curvilinear, basin floor shall be flat.	
4.0	:1	If a basin is proposed, pond side slopes	← ≥3:1
135.22	ft	Peak elevation of the 10-year storm event (infiltration can be used in analysis)	
135.86	ft	Peak elevation of the 50-year storm event (infiltration can be used in analysis)	
137.00	ft	Elevation of the top of the practice (if a basin, this is the elevation of the berm)	
YES		10 peak elevation ≤ Elevation of the top of the trench?[5]	← yes
YES		If a basin is proposed, 50-year peak elevation ≤ Elevation of berm?	← yes

1. Volume below the lowest invert of the outlet structure and excludes forebay volume
2. $Ksat_{DESIGN}$ includes a factor of safety. See Env-Wq 1504.14 for requirements for determining the infiltr. rate
3. 1' separation if treatment not required; 4' for treatment in GPAs & WSIPAs; & 3' in all other areas.
4. Clean, washed well graded diameter of 1.5 to 3 inches above the in-situ soil.
5. If 50-year peak elevation exceeds top of trench, the overflow must be routed in HydroCAD as secondary discharge.

Designer's Notes:

Two Sediment Forebays are included in this pond.

Each forebay sub-watershed's WQV was calculated and the forebay sized to a capacity greater than 25%

The number above reflect the combine forebay volume.

Pond Report

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Pond No. 4 - A1-5

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 133.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	133.00	35,500	0	0
1.00	134.00	39,300	37,380	37,380
2.00	135.00	43,200	41,231	78,611
3.00	136.00	47,200	45,181	123,791
4.00	137.00	51,300	49,231	173,022

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	Inactive	0.00	0.00
Span (in)	= 24.00	6.00	0.00	0.00
No. Barrels	= 1	4	0	0
Invert El. (ft)	= 132.00	134.50	0.00	0.00
Length (ft)	= 185.00	0.50	0.00	0.00
Slope (%)	= 1.06	0.00	0.00	n/a
N-Value	= .012	.012	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.00	0.00	30.00	0.00
Crest El. (ft)	= 135.00	134.50	136.00	0.00
Weir Coeff.	= 3.33	4.40	2.60	3.33
Weir Type	= 1	120 degV	Broad	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 1.500 (by Contour)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	133.00	0.00	0.00	---	---	0.00	---	0.00	---	0.000	---	0.000
1.00	37,380	134.00	5.35 ic	0.00	---	---	0.00	---	0.00	---	1.365	---	1.365
2.00	78,611	135.00	5.35 ic	0.00	---	---	0.00	0.78	0.00	---	1.500	---	2.278
3.00	123,791	136.00	24.68 ic	0.00	---	---	24.68 s	12.12	0.00	---	1.639	---	38.44
4.00	173,022	137.00	29.99 ic	0.00	---	---	29.98 s	43.47	78.00	---	1.781	---	153.23

General Calculations - WQV and WQF (optional worksheet)

This worksheet may be useful when designing a BMP that does not fit into one of the specific worksheets already provided (i.e. for a technology which is not a stormwater wetland, infiltration practice, etc.)

Water Quality Volume (WQV)

7.21	ac	A = Area draining to the practice
4.66	ac	A_I = Impervious area draining to the practice
0.65	decimal	I = percent impervious area draining to the practice, in decimal form
0.63	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)
4.55	ac-in	WQV= 1" x Rv x A
16,533	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")

Water Quality Flow (WQF)

1	inches	P = amount of rainfall. For WQF in NH, P = 1".
0.63	inches	Q = water quality depth. Q = WQV/A
96	unitless	CN = unit peak discharge curve number. $CN = 1000/(10+5P+10Q-10*[Q^2 + 1.25*Q*P]^{0.5})$
0.4	inches	S = potential maximum retention. S = (1000/CN) - 10
0.083	inches	Ia = initial abstraction. Ia = 0.2S
10.0	minutes	T_c = Time of Concentration
660.0	cfs/mi^2/in	qu is the unit peak discharge. Obtain this value from TR-55 exhibits 4-II and 4-III
4.697	cfs	WQF = q_u x WQV. Conversion: to convert "cfs/mi^2/in * ac-in" to "cfs" multiply by 1mi^2/640ac

Designer's Notes: Watershed A1-6

An 8 ft model, down stream defender hydrodynamic unit will be used to treat the water quality volume from this watershed.
The units is rated for 80% TSS removeal of OK-110 partical size for flows up to 8.82cfs
Product details are attached.

While this unit will treat 80% TSS removal, treated flows are discharged to Infiltration Basin A1-2, providing additional treatment at 90% TSS removal.

Technical Abstract
Downstream Defender®

Performance Verification of Fine Sediment Removal with US Silica OK-110

The Downstream Defender® is an advanced Hydrodynamic Vortex Separator intended for removing the bulk of the pollutant load from urban stormwater runoff. Flow modifying internal components (Fig.1) differentiate the Downstream Defender® from conventional gravity-based and other vortex separators. These internals are designed to facilitate high-rate separation of pollutants and minimize turbulence. The design also ensures that bypassing is prevented and the entire flow is treated. Compared to devices that have poorly designed internal components and/or an internal bypass that discharges a portion of flow with no treatment, the Downstream Defender® captures and retains more of the annual pollutant load.

Capable of providing high pollutant removals for a wide range of flow rates with minimal headlosses, the Downstream Defender® is an economical solution for constrained sites. Its proven efficiency ensures the longevity and simplifies the maintenance of subsurface storage, infiltration and filtration practices.

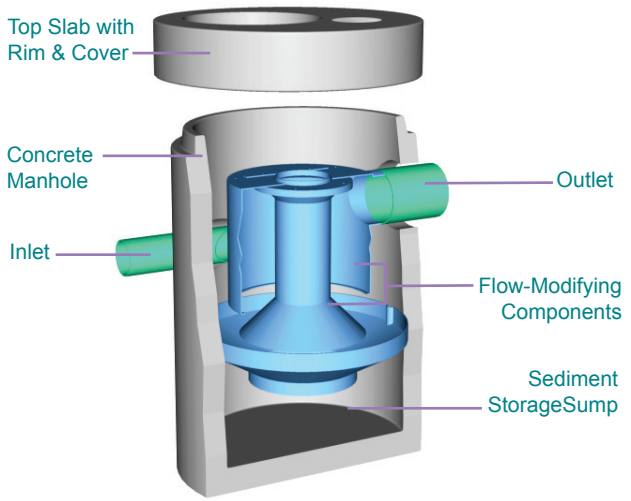

Fig.1 The unique internal components of the Downsream Defender® enhance pollutant removal performance and prevent washout.

Fine Sediment Removal

To quantify the pollutant removal efficacy, a full-scale 4-ft diameter Downstream Defender® was tested under controlled laboratory conditions. Test procedures were based on protocols used for regulatory approval throughout North America.

Commercially available U.S. Silica brand OK-110 (Fig.2) was used to determine the Downstream Defender® treatment loading rate that achieves an 80%-removal efficiency goal. OK-110 has a fine gradation primarily in the 75-150 micron range with a mean of 106-micron. Because about 20% of the particles are between 50-75 micron, use of OK-110 sediment provides a conservative estimate of annual load reductions.

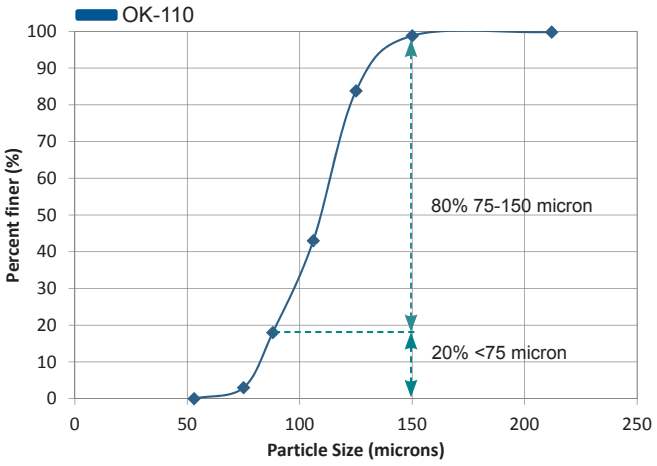

Fig.2 Particle size distribution of the U.S. Silica OK-110 test sediment.

For performance testing, clean water from a 23,000 gal. reservoir was pumped to the Downstream Defender® at flow rates varying from about 0.4 to 2.2 cfs (Fig.3). A concentrated slurry of test sediment was pumped into the inlet pipe at an injection rate that delivered influent concentrations ranging from 200-300 mg/L.

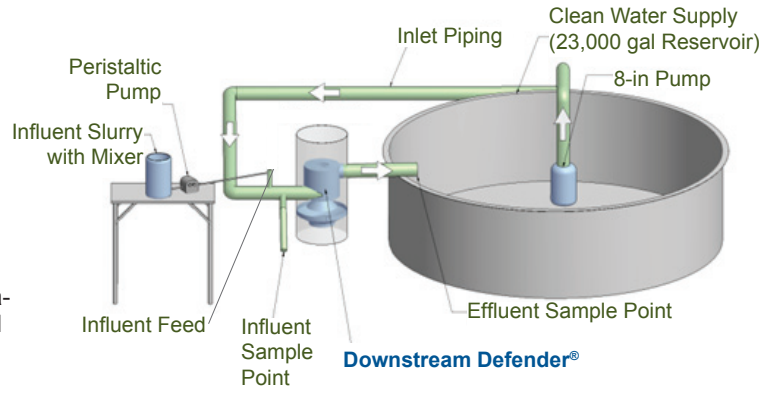

Fig.3 Set-up of the Portland, Maine hydraulic testing facility.

Downstream Defender®

Performance Test Procedures

Five influent and effluent grab samples were taken at 4 different flow rates for a total of 20 samples (Fig.4). All influent and effluent samples were analyzed for Total Suspended Solids (TSS) by APHA SM2540D.

Fig.4 Grab samples were collected from the influent (not pictured) and effluent (above) over a range of hydraulic loading rates.

Performance Results

The resulting test data demonstrates 80% removal of fine sediment for all flows up to 1.56 cfs and 65% efficiency at the highest flow rate tested at 2.2 cfs. As the Downstream Defender® does not incorporate an internal bypass, it will continue to capture sediment at all states of flow up to and including its rated peak treatment flow rate (PTFR). By way of contrast, internally bypassing units will begin to discharge untreated flows as soon as flows exceed their rated treatment flows. For example, tests for the 4-ft Downstream Defender® clearly show continual positive removal efficiencies for flows in excess of its rated treatment flow of 1.56 cfs and positive removals even at its peak rated flow of 3 cfs (Fig.5).

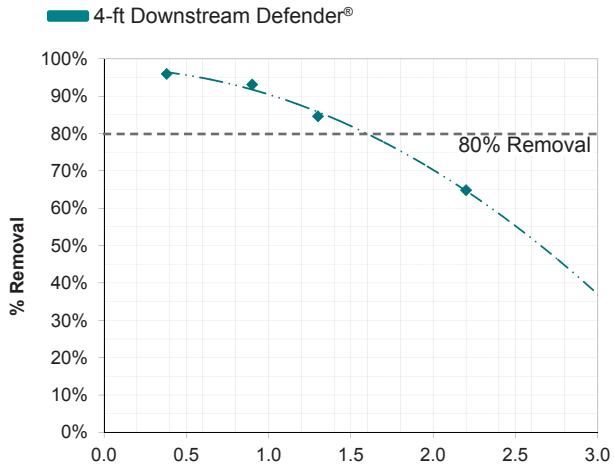

Fig.5 OK-110 silica sand removal efficiency results of the 4-ft Downstream Defender®.

These results confirm the efficacy of the Downstream Defender® for pollutant capture over a wide range of tested flow rates and highlight the benefits of its specially designed internal components that stabilize the flows and prevent bypassing of untreated flow.

Downstream Defender® Sizing

Test results were used to determine the treatment flow rates for larger Downstream Defender® models (see table below). For design purposes, the selected model's Treatment Flow Rate must be greater or equal to the site's Water Quality Flow Rate (WQf).

Model Unit Diameter	Maximum Pipe Diameter	Treatment Flow Rates for 80% TSS Removal	Peak Treatment Flow Rates
(ft)	(in)	(cfs)	(cfs)
4	12	1.56	3.0
6	18	4.25	8.0
8	24	8.82	15.0
10	30	15.42	25.0
12	36	24.32	38.0

The PTFR and maximum pipe size must be considered to determine whether the application of a given Downstream Defender® model is appropriate for the site. An offline configuration or arrangement may be used to overcome constraints presented by the Downstream Defender®'s maximum allowable pipe diameter or PTFR. Contact Hydro International for technical support and design assistance.

Fig.6 Model sizes range from 4-ft to 12-ft in diameter.

Hydro International, 94 Hutchins Drive, Portland, ME 04102
Tel: 207.756.6200 Fax: 207.756.6212
Email: stormwaterinquiry@hydro-int.com Web: www.hydro-int.com

Stormwater Solutions

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INFILTRATION PRACTICE CRITERIA
(Env-Wq 1508.06)

Type/Node Name: **A6-2 Infiltration Basin**

Enter the type of infiltration practice (e.g., basin, trench) and the node name in the drainage analysis, if applicable

Yes		Have you reviewed Env-Wq 1508.06(a) to ensure that infiltration is allowed?	
29.90	ac	A = Area draining to the practice	
23.47	ac	A_I = Impervious area draining to the practice	
0.78	decimal	I = percent impervious area draining to the practice, in decimal form	
0.76	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
22.62	ac-in	WQV= 1" x Rv x A	
82,103	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
20,526	cf	25% x WQV (check calc for sediment forebay volume)	
Sed. Forebay		Method of pretreatment? (not required for clean or roof runoff)	
21,812	cf	V_{SED} = sediment forebay volume, if used for pretreatment	← ≥ 25%WQV
161,989	cf	V = volume[1] (attach a stage-storage table)	← ≥ WQV
34,672	sf	A_{SA} = surface area of the bottom of the pond	
1.50	iph	$Ksat_{DESIGN}$ = design infiltration rate[2]	
18.9	hours	T_{DRAIN} = drain time = V / (A_{SA} * I_{DESIGN})	← ≤ 72-hrs
129.00	feet	E_{BTM} = elevation of the bottom of the basin	
125.00	feet	E_{SHWT} = elevation of SHWT (if none found, enter the lowest elevation of the test pit)	
109.00	feet	E_{ROCK} = elevation of bedrock (if none found, enter the lowest elevation of the test pit)	
4.00	feet	D_{SHWT} = separation from SHWT	← ≥ *[3]
20.0	feet	D_{ROCK} = separation from bedrock	← ≥ *[3]
	ft	D_{amend} = Depth of amended soil, if applicable due high infiltation rate	← ≥ 24"
	ft	D_T = depth of trench, if trench proposed	← 4 - 10 ft
	Yes/No	If a trench or underground system is proposed, observation well provided[4]	
		If a trench is proposed, material in trench	
	On-site Soil	If a basin is proposed, basin floor material	
Yes	Yes/No	If a basin is proposed, the perimeter should be curvilinear, basin floor shall be flat.	
4.0	:1	If a basin is proposed, pond side slopes	← ≥3:1
117.29	ft	Peak elevation of the 10-year storm event (infiltration can be used in analysis)	
118.64	ft	Peak elevation of the 50-year storm event (infiltration can be used in analysis)	
120.00	ft	Elevation of the top of the practice (if a basin, this is the elevation of the berm)	
YES		10 peak elevation ≤ Elevation of the top of the trench?[5]	← yes
YES		If a basin is proposed, 50-year peak elevation ≤ Elevation of berm?	← yes

1. Volume below the lowest invert of the outlet structure and excludes forebay volume
2. $Ksat_{DESIGN}$ includes a factor of safety. See Env-Wq 1504.14 for requirements for determining the infiltr. rate
3. 1' separation if treatment not required; 4' for treatment in GPAs & WSIPAs; & 3' in all other areas.
4. Clean, washed well graded diameter of 1.5 to 3 inches above the in-situ soil.
5. If 50-year peak elevation exceeds top of trench, the overflow must be routed in HydroCAD as secondary discharge.

Designer's Notes:

Two Sediment Forebays are included in this pond.

Each forebay sub-watershed's WQV was calculated and the forebay sized to a capacity greater than 25%

The number above reflect the combine forebay volume.

Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Saturday, 05 / 9 / 2020

Pond No. 8 - A6-2

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 112.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	112.00	34,672	0	0
1.00	113.00	38,208	36,422	36,422
2.00	114.00	49,792	43,868	80,290
3.00	115.00	55,641	52,684	132,974
4.00	116.00	60,460	58,028	191,002
5.00	117.00	64,735	62,579	253,581
6.00	118.00	69,111	66,904	320,486
7.00	119.00	73,587	71,330	391,816
8.00	120.00	78,164	75,857	467,672

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	6.00	0.00	0.00
Span (in)	= 12.00	6.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 114.00	115.50	0.00	0.00
Length (ft)	= 55.00	0.50	0.00	0.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.00	30.00	0.00	0.00
Crest El. (ft)	= 118.00	119.00	0.00	0.00
Weir Coeff.	= 3.33	2.60	3.33	3.33
Weir Type	= Rect	Broad	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 1.500 (by Contour)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	112.00	0.00	0.00	---	---	0.00	0.00	---	---	0.000	---	0.000
1.00	36,422	113.00	0.00	0.00	---	---	0.00	0.00	---	---	1.327	---	1.327
2.00	80,290	114.00	0.00	0.00	---	---	0.00	0.00	---	---	1.729	---	1.729
3.00	132,974	115.00	0.00	0.00	---	---	0.00	0.00	---	---	1.932	---	1.932
4.00	191,002	116.00	0.48 ic	0.47 ic	---	---	0.00	0.00	---	---	2.099	---	2.572
5.00	253,581	117.00	1.07 ic	1.06 ic	---	---	0.00	0.00	---	---	2.248	---	3.305
6.00	320,486	118.00	1.44 ic	1.42 ic	---	---	0.00	0.00	---	---	2.400	---	3.818
7.00	391,816	119.00	7.49 oc	0.11 ic	---	---	7.38 s	0.00	---	---	2.555	---	10.05
8.00	467,672	120.00	8.29 oc	0.05 ic	---	---	8.13 s	78.00	---	---	2.714	---	88.89

INFILTRATION PRACTICE CRITERIA
(Env-Wq 1508.06)

Type/Node Name: **A11-2 Infiltration Basin**

Enter the type of infiltration practice (e.g., basin, trench) and the node name in the drainage analysis, if applicable

Yes		Have you reviewed Env-Wq 1508.06(a) to ensure that infiltration is allowed?	
41.65	ac	A = Area draining to the practice	
31.28	ac	A_I = Impervious area draining to the practice	
0.75	decimal	I = percent impervious area draining to the practice, in decimal form	
0.73	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
30.23	ac-in	WQV= 1" x Rv x A	
109,751	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
27,438	cf	25% x WQV (check calc for sediment forebay volume)	
Sed. Forebay		Method of pretreatment? (not required for clean or roof runoff)	
29,250	cf	V_{SED} = sediment forebay volume, if used for pretreatment	← ≥ 25%WQV
151,585	cf	V = volume[1] (attach a stage-storage table)	← ≥ WQV
60,871	sf	A_{SA} = surface area of the bottom of the pond	
1.50	iph	$Ksat_{DESIGN}$ = design infiltration rate[2]	
14.4	hours	T_{DRAIN} = drain time = V / (A_{SA} * I_{DESIGN})	← ≤ 72-hrs
114.00	feet	E_{BTM} = elevation of the bottom of the basin	
94.00	feet	E_{SHWT} = elevation of SHWT (if none found, enter the lowest elevation of the test pit)	
84.00	feet	E_{ROCK} = elevation of bedrock (if none found, enter the lowest elevation of the test pit)	
20.00	feet	D_{SHWT} = separation from SHWT	← ≥ *[3]
30.0	feet	D_{ROCK} = separation from bedrock	← ≥ *[3]
	ft	D_{amend} = Depth of amended soil, if applicable due high infiltation rate	← ≥ 24"
	ft	D_T = depth of trench, if trench proposed	← 4 - 10 ft
	Yes/No	If a trench or underground system is proposed, observation well provided[4]	
		If a trench is proposed, material in trench	
On-site Soils		If a basin is proposed, basin floor material	
Yes	Yes/No	If a basin is proposed, the perimeter should be curvilinear, basin floor shall be flat.	
4.0	:1	If a basin is proposed, pond side slopes	← ≥3:1
117.93	ft	Peak elevation of the 10-year storm event (infiltration can be used in analysis)	
118.93	ft	Peak elevation of the 50-year storm event (infiltration can be used in analysis)	
120.00	ft	Elevation of the top of the practice (if a basin, this is the elevation of the berm)	
YES		10 peak elevation ≤ Elevation of the top of the trench?[5]	← yes
YES		If a basin is proposed, 50-year peak elevation ≤ Elevation of berm?	← yes

1. Volume below the lowest invert of the outlet structure and excludes forebay volume
2. $Ksat_{DESIGN}$ includes a factor of safety. See Env-Wq 1504.14 for requirements for determining the infiltr. rate
3. 1' separation if treatment not required; 4' for treatment in GPAs & WSIPAs; & 3' in all other areas.
4. Clean, washed well graded diameter of 1.5 to 3 inches above the in-situ soil.
5. If 50-year peak elevation exceeds top of trench, the overflow must be routed in HydroCAD as secondary discharge.

Designer's Notes:

Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Saturday, 05 / 9 / 2020

Pond No. 10 - A11-2

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 113.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	114.00	60,871	0	0
1.00	115.00	66,010	63,417	63,417
2.00	116.00	71,182	68,573	131,990
3.00	117.00	85,827	78,383	210,372
4.00	118.00	93,006	89,384	299,756
5.00	119.00	99,952	96,449	396,204
6.00	120.00	105,628	102,767	498,971

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 36.00	Inactive	0.00	0.00
Span (in)	= 36.00	12.00	0.00	0.00
No. Barrels	= 1	3	0	0
Invert El. (ft)	= 115.00	116.50	0.00	0.00
Length (ft)	= 70.00	0.50	0.00	0.00
Slope (%)	= 5.67	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.00	0.00	30.00	0.00
Crest El. (ft)	= 117.50	116.75	119.00	0.00
Weir Coeff.	= 3.33	4.40	2.60	3.33
Weir Type	= 1	120 degV	Broad	---
Multi-Stage	= Yes	Yes	No	No

Exfil.(in/hr) = 1.500 (by Contour)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	114.00	0.00	0.00	---	---	0.00	---	0.00	---	0.000	---	0.000
1.00	63,417	115.00	0.00	0.00	---	---	0.00	---	0.00	---	2.292	---	2.292
2.00	131,990	116.00	0.00	0.00	---	---	0.00	---	0.00	---	2.472	---	2.472
3.00	210,372	117.00	0.15 ic	0.00	---	---	0.00	0.14	0.00	---	2.980	---	3.118
4.00	299,756	118.00	19.74 ic	0.00	---	---	11.77	7.68 s	0.00	---	3.229	---	22.69
5.00	396,204	119.00	51.15 ic	0.00	---	---	34.80 s	16.35 s	0.00	---	3.471	---	54.61
6.00	498,971	120.00	62.97 ic	0.00	---	---	39.96 s	23.00 s	78.00	---	3.668	---	144.62

INFILTRATION PRACTICE CRITERIA
(Env-Wq 1508.06)

Type/Node Name: **A11-3 Infiltration Basin**

Enter the type of infiltration practice (e.g., basin, trench) and the node name in the drainage analysis, if applicable

Yes		Have you reviewed Env-Wq 1508.06(a) to ensure that infiltration is allowed?	
3.46	ac	A = Area draining to the practice	
0.45	ac	A_I = Impervious area draining to the practice	
0.13	decimal	I = percent impervious area draining to the practice, in decimal form	
0.17	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
0.58	ac-in	WQV= 1" x Rv x A	
2,098	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
525	cf	25% x WQV (check calc for sediment forebay volume)	
Sed. Forebay		Method of pretreatment? (not required for clean or roof runoff)	
886	cf	V_{SED} = sediment forebay volume, if used for pretreatment	← ≥ 25%WQV
12,205	cf	V = volume[1] (attach a stage-storage table)	← ≥ WQV
1,100	sf	A_{SA} = surface area of the bottom of the pond	
1.50	iph	$Ksat_{DESIGN}$ = design infiltration rate[2]	
15.3	hours	T_{DRAIN} = drain time = V / (A_{SA} * I_{DESIGN})	← ≤ 72-hrs
108.00	feet	E_{BTM} = elevation of the bottom of the basin	
94.00	feet	E_{SHWT} = elevation of SHWT (if none found, enter the lowest elevation of the test pit)	
84.00	feet	E_{ROCK} = elevation of bedrock (if none found, enter the lowest elevation of the test pit)	
14.00	feet	D_{SHWT} = separation from SHWT	← ≥ *[3]
24.0	feet	D_{ROCK} = separation from bedrock	← ≥ *[3]
	ft	D_{amend} = Depth of amended soil, if applicable due high infiltation rate	← ≥ 24"
	ft	D_T = depth of trench, if trench proposed	← 4 - 10 ft
	Yes/No	If a trench or underground system is proposed, observation well provided[4]	
		If a trench is proposed, material in trench	
On-site Soils		If a basin is proposed, basin floor material	
Yes	Yes/No	If a basin is proposed, the perimeter should be curvilinear, basin floor shall be flat.	
4.0	:1	If a basin is proposed, pond side slopes	← ≥3:1
109.56	ft	Peak elevation of the 10-year storm event (infiltration can be used in analysis)	
110.67	ft	Peak elevation of the 50-year storm event (infiltration can be used in analysis)	
112.00	ft	Elevation of the top of the practice (if a basin, this is the elevation of the berm)	
YES		10 peak elevation ≤ Elevation of the top of the trench?[5]	← yes
YES		If a basin is proposed, 50-year peak elevation ≤ Elevation of berm?	← yes

1. Volume below the lowest invert of the outlet structure and excludes forebay volume
2. $Ksat_{DESIGN}$ includes a factor of safety. See Env-Wq 1504.14 for requirements for determining the infiltr. rate
3. 1' separation if treatment not required; 4' for treatment in GPAs & WSIPAs; & 3' in all other areas.
4. Clean, washed well graded diameter of 1.5 to 3 inches above the in-situ soil.
5. If 50-year peak elevation exceeds top of trench, the overflow must be routed in HydroCAD as secondary discharge.

Designer's Notes:

Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Saturday, 05 / 9 / 2020

Pond No. 11 - A11-3

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 108.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	108.00	1,100	0	0
4.00	112.00	4,100	9,764	9,764

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 107.00	0.00	0.00	0.00
Length (ft)	= 110.00	0.00	0.00	0.00
Slope (%)	= 1.36	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.00	30.00	0.00	0.00
Crest El. (ft)	= 109.25	112.00	0.00	0.00
Weir Coeff.	= 3.33	2.60	3.33	3.33
Weir Type	= 1	Broad	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 1.500 (by Contour)			
TW Elev. (ft)	= 0.00			

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	108.00	0.00	---	---	---	0.00	0.00	---	---	0.000	---	0.000
4.00	9,764	112.00	6.67 oc	---	---	---	6.44 s	0.00	---	---	0.142	---	6.584

INFILTRATION PRACTICE CRITERIA
(Env-Wq 1508.06)

Type/Node Name: **B1-2 Infiltration Basin**

Enter the type of infiltration practice (e.g., basin, trench) and the node name in the drainage analysis, if applicable

Yes		Have you reviewed Env-Wq 1508.06(a) to ensure that infiltration is allowed?	
15.90	ac	A = Area draining to the practice	
11.57	ac	A_I = Impervious area draining to the practice	
0.73	decimal	I = percent impervious area draining to the practice, in decimal form	
0.70	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
11.21	ac-in	WQV= 1" x Rv x A	
40,685	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
10,171	cf	25% x WQV (check calc for sediment forebay volume)	
Sed. Forebay		Method of pretreatment? (not required for clean or roof runoff)	
13,380	cf	V_{SED} = sediment forebay volume, if used for pretreatment	← ≥ 25%WQV
97,159	cf	V = volume[1] (attach a stage-storage table)	← ≥ WQV
23,219	sf	A_{SA} = surface area of the bottom of the pond	
1.50	iph	$Ksat_{DESIGN}$ = design infiltration rate[2]	
14.0	hours	T_{DRAIN} = drain time = V / (A_{SA} * I_{DESIGN})	← ≤ 72-hrs
129.00	feet	E_{BTM} = elevation of the bottom of the basin	
125.00	feet	E_{SHWT} = elevation of SHWT (if none found, enter the lowest elevation of the test pit)	
118.00	feet	E_{ROCK} = elevation of bedrock (if none found, enter the lowest elevation of the test pit)	
4.00	feet	D_{SHWT} = separation from SHWT	← ≥ *[3]
11.0	feet	D_{ROCK} = separation from bedrock	← ≥ *[3]
	ft	D_{amend} = Depth of amended soil, if applicable due high infiltation rate	← ≥ 24"
	ft	D_T = depth of trench, if trench proposed	← 4 - 10 ft
	Yes/No	If a trench or underground system is proposed, observation well provided[4]	
		If a trench is proposed, material in trench	
On-site Soils		If a basin is proposed, basin floor material	
Yes	Yes/No	If a basin is proposed, the perimeter should be curvilinear, basin floor shall be flat.	
4.0	:1	If a basin is proposed, pond side slopes	← ≥3:1
132.77	ft	Peak elevation of the 10-year storm event (infiltration can be used in analysis)	
133.76	ft	Peak elevation of the 50-year storm event (infiltration can be used in analysis)	
135.00	ft	Elevation of the top of the practice (if a basin, this is the elevation of the berm)	
YES		10 peak elevation ≤ Elevation of the top of the trench?[5]	← yes
YES		If a basin is proposed, 50-year peak elevation ≤ Elevation of berm?	← yes

1. Volume below the lowest invert of the outlet structure and excludes forebay volume
2. $Ksat_{DESIGN}$ includes a factor of safety. See Env-Wq 1504.14 for requirements for determining the infiltr. rate
3. 1' separation if treatment not required; 4' for treatment in GPAs & WSIPAs; & 3' in all other areas.
4. Clean, washed well graded diameter of 1.5 to 3 inches above the in-situ soil.
5. If 50-year peak elevation exceeds top of trench, the overflow must be routed in HydroCAD as secondary discharge.

Designer's Notes:

Two Sediment Forebays are included in this pond.

Each forebay sub-watershed's WQV was calculated and the forebay sized to a capacity greater than 25%

The number above reflect the combine forebay volume.

Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Saturday, 05 / 9 / 2020

Pond No. 13 - B1-2

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 129.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	129.00	23,219	0	0
1.00	130.00	26,154	24,669	24,669
2.00	131.00	36,456	31,160	55,829
3.00	132.00	41,922	39,153	94,982
4.00	133.00	47,300	44,580	139,562
5.00	134.00	51,019	49,143	188,705
6.00	135.00	54,834	52,910	241,615

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	6.00	0.00	0.00
Span (in)	= 12.00	6.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 128.00	132.00	0.00	0.00
Length (ft)	= 141.00	0.50	0.00	0.00
Slope (%)	= 0.71	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.00	30.00	0.00	0.00
Crest El. (ft)	= 133.50	134.00	0.00	0.00
Weir Coeff.	= 3.33	2.60	3.33	3.33
Weir Type	= 1	Broad	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 1.500 (by Contour)			
TW Elev. (ft)	= 0.00			

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	129.00	0.00	0.00	---	---	0.00	0.00	---	---	0.000	---	0.000
1.00	24,669	130.00	2.60 oc	0.00	---	---	0.00	0.00	---	---	0.908	---	0.908
2.00	55,829	131.00	2.60 oc	0.00	---	---	0.00	0.00	---	---	1.266	---	1.266
3.00	94,982	132.00	2.60 oc	0.00	---	---	0.00	0.00	---	---	1.456	---	1.456
4.00	139,562	133.00	2.60 oc	0.82 ic	---	---	0.00	0.00	---	---	1.642	---	2.461
5.00	188,705	134.00	6.34 oc	0.24 ic	---	---	6.10 s	0.00	---	---	1.771	---	8.108
6.00	241,615	135.00	6.88 oc	0.05 ic	---	---	6.81 s	78.00	---	---	1.904	---	86.77

INFILTRATION PRACTICE CRITERIA
(Env-Wq 1508.06)

Type/Node Name: **B6-2 Infiltration Basin**

Enter the type of infiltration practice (e.g., basin, trench) and the node name in the drainage analysis, if applicable

Yes		Have you reviewed Env-Wq 1508.06(a) to ensure that infiltration is allowed?	
6.19	ac	A = Area draining to the practice	
2.57	ac	A_I = Impervious area draining to the practice	
0.42	decimal	I = percent impervious area draining to the practice, in decimal form	
0.42	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
2.62	ac-in	WQV= 1" x Rv x A	
9,520	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
2,380	cf	25% x WQV (check calc for sediment forebay volume)	
Sed. Forebay		Method of pretreatment? (not required for clean or roof runoff)	
4,694	cf	V_{SED} = sediment forebay volume, if used for pretreatment	← ≥ 25%WQV
63,409	cf	V = volume[1] (attach a stage-storage table)	← ≥ WQV
27,364	sf	A_{SA} = surface area of the bottom of the pond	
1.50	iph	$Ksat_{DESIGN}$ = design infiltration rate[2]	
2.8	hours	T_{DRAIN} = drain time = V / (A_{SA} * I_{DESIGN})	← ≤ 72-hrs
130.00	feet	E_{BTM} = elevation of the bottom of the basin	
126.00	feet	E_{SHWT} = elevation of SHWT (if none found, enter the lowest elevation of the test pit)	
109.00	feet	E_{ROCK} = elevation of bedrock (if none found, enter the lowest elevation of the test pit)	
4.00	feet	D_{SHWT} = separation from SHWT	← ≥ *[3]
21.0	feet	D_{ROCK} = separation from bedrock	← ≥ *[3]
	ft	D_{amend} = Depth of amended soil, if applicable due high infiltation rate	← ≥ 24"
	ft	D_T = depth of trench, if trench proposed	← 4 - 10 ft
	Yes/No	If a trench or underground system is proposed, observation well provided[4]	
		If a trench is proposed, material in trench	
On-site Soils		If a basin is proposed, basin floor material	
Yes	Yes/No	If a basin is proposed, the perimeter should be curvilinear, basin floor shall be flat.	
4.0	:1	If a basin is proposed, pond side slopes	← ≥3:1
133.06	ft	Peak elevation of the 10-year storm event (infiltration can be used in analysis)	
133.87	ft	Peak elevation of the 50-year storm event (infiltration can be used in analysis)	
135.00	ft	Elevation of the top of the practice (if a basin, this is the elevation of the berm)	
YES		10 peak elevation ≤ Elevation of the top of the trench?[5]	← yes
YES		If a basin is proposed, 50-year peak elevation ≤ Elevation of berm?	← yes

1. Volume below the lowest invert of the outlet structure and excludes forebay volume
2. $Ksat_{DESIGN}$ includes a factor of safety. See Env-Wq 1504.14 for requirements for determining the infiltr. rate
3. 1' separation if treatment not required; 4' for treatment in GPAs & WSIPAs; & 3' in all other areas.
4. Clean, washed well graded diameter of 1.5 to 3 inches above the in-situ soil.
5. If 50-year peak elevation exceeds top of trench, the overflow must be routed in HydroCAD as secondary discharge.

Designer's Notes:

Two Sediment Forebays are included in this pond.

Each forebay sub-watershed's WQV was calculated and the forebay sized to a capacity greater than 25%

The number above reflect the combine forebay volume.

Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Saturday, 05 / 9 / 2020

Pond No. 15 - B6-2

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 130.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	130.00	27,364	0	0
1.00	131.00	31,150	29,234	29,234
2.00	132.00	37,300	34,175	63,409
3.00	133.00	42,164	39,703	103,112
4.00	134.00	48,484	45,283	148,395
5.00	135.00	54,100	51,261	199,656

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 30.00	Inactive	0.00	0.00
Span (in)	= 30.00	12.00	0.00	0.00
No. Barrels	= 1	2	0	0
Invert El. (ft)	= 129.00	132.05	0.00	0.00
Length (ft)	= 52.00	0.50	0.00	0.00
Slope (%)	= 7.69	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.00	0.00	30.00	0.00
Crest El. (ft)	= 133.50	132.05	134.00	0.00
Weir Coeff.	= 3.33	4.40	2.60	3.33
Weir Type	= 1	120 degV	Broad	---
Multi-Stage	= Yes	Yes	No	No

Exfil.(in/hr) = 1.500 (by Contour)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	130.00	0.00	0.00	---	---	0.00	---	0.00	---	0.000	---	0.000
1.00	29,234	131.00	6.37 ic	0.00	---	---	0.00	---	0.00	---	1.082	---	1.082
2.00	63,409	132.00	6.37 ic	0.00	---	---	0.00	---	0.00	---	1.295	---	1.295
3.00	103,112	133.00	6.37 ic	0.00	---	---	0.00	3.87	0.00	---	1.464	---	5.334
4.00	148,395	134.00	34.49 ic	0.00	---	---	11.77	22.72 s	0.00	---	1.683	---	36.17
5.00	199,656	135.00	50.79 ic	0.00	---	---	27.72 s	23.07 s	78.00	---	1.878	---	130.67

INFILTRATION PRACTICE CRITERIA
(Env-Wq 1508.06)

Type/Node Name: **B6-3 FOREBAY FEATURE ONLY to Infiltration Basin**

Enter the type of infiltration practice (e.g., basin, trench) and the node name in the drainage analysis, if applicable

Yes		Have you reviewed Env-Wq 1508.06(a) to ensure that infiltration is allowed?	
3.93	ac	A = Area draining to the practice	
3.32	ac	A_I = Impervious area draining to the practice	
0.84	decimal	I = percent impervious area draining to the practice, in decimal form	
0.81	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
3.18	ac-in	WQV= 1" x Rv x A	
11,560	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
2,890	cf	25% x WQV (check calc for sediment forebay volume)	
Sed. Forebay		Method of pretreatment? (not required for clean or roof runoff)	
2,991	cf	V_{SED} = sediment forebay volume, if used for pretreatment	← ≥ 25%WQV
N/A	cf	V = volume[1] (attach a stage-storage table)	← ≥ WQV
N/A	sf	A_{SA} = surface area of the bottom of the pond	
N/A	iph	$Ksat_{DESIGN}$ = design infiltration rate[2]	
-	hours	T_{DRAIN} = drain time = V / (A_{SA} * I_{DESIGN})	← ≤ 72-hrs
134.00	feet	E_{BTM} = elevation of the bottom of the basin	
128.75	feet	E_{SHWT} = elevation of SHWT (if none found, enter the lowest elevation of the test pit)	
120.00	feet	E_{ROCK} = elevation of bedrock (if none found, enter the lowest elevation of the test pit)	
5.25	feet	D_{SHWT} = separation from SHWT	← ≥ *[3]
14.0	feet	D_{ROCK} = separation from bedrock	← ≥ *[3]
	ft	D_{amend} = Depth of amended soil, if applicable due high infiltation rate	← ≥ 24"
	ft	D_T = depth of trench, if trench proposed	← 4 - 10 ft
	Yes/No	If a trench or underground system is proposed, observation well provided[4]	
		If a trench is proposed, material in trench	
On-site Soils		If a basin is proposed, basin floor material	
Yes	Yes/No	If a basin is proposed, the perimeter should be curvilinear, basin floor shall be flat.	
4.0	:1	If a basin is proposed, pond side slopes	← ≥3:1
138.32	ft	Peak elevation of the 10-year storm event (infiltration can be used in analysis)	
139.02	ft	Peak elevation of the 50-year storm event (infiltration can be used in analysis)	
141.00	ft	Elevation of the top of the practice (if a basin, this is the elevation of the berm)	
YES		10 peak elevation ≤ Elevation of the top of the trench?[5]	← yes
YES		If a basin is proposed, 50-year peak elevation ≤ Elevation of berm?	← yes

1. Volume below the lowest invert of the outlet structure and excludes forebay volume
2. $Ksat_{DESIGN}$ includes a factor of safety. See Env-Wq 1504.14 for requirements for determining the infiltr. rate
3. 1' separation if treatment not required; 4' for treatment in GPAs & WSIPAs; & 3' in all other areas.
4. Clean, washed well graded diameter of 1.5 to 3 inches above the in-situ soil.
5. If 50-year peak elevation exceeds top of trench, the overflow must be routed in HydroCAD as secondary discharge.

Designer's Notes:

This feature is used only for attenuation and to accomidate, ata a minimum, the 25% pre-tretment volume of the watershed before dischargeing stormwater to Infiltration basin B6-2 for treatment and groundwater recharge.

Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Saturday, 05 / 9 / 2020

Pond No. 16 - B6-3

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 134.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	134.00	2,600	0	0
1.00	135.00	3,400	2,991	2,991
2.00	136.00	4,400	3,889	6,880
3.00	137.00	5,400	4,891	11,771
4.00	138.00	6,600	5,989	17,760
5.00	139.00	7,900	7,240	25,000
6.00	140.00	9,200	8,541	33,540
7.00	141.00	10,700	9,940	43,480

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	6.00	0.00	0.00
Span (in)	= 15.00	6.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 133.00	135.00	0.00	0.00
Length (ft)	= 150.00	0.50	0.00	0.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.00	0.00	0.00	0.00
Crest El. (ft)	= 138.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	134.00	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
1.00	2,991	135.00	3.58 ic	0.00	---	---	0.00	---	---	---	---	---	0.000
2.00	6,880	136.00	3.58 ic	0.82 ic	---	---	0.00	---	---	---	---	---	0.819
3.00	11,771	137.00	3.58 ic	1.25 ic	---	---	0.00	---	---	---	---	---	1.251
4.00	17,760	138.00	3.58 ic	1.57 ic	---	---	0.00	---	---	---	---	---	1.568
5.00	25,000	139.00	11.03 oc	0.18 ic	---	---	10.85 s	---	---	---	---	---	11.03
6.00	33,540	140.00	11.91 oc	0.07 ic	---	---	11.79 s	---	---	---	---	---	11.86
7.00	43,480	141.00	12.71 oc	0.04 ic	---	---	12.46 s	---	---	---	---	---	12.50

INFILTRATION PRACTICE CRITERIA
(Env-Wq 1508.06)

Type/Node Name: **B6-4 FOREBAY FEATURE ONLY to Infiltration Basin**

Enter the type of infiltration practice (e.g., basin, trench) and the node name in the drainage analysis, if applicable

Yes		Have you reviewed Env-Wq 1508.06(a) to ensure that infiltration is allowed?	
9.56	ac	A = Area draining to the practice	
6.89	ac	A_I = Impervious area draining to the practice	
0.72	decimal	I = percent impervious area draining to the practice, in decimal form	
0.70	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
6.68	ac-in	WQV= 1" x Rv x A	
24,245	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
6,061	cf	25% x WQV (check calc for sediment forebay volume)	
Sed. Forebay		Method of pretreatment? (not required for clean or roof runoff)	
6,779	cf	V_{SED} = sediment forebay volume, if used for pretreatment	← ≥ 25%WQV
N/A	cf	V = volume[1] (attach a stage-storage table)	← ≥ WQV
N/A	sf	A_{SA} = surface area of the bottom of the pond	
N/A	iph	$Ksat_{DESIGN}$ = design infiltration rate[2]	
-	hours	T_{DRAIN} = drain time = V / (A_{SA} * I_{DESIGN})	← ≤ 72-hrs
134.00	feet	E_{BTM} = elevation of the bottom of the basin	
128.50	feet	E_{SHWT} = elevation of SHWT (if none found, enter the lowest elevation of the test pit)	
122.00	feet	E_{ROCK} = elevation of bedrock (if none found, enter the lowest elevation of the test pit)	
5.50	feet	D_{SHWT} = separation from SHWT	← ≥ *[3]
12.0	feet	D_{ROCK} = separation from bedrock	← ≥ *[3]
	ft	D_{amend} = Depth of amended soil, if applicable due high infiltation rate	← ≥ 24"
	ft	D_T = depth of trench, if trench proposed	← 4 - 10 ft
	Yes/No	If a trench or underground system is proposed, observation well provided[4]	
		If a trench is proposed, material in trench	
On-site Soils		If a basin is proposed, basin floor material	
Yes	Yes/No	If a basin is proposed, the perimeter should be curvilinear, basin floor shall be flat.	
4.0	:1	If a basin is proposed, pond side slopes	← ≥3:1
138.70	ft	Peak elevation of the 10-year storm event (infiltration can be used in analysis)	
139.75	ft	Peak elevation of the 50-year storm event (infiltration can be used in analysis)	
141.00	ft	Elevation of the top of the practice (if a basin, this is the elevation of the berm)	
YES		10 peak elevation ≤ Elevation of the top of the trench?[5]	← yes
YES		If a basin is proposed, 50-year peak elevation ≤ Elevation of berm?	← yes

1. Volume below the lowest invert of the outlet structure and excludes forebay volume
2. $Ksat_{DESIGN}$ includes a factor of safety. See Env-Wq 1504.14 for requirements for determining the infiltr. rate
3. 1' separation if treatment not required; 4' for treatment in GPAs & WSIPAs; & 3' in all other areas.
4. Clean, washed well graded diameter of 1.5 to 3 inches above the in-situ soil.
5. If 50-year peak elevation exceeds top of trench, the overflow must be routed in HydroCAD as secondary discharge.

Designer's Notes:

This feature is used only for attenuation and to accomidate, ata a minimum, the 25% pre-tretment volume of the watershed before dischargeing stormwater to Infiltration basin B6-2 for treatment and groundwater recharge.

Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020 Saturday, 05 / 9 / 2020

Pond No. 17 - B6-4

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 134.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	134.00	2,500	0	0
1.00	135.00	3,400	2,938	2,938
2.00	136.00	4,300	3,841	6,779
3.00	137.00	5,300	4,791	11,570
4.00	138.00	6,400	5,841	17,411
5.00	139.00	7,700	7,039	24,450
6.00	140.00	9,000	8,341	32,791
7.00	141.00	10,400	9,691	42,481

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 30.00	12.00	0.00	0.00
Span (in)	= 30.00	12.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 134.60	136.00	0.00	0.00
Length (ft)	= 920.00	0.50	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 10.00	0.00	0.00	0.00
Crest El. (ft)	= 137.75	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	134.00	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
1.00	2,938	135.00	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
2.00	6,779	136.00	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
3.00	11,570	137.00	2.73 ic	2.67 ic	---	---	0.00	---	---	---	---	---	2.674
4.00	17,411	138.00	8.79 ic	4.63 ic	---	---	4.16	---	---	---	---	---	8.794
5.00	24,450	139.00	31.22 oc	1.94 ic	---	---	29.27 s	---	---	---	---	---	31.21
6.00	32,791	140.00	34.09 oc	0.95 ic	---	---	33.13 s	---	---	---	---	---	34.08
7.00	42,481	141.00	36.39 oc	0.61 ic	---	---	35.73 s	---	---	---	---	---	36.34

Groundwater Recharge Volume (GRV) Calculation

6.78	ac	Area of HSG A soil that was replaced by impervious cover	0.40"
133.21	ac	Area of HSG B soil that was replaced by impervious cover	0.25"
-	ac	Area of HSG C soil that was replaced by impervious cover	0.10"
7.15	ac	Area of HSG D soil or impervious cover that was replaced by impervious cover	0.0"
0.24	inches	Rd = weighted groundwater recharge depth	
36.015	ac-in	GRV = AI * Rd	
130,733	cf	GRV conversion (ac-in x 43,560 sf/ac x 1ft/12")	

Provide calculations below showing that the project meets the groundwater recharge requirements (Env-Wq 1507.04):

APPENDIX I

Stormwater Management Report
(Under Separate Cover)

APPENDIX J

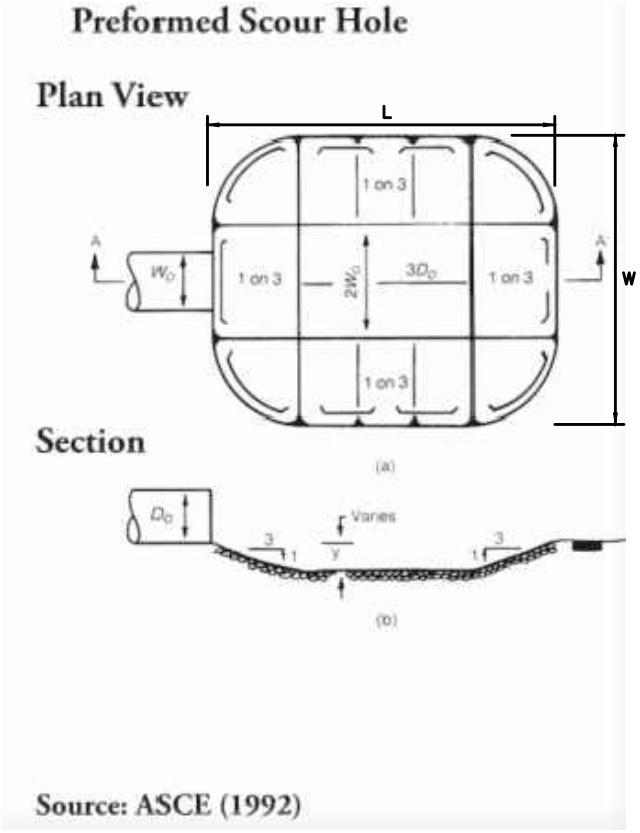
Energy Dissipating Performed Scour Pad Detail

PREFORMED SCOUR HOLE SIZING CHART

W_0 [IN]	$2W_0$ [FT]	$3D_0$ [FT]	Y [FT]	W [FT]	L [FT]	RIPRAP d [IN]
12	2	3	0.5	5	6	6"–12"
15	2.5	3.75	0.625	6.25	7.5	9"–15"
18	3	4.5	0.75	7.5	9	9"–15"
24	4	6	1	10	12	12"–18"
30	5	6.5	1.25	12.5	15	12"–18"
36	6	9	1.5	15	18	12"–18"
42	7	10.5	1.75	17.5	21	12"–18"
48	8	12	2	20	24	12"–18"
60	10	15	2.5	25	30	12"–18"
72	12	18	3	30	36	12"–18"

NOTES:

RIPRAP IS TO BE WELL GRADED. OPTIMUM GRADATION OF RIPRAP IS 50 PERCENT OF THE STONE BY WEIGHT IS TO BE SMALLER THAN THE MEDIAN STONE DIAMETER. APPROXIMATE RIPRAP DIAMETER IS INDICATED IN THE ABOVE SIZING CHART AS d [IN].



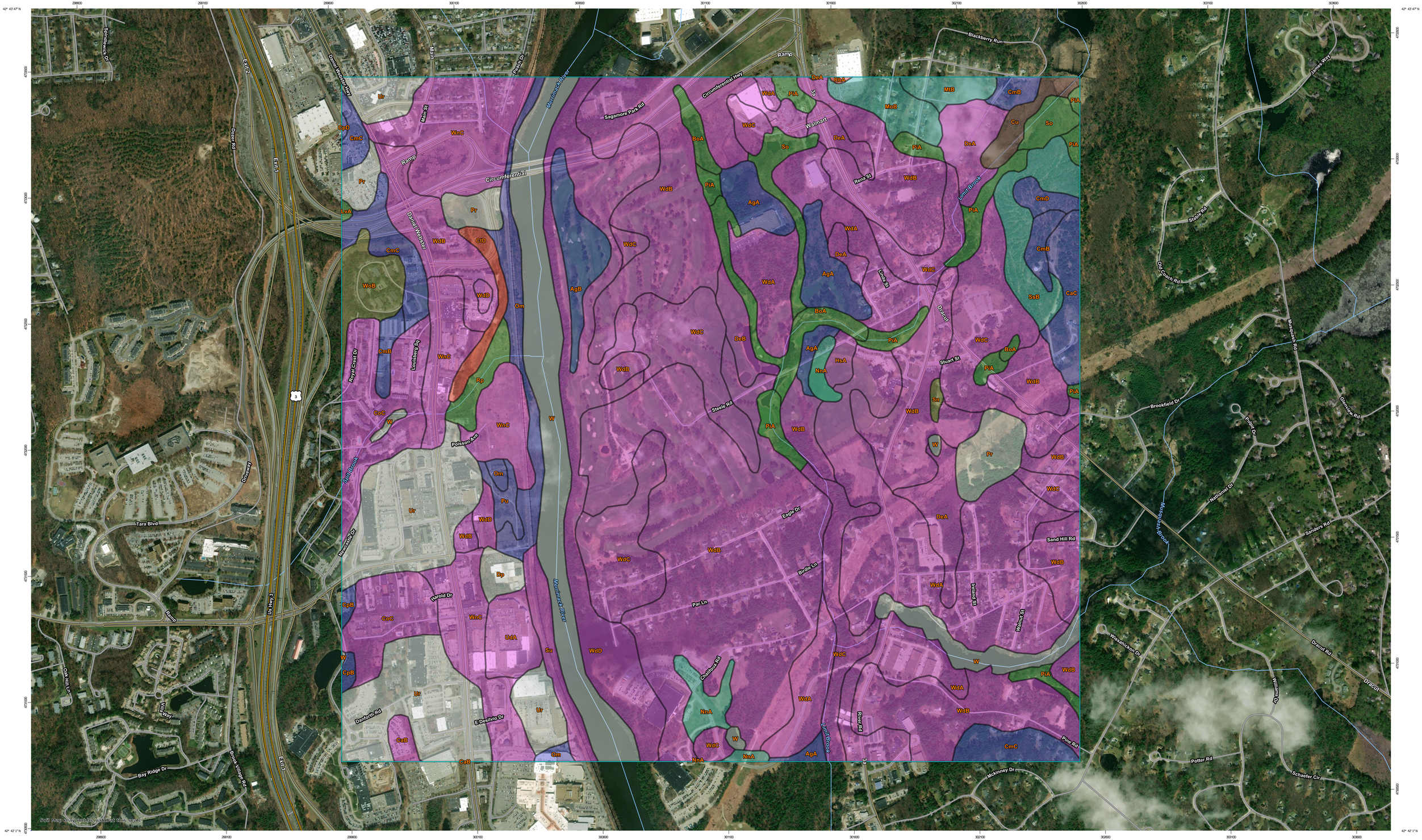
PREFORMED SCOUR HOLE

N.T.S

SOURCE: HUDSON LOGISTICS CENTER, SITE PLAN & WETLANDS CONDITIONAL USE APPLICATIONS, BY LANGAN, SHEET CG502

APPENDIX K

Site Specific Soil Survey Report



Map Scale: 1:6,740 if printed on D landscape (34" x 22") sheet.
Meters
0 50 100 200 300
Feet
0 300 600 1200 1800
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

USDA **Natural Resources Conservation Service**

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Hillsborough County, New Hampshire, Eastern Part
Survey Area Data: Version 21, Sep 16, 2019

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

Date(s) aerial images were photographed: May 22, 2015—Jun 14, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
AgA	Agawam fine sandy loam, 0 to 3 percent slopes	B	35.1	1.8%
AgB	Agawam fine sandy loam, 3 to 8 percent slopes	B	19.8	1.0%
BoA	Borohemists, nearly level	A/D	24.1	1.2%
CaB	Canton fine sandy loam, 0 to 8 percent slopes	A	4.3	0.2%
CaC	Canton fine sandy loam, 8 to 15 percent slopes	B	17.6	0.9%
CmB	Canton fine sandy loam, 0 to 8 percent slopes, very stony	B	16.3	0.8%
CmC	Canton fine sandy loam, 8 to 15 percent slopes, very stony	B	35.5	1.8%
CmD	Canton fine sandy loam, 15 to 25 percent slopes, very stony	B	5.9	0.3%
CoC	Canton-Urban land complex, 3 to 15 percent slopes	A	69.2	3.5%
CpB	Chatfield-Hollis-Canton complex, 3 to 8 percent slopes	B	3.5	0.2%
CpD	Chatfield-Hollis-Canton complex, 15 to 25 percent slopes, very rocky	B	0.5	0.0%
CtD	Chatfield-Hollis-Rock outcrop complex, 15 to 35 percent slopes	D	9.4	0.5%
Cu	Swansea mucky peat, 0 to 2 percent slopes	B/D	9.7	0.5%
DeA	Deerfield loamy fine sand, 0 to 3 percent slopes	A	46.5	2.4%
DeB	Deerfield loamy fine sand, 3 to 8 percent slopes	A	10.5	0.5%
Dp	Dumps		6.9	0.4%
HsA	Hinckley loamy sand, 0 to 3 percent slopes	A	4.8	0.2%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
LvA	Leicester-Walpole complex stony, 0 to 3 percent slopes	A/D	0.7	0.0%
MoB	Montauk fine sandy loam, 3 to 8 percent slopes	C	16.2	0.8%
MtB	Montauk fine sandy loam, 0 to 8 percent slopes, very stony	C	8.9	0.4%
NnA	Ninigret fine sandy loam, 0 to 3 percent slopes	C	16.1	0.8%
Om	Occum fine sandy loam, high bottom	B	30.2	1.5%
PiA	Pipestone loamy sand, 0 to 3 percent slopes	A/D	36.4	1.8%
Pr	Pits, gravel		31.7	1.6%
Pu	Pootatuck fine sandy loam	B	5.7	0.3%
RbA	Ridgebury fine sandy loam, 0 to 3 percent slopes	D	0.4	0.0%
Rp	Rippowam fine sandy loam	A/D	8.9	0.5%
Sn	Saugatuck loamy sand	C/D	1.6	0.1%
So	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	A/D	19.2	1.0%
SsB	Scituate fine sandy loam, 3 to 8 percent slopes	C	25.7	1.3%
Su	Suncook loamy fine sand	A	15.1	0.8%
UdA	Udipsamments, nearly level	A	15.7	0.8%
Ur	Urban land		131.4	6.7%
W	Water (less than 40 acres)		101.1	5.1%
WdA	Windsor loamy sand, 0 to 3 percent slopes	A	226.8	11.5%
WdB	Windsor loamy sand, 3 to 8 percent slopes	A	541.1	27.4%
WdC	Windsor loamy sand, 8 to 15 percent slopes	A	176.0	8.9%
WdD	Windsor loamy sand, 15 to 35 percent slopes	A	102.3	5.2%
WnC	Windsor-Urban land complex, 3 to 15 percent slopes	A	126.3	6.4%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
WoB	Woodbridge fine sandy loam, 3 to 8 percent slopes	C/D	17.7	0.9%
Totals for Area of Interest			**1,975.0**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

SITE-SPECIFIC SOIL SURVEY REPORT
HUDSON LOGISTICS CENTER
LOWELL AND STEEL ROADS
HUDSON, NH
GES # 2019216

1. MAPPING STANDARDS

Site-Specific Soil Mapping Standards for New Hampshire and Vermont. SSSNNE Special Publication No. 3, Version 5.0, December 2017. This map product is within the technical standards of the National Cooperative Soil Survey. It is a special product, intended for the submission to NH DES Alteration of Terrain. It was produced by a professional soil scientist and is not a product of the USDA Natural Resource Conservation Service.

The site specific soil survey was produced May 4, 2020, and was prepared by James P. Gove, CSS # 004, Gove Environmental Services, Inc. The location of the soil survey is at Lowell and Steele Roads in Hudson, NH.

Soils were identified with the New Hampshire State-wide Numerical Soils Legend, USDA NRCS, Durham, NH. Issue # 10, January 2011.

High Intensity Soil Survey (HISS) conversion is determined by the soil properties identified in "High Intensity Soil Mapping Standard for NH", SSSNNE Special Publication Number 1, December, 2017.

Hydrologic Soil Groups are determined from SSSNNE Special Publication Number 5, "Ksat Values for New Hampshire Soils", September, 2009.

2. DATE SOIL MAP PRODUCED

May 4, 2020

3. GEOGRAPHIC LOCATION AND SIZE OF SITE

Approximately 300 acres was soil mapped. Tax map 234, Lots 5, 34 & 35 and Tax Map 239, Lot 1. The site is located in Hudson, NH.

4. PURPOSE OF THE SOIL MAP

The preparation of this map was requested by LANGAN. The purpose was to meet the requirements of NH Alteration of Terrain.

8 Continental Dr Bldg 2 Unit H, Exeter, NH 03833-7526
Ph (603) 778 0644 / *Fax* (603) 778 0654
info@gesinc.biz
www.gesinc.biz

5. SOIL IDENTIFICATION LEGEND

SOIL SYMBOL	SOIL MAP UNIT NAME	HISS CONVERSION	HSG
4	POOTATUCK VFSL	371	B
24	AGAWAM FSL	211	B
115	SCARBORO MUCK	611	D
400	UDORTHENTS, SANDY	211	A
513	NINIGRET FSL	311	B
540	RAYPOL LFS	511	D
699	URBAN LAND	N/A	IMPERVIOUS
917	NINIGRET VARIANT (swpd)	411	C
PONDS	OPEN WATER	N/A	N/A

SLOPE PHASES: 0-8% = B 8-15% = C 15-25% = D 25%+ = E

6. SOIL MAP UNIT DESCRIPTIONS

4 POOTATUCK VERY FINE SANDY LOAM occurs on flood plains that flood sporadically. These are fine textured soils that are moderately well drained. In this case, the Pootatuck series is found adjacent the Merrimac River.

24 AGAWAM FINE SANDY LOAM occurs on glacial outwash plains and alluvial deposits. The Agawam series has a fine sandy loam topsoil and subsoil, then becomes loamy sand in the substratum. This is a well-drained soil with estimated seasonal high water tables deeper than 40 inches. While this soil map unit is in a golf course that has undergone significant grading, the essential soil characteristics are present to identify the soil series. Common inclusions in depressions and swales is the soil series Ninigret.

115 SCARBORO MUCK occurs in the wetlands on the site. Scarboro is very poorly drained and has an organic topsoil. Common inclusions are the poorly drained Raypol series and the Borohemists that have deeper organic deposits.

400 UDORTHENTS, SANDY represent areas on the site where excavation and filling have occurred to the extent that no soil characteristics remain to classify as a soil series. These are typically sandy or gravelly areas that are well to excessively drained.

513 NINIGRET FINE SANDY LOAM is the moderately well drained analog of the Agawam soil series. This is a moderately well drained soil that has an estimated seasonal high water table 20 to 30 inches below the soil surface. Like Agawam, the topsoil is fine sandy loam, the subsoil is fine sandy loam, and the substratum becomes coarser such as loamy sand or fine sand. It occurs on the same glacial outwash landforms as Agawam,

but is found more in the flat areas, drainage ways and swales. Inclusions are Deerfield loamy sand and the Ninigret Variant.

917 NINIGRET VARIANT (SOMEWHAT POORLY DRAINED) is the wetter analog of the Ninigret series. This is a somewhat poorly drained soil that has a seasonal high water table from 0 to 15 inches below the soil surface, but has high chroma matrices that do not make the soil hydric. This most occurs on this site as an inclusion to the Ninigret map unit.

540 RAYPOL LOAMY FINE SAND is a hydric soil that is found on glacial outwash plains. It is found in conjunction with Agawam, Ninigret and Ninigret variant. It is found between the upland moderately well drained and somewhat poorly drained soils and the very poorly drained Scarboro muck. It is typically identified as wetlands.

699 URBAN LAND is a map unit that represents impervious areas of buildings, pavement and packed gravel parking areas.

7. RESPONSIBLE SOIL SCIENTIST

James P. Gove, C.S.S. #004

8. OTHER DISTINGUISHING FEATURES OF SITE

It is clear that a significant amount of soil disturbance took place on the site. In addition to greens being constructed, as well as sand traps, there has been significant grading of some of the fairways,

9. MAXIMUM SIZE OF LIMITING INCLUSIONS

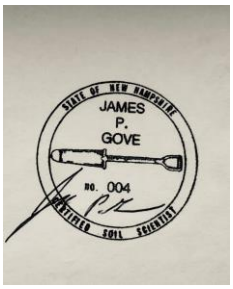
Scitico may have up to 15% inclusions of very poorly drained Maybid.

Filled areas of Udorthents commonly have inclusions of 15 to 40%.

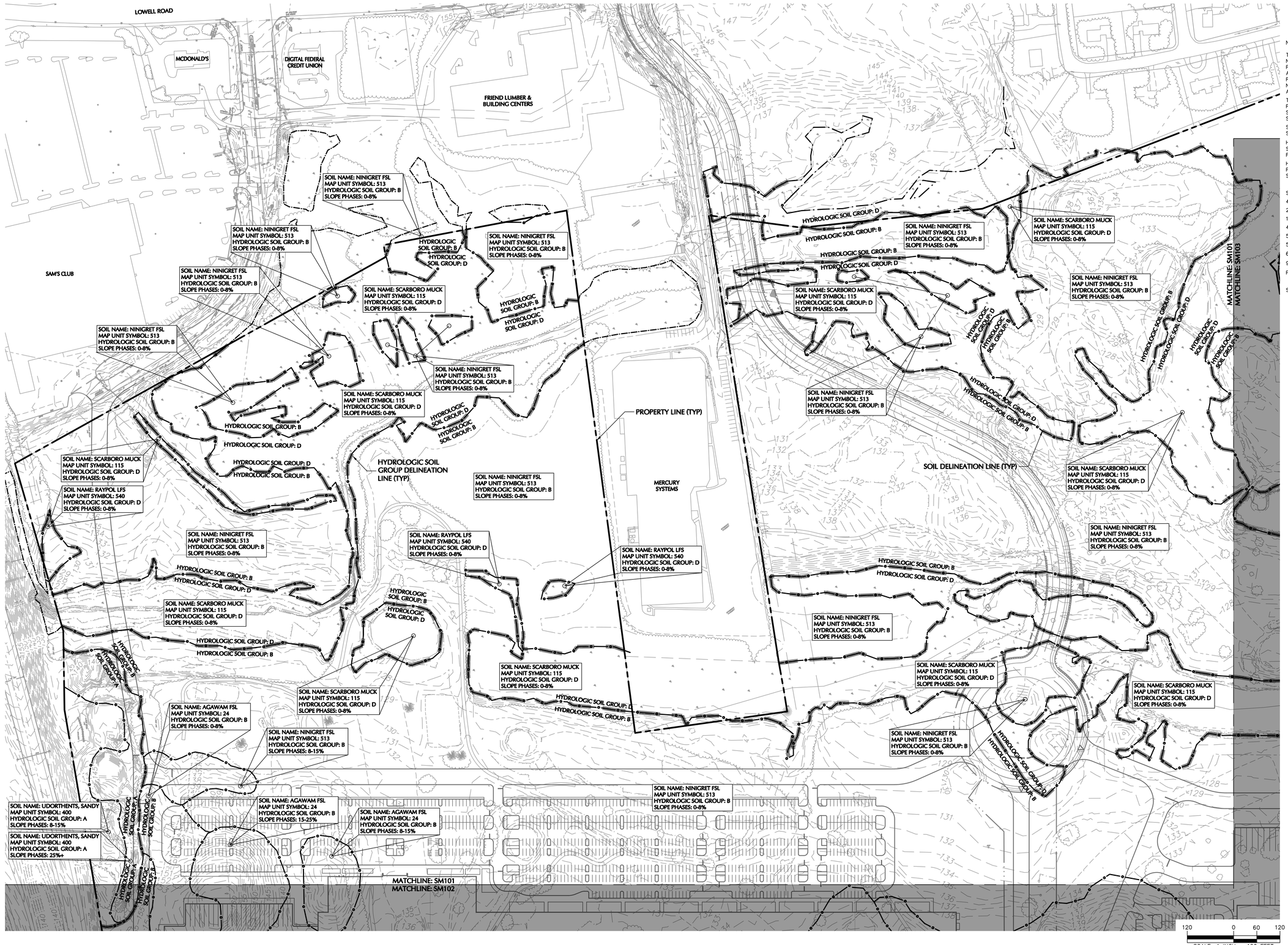
Eldridge may have up to 15% inclusions of Newfields.

10. SPECIAL FEATURE SYMBOLS

Open water areas were identified as ponds.


STATE OF NEW HAMPSHIRE
JAMES
P.
GOVE
NO. 004
CERTIFIED SOIL SCIENTIST

May 5, 2020



NOTE:

THIS MAP PRODUCT IS WITHIN THE TECHNICAL STANDARDS OF THE NATIONAL COOPERATIVE SOIL SURVEY. IT IS A SPECIAL PURPOSE PRODUCT, INTENDED FOR INFILTRATION REQUIREMENTS BY THE NH DES ALTERATION OF TERRAIN BUREAU. IT WAS PRODUCED BY A PROFESSIONAL SOIL SCIENTIST, AND IS NOT A PRODUCT OF THE USDA NATURAL RESOURCES CONSERVATION SERVICE. THERE IS A REPORT THAT ACCOMPANIES THIS MAP.

THE SITE SPECIFIC SOIL SURVEY WAS PRODUCED MAY 4, 2020, AND WAS PREPARED BY JAMES P. GOVE, CSS # 004, GOVE ENVIRONMENTAL SERVICES, INC. THE LOCATION OF THE SOIL SURVEY IS AT LOWELL AND STEELE ROADS IN HUDSON, NH.

SOILS WERE IDENTIFIED WITH THE NEW HAMPSHIRE STATE-WIDE NUMERICAL SOILS LEGEND, USDA NRCS, DURHAM, NH. ISSUE # 10, JANUARY 2011.

HIGH INTENSITY SOIL SURVEY (HISS) CONVERSION IS DETERMINED BY THE SOIL PROPERTIES IDENTIFIED IN "HIGH INTENSITY SOIL MAPPING STANDARD FOR NH", SSSNNE SPECIAL PUBLICATION NUMBER 1, DECEMBER, 2017.

HYDROLOGIC SOIL GROUPS ARE DETERMINED FROM SSSNNE SPECIAL PUBLICATION NUMBER 5, "KSAT VALUES FOR NEW HAMPSHIRE SOILS", SEPTEMBER, 2009.

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540	RAYPOL LFS	511	D
699	URBAN LAND	N/A	IMPERVIOUS
917	NINIGRET VARIANT (SWPD)	411	C
PONDS	OPEN WATER	N/A	N/A

SLOPE PHASES: 0-8% = B 8-15% = C 15-25% = D 25%+ = E

LEGEND	
PROPERTY LINE	
SOIL DELINEATION LINE	
HYDROLOGIC SOIL GROUP DELINEATION LINE	

Date	Description	No.
Revisions		

Signature Date

LANGAN

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Project

PROJECT HUDSON

MAP No. 239, LOT No. 1

HUDSON NEW HAMPSHIRE

Drawing Title

SITE SPECIFIC SOIL MAP PLAN I

Project No.	Drawing No.
151010101	SSSM101
Date: 05-12-2020	
Drawn By: CLR	
Checked By: NLK	Sheet 0 of 10

Project No. 151010101

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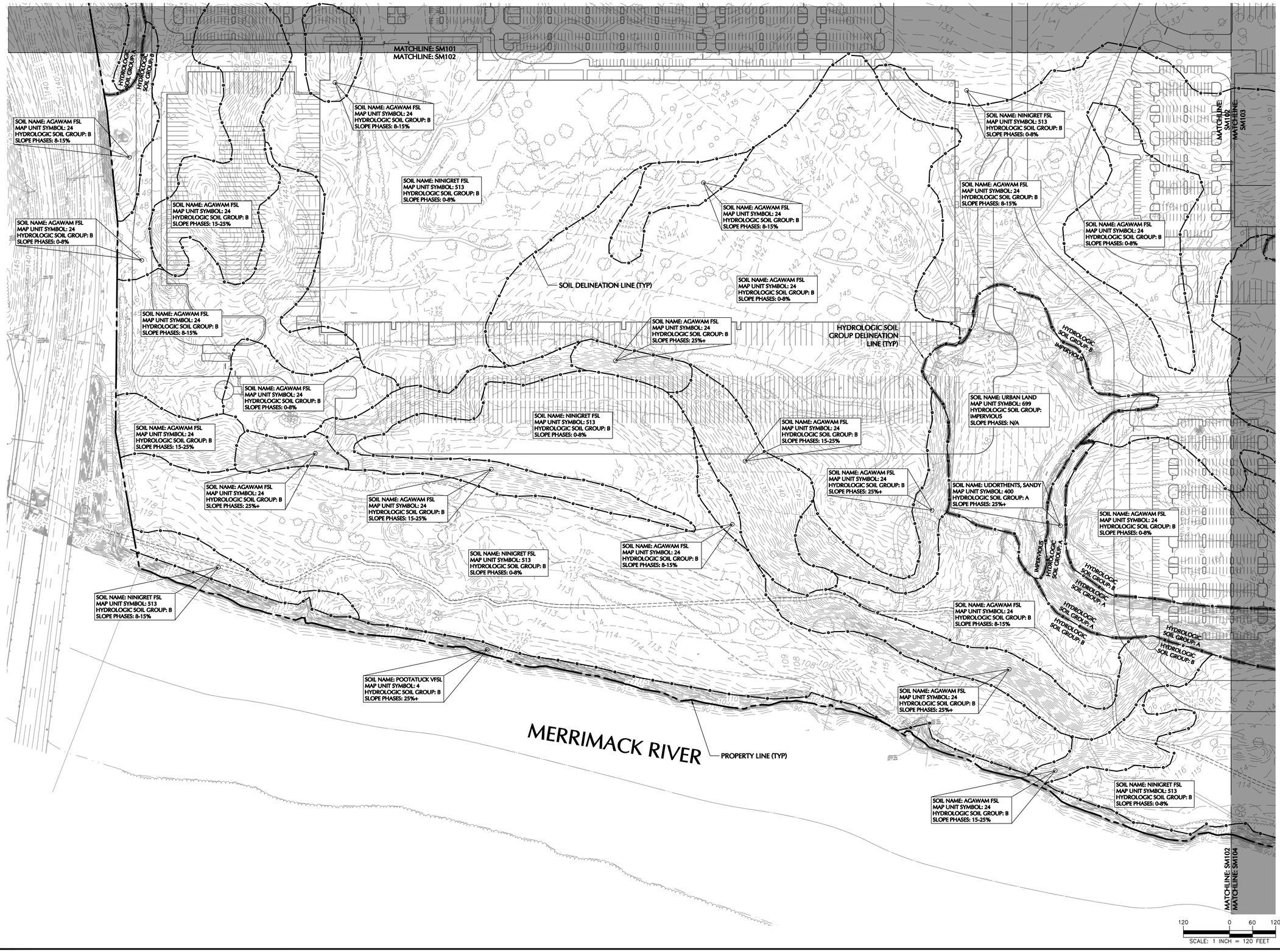
Date: 5/15/2020 Time: 10:18 User: craczkowski Style Table: Langan.stb Layout: SOIL MAP I Document Code: 151010101-0203-CA101-0101



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917	NINIGRET VARIANT (SWPD)	411	C
PONDS	OPEN WATER	N/A	N/A

SLOPE PHASES: 0-8% = B 8-15% = C 15-25% = D 25%+ = E

LEGEND	
PROPERTY LINE	
SOIL DELINEATION LINE	
HYDROLOGIC SOIL GROUP DELINEATION LINE	

Date	Description	No.
Revisions		

Signature Date

LANGAN

888 Boylston Street, Ste 510
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Project

PROJECT HUDSON

MAP No. 239, LOT No. 1

HUDSON **NEW HAMPSHIRE**

Drawing Title

SITE SPECIFIC SOIL MAP PLAN II

Project No.	Drawing No.
151010101	SSSM102
Date: **05-12-2020**	
Drawn By: **CLR**	
Checked By: **NLK**	Sheet **0** of **10**

LANGAN Project No. 151010101

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THE SITE SPECIFIC SOIL SURVEY WAS PRODUCED MAY 4, 2020, AND WAS PREPARED BY JAMES P. GOVE, CSS # 004, GOVE ENVIRONMENTAL SERVICES, INC. THE LOCATION OF THE SOIL SURVEY IS AT LOWELL AND STEELE ROADS IN HUDSON, NH.

SOILS WERE IDENTIFIED WITH THE NEW HAMPSHIRE STATE-WIDE NUMERICAL SOILS LEGEND, USDA NRCS, DURHAM, NH. ISSUE # 10, JANUARY 2011.

HIGH INTENSITY SOIL SURVEY (HISS) CONVERSION IS DETERMINED BY THE SOIL PROPERTIES IDENTIFIED IN "HIGH INTENSITY SOIL MAPPING STANDARD FOR NH", SSSNNE SPECIAL PUBLICATION NUMBER 1, DECEMBER, 2017.

HYDROLOGIC SOIL GROUPS ARE DETERMINED FROM SSSNNE SPECIAL PUBLICATION NUMBER 5, "KSAT VALUES FOR NEW HAMPSHIRE SOILS", SEPTEMBER, 2009.

SOIL MAP SYMBOL	SOIL MAP UNIT NAME	HISS CONVERSION	HSG
4	POOTATUCK VFSL	371	B
24	AGAWAM FSL	211	B
115	SCARBORO MUCK	611	D
400	UDORTHENTS, SANDY	211	A
513	NINIGRET FSL	311	B
540	RAYPOL LFS	511	D
699	URBAN LAND	N/A	IMPERVIOUS
917	NINIGRET VARIANT (SWPD)	411	C
PONDS	OPEN WATER	N/A	N/A

SLOPE PHASES: 0-8% = B 8-15% = C 15-25% = D 25%+ = E

LEGEND

PROPERTY LINE	
SOIL DELINEATION LINE	
HYDROLOGIC SOIL GROUP DELINEATION LINE	

Date	Description	No.
Revisions		

Signature Date

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PROJECT HUDSON

MAP No. 239, LOT No. 1

HUDSON NEW HAMPSHIRE

Drawing Title

SITE SPECIFIC SOIL MAP PLAN III

Project No.	Drawing No.
151010101	SSSM103
Date: 05-12-2020	
Drawn By: CLR	
Checked By: NLK	Sheet 0 of 10

LANGAN Project No. 151010101

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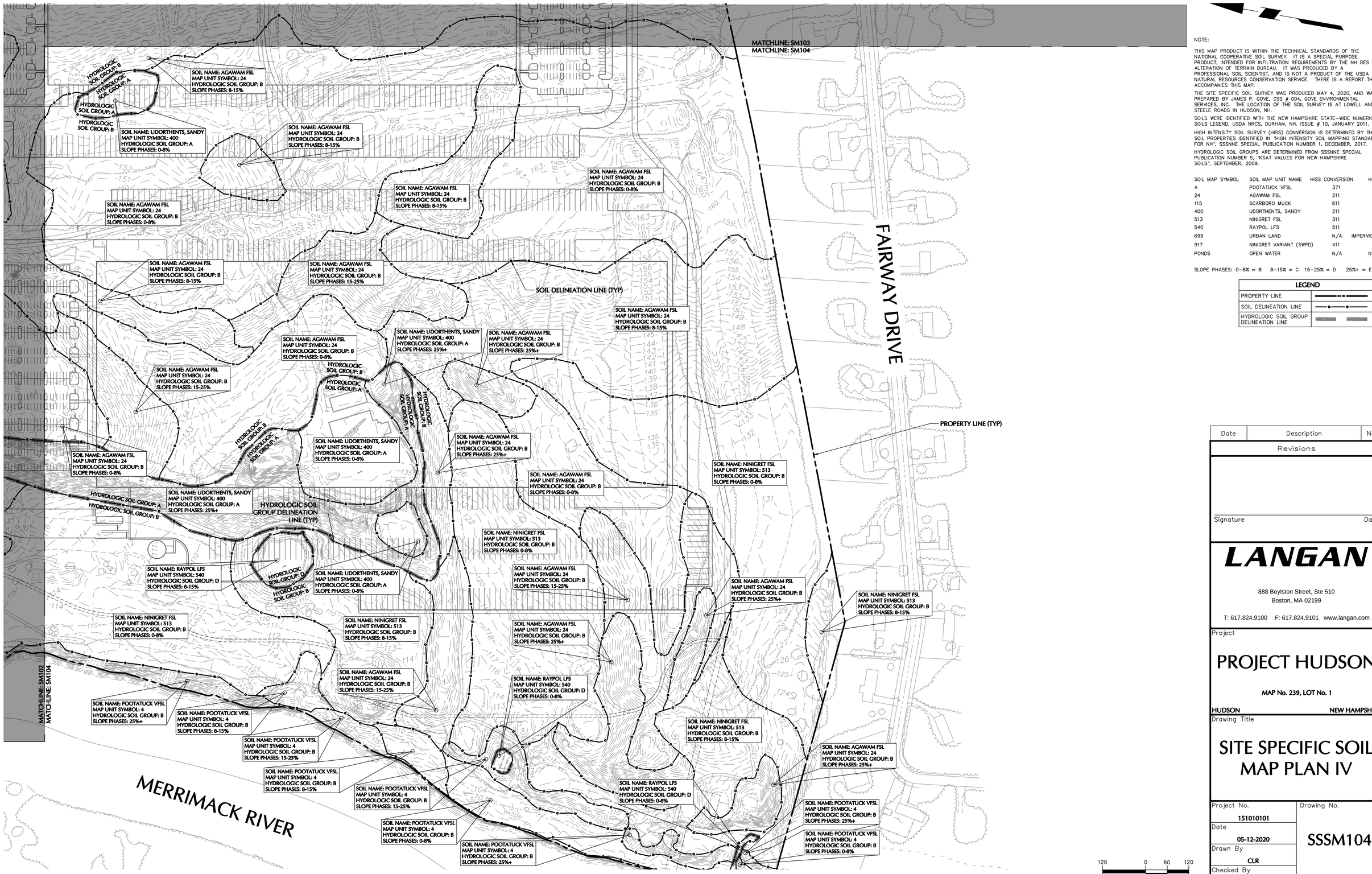

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THE SITE SPECIFIC SOIL SURVEY WAS PRODUCED MAY 4, 2020, AND WAS PREPARED BY JAMES P. GOVE, CSS # 004, GOVE ENVIRONMENTAL SERVICES, INC. THE LOCATION OF THE SOIL SURVEY IS AT LOWELL AND STEELE ROADS IN HUDSON, NH.

SOILS WERE IDENTIFIED WITH THE NEW HAMPSHIRE STATE-WIDE NUMERICAL SOILS LEGEND, USDA NRCS, DURHAM, NH. ISSUE # 10, JANUARY 2011.

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HYDROLOGIC SOIL GROUPS ARE DETERMINED FROM SSSNNE SPECIAL PUBLICATION NUMBER 5, "KSAT VALUES FOR NEW HAMPSHIRE SOILS", SEPTEMBER, 2009.

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917	NINIGRET VARIANT (SWPD)	411	C
PONDS	OPEN WATER	N/A	N/A

SLOPE PHASES: 0-8% = B 8-15% = C 15-25% = D 25%+ = E

LEGEND	
PROPERTY LINE	
SOIL DELINEATION LINE	
HYDROLOGIC SOIL GROUP DELINEATION LINE	

Date	Description	No.
Revisions		

Signature Date

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PROJECT HUDSON

MAP No. 239, LOT No. 1

HUDSON NEW HAMPSHIRE

Drawing Title

SITE SPECIFIC SOIL MAP PLAN IV

Project No.	Drawing No.
151010101	SSSM104
Date: 05-12-2020	
Drawn By: CLR	
Checked By: NLK	Sheet 0 of 10

Project No. 151010101

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APPENDIX L

Infiltration Feasibility Report

Infiltration Feasibility Report

Hudson Logistic Center
Hudson New Hampshire
[Date of Report]

To be completed during construction

TABLE OF CONTENTS:

The project proposes seven systems that require infiltration to function properly. These systems are identified on the plans as Infiltration Basin A1-2, A1-5, A6-2, A11-2, A11-3, B1-2, and B6-2.

I. Location of the practice

Infiltration Basin A1-2 – this basin is located

Infiltration Basin A1-5 – this basin is located

Infiltration Basin A6-2 – this basin is located

Infiltration Basin A11-2 – this basin is located

Infiltration Basin A11-3 – this basin is located

Infiltration Basin B1-2 – this basin is located

Infiltration Basin B6-2 – this basin is located

II. Existing topography at the location of the practice

Infiltration Basin A1-2 – the existing topography within the area of the infiltration basin is

Infiltration Basin A1-5 – the existing topography within the area of the infiltration basin is

Infiltration Basin A6-2 – the existing topography within the area of the infiltration basin is

Infiltration Basin A11-2 – the existing topography within the area of the infiltration basin is

Infiltration Basin A11-3 – the existing topography within the area of the infiltration basin is

Infiltration Basin B1-2 – the existing topography within the area of the infiltration basin is

Infiltration Basin B6-2 – the existing topography within the area of the infiltration basin is

III. Test pit or boring locations

In accordance with Env-Wq 1504.12(c), NHDES requires that a minimum number of test pits or borings be dug or drilled in the location of the system, depending on the size of the proposed system.

Infiltration Basin A1-2 – this basin is

Infiltration Basin A1-5 – this basin is

Infiltration Basin A6-2 – this basin is

Infiltration Basin A11-2 – this basin is

Infiltration Basin A11-3 – this basin is

Infiltration Basin B1-2 – this basin is

Infiltration Basin B6-2 – this basin is

IV. Seasonal high water table (SHWT) and bedrock elevations

The following test pit data was collected on.

Infiltration Basin A1-2 –
Bottom of Pond Elevation =

TP#: Existing Surface Elevation of TP =
SHWT =
BEDROCK =
Deepest Elevation of TP =

TP#: Existing Surface Elevation of TP =
SHWT =
BEDROCK =
Deepest Elevation of TP =

Infiltration Basin A1-5 –
Bottom of Pond Elevation =

TP#: Existing Surface Elevation of TP =
SHWT =
BEDROCK =
Deepest Elevation of TP =

TP#: Existing Surface Elevation of TP =
SHWT =
BEDROCK =
Deepest Elevation of TP =

Infiltration Basin A6-2 –
Bottom of Pond Elevation =

TP#: Existing Surface Elevation of TP =
SHWT =
BEDROCK =
Deepest Elevation of TP =

TP#: Existing Surface Elevation of TP =
SHWT =

BEDROCK =
Deepest Elevation of TP =

Infiltration Basin A11-2 –
Bottom of Pond Elevation =

TP#: Existing Surface Elevation of TP =
SHWT =
BEDROCK =
Deepest Elevation of TP =

TP#: Existing Surface Elevation of TP =
SHWT =
BEDROCK =
Deepest Elevation of TP =

Infiltration Basin A11-3 –
Bottom of Pond Elevation =

TP#: Existing Surface Elevation of TP =
SHWT =
BEDROCK =
Deepest Elevation of TP =

TP#: Existing Surface Elevation of TP =
SHWT =
BEDROCK =
Deepest Elevation of TP =

Infiltration Basin B1-2 –
Bottom of Pond Elevation =

TP#: Existing Surface Elevation of TP =
SHWT =
BEDROCK =
Deepest Elevation of TP =

TP#: Existing Surface Elevation of TP =
SHWT =

BEDROCK =
Deepest Elevation of TP =

Infiltration Basin B6-2 –
Bottom of Pond Elevation =

TP#: Existing Surface Elevation of TP =
SHWT =
BEDROCK =
Deepest Elevation of TP =

TP#: Existing Surface Elevation of TP =
SHWT =
BEDROCK =
Deepest Elevation of TP =

V. Profile descriptions

VI. Soil plan in the area of the proposed practice(s)

VII. Summary of [Default, Field Testing, or Lab Testing] data used to determine the infiltration rate

Infiltration Basin A1-2– the infiltration rate was determined using the Field Measurement method described in Env-Wq 1504.13.

The basin is located within native material identified in the Soil Series survey as _____.

Using Ksat Values for New Hampshire Soils, Society of Soil Scientist of Northern New England, Special Publication No.5, September 2009, the lowest value under the basin floor elevation is: _____.

After applying a factor of safety, the design rate used in the drainage analysis is _____.

Infiltration Basin A1-5– the infiltration rate was determined using the Field Measurement method described in Env-Wq 1504.13.

The basin is located within native material identified in the Soil Series survey as _____.

Using Ksat Values for New Hampshire Soils, Society of Soil Scientist of Northern New England, Special Publication No.5, September 2009, the lowest value under the basin floor elevation is: _____.

After applying a factor of safety, the design rate used in the drainage analysis is _____.

Infiltration Basin A6-2– the infiltration rate was determined using the Field Measurement method described in Env-Wq 1504.13.

The basin is located within native material identified in the Soil Series survey as _____.

Using Ksat Values for New Hampshire Soils, Society of Soil Scientist of Northern New England, Special Publication No.5, September 2009, the lowest value under the basin floor elevation is: _____.

After applying a factor of safety, the design rate used in the drainage analysis is _____.

Infiltration Basin A11-2– the infiltration rate was determined using the Field Measurement method described in Env-Wq 1504.13.

The basin is located within native material identified in the Soil Series survey as _____.

Using Ksat Values for New Hampshire Soils, Society of Soil Scientist of Northern New England, Special Publication No.5, September 2009, the lowest value under the basin floor elevation is: _____.

After applying a factor of safety, the design rate used in the drainage analysis is _____.

Infiltration Basin A11-3– the infiltration rate was determined using the Field Measurement method described in Env-Wq 1504.13.

The basin is located within native material identified in the Soil Series survey as _____.

Using Ksat Values for New Hampshire Soils, Society of Soil Scientist of Northern New England, Special Publication No.5, September 2009, the lowest value under the basin floor elevation is: _____.

After applying a factor of safety, the design rate used in the drainage analysis is _____.

Infiltration Basin B6-2– the infiltration rate was determined using the Field Measurement method described in Env-Wq 1504.13.

The basin is located within native material identified in the Soil Series survey as _____.

Using Ksat Values for New Hampshire Soils, Society of Soil Scientist of

Northern New England, Special Publication No.5, September 2009, the lowest value under the basin floor elevation is: _____.

After applying a factor of safety, the design rate used in the drainage analysis is _____.

APPENDIX M

Registration and Notification Form

Additional geotechnical investigation, including infiltration testing, is currently underway. Based on the newly collected data, the applicability of this appendix will be assessed and completed if necessary.

APPENDIX N

Construction Inspection and Maintenance Manual

INSPECTION AND MAINTENANCE MANUAL

for

Hudson Logics Center
43 Lowell Road
Hudson, New Hampshire

Prepared For:

Hillwood Enterprises, L.P.
5050 w. Tilghman Street, Suite 435
Allentown, PA 18104

Prepared By:

Langan Engineering & Environmental Services, Inc.
888 Boylston Street, Suite 510
Boston, MA 02199

Timothy D. O'Neill, P.E
New Hampshire Professional Engineer No. 16259

John D. Plante, P.E.
New Hampshire Professional Engineer No. 14072

May 2020
Langan Project No. 1510101

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TABLES

1 MANUAL INTRODUCTION

This manual was designed in line with the Chapter Env-Wq 1500 Alteration of Terrain of the "New Hampshire Code of Administrative Rules" and the "New Hampshire Stormwater Manual" to address stormwater management on site. In initial threat to stormwater pollution from the proposed development is pollution caused by soil erosion and sedimentation during construction. Future potential sources of pollution are caused by the use and operation of the site after construction is completed. This manual focuses on the soil erosion and sediment control phase of inspections and maintenance through the construction period. A separate Operations and Maintenance Manual can be found for the long-term operation of the facilities as an appendix to the stormwater management report.

The general contractor for the development employed through Hillwood Enterprises, L.P. will be responsible for the implementation of this manual. The general contractor will be responsible for installation and maintenance of soil erosion and sediment control features. Additionally, they will in

2 BACKGROUND

This construction phase inspection and maintenance manual has been prepared in support of the proposed development of a 367.4 acre site located at 43 Steele Road in the Town of Hudson New Hampshire. The existing two parcel site is currently developed as a 39 hole golf course known as Green Meadow Golf Club and is accessed from Steele Road. The existing topography on the site exhibits significant grade changes of up to 90 feet in elevation change. Many high and low points, and rolling topography can be found on site.

The proposed development is the construction and operation of three distribution warehousing facilities known collectively as the Hudson Logistics Center. Three Lots A, B, and C and a subdivision road way will be create from the existing two parcel site. Lot A will include the construction of a ±1,079,700 sf building with a finished floor elevation ±142.75 feet, Lot B will include the construction of a ±923,600 sf building with a finished floor elevation of ±146.5 ft, and Lot C will include the construction of a ±522,000 sf building with a finished floor elevation ±147.50 feet. The current access from Steel road is unable to support the facilities as the main access road. A right of way will be created and new access road constructed for the development. A secondary access is also proposed in the north east section of Lot A. Upgraded utility service lines will be brought to the site within the proposed right of way.

It is the purpose of this inspection and maintenance manual to insure the effective and continued operation of the proposed soil erosion and sediment control features through the construction phase of this development. The proposed features can be seen in the attached appendices, design documents entitled "Hudson Logistics Center – Site Plan & Wetlands Conditional Use Applications" dated May 21, 2020 by Langan Engineering & Environmental Services, Inc. All erosion control measures are to be installed in line with the New Hampshire Department of Environmental Services Stormwater Manual.

3 CONSTRUCTION PHASING

Due to the complexities of construction sequencing on a project of this magnitude, a general contractor would need to outline specific details of scheduling based on their personal approach. As a general contractor has not been chosen for the development at this stage in the permitting process, a rough three phased construction sequence identifying major construction actives has been outlined below. The schedule below is subject to change based on input from the general contractor, availability of materials and final permitting approval.

Phase 1

Quarter 3 2020

- Install phase 1 Soil Erosion and Sediment control Measures
- Install construction and demolition staging areas
- Utility and services disconnect
- Establish temporary services
- Site demolition, clearing and grubbing

Quarter 4 2020

- Install and construction Northeastern stream crossing

Phase 2

Quarter 4 2020

- Install phase 2 Soil Erosion and Sediment control Measures
- Mass earthwork and rough grading
- Retaining wall construction
- Building pad construction

Quarter 4 2020 / Quarter Q1 2021

- Begin construction on proposed Right of Way

Phase 3

Quarter 2 2021

- Install phase 3 Soil Erosion and Sediment control Measures
- Stormwater conveyance system and utility installation
- Building construction
- Paving and landscaping installation

- Final site stabilization

Quarter 3 2021

- Certificate of Occupancy
- Removal of Soil Erosion and Sediment Control features

4 SOIL EROSION AND SEDIMENT CONTROL FEATURES

During construction the three phased soil erosion and sediment control measures outlined in the CE Series of the design documents will be implemented. The design includes the following features:

1. Construction Entrances – A temporary 12" thick, 23' wide by 75' long, stone pad construction entrance will be installed as shown in Soil Erosion and Sediment Control Plans. It may be necessary to clean vehicle tires at this location.
2. Perimeter Controls - Placed along the toe of erosion prone slopes, inlets or adjacent to sensitive areas. Typically, these features are places in down grading areas, parallel to the topography as to avoid channelization.
    a. Silt Fencing – Filters sediment suspended in run off.
    b. Fiber Rolls – Filters sediment suspended in run off with a high flow through rate.
    c. Compost Filter Tubes – Filters sediment suspended in run off with a high flow rate. Has a higher filtration rate and sediment storage capacity than filer tubes. Specific types of compost can also provide pollutant removal from run off and are to places along the border of down gradient, high run off sensitive areas such as wetlands.
3. Inlet Protection – Silt fencing, composite filter tube, and silt sacks shall be used at all catch basins and drainage inlets upon start of work or immediately after installation and remain until all disturbed area surrounding the inlets are stabilized.
4. Run off Protection – to provide flow attenuation and settlement of suspended solids before leaving the site.
    a. Diversion Channels – Used to intercept and divert flows to temporary treatment controls for sediment laden run off.
    b. Sediment Basins – A water impoundment constructed to capture and store sediment and/or debris.
    c. Sediment Traps – A small, temporary ponding area to intercept sediment-laden runoff from small disturbed areas.
5. Surface Stabilization
    a. Erosion Control Blankets – To be placed on steep and highly erodible slopes during construction.

b. Surface Roughening - Groove slope by cutting furrows along the contour, creating irregularities in the soil surface to catch rainwater and retain lime, fertilizer, and seed.
c. Mulching and/or Temporary Seeding – Areas should be mulched immediately following seeding. Areas within 100 feet of streams, wetlands and in lake watersheds should be mulched within seven days of exposing soil or prior to storm event. Temporary vegetation cover should be applied where exposed soil surfaces will not be final graded within 45 days from initial disturbance.
d. Permanent Seeding – Permanent vegetation is to be seeded or sodded on all exposed areas within ten days after final grading. Mulch as necessary for seed protection and establishment. Lime and fertilize prior to permanent seeding.

6. Stock Pile Locations – Silt fencing and composite filter tube shall be installed around stockpiles immediately upon stockpiling materials. These should not be removed until the stockpile is stabilized or removed. Side slopes shall be seeded or stabilized with erosion control mats if not disturbed for thirty days. Designated locations for stockpiling materials with appropriate perimeter control measure are identified in the design documents. These locations are sited to avoid impact to sensitive areas if erosion takes place.
7. Dust Control – Dust shall be controlled by sprinkling or other approved method. The contractor is responsible for all paved roadways, on and off-site, which must be kept free of site-generated sediment at all times. All areas within 500 feet of an inhabited dwelling shall be wetted as necessary to provide dust control.
8. Street Sweeping – If offsite tracking or sediment from the development is observed in the roadways, street sweeping will be performed as required.
9. Storage – The contractor will be responsible for proper storage of any materials, such as chemicals, fluids (fuel, oils, etc.) waste materials, etc. These storage procedures must be designed to ensure pollutants are not discharged into any waters of the State of New Hampshire.

5 STORMWATER POLLUTION CONTROL FEATURES

The following measures will be taken during the construction of the development to address potential pollutants:

1. Stabilization – Reduces the ability for pollutants to travel of site with eroded materials.
    a. Vegetation – Vegetation filters pollutants out of stormwater as it flows overland.
2. Structural Practices– Provides control for run off during construction period.
    a. Soil Stockpile protection – Protects highly erodible, unstable, recently disturbed materials in place on site.

b. Inlet Protection – Prevents pollutants such as trash from entering the conveyance system.
c. Perimeter Controls – Prevents trach from leaving the site. Some perimeter controls may include a pollutant removal filtering capacity.
d. Sediment Trap – Provides a location for run off from construction areas up to 5 acres. Designed with a specific volume based off of the site conditions, run off resides here to settle suspended solids before being discharged downstream.
e. Sediment Basin – Provides a location for run off from construction areas up to ± 40 acres. Designed with a specific volume based off of the site conditions, run off resides here to settle suspended solids before being discharged downstream.
f. Diversion Channel – Intercepts run off flows which may contain suspended solids or pollutants and directs them to a safe location or other feature.

3. Stormwater Management – Construction stormwater runoff will be managed by the above features. Long term operation and maintenance of the facility's stormwater management system can be found in the report entitled "Stormwater Management Report" dated May 2020 by Langan Engineering & Environmental Services, Inc. in attached appendices.
4. Sanitary – Portable sanitary units will be on site for all workers to use through the construction phase of the project. Licensed sanitary waste management contractors will regularly remove waste from the portable units.
5. Waste – Site general contractor will be responsible for all trash and construction debris from the site. It will be taken to an approved location. No waste will be buried on site and all lose waste will be collected to avoid floating during runoff events.
6. Regulatory Compliance – The project has been designed in accordance with local, state and federal guidelines. Inspection schedules, notifications and clos out procedures will be adhered to.

6 MAINTENANCE

Soil erosion and sediment control measures should be checked weekly as well as after all rainfall events of at least 0.5 inches. Any repairs should be made immediately to maintain all measures that were designed. More about inspections is discussed in section 8.

Maintenance for devises called out in the plans include:

1. Silt Fences and Fiber Rolls – Sediment must be removed from the upstream side of the silt fence (or other erosion control device) once the depth of the collected sediment reached a third the height of the silt fence.
2. Inlet Protection – Any sediment within a siltsack will be removed and properly disposed of.
3. Disposal of Sediment – The owner's soil engineer shall determine how to dispose of any collected sediment.
4. Temporary Measure – All temporary measures will only be removed once disturbed area is fully stabilized and all construction activities have concluded.
5. Sediment Traps – Should be cleaned out once sediment has accumulated to 50% of its original volume. If geotextile fabric or stone used around a pipe-outlet riser should be checked periodically and replaced when the material has become clogging with sediment.
6. Sediment Basins – Water discharged from sediment basins should be monitored during storm events to determine how well they are functioning and if sedimentation is apparent, additional erosion control measures should be applied to eliminate sedimentation. Sediment should be removed and restored to original capacity when sediment has accumulated to the original design sediment storage volume (this may not be the total volume of the basin). If geotextile fabric or stone used around a pipe-outlet riser should be checked periodically and replaced when the material has become clogging with sediment,
7. Diversion Channels – The channel must be stabilized immediately following installation to prevent erosion of diversion itself. Should not be steep enough to cause erosion due to high velocity channel flow. If this occurs, corrective action should be taken to stabilize the channel and berm. Should be cleaned out after every significant storm and any damages caused by a storm or construction must be repaired by the end of the workday.
8. Construction Entrance/Exit – When the control pad becomes ineffective, the stone and collected soil should be removed, regraded on site, and stabilized, then reconstructed. The pavement at exits should be swept whenever soil material is tracked onto adjacent pavement or travelled way. Wheel washing should be conducted on an area stabilized with aggregate, which drains to an approved sediment-trapping device. Sediment should be prevented from entering storm drains, ditched, and waterways.

7 SPILL PREVENTION AND RESPONSE

Workers must follow basics for spill prevention, as well as specifics for certain materials. If a spill does occur, workers on site must follow procedures in this section.

1. Basics
    a. Quantity of Material - Only keep enough material on site that you need.
    b. Excavated Material – All soil not to be used for final grading/landscaping shall be removed from the site immediately, in accordance with applicable state and local law.
    c. Storage – All materials should be stored in appropriate containers and covered. If covering is not possible, the material must be covered with polyethylene or polypropylene sheeting.
    d. Label Products – Products will be stored with their original label from their manufacturer affixed in a legible way, to each container.
    e. Mixing – Products will only be mixed if recommended by manufacturer.
    f. Disposal – Products will try to be used entirely from each container prior to the disposal of container. Manufacturer's recommendations for proper disposal will be followed.
    g. Inspections – Site superintendent will do daily site inspections to insure proper storage, labeling and disposal of materials.
2. Specific Products
    a. Concrete – Concrete trucks will not wash out, discharge concrete, or drum wash water anywhere onside that could potentially reach a storm drainage system, waterway, or wetland. If washing occurs onsite, a sump basin is recommended and should be reinforced with silt fencing.
    b. Fertilizers – Fertilizer must be stored in a covered area, with any partially used bags stored in a sealed plastic bin. Fertilizer will only be applied in the minimum amounts based off manufacturer's recommendations, and will be worked into the soil when applied to avoid runoff.
    c. Paints – Containers will be clearly labeled, tightly sealed, and neatly stored. All extra paint will be disposed of based of manufacturer's recommendations.
    d. Petroleum Products – All vehicles onsite will be monitored for leaks and will regularly receive maintenance to reduce chance of leaks. Products must be labeled clearly and stored in tightly sealed containers or offsite. All asphalt substances used onsite will be applied according to the manufacturer's recommendations.
3. Spill Response
    a. Awareness and Materials – General contractor will inform all site personnel aware of all procedures, where all required materials are for clean-up. Required materials include shovels, brooms, rags, goggles, gloves, absorbent materials (sawdust, sand, etc.), and plastic/metal

containers specifically there for this purpose. The materials needed will be present on site at all times.

b. Response Time – Spills will be cleaned up immediately.
c. Safety – The area the spill occurred in will be kept ventilated, and workers in the area will wear appropriate personal protective equipment.

Reporting – If the spill is toxic or hazardous, it must be reported to the appropriate state or local government agency, regardless of the size of the spill. The spill prevention plan will then change to prevent injury/contact with the toxic/hazardous substance.

8 INSPECTION

Qualified personnel will inspect locations where vehicles enter/exit the site, as well as any area not stabilized during construction, and all structural control measures. These inspections will occur within 24 hours of a 0.5-inch or greater storm event, and at least every seven-calendar days. The qualified person must also ensure that all soil erosion and sediment control featured are properly installed and maintained on the construction site before predicted major storms. A major storm is defined as a storm predicted by the National Office of Atmospheric Administration Weather Service with warnings of flooding, severe thunderstorms or similarly severe weather conditions or effects.

The contractor is responsible for ensuring inspections are performed, recorded, and if necessary, corrected. Inspections include:

1. Construction Entrances/Exits – Vehicle Entrances/Exits will be checked for effectiveness, to ensure sediment is not being carried off-site.
2. Stabilization – Disturbed areas and storage areas that are exposed to rainfall must be inspected for evidence of or the potential for pollution and erosion.
3. Structural Controls – Silt fences, fiber rolls, siltsacks, etc. must be checked for proper anchoring, positioning, that they are trapping sediment, and if they need to have sediment or other debris removed.
4. Sediment Traps, Sediment Basins – Check to see if sediment has been building up within trap/basin. If sediment has built up in trap above 50% of its volume, do appropriate maintenance. If sediment is building up in basin, do appropriate maintenance. If geotextile fabric or stone used around a pipe-outlet riser should be checked periodically and replaced when the material has become clogging with sediment.
5. Diversion Channels – This measure should be used immediately above a new cut or soil fill slope or around the perimeter of a disturbed area. Check for erosion of

channel itself. If this is occurring, channel must be repaired and the slope decreased if necessary.

6. Discharge – Location of discharge from the site must be checked to make sure soil erosion and sediment control measures are being successful in preventing significant amounts of pollution and sediment.

The qualified site inspector will complete a field report for each site inspection. A copy of the field report will be included in this manual (which remains on site), as well as sent to the owner, owner's representative, and the general contractor. Any recommendations/ changes to the Stormwater Pollution Control Plan shall be revised immediately, and any modifications on site should be completed by the contractor within three days following the site visit. Any changes made to the Soil Erosion and Sediment Control Plans should be noted in the field report. A sample inspection form is shown as Tables 4.

The field report must be completed and signed by the field inspector in charge of soil erosion and sediment control and kept in this manual table.

Before construction begins, the project representative must meet with the Town of Hudson's Enforcement Officer to discuss and agree on the method of installation and maintenance of the soil erosion and sediment control measures. The project representative is responsible for contacting the Town of Hudson's Enforcement Officer to perform on-site inspections. Construction cannot start or continue without the Enforcement Officer's approval. The project representative shall be responsible for ensuring compliance with all aspects of this manual and informing the enforcement officers or any responsible party during construction. The soil erosion and sediment control measures must only be removed once full site stabilization is complete and a receipt of authorization form the Town of Hudson's Enforcement Officer has been received.

9 COMPLETION OF PROJECT

Once the project is complete, and the site is stabilized, the owner is responsible for inspecting and maintenance of the stormwater systems. Inspections should be done twice a year, once in the fall after the leaves have fallen from the trees and another in the spring once all the snow melts. The owner should look for a buildup of sediment in infiltration basins and catch basins as well as checking the site for erosion projects that may have occurred. Some maintenance may be required once inspection is complete (vacuuming and cleaning infiltration basins and catch basins). For a full description of inspection and maintenance procedures for the long term operation and maintenance of these facilities, refer to the report entitled

"Stormwater Management Report" dated May 2020 by Langan Engineering & Environmental Services, Inc. in attached appendices.

10 CONTRACTORS

This manual identifies site contractors and subcontractors, which may have the potential to cause pollution of the waters of the State of New Hampshire. Each such contractor and subcontractor shall sign a copy of the certification statement shown below. (See Table 3 for blank form). A copy of such certifications shall be maintained on site during construction.

"I certify under penalty of the law that I have read and understand the terms and conditions of the general permit for the discharge of stormwater associated with construction activity. I understand that as a contractor or subcontractor at the site, I am covered by this general permit, and must comply with the terms and conditions of this permit, including but not limited to the requirements of the stormwater pollution control plan prepared for the site."

_____	_____
Name	Title
_____	_____
Contractor Name	Address
_____	_____
Site Telephone	Office Telephone
_____	_____
Emergency (24 hour) Telephone	Date

11 REFERENCES

A copy of this manual must remain on-site from the day construction begins until the day construction is completed.

A copy of the Stormwater Pollution Plan and inspection reports required by the general permit shall be retained for a period of at least three years from the date that construction is complete.

TABLE 1

GENERAL SITE INFORMATION

A. Location of Site:

Lowell Road
Hudson, New Hampshire

B. Landowner:

Green Meadow Golf Club, Inc. – Friel (Lots 239/1 & 234/34)
55 Marsh Road
Hudson, New Hampshire

C. Name and Address of General Contractor:

_____

_____

_____

Telephone: _____

Name and Address of Emergency Contact:

_____

_____

_____

Telephone: _____

D. Site Contact (Project Representative):

Name: _____

Telephone: _____

TABLE 2

SUB-CONTRACTORS

Name and Address of General Contractor:

A. _____

_____

_____

Telephone: _____

Site Contact and Telephone: _____

B. _____

_____

_____

Telephone: _____

C. _____

_____

_____

Telephone: _____

D. _____

_____

_____

Telephone: _____

TABLE 3

CONTRACTOR CERTIFICATION FOR
STORMWATER POLLUTION PREVENTION ACTIVITIES

"I certify under penalty of the law that I have read and understand the terms and conditions of the Alteration of Terrain permit for the discharge of stormwater associated with construction activity. I understand that as a contractor or subcontractor at the site, I am covered by this general permit, and must comply with the terms and conditions of this permit, including but not limited to the requirements of the stormwater pollution control plan prepared for the site."

_____	_____
Name	Title
_____	_____
General Contractor	Address
_____	_____
Site Telephone	Office Telephone
_____	_____
Emergency (24 hour) Telephone	Date

TABLE 4

SOIL EROSION AND SEDIMENT CONTROL INSPECTION CHECKLIST

Inspector: _____ Date: _____

Weather: _____ Time: _____

Site Feature	**Is There a Problem**	**Notes (What is the issue/Who will be notified)**
Inlet Protection		
Perimeter Controls		
Vegetation		
Soil Stockpiles and Sediment Traps		
Discharge Locations		
Diversion Swales		
Sediment Basins		
Exposed Surfaces (Soil or Materials)		
Other		

Corrective action taken while on site?

SIGNATURE: _____ **SIGNATURE:** _____

General Contractor On-Site Agent

UNBOUND, LOOSE DOCUMENTS

Signed Application Form

ALTERATION OF TERRAIN PERMIT APPLICATION

Water Division/ Alteration of Terrain Bureau/ Land Resources Management
Check the Status of your Application: www.des.nh.gov/onestop

RSA/ Rule: RSA 485-A:17, Env-Wq 1500

Administrative Use Only	Administrative Use Only	Administrative Use Only	File Number:
			Check No.
			Amount:
			Initials:

1. APPLICANT INFORMATION (INTENDED PERMIT HOLDER)			
Applicant Name: Hillwood Enterprises, L.P.		Contact Name: Justin Dunn	
Email: justin.dunn@hillwood.com		Daytime Telephone: 617-824-9100	
Mailing Address: 5050 W. Tilgham St., Suite 435			
Town/City: Allentown		State: PA	Zip Code: 18104
2. APPLICANT'S AGENT INFORMATION If none, check here: ☐			
Business Name: Langan Engineering & Environmental Service		Contact Name: Nathan Kirschner	
Email: NKirschner@Langan.com		Daytime Telephone: 617-824-9100	
Address: 888 Boylston Street			
Town/City: Boston		State: MA	Zip Code: 02116
3. PROPERTY OWNER INFORMATION (IF DIFFERENT FROM APPLICANT)			
Applicant Name: Green Meadow Golf Club, Inc.		Contact Name: Ryan Friel	
Email: rfriel@frielgolf.com		Daytime Telephone: 603-882-8893	
Mailing Address: 55 Marsh Road			
Town/City: Hudson		State: NH	Zip Code: 03501
4. PROPERTY OWNER'S AGENT INFORMATION If none, check here: ☐			
Business Name: Welts, White & Fontaine, PC		Contact Name: Thomas J. Leonard	
Email: tjleonard@lawyersnh.com		Daytime Telephone: 603-883-0797	
Address: 29 Factory Street, PO Box 507			
Town/City: Nashua		State: NH	Zip Code: 03061
5. CONSULTANT INFORMATION If none, check here: ☐			
Engineering Firm: Langan Engineering & Environmental Service		Contact Name: Nathan Kirschner	
Email: NKirschner@Langan.com		Daytime Telephone: 617-824-9100	
Address: 888 Boylston Street			
Town/City: Boston		State: MA	Zip Code: 02116

6. PROJECT TYPE

☐ Excavation Only ☐ Residential ☒ Commercial ☐ Golf Course ☐ School ☐ Municipal
☐ Agricultural ☐ Land Conversion ☐ Other:

7. PROJECT LOCATION INFORMATION

Project Name: Huson Logistics Center

Street/Road Address: Lowell Road

Town/City: Town of Hudson	County: Hillsborough

Tax Map: 234; 239	Block:	Lot Number: 5, 34, 35; 1	Unit:

Location Coordinates: 42°43'5.86"N; 71°25'55.71"W ☒ Latitude/Longitude ☐ UTM ☐ State Plane

Post-development, will the proposed project withdraw from or directly discharge to any of the following? If yes, identify the purpose.

1. Stream or Wetland Purpose: Maintain Existing Stormwater Discharge Locations	☒ Yes ☐ No	☐ Withdrawal	☒ Discharge
2. Man-made pond created by impounding a stream or wetland Purpose: Stormwater Management / Treatment	☒ Yes ☐ No	☐ Withdrawal	☒ Discharge
3. Unlined pond dug into the water table Purpose:	☐ Yes ☒ No	☐ Withdrawal	☐ Discharge

Post-development, will the proposed project discharge to:

- A surface water impaired for phosphorus and/or nitrogen? ☒ No ☐ **Yes - include information to demonstrate that project will not cause net increase in phosphorus and/or nitrogen**
- A Class A surface water or Outstanding Resource Water? ☒ No ☐ **Yes - include information to demonstrate that project will not cause net increase in phosphorus and/or nitrogen**
- A lake or pond not covered previously? ☒ No ☐ **Yes - include information to demonstrate that project will not cause net increase in phosphorus in the lake or pond**

Is the project a High Load area? ☐ Yes ☒ No
If yes, specify the type of high load land use or activity: _____

Is the project within a Water Supply Intake Protection Area (WSIPA)? ☐ Yes ☒ No
Is the project within a Groundwater Protection Area (GPA)? ☒ Yes ☐ No
Will the well setbacks identified in Env-Wq 1508.02 be met? ☒ Yes ☐ No

Existing wells are inactive and to be removed

Note: Guidance document titled "*Using NHDES's OneStop WebGIS to Locate Protection Areas*" is available online. For more details on the restrictions in these areas, read Chapter 3.1 in Volume 2 of the NH Stormwater Manual.

Is any part of the property within the 100-year floodplain? ☒ Yes ☐ No
If yes: Cut volume: 0 cubic feet within the 100-year floodplain
Fill volume: 0 cubic feet within the 100-year floodplain

☒ Project **IS** within **¼ mile of a designated river** Name of River: Merrimack River - NHRIV700061206-24
☐ Project is **NOT** within ¼ mile of a designated river

☐ Project **IS** within **a Coastal/Great Bay Region community** - **include info required by Env-Wq 1503.08(l) if applicable**
☒ Project is **NOT** within a Coastal/Great Bay Region community

8. BRIEF PROJECT DESCRIPTION (PLEASE DO NOT REPLY "SEE ATTACHED")

The project proposes the redevelopment of Greenmeadow Golf Club into the Hudson Logistics Center. The subject site is rough 372.13 acres and is located off Lowell Rd and Steele Rd. The existing 39 hole golf course is proposed to be turned in to three new distribution and logistic building. The three buildings will total an approximate, combine footprint of 2,603,400 sf. The construction will include associated truck courts, roadways, parking lots, utilities, landscaping, retaining walls and stormwater management features.The property will be accessed primarily via a new dedicated subdivision road off of Lowell Road and a secondary access off to the west of the the existing Sam's Club building along Lowell Road.

9. IF APPLICABLE, DESCRIBE ANY WORK STARTED PRIOR TO RECEIVING PERMIT

10. ADDITIONAL REQUIRED INFORMATION

A. Date a copy of the application was sent to the municipality as required by Env-Wq 1503.05(e)[1]: 06/23/2020
(Attach proof of delivery)

B. Date a copy of the application was sent to the local river advisory committee if required by Env-Wq 1503.05(e)[2]: 6 /23/2020
(Attach proof of delivery)

C. Type of plan required: ☐ Land Conversion ☒ Detailed Development ☐ Excavation, Grading & Reclamation ☐ Steep Slope

D. Additional plans required: ☒ Stormwater Drainage & Hydrologic Soil Groups ☒ Source Control ☐ Chloride Management

E. Total area of disturbance: _____ square feet ±10 mil

F. Additional impervious cover as a result of the project: _____ square feet (use the "-" symbol to indicate a net reduction in impervious coverage). ±6.4 mil plus ±5.9 mil
Total final impervious cover: _____ square feet

G. Total undisturbed cover: _____ square feet ±5.8 mil

H. Number of lots proposed: 4

I. Total length of roadway: _____ linear feet ±3,400 LFT

J. Name(s) of receiving water(s): NHRIV700061206-13 (UNNAMED BROOK - TO MERRIMACK RIVER); NHRIV700061206-23 (MUSQUASH BROOK - LIMIT BROOK); NHRIV700061206-24 (MERRIMACK RIVER)

K. Identify all other NHDES permits required for the project, and for each indicate whether an application has been filed and is pending, or if the required approval has been issued provide the permit number, registration date, or approval letter number, as applicable.

Type of Approval	Application Filed?	Status	
		Pending	If Issued:
1. Water Supply Approval	☐ Yes ☒ No ☐ N/A	☐	Permit number:
2. Wetlands Permit	☒ Yes ☐ No ☐ N/A	☒	Permit number:
3. Shoreland Permit	☒ Yes ☐ No ☐ N/A	☒	Permit number:
4. UIC Registration	☐ Yes ☒ No ☐ N/A	☐	Registration date:
5. Large/Small Community Well Approval	☐ Yes ☒ No ☐ N/A	☐	Approval letter date:
6. Large Groundwater Withdrawal Permit	☐ Yes ☒ No ☐ N/A	☐	Permit number:
7. Other:	☒ Yes ☐ No	☒	Permit number: NHDES Wetlands Bureau Major Impact Dredge and Fill Application

L. List all species identified by the Natural Heritage Bureau as threatened or endangered or of concern: Persius Dusky Wing, Arrow-head Rattlebox, River Birth, Wild Lupine, Eastern Box Turtle

M. Using NHDES's Web GIS OneStop program (www2.des.state.nh.us/gis/onestop/), with the Surface Water Impairment layer turned on, list the impairments identified for each receiving water. If no pollutants are listed, enter "N/A."
Aluminum, Chlorophyll-a, Escherichia coli

N. Did the applicant/applicant's agent have a pre-application meeting with AOT staff? ☒ Yes ☐ No
If yes, name of staff member: Ridgely Mauck, P.E - Program Supervisor – Permitting & Bethann McCarthy, P.E.

O. Will blasting of bedrock be required? ☐ Yes ☒ No If yes, estimated quantity of blast rock: _____ cubic yards
If yes, standard blasting BMP notes must be placed on the plans, available at:
http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-10-12.pdf

NOTE: If greater than 5,000 cubic yards of blast rock will be generated, a groundwater monitoring program must be developed and submitted to NHDES. Contact AOT staff for additional detail.

[1] Env-Wq 1503.05(c)(6), requires proof that a completed application form, checklist, plans and specifications, and all other supporting materials have been sent or delivered to the governing body of each municipality in which the project is proposed.

[2] Env-Wq 1503.05(c)(6), requires proof that a completed application form, checklist, plans and specifications, and all other supporting materials have been sent or delivered to the Local River Advisory Committee, if the project is within ¼ mile of a designated river.

11. CHECK ALL APPLICATION ATTACHMENTS THAT APPLY (SUBMIT WITH APPLICATION IN ORDER LISTED)

LOOSE:

- ☒ Signed application form: des.nh.gov/organization/divisions/water/aot/index.htm (with attached proof(s) of delivery)
- ☒ Check for the application fee: des.nh.gov/organization/divisions/water/aot/fees.htm
- ☒ Color copy of a USGS map with the property boundaries outlined (1" = 2,000' scale)
- ☒ If Applicant is not the property owner, proof that the applicant will have a legal right to undertake the project on the property if a permit is issued to the applicant.

BIND IN A REPORT IN THE FOLLOWING ORDER:

- ☒ Copy of the signed application form & application checklist (des.nh.gov/organization/divisions/water/aot/index.htm)
- ☒ Copy of the check
- ☒ Copy of the USGS map with the property boundaries outlined (1" = 2,000' scale)
- ☒ Narrative of the project with a summary table of the peak discharge rate for the off-site discharge points
- ☒ Web GIS printout with the "Surface Water Impairments" layer turned on - http://www4.des.state.nh.us/onestopdatamapper/onestopmapper.aspx
- ☒ Web GIS printouts with the AOT screening layers turned on - http://www4.des.state.nh.us/onestopdatamapper/onestopmapper.aspx
- ☒ NHB letter using DataCheck Tool – www.nhdfl.org/about-forests-and-lands/bureaus/natural-heritage-bureau/
- ☒ The Web Soil Survey Map with project's watershed outlined – websoilsurvey.nrcs.usda.gov
- ☒ Aerial photograph (1" = 2,000' scale with the site boundaries outlined)
- ☒ Photographs representative of the site
- ☒ Groundwater Recharge Volume calculations (one worksheet for each permit application): des.nh.gov/organization/divisions/water/aot/documents/bmp_worksh.xls
- ☒ BMP worksheets (one worksheet for each treatment system): des.nh.gov/organization/divisions/water/aot/documents/bmp_worksh.xls
- ☒ Drainage analysis, stamped by a professional engineer (see Application Checklist for details)
- ☒ Riprap apron or other energy dissipation or stability calculations
- ☒ Site Specific Soil Survey report, stamped and with a certification note prepared by the soil scientist that the survey was done in accordance with the Site Specific Soil Mapping standards, *Site-Specific Soil Mapping Standards for NH & VT, SSSNNE Special Publication No. 3*.
- ☐ Infiltration Feasibility Report (example online) [Env-Wq 1503.08(f)(3)] Information to be gathered at a future date. Included in the Stormwater Managament Report
- ☐ Registration and Notification Form for Storm Water Infiltration to Groundwater (UIC Registration-for underground systems only, including drywells and trenches): (http://des.nh.gov/organization/divisions/water/dwgb/dwspp/gw_discharge) Applicability is TBD pending results of additional geotechnical investigation including infiltration testing.
- ☒ Inspection and maintenance manual with, if applicable, long term maintenance agreements [Env-Wq 1503.08(g)]
- ☒ Source control plan Refer to Stormwater Management Report

PLANS:

- ☒ One set of design plans on 34 - 36" by 22 - 24" white paper (see Application Checklist for details)
- ☒ Pre & post-development color coded soil plans on 11" x 17" (see Application Checklist for details)
- ☒ Pre & post-development drainage area plans on 34 - 36" by 22 - 24" white paper (see Application Checklist for details)

100-YEAR FLOODPLAIN REPORT:

- ☒ All information required in Env-Wq 1503.09, submitted as a separate report.

ADDITIONAL INFORMATION RE: NUTRIENTS, CLIMATE

- ☒ See Checklist for Details

☒ **REVIEW APPLICATION FOR COMPLETENESS & CONFIRM INFORMATION LISTED ON THE APPLICATION IS INCLUDED WITH SUBMITTAL.**

12. REQUIRED SIGNATURES

NLK By initialing here, I acknowledge that I am required by Env-Wq 1503.20(e) to submit a copy of all approved documents to the department in PDF format on a CD within one week after permit approval.

By signing below, I certify that:

- The information contained in or otherwise submitted with this application is true, complete, and not misleading to the best of my knowledge and belief;
- I understand that the submission of false, incomplete, or misleading information constitutes grounds for the department to deny the application, revoke any permit that is granted based on the information, and/or refer the matter to the board of professional engineers established by RSA 310-A:3 if I am a professional engineer; and
- I understand that I am subject to the penalties specified in New Hampshire law for falsification in official matters, currently RSA 641.

☐ APPLICANT ☒ APPLICANT'S AGENT:

Signature: _____ Date: 6/22/2020

Name (print or type): Nathan Kirschner Title: Senior Project Manager

☐ PROPERTY OWNER ☒ PROPERTY OWNER'S AGENT:

Signature: _____ Date: 6/22/2020

Name (print or type): Nathan Kirschner Title: Senior Project Manager

Swap for live signature

ATTACHMENT A:
ALTERATION OF TERRAIN PERMIT APPLICATION CHECKLIST

Check the box to indicate the item has been provided or provide an explanation why the item does not apply.

DESIGN PLANS

☒ Plans printed on 34 - 36" by 22 - 24" white paper

☒ PE stamp

☒ Wetland delineation

☒ Temporary erosion control measures

☒ Treatment for all stormwater runoff from impervious surfaces such as roadways (including gravel roadways), parking areas, and non-residential roof runoff. Guidance on treatment BMPs can be found in Volume 2, Chapter 4 of the NH Stormwater Management Manual.

☒ Pre-existing 2-foot contours

☒ Proposed 2-foot contours

☐ Drainage easements protecting the drainage/treatment structures — To be determined at a later date in coordination with local authority.

☒ Compliance with the Wetlands Bureau, RSA 482- A http://des.nh.gov/organization/divisions/water/wetlands/index.htm. Note that artificial detention in wetlands is not allowed.

☒ Compliance with the Comprehensive Shoreland Protection Act, RSA 483-B. http://des.nh.gov/organization/divisions/water/wetlands/cspa

☒ Benches. Benching is needed if you have more than 20 feet change in elevation on a 2:1 slope, 30 feet change in elevation on a 3:1 slope, 40 feet change in elevation on a 4:1 slope.

☐ Check to see if any proposed ponds need state Dam permits. http://des.nh.gov/organization/divisions/water/dam/documents/damdef.pdf — Pending local approval of stormwater management system, proposed ponds will be sent for state Dam permit review.

DETAILS

☒ Typical roadway x-section

☒ Detention basin with inverts noted on the outlet structure

☐ Stone berm level spreader — Not in use.

☒ Outlet protection – riprap aprons — Use of pre-formed scour holes.

☒ A general installation detail for an erosion control blanket

☒ Silt fences or mulch berm

☒ Storm drain inlet protection. Note that since hay bales must be embedded 4 inches into the ground, they are not to be used on hard surfaces such as pavement.

☒ Hay bale barriers

☐ Stone check dams — Not in use.

☒ Gravel construction exit

☒ Temporary sediment trap

☒ The treatment BMP's proposed

☒ Any innovative BMP's proposed

CONSTRUCTION SEQUENCE/EROSION CONTROL

☒ Note that the project is to be managed in a manner that meets the requirements and intent of RSA 430:53 and Chapter Agr 3800 relative to invasive species.

☒ Note that perimeter controls shall be installed prior to earth moving operations.

☒ Note that temporary water diversion (swales, basins, etc) must be used as necessary until areas are stabilized.

☒ Note that ponds and swales shall be installed early on in the construction sequence (before rough grading the site).

☒ Note that all ditches and swales shall be stabilized prior to directing runoff to them.

☒ Note that all roadways and parking lots shall be stabilized within 72 hours of achieving finished grade.

☒ Note that all cut and fill slopes shall be seeded/loamed within 72 hours of achieving finished grade

☒ Note that all erosion controls shall be inspected weekly AND after every half-inch of rainfall.

☒ Note the limits on the open area allowed, see Env-Wq 1505.02 for detailed information.

Example note: The smallest practical area shall be disturbed during construction, but in no case shall exceed 5 acres at any one time before disturbed areas are stabilized.

☒ Note the definition of the word “stable”

Example note: An area shall be considered stable if one of the following has occurred:

- Base course gravels have been installed in areas to be paved.
- A minimum of 85 percent vegetated growth has been established.
- A minimum of 3 inches of non-erosive material such stone or riprap has been installed.
- Or, erosion control blankets have been properly installed.

☒ Note the limit of time an area may be exposed
Example note: All areas shall be stabilized within 45 days of initial disturbance.

☒ Provide temporary and permanent seeding specifications. (Reed canary grass is listed in the Green Book; however, this is a problematic species according to the Wetlands Bureau and therefore should not be specified)

☒ Provide winter construction notes that meet or exceed our standards.

Standard Winter Notes:

- All proposed vegetated areas that do not exhibit a minimum of 85 percent vegetative growth by October 15, or which are disturbed after October 15, shall be stabilized by seeding and installing erosion control blankets on slopes greater than 3:1, and seeding and placing 3 to 4 tons of mulch per acre, secured with anchored netting, elsewhere. The installation of erosion control blankets or mulch and netting shall not occur over accumulated snow or on frozen ground and shall be completed in advance of thaw or spring melt events.
- All ditches or swales which do not exhibit a minimum of 85 percent vegetative growth by October 15, or which are disturbed after October 15, shall be stabilized temporarily with stone or erosion control blankets appropriate for the design flow conditions.
- After October 15, incomplete road or parking surfaces, where work has stopped for the winter season, shall be protected with a minimum of 3 inches of crushed gravel per NHDOT item 304.3.

☒ Note at the end of the construction sequence that “Lot disturbance, other than that shown on the approved plans, shall not commence until after the roadway has the base course to design elevation and the associated drainage is complete and stable.” – This note is applicable to single/duplex family subdivisions, when lot development is not part of the permit.

DRAINAGE ANALYSES

Please double-side 8 ½" × 11" sheets where possible but, **do not** reduce the text such that more than one page fits on one side.

☒ PE stamp

☒ Rainfall amount obtained from the Northeast Regional Climate Center- http://precip.eas.cornell.edu/. Include extreme precipitation table as obtained from the above referenced website.

☒ Drainage analyses, in the following order:

- Pre-development analysis: Drainage diagram.
- Pre-development analysis: Area Listing and Soil Listing.
- Pre-development analysis: Node listing 1-year (if applicable), 2-year, 10-year and 50-year.
- Pre-development analysis: Full summary of the 10-year storm.
- Post-development analysis: Drainage diagram.
- Post-development analysis: Area Listing and Soil Listing.
- Post-development analysis: Node listing for the 2-year, 10-year and 50-year.
- Post-development analysis: Full summary of the 10-year storm.

☒ Review the Area Listing and Soil Listing reports

- Hydrologic soil groups (HSG) match the HSGs on the soil maps provided.
- There is the same or less HSG A soil area after development (check for each HSG).
- There is the same or less "woods" cover in the post-development.
- Undeveloped land was assumed to be in "good" condition.
- The amount of impervious cover in the analyses is correct.

Note: A good check is to subtract the total impervious area used in the pre analysis from the total impervious area used in the post-analysis. For residential projects without demolition occurring, a good check is to take this change in impervious area, subtract out the roadway and divide the remaining by the number of houses/units proposed. Do these numbers make sense?

☒ Check the storage input used to model the ponds.

☒ Check to see if the artificial berms pass the 50-year storm, i.e., make sure the constructed berms on ponds are not overtopped.

☒ Check the outlet structure proposed and make sure it matches that modeled.

☒ Check to see if the total areas in the pre and post analyses are same.

☒ Confirm the correct NRCS storm type was modeled (Coos, Carroll & Grafton counties are Type II, all others Type III).

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PRE- AND POST-DEVELOPMENT DRAINAGE AREA PLANS

☒ Plans printed on 34 - 36" by 22 - 24" on white paper.

☒ Submit these plans separate from the soil plans.

☒ A north arrow.

☒ A scale.

☒ Labeled subcatchments, reaches and ponds.

☒ Tc lines.

☒ A clear delineation of the subcatchment boundaries.

☒ Roadway station numbers.

☒ Culverts and other conveyance structures.

PRE AND POST-DEVELOPMENT COLOR-CODED SOIL PLANS

☒ 11" × 17"sheets suitable, as long as it is readable.

☒ Submit these plans separate from the drainage area plans.

☒ A north arrow.

☒ A scale.

☒ Name of the soil scientist who performed the survey and date the soil survey took place.

☒ 2-foot contours (5-foot contours if application is for a gravel pit) as well as other surveyed features.

☒ Delineation of the soil boundaries and wetland boundaries.

☒ Delineation of the subcatchment boundaries.

☒ Soil series symbols (e.g., 26).

☒ A key or legend which identifies each soil series symbol and its associated soil series name (e.g., 26 = Windsor).

☒ The hydrologic soil group color coding (A = Green, B = yellow, C= orange, D=red, Water=blue, & Impervious = gray).

Please note that excavation projects (e.g., gravel pits) have similar requirements to that above, however the following are common exceptions/additions:

☐ Drainage report is not needed if site does not have off-site flow.

Not Applicable

☐ 5 foot contours allowed rather than 2 foot.

☐ No PE stamp needed on the plans.

☐ Add a note to the plans that the applicant must submit to the Department of Environmental Services a written update of the project and revised plans documenting the project status every five years from the date of the Alteration of Terrain permit.

☐ Add reclamation notes.

See NRCS publication titled: *Vegetating New Hampshire Sand and Gravel Pits* for a good resource, it is posted online at: http://des.nh.gov/organization/divisions/water/aot/categories/publications.

ADDITIONAL INFORMATION RE: NUTRIENTS, CLIMATE

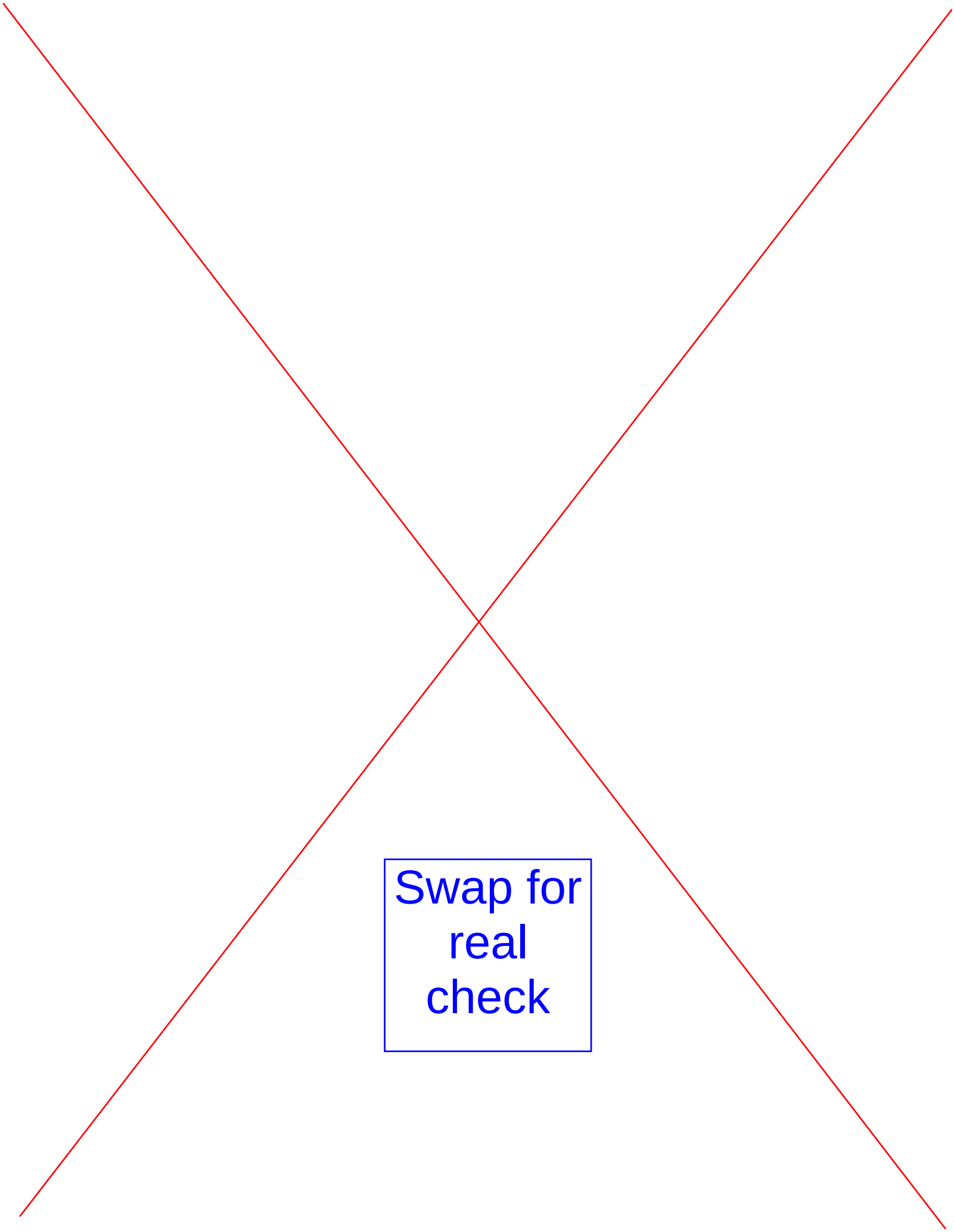
☒ If project will discharge stormwater to a surface water impaired for phosphorus and/or nitrogen, include information to demonstrate that project will not cause net increase in phosphorus and/or nitrogen.

☒ If project will discharge stormwater to a Class A surface water or Outstanding Resource Water, include information to demonstrate that project will not cause net increase in phosphorus and/or nitrogen.

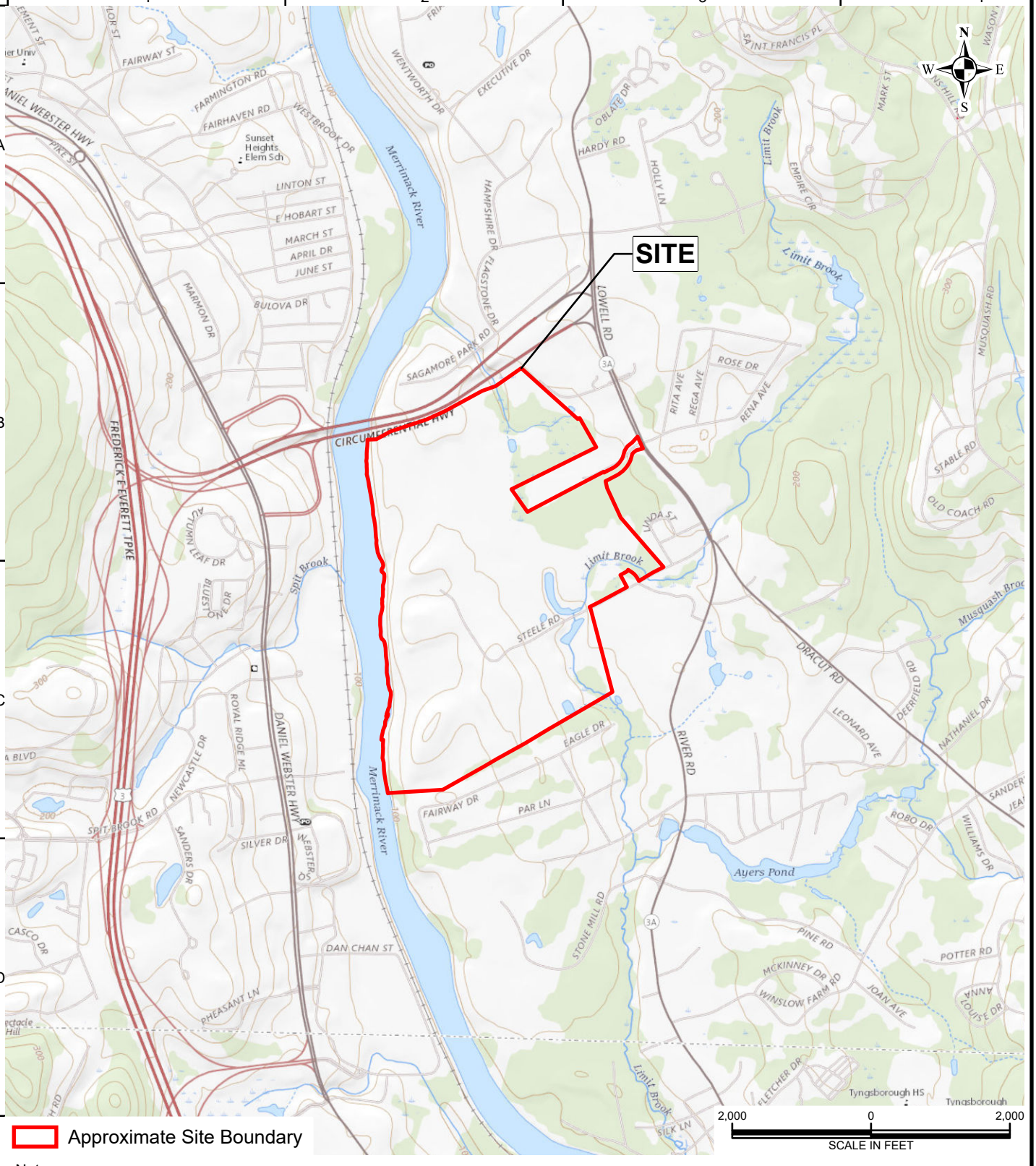
☒ If project will discharge stormwater to a lake or pond not covered previously, include information to demonstrate that project will not cause net increase in phosphorus in the lake or pond.

☒ If project is within a Coastal/Great Bay Region community, include info required by Env-Wq 1503.08(l) if applicable.

Check – Application Fee


Swap for
real
check

Color USGS Map



Approximate Site Boundary

Notes:
Basemap provided by United States Geological Survey. Quadrangle: Nashua South, NH, dated: 2018.

LANGAN
888 Boylston Street, Suite 510
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Langan Engineering & Environmental Services, Inc.
Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C.
Langan International
Collectively known as Langan

Project	HILLWOOD HUDSON HILLSBOROUGH COUNTY NEW HAMPSHIRE
Drawing Title	SITE LOCATION MAP
Project No.	151010101
Figure	1
Date	05/18/2020
Scale	1" = 2,000'
Drawn By	MG
Submission Date	
Sheet	Sheet 1 of 5

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Legal Right to Undertake Project

LETTER OF AUTHORIZATION

Thomas P. Friel and Philip J. Friel, III, the owners of property depicted on the Town of Hudson, New Hampshire Assessors Maps as Tax Map 234, Lot 34 (273 Lowell Road), do hereby authorize Hillwood Enterprises, L.P, ("Applicant"), and/or its agents and any engineering firm, or architecture firm or attorneys which Applicant may designate, to execute, submit, and prosecute land use applications and any applicable materials to any local, state and/or federal governmental entities, including but not limited to, applications filed with the Town of Hudson, New Hampshire, and to take any action necessary for the application and permitting process, including but not limited to, attendance and presentation at public hearings, of the said Property.

Dated: April 16, 2020

By: _____ TF
Thomas P. Friel

By: _____
Philip J. Friel, III

LETTER OF AUTHORIZATION

GREENMEADOW GOLF CLUB, INC., a New Hampshire corporation, owner of property depicted on the Town of Hudson, New Hampshire Assessors Maps as Tax Map 234, Lot 5 (11 Steele Road), Tax Map 234, Lot 6 (15 Steele Road), and, Tax Map 239, Lot 1 (43 Steele Road)(collectively, the "Property"), do hereby authorize Hillwood Enterprises, L.P ("Applicant"), and/or its agents and any engineering firm, or architecture firm or attorneys which Applicant may designate, to execute, submit, and prosecute land use applications and any applicable materials to any local, state and/or federal governmental entities, including but not limited to, applications filed with the Town of Hudson, New Hampshire, and to take any action necessary for the application and permitting process, including but not limited to, attendance and presentation at public hearings, of the said Property.

Dated: April 16, 2020

GREENMEADOW GOLF CLUB, INC.

By: _____

Title: Vice President,
duly authorized.

HILLWOOD
A PEROT COMPANY

AUTHORIZATION

HILLWOOD ENTERPRISES, L. P., with business address at 5050 W. Tilghman Street, Suite 435, Allentown, PA 18104, hereby authorizes and designates its agents, Smolak & Vaughan LLP, Langan Engineering & Environmental Services, Inc., and Donahue, Tucker & Ciandella, PLLC, to execute, submit, and prosecute land use applications and any applicable materials to any local, state and/or federal governmental entities, including but not limited to, applications filed with the Town of Hudson, New Hampshire, and to take any action necessary for the application and permitting process, including but not limited to, attendance and presentation at public hearings, with respect to the following parcels of the land as Hillwood is authorized by said property owners, for the following properties, including: (a) 11, 15 and 43 Steele Road -- Tax Map 234, Lot 5 (11 Steele Road), Tax Map 234, Lot 6 (15 Steele Road), and, Tax Map 239, Lot 1 (43 Steele Road), owned by Greenmeadow Golf Club, Inc.; and, (b) 273 Lowell Road -- Tax Map 234, Lot 34, owned by Thomas P. Friel and Philip J. Friel, III.

Dated: April 21, 2020

Hillwood Enterprises, L.P.,
a Texas limited partnership

By: AHB, LLC,
a Texas limited liability company
its general partner

By: _____
Name: Gary B. Frederick
Title: Sr. Vice President, duly authorized.