Dry Well Report
Lot 19 in Block 386.02
Franklin Township
Somerset County, New Jersey

May 12, 2020

Prepared By:
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32 Brower Lane
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Hillsborough, New Jersey 08844

Michael K. Ford

Michael K. Ford, N.J.P.E. No. 34722

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Item

I. Dry Well Volume Analysis

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Dry Well Volume Analysis

Required Storage Volume Calculation

Two proposed structures and pavement drive = 8,145 sf

Use 3.0 inch rainfall event (per prior project stormwater calculations approved by Twp. Eng Dept.)

Required Storage Volume =

(8,145 sf) X 3 inches/12 = 2,036 cf

Dry Well Volume Calculation

One Dry Well storage volume per StormTech ADS Volume Calculation sheet 1,172 cf

Total storage on site (2 Dry Wells) – 1,172 cf x 2 = 2,344 cf

Proposed Storage Volume (2,344 cf) > Required Storage Volume (2,036 cf) ok (Two Dry Wells)

Michael K. Ford

Michael K. Ford, NJPE Lic. No. 34722

5-12-20

Date

Please Reply To:
CENTRAL NJ OFFICE • 32 Brower Lane, Bldg. B, PO Box 5877 • Hillsborough NJ 08844 • 908.359.8291• Fax: 908.359.1580
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II. Stormtech ADS Volume Calculation Sheet

Project:

Chamber Model -	SC-310	
Units -	**Imperial**	Click Here for Metric
	100	
Number of chambers -	36	
Voids in the stone (porosity) -	33	%
Base of STONE Elevation -	109.00	ft
Amount of Stone Above Chambers -	6	in
Amount of Stone Below Chambers -	6	in
Area of system -	1060	sf

Min. Area - 854 sf min. area

☑ Include Perimeter Stone in Calculations

StormTech SC-310 Cumulative Storage Volumes

Height of System *(inches)*	Incremental Single Chamber *(cubic feet)*	Incremental Total Chamber *(cubic feet)*	Incremental Stone *(cubic feet)*	Incremental Ch & St *(cubic feet)*	Cumulative Chamber *(cubic feet)*	Elevation *(feet)*
28	0.00	0.00	29.15	29.15	1172.21	111.33
27	0.00	0.00	29.15	29.15	1143.06	111.25
26	0.00	0.00	29.15	29.15	1113.91	111.17
25	0.00	0.00	29.15	29.15	1084.76	111.08
24	0.00	0.00	29.15	29.15	1055.61	111.00
23	0.00	0.00	29.15	29.15	1026.46	110.92
22	0.06	2.12	28.45	30.57	997.31	110.83
21	0.15	5.57	27.31	32.88	966.75	110.75
20	0.27	9.57	25.99	35.56	933.86	110.67
19	0.54	19.61	22.68	42.29	898.30	110.58
18	0.70	25.35	20.79	46.13	856.01	110.50
17	0.82	29.68	19.35	49.04	809.88	110.42
16	0.92	33.28	18.17	51.45	760.84	110.33
15	1.01	36.54	17.09	53.63	709.39	110.25
14	1.09	39.40	16.15	55.55	655.76	110.17
13	1.15	41.55	15.44	56.99	600.21	110.08
12	1.21	43.74	14.72	58.45	543.22	110.00
11	1.27	45.90	14.00	59.90	484.76	109.92
10	1.32	47.68	13.41	61.10	424.86	109.83
9	1.36	49.14	12.93	62.07	363.76	109.75
8	1.40	50.58	12.46	63.04	301.69	109.67
7	1.43	51.65	12.11	63.75	238.65	109.58
6	0.00	0.00	29.15	29.15	174.90	109.50
5	0.00	0.00	29.15	29.15	145.75	109.42
4	0.00	0.00	29.15	29.15	116.60	109.33
3	0.00	0.00	29.15	29.15	87.45	109.25
2	0.00	0.00	29.15	29.15	58.30	109.17
1	0.00	0.00	29.15	29.15	29.15	109.08

III. Dry Well Calculations Sheet

Dry Well Calculation Sheet

Dry Well 1

100 year storm volume from 0.04 Acres = 1,155 sf
Dry Well 1 volume of 1,172 cf which is less

Permeability Rate 10.58 in/hr per SL# 1
Design Permeability Rate 5.29 in/hr
1,155 cf / 1,060 sf = 1.09 ft = 13.08 in
13.08 in / 5.29 in/hr = 2.5 hr to drain dry well

Dry Well 2

100 year storm volume from 0.04 Acres = 1,155 sf
Dry Well 2 volume of 1,172 cf which is less

Permeability Rate 5.83 in/hr per SL# 2
Design Permeability Rate 2.92 in/hr
1,155 cf / 1,060 sf = 1.09 ft = 13.08 in
13.08 in / 2.92 in/hr = 4.5 hr to drain dry well

IV. Soil Logs/Permeability Tests

FORM 2-B SOIL LOGS AND INTERPRETATION
Somerset County/Franklin Township

Applicant's Name Crestwood Properties, LLC Block 386.02 Lot 19 Proposed Lot: 19.01

1. Log Number Dry Well SL #1 Method (Check One): Profile Pit: _____ Boring: _____
   Date Recorded: 4/15/20 & 4/16/20

2. Soil Log

Depth (inches) Top-Bottom	Munsell Color Name and Symbol; Estimated Textural Class; Estimated Volume % Coarse Fragment, If Present; Structure; Moist or Dry Consistence; Mottling - Abundance, Size and Contrast, If Present
0 - 12"	7.5YR 3/3 Silt Loam; Granular, Friable
12 - 36"	5YR 4/4 Gravelly Clay Loam; Angular Blocky, Firm
36 - 120"	5YR 4/4 Fractured Shale; 15% Loam
	No Mottles
	Water @ 42"

3. Ground Water Observations:
   X Seepage - Indicate Depth: 42"
   _____ Pit/Boring Flooded - Depth After 24 Hours = _____

4. Soil Limiting Zones:
   X Fractured Rock Substratum - Depth to Top 36"
   X Massive Rock Substratum - Depth to Top 120"
   _____ Excessively Coarse Horizon - Depth Top to Bottom _____
   _____ Excessively Coarse Substratum - Depth to Top _____
   _____ Hydraulically Restrictive Horizon - Depth Top to Bottom _____
   _____ Hydraulically Restrictive Substratum - Depth to Top _____
   _____ Perched Zone of Saturation - Depth Top to Bottom _____
   _____ Regional Zone of Saturation - Depth to Top _____

5. Soil Suitability Classification: _____

I hereby certify that the information furnished on Form 2b of this application is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (NJSA 58:10a-1 et seq.) and is subject to penalties as prescribed in NJAC 7:14-8.

Signature of Site Evaluator Kyle J. Paterson Date 4/16/2020

Signature of Engineer _____ Date _____
Michael K. Ford, NJ PE No. 34722

FORM 2-B SOIL LOGS AND INTERPRETATION
Somerset County/Franklin Township

Applicant's Name Crestwood Properties, LLC Block 386.02 Lot 19 Proposed Lot: 19.01

1. Log Number Dry Well SL# 2 Method (Check One): Profile Pit: _____ Boring: _____
   Date Recorded: 4/15/20 & 4/16/20

2. Soil Log

Depth (inches) Top-Bottom	Munsell Color Name and Symbol; Estimated Textural Class; Estimated Volume % Coarse Fragment, If Present; Structure; Moist or Dry Consistence; Mottling - Abundance, Size and Contrast, If Present
0 - 10”	5YR 4/3 Loam; Granular, Friable
10 - 20”	5YR 4/4 Gravelly Silt Loam; Subangular Blocky, Friable
20 - 55”	5YR 4/4 Blocky Shale; 15% Loam
55 - 126”	5YR 4/4 Fractured Shale; 10% Loam
	No Mottles
	Water @ 30”

3. Ground Water Observations:
   X Seepage - Indicate Depth: 30”
   _____ Pit/Boring Flooded - Depth After 24 Hours = _____

4. Soil Limiting Zones:
   X Fractured Rock Substratum - Depth to Top 55”
   X Massive Rock Substratum - Depth to Top 126”
   _____ Excessively Coarse Horizon - Depth Top to Bottom
   _____ Excessively Coarse Substratum - Depth to Top
   _____ Hydraulically Restrictive Horizon - Depth Top to Bottom
   _____ Hydraulically Restrictive Substratum - Depth to Top
   _____ Perched Zone of Saturation - Depth Top to Bottom
   _____ Regional Zone of Saturation - Depth to Top

5. Soil Suitability Classification:

I hereby certify that the information furnished on Form 2b of this application is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (NJSA 58:10a-1 et seq.) and is subject to penalties as prescribed in NJAC 7:14-8.

Signature of Site Evaluator Kyle J. Paterson Date 4/16/2020

Signature of Engineer _____ Date _____
Michael K. Ford, NJ PE No. 34722

FORM 3F - PIT-BAIL TEST DATA SHEET

Applicant: 0.00 Date Tested: 4/15-16/20

Block: 386.02 Lot: 19 Prop. Lot 18 Franklin Township

SEE SOIL LOG DW SL#1

PIT BAIL #: DW SL#1

Depth to pit bottom: 5.75 ft. 24 static water level: 3.50 ft. (Dwater)

Depth to Impermeable Strata: 8.63 ft.; H = Dstratum - Dwater: 5.13 ft.
(Dstratum) 1.5 x pit depth assumed

Calculate the following values and enter into the table below:

An = water surface area in square feet

hrise = water level rise in inches

Aav = average water surface area (An + previous An)/2 in sft.

h = average height of water level above Dstratum
(take average of current water level and previous water level, convert to feet, and subtract from Dstratum) in ft.

Ka = hrise/t x Aav/2.27 ($H^2 - h^2$) x 60 min/hr (K in inches/hr)

Tn(min)		Dwater(in)	l, w (ft)		An(sft)	hrise(in)	Aav(sft)	) h(ft)	Ka
t0	0	69.00	0.00	0.00	0.00				
t1	10	64.00	3.17	2.50	7.92	5.00	3.96	3.08	3.12
t2	10	62.50	3.50	2.50	8.75	1.50	8.33	3.35	2.20
t3	10	60.50	4.17	2.50	10.42	2.00	9.58	3.50	3.61
t4	10	59.25	4.83	2.50	12.08	1.25	11.25	3.64	2.85
t5	10	58.25	5.25	2.50	13.13	1.00	12.60	3.73	2.70
t6	10	57.00	5.42	2.50	13.54	1.25	13.33	3.82	3.78

Final pit depth (Dstratum) 5.75 ft.

24-hour groundwater reading 3.50 ft.

Height of 24 hour-reading above Dstratum 2.25 ft. (H)

Average height of water level above Dstratum 0.95 ft. (h)
(take average of d beginning and end of last time interval recorded, convert to feet, and subtract from Dstratum)

Calculate K using above data and final time interval of test:

K = [hrise / t] x [Aav / 2.27 (H- h)] x 60 min/hr

= [1.25 / 10]x[13.33 / 2.27 (5.06 - 0.90) x 60 min/hr

= 10.58 in/hr

I hereby certify that the information furnished on this form is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.) and is subject to penalties as prescribed in N.J.A.C. 7:14-8.

N.J.P.E. #34722

Engineer's Signature Michael K. Ford

License # and Seal

FORM 3F - PIT-BAIL TEST DATA SHEET

Applicant: 0.00 Date Tested: 4/15-16/20

Block: 386.02 Lot: 19 Prop. Lot 18 Franklin Township

SEE SOIL LOG DW SL#2

PIT BAIL #: DW SL#2

Depth to pit bottom: 6.00 ft. 24 static water level: 2.50 ft. (Dwater)

Depth to Impermeable Strata: 9.00 ft.; H = Dstratum - Dwater: 6.50 ft.

(Dstratum) 1.5 x pit depth assumed

Calculate the following values and enter into the table below:

An = water surface area in square feet

hrise = water level rise in inches

Aav = average water surface area (An + previous An)/2 in sft.

h = average height of water level above Dstratum

(take average of current water level and previous water level, convert to feet, and subtract from Dstratum) in ft.

$Ka = hrise/t \times Aav/2.27 (H - h)^2 \times 60 \text{ min/hr}$ (K in inches/hr)

Tn(min)		Dwater(in)	l, w (ft)		An(sft)	hrise(in)	Aav(sft)	) h(ft)	Ka
t0	0	70.50	3.67	2.50	9.17				
t1	10	68.00	4.25	2.50	10.63	2.50	9.90	3.23	2.05
t2	10	65.25	4.83	2.50	12.08	2.75	11.35	3.45	2.72
t3	10	63.25	5.50	2.50	13.75	2.00	12.92	3.65	2.36
t4	10	61.50	6.08	2.50	15.21	1.75	14.48	3.80	2.41
t5	10	60.00	6.50	2.50	16.25	1.50	15.73	3.94	2.33
t6	10	58.50	6.58	2.50	16.46	1.50	16.35	4.06	2.52

Final pit depth (Dstratum) 6.00 ft.

24-hour groundwater reading 2.50 ft.

Height of 24 hour-reading above Dstratum 3.50 ft. (H)

Average height of water level above Dstratum 1.06 ft. (h)

(take average of d beginning and end of last time interval recorded, convert to feet, and subtract from Dstratum)

Calculate K using above data and final time interval of test:

$K = [hrise / t] \times [Aav / 2.27 (H - h)] \times 60 \text{ min/hr}$

$= [1.50 / 10] \times [16.35 / 2.27 (12.25 - 1.13) \times 60 \text{ min/hr}$

$= 5.83 \text{ in/hr}$

I hereby certify that the information furnished on this form is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.) and is subject to penalties as prescribed in N.J.A.C. 7:14-8.

N.J.P.E. #34722

Engineer's Signature Michael K. Ford

License # and Seal

V. Dwelling 100 Year Storm Routing

Storm Event	Synthetic curve 100YR
Return Event	100 years
Duration	1,440.000 min
Depth	8.2 in
Time of Concentration (Composite)	6.000 min
Area (User Defined)	0.040 acres

Computational Time Increment	0.800 min
Time to Peak (Computed)	725.600 min
Flow (Peak, Computed)	0.27 ft³/s
Output Increment	3.000 min
Time to Flow (Peak Interpolated Output)	726.000 min
Flow (Peak Interpolated Output)	0.27 ft³/s

Drainage Area	
SCS CN (Composite)	98.000
Area (User Defined)	0.040 acres
Maximum Retention (Pervious)	0.2 in
Maximum Retention (Pervious, 20 percent)	0.0 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	8.0 in
Runoff Volume (Pervious)	1,155.804 ft³

Hydrograph Volume (Area under Hydrograph curve)	
Volume	1,155.000 ft³

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	6.000 min
Computational Time Increment	0.800 min
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	0.45 ft³/s

VI. Groundwater Mounding Analysis

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days or inches & hours)

Input Values		
10.6000	***R***	Recharge (infiltration) rate (feet/day)
0.150	Sy	Specific yield, Sy (dimensionless, between 0 and 1)
106.00	K	Horizontal hydraulic conductivity, Kh (feet/day)*
24.660	x	1/2 length of basin (x direction, in feet)
10.750	y	1/2 width of basin (y direction, in feet)
0.100	t	duration of infiltration period (days)
30.000	hi(0)	initial thickness of saturated zone (feet)

30.963	h(max)	maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
0.963	**Δ**h(max)	maximum groundwater mounding (beneath center of basin at end of infiltration period)

Conversion Table

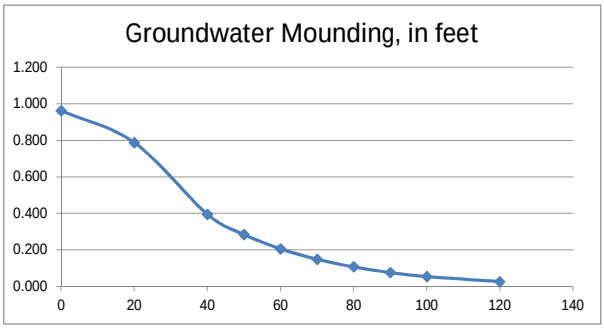
inch/hour	feet/day
0.67	1.33
2.00	4.00

hours	days
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
0.963	0
0.789	20
0.395	40
0.285	50
0.206	60
0.149	70
0.107	80
0.076	90
0.054	100
0.027	120

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
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use consistent units (e.g. feet & days or inches & hours)

Conversion Table

	inch/hour	feet/day
	0.67	1.33
	2.00	4.00

hours	days
36	1.50

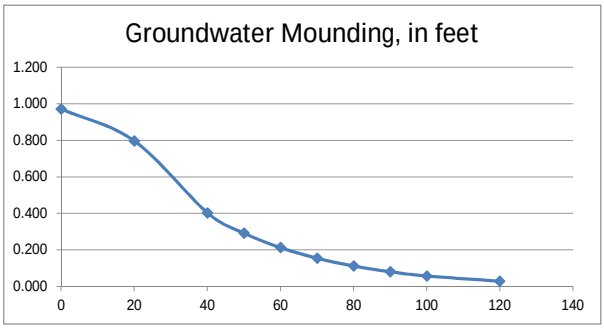
In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

Input Values		
5.8400	***R***	Recharge (infiltration) rate (feet/day)
0.150	Sy	Specific yield, Sy (dimensionless, between 0 and 1)
58.40	K	Horizontal hydraulic conductivity, Kh (feet/day)*
24.660	x	1/2 length of basin (x direction, in feet)
10.750	y	1/2 width of basin (y direction, in feet)
0.188	t	duration of infiltration period (days)
30.000	hi(0)	initial thickness of saturated zone (feet)

30.972	h(max)	maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
0.972	**Δ**h(max)	maximum groundwater mounding (beneath center of basin at end of infiltration period)

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
0.972	0
0.798	20
0.403	40
0.292	50
0.213	60
0.155	70
0.112	80
0.080	90
0.057	100
0.029	120

Re-Calculate Now



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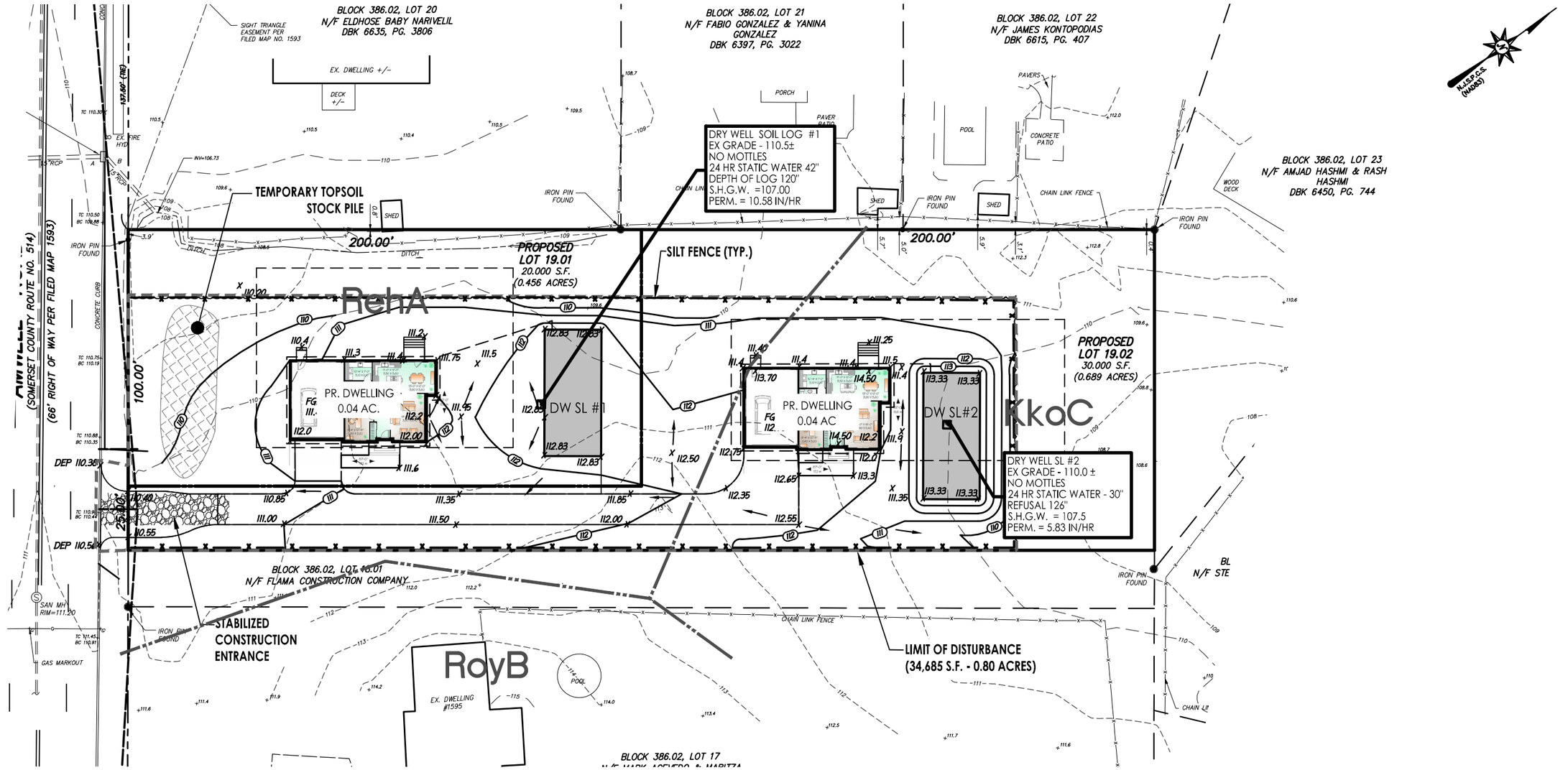
VII. Dry Well Soil Log Exhibit



			DATE: DECEMBER 5, 2019
			SCALE: 1" = 20'
			DESIGNED BY: M.K.F.
			DRAWN BY: A.B.
			CHECKED BY: M.K.F.
REVISIONS	AUTH.	DATE	JOB No. 1720FS

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Water / Wastewater
Municipal Engineering
Land Surveying
Professional Planning
Landscape Architecture

Michael K. Ford, P.E.
Professional Engineering, New Jersey Lic. No. 34722

DRY WELL SOIL LOG EXHIBIT
FOR
BLOCK 386.02, LOT 19
SITUATED IN
FRANKLIN TOWNSHIP,
SOMERSET COUNTY, NEW JERSEY

F:\JOBFILE\1720FS\ENG\HYDRO\1720FS-DA PLANS5-4-20.DWG

F.Bk. Pg.