Stormwater Management Study

Northern Pass Transmission, LLC

Transition Station #6

Project No. 58466

RE-ISSUED FOR PERMITTING

December 13, 2016

Stormwater Management Study

prepared for

Northern Pass Transmission, LLC

Transition Station #6
Daniel Webster Highway, Bridgewater, NH 03264

Project No. 58466

RE-ISSUED FOR PERMITTING
December 13, 2016

prepared by

Burns & McDonnell Engineering Company, Inc.

INDEX AND CERTIFICATION

Northern Pass Transmission, LLC
Stormwater Management Study
Transition Station #6 – Project No. 58466
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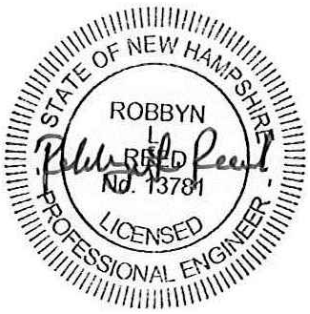
Report Index

Certification

I hereby certify, as a Professional Engineer in the State of New Hampshire, that the information in this document was assembled under my direct personal charge. This report is not intended or represented to be suitable for reuse by the Northern Pass Transmission, LLC or others without specific verification or adaptation by the Engineer.



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Dec 13 2016

Robbyn Reed, P.E. Date

Additional reference information provided by others and not certified by the above sealing Engineer.

Section Number	Section Title
Appendix F	FEMA Flood Insurance Rate Map
Appendix G	Soil Survey Reports (By Others)
Appendix H	Geotechinical Report (By Others)
Appendix I	Wetlands Delineation Report (By Others)

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LIST OF ABBREVIATIONS

Abbreviation	Term/Phrase/Name
BMcD	Burns & McDonnell
BMP	Best Management Practice
CFS	Cubic Feet per Second
E&S	Erosion and Sedimentation Control
FPS	Feet per Second
FT	Feet
LF	Linear Feet
LiDAR	Light Detection and Ranging
NAD	North American Datum
NAVD	North American Vertical Datum
NH DES	New Hampshire Department of Environmental Services
ORW	Outstanding Resource Water
ROW	Right-of-way
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids
WQF	Water Quality Flow
WQV	Water Quality Volume

1.0 PROJECT OVERVIEW

1.1 Location and Project Summary

Northern Pass Transmission, LLC (NPT) plans to construct Transition Station #6, a new transition station located on Eversource owned property on the Daniel Webster Highway, Bridgewater, NH 03264 N43^{o}42'41.24" latitude and –W71^{o}39'25.91" longitude) in Bridgewater, Grafton County, NH (Site). Refer to Figure 1-1: USGS Site Location Map.

The Site is bounded by the Daniel Webster Highway on the west, wooded terrain to the south, the Boston and Maine Railroad to the east and John Jenness Road to the north. The Site is located within the surface watershed of the Pemigewasset River.

Pre-development conditions primarily consist of undeveloped woodland areas and an open meadow area on the north end of the site. The south end of the site consists of several low areas that hold water, but generally flows to the northwest toward an existing culvert under the Daniel Webster Highway. The northern portion of the site flows to the southwest toward the culvert under the Daniel Webster Highway.

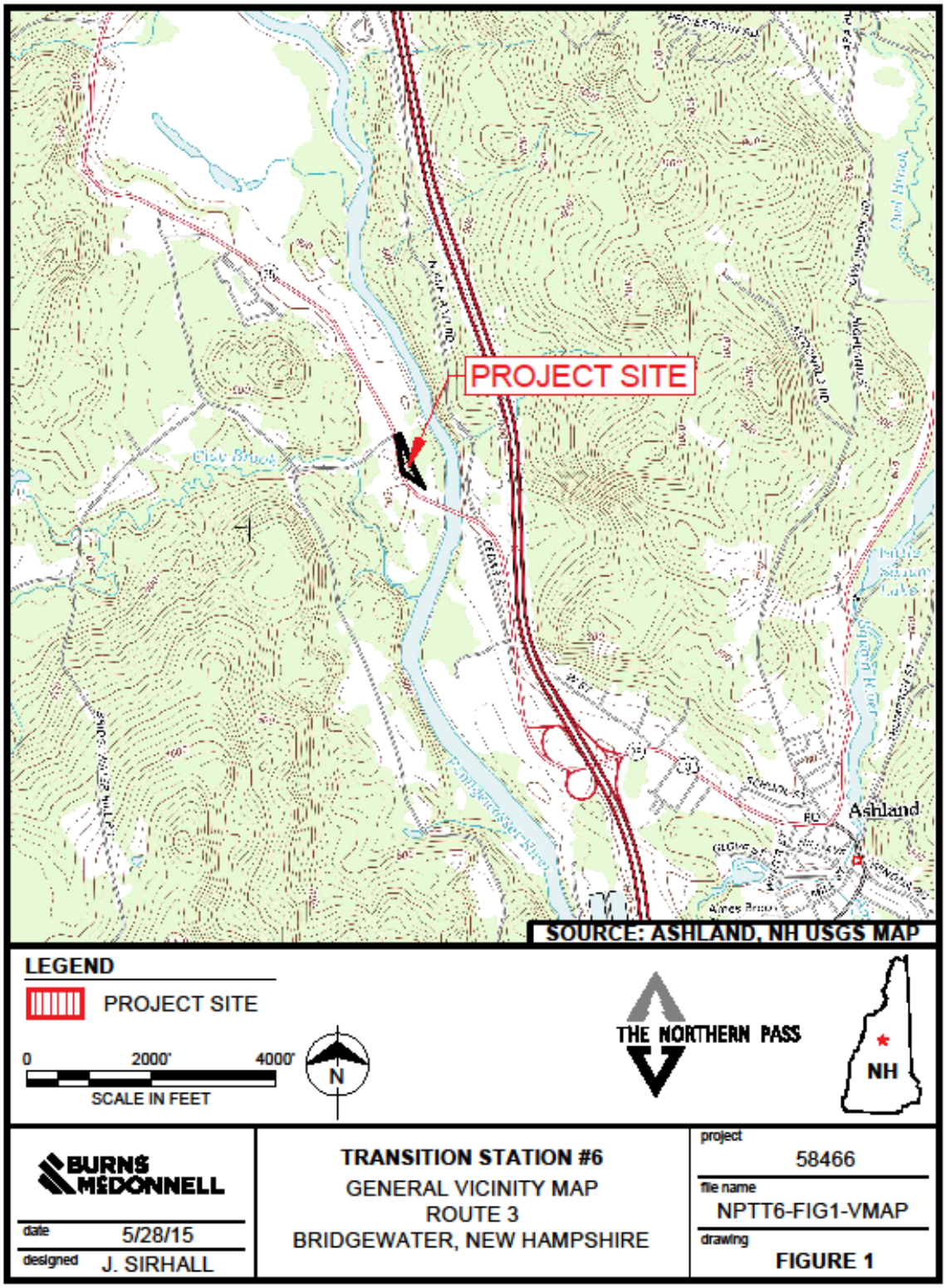
The post-development conditions of the Site include construction of a transition station associated with the Northern Pass Transmission (NPT) project. The NPT project is an approximately 200-mile AC and DC transmission line route extending from the United States/Canadian border in Pittsburg, NH to Deerfield, NH. The station development consists of a gravel pad approximately 86-ft by 139-ft with a perimeter fence and access gates. A gravel access drive and turnaround pad is also proposed. The post-development conditions will increase the peak stormwater runoff rate and as a result, stormwater attenuation systems will be implemented. Wherever possible, the pre-development drainage and grading patterns were maintained in the post-development conditions.

A hydrologic model was developed to evaluate the pre- and post-development drainage conditions on the Site for the 2-, 10-, and 50-year design frequency storm events. The results of the analysis indicate that there is no increase in peak discharge rates in post-development conditions from pre-development conditions. The analyses summary, results, and model output are located in further sections.

The Project Site area is 2.07 acres. The Project will result in approximately 1.49-acres of disturbance of which 1.40-acres are on-site and 0.09-acres are off-site in roadways.

There is no impervious cover on the site currently. The improvements will add 0.011 acres of impervious cover. The total undisturbed cover of the Site is 0.55 acres.

Figure 1-1: USGS Site Location Map



1.2 Existing Conditions Survey Information

An Existing Conditions Plan with topography was prepared for the Project and was used as a base throughout the analysis and design of the Site Development Plans and Stormwater Management Study. In the instance where the watershed areas extended outside the survey topography limits, State published LiDAR was obtained from the New Hampshire GRANIT Statewide GIS Clearinghouse and used to determine the watershed limits.

Horizontal Datum: The survey references the New Hampshire State Plane Coordinate System, NAD 83. The Site Development Plans are drawn in the same state plane coordinate system.

Vertical Datum: North American Vertical Datum of 1988 (NAVD88). The proposed elevations referenced within the Site Development Plans refer to the same vertical datum.

1.3 Geotechnical Investigations

A Geotechnical Engineering Report has been prepared for NPT.

- "Geotechnical Engineering Report, Transition Station #6 Project, Northern Pass Transmission Line, Bridgewater, New Hampshire" by Quanta Subsurface.

Furthermore, infiltration testing has been completed for the site at specified locations relevant to the Stormwater Management Study. Refer to the Infiltration Feasibility Report included in Appendix H.

The geotechnical investigation report can be found in Appendix H.

1.4 Soils

National Resource Conservation Service (NRCS) Web Soil Survey describes the soil at the Project Site as Adams loamy sand, gravel pit and Udorthents. The soils were classified as hydrologic soil group A. Six soil types are present on and in the vicinity of the Project Site according to the US Department of Agriculture Soil Conservation Service Soil Survey for Grafton County, New Hampshire. The NRCS Web Soil Survey information is located in Appendix G

There is also a survey report for the site entitled "Northern Pass Transmission Project, Soil Survey Report for the Bethlehem and Bridgewater Transition Stations" by Normandeau Environmental Consultants, dated June 9, 2015 that describes four types of soils that are present at the Project Site.

Two areas of Udorthents were mapped with slightly different characteristics. The northernmost Udorthent area had 11 inches of fill over the native soil. The fill consisted of fine sandy loam with 5% course

fragments as gravel and cobbles. This map unit also includes portions of the elevated road bed, that consists of fill or borrow, along the west side of the site.

The southern Udorthents map unit consisted of 20 inches to 29 inches of non-native (fill) soil over the natural soil profile, which consists of Adams loamy fine sand. The fill was observed to be typical glacio-fluvial derived soil. It is theorized that the top layer was removed from the road footprint for construction and was deposited in this area that that time.

Near the center of the site is a man-made Udipsammet. The area appears to have been used in the past as a borrow pit and is several feet below the surrounding landscape. The original A and B soil horizons are generally absent in this area. Consequently, the water table was observed at 28 inches below ground surface. Most of the soils were classified as hydrologic soil group A with one classified as hydrologic group B. The soil survey report is located in Appendix G.

Table 1-1 below lists the soil types and hydrologic soil groups.

Table 1-1: Soil Types

Map Legend	Soil Type	Hydrologic Soil Group
36B	Adams loamy fine sand, slopes 3 to 8 percent	A
299A	Udorthents, smoothed, slopes 0 to 3 percent	A
299B	Udorthents, smoothed, slopes 3 to 8 percent	A
300B	Udipsamments, nearly level, slopes 3 to 8 percent	B
36A	Adams loamy sand, 0 to 3 percent slopes	A
36C	Adams loamy sand, 8 to 15 percent slopes	A
36E	Adams loamy sand, 15 to 60 percent slopes	A
201	Ondawa fine sandy loam, 0 to 3 percent slopes, occasionally flooded	A

Map Legend	Soil Type	Hydrologic Soil Group
298	Pits, Gravel	Unknown
299	Udorthents, smoothed	Unknown

The soils series 298 and 299 have an erosion factor K that is not rated, however the soil series 36C which covers most of the site has a K-Factor of 0.10. The erosion factor K, with values ranging from 0.02 to 0.69, signifies how susceptible a soil is to erosion. The larger the K value the more susceptible the soil is to erosion by water. The K factor for the Project site indicates that the soils have a low susceptibility to erosion by water. The gravel pit and Udorthents areas may be susceptible erosion will be resolved by the site stabilization with rock and native vegetation.

1.5 Wetlands, Rivers, Streams and Vernal Pools

A report entitled "Wetlands, Rivers, Streams and Vernal Pools Resource Report and Impact Analysis" by Normandeau Environmental Consultants, dated October 1, 2015 has been prepared for the NPT Project. Environmentally sensitive areas were found within the Project Site. Refer to Appendix I for a copy of this report.

1.6 Floodplain

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Map No.33009C1010E for Grafton County, New Hampshire, Effective Date February 20, 2008, the Project Site is located within Zone X, which are areas determined to be outside the 0.2% annual chance floodplain. The FIRM Map is located in Appendix F.

1.7 Receiving Surface Waters

The Site is within the Pemigewasset River Watershed.

1.8 Pre-Development Site Conditions

The Pre-Developed site consists of heavy forested shallow terrain on the south end of the site and an open meadow area on the north end of the site that drains to the west toward the Daniel Webster Highway. There is only one discharge point from this site which is a culvert under the Daniel Webster Highway.

1.9 Post-Development Site Conditions

Pre-developed stormwater drainage patterns are mimicked in post-developed conditions and utilize the same aforementioned Site discharge point as pre-development. Pre- and Post-development watershed maps are located in Appendix A. The post-development peak stormwater discharge rates are the same or below pre-development rates.

No new water or septic/sanitary sewer services are required for the Project.

No proposed improvements are located within a FEMA 100-year flood plain as a result, there are no adverse impacts to properties as a result.

* * * * *

2.0 HYDROLOGY AND HYDRAULICS

The stormwater management for the Project has been developed to minimize the downstream effects of development at the Site. The stormwater requirements set forth by the New Hampshire Department of Environmental Services Stormwater Manual Volumes 1, 2, & 3, dated December 2008 and the New Hampshire Department of Transportation Manual on Design for Highways, Revision Date April 1998 were followed to the maximum extent practical for the design of the Site Development Plans and this Report.

The development of the Site results in the need to attenuate stormwater onsite. Two above-ground infiltration basins are proposed and discussed in further detail below. The following is the data used in the stormwater management analysis.

2.1 Methodology and Design Criteria

2.1.1 Rainfall Data

Type II 24-hour rainfall depths for the site location were obtained from the Northeast Regional Climate Center – http://precip.eas.cornell.edu/.

Table 2-1: 24-Hour Type II Rainfall Data

Return Frequency (yr)	24 Hour Depth (in)
2	2.67
10	3.85
50	5.56

2.1.2 Runoff Data

The stormwater runoff calculations were completed using the USDA NRCS/SCS TR-55 runoff curve number method in Bentley's PondPack V8i modeling software. Refer to Appendix B for the inputs and generated outputs. The input values that were used in the PondPack model are shown in the tables below.

Maximum sheet flow length for unpaved areas according to the NH DES Stormwater Manual is 100-ft. Below are the standard SCS runoff curve numbers used in the hydrology modeling and the pre-development and post-development watershed cover data used in the hydrology modeling.

Table 2-2: Standard SCS Runoff Curve Numbers

Land Type	Hydrologic Soil Group	Curve Number
Woods	A	30
Woods	B	55
Meadow	A	30
Meadow	B	58
Gravel	A	76
Gravel	B	85
Impervious (Asphalt Pavement, Water, Structures, Foundations)	-	98

Table 2-3: Pre-Developed Model Data

Subarea	Area (ac)	Curve Number	Time of Concentration (Minutes)
1	4.181	39	5.0

Table 2-4: Post-Developed Model Data

Subarea	Area (ac)	Composite Curve Number	Time of Concentration (Minutes)
1	2.086	58	5.0
2	2.095	35	5.0
Total	4.181	-	-

The below table summarizes the Manning's roughness coefficients used in the analysis.

Table 2-5: Manning's Roughness Coefficients

Surface Description	Manning's n
Grass, Dense grasses (sheet)	0.240
Woods, Dense underbrush (sheet)	0.800
Smooth Surface Gravel/Pavement (sheet)	0.100
Woods, Light underbrush (sheet)	0.400
Riprap (D50 = 6") lined channel	0.069
Concrete/RCP	0.013
PVC	0.010
HDPE	0.012
Earth-Straight Channel	0.030
Grass w/ NAG Stabilization	0.045

2.2 Stormwater Modeling Results

For the proposed Project, two new infiltration basins are proposed to be constructed on the site, one on the north side and one on the south side. Runoff from the proposed access road, turnaround pad and transition station pad will flow northwest and collect into Swale A. Swale A will transition into Swale B which will intercept Drainline A. Drainline A discharges to the north infiltration basin. Drainline B is the outlet pipe from the north infiltration basin and will intercept the existing culvert under the Daniel Webster Highway. Runoff from the eastern and southern portions of the site that will be below the access road, turnaround and transition station will be collected by Swales C, D & E which will intercept Drainline C. Drainline C discharges to the south infiltration basin. Drainline D is the outlet pipe from the south infiltration basin and will intercept the existing culvert under the Daniel Webster Highway. The infiltration basins each include a concrete outlet control structure to control the runoff rate from the basin and an emergency spillway to manage storm events larger than the 50 year storm event.

The proposed infiltration basins were analyzed to mitigate the impacts of stormwater runoff from changes in drainage patterns that would result from the construction of this project. The hydrology model was analyzed using an infiltration rate of 12 inches per hour for the North Infiltration Basin and a rate of 1.2 inches per hour for the South Infiltration Basin (based on results from field data). Both basins are designed to store and attenuate peak flows from storm events. The concrete outlet control structures will control the rate of runoff to below the pre-development runoff as shown by the modeling results. The following tables summarize flow conditions for the Project and the reduction of flow achieved by the infiltration basins.

There is only one Analysis Point for the Site located at the existing Outlet-1. The tables below summarize the pre- and post-developed peak discharge runoff rates from the analysis point. Refer to Appendix A for the Pre-Developed and Post-Developed Watershed Maps. Modeling results and output can be found in Appendix B.

Table 2-6: Outlet-1 Flow

Return Frequency (yr)	Pre-Developed Flow (cfs)	Post-Developed Flow (cfs)
2	0.00	0.00
10	0.02	0.00
50	0.76	0.12

2.3 Infiltration Basin Design

The north and south infiltration basins were designed and analyzed to provide long term stormwater attenuation, water quality treatment, and infiltration once the Project has been constructed. The basins have been designed to meet the requirements in the NH DES Stormwater Manual. The infiltration basins contain storm events up to and including the 50-year design storm with a minimum 1-ft freeboard above the emergency spillway crest elevations. The infiltration basins have been designed so as to not require a State Dam permit. The below tables summarize the infiltration basin storage volumes and water surface elevations with respect to the design storm events.

Table 2-7: Infiltration Basin Storage Volumes

Elevation (feet-NAVD88)	Surface Area (ac)	Cumulative Storage Volume (Acre-ft)
North Infiltration Basin		
483.00	0.020	--
483.50	0.025	0.0113
484.00	0.030	0.0250
485.00	0.041	0.0606
485.15	0.043	0.0670
486.00	0.054	0.1081
487.00	0.068	0.1688
488.00	0.083	0.2439
South Infiltration Basin		
480.65	0.008	--
481.15	0.010	0.0044
481.65	0.013	0.0101
482.25	0.017	0.0190
482.65	0.019	0.0262
483.15	0.023	0.0369
483.65	0.027	0.0496
484.15	0.032	0.0644

Table 2-8: Infiltration Basin Water Surface Elevation

Return Frequency (yr)	Maximum Water Surface Elevation (ft)
North Infiltration Basin	
2	483.13
10	483.88
50	485.54
South Infiltration Basin	
2	480.65
10	480.66
50	481.95

2.4 Stormwater Swales

The Stormwater swales are designed for the 10-year storm event with a minimum of one foot of freeboard. In addition, all open swales are expected to convey the 100-year storm event without overtopping. The open swales will be lined with erosion control blankets and vegetated or lined with riprap around curves as specified in the Site Development Plans. The following table summarizes the design criteria as well as the proposed lining for the proposed open swales. The results show that the swale will be stable for storms up to the 10 year flow.

Table 2-9: Stormwater Swale Summary

Swale	10 Year Max. Flow (cfs)	10 Year Velocity (ft/s)	100 Year Max. Flow (cfs)	100 Year Velocity (ft/s)	Swale Depth (ft)	Swale Width (ft)	Side Slopes (H:V ft)	Slope (%)
A	1.60	1.25	6.43	1.25	2.0	2.0	3:1 & 9:1	0.50
B	1.60	1.25	6.43	0.74	2.0	0.0	12:1 & 100:1	0.50
C	0.00	0.00	0.39	0.86	2.0	0.0	10:1 & 3:1	0.46
D	0.00	0.00	0.39	0.65	1.70	0.0	20:1 & 3:1	0.31
E	0.00	0.00	0.39	1.53	2.0	0.0	10:1 & 3:1	2.12

Refer to Appendix C for the FlowMaster model results for the Swales.

The table below summarizes the stormwater swale stabilization types. The calculations can be found in Appendix C.

Table 2-10: Stormwater Swale Stability

Swale	Stabilization Type	10 Yr. Design Discharge (cfs)	Allowable Shear Stress (psf)	Calculated Shear Stress (psf)
A	Unreinforced Vegetation	1.60	5.73	0.30
B	Unreinforced Vegetation	1.60	5.73	0.15
C	Unreinforced Vegetation	0.00	5.73	0.00
D	Unreinforced Vegetation	0.00	5.73	0.00
E	Unreinforced Vegetation	0.00	5.73	0.00

2.5 Basin Spillway

The infiltration basin is designed to contain the 100-year storm event without overtopping; the spillway is designed to provide for emergency flow for events higher than the 100-year storm. The spillway was modeled with a headwater elevation 6 inches (0.50') higher than the crest for modeling purposes. The basin spillway will be lined with 12" riprap as specified in the Site Development Plans.

Table 2-11: Basin Spillway Summary & Stability

100 Year Max. Flow (cfs)	100 Year Velocity (ft/s)	Spillway (weir) Width (ft)	Side Slopes (H:V ft)	Downstream Slope (%)	Allowable Shear Stress (psf)	Calculated Shear Stress
North Spillway						
1.90	1.90	2.0	3:1	33	4	2.67
South Spillway						
1.90	1.90	2.0	3:1	33	4	2.67

Refer to Appendix C for the spillway and shear flow calculations.

2.6 Storm Drainage System

Storm drainage collection system is modeled using Bentley FlowMaster. Drainline B drains the north infiltration basin. Drainline D1 & D2 drain the southern infiltration basin. The stormdrain calculations for pipes B, D1 and D2 are located in Appendix C. A perforated underdrain is proposed along the west side of the transition station and the turnaround area to relieve subsurface stormwater which will aid in surface drainage. The underdrain was also modeled in Bentley Flow Master and the calculations are shown Appendix C. Below is a summary of the proposed storm drains and design criteria. Riprap outlet protection is provided at all pipe discharge locations refer to Section 2.8 for further information.

Table 2-12: Storm Drains

Culvert	Size	Material	Roughness Coefficient	Length (ft)	Slope (%)	10-Year Design Discharge (cfs)	25-Year Design Discharge (cfs)	100-Year Design Discharge (cfs)
B	15”	HDPE	0.012	210	0.50	0.00	0.00	0.25
D1	12”	HDPE	0.012	82	0.30	0.00	0.00	0.00
D2	12”	HDPE	0.012	224	0.28	0.00	0.00	0.00
UD	8”	PVC	0.010	247	0.66	0.26	0.61	0.83

2.7 Culverts

In accordance with the New Hampshire Department of Transportation Manual on Drainage Design for Highways, all culverts are designed for the 10-year storm event. They are expected to convey the 25-year and 100-year design storm events without overtopping as they are an integral part of the stormwater system. Drainline A conveys runoff from the access road, turnaround pad and the transition station pad and the northern portion of the site and outlets into the north infiltration basin. Drainline C conveys runoff from the area below the access road, turnaround pad and transition station on the eastern and southern portion of the site and outlets into the south infiltration basin. The culverts have been designed as to not be considered a dam. Below is a summary of the proposed culverts and design criteria. The culvert calculations for culverts A and C were performed using Bentley CulvertMaster and are located in Appendix C.

Table 2-13: Culverts

Culvert	Size	Material	Roughness Coefficient	Length (ft)	Slope (%)	10-Year Design Discharge (cfs)	25-Year Design Discharge (cfs)	100-Year Design Discharge (cfs)
A	15”	HDPE	0.012	38	1.00	1.60	2.94	6.43
C	15”	HDPE	0.012	25	0.80	0.00	0.01	0.39

2.8 Outlet Protection

Outlet protection is designed for the 25-year frequency design storm as required by the NH DES Stormwater Manual. Outlets for Drainline B, D1 & D2 are not included in the table because they outlet into manholes. Calculations for riprap apron protection are located in Appendix C.

Table 2-14: Outlet Protection

Outlet No.	Length (ft)	Depth (ft)	Width at Culvert (ft)	Width at End of Apron (ft)	Median Stone Size (in)	25-Year Flow (cfs)	25-Year Velocity (fps)
A	13	1.5	3.5	17	6	2.94	5.40
C	9	1.5	3.5	13	6	0.01	0.11

* * * * *

3.0 BEST MANAGEMENT PRACTICES

The proposed Stormwater Management System contains Best Management Practices (BMPs) that will, if maintained properly, provide treatment of Site generated stormwater runoff. The proposed BMPs are described below.

3.1 Groundwater Recharge Volume & Water Quality Volume

There are two locations that will treat the runoff from the impervious areas of the site. The first area is the north infiltration basin that will treat the runoff from the northern portion of the existing Daniel Webster Highway that drains into the northern portion of the site and the structure and foundations on the transition station pad. The Water Quality Volume (WQV) that is required to be treated from these areas is 1,248 cubic feet. The storm water pond has a permanent pool volume of 2,277 cubic feet which is above the minimum required. The second area is the south infiltration basin that will treat the runoff from the southern portion of the existing Daniel Webster Highway that drains into the southern portion of the site. The Water Quality Volume (WQV) that is required to be treated from these areas is 792 cubic feet. The storm water pond has a permanent pool volume of 827 cubic feet which is above the minimum required.

The Groundwater Recharge Volume (GRV) that is needed due to the new impervious foundation cover is 4 cubic feet, this volume will infiltrate into the north infiltration basin. The worksheets for the infiltration basins and Groundwater Recharge Volume (GRV) are located in Appendix D.

3.2 Temporary Erosion Controls

During construction of the proposed station, the Contractor will be responsible for installation, implementation, and maintenance of temporary erosion and sedimentation control measures, that if implemented and maintained properly, will help to prevent off-site tracking and conveyance of waterborne loss of sediment and debris. The specific measures proposed are located in the Site Development Plans, which are under separate cover.

Temporary erosion and sedimentation controls shall not be removed until construction is complete and site stabilization is achieved.

3.3 Permanent Erosion Controls

Upon completion of construction, the Site shall be stabilized by one or more of the following measures in accordance with the Site Development Plans (under separate cover):

3.3.1 Crushed Rock/Paving

Crushed rock will be installed on the station pad area, access road and turnaround area.

3.3.2 Seeding

Any disturbed area not proposed as an impervious or gravel surface will be restored to natural meadow vegetation over 4" of topsoil. Planting and mulching of permanent seed will occur as soon as practical after final grading, placement of topsoil, and soil preparation has been completed. Seeding should occur during the growing season.

3.3.3 Stormwater Swale Lining

Stormwater swales will be vegetated or lined with permanent riprap around the curves as to help prevent erosion.

3.3.4 Outlet Protection

Pipe outlets implement riprap outlet protection to help prevent scouring and erosion.

3.3.5 Flood Protection Analysis

Flood protection has been implemented for the infiltration basins as follows:

- Swales have been designed to convey the 10-year, 24-hour storm event with minimum 1.0 ft. of freeboard;
- Swales have been designed to convey the 100-year, 24-hour storm event;
- Infiltration basins will detain the 2-year through 100-year, 24-hour storm event;
- An emergency spillway will be used to convey storm events larger than the 100-year storm, 24-hour event.

3.4 Antidegredation

There is no greater than 10% effective impervious cover (EIC) but there is less than 65% undisturbed cover within the property boundary of the Site, therefore the pollutant loading calculations are required to be performed according to the NHDES 1065 Rule. Refer to the Site Cover Plan located in Appendix A.

The Site stormwater runoff also discharges to an impaired receiving water according to the EPA 2008 Waterbody Report for Clay Brook. As a result, pollutant loading calculations were performed using the NH DES standard Simple Method worksheet to demonstrate that there is no increase in Total Suspended

Solids (TSS), Total Phosphorus (TP), and Total Nitrogen (TN) resulting from the Project. The pollutant loading calculations and other supporting information are located in Appendix J. Also, an impervious area summary table has been prepared to outline the impervious areas draining to the proposed BMP, refer to Appendix D.

The Simple Method generates pollutant loads based on the pre- and post- drainage areas indicated on the Watershed Maps located in Appendix A. The proposed BMPs are infiltration basins designed to infiltrate the stormwater and remove a percentage of the pollutants. The treatment BMPs provide water quality and limit post-development pollutant levels to less than the pre-development pollutant levels.

The Site lies within the NE Regional Mercury Total Maximum Daily Load (TMDL) according to the EPA 2008 Waterbody Report for Clay Brook. The Project is not anticipated to produce mercury byproducts, therefore restrictions from the NE Regional Mercury TMDL are not applicable.

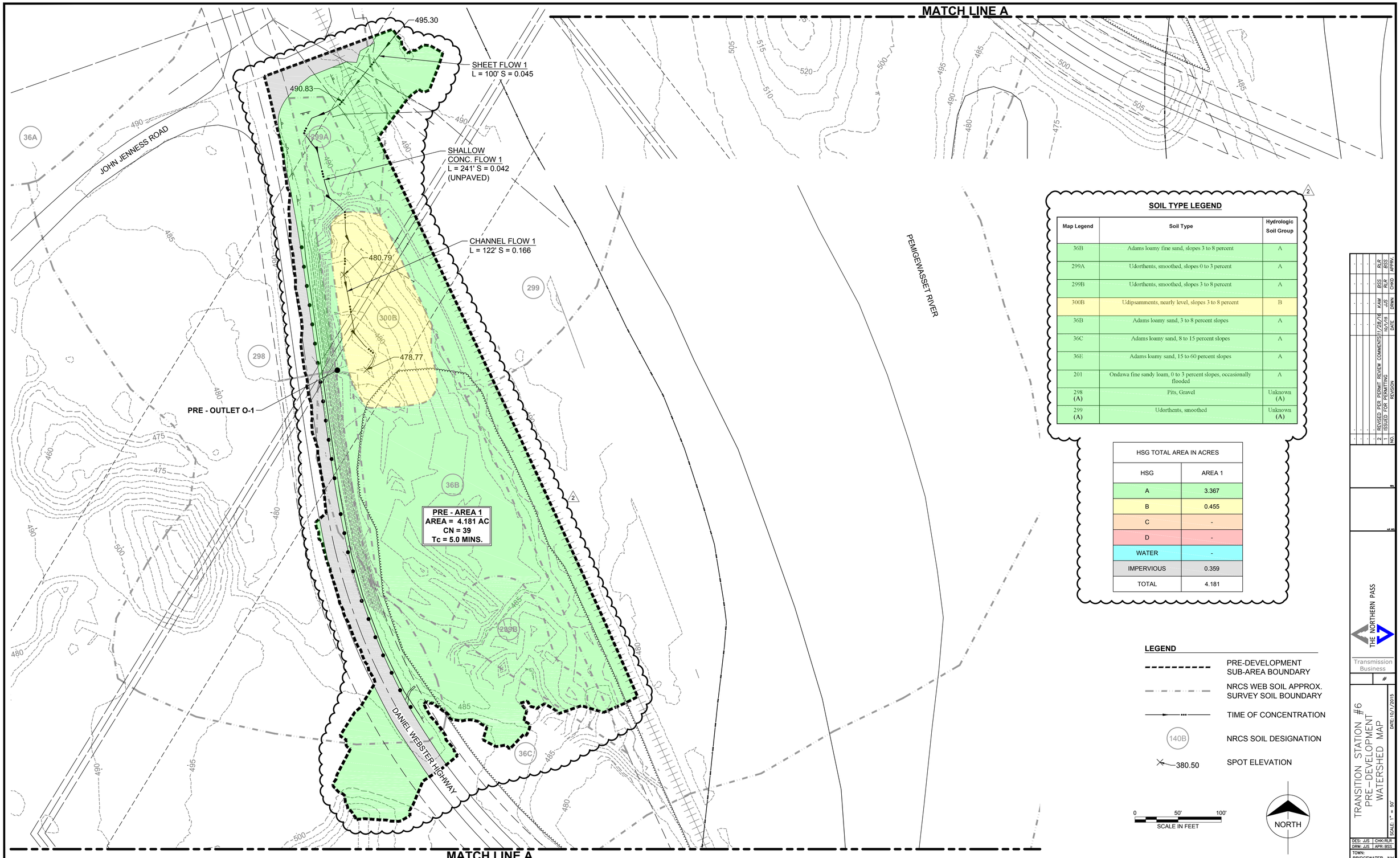
* * * * *

4.0 CONCLUSION

In order to mitigate the impacts of stormwater runoff caused by the addition of the transition station, several BMPs were implemented. Those BMPs include the addition of vegetated swales, riprap lined swales and two infiltration basins. The inflation basins will also reduce the post-developed peak discharge rates below that of the pre-developed flows for the 2-year through the 50-year storm events. The infiltration basins utilize one outlet control structure and emergency spillway each. The outlet control structure will control up to and including the 100-year storm event. The storm events larger than the 100-year storm event will discharge through the emergency spillway. The on-site BMPs have been designed in accordance with the New Hampshire Department of Environmental Services Stormwater Manual Volumes 1, 2, & 3.

* * * * *

APPENDIX A – PRE- AND POST-DEVELOPMENT WATERSHED MAPS



SOIL TYPE LEGEND

Map Legend	Soil Type	Hydrologic Soil Group
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36C	Adams loamy sand, 8 to 15 percent slopes	A
36E	Adams loamy sand, 15 to 60 percent slopes	A
201	Ondawa fine sandy loam, 0 to 3 percent slopes, occasionally flooded	A
298 (A)	Pits, Gravel	Unknown (A)
299 (A)	Udorthents, smoothed	Unknown (A)

HSG TOTAL AREA IN ACRES	
HSG	AREA 1
A	3.367
B	0.455
C	-
D	-
WATER	-
IMPERVIOUS	0.359
TOTAL	4.181

LEGEND

- PRE-DEVELOPMENT SUB-AREA BOUNDARY
- NRCS WEB SOIL APPROX. SURVEY SOIL BOUNDARY
- TIME OF CONCENTRATION
- 140B — NRCS SOIL DESIGNATION
- 380.50 — SPOT ELEVATION

0 50' 100'
SCALE IN FEET

NORTH

FOR PERMITTING PURPOSES ONLY NOT FOR CONSTRUCTION

NO.	REVISION	DATE	DRWN	CHKD	APPRV.
2	REVISED FOR PERMIT REVIEW COMMENTS	11/28/14	KAM	RLR	RLR
1	ISSUED FOR PERMITTING	10/24/14	JJS	BSS	BSS

THE NORTHERN PASS
Transmission Business

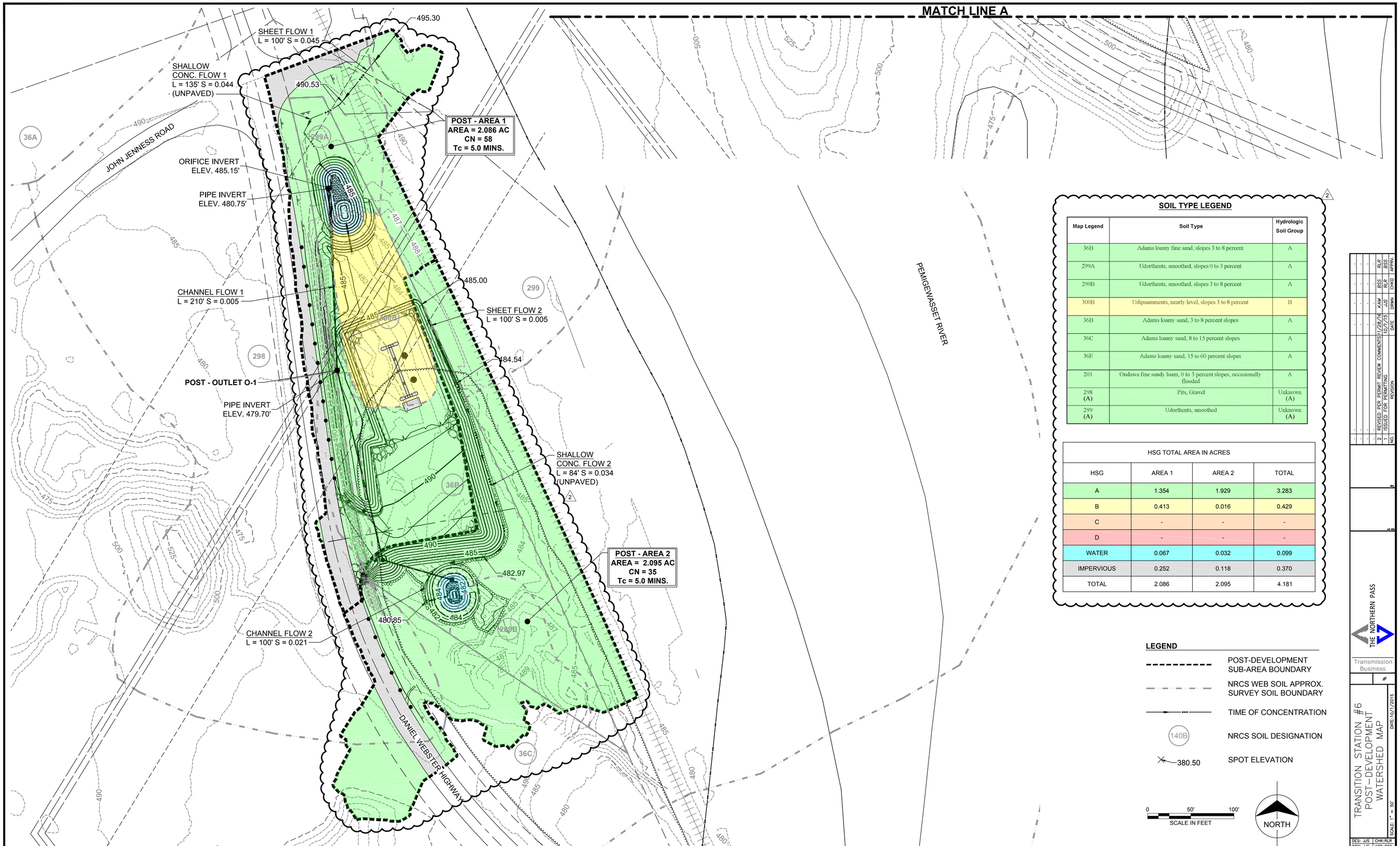
TRANSITION STATION #6
PRE-DEVELOPMENT WATERSHED MAP

SCALE: 1" = 50'
DATE: 10/7/2015

DES: JJS | CHK: RLR
DRW: JJS | APR: BSS

TOWN: BRIDGEWATER, NH
TRANSMISSION LINE:
MILE NO:
SHEET 1 OF 2
NPTT9-WSPRE

REVISION: XXX



SOIL TYPE LEGEND

Map Legend	Soil Type	Hydrologic Soil Group
36B	Adams loamy fine sand, slopes 3 to 8 percent	A
299A	Udorthents, smoothed, slopes 0 to 3 percent	A
299B	Udorthents, smoothed, slopes 3 to 8 percent	A
300B	Udipsamments, nearly level, slopes 3 to 8 percent	B
36B	Adams loamy sand, 3 to 8 percent slopes	A
36C	Adams loamy sand, 8 to 15 percent slopes	A
36E	Adams loamy sand, 15 to 60 percent slopes	A
201	Ondawa fine sandy loam, 0 to 3 percent slopes, occasionally flooded	A
298 (A)	Pits, Gravel	Unknown (A)
299 (A)	Udorthents, smoothed	Unknown (A)

HSG TOTAL AREA IN ACRES

HSG	AREA 1	AREA 2	TOTAL
A	1.354	1.929	3.283
B	0.413	0.016	0.429
C	-	-	-
D	-	-	-
WATER	0.067	0.032	0.099
IMPERVIOUS	0.252	0.118	0.370
TOTAL	2.086	2.095	4.181

LEGEND

- POST-DEVELOPMENT SUB-AREA BOUNDARY
- NRCS WEB SOIL APPROX. SURVEY SOIL BOUNDARY
- TIME OF CONCENTRATION
- 140B — NRCS SOIL DESIGNATION
- 380.50 — SPOT ELEVATION

0 50' 100'
SCALE IN FEET

NORTH

FOR PERMITTING PURPOSES ONLY
NOT FOR CONSTRUCTION

NO.	REVISION	DATE	DRWN	CHKD	APPRV.
2	REVISED PER PERMIT REVIEW COMMENTS	11/28/16	KAM	RLR	RLR
1	ISSUED FOR PERMITTING	10/7/15	RLR	BSS	BSS

THE NORTHERN PASS
Transmission Business

TRANSITION STATION #6
POST-DEVELOPMENT
WATERSHED MAP

DATE: 10/1/2015
SCALE: 1" = 50'

DES: JJS CHK: RLR
DRW: JJS APR: BSS

TOWN: BRIDGEWATER, NH
TRANSMISSION LINE:
MILE NO:
SHEET 2 OF 2
NPTT9-WSPOST
REVISION: XXX

MATCH LINE A

JOHN JENNESS ROAD

PEMIGEWASSET RIVER

DANIEL WEBSTER HIGHWAY

PRE - OUTLET O-1

PRE - AREA 1
AREA = 4.181 AC
CN = 39
Tc = 5.0 MINS.

COVER TYPE TOTAL AREA IN ACRES	
COVER TYPE	AREA 1
WOODS (HSG A)	1.658
WOODS (HSG UNKNOWN) A	0.054
WOODS (HSG B)	0.057
MEADOW (HSG A)	0.812
MEADOW (HSG UNKNOWN) A	0.843
MEADOW (HSG B)	0.398
IMPERVIOUS (HSG A)	0.064
IMPERVIOUS (HSG UNKNOWN) A	0.295
TOTAL	4.181

LEGEND

- PRE-DEVELOPMENT SUB-AREA BOUNDARY
- NRCS WEB SOIL APPROX. SURVEY SOIL BOUNDARY
- TIME OF CONCENTRATION
- 140B NRCS SOIL DESIGNATION

0 50' 100'
SCALE IN FEET

NORTH

MATCH LINE A

NOTES:

REFER TO PRE-DEVELOPMENT WATERSHED MAP DRAWING NPTT9-WSPRE FOR FURTHER INFORMATION

FOR PERMITTING PURPOSES ONLY NOT FOR CONSTRUCTION

NO.	REVISION	DATE	DRWN	CHKD	APPRV.
1	ISSUED FOR PERMITTING	11/28/16	KAM	RLR	RLR

THE NORTHERN PASS
Transmission Business

TRANSITION STATION #6
PRE-DEVELOPMENT
COVER TYPE SUMMARY

DATE: 07/12/2016
SCALE: 1" = 50'

DES: XXX CHK: XXX
DRW: XXX APR: XXX
TOWN: BRIDGEWATER, NH
TRANSMISSION LINE:
MILE NO:
SHEET 1 OF 2
NPTT9-WSPRE-COVER
REVISION: XXX

COVER TYPE TOTAL AREA IN ACRES

COVER TYPE	AREA 1	AREA 2	TOTAL
WOODS (HSG A)	-	0.897	0.897
WOODS (HSG UNKNOWN) A	-	0.053	0.053
MEADOW (HSG A)	0.308	0.685	0.993
MEADOW (HSG UNKNOWN) A	0.614	0.294	0.908
MEADOW (HSG B)	0.226	0.016	0.242
IMPERVIOUS (HSG A)	0.042	0.023	0.065
IMPERVIOUS (HSG UNKNOWN) A	0.200	0.095	0.295
IMPERVIOUS (HSG B)	0.010	-	0.010
GRAVEL (HSG A)	0.423	-	0.423
GRAVEL (HSG UNKNOWN) A	0.009	-	0.009
GRAVEL (HSG B)	0.187	-	0.187
WATER (HSG A)	0.050	0.032	0.082
WATER (HSG B)	0.017	-	0.017
TOTAL	2.086	2.095	4.181

NOTES:

REFER TO PRE-DEVELOPMENT WATERSHED MAP DRAWING NPTT9-WSPOST FOR FURTHER INFORMATION

FOR PERMITTING PURPOSES ONLY
NOT FOR CONSTRUCTION

NO.	REVISION	DATE	DRWN	CHKD	APPRV.
1	ISSUED FOR PERMITTING	11/28/16	KAM	RLR	RLR

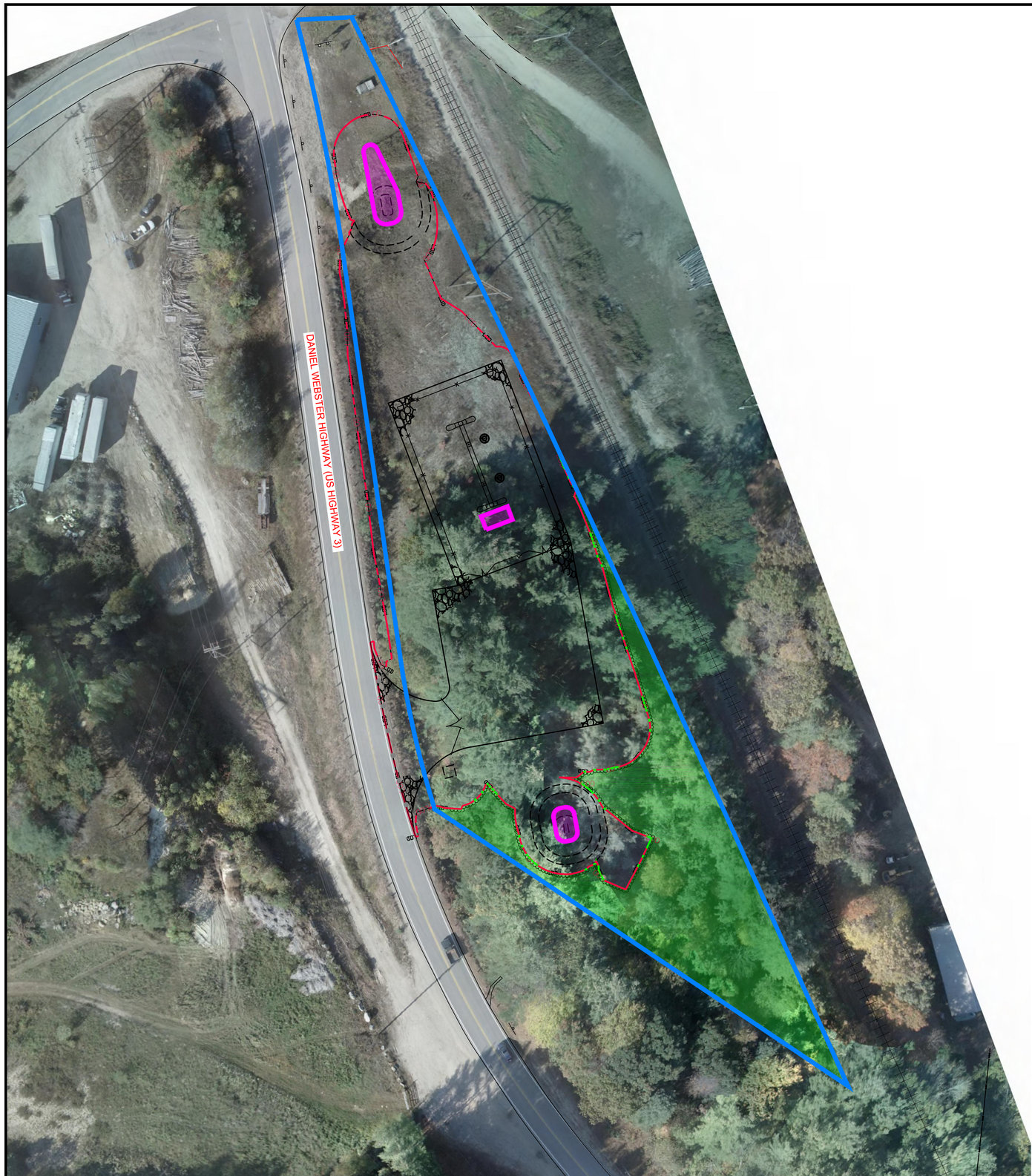
THE NORTHERN PASS
Transmission Business

TRANSITION STATION #6
POST-DEVELOPMENT
COVER TYPE SUMMARY

DATE:07/12/2016
SCALE: 1" = 50'

DES: XXX CHK:XXX
DRW: XXX APR: XXX

TOWN: BRIDGEWATER, NH
TRANSMISSION LINE:
MILE NO:
SHEET 2 OF 2
NPTT9-WSPOST-COVER
REVISION: XXX



LEGEND

- EI - EXISTING IMPERVIOUS AREA
- UDC - UNDISTURBED COVER
- PI - PROPOSED IMPERVIOUS AREA
- DIA - PROPOSED DISCONNECTED IMPERVIOUS AREA
- EXISTING PARCEL LINE
- LOD — PROPOSED LIMIT OF DISTURBANCE LINE (LOD)

MAP REFERENCES:

1. 2011 ORTHOIMAGERY OBTAINED IN .SID FORMAT FROM NH STATEWIDE GIS CLEARINGHOUSE WEBSITE AT www.granit.unh.edu.

NOTES:

1. NPDES/LIMIT OF DISTURBANCE (LOD) AREA TOTAL = 1.49 ACRES, OF WHICH 1.40 ACRES IS ON-SITE DISTURBANCE AND 0.09 ACRES IS OFF-SITE DISTURBANCE.

SITE COVER AREA

ITEM	DESCRIPTION	AREA (SF)	AREA (AC)
PS	PARCEL SIZE	90,225	2.07
EI	EXISTING IMPERVIOUS	0	0.00
PI	PROPOSED IMPERVIOUS	1,405	0.03
PDA	PROPOSED DISTURBED AREA (WITHIN PROPERTY LINE)	60,857	1.40
UDC	UNDISTURBED COVER	22,746	0.52
DIA	PROPOSED DISCONNECTED IMPERVIOUS AREA	1,405	0.03

SITE COVER TABULATION

ITEM	DESCRIPTION	FORMULA	TOTAL
TIC	TOTAL IMPERVIOUS COVER (ACRES)	EI + PI	0.03 AC
EIC	EFFECTIVE IMPERVIOUS COVER (ACRES)	TIC - DA	0.00 AC
EIC %	EIC PERCENTAGE	EIC / PS	0.0%
UDC %	UDC PERCENTAGE	UDC / PS	25.2%

NORTH

0 20' 40' 80'
SCALE IN FEET

FOR PERMITTING PURPOSES ONLY NOT FOR CONSTRUCTION

NO.	REVISION	DATE	DRWN	CHKD	APPRV.
1	ISSUED FOR PERMITTING	10/1/15	JJS	RLR	BSS

THE NORTHERN PASS
Transmission Business

TRANSITION STATION #6
SITE COVER PLAN

DATE: 10/1/2015
SCALE: 1" = 40'

DES: JJS CHK: RLR
DRW: JJS APR: BSS
TOWN: BRIDGEWATER, NH
TRANSMISSION LINE:
MILE NO:
SHEET 1 OF 1
NPTT9-SCP
REVISION: 11/10/2013

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APPENDIX B – HYDROLOGY MODEL (PONDPACK)

Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Smoothing	Yes
State	New Hampshire
Location	
Longitude	71.657 degrees West
Latitude	43.711 degrees North
Elevation	Unknown/Unavailable
Date/Time	Tue, 05 May 2015 19:57:03 -0400

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.26	0.39	0.49	0.64	0.80	1.00	**1yr**	0.69	0.94	1.16	1.45	1.82	2.28	2.57	**1yr**	2.02	2.47	2.84	3.49	4.06	**1yr**
2yr	0.31	0.47	0.59	0.77	0.97	1.22	**2yr**	0.84	1.12	1.41	1.75	2.16	2.67	3.00	**2yr**	2.36	2.89	3.34	4.04	4.64	**2yr**
5yr	0.37	0.57	0.71	0.96	1.22	1.54	**5yr**	1.06	1.42	1.78	2.20	2.69	3.28	3.76	**5yr**	2.91	3.62	4.13	4.93	5.61	**5yr**
10yr	0.41	0.65	0.82	1.12	1.45	1.85	**10yr**	1.26	1.71	2.13	2.62	3.19	3.85	4.46	**10yr**	3.40	4.28	4.85	5.73	6.49	**10yr**
25yr	0.49	0.78	1.00	1.38	1.83	2.33	**25yr**	1.58	2.17	2.69	3.29	3.98	4.74	5.58	**25yr**	4.20	5.37	6.01	7.01	7.87	**25yr**
50yr	0.56	0.90	1.16	1.62	2.18	2.79	**50yr**	1.88	2.62	3.22	3.93	4.70	5.56	6.62	**50yr**	4.92	6.37	7.07	8.17	9.11	**50yr**
100yr	0.64	1.04	1.34	1.90	2.59	3.33	**100yr**	2.24	3.15	3.85	4.68	5.56	6.51	7.85	**100yr**	5.76	7.55	8.32	9.53	10.54	**100yr**
200yr	0.74	1.21	1.57	2.24	3.09	3.98	**200yr**	2.66	3.80	4.59	5.55	6.57	7.64	9.32	**200yr**	6.76	8.96	9.79	11.11	12.21	**200yr**
500yr	0.90	1.47	1.92	2.78	3.90	5.04	**500yr**	3.36	4.88	5.81	6.99	8.19	9.43	11.70	**500yr**	8.35	11.25	12.16	13.63	14.83	**500yr**

Lower Confidence Limits

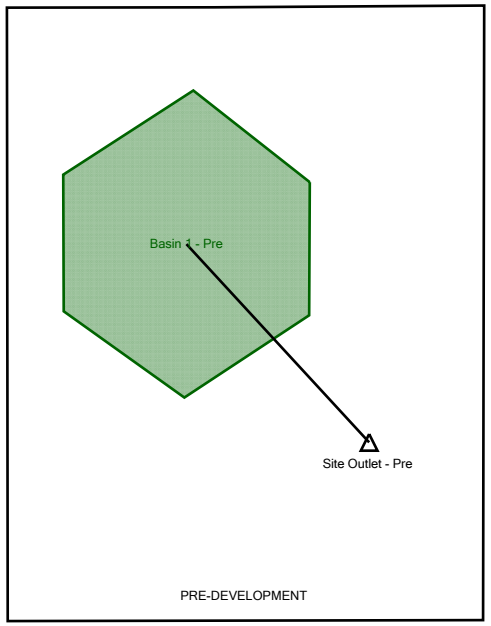
	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.22	0.35	0.42	0.57	0.70	0.88	**1yr**	0.60	0.86	0.99	1.31	1.63	2.12	2.19	**1yr**	1.87	2.11	2.31	3.03	3.59	**1yr**
2yr	0.30	0.46	0.56	0.76	0.94	1.11	**2yr**	0.81	1.09	1.26	1.67	2.15	2.60	2.92	**2yr**	2.31	2.81	3.25	3.94	4.51	**2yr**
5yr	0.34	0.52	0.65	0.89	1.13	1.34	**5yr**	0.98	1.31	1.52	1.96	2.52	3.06	3.49	**5yr**	2.71	3.35	3.86	4.65	5.28	**5yr**
10yr	0.37	0.57	0.71	0.99	1.27	1.52	**10yr**	1.10	1.49	1.73	2.19	2.83	3.46	3.95	**10yr**	3.07	3.80	4.41	5.28	5.95	**10yr**
25yr	0.42	0.64	0.79	1.13	1.49	1.81	**25yr**	1.28	1.77	2.05	2.56	3.32	4.07	4.70	**25yr**	3.60	4.52	5.26	6.26	6.96	**25yr**
50yr	0.46	0.69	0.86	1.24	1.67	2.06	**50yr**	1.44	2.01	2.34	2.86	3.74	4.62	5.34	**50yr**	4.09	5.14	6.01	7.14	7.85	**50yr**
100yr	0.50	0.76	0.95	1.37	1.88	2.34	**100yr**	1.62	2.28	2.67	3.37	4.24	5.20	6.10	**100yr**	4.60	5.87	6.91	8.17	8.85	**100yr**
200yr	0.55	0.82	1.04	1.51	2.10	2.64	**200yr**	1.82	2.58	3.05	3.83	4.68	5.88	6.99	**200yr**	5.20	6.72	7.93	9.36	10.01	**200yr**
500yr	0.62	0.92	1.19	1.73	2.45	3.09	**500yr**	2.12	3.02	3.65	4.53	5.42	6.94	8.36	**500yr**	6.14	8.04	9.55	11.23	11.77	**500yr**

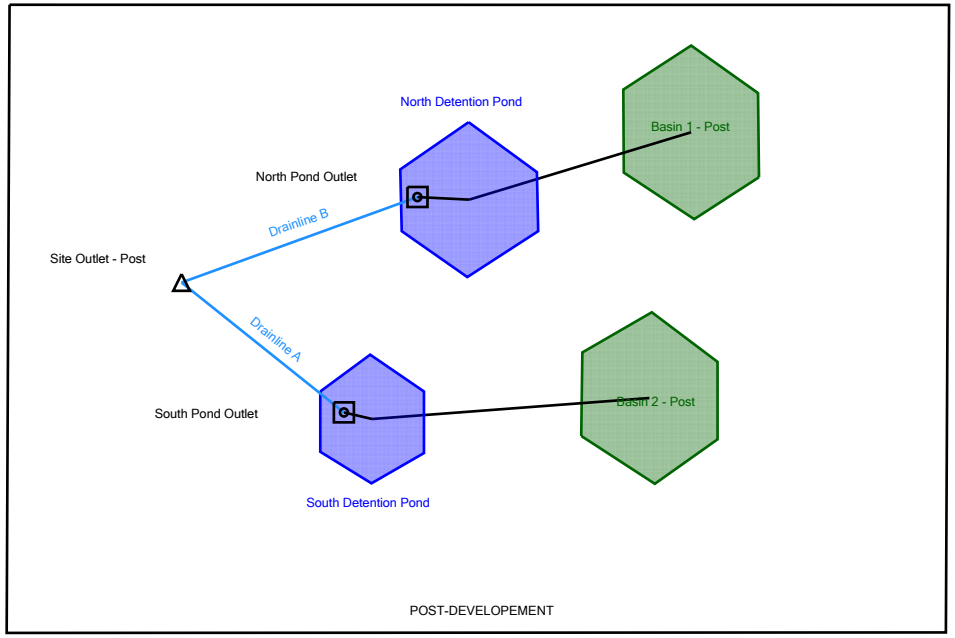
Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.28	0.43	0.53	0.71	0.88	1.04	**1yr**	0.76	1.01	1.17	1.53	1.94	2.42	2.73	**1yr**	2.14	2.63	3.00	3.68	4.31	**1yr**
2yr	0.32	0.50	0.62	0.84	1.03	1.20	**2yr**	0.89	1.17	1.36	1.78	2.31	2.77	3.13	**2yr**	2.45	3.01	3.45	4.15	4.79	**2yr**
5yr	0.40	0.61	0.76	1.05	1.33	1.59	**5yr**	1.15	1.56	1.78	2.27	2.88	3.52	4.04	**5yr**	3.11	3.88	4.40	5.24	5.97	**5yr**
10yr	0.48	0.74	0.92	1.28	1.66	1.99	**10yr**	1.43	1.94	2.20	2.68	3.39	4.24	4.89	**10yr**	3.76	4.71	5.32	6.25	7.09	**10yr**
25yr	0.62	0.95	1.18	1.68	2.21	2.69	**25yr**	1.91	2.63	2.92	3.43	4.31	5.42	6.37	**25yr**	4.79	6.13	6.80	7.86	8.91	**25yr**
50yr	0.75	1.15	1.43	2.05	2.76	3.39	**50yr**	2.38	3.32	3.61	4.13	5.19	6.52	7.76	**50yr**	5.77	7.46	8.20	9.37	10.58	**50yr**
100yr	0.92	1.39	1.74	2.52	3.45	4.30	**100yr**	2.98	4.20	4.46	5.32	6.23	7.85	9.46	**100yr**	6.95	9.10	9.89	11.15	12.56	**100yr**
200yr	1.12	1.68	2.13	3.09	4.31	5.45	**200yr**	3.72	5.33	5.53	6.46	8.52	9.46	11.53	**200yr**	8.38	11.08	11.94	13.25	14.92	**200yr**
500yr	1.46	2.17	2.79	4.05	5.76	7.49	**500yr**	4.97	7.32	7.34	8.35	11.14	12.09	14.98	**500yr**	10.70	14.41	15.30	16.67	18.74	**500yr**

Powered by ACIS
Northeast Regional Climate Center

Scenario: TS #6 - 50 year





NPT Transition Station #6

Project Summary

Title	Northern Pass Transition Station #6
Engineer	R. Reed
Company	Burns & McDonnell
Date	12/2/2016

Notes

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft³)	Time to Peak (hours)	Peak Flow (ft³/s)
Basin 1 - Pre	TS #6 - 2 year	2	0.000	0.000	0.00
Basin 1 - Pre	TS #6 - 10 year	10	480.000	24.000	0.02
Basin 1 - Pre	TS #6 - 50 year	50	4,949.000	12.050	0.76
Basin 1 - Pre	TS #6 - 100 year	100	9,097.000	12.000	2.44
Basin 1 - Post	TS #6 - 2 year	2	1,331.000	12.050	0.24
Basin 1 - Post	TS #6 - 10 year	10	4,518.000	12.000	1.60
Basin 1 - Post	TS #6 - 50 year	50	11,254.000	11.950	4.48
Basin 1 - Post	TS #6 - 100 year	100	15,742.000	11.950	6.43
Basin 2 - Post	TS #6 - 2 year	2	0.000	0.000	0.00
Basin 2 - Post	TS #6 - 10 year	10	7.000	24.000	0.00
Basin 2 - Post	TS #6 - 50 year	50	1,264.000	12.900	0.04
Basin 2 - Post	TS #6 - 100 year	100	2,772.000	12.050	0.39

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft³)	Time to Peak (hours)	Peak Flow (ft³/s)
Site Outlet - Pre	TS #6 - 2 year	2	0.000	0.000	0.00
Site Outlet - Pre	TS #6 - 10 year	10	480.000	24.000	0.02
Site Outlet - Pre	TS #6 - 50 year	50	4,949.000	12.050	0.76
Site Outlet - Pre	TS #6 - 100 year	100	9,097.000	12.000	2.44
Site Outlet - Post	TS #6 - 2 year	2	0.000	0.000	0.00
Site Outlet - Post	TS #6 - 10 year	10	0.000	0.000	0.00
Site Outlet - Post	TS #6 - 50 year	50	388.000	12.350	0.12
Site Outlet - Post	TS #6 - 100 year	100	2,580.000	12.350	0.25

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft³)	Time to Peak (hours)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ft³)
North Detention Pond (IN)	TS #6 - 2 year	2	1,331.000	12.050	0.24	(N/A)	(N/A)
North Detention Pond (OUT)	TS #6 - 2 year	2	0.000	0.000	0.00	483.13	113.000
North Detention Pond (IN)	TS #6 - 10 year	10	4,518.000	12.000	1.60	(N/A)	(N/A)
North Detention Pond (OUT)	TS #6 - 10 year	10	0.000	0.000	0.00	483.88	938.000
North Detention Pond (IN)	TS #6 - 50 year	50	11,254.000	11.950	4.48	(N/A)	(N/A)
North Detention Pond (OUT)	TS #6 - 50 year	50	388.000	12.350	0.12	485.54	3,686.000
North Detention Pond (IN)	TS #6 - 100 year	100	15,742.000	11.950	6.43	(N/A)	(N/A)

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft³)	Time to Peak (hours)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ft³)
North Detention Pond (OUT)	TS #6 - 100 year	100	1,548.000	12.350	0.25	486.37	5,595.000
South Detention Pond (IN)	TS #6 - 2 year	2	0.000	0.000	0.00	(N/A)	(N/A)
South Detention Pond (OUT)	TS #6 - 2 year	2	0.000	0.000	0.00	480.65	0.000
South Detention Pond (IN)	TS #6 - 10 year	10	7.000	24.000	0.00	(N/A)	(N/A)
South Detention Pond (OUT)	TS #6 - 10 year	10	0.000	0.000	0.00	480.66	5.000
South Detention Pond (IN)	TS #6 - 50 year	50	1,264.000	12.900	0.04	(N/A)	(N/A)
South Detention Pond (OUT)	TS #6 - 50 year	50	0.000	0.000	0.00	481.95	626.000
South Detention Pond (IN)	TS #6 - 100 year	100	2,772.000	12.050	0.39	(N/A)	(N/A)
South Detention Pond (OUT)	TS #6 - 100 year	100	1,033.000	15.450	0.05	482.40	940.000

Subsection: Time-Depth Curve
Label: TS #6

Return Event: 10 years
Storm Event: 10 Year Storm

Time-Depth Curve: 10 Year Storm	
Label	10 Year Storm
Start Time	0.000 hours
Increment	0.100 hours
End Time	24.000 hours
Return Event	10 years

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
0.000	0.0	0.0	0.0	0.0	0.0
0.500	0.0	0.0	0.0	0.0	0.0
1.000	0.0	0.0	0.0	0.1	0.1
1.500	0.1	0.1	0.1	0.1	0.1
2.000	0.1	0.1	0.1	0.1	0.1
2.500	0.1	0.1	0.1	0.1	0.1
3.000	0.1	0.1	0.1	0.1	0.2
3.500	0.2	0.2	0.2	0.2	0.2
4.000	0.2	0.2	0.2	0.2	0.2
4.500	0.2	0.2	0.2	0.2	0.2
5.000	0.2	0.2	0.3	0.3	0.3
5.500	0.3	0.3	0.3	0.3	0.3
6.000	0.3	0.3	0.3	0.3	0.3
6.500	0.3	0.4	0.4	0.4	0.4
7.000	0.4	0.4	0.4	0.4	0.4
7.500	0.4	0.4	0.4	0.4	0.5
8.000	0.5	0.5	0.5	0.5	0.5
8.500	0.5	0.5	0.5	0.5	0.6
9.000	0.6	0.6	0.6	0.6	0.6
9.500	0.6	0.6	0.7	0.7	0.7
10.000	0.7	0.7	0.7	0.7	0.8
10.500	0.8	0.8	0.8	0.9	0.9
11.000	0.9	0.9	1.0	1.0	1.0
11.500	1.1	1.2	1.4	1.7	2.2
12.000	2.6	2.6	2.7	2.7	2.8
12.500	2.8	2.9	2.9	2.9	2.9
13.000	3.0	3.0	3.0	3.0	3.1
13.500	3.1	3.1	3.1	3.1	3.1
14.000	3.2	3.2	3.2	3.2	3.2
14.500	3.2	3.2	3.3	3.3	3.3
15.000	3.3	3.3	3.3	3.3	3.3
15.500	3.3	3.4	3.4	3.4	3.4
16.000	3.4	3.4	3.4	3.4	3.4
16.500	3.4	3.4	3.4	3.5	3.5
17.000	3.5	3.5	3.5	3.5	3.5
17.500	3.5	3.5	3.5	3.5	3.5
18.000	3.5	3.6	3.6	3.6	3.6
18.500	3.6	3.6	3.6	3.6	3.6
19.000	3.6	3.6	3.6	3.6	3.6
19.500	3.6	3.6	3.6	3.7	3.7
20.000	3.7	3.7	3.7	3.7	3.7
20.500	3.7	3.7	3.7	3.7	3.7
21.000	3.7	3.7	3.7	3.7	3.7

Subsection: Time-Depth Curve
Label: TS #6

Return Event: 10 years
Storm Event: 10 Year Storm

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
21.500	3.7	3.7	3.7	3.8	3.8
22.000	3.8	3.8	3.8	3.8	3.8
22.500	3.8	3.8	3.8	3.8	3.8
23.000	3.8	3.8	3.8	3.8	3.8
23.500	3.8	3.8	3.8	3.8	3.8
24.000	3.9	(N/A)	(N/A)	(N/A)	(N/A)

Subsection: Time-Depth Curve
Label: TS #6

Return Event: 100 years
Storm Event: 100 Year Storm

Time-Depth Curve: 100 Year Storm	
Label	100 Year Storm
Start Time	0.000 hours
Increment	0.100 hours
End Time	24.000 hours
Return Event	100 years

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
0.000	0.0	0.0	0.0	0.0	0.0
0.500	0.0	0.0	0.0	0.1	0.1
1.000	0.1	0.1	0.1	0.1	0.1
1.500	0.1	0.1	0.1	0.1	0.1
2.000	0.1	0.2	0.2	0.2	0.2
2.500	0.2	0.2	0.2	0.2	0.2
3.000	0.2	0.2	0.2	0.3	0.3
3.500	0.3	0.3	0.3	0.3	0.3
4.000	0.3	0.3	0.3	0.3	0.3
4.500	0.4	0.4	0.4	0.4	0.4
5.000	0.4	0.4	0.4	0.4	0.5
5.500	0.5	0.5	0.5	0.5	0.5
6.000	0.5	0.5	0.5	0.6	0.6
6.500	0.6	0.6	0.6	0.6	0.6
7.000	0.6	0.7	0.7	0.7	0.7
7.500	0.7	0.7	0.7	0.8	0.8
8.000	0.8	0.8	0.8	0.8	0.8
8.500	0.9	0.9	0.9	0.9	0.9
9.000	1.0	1.0	1.0	1.0	1.0
9.500	1.1	1.1	1.1	1.1	1.2
10.000	1.2	1.2	1.2	1.3	1.3
10.500	1.3	1.4	1.4	1.4	1.5
11.000	1.5	1.6	1.6	1.7	1.8
11.500	1.8	2.0	2.3	2.8	3.7
12.000	4.3	4.4	4.5	4.6	4.7
12.500	4.8	4.8	4.9	4.9	5.0
13.000	5.0	5.1	5.1	5.1	5.2
13.500	5.2	5.2	5.3	5.3	5.3
14.000	5.3	5.4	5.4	5.4	5.4
14.500	5.5	5.5	5.5	5.5	5.5
15.000	5.6	5.6	5.6	5.6	5.6
15.500	5.6	5.7	5.7	5.7	5.7
16.000	5.7	5.7	5.8	5.8	5.8
16.500	5.8	5.8	5.8	5.8	5.9
17.000	5.9	5.9	5.9	5.9	5.9
17.500	5.9	5.9	6.0	6.0	6.0
18.000	6.0	6.0	6.0	6.0	6.0
18.500	6.1	6.1	6.1	6.1	6.1
19.000	6.1	6.1	6.1	6.1	6.1
19.500	6.2	6.2	6.2	6.2	6.2
20.000	6.2	6.2	6.2	6.2	6.2
20.500	6.2	6.2	6.3	6.3	6.3
21.000	6.3	6.3	6.3	6.3	6.3

Subsection: Time-Depth Curve
Label: TS #6

Return Event: 100 years
Storm Event: 100 Year Storm

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
21.500	6.3	6.3	6.3	6.3	6.4
22.000	6.4	6.4	6.4	6.4	6.4
22.500	6.4	6.4	6.4	6.4	6.4
23.000	6.4	6.4	6.5	6.5	6.5
23.500	6.5	6.5	6.5	6.5	6.5
24.000	6.5	(N/A)	(N/A)	(N/A)	(N/A)

Subsection: Time-Depth Curve
Label: TS #6

Return Event: 2 years
Storm Event: 2 Year Storm

Time-Depth Curve: 2 Year Storm	
Label	2 Year Storm
Start Time	0.000 hours
Increment	0.100 hours
End Time	24.000 hours
Return Event	2 years

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
0.000	0.0	0.0	0.0	0.0	0.0
0.500	0.0	0.0	0.0	0.0	0.0
1.000	0.0	0.0	0.0	0.0	0.0
1.500	0.0	0.0	0.0	0.1	0.1
2.000	0.1	0.1	0.1	0.1	0.1
2.500	0.1	0.1	0.1	0.1	0.1
3.000	0.1	0.1	0.1	0.1	0.1
3.500	0.1	0.1	0.1	0.1	0.1
4.000	0.1	0.1	0.1	0.1	0.1
4.500	0.1	0.2	0.2	0.2	0.2
5.000	0.2	0.2	0.2	0.2	0.2
5.500	0.2	0.2	0.2	0.2	0.2
6.000	0.2	0.2	0.2	0.2	0.2
6.500	0.2	0.2	0.2	0.3	0.3
7.000	0.3	0.3	0.3	0.3	0.3
7.500	0.3	0.3	0.3	0.3	0.3
8.000	0.3	0.3	0.3	0.3	0.3
8.500	0.4	0.4	0.4	0.4	0.4
9.000	0.4	0.4	0.4	0.4	0.4
9.500	0.4	0.4	0.5	0.5	0.5
10.000	0.5	0.5	0.5	0.5	0.5
10.500	0.5	0.6	0.6	0.6	0.6
11.000	0.6	0.6	0.7	0.7	0.7
11.500	0.8	0.8	0.9	1.2	1.5
12.000	1.8	1.8	1.9	1.9	1.9
12.500	2.0	2.0	2.0	2.0	2.0
13.000	2.1	2.1	2.1	2.1	2.1
13.500	2.1	2.1	2.2	2.2	2.2
14.000	2.2	2.2	2.2	2.2	2.2
14.500	2.2	2.2	2.3	2.3	2.3
15.000	2.3	2.3	2.3	2.3	2.3
15.500	2.3	2.3	2.3	2.3	2.3
16.000	2.3	2.4	2.4	2.4	2.4
16.500	2.4	2.4	2.4	2.4	2.4
17.000	2.4	2.4	2.4	2.4	2.4
17.500	2.4	2.4	2.4	2.4	2.5
18.000	2.5	2.5	2.5	2.5	2.5
18.500	2.5	2.5	2.5	2.5	2.5
19.000	2.5	2.5	2.5	2.5	2.5
19.500	2.5	2.5	2.5	2.5	2.5
20.000	2.5	2.5	2.5	2.6	2.6
20.500	2.6	2.6	2.6	2.6	2.6
21.000	2.6	2.6	2.6	2.6	2.6

Subsection: Time-Depth Curve
Label: TS #6

Return Event: 2 years
Storm Event: 2 Year Storm

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
21.500	2.6	2.6	2.6	2.6	2.6
22.000	2.6	2.6	2.6	2.6	2.6
22.500	2.6	2.6	2.6	2.6	2.6
23.000	2.6	2.6	2.6	2.6	2.7
23.500	2.7	2.7	2.7	2.7	2.7
24.000	2.7	(N/A)	(N/A)	(N/A)	(N/A)

Subsection: Time-Depth Curve
Label: TS #6

Return Event: 50 years
Storm Event: 50 Year Storm

Time-Depth Curve: 50 Year Storm	
Label	50 Year Storm
Start Time	0.000 hours
Increment	0.100 hours
End Time	24.000 hours
Return Event	50 years

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
0.000	0.0	0.0	0.0	0.0	0.0
0.500	0.0	0.0	0.0	0.0	0.1
1.000	0.1	0.1	0.1	0.1	0.1
1.500	0.1	0.1	0.1	0.1	0.1
2.000	0.1	0.1	0.1	0.1	0.1
2.500	0.2	0.2	0.2	0.2	0.2
3.000	0.2	0.2	0.2	0.2	0.2
3.500	0.2	0.2	0.2	0.3	0.3
4.000	0.3	0.3	0.3	0.3	0.3
4.500	0.3	0.3	0.3	0.3	0.3
5.000	0.4	0.4	0.4	0.4	0.4
5.500	0.4	0.4	0.4	0.4	0.4
6.000	0.4	0.5	0.5	0.5	0.5
6.500	0.5	0.5	0.5	0.5	0.5
7.000	0.6	0.6	0.6	0.6	0.6
7.500	0.6	0.6	0.6	0.6	0.7
8.000	0.7	0.7	0.7	0.7	0.7
8.500	0.7	0.8	0.8	0.8	0.8
9.000	0.8	0.8	0.9	0.9	0.9
9.500	0.9	0.9	0.9	1.0	1.0
10.000	1.0	1.0	1.1	1.1	1.1
10.500	1.1	1.2	1.2	1.2	1.3
11.000	1.3	1.3	1.4	1.5	1.5
11.500	1.6	1.7	2.0	2.4	3.2
12.000	3.7	3.8	3.9	4.0	4.0
12.500	4.1	4.1	4.2	4.2	4.3
13.000	4.3	4.3	4.4	4.4	4.4
13.500	4.4	4.5	4.5	4.5	4.5
14.000	4.6	4.6	4.6	4.6	4.6
14.500	4.7	4.7	4.7	4.7	4.7
15.000	4.7	4.8	4.8	4.8	4.8
15.500	4.8	4.8	4.9	4.9	4.9
16.000	4.9	4.9	4.9	4.9	4.9
16.500	5.0	5.0	5.0	5.0	5.0
17.000	5.0	5.0	5.0	5.0	5.1
17.500	5.1	5.1	5.1	5.1	5.1
18.000	5.1	5.1	5.1	5.2	5.2
18.500	5.2	5.2	5.2	5.2	5.2
19.000	5.2	5.2	5.2	5.2	5.2
19.500	5.3	5.3	5.3	5.3	5.3
20.000	5.3	5.3	5.3	5.3	5.3
20.500	5.3	5.3	5.3	5.4	5.4
21.000	5.4	5.4	5.4	5.4	5.4

Subsection: Time-Depth Curve
Label: TS #6

Return Event: 50 years
Storm Event: 50 Year Storm

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
21.500	5.4	5.4	5.4	5.4	5.4
22.000	5.4	5.4	5.4	5.5	5.5
22.500	5.5	5.5	5.5	5.5	5.5
23.000	5.5	5.5	5.5	5.5	5.5
23.500	5.5	5.5	5.5	5.5	5.6
24.000	5.6	(N/A)	(N/A)	(N/A)	(N/A)

Subsection: Time of Concentration Calculations
Label: Basin 1 - Post

Return Event: 2 years
Storm Event: 2 Year Storm

Time of Concentration Results

Segment #1: TR-55 Sheet Flow	
Hydraulic Length	100.00 ft
Manning's n	0.011
Slope	0.045 ft/ft
2 Year 24 Hour Depth	2.7 in
Average Velocity	1.74 ft/s
Segment Time of Concentration	0.016 hours

Segment #2: TR-55 Shallow Concentrated Flow	
Hydraulic Length	135.00 ft
Is Paved?	False
Slope	0.044 ft/ft
Average Velocity	3.38 ft/s
Segment Time of Concentration	0.011 hours

Segment #3: TR-55 Channel Flow	
Flow Area	1.2 ft^2
Hydraulic Length	210.00 ft
Manning's n	0.018
Slope	0.005 ft/ft
Wetted Perimeter	3.93 ft
Average Velocity	2.70 ft/s
Segment Time of Concentration	0.022 hours

Time of Concentration (Composite)	
Time of Concentration (Composite)	0.083 hours

= = = = SCS Channel Flow

Tc =

R = Qa / Wp
V = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

(Lf / V) / 3600

Where:

R= Hydraulic radius
Aq= Flow area, square feet
Wp= Wetted perimeter, feet
V= Velocity, ft/sec
Sf= Slope, ft/ft
n= Manning's n
Tc= Time of concentration, hours
Lf= Flow length, feet

= = = = SCS TR-55 Shallow Concentration Flow

Tc =

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Paved Surface:
V = 20.3282 * (Sf**0.5)

(Lf / V) / 3600

Where:

V= Velocity, ft/sec
Sf= Slope, ft/ft
Tc= Time of concentration, hours
Lf= Flow length, feet

= = = = SCS TR-55 Sheet Flow

Tc = (0.007 * ((n * Lf)**0.8)) / ((P**0.5) * (Sf**0.4))

Where:

Tc= Time of concentration, hours
n= Manning's n
Lf= Flow length, feet
P= 2yr, 24hr Rain depth, inches
Sf= Slope, %

Subsection: Time of Concentration Calculations
Return Event: 2 years
Label: Basin 1 - Pre
Storm Event: 2 Year Storm

Time of Concentration Results

Segment #1: TR-55 Sheet Flow	
Hydraulic Length	100.00 ft
Manning's n	0.011
Slope	0.045 ft/ft
2 Year 24 Hour Depth	2.7 in
Average Velocity	1.74 ft/s
Segment Time of Concentration	0.016 hours

Segment #2: TR-55 Shallow Concentrated Flow	
Hydraulic Length	241.00 ft
Is Paved?	False
Slope	0.042 ft/ft
Average Velocity	3.31 ft/s
Segment Time of Concentration	0.020 hours

Segment #3: TR-55 Channel Flow	
Flow Area	31.0 ft²
Hydraulic Length	122.00 ft
Manning's n	0.030
Slope	0.166 ft/ft
Wetted Perimeter	46.00 ft
Average Velocity	15.55 ft/s
Segment Time of Concentration	0.002 hours

Time of Concentration (Composite)	
Time of Concentration (Composite)	0.083 hours

= = = = SCS Channel Flow

Tc =

R = Qa / Wp
V = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

(Lf / V) / 3600

Where:

R= Hydraulic radius
Aq= Flow area, square feet
Wp= Wetted perimeter, feet
V= Velocity, ft/sec
Sf= Slope, ft/ft
n= Manning's n
Tc= Time of concentration, hours
Lf= Flow length, feet

= = = = SCS TR-55 Shallow Concentration Flow

Tc =

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Paved Surface:
V = 20.3282 * (Sf**0.5)

(Lf / V) / 3600

Where:

V= Velocity, ft/sec
Sf= Slope, ft/ft
Tc= Time of concentration, hours
Lf= Flow length, feet

= = = = SCS TR-55 Sheet Flow

Tc = (0.007 * ((n * Lf)**0.8)) / ((P**0.5) * (Sf**0.4))

Where:

Tc= Time of concentration, hours
n= Manning's n
Lf= Flow length, feet
P= 2yr, 24hr Rain depth, inches
Sf= Slope, %

Subsection: Time of Concentration Calculations
Return Event: 2 years
Label: Basin 2 - Post
Storm Event: 2 Year Storm

Time of Concentration Results

Segment #1: TR-55 Sheet Flow	
Hydraulic Length	100.00 ft
Manning's n	0.011
Slope	0.005 ft/ft
2 Year 24 Hour Depth	2.7 in
Average Velocity	0.72 ft/s
Segment Time of Concentration	0.038 hours

Segment #2: TR-55 Shallow Concentrated Flow	
Hydraulic Length	84.00 ft
Is Paved?	False
Slope	0.034 ft/ft
Average Velocity	2.98 ft/s
Segment Time of Concentration	0.008 hours

Segment #3: TR-55 Channel Flow	
Flow Area	3.0 ft^2
Hydraulic Length	100.00 ft
Manning's n	0.030
Slope	0.021 ft/ft
Wetted Perimeter	6.30 ft
Average Velocity	4.39 ft/s
Segment Time of Concentration	0.006 hours

Time of Concentration (Composite)	
Time of Concentration (Composite)	0.083 hours

Subsection: Time of Concentration Calculations | Return Event: 2 years
Label: Basin 2 - Post | Storm Event: 2 Year Storm

= = = = SCS Channel Flow

Tc =

R = Qa / Wp
V = (1.49 * (R**(2/3)) * (Sf**-0.5)) / n

(Lf / V) / 3600

Where:

R= Hydraulic radius
Aq= Flow area, square feet
Wp= Wetted perimeter, feet
V= Velocity, ft/sec
Sf= Slope, ft/ft
n= Manning's n
Tc= Time of concentration, hours
Lf= Flow length, feet

= = = = SCS TR-55 Shallow Concentration Flow

Tc =

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Paved Surface:
V = 20.3282 * (Sf**0.5)

(Lf / V) / 3600

Where:

V= Velocity, ft/sec
Sf= Slope, ft/ft
Tc= Time of concentration, hours
Lf= Flow length, feet

= = = = SCS TR-55 Sheet Flow

Tc = (0.007 * ((n * Lf)**0.8)) / ((P**0.5) * (Sf**0.4))

Where:

Tc= Time of concentration, hours
n= Manning's n
Lf= Flow length, feet
P= 2yr, 24hr Rain depth, inches
Sf= Slope, %

Subsection: Runoff CN-Area
Label: Basin 1 - Post

Return Event: 2 years
Storm Event: 2 Year Storm

Runoff Curve Number Data

Soil/Surface Description	CN	Area (acres)	C (%)	UC (%)	Adjusted CN
Meadow - cont. grass (non grazed) - ---- - Soil A	30.000	0.308	0.0	0.0	30.000
Meadow - cont. grass (non grazed) - ---- - Soil A	30.000	0.614	0.0	0.0	30.000
Meadow - cont. grass (non grazed) - ---- - Soil B	58.000	0.226	0.0	0.0	58.000
Impervious Areas - Paved parking lots, roofs, driveways, Streets and roads - Soil A	98.000	0.042	0.0	0.0	98.000
Impervious Areas - Paved parking lots, roofs, driveways, Streets and roads - Soil A (Unknown, Assumed A)	98.000	0.200	0.0	0.0	98.000
Impervious Areas - Paved parking lots, roofs, driveways, Streets and roads - Soil B	98.000	0.010	0.0	0.0	98.000
Impervious Areas - Gravel (w/ right-of-way) - Soil A	76.000	0.423	0.0	0.0	76.000
Impervious Areas - Gravel (w/ right-of-way) - Soil A (Unknown, assumed A)	76.000	0.009	0.0	0.0	76.000
Impervious Areas - Gravel (w/ right-of-way) - Soil B	85.000	0.187	0.0	0.0	85.000
Water/Pond Soil A	98.000	0.050	0.0	0.0	98.000
Water/Pond Soil B	98.000	0.017	0.0	0.0	98.000
COMPOSITE AREA & WEIGHTED CN --->	(N/A)	2.086	(N/A)	(N/A)	57.889

Subsection: Runoff CN-Area
Label: Basin 1 - Pre

Return Event: 2 years
Storm Event: 2 Year Storm

Runoff Curve Number Data

Soil/Surface Description	CN	Area (acres)	C (%)	UC (%)	Adjusted CN
Woods - good - Soil A	30.000	1.658	0.0	0.0	30.000
Woods - good - Soil A (HSG Unknown, assumed A)	30.000	0.054	0.0	0.0	30.000
Woods - good - Soil B	55.000	0.057	0.0	0.0	55.000
Meadow - cont. grass (non grazed) - ---- - Soil A	30.000	0.812	0.0	0.0	30.000
Meadow - cont. grass (non grazed) - ---- - Soil A (HSG Unknown, assumed A)	30.000	0.843	0.0	0.0	30.000
Meadow - cont. grass (non grazed) - ---- - Soil B	58.000	0.398	0.0	0.0	58.000
Impervious Areas - Paved parking lots, roofs, driveways, Streets and roads - Soil A	98.000	0.064	0.0	0.0	98.000
Impervious Areas - Paved parking lots, roofs, driveways, Streets and roads - Soil A - (HSG Unknown, assumed A)	98.000	0.295	0.0	0.0	98.000
COMPOSITE AREA & WEIGHTED CN --->	(N/A)	4.181	(N/A)	(N/A)	38.845

Subsection: Runoff CN-Area
Label: Basin 2 - Post

Return Event: 2 years
Storm Event: 2 Year Storm

Runoff Curve Number Data

Soil/Surface Description	CN	Area (acres)	C (%)	UC (%)	Adjusted CN
Woods - good - Soil A	30.000	0.897	0.0	0.0	30.000
Woods - good - Soil A (Unknown, Assumed A)	30.000	0.053	0.0	0.0	30.000
Meadow - cont. grass (non grazed) - ---- - Soil A	30.000	0.685	0.0	0.0	30.000
Meadow - cont. grass (non grazed) - ---- - Soil A (Unknown, Assumed A)	30.000	0.294	0.0	0.0	30.000
Meadow - cont. grass (non grazed) - ---- - Soil B	58.000	0.016	0.0	0.0	58.000
Impervious Areas - Paved parking lots, roofs, driveways, Streets and roads - Soil A	98.000	0.023	0.0	0.0	98.000
Impervious Areas - Paved parking lots, roofs, driveways, Streets and roads - Soil A (Unknown, Assumed A)	98.000	0.095	0.0	0.0	98.000
Water/Pond Soil A	98.000	0.032	0.0	0.0	98.000
COMPOSITE AREA & WEIGHTED CN --->	(N/A)	2.095	(N/A)	(N/A)	35.083

Subsection: Unit Hydrograph Summary
Label: Basin 1 - Post

Return Event: 2 years
Storm Event: 2 Year Storm

Storm Event	2 Year Storm
Return Event	2 years
Duration	24.000 hours
Depth	2.7 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	2.086 acres

Computational Time Increment	0.011 hours
Time to Peak (Computed)	12.022 hours
Flow (Peak, Computed)	0.28 ft^3/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.050 hours
Flow (Peak Interpolated Output)	0.24 ft^3/s

Drainage Area	
SCS CN (Composite)	58.000
Area (User Defined)	2.086 acres
Maximum Retention (Pervious)	7.2 in
Maximum Retention (Pervious, 20 percent)	1.4 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	0.2 in
Runoff Volume (Pervious)	1,335.535 ft^3

Hydrograph Volume (Area under Hydrograph curve)	
Volume	1,331.000 ft^3

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.083 hours
Computational Time Increment	0.011 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	28.36 ft^3/s
Unit peak time, Tp	0.056 hours
Unit receding limb, Tr	0.222 hours
Total unit time, Tb	0.278 hours

Subsection: Unit Hydrograph (Hydrograph Table) Return Event: 2 years
Label: Basin 1 - Post Storm Event: 2 Year Storm

Storm Event	2 Year Storm
Return Event	2 years
Duration	24.000 hours
Depth	2.7 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	2.086 acres

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
11.850	0.00	0.00	0.08	0.23	0.24
12.100	0.13	0.10	0.10	0.09	0.09
12.350	0.09	0.08	0.08	0.07	0.07
12.600	0.06	0.06	0.06	0.06	0.06
12.850	0.06	0.06	0.05	0.05	0.05
13.100	0.05	0.05	0.05	0.05	0.05
13.350	0.05	0.05	0.05	0.04	0.04
13.600	0.04	0.04	0.04	0.04	0.04
13.850	0.04	0.04	0.04	0.04	0.04
14.100	0.04	0.04	0.04	0.04	0.04
14.350	0.04	0.04	0.04	0.04	0.04
14.600	0.03	0.03	0.03	0.03	0.03
14.850	0.03	0.03	0.03	0.03	0.03
15.100	0.03	0.03	0.03	0.03	0.03
15.350	0.03	0.03	0.03	0.03	0.03
15.600	0.03	0.03	0.03	0.03	0.03
15.850	0.03	0.03	0.03	0.03	0.03
16.100	0.03	0.03	0.03	0.03	0.03
16.350	0.03	0.03	0.03	0.03	0.03
16.600	0.03	0.03	0.03	0.03	0.03
16.850	0.03	0.03	0.03	0.03	0.03
17.100	0.03	0.03	0.03	0.02	0.02
17.350	0.02	0.02	0.02	0.02	0.02
17.600	0.02	0.02	0.02	0.02	0.02
17.850	0.02	0.02	0.02	0.02	0.02
18.100	0.02	0.02	0.02	0.02	0.02
18.350	0.02	0.02	0.02	0.02	0.02
18.600	0.02	0.02	0.02	0.02	0.02
18.850	0.02	0.02	0.02	0.02	0.02
19.100	0.02	0.02	0.02	0.02	0.02
19.350	0.02	0.02	0.02	0.02	0.02
19.600	0.02	0.02	0.02	0.02	0.02
19.850	0.02	0.02	0.02	0.02	0.02
20.100	0.02	0.02	0.02	0.02	0.02
20.350	0.02	0.02	0.02	0.02	0.02
20.600	0.02	0.02	0.02	0.02	0.02
20.850	0.02	0.02	0.02	0.02	0.02
21.100	0.02	0.02	0.02	0.02	0.02
21.350	0.02	0.02	0.02	0.02	0.02
21.600	0.02	0.02	0.02	0.02	0.02
21.850	0.02	0.02	0.02	0.02	0.02
22.100	0.02	0.02	0.02	0.02	0.02

Subsection: Unit Hydrograph (Hydrograph Table) Return Event: 2 years
Label: Basin 1 - Post Storm Event: 2 Year Storm

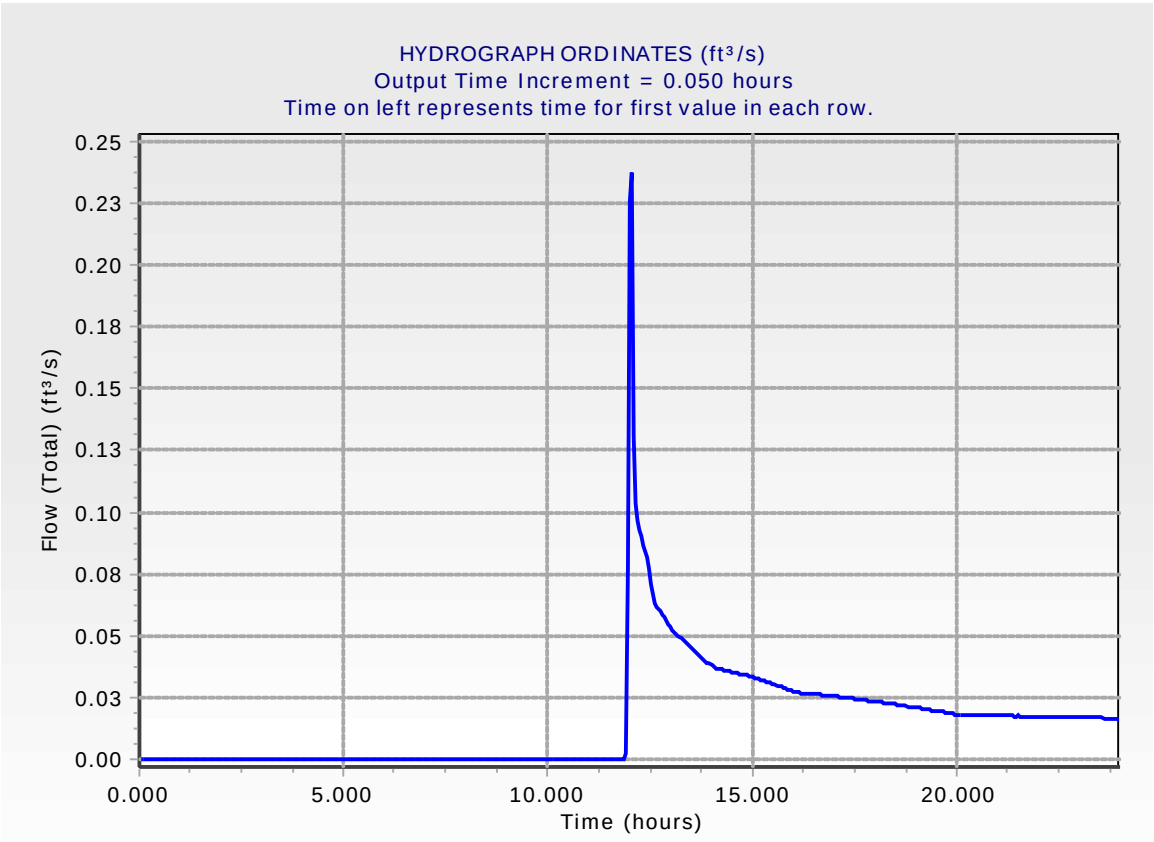
HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
22.350	0.02	0.02	0.02	0.02	0.02
22.600	0.02	0.02	0.02	0.02	0.02
22.850	0.02	0.02	0.02	0.02	0.02
23.100	0.02	0.02	0.02	0.02	0.02
23.350	0.02	0.02	0.02	0.02	0.02
23.600	0.02	0.02	0.02	0.02	0.02
23.850	0.02	0.02	0.02	0.02	(N/A)

NPT Transition Station #6

Subsection: Unit Hydrograph (Hydrograph Table) | Return Event: 2 years

Label: Basin 1 - Post | Storm Event: 2 Year Storm



Subsection: Unit Hydrograph Summary
Label: Basin 1 - Post

Return Event: 10 years
Storm Event: 10 Year Storm

Storm Event	10 Year Storm
Return Event	10 years
Duration	24.000 hours
Depth	3.9 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	2.086 acres

Computational Time Increment	0.011 hours
Time to Peak (Computed)	12.011 hours
Flow (Peak, Computed)	1.63 ft^3/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.000 hours
Flow (Peak Interpolated Output)	1.60 ft^3/s

Drainage Area	
SCS CN (Composite)	58.000
Area (User Defined)	2.086 acres
Maximum Retention (Pervious)	7.2 in
Maximum Retention (Pervious, 20 percent)	1.4 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	0.6 in
Runoff Volume (Pervious)	4,529.628 ft^3

Hydrograph Volume (Area under Hydrograph curve)	
Volume	4,518.000 ft^3

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.083 hours
Computational Time Increment	0.011 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	28.36 ft^3/s
Unit peak time, Tp	0.056 hours
Unit receding limb, Tr	0.222 hours
Total unit time, Tb	0.278 hours

Subsection: Unit Hydrograph (Hydrograph Table) Return Event: 10 years
Label: Basin 1 - Post Storm Event: 10 Year Storm

Storm Event	10 Year Storm
Return Event	10 years
Duration	24.000 hours
Depth	3.9 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	2.086 acres

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
11.700	0.00	0.00	0.08	0.44	1.10
11.950	1.48	1.60	1.23	0.59	0.43
12.200	0.37	0.35	0.33	0.31	0.29
12.450	0.26	0.24	0.22	0.21	0.20
12.700	0.20	0.19	0.19	0.18	0.18
12.950	0.17	0.16	0.16	0.16	0.15
13.200	0.15	0.15	0.14	0.14	0.14
13.450	0.13	0.13	0.13	0.13	0.12
13.700	0.12	0.12	0.12	0.11	0.11
13.950	0.11	0.11	0.11	0.10	0.10
14.200	0.10	0.10	0.10	0.10	0.10
14.450	0.10	0.10	0.10	0.10	0.10
14.700	0.09	0.09	0.09	0.09	0.09
14.950	0.09	0.09	0.09	0.09	0.09
15.200	0.09	0.09	0.08	0.08	0.08
15.450	0.08	0.08	0.08	0.08	0.08
15.700	0.08	0.08	0.08	0.07	0.07
15.950	0.07	0.07	0.07	0.07	0.07
16.200	0.07	0.07	0.07	0.07	0.07
16.450	0.07	0.07	0.07	0.07	0.07
16.700	0.07	0.07	0.07	0.07	0.07
16.950	0.07	0.06	0.06	0.06	0.06
17.200	0.06	0.06	0.06	0.06	0.06
17.450	0.06	0.06	0.06	0.06	0.06
17.700	0.06	0.06	0.06	0.06	0.06
17.950	0.06	0.06	0.06	0.06	0.06
18.200	0.06	0.06	0.06	0.06	0.06
18.450	0.06	0.06	0.05	0.05	0.05
18.700	0.05	0.05	0.05	0.05	0.05
18.950	0.05	0.05	0.05	0.05	0.05
19.200	0.05	0.05	0.05	0.05	0.05
19.450	0.05	0.05	0.05	0.05	0.05
19.700	0.05	0.05	0.05	0.05	0.04
19.950	0.04	0.04	0.04	0.04	0.04
20.200	0.04	0.04	0.04	0.04	0.04
20.450	0.04	0.04	0.04	0.04	0.04
20.700	0.04	0.04	0.04	0.04	0.04
20.950	0.04	0.04	0.04	0.04	0.04
21.200	0.04	0.04	0.04	0.04	0.04
21.450	0.04	0.04	0.04	0.04	0.04
21.700	0.04	0.04	0.04	0.04	0.04
21.950	0.04	0.04	0.04	0.04	0.04

Subsection: Unit Hydrograph (Hydrograph Table) Return Event: 10 years
Label: Basin 1 - Post Storm Event: 10 Year Storm

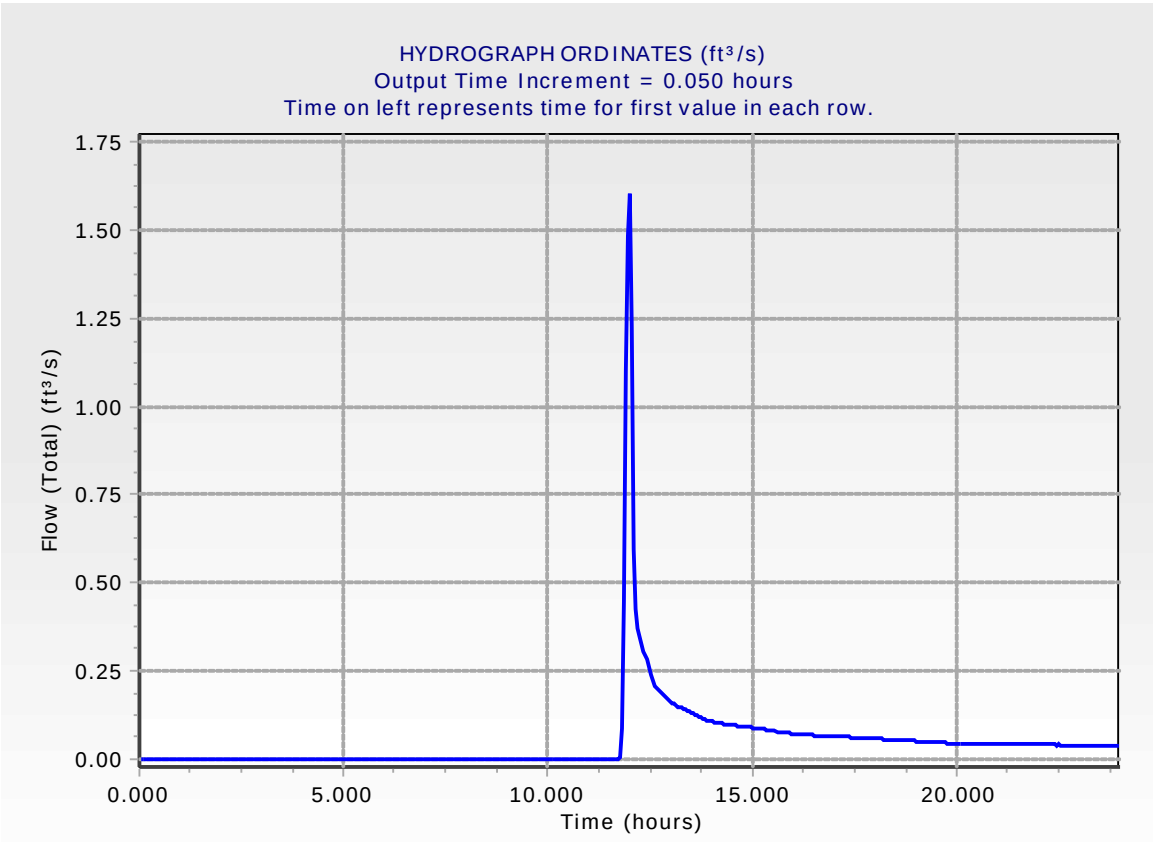
HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
22.200	0.04	0.04	0.04	0.04	0.04
22.450	0.04	0.04	0.04	0.04	0.04
22.700	0.04	0.04	0.04	0.04	0.04
22.950	0.04	0.04	0.04	0.04	0.04
23.200	0.04	0.04	0.04	0.04	0.04
23.450	0.04	0.04	0.04	0.04	0.04
23.700	0.04	0.04	0.04	0.04	0.04
23.950	0.04	0.04	(N/A)	(N/A)	(N/A)

NPT Transition Station #6

Subsection: Unit Hydrograph (Hydrograph Table) | Return Event: 10 years

Label: Basin 1 - Post | Storm Event: 10 Year Storm



Subsection: Unit Hydrograph Summary
Label: Basin 1 - Post

Return Event: 50 years
Storm Event: 50 Year Storm

Storm Event	50 Year Storm
Return Event	50 years
Duration	24.000 hours
Depth	5.6 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	2.086 acres

Computational Time Increment	0.011 hours
Time to Peak (Computed)	11.933 hours
Flow (Peak, Computed)	4.54 ft^3/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	11.950 hours
Flow (Peak Interpolated Output)	4.48 ft^3/s

Drainage Area	
SCS CN (Composite)	58.000
Area (User Defined)	2.086 acres
Maximum Retention (Pervious)	7.2 in
Maximum Retention (Pervious, 20 percent)	1.4 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	1.5 in
Runoff Volume (Pervious)	11,276.223 ft^3

Hydrograph Volume (Area under Hydrograph curve)	
Volume	11,254.000 ft^3

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.083 hours
Computational Time Increment	0.011 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	28.36 ft^3/s
Unit peak time, Tp	0.056 hours
Unit receding limb, Tr	0.222 hours
Total unit time, Tb	0.278 hours

Subsection: Unit Hydrograph (Hydrograph Table) Return Event: 50 years
Label: Basin 1 - Post Storm Event: 50 Year Storm

Storm Event	50 Year Storm
Return Event	50 years
Duration	24.000 hours
Depth	5.6 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	2.086 acres

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
11.300	0.00	0.00	0.01	0.02	0.03
11.550	0.06	0.12	0.26	0.48	0.86
11.800	1.39	2.49	4.06	4.48	4.31
12.050	3.12	1.47	1.02	0.89	0.82
12.300	0.76	0.71	0.66	0.60	0.55
12.550	0.51	0.47	0.45	0.44	0.43
12.800	0.41	0.40	0.39	0.38	0.36
13.050	0.35	0.34	0.33	0.33	0.32
13.300	0.31	0.31	0.30	0.29	0.28
13.550	0.28	0.27	0.27	0.26	0.26
13.800	0.25	0.24	0.24	0.23	0.23
14.050	0.22	0.22	0.22	0.22	0.21
14.300	0.21	0.21	0.21	0.21	0.21
14.550	0.20	0.20	0.20	0.20	0.20
14.800	0.19	0.19	0.19	0.19	0.19
15.050	0.19	0.18	0.18	0.18	0.18
15.300	0.18	0.17	0.17	0.17	0.17
15.550	0.17	0.16	0.16	0.16	0.16
15.800	0.16	0.15	0.15	0.15	0.15
16.050	0.15	0.15	0.14	0.14	0.14
16.300	0.14	0.14	0.14	0.14	0.14
16.550	0.14	0.14	0.14	0.14	0.14
16.800	0.14	0.14	0.13	0.13	0.13
17.050	0.13	0.13	0.13	0.13	0.13
17.300	0.13	0.13	0.13	0.13	0.13
17.550	0.13	0.12	0.12	0.12	0.12
17.800	0.12	0.12	0.12	0.12	0.12
18.050	0.12	0.12	0.12	0.12	0.12
18.300	0.11	0.11	0.11	0.11	0.11
18.550	0.11	0.11	0.11	0.11	0.11
18.800	0.11	0.11	0.11	0.10	0.10
19.050	0.10	0.10	0.10	0.10	0.10
19.300	0.10	0.10	0.10	0.10	0.10
19.550	0.10	0.09	0.09	0.09	0.09
19.800	0.09	0.09	0.09	0.09	0.09
20.050	0.09	0.09	0.09	0.09	0.09
20.300	0.09	0.09	0.09	0.09	0.09
20.550	0.09	0.09	0.09	0.09	0.09
20.800	0.09	0.09	0.09	0.08	0.08
21.050	0.08	0.08	0.08	0.08	0.08
21.300	0.08	0.08	0.08	0.08	0.08
21.550	0.08	0.08	0.08	0.08	0.08

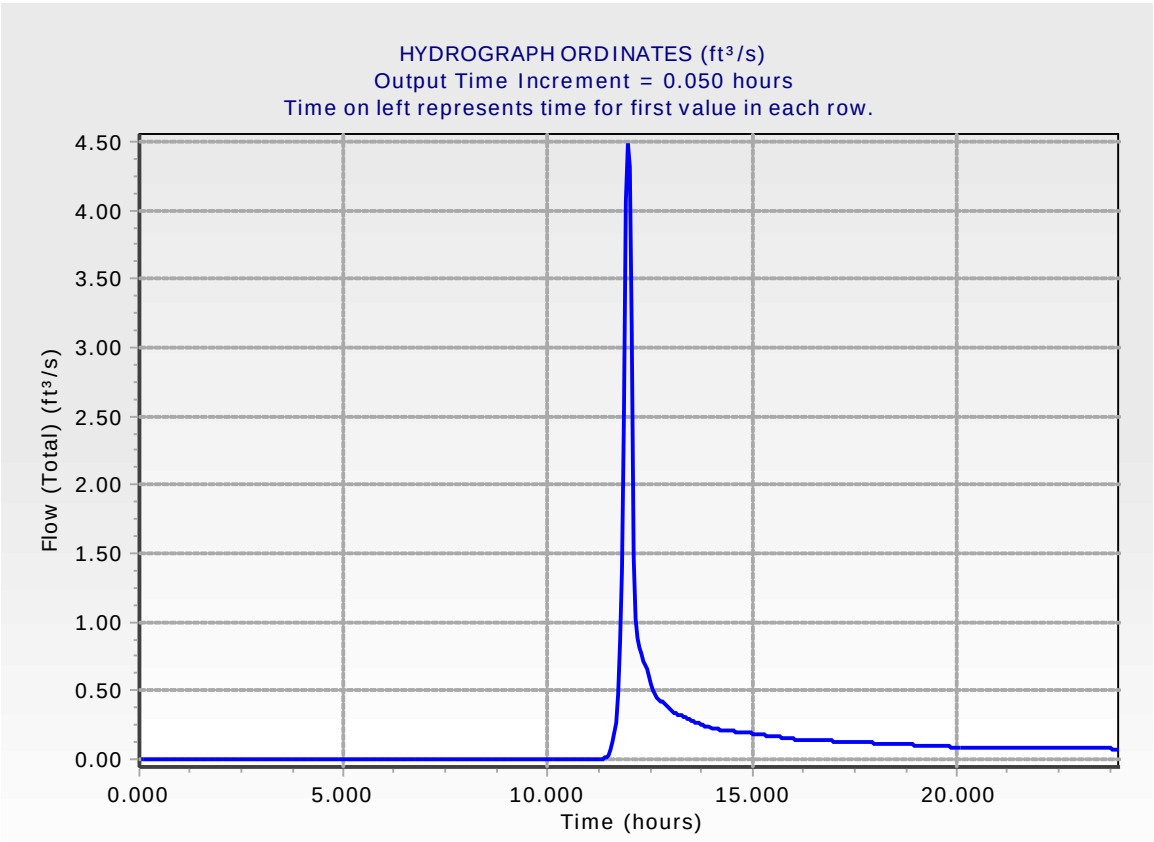
Subsection: Unit Hydrograph (Hydrograph Table) Return Event: 50 years
Label: Basin 1 - Post Storm Event: 50 Year Storm

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
21.800	0.08	0.08	0.08	0.08	0.08
22.050	0.08	0.08	0.08	0.08	0.08
22.300	0.08	0.08	0.08	0.08	0.08
22.550	0.08	0.08	0.08	0.08	0.08
22.800	0.08	0.08	0.08	0.08	0.08
23.050	0.08	0.08	0.08	0.08	0.08
23.300	0.08	0.08	0.08	0.08	0.08
23.550	0.08	0.08	0.08	0.08	0.08
23.800	0.08	0.08	0.08	0.08	0.08

Subsection: Unit Hydrograph (Hydrograph Table) Return Event: 50 years

Label: Basin 1 - Post Storm Event: 50 Year Storm



Subsection: Unit Hydrograph Summary
Label: Basin 1 - Post

Return Event: 100 years
Storm Event: 100 Year Storm

Storm Event	100 Year Storm
Return Event	100 years
Duration	24.000 hours
Depth	6.5 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	2.086 acres

Computational Time Increment	0.011 hours
Time to Peak (Computed)	11.933 hours
Flow (Peak, Computed)	6.58 ft^3/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	11.950 hours
Flow (Peak Interpolated Output)	6.43 ft^3/s

Drainage Area	
SCS CN (Composite)	58.000
Area (User Defined)	2.086 acres
Maximum Retention (Pervious)	7.2 in
Maximum Retention (Pervious, 20 percent)	1.4 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	2.1 in
Runoff Volume (Pervious)	15,769.281 ft^3

Hydrograph Volume (Area under Hydrograph curve)	
Volume	15,742.000 ft^3

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.083 hours
Computational Time Increment	0.011 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	28.36 ft^3/s
Unit peak time, Tp	0.056 hours
Unit receding limb, Tr	0.222 hours
Total unit time, Tb	0.278 hours

Subsection: Unit Hydrograph (Hydrograph Table) Return Event: 100 years
Label: Basin 1 - Post Storm Event: 100 Year Storm

Storm Event	100 Year Storm
Return Event	100 years
Duration	24.000 hours
Depth	6.5 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	2.086 acres

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
10.850	0.00	0.00	0.01	0.01	0.02
11.100	0.03	0.04	0.05	0.06	0.07
11.350	0.09	0.10	0.12	0.14	0.22
11.600	0.35	0.61	0.98	1.56	2.34
11.850	3.89	6.03	6.43	6.04	4.31
12.100	2.02	1.40	1.21	1.11	1.04
12.350	0.96	0.89	0.81	0.74	0.68
12.600	0.63	0.61	0.59	0.57	0.56
12.850	0.54	0.52	0.50	0.48	0.47
13.100	0.46	0.45	0.44	0.43	0.42
13.350	0.41	0.40	0.39	0.38	0.37
13.600	0.36	0.35	0.35	0.34	0.33
13.850	0.32	0.32	0.31	0.30	0.30
14.100	0.29	0.29	0.29	0.28	0.28
14.350	0.28	0.28	0.27	0.27	0.27
14.600	0.27	0.26	0.26	0.26	0.26
14.850	0.25	0.25	0.25	0.25	0.24
15.100	0.24	0.24	0.24	0.23	0.23
15.350	0.23	0.23	0.22	0.22	0.22
15.600	0.22	0.21	0.21	0.21	0.20
15.850	0.20	0.20	0.20	0.19	0.19
16.100	0.19	0.19	0.19	0.19	0.19
16.350	0.19	0.18	0.18	0.18	0.18
16.600	0.18	0.18	0.18	0.18	0.18
16.850	0.18	0.18	0.17	0.17	0.17
17.100	0.17	0.17	0.17	0.17	0.17
17.350	0.17	0.17	0.17	0.16	0.16
17.600	0.16	0.16	0.16	0.16	0.16
17.850	0.16	0.16	0.16	0.15	0.15
18.100	0.15	0.15	0.15	0.15	0.15
18.350	0.15	0.15	0.15	0.15	0.14
18.600	0.14	0.14	0.14	0.14	0.14
18.850	0.14	0.14	0.14	0.13	0.13
19.100	0.13	0.13	0.13	0.13	0.13
19.350	0.13	0.13	0.13	0.12	0.12
19.600	0.12	0.12	0.12	0.12	0.12
19.850	0.12	0.12	0.12	0.11	0.11
20.100	0.11	0.11	0.11	0.11	0.11
20.350	0.11	0.11	0.11	0.11	0.11
20.600	0.11	0.11	0.11	0.11	0.11
20.850	0.11	0.11	0.11	0.11	0.11
21.100	0.11	0.11	0.11	0.11	0.11

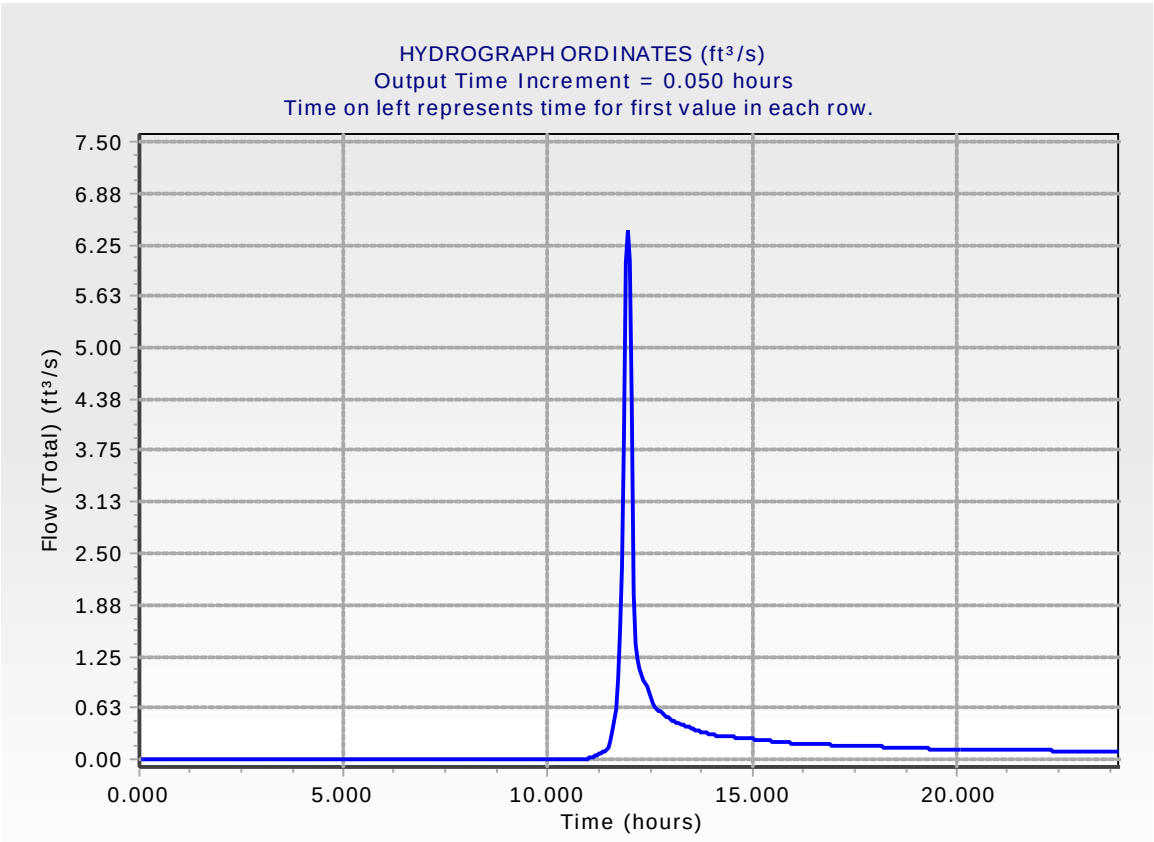
Subsection: Unit Hydrograph (Hydrograph Table) Return Event: 100 years
Label: Basin 1 - Post Storm Event: 100 Year Storm

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
21.350	0.11	0.11	0.11	0.11	0.11
21.600	0.11	0.11	0.11	0.11	0.11
21.850	0.11	0.11	0.11	0.11	0.11
22.100	0.11	0.11	0.11	0.11	0.11
22.350	0.10	0.10	0.10	0.10	0.10
22.600	0.10	0.10	0.10	0.10	0.10
22.850	0.10	0.10	0.10	0.10	0.10
23.100	0.10	0.10	0.10	0.10	0.10
23.350	0.10	0.10	0.10	0.10	0.10
23.600	0.10	0.10	0.10	0.10	0.10
23.850	0.10	0.10	0.10	0.10	(N/A)

Subsection: Unit Hydrograph (Hydrograph Table) Return Event: 100 years

Label: Basin 1 - Post Storm Event: 100 Year Storm



Subsection: Unit Hydrograph Summary
Label: Basin 1 - Pre

Return Event: 2 years
Storm Event: 2 Year Storm

Storm Event	2 Year Storm
Return Event	2 years
Duration	24.000 hours
Depth	2.7 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	4.181 acres

Computational Time Increment	0.011 hours
Time to Peak (Computed)	0.000 hours
Flow (Peak, Computed)	0.00 ft^3/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	0.000 hours
Flow (Peak Interpolated Output)	0.00 ft^3/s

Drainage Area	
SCS CN (Composite)	39.000
Area (User Defined)	4.181 acres
Maximum Retention (Pervious)	15.6 in
Maximum Retention (Pervious, 20 percent)	3.1 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	0.0 in
Runoff Volume (Pervious)	0.000 ft^3

Hydrograph Volume (Area under Hydrograph curve)	
Volume	0.000 ft^3

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.083 hours
Computational Time Increment	0.011 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	56.85 ft^3/s
Unit peak time, Tp	0.056 hours
Unit receding limb, Tr	0.222 hours
Total unit time, Tb	0.278 hours

Subsection: Unit Hydrograph (Hydrograph Table) Return Event: 2 years

Label: Basin 1 - Pre Storm Event: 2 Year Storm

Storm Event	2 Year Storm
Return Event	2 years
Duration	24.000 hours
Depth	2.7 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	4.181 acres

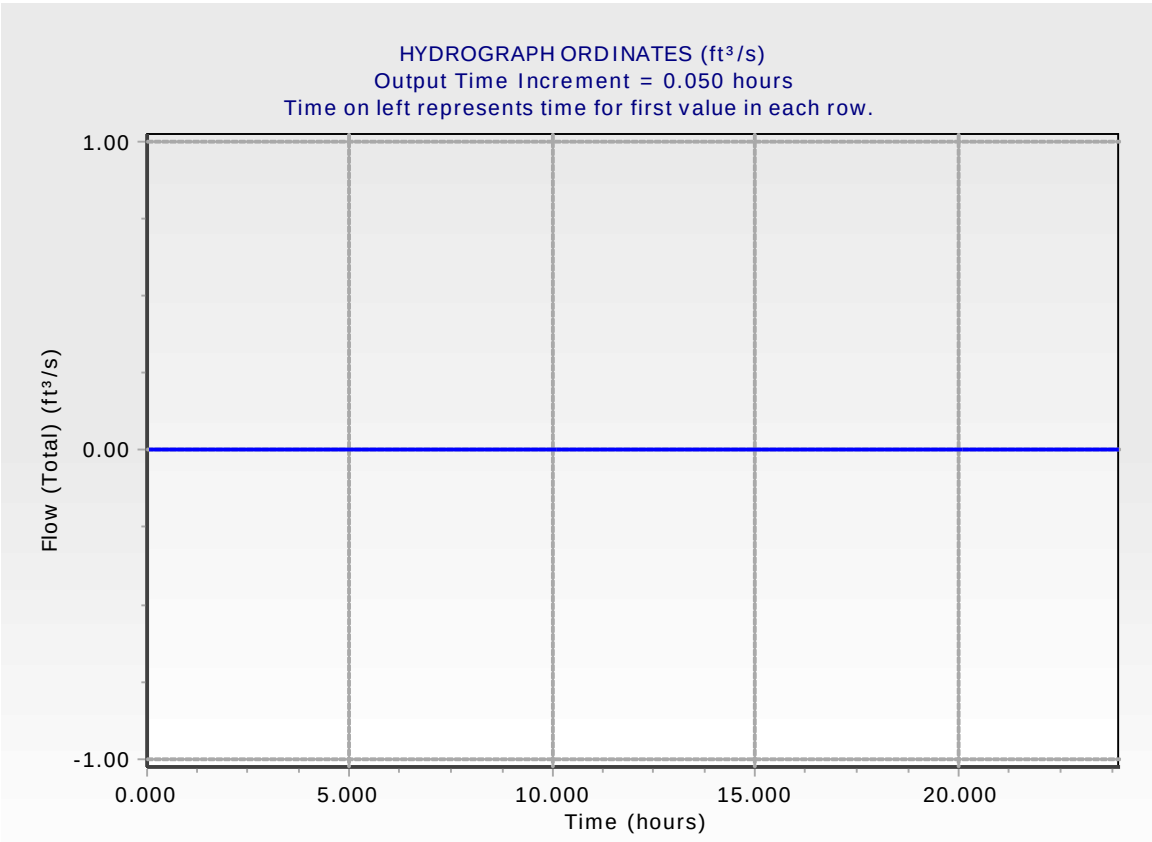
HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	0.00	(N/A)	(N/A)	(N/A)

NPT Transition Station #6

Subsection: Unit Hydrograph (Hydrograph Table) | Return Event: 2 years

Label: Basin 1 - Pre | Storm Event: 2 Year Storm



Subsection: Unit Hydrograph Summary
Label: Basin 1 - Pre

Return Event: 10 years
Storm Event: 10 Year Storm

Storm Event	10 Year Storm
Return Event	10 years
Duration	24.000 hours
Depth	3.9 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	4.181 acres

Computational Time Increment	0.011 hours
Time to Peak (Computed)	24.000 hours
Flow (Peak, Computed)	0.02 ft^3/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	24.000 hours
Flow (Peak Interpolated Output)	0.02 ft^3/s

Drainage Area	
SCS CN (Composite)	39.000
Area (User Defined)	4.181 acres
Maximum Retention (Pervious)	15.6 in
Maximum Retention (Pervious, 20 percent)	3.1 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	0.0 in
Runoff Volume (Pervious)	483.268 ft^3

Hydrograph Volume (Area under Hydrograph curve)	
Volume	480.000 ft^3

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.083 hours
Computational Time Increment	0.011 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	56.85 ft^3/s
Unit peak time, Tp	0.056 hours
Unit receding limb, Tr	0.222 hours
Total unit time, Tb	0.278 hours

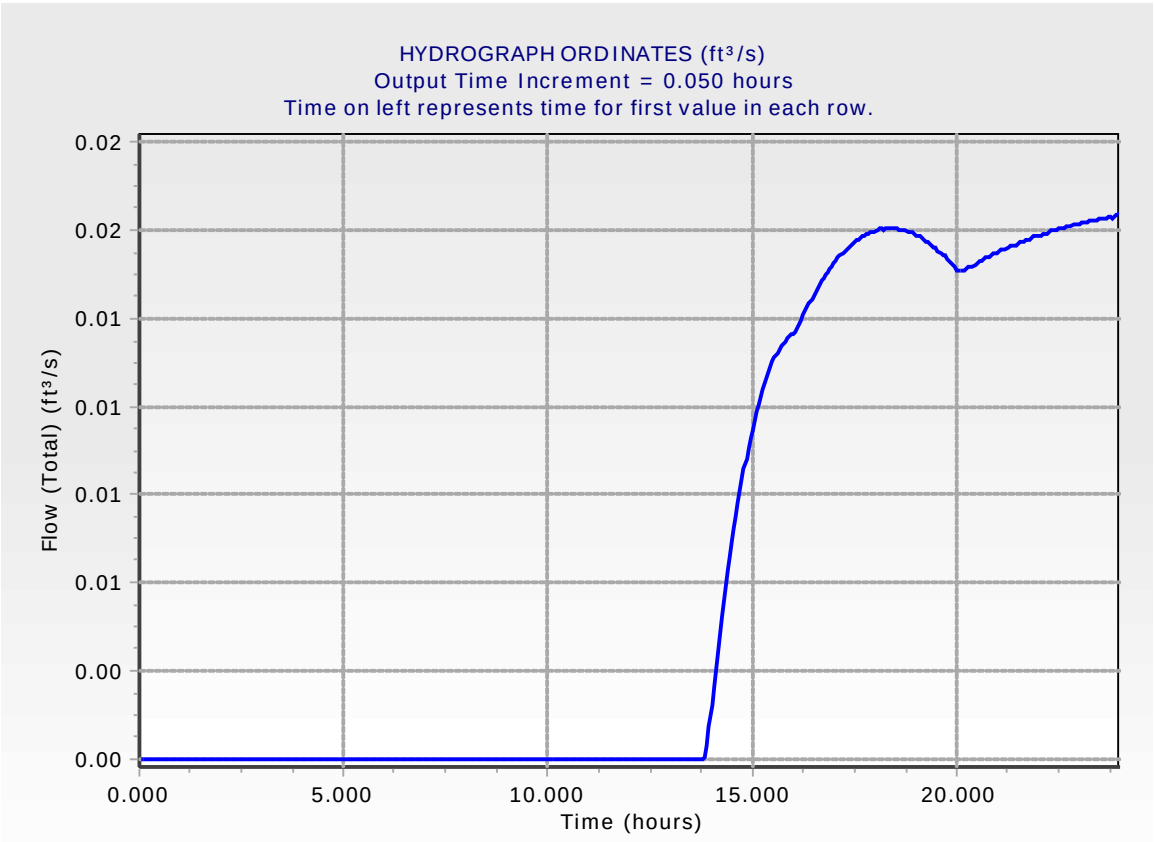
Subsection: Unit Hydrograph (Hydrograph Table) Return Event: 10 years
Label: Basin 1 - Pre Storm Event: 10 Year Storm

Storm Event	10 Year Storm
Return Event	10 years
Duration	24.000 hours
Depth	3.9 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	4.181 acres

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
13.950	0.00	0.00	0.00	0.00	0.00
14.200	0.00	0.00	0.00	0.00	0.01
14.450	0.01	0.01	0.01	0.01	0.01
14.700	0.01	0.01	0.01	0.01	0.01
14.950	0.01	0.01	0.01	0.01	0.01
15.200	0.01	0.01	0.01	0.01	0.01
15.450	0.01	0.01	0.01	0.01	0.01
15.700	0.01	0.01	0.01	0.01	0.01
15.950	0.01	0.01	0.01	0.01	0.01
16.200	0.01	0.01	0.01	0.01	0.01
16.450	0.01	0.01	0.01	0.01	0.01
16.700	0.01	0.01	0.01	0.01	0.01
16.950	0.01	0.01	0.01	0.01	0.01
17.200	0.01	0.01	0.01	0.01	0.01
17.450	0.01	0.01	0.01	0.01	0.01
17.700	0.01	0.01	0.01	0.01	0.01
17.950	0.01	0.01	0.01	0.02	0.02
18.200	0.02	0.02	0.02	0.02	0.02
18.450	0.02	0.02	0.02	0.02	0.02
18.700	0.02	0.01	0.01	0.01	0.01
18.950	0.01	0.01	0.01	0.01	0.01
19.200	0.01	0.01	0.01	0.01	0.01
19.450	0.01	0.01	0.01	0.01	0.01
19.700	0.01	0.01	0.01	0.01	0.01
19.950	0.01	0.01	0.01	0.01	0.01
20.200	0.01	0.01	0.01	0.01	0.01
20.450	0.01	0.01	0.01	0.01	0.01
20.700	0.01	0.01	0.01	0.01	0.01
20.950	0.01	0.01	0.01	0.01	0.01
21.200	0.01	0.01	0.01	0.01	0.01
21.450	0.01	0.01	0.01	0.01	0.01
21.700	0.01	0.01	0.01	0.01	0.01
21.950	0.01	0.01	0.01	0.01	0.01
22.200	0.01	0.01	0.01	0.01	0.01
22.450	0.02	0.02	0.02	0.02	0.02
22.700	0.02	0.02	0.02	0.02	0.02
22.950	0.02	0.02	0.02	0.02	0.02
23.200	0.02	0.02	0.02	0.02	0.02
23.450	0.02	0.02	0.02	0.02	0.02
23.700	0.02	0.02	0.02	0.02	0.02
23.950	0.02	0.02	(N/A)	(N/A)	(N/A)

Subsection: Unit Hydrograph (Hydrograph Table) Return Event: 10 years
Label: Basin 1 - Pre Storm Event: 10 Year Storm



Subsection: Unit Hydrograph Summary
Label: Basin 1 - Pre

Return Event: 50 years
Storm Event: 50 Year Storm

Storm Event	50 Year Storm
Return Event	50 years
Duration	24.000 hours
Depth	5.6 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	4.181 acres

Computational Time Increment	0.011 hours
Time to Peak (Computed)	12.033 hours
Flow (Peak, Computed)	0.85 ft^3/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.050 hours
Flow (Peak Interpolated Output)	0.76 ft^3/s

Drainage Area	
SCS CN (Composite)	39.000
Area (User Defined)	4.181 acres
Maximum Retention (Pervious)	15.6 in
Maximum Retention (Pervious, 20 percent)	3.1 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	0.3 in
Runoff Volume (Pervious)	4,966.304 ft^3

Hydrograph Volume (Area under Hydrograph curve)	
Volume	4,949.000 ft^3

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.083 hours
Computational Time Increment	0.011 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	56.85 ft^3/s
Unit peak time, Tp	0.056 hours
Unit receding limb, Tr	0.222 hours
Total unit time, Tb	0.278 hours

Subsection: Unit Hydrograph (Hydrograph Table) Return Event: 50 years
Label: Basin 1 - Pre Storm Event: 50 Year Storm

Storm Event	50 Year Storm
Return Event	50 years
Duration	24.000 hours
Depth	5.6 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	4.181 acres

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

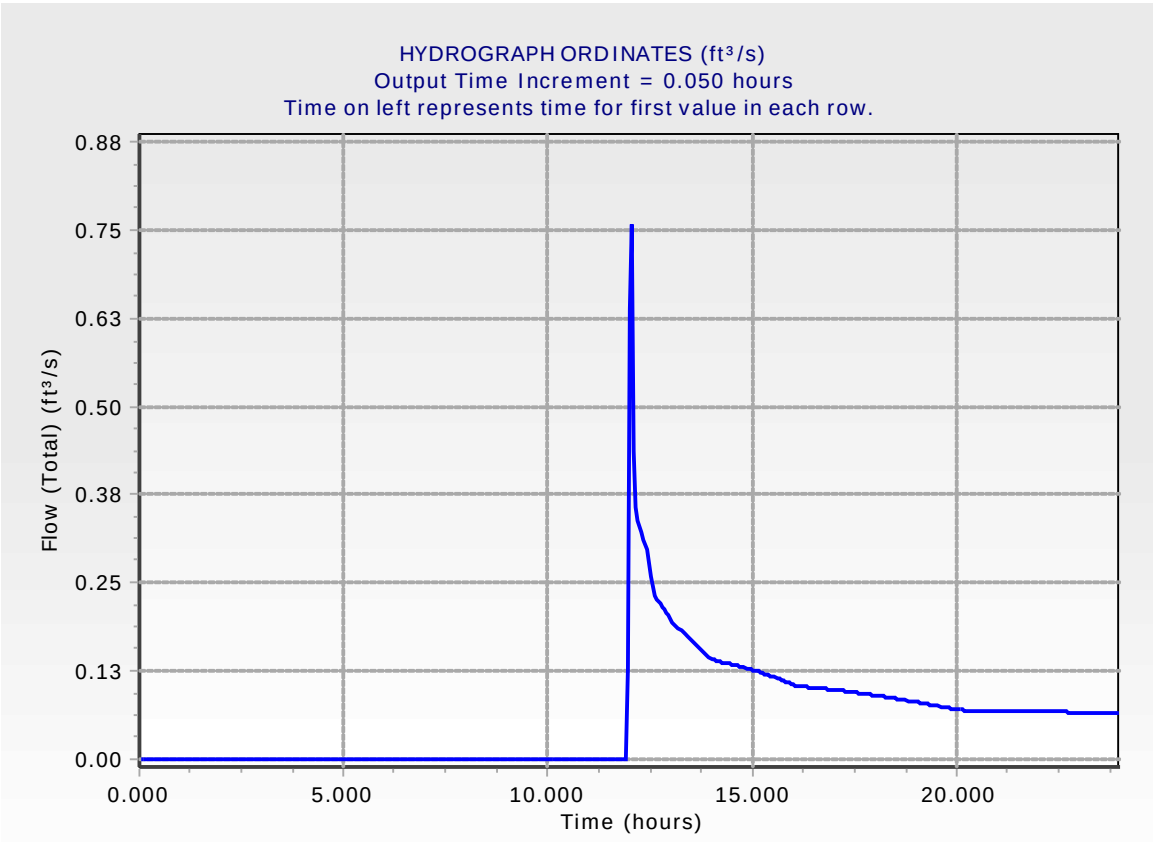
Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
11.900	0.00	0.13	0.64	0.76	0.44
12.150	0.36	0.34	0.33	0.32	0.31
12.400	0.30	0.28	0.26	0.24	0.23
12.650	0.23	0.22	0.22	0.22	0.21
12.900	0.21	0.20	0.20	0.19	0.19
13.150	0.19	0.19	0.18	0.18	0.18
13.400	0.17	0.17	0.17	0.17	0.16
13.650	0.16	0.16	0.16	0.15	0.15
13.900	0.15	0.15	0.14	0.14	0.14
14.150	0.14	0.14	0.14	0.14	0.14
14.400	0.14	0.14	0.13	0.13	0.13
14.650	0.13	0.13	0.13	0.13	0.13
14.900	0.13	0.13	0.13	0.13	0.13
15.150	0.12	0.12	0.12	0.12	0.12
15.400	0.12	0.12	0.12	0.12	0.11
15.650	0.11	0.11	0.11	0.11	0.11
15.900	0.11	0.11	0.11	0.10	0.10
16.150	0.10	0.10	0.10	0.10	0.10
16.400	0.10	0.10	0.10	0.10	0.10
16.650	0.10	0.10	0.10	0.10	0.10
16.900	0.10	0.10	0.10	0.10	0.10
17.150	0.10	0.10	0.10	0.10	0.10
17.400	0.10	0.09	0.09	0.09	0.09
17.650	0.09	0.09	0.09	0.09	0.09
17.900	0.09	0.09	0.09	0.09	0.09
18.150	0.09	0.09	0.09	0.09	0.09
18.400	0.09	0.09	0.09	0.09	0.08
18.650	0.08	0.08	0.08	0.08	0.08
18.900	0.08	0.08	0.08	0.08	0.08
19.150	0.08	0.08	0.08	0.08	0.08
19.400	0.08	0.08	0.08	0.08	0.07
19.650	0.07	0.07	0.07	0.07	0.07
19.900	0.07	0.07	0.07	0.07	0.07
20.150	0.07	0.07	0.07	0.07	0.07
20.400	0.07	0.07	0.07	0.07	0.07
20.650	0.07	0.07	0.07	0.07	0.07
20.900	0.07	0.07	0.07	0.07	0.07
21.150	0.07	0.07	0.07	0.07	0.07
21.400	0.07	0.07	0.07	0.07	0.07
21.650	0.07	0.07	0.07	0.07	0.07
21.900	0.07	0.07	0.07	0.07	0.07
22.150	0.07	0.07	0.07	0.07	0.07

Subsection: Unit Hydrograph (Hydrograph Table) Return Event: 50 years
Label: Basin 1 - Pre Storm Event: 50 Year Storm

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
22.400	0.07	0.07	0.07	0.07	0.07
22.650	0.07	0.07	0.07	0.07	0.07
22.900	0.07	0.07	0.07	0.07	0.07
23.150	0.07	0.07	0.07	0.07	0.07
23.400	0.07	0.07	0.07	0.07	0.07
23.650	0.07	0.07	0.07	0.07	0.07
23.900	0.07	0.07	0.07	(N/A)	(N/A)

Subsection: Unit Hydrograph (Hydrograph Table) Return Event: 50 years
Label: Basin 1 - Pre Storm Event: 50 Year Storm



Subsection: Unit Hydrograph Summary
Label: Basin 1 - Pre

Return Event: 100 years
Storm Event: 100 Year Storm

Storm Event	100 Year Storm
Return Event	100 years
Duration	24.000 hours
Depth	6.5 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	4.181 acres

Computational Time Increment	0.011 hours
Time to Peak (Computed)	12.022 hours
Flow (Peak, Computed)	2.63 ft^3/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.000 hours
Flow (Peak Interpolated Output)	2.44 ft^3/s

Drainage Area	
SCS CN (Composite)	39.000
Area (User Defined)	4.181 acres
Maximum Retention (Pervious)	15.6 in
Maximum Retention (Pervious, 20 percent)	3.1 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	0.6 in
Runoff Volume (Pervious)	9,124.764 ft^3

Hydrograph Volume (Area under Hydrograph curve)	
Volume	9,097.000 ft^3

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.083 hours
Computational Time Increment	0.011 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	56.85 ft^3/s
Unit peak time, Tp	0.056 hours
Unit receding limb, Tr	0.222 hours
Total unit time, Tb	0.278 hours

Subsection: Unit Hydrograph (Hydrograph Table) Return Event: 100 years
Label: Basin 1 - Pre Storm Event: 100 Year Storm

Storm Event	100 Year Storm
Return Event	100 years
Duration	24.000 hours
Depth	6.5 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	4.181 acres

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
11.800	0.00	0.01	0.52	1.64	2.44
12.050	2.11	1.08	0.81	0.73	0.69
12.300	0.66	0.62	0.59	0.54	0.50
12.550	0.47	0.44	0.42	0.42	0.41
12.800	0.40	0.39	0.38	0.37	0.36
13.050	0.35	0.34	0.33	0.33	0.32
13.300	0.32	0.31	0.31	0.30	0.29
13.550	0.29	0.28	0.28	0.27	0.27
13.800	0.26	0.26	0.25	0.25	0.24
14.050	0.24	0.24	0.23	0.23	0.23
14.300	0.23	0.23	0.23	0.23	0.22
14.550	0.22	0.22	0.22	0.22	0.22
14.800	0.22	0.21	0.21	0.21	0.21
15.050	0.21	0.21	0.20	0.20	0.20
15.300	0.20	0.20	0.19	0.19	0.19
15.550	0.19	0.19	0.18	0.18	0.18
15.800	0.18	0.18	0.17	0.17	0.17
16.050	0.17	0.17	0.17	0.17	0.17
16.300	0.16	0.16	0.16	0.16	0.16
16.550	0.16	0.16	0.16	0.16	0.16
16.800	0.16	0.16	0.16	0.16	0.16
17.050	0.16	0.16	0.15	0.15	0.15
17.300	0.15	0.15	0.15	0.15	0.15
17.550	0.15	0.15	0.15	0.15	0.15
17.800	0.15	0.14	0.14	0.14	0.14
18.050	0.14	0.14	0.14	0.14	0.14
18.300	0.14	0.14	0.14	0.14	0.13
18.550	0.13	0.13	0.13	0.13	0.13
18.800	0.13	0.13	0.13	0.13	0.13
19.050	0.13	0.12	0.12	0.12	0.12
19.300	0.12	0.12	0.12	0.12	0.12
19.550	0.12	0.12	0.11	0.11	0.11
19.800	0.11	0.11	0.11	0.11	0.11
20.050	0.11	0.11	0.11	0.11	0.11
20.300	0.11	0.11	0.11	0.11	0.11
20.550	0.11	0.11	0.11	0.11	0.11
20.800	0.11	0.11	0.11	0.11	0.11
21.050	0.11	0.11	0.11	0.10	0.10
21.300	0.11	0.10	0.10	0.10	0.10
21.550	0.10	0.10	0.10	0.10	0.10
21.800	0.10	0.10	0.10	0.10	0.10
22.050	0.10	0.10	0.10	0.10	0.10

Subsection: Unit Hydrograph (Hydrograph Table) Return Event: 100 years
Label: Basin 1 - Pre Storm Event: 100 Year Storm

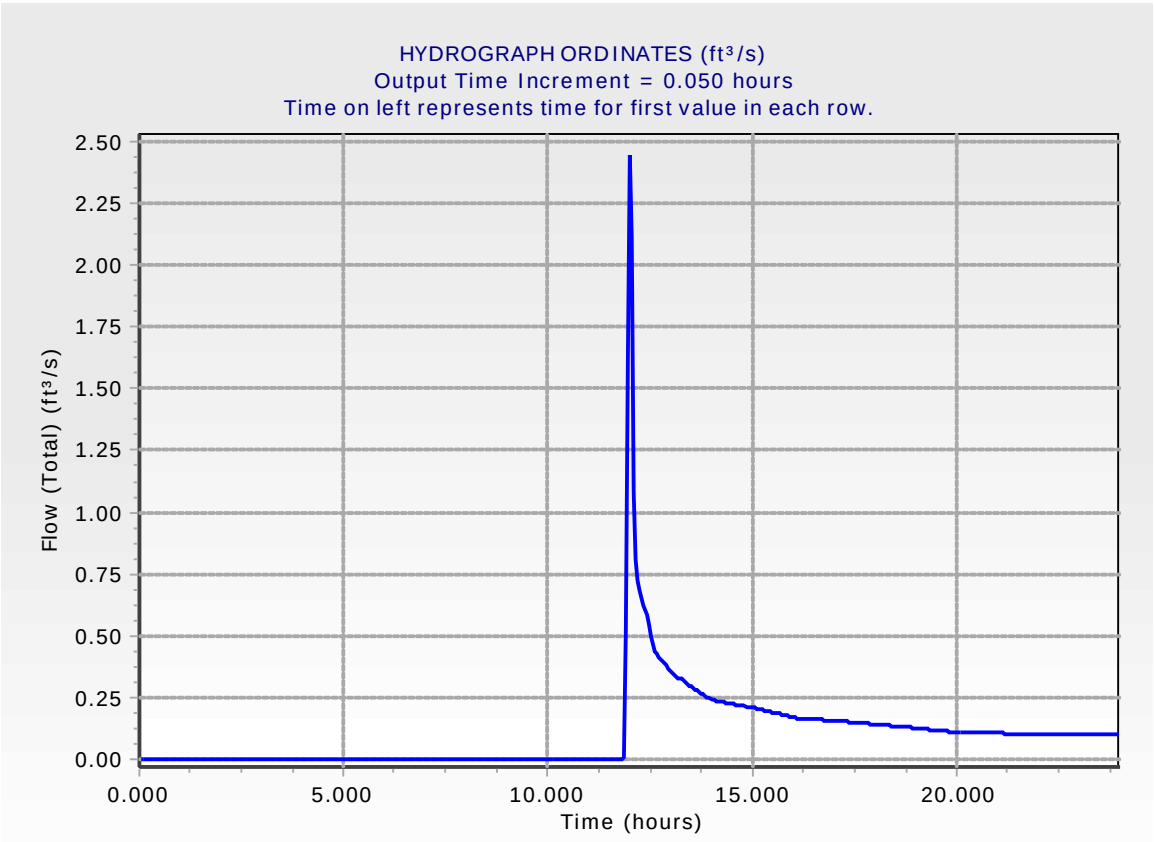
HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
22.300	0.10	0.10	0.10	0.10	0.10
22.550	0.10	0.10	0.10	0.10	0.10
22.800	0.10	0.10	0.10	0.10	0.10
23.050	0.10	0.10	0.10	0.10	0.10
23.300	0.10	0.10	0.10	0.10	0.10
23.550	0.10	0.10	0.10	0.10	0.10
23.800	0.10	0.10	0.10	0.10	0.10

NPT Transition Station #6

Subsection: Unit Hydrograph (Hydrograph Table) | Return Event: 100 years

Label: Basin 1 - Pre | Storm Event: 100 Year Storm



Subsection: Unit Hydrograph Summary
Label: Basin 2 - Post

Return Event: 2 years
Storm Event: 2 Year Storm

Storm Event	2 Year Storm
Return Event	2 years
Duration	24.000 hours
Depth	2.7 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	2.095 acres

Computational Time Increment	0.011 hours
Time to Peak (Computed)	0.000 hours
Flow (Peak, Computed)	0.00 ft^3/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	0.000 hours
Flow (Peak Interpolated Output)	0.00 ft^3/s

Drainage Area	
SCS CN (Composite)	35.000
Area (User Defined)	2.095 acres
Maximum Retention (Pervious)	18.6 in
Maximum Retention (Pervious, 20 percent)	3.7 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	0.0 in
Runoff Volume (Pervious)	0.000 ft^3

Hydrograph Volume (Area under Hydrograph curve)	
Volume	0.000 ft^3

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.083 hours
Computational Time Increment	0.011 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	28.48 ft^3/s
Unit peak time, Tp	0.056 hours
Unit receding limb, Tr	0.222 hours
Total unit time, Tb	0.278 hours

Subsection: Unit Hydrograph (Hydrograph Table) Return Event: 2 years
Label: Basin 2 - Post Storm Event: 2 Year Storm

Storm Event	2 Year Storm
Return Event	2 years
Duration	24.000 hours
Depth	2.7 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	2.095 acres

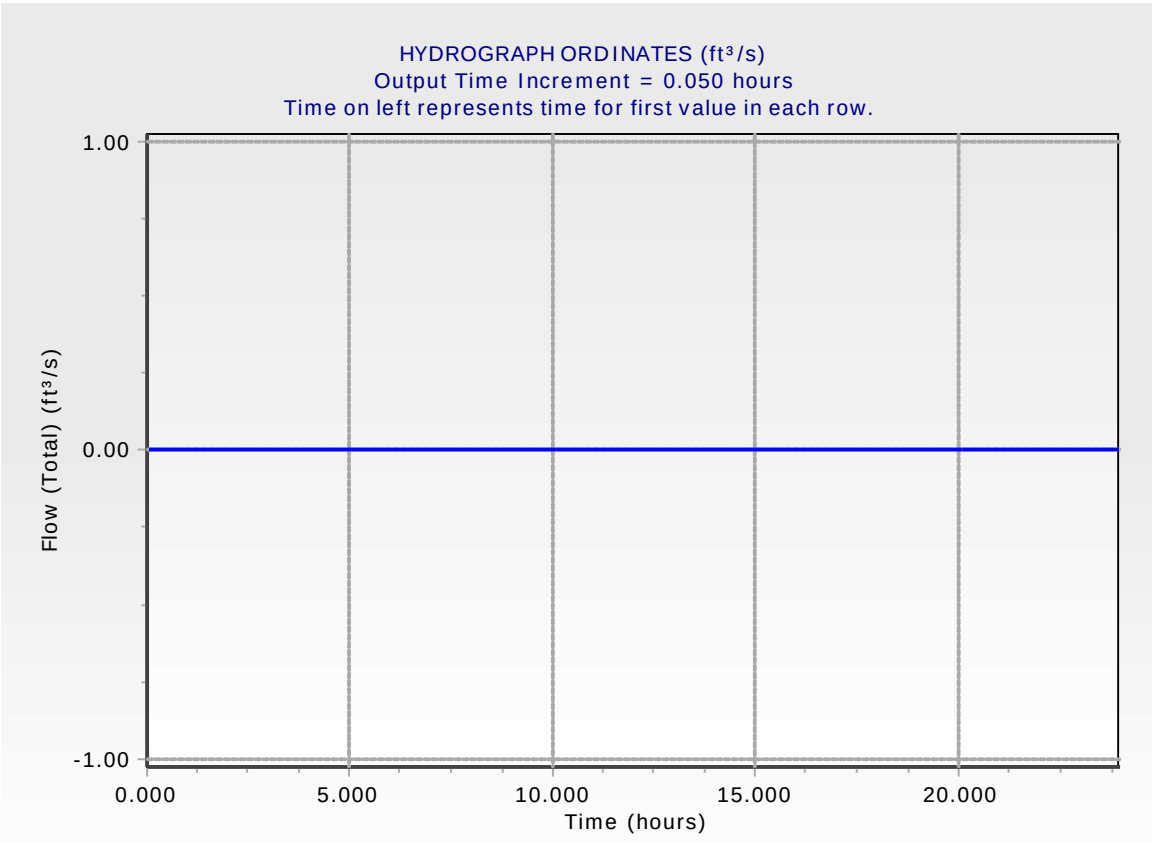
HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	0.00	(N/A)	(N/A)	(N/A)

NPT Transition Station #6

Subsection: Unit Hydrograph (Hydrograph Table) | Return Event: 2 years

Label: Basin 2 - Post | Storm Event: 2 Year Storm



Subsection: Unit Hydrograph Summary
Label: Basin 2 - Post

Return Event: 10 years
Storm Event: 10 Year Storm

Storm Event	10 Year Storm
Return Event	10 years
Duration	24.000 hours
Depth	3.9 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	2.095 acres

Computational Time Increment	0.011 hours
Time to Peak (Computed)	24.000 hours
Flow (Peak, Computed)	0.00 ft^3/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	24.000 hours
Flow (Peak Interpolated Output)	0.00 ft^3/s

Drainage Area	
SCS CN (Composite)	35.000
Area (User Defined)	2.095 acres
Maximum Retention (Pervious)	18.6 in
Maximum Retention (Pervious, 20 percent)	3.7 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	0.0 in
Runoff Volume (Pervious)	7.366 ft^3

Hydrograph Volume (Area under Hydrograph curve)	
Volume	7.000 ft^3

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.083 hours
Computational Time Increment	0.011 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	28.48 ft^3/s
Unit peak time, Tp	0.056 hours
Unit receding limb, Tr	0.222 hours
Total unit time, Tb	0.278 hours

Subsection: Unit Hydrograph (Hydrograph Table) Return Event: 10 years
Label: Basin 2 - Post Storm Event: 10 Year Storm

Storm Event	10 Year Storm
Return Event	10 years
Duration	24.000 hours
Depth	3.9 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	2.095 acres

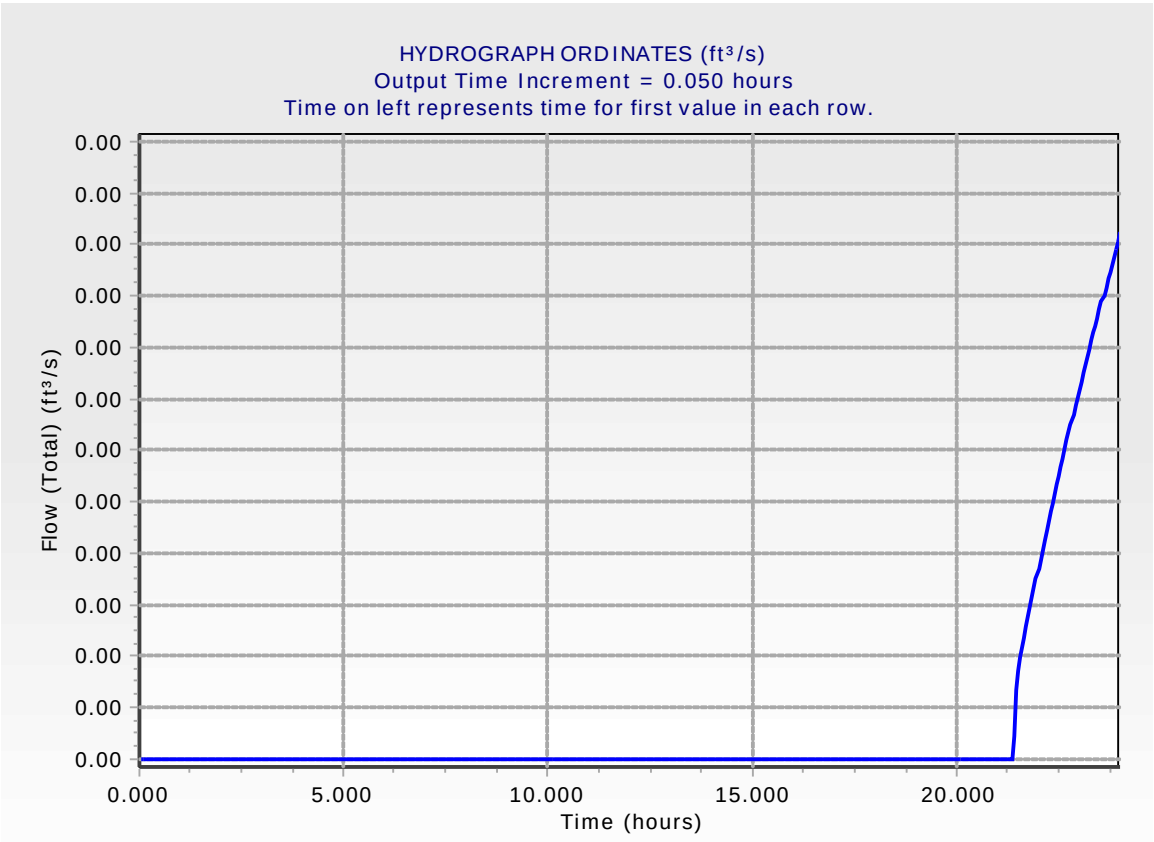
HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
23.350	0.00	0.00	0.00	0.00	0.00
23.600	0.00	0.00	0.00	0.00	0.00
23.850	0.00	0.00	0.00	0.00	(N/A)

NPT Transition Station #6

Subsection: Unit Hydrograph (Hydrograph Table) | Return Event: 10 years

Label: Basin 2 - Post | Storm Event: 10 Year Storm



Subsection: Unit Hydrograph Summary
Label: Basin 2 - Post

Return Event: 50 years
Storm Event: 50 Year Storm

Storm Event	50 Year Storm
Return Event	50 years
Duration	24.000 hours
Depth	5.6 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	2.095 acres

Computational Time Increment	0.011 hours
Time to Peak (Computed)	12.922 hours
Flow (Peak, Computed)	0.04 ft^3/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.900 hours
Flow (Peak Interpolated Output)	0.04 ft^3/s

Drainage Area	
SCS CN (Composite)	35.000
Area (User Defined)	2.095 acres
Maximum Retention (Pervious)	18.6 in
Maximum Retention (Pervious, 20 percent)	3.7 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	0.2 in
Runoff Volume (Pervious)	1,268.965 ft^3

Hydrograph Volume (Area under Hydrograph curve)	
Volume	1,264.000 ft^3

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.083 hours
Computational Time Increment	0.011 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	28.48 ft^3/s
Unit peak time, Tp	0.056 hours
Unit receding limb, Tr	0.222 hours
Total unit time, Tb	0.278 hours

Subsection: Unit Hydrograph (Hydrograph Table) Return Event: 50 years
Label: Basin 2 - Post Storm Event: 50 Year Storm

Storm Event	50 Year Storm
Return Event	50 years
Duration	24.000 hours
Depth	5.6 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	2.095 acres

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
12.050	0.00	0.00	0.01	0.02	0.03
12.300	0.04	0.04	0.04	0.04	0.04
12.550	0.04	0.04	0.04	0.04	0.04
12.800	0.04	0.04	0.04	0.04	0.04
13.050	0.04	0.04	0.04	0.04	0.04
13.300	0.04	0.04	0.04	0.04	0.04
13.550	0.04	0.04	0.04	0.04	0.04
13.800	0.04	0.04	0.04	0.04	0.04
14.050	0.04	0.04	0.04	0.04	0.04
14.300	0.04	0.04	0.04	0.04	0.04
14.550	0.04	0.04	0.04	0.04	0.04
14.800	0.04	0.04	0.04	0.04	0.04
15.050	0.04	0.04	0.04	0.04	0.04
15.300	0.04	0.04	0.03	0.03	0.03
15.550	0.03	0.03	0.03	0.03	0.03
15.800	0.03	0.03	0.03	0.03	0.03
16.050	0.03	0.03	0.03	0.03	0.03
16.300	0.03	0.03	0.03	0.03	0.03
16.550	0.03	0.03	0.03	0.03	0.03
16.800	0.03	0.03	0.03	0.03	0.03
17.050	0.03	0.03	0.03	0.03	0.03
17.300	0.03	0.03	0.03	0.03	0.03
17.550	0.03	0.03	0.03	0.03	0.03
17.800	0.03	0.03	0.03	0.03	0.03
18.050	0.03	0.03	0.03	0.03	0.03
18.300	0.03	0.03	0.03	0.03	0.03
18.550	0.03	0.03	0.03	0.03	0.03
18.800	0.03	0.03	0.03	0.03	0.03
19.050	0.03	0.03	0.03	0.03	0.03
19.300	0.03	0.03	0.03	0.03	0.02
19.550	0.02	0.02	0.02	0.02	0.02
19.800	0.02	0.02	0.02	0.02	0.02
20.050	0.02	0.02	0.02	0.02	0.02
20.300	0.02	0.02	0.02	0.02	0.02
20.550	0.02	0.02	0.02	0.02	0.02
20.800	0.02	0.02	0.02	0.02	0.02
21.050	0.02	0.02	0.02	0.02	0.02
21.300	0.02	0.02	0.02	0.02	0.02
21.550	0.02	0.02	0.02	0.02	0.02
21.800	0.02	0.02	0.02	0.02	0.02
22.050	0.02	0.02	0.02	0.02	0.02
22.300	0.02	0.02	0.02	0.02	0.02

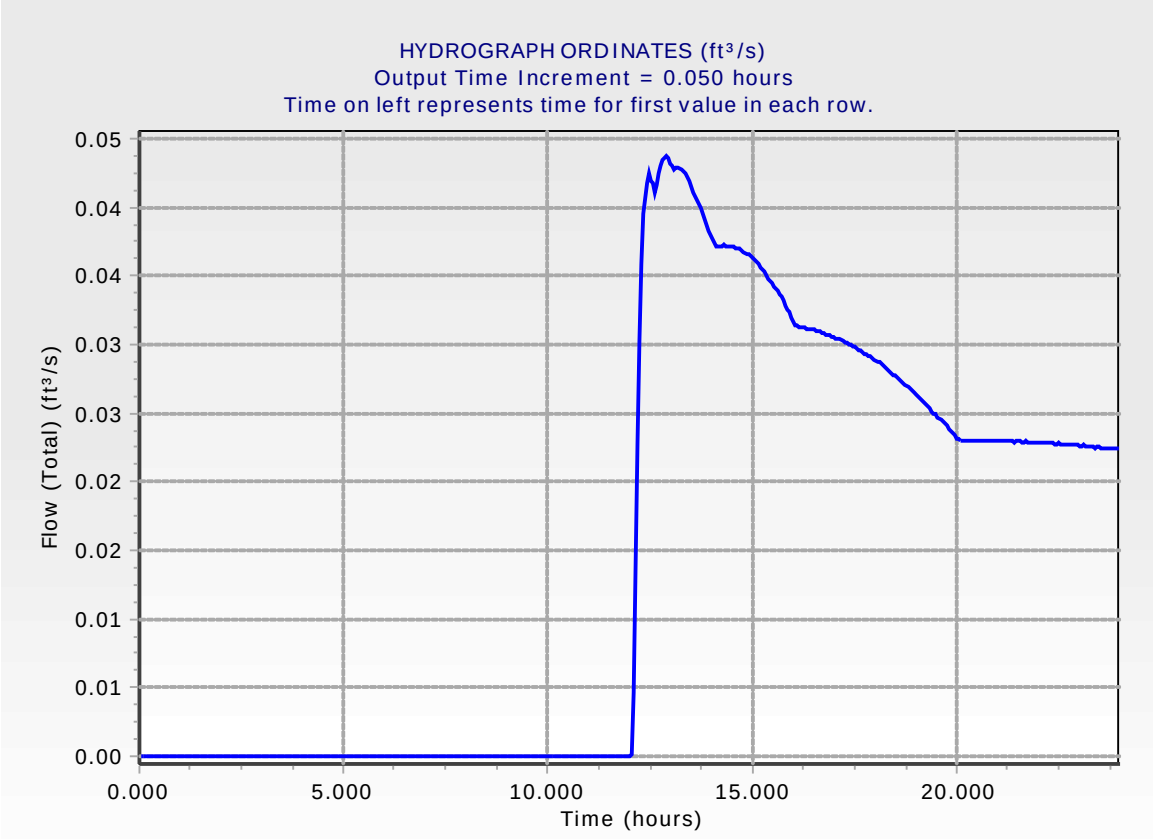
Subsection: Unit Hydrograph (Hydrograph Table) Return Event: 50 years
Label: Basin 2 - Post Storm Event: 50 Year Storm

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
22.550	0.02	0.02	0.02	0.02	0.02
22.800	0.02	0.02	0.02	0.02	0.02
23.050	0.02	0.02	0.02	0.02	0.02
23.300	0.02	0.02	0.02	0.02	0.02
23.550	0.02	0.02	0.02	0.02	0.02
23.800	0.02	0.02	0.02	0.02	0.02

Subsection: Unit Hydrograph (Hydrograph Table) Return Event: 50 years

Label: Basin 2 - Post Storm Event: 50 Year Storm



Subsection: Unit Hydrograph Summary
Label: Basin 2 - Post

Return Event: 100 years
Storm Event: 100 Year Storm

Storm Event	100 Year Storm
Return Event	100 years
Duration	24.000 hours
Depth	6.5 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	2.095 acres

Computational Time Increment	0.011 hours
Time to Peak (Computed)	12.033 hours
Flow (Peak, Computed)	0.44 ft^3/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.050 hours
Flow (Peak Interpolated Output)	0.39 ft^3/s

Drainage Area	
SCS CN (Composite)	35.000
Area (User Defined)	2.095 acres
Maximum Retention (Pervious)	18.6 in
Maximum Retention (Pervious, 20 percent)	3.7 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	0.4 in
Runoff Volume (Pervious)	2,781.946 ft^3

Hydrograph Volume (Area under Hydrograph curve)	
Volume	2,772.000 ft^3

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.083 hours
Computational Time Increment	0.011 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	28.48 ft^3/s
Unit peak time, Tp	0.056 hours
Unit receding limb, Tr	0.222 hours
Total unit time, Tb	0.278 hours

Subsection: Unit Hydrograph (Hydrograph Table) Return Event: 100 years
Label: Basin 2 - Post Storm Event: 100 Year Storm

Storm Event	100 Year Storm
Return Event	100 years
Duration	24.000 hours
Depth	6.5 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	2.095 acres

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
11.900	0.00	0.05	0.31	0.39	0.23
12.150	0.19	0.18	0.18	0.18	0.17
12.400	0.16	0.15	0.14	0.14	0.13
12.650	0.13	0.12	0.12	0.12	0.12
12.900	0.12	0.11	0.11	0.11	0.11
13.150	0.11	0.10	0.10	0.10	0.10
13.400	0.10	0.10	0.09	0.09	0.09
13.650	0.09	0.09	0.09	0.09	0.09
13.900	0.08	0.08	0.08	0.08	0.08
14.150	0.08	0.08	0.08	0.08	0.08
14.400	0.08	0.08	0.08	0.08	0.08
14.650	0.07	0.07	0.07	0.07	0.07
14.900	0.07	0.07	0.07	0.07	0.07
15.150	0.07	0.07	0.07	0.07	0.07
15.400	0.07	0.07	0.07	0.07	0.06
15.650	0.06	0.06	0.06	0.06	0.06
15.900	0.06	0.06	0.06	0.06	0.06
16.150	0.06	0.06	0.06	0.06	0.06
16.400	0.06	0.06	0.06	0.06	0.06
16.650	0.06	0.06	0.06	0.06	0.06
16.900	0.06	0.06	0.06	0.06	0.06
17.150	0.06	0.06	0.05	0.05	0.05
17.400	0.05	0.05	0.05	0.05	0.05
17.650	0.05	0.05	0.05	0.05	0.05
17.900	0.05	0.05	0.05	0.05	0.05
18.150	0.05	0.05	0.05	0.05	0.05
18.400	0.05	0.05	0.05	0.05	0.05
18.650	0.05	0.05	0.05	0.05	0.05
18.900	0.05	0.05	0.05	0.05	0.05
19.150	0.05	0.05	0.04	0.04	0.04
19.400	0.04	0.04	0.04	0.04	0.04
19.650	0.04	0.04	0.04	0.04	0.04
19.900	0.04	0.04	0.04	0.04	0.04
20.150	0.04	0.04	0.04	0.04	0.04
20.400	0.04	0.04	0.04	0.04	0.04
20.650	0.04	0.04	0.04	0.04	0.04
20.900	0.04	0.04	0.04	0.04	0.04
21.150	0.04	0.04	0.04	0.04	0.04
21.400	0.04	0.04	0.04	0.04	0.04
21.650	0.04	0.04	0.04	0.04	0.04
21.900	0.04	0.04	0.04	0.04	0.04
22.150	0.04	0.04	0.04	0.04	0.04

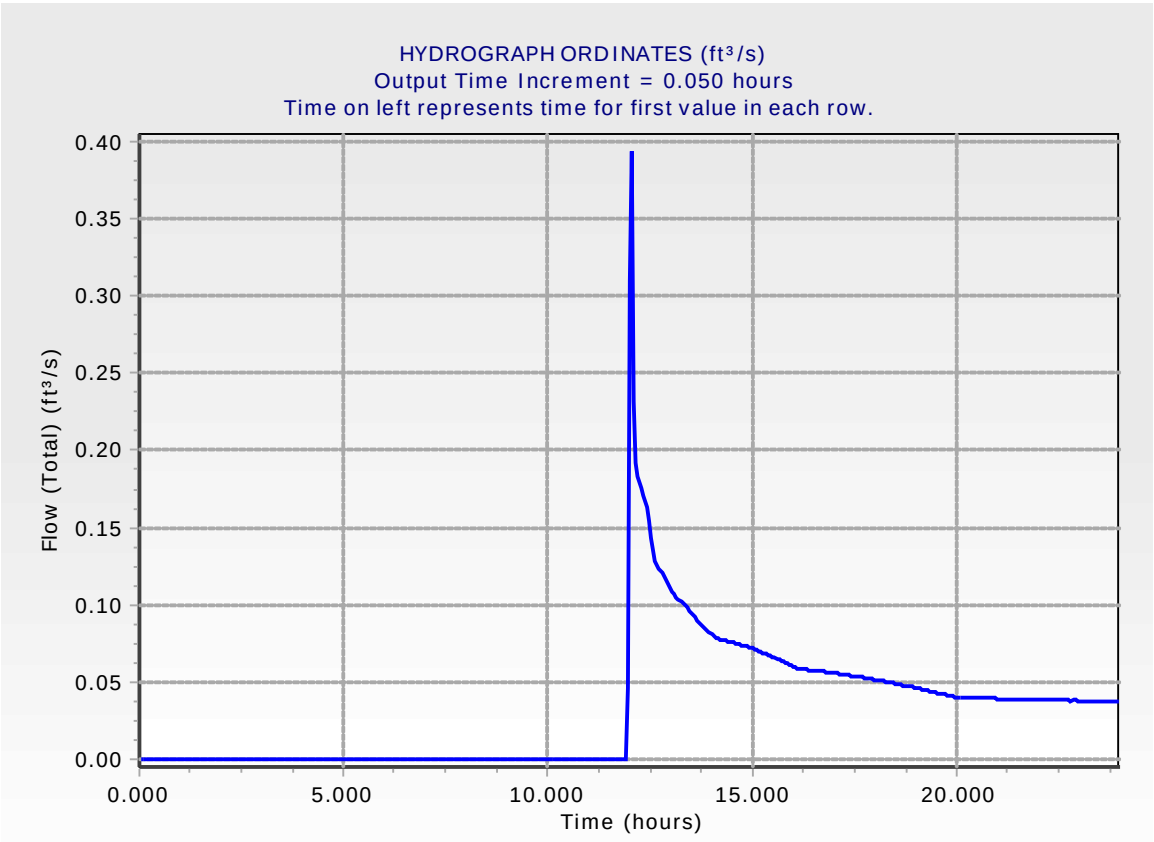
Subsection: Unit Hydrograph (Hydrograph Table) Return Event: 100 years
Label: Basin 2 - Post Storm Event: 100 Year Storm

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
22.400	0.04	0.04	0.04	0.04	0.04
22.650	0.04	0.04	0.04	0.04	0.04
22.900	0.04	0.04	0.04	0.04	0.04
23.150	0.04	0.04	0.04	0.04	0.04
23.400	0.04	0.04	0.04	0.04	0.04
23.650	0.04	0.04	0.04	0.04	0.04
23.900	0.04	0.04	0.04	(N/A)	(N/A)

Subsection: Unit Hydrograph (Hydrograph Table) Return Event: 100 years

Label: Basin 2 - Post Storm Event: 100 Year Storm



Subsection: Addition Summary
Label: Site Outlet - Post

Return Event: 2 years
Storm Event: 2 Year Storm

Summary for Hydrograph Addition at 'Site Outlet - Post'

Upstream Link	Upstream Node
Drainline B	North Detention Pond
Drainline A	South Detention Pond

Node Inflows

Inflow Type	Element	Volume (ft^3)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	Drainline B	0.000	0.000	0.00
Flow (From)	Drainline A	0.000	0.000	0.00
Flow (In)	Site Outlet - Post	0.000	0.000	0.00

Subsection: Addition Summary
Label: Site Outlet - Post

Return Event: 10 years
Storm Event: 10 Year Storm

Summary for Hydrograph Addition at 'Site Outlet - Post'

Upstream Link	Upstream Node
Drainline B	North Detention Pond
Drainline A	South Detention Pond

Node Inflows

Inflow Type	Element	Volume (ft^3)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	Drainline B	0.000	0.000	0.00
Flow (From)	Drainline A	0.000	0.000	0.00
Flow (In)	Site Outlet - Post	0.000	0.000	0.00

Subsection: Addition Summary
Label: Site Outlet - Post

Return Event: 50 years
Storm Event: 50 Year Storm

Summary for Hydrograph Addition at 'Site Outlet - Post'

Upstream Link	Upstream Node
Drainline B	North Detention Pond
Drainline A	South Detention Pond

Node Inflows

Inflow Type	Element	Volume (ft^3)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	Drainline B	388.338	12.350	0.12
Flow (From)	Drainline A	0.000	0.000	0.00
Flow (In)	Site Outlet - Post	388.338	12.350	0.12

Subsection: Addition Summary
Label: Site Outlet - Post

Return Event: 100 years
Storm Event: 100 Year Storm

Summary for Hydrograph Addition at 'Site Outlet - Post'

Upstream Link	Upstream Node
Drainline B	North Detention Pond
Drainline A	South Detention Pond

Node Inflows

Inflow Type	Element	Volume (ft^3)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	Drainline B	1,547.793	12.350	0.25
Flow (From)	Drainline A	1,032.665	15.450	0.05
Flow (In)	Site Outlet - Post	2,580.458	12.350	0.25

Subsection: Addition Summary
Label: Site Outlet - Pre

Return Event: 2 years
Storm Event: 2 Year Storm

Summary for Hydrograph Addition at 'Site Outlet - Pre'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	Basin 1 - Pre

Node Inflows

Inflow Type	Element	Volume (ft^3)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	Basin 1 - Pre	0.000	0.000	0.00
Flow (In)	Site Outlet - Pre	0.000	0.000	0.00

Subsection: Addition Summary
Label: Site Outlet - Pre

Return Event: 10 years
Storm Event: 10 Year Storm

Summary for Hydrograph Addition at 'Site Outlet - Pre'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	Basin 1 - Pre

Node Inflows

Inflow Type	Element	Volume (ft³)	Time to Peak (hours)	Flow (Peak) (ft³/s)
Flow (From)	Basin 1 - Pre	479.573	24.000	0.02
Flow (In)	Site Outlet - Pre	479.573	24.000	0.02

Subsection: Addition Summary
Label: Site Outlet - Pre

Return Event: 50 years
Storm Event: 50 Year Storm

Summary for Hydrograph Addition at 'Site Outlet - Pre'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	Basin 1 - Pre

Node Inflows

Inflow Type	Element	Volume (ft³)	Time to Peak (hours)	Flow (Peak) (ft³/s)
Flow (From)	Basin 1 - Pre	4,949.358	12.050	0.76
Flow (In)	Site Outlet - Pre	4,949.358	12.050	0.76

Subsection: Addition Summary
Label: Site Outlet - Pre

Return Event: 100 years
Storm Event: 100 Year Storm

Summary for Hydrograph Addition at 'Site Outlet - Pre'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	Basin 1 - Pre

Node Inflows

Inflow Type	Element	Volume (ft³)	Time to Peak (hours)	Flow (Peak) (ft³/s)
Flow (From)	Basin 1 - Pre	9,096.707	12.000	2.44
Flow (In)	Site Outlet - Pre	9,096.707	12.000	2.44

NPT Transition Station #6

Subsection: Elevation-Area Volume Curve
Return Event: 2 years
Label: North Detention Pond
Storm Event: 2 Year Storm

Elevation (ft)	Planimeter (ft²)	Area (acres)	A1+A2+sqr (A1*A2) (acres)	Volume (ft³)	Volume (Total) (ft³)
483.00	0.0	0.020	0.000	0.000	0.000
483.50	0.0	0.025	0.067	489.000	489.000
484.00	0.0	0.030	0.082	597.000	1,086.000
485.00	0.0	0.041	0.106	1,546.000	2,632.000
485.15	0.0	0.043	0.126	275.000	2,908.000
486.00	0.0	0.054	0.145	1,788.000	4,696.000
487.00	0.0	0.068	0.182	2,638.000	7,335.000
488.00	0.0	0.083	0.225	3,268.000	10,603.000

NPT Transition Station #6

Subsection: Elevation-Area Volume Curve
Return Event: 2 years
Label: South Detention Pond
Storm Event: 2 Year Storm

Elevation (ft)	Planimeter (ft²)	Area (acres)	A1+A2+sqr (A1*A2) (acres)	Volume (ft³)	Volume (Total) (ft³)
480.65	0.0	0.008	0.000	0.000	0.000
481.15	0.0	0.010	0.027	196.000	196.000
481.65	0.0	0.013	0.034	250.000	445.000
482.15	0.0	0.016	0.043	315.000	761.000
482.65	0.0	0.019	0.052	381.000	1,141.000
483.15	0.0	0.023	0.063	457.000	1,598.000
483.65	0.0	0.027	0.075	544.000	2,142.000
484.15	0.0	0.032	0.088	642.000	2,784.000

Subsection: Outlet Input Data
Label: Composite Outlet Structure - 1

Return Event: 2 years
Storm Event: 2 Year Storm

Requested Pond Water Surface Elevations	
Minimum (Headwater)	483.00 ft
Increment (Headwater)	0.50 ft
Maximum (Headwater)	488.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Inlet Box	Riser - 1	Forward	Culvert - 1	486.41	488.00
Orifice-Circular	Orifice - 1	Forward	Culvert - 1	485.15	488.00
Culvert-Circular	Culvert - 1	Forward	TW	480.75	488.00
Irregular Weir	Weir - 1	Forward	TW	487.00	488.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Subsection: Outlet Input Data
Label: Composite Outlet Structure - 1

Return Event: 2 years
Storm Event: 2 Year Storm

Structure ID: Orifice - 1 Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	485.15 ft
Orifice Diameter	3.0 in
Orifice Coefficient	0.600

Structure ID: Riser - 1 Structure Type: Inlet Box	
Number of Openings	1
Elevation	486.41 ft
Orifice Area	4.0 ft²
Orifice Coefficient	0.600
Weir Length	3.75 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1.000
Manning's n	0.000
Kev, Charged Riser	0.000
Weir Submergence	False
Orifice H to crest	False

Subsection: Outlet Input Data
Label: Composite Outlet Structure - 1

Return Event: 2 years
Storm Event: 2 Year Storm

Structure ID: Culvert - 1 Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	15.0 in
Length	210.00 ft
Length (Computed Barrel)	210.00 ft
Slope (Computed)	0.005 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	0.200
Kb	0.023
Kr	0.000
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 1
K	0.0045
M	2.0000
C	0.0317
Y	0.6900
T1 ratio (HW/D)	1.093
T2 ratio (HW/D)	1.195
Slope Correction Factor	-0.500

Use unsubmerged inlet control 0 equation below T1 elevation.
Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...

T1 Elevation	482.12 ft	T1 Flow	4.80 ft^3/s
T2 Elevation	482.24 ft	T2 Flow	5.49 ft^3/s

Subsection: Outlet Input Data
Label: Composite Outlet Structure - 1

Return Event: 2 years
Storm Event: 2 Year Storm

Structure ID: Weir - 1
Structure Type: Irregular Weir

Station (ft)	Elevation (ft)
0.00	1.00
3.00	0.00
5.00	0.00
8.00	1.00

Lowest Elevation	487.00 ft
Weir Coefficient	3.00 (ft^0.5)/s

Structure ID: TW
Structure Type: TW Setup, DS Channel

Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft^3/s
Flow Tolerance (Maximum)	10.000 ft^3/s

Subsection: Outlet Input Data
Label: Composite Outlet Structure - 2

Return Event: 2 years
Storm Event: 2 Year Storm

Requested Pond Water Surface Elevations	
Minimum (Headwater)	480.65 ft
Increment (Headwater)	0.50 ft
Maximum (Headwater)	484.15 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Inlet Box	Riser - 2	Forward	Culvert - 2	483.00	484.15
Orifice-Circular	Orifice - 2	Forward	Culvert - 2	482.25	484.15
Culvert-Circular	Culvert - 2	Forward	TW	480.58	484.15
Irregular Weir	Weir - 2	Forward	TW	483.15	484.15
Tailwater Settings	Tailwater			(N/A)	(N/A)

Subsection: Outlet Input Data
Label: Composite Outlet Structure - 2

Return Event: 2 years
Storm Event: 2 Year Storm

Structure ID: Orifice - 2 Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	482.25 ft
Orifice Diameter	3.0 in
Orifice Coefficient	0.600

Structure ID: Riser - 2 Structure Type: Inlet Box	
Number of Openings	1
Elevation	483.00 ft
Orifice Area	4.0 ft²
Orifice Coefficient	0.600
Weir Length	3.75 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1.000
Manning's n	0.000
Kev, Charged Riser	0.000
Weir Submergence	False
Orifice H to crest	False

Subsection: Outlet Input Data
Label: Composite Outlet Structure - 2

Return Event: 2 years
Storm Event: 2 Year Storm

Structure ID: Culvert - 2 Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	12.0 in
Length	304.00 ft
Length (Computed Barrel)	304.00 ft
Slope (Computed)	0.003 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	0.200
Kb	0.031
Kr	0.000
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 1
K	0.0045
M	2.0000
C	0.0317
Y	0.6900
T1 ratio (HW/D)	0.000
T2 ratio (HW/D)	1.196
Slope Correction Factor	-0.500

Use unsubmerged inlet control 0 equation below T1 elevation.
Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...

T1 Elevation	480.58 ft	T1 Flow	2.75 ft^3/s
T2 Elevation	481.78 ft	T2 Flow	3.14 ft^3/s

Subsection: Outlet Input Data
Label: Composite Outlet Structure - 2

Return Event: 2 years
Storm Event: 2 Year Storm

Structure ID: Weir - 2
Structure Type: Irregular Weir

Station (ft)	Elevation (ft)
0.00	1.00
3.00	0.00
5.00	0.00
8.00	1.00

Lowest Elevation	483.15 ft
Weir Coefficient	3.00 (ft^0.5)/s

Structure ID: TW
Structure Type: TW Setup, DS Channel

Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft^3/s
Flow Tolerance (Maximum)	10.000 ft^3/s

Subsection: Level Pool Pond Routing Summary
Label: North Detention Pond (IN)

Return Event: 2 years
Storm Event: 2 Year Storm

Infiltration	
Infiltration Method (Computed)	Average Infiltration Rate
Infiltration Rate (Average)	12.0000 in/h

Initial Conditions	
Elevation (Water Surface, Initial)	483.00 ft
Volume (Initial)	0.000 ft³
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	0.24 ft³/s	Time to Peak (Flow, In)	12.050 hours
Infiltration (Peak)	0.08 ft³/s	Time to Peak (Infiltration)	12.450 hours
Flow (Peak Outlet)	0.00 ft³/s	Time to Peak (Flow, Outlet)	0.000 hours

Elevation (Water Surface, Peak)	483.13 ft
Volume (Peak)	112.903 ft³

Mass Balance (ft³)	
Volume (Initial)	0.000 ft³
Volume (Total Inflow)	1,331.000 ft³
Volume (Total Infiltration)	1,307.000 ft³
Volume (Total Outlet Outflow)	0.000 ft³
Volume (Retained)	22.000 ft³
Volume (Unrouted)	-2.000 ft³
Error (Mass Balance)	0.2 %

Subsection: Level Pool Pond Routing Summary
Label: North Detention Pond (IN)

Return Event: 10 years
Storm Event: 10 Year Storm

Infiltration	
Infiltration Method (Computed)	Average Infiltration Rate
Infiltration Rate (Average)	12.0000 in/h

Initial Conditions	
Elevation (Water Surface, Initial)	483.00 ft
Volume (Initial)	0.000 ft³
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	1.60 ft³/s	Time to Peak (Flow, In)	12.000 hours
Infiltration (Peak)	0.35 ft³/s	Time to Peak (Infiltration)	12.250 hours
Flow (Peak Outlet)	0.00 ft³/s	Time to Peak (Flow, Outlet)	0.000 hours

Elevation (Water Surface, Peak)	483.88 ft
Volume (Peak)	937.813 ft³

Mass Balance (ft³)	
Volume (Initial)	0.000 ft³
Volume (Total Inflow)	4,518.000 ft³
Volume (Total Infiltration)	4,461.000 ft³
Volume (Total Outlet Outflow)	0.000 ft³
Volume (Retained)	52.000 ft³
Volume (Unrouted)	-5.000 ft³
Error (Mass Balance)	0.1 %

Subsection: Level Pool Pond Routing Summary
Label: North Detention Pond (IN)

Return Event: 50 years
Storm Event: 50 Year Storm

Infiltration	
Infiltration Method (Computed)	Average Infiltration Rate
Infiltration Rate (Average)	12.0000 in/h

Initial Conditions	
Elevation (Water Surface, Initial)	483.00 ft
Volume (Initial)	0.000 ft³
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	4.48 ft³/s	Time to Peak (Flow, In)	11.950 hours
Infiltration (Peak)	0.58 ft³/s	Time to Peak (Infiltration)	12.350 hours
Flow (Peak Outlet)	0.12 ft³/s	Time to Peak (Flow, Outlet)	12.350 hours

Elevation (Water Surface, Peak)	485.54 ft
Volume (Peak)	3,686.082 ft³

Mass Balance (ft³)	
Volume (Initial)	0.000 ft³
Volume (Total Inflow)	11,254.000 ft³
Volume (Total Infiltration)	10,753.000 ft³
Volume (Total Outlet Outflow)	388.000 ft³
Volume (Retained)	104.000 ft³
Volume (Unrouted)	-9.000 ft³
Error (Mass Balance)	0.1 %

Subsection: Level Pool Pond Routing Summary
Label: North Detention Pond (IN)

Return Event: 100 years
Storm Event: 100 Year Storm

Infiltration	
Infiltration Method (Computed)	Average Infiltration Rate
Infiltration Rate (Average)	12.0000 in/h

Initial Conditions	
Elevation (Water Surface, Initial)	483.00 ft
Volume (Initial)	0.000 ft³
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	6.43 ft³/s	Time to Peak (Flow, In)	11.950 hours
Infiltration (Peak)	0.71 ft³/s	Time to Peak (Infiltration)	12.350 hours
Flow (Peak Outlet)	0.25 ft³/s	Time to Peak (Flow, Outlet)	12.350 hours

Elevation (Water Surface, Peak)	486.37 ft
Volume (Peak)	5,594.768 ft³

Mass Balance (ft³)	
Volume (Initial)	0.000 ft³
Volume (Total Inflow)	15,742.000 ft³
Volume (Total Infiltration)	14,048.000 ft³
Volume (Total Outlet Outflow)	1,548.000 ft³
Volume (Retained)	135.000 ft³
Volume (Unrouted)	-11.000 ft³
Error (Mass Balance)	0.1 %

Subsection: Pond Infiltration Hydrograph
Label: North Detention Pond (INF)

Return Event: 2 years
Storm Event: 2 Year Storm

Peak Discharge	0.08 ft³/s
Time to Peak	12.450 hours
Hydrograph Volume	1,303.812 ft³

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
11.900	0.00	0.00	0.02	0.04	0.06
12.150	0.06	0.07	0.07	0.07	0.07
12.400	0.08	0.08	0.08	0.07	0.07
12.650	0.07	0.07	0.07	0.07	0.07
12.900	0.07	0.07	0.06	0.06	0.06
13.150	0.06	0.06	0.06	0.06	0.06
13.400	0.06	0.05	0.05	0.05	0.05
13.650	0.05	0.05	0.05	0.05	0.05
13.900	0.05	0.05	0.04	0.04	0.04
14.150	0.04	0.04	0.04	0.04	0.04
14.400	0.04	0.04	0.04	0.04	0.04
14.650	0.04	0.04	0.04	0.04	0.04
14.900	0.04	0.04	0.04	0.04	0.04
15.150	0.03	0.03	0.03	0.03	0.03
15.400	0.03	0.03	0.03	0.03	0.03
15.650	0.03	0.03	0.03	0.03	0.03
15.900	0.03	0.03	0.03	0.03	0.03
16.150	0.03	0.03	0.03	0.03	0.03
16.400	0.03	0.03	0.03	0.03	0.03
16.650	0.03	0.03	0.03	0.03	0.03
16.900	0.03	0.03	0.03	0.03	0.03
17.150	0.03	0.03	0.03	0.03	0.03
17.400	0.03	0.03	0.03	0.03	0.03
17.650	0.03	0.03	0.02	0.02	0.02
17.900	0.02	0.02	0.02	0.02	0.02
18.150	0.02	0.02	0.02	0.02	0.02
18.400	0.02	0.02	0.02	0.02	0.02
18.650	0.02	0.02	0.02	0.02	0.02
18.900	0.02	0.02	0.02	0.02	0.02
19.150	0.02	0.02	0.02	0.02	0.02
19.400	0.02	0.02	0.02	0.02	0.02
19.650	0.02	0.02	0.02	0.02	0.02
19.900	0.02	0.02	0.02	0.02	0.02
20.150	0.02	0.02	0.02	0.02	0.02
20.400	0.02	0.02	0.02	0.02	0.02
20.650	0.02	0.02	0.02	0.02	0.02
20.900	0.02	0.02	0.02	0.02	0.02
21.150	0.02	0.02	0.02	0.02	0.02
21.400	0.02	0.02	0.02	0.02	0.02
21.650	0.02	0.02	0.02	0.02	0.02
21.900	0.02	0.02	0.02	0.02	0.02
22.150	0.02	0.02	0.02	0.02	0.02
22.400	0.02	0.02	0.02	0.02	0.02
22.650	0.02	0.02	0.02	0.02	0.02
22.900	0.02	0.02	0.02	0.02	0.02
23.150	0.02	0.02	0.02	0.02	0.02

Subsection: Pond Infiltration Hydrograph
Label: North Detention Pond (INF)

Return Event: 2 years
Storm Event: 2 Year Storm

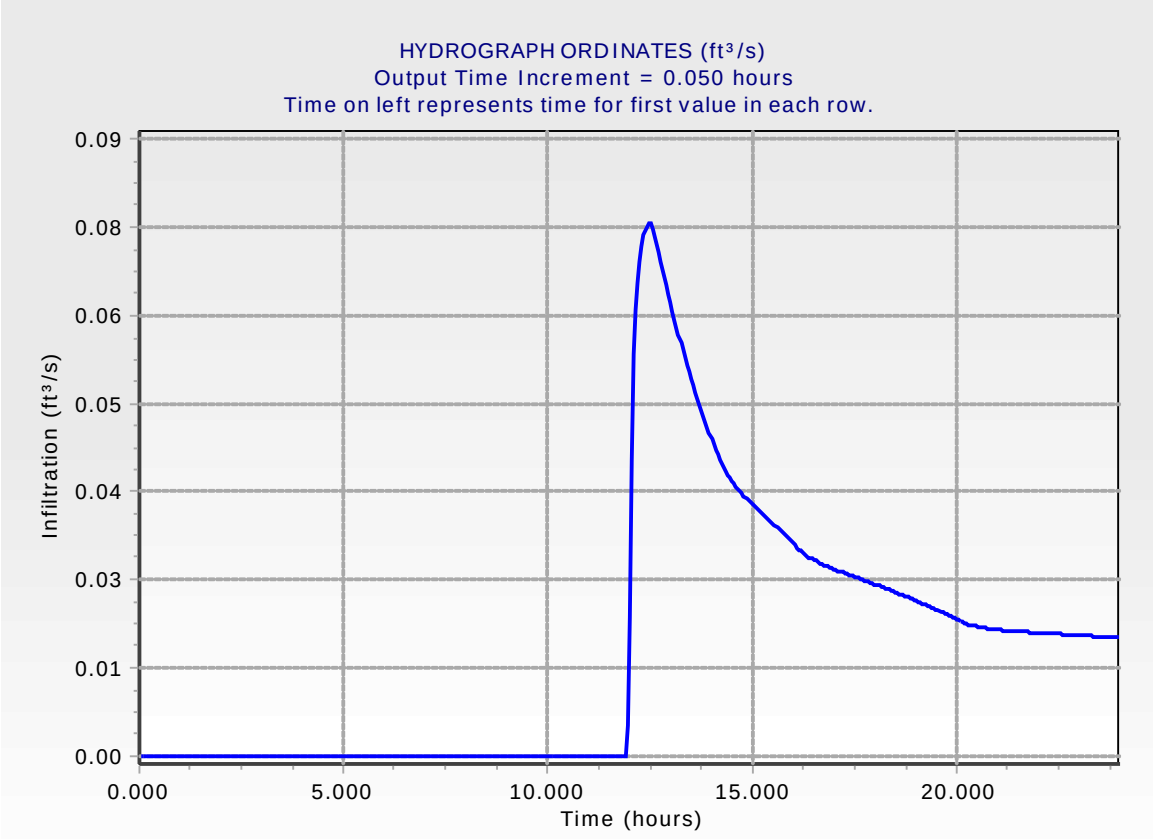
HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
23.400	0.02	0.02	0.02	0.02	0.02
23.650	0.02	0.02	0.02	0.02	0.02
23.900	0.02	0.02	0.02	(N/A)	(N/A)

NPT Transition Station #6

Subsection: Pond Infiltration Hydrograph
Label: North Detention Pond (INF)

Return Event: 2 years
Storm Event: 2 Year Storm



Subsection: Pond Infiltration Hydrograph
Label: North Detention Pond (INF)

Return Event: 10 years
Storm Event: 10 Year Storm

Peak Discharge	0.35 ft³/s
Time to Peak	12.250 hours
Hydrograph Volume	4,454.097 ft³

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
11.750	0.00	0.00	0.03	0.11	0.23
12.000	0.31	0.33	0.34	0.35	0.35
12.250	0.35	0.35	0.35	0.35	0.35
12.500	0.34	0.34	0.34	0.34	0.33
12.750	0.33	0.33	0.33	0.32	0.32
13.000	0.32	0.32	0.31	0.31	0.31
13.250	0.30	0.30	0.28	0.27	0.25
13.500	0.24	0.23	0.22	0.21	0.20
13.750	0.19	0.18	0.18	0.17	0.16
14.000	0.16	0.15	0.15	0.14	0.14
14.250	0.13	0.13	0.13	0.12	0.12
14.500	0.12	0.12	0.11	0.11	0.11
14.750	0.11	0.11	0.11	0.10	0.10
15.000	0.10	0.10	0.10	0.10	0.10
15.250	0.10	0.09	0.09	0.09	0.09
15.500	0.09	0.09	0.09	0.09	0.09
15.750	0.09	0.08	0.08	0.08	0.08
16.000	0.08	0.08	0.08	0.08	0.08
16.250	0.08	0.08	0.07	0.07	0.07
16.500	0.07	0.07	0.07	0.07	0.07
16.750	0.07	0.07	0.07	0.07	0.07
17.000	0.07	0.07	0.07	0.07	0.07
17.250	0.07	0.07	0.07	0.07	0.07
17.500	0.06	0.06	0.06	0.06	0.06
17.750	0.06	0.06	0.06	0.06	0.06
18.000	0.06	0.06	0.06	0.06	0.06
18.250	0.06	0.06	0.06	0.06	0.06
18.500	0.06	0.06	0.06	0.06	0.06
18.750	0.06	0.06	0.06	0.06	0.06
19.000	0.05	0.05	0.05	0.05	0.05
19.250	0.05	0.05	0.05	0.05	0.05
19.500	0.05	0.05	0.05	0.05	0.05
19.750	0.05	0.05	0.05	0.05	0.05
20.000	0.05	0.05	0.05	0.05	0.05
20.250	0.05	0.05	0.05	0.05	0.04
20.500	0.04	0.04	0.04	0.04	0.04
20.750	0.04	0.04	0.04	0.04	0.04
21.000	0.04	0.04	0.04	0.04	0.04
21.250	0.04	0.04	0.04	0.04	0.04
21.500	0.04	0.04	0.04	0.04	0.04
21.750	0.04	0.04	0.04	0.04	0.04
22.000	0.04	0.04	0.04	0.04	0.04
22.250	0.04	0.04	0.04	0.04	0.04
22.500	0.04	0.04	0.04	0.04	0.04
22.750	0.04	0.04	0.04	0.04	0.04
23.000	0.04	0.04	0.04	0.04	0.04

Subsection: Pond Infiltration Hydrograph
Label: North Detention Pond (INF)

Return Event: 10 years
Storm Event: 10 Year Storm

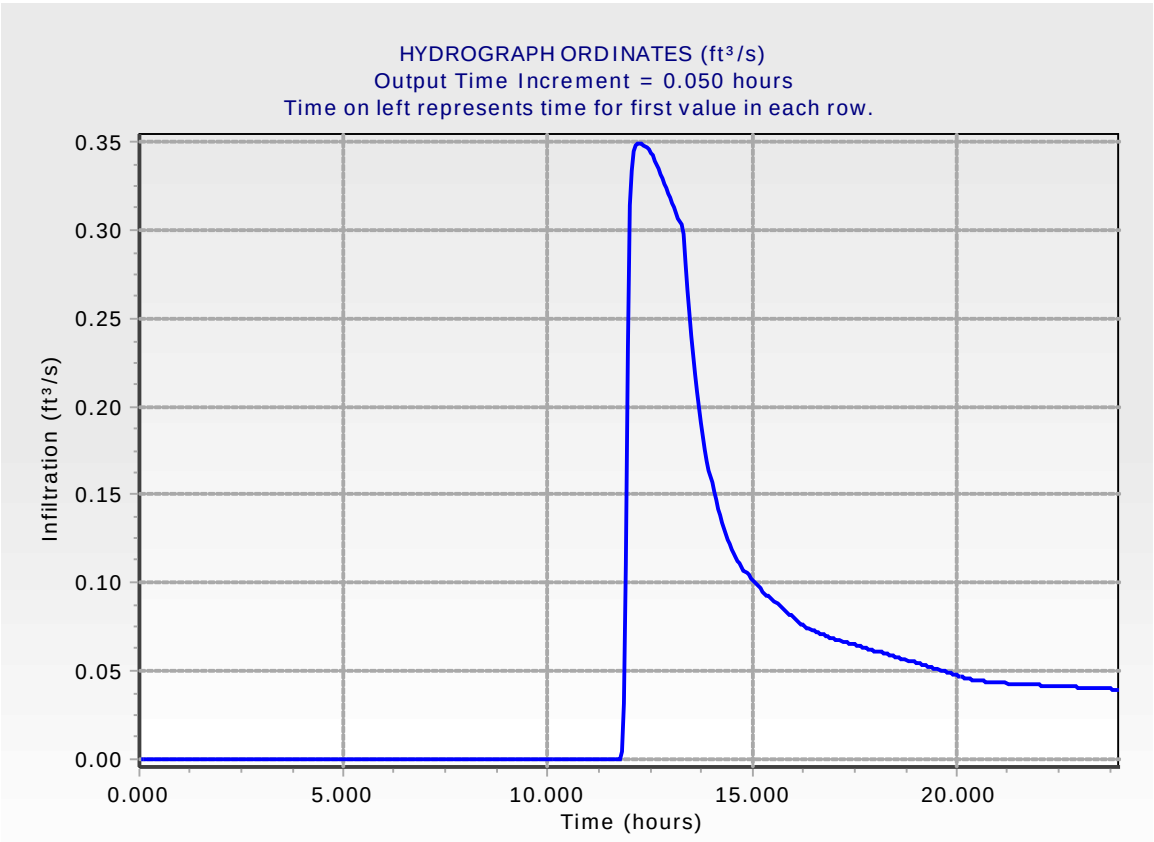
HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
23.250	0.04	0.04	0.04	0.04	0.04
23.500	0.04	0.04	0.04	0.04	0.04
23.750	0.04	0.04	0.04	0.04	0.04
24.000	0.04	(N/A)	(N/A)	(N/A)	(N/A)

NPT Transition Station #6

Subsection: Pond Infiltration Hydrograph
Label: North Detention Pond (INF)

Return Event: 10 years
Storm Event: 10 Year Storm



Subsection: Pond Infiltration Hydrograph
Label: North Detention Pond (INF)

Return Event: 50 years
Storm Event: 50 Year Storm

Peak Discharge	0.58 ft³/s
Time to Peak	12.350 hours
Hydrograph Volume	10,739.677 ft³

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
11.400	0.00	0.00	0.00	0.01	0.02
11.650	0.04	0.07	0.13	0.24	0.32
11.900	0.37	0.44	0.50	0.54	0.56
12.150	0.57	0.58	0.58	0.58	0.58
12.400	0.58	0.58	0.58	0.57	0.57
12.650	0.57	0.57	0.56	0.56	0.56
12.900	0.55	0.55	0.55	0.54	0.54
13.150	0.54	0.53	0.53	0.53	0.52
13.400	0.52	0.52	0.52	0.51	0.51
13.650	0.51	0.50	0.50	0.50	0.49
13.900	0.49	0.48	0.48	0.48	0.47
14.150	0.47	0.46	0.46	0.46	0.45
14.400	0.45	0.45	0.44	0.44	0.44
14.650	0.43	0.43	0.42	0.42	0.42
14.900	0.41	0.41	0.41	0.40	0.40
15.150	0.40	0.39	0.39	0.38	0.38
15.400	0.38	0.37	0.37	0.37	0.36
15.650	0.36	0.36	0.35	0.35	0.35
15.900	0.34	0.34	0.34	0.33	0.33
16.150	0.33	0.32	0.32	0.32	0.31
16.400	0.31	0.31	0.30	0.29	0.28
16.650	0.26	0.25	0.24	0.23	0.22
16.900	0.21	0.20	0.19	0.19	0.18
17.150	0.18	0.17	0.17	0.16	0.16
17.400	0.16	0.15	0.15	0.15	0.15
17.650	0.14	0.14	0.14	0.14	0.14
17.900	0.13	0.13	0.13	0.13	0.13
18.150	0.13	0.13	0.13	0.12	0.12
18.400	0.12	0.12	0.12	0.12	0.12
18.650	0.12	0.12	0.12	0.11	0.11
18.900	0.11	0.11	0.11	0.11	0.11
19.150	0.11	0.11	0.11	0.11	0.11
19.400	0.10	0.10	0.10	0.10	0.10
19.650	0.10	0.10	0.10	0.10	0.10
19.900	0.10	0.10	0.10	0.09	0.09
20.150	0.09	0.09	0.09	0.09	0.09
20.400	0.09	0.09	0.09	0.09	0.09
20.650	0.09	0.09	0.09	0.09	0.09
20.900	0.09	0.09	0.09	0.09	0.09
21.150	0.09	0.09	0.09	0.09	0.09
21.400	0.09	0.09	0.08	0.08	0.08
21.650	0.08	0.08	0.08	0.08	0.08
21.900	0.08	0.08	0.08	0.08	0.08
22.150	0.08	0.08	0.08	0.08	0.08
22.400	0.08	0.08	0.08	0.08	0.08
22.650	0.08	0.08	0.08	0.08	0.08

Subsection: Pond Infiltration Hydrograph
Label: North Detention Pond (INF)

Return Event: 50 years
Storm Event: 50 Year Storm

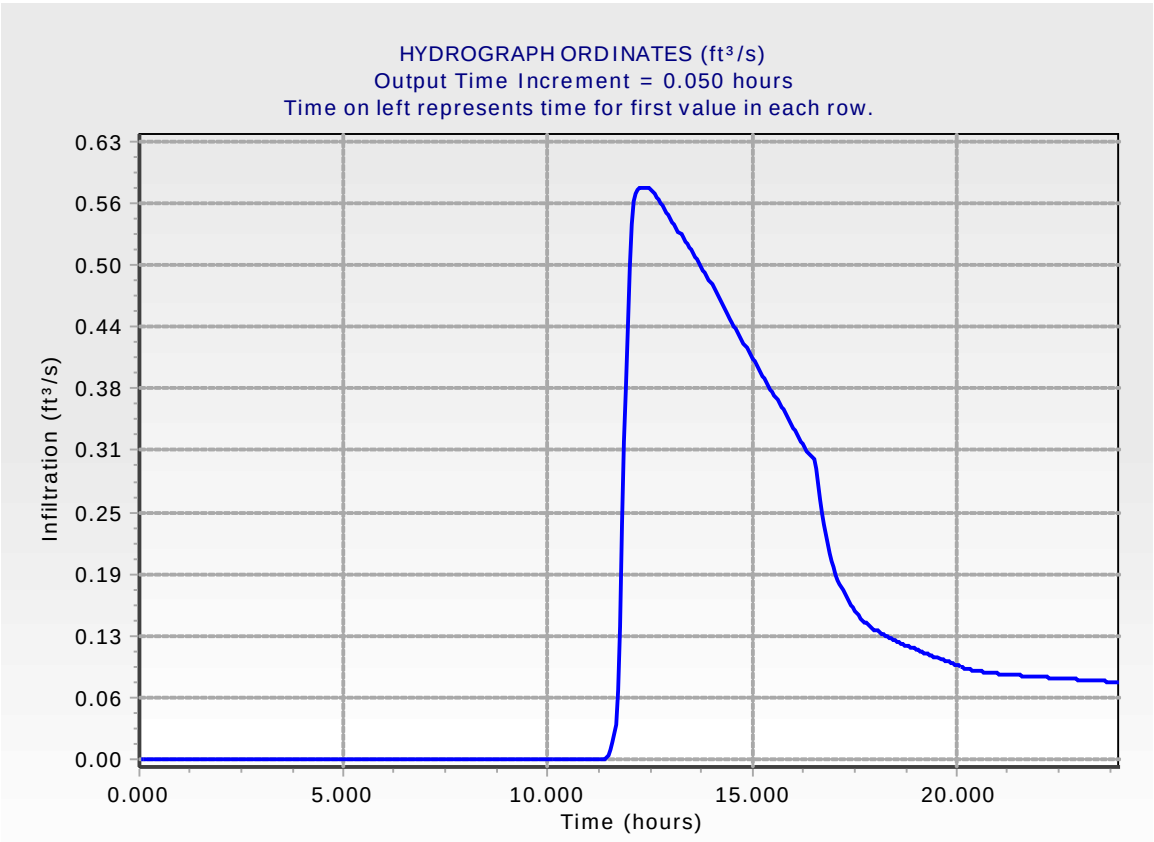
HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
22.900	0.08	0.08	0.08	0.08	0.08
23.150	0.08	0.08	0.08	0.08	0.08
23.400	0.08	0.08	0.08	0.08	0.08
23.650	0.08	0.08	0.08	0.08	0.08
23.900	0.08	0.08	0.08	(N/A)	(N/A)

NPT Transition Station #6

Subsection: Pond Infiltration Hydrograph
Label: North Detention Pond (INF)

Return Event: 50 years
Storm Event: 50 Year Storm



Subsection: Pond Infiltration Hydrograph
Label: North Detention Pond (INF)

Return Event: 100 years
Storm Event: 100 Year Storm

Peak Discharge	0.71 ft³/s
Time to Peak	12.350 hours
Hydrograph Volume	14,030.537 ft³

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
10.950	0.00	0.00	0.00	0.01	0.01
11.200	0.01	0.02	0.02	0.03	0.03
11.450	0.04	0.05	0.07	0.09	0.13
11.700	0.20	0.30	0.33	0.38	0.46
11.950	0.54	0.61	0.67	0.69	0.70
12.200	0.71	0.71	0.71	0.71	0.71
12.450	0.71	0.71	0.70	0.70	0.70
12.700	0.69	0.69	0.68	0.68	0.68
12.950	0.67	0.67	0.66	0.66	0.65
13.200	0.65	0.64	0.64	0.63	0.63
13.450	0.62	0.62	0.61	0.61	0.60
13.700	0.59	0.59	0.59	0.58	0.58
13.950	0.57	0.57	0.56	0.56	0.55
14.200	0.55	0.54	0.54	0.53	0.53
14.450	0.53	0.52	0.52	0.52	0.51
14.700	0.51	0.51	0.50	0.50	0.50
14.950	0.49	0.49	0.49	0.48	0.48
15.200	0.47	0.47	0.47	0.46	0.46
15.450	0.46	0.45	0.45	0.45	0.44
15.700	0.44	0.44	0.43	0.43	0.42
15.950	0.42	0.42	0.41	0.41	0.41
16.200	0.40	0.40	0.40	0.39	0.39
16.450	0.39	0.38	0.38	0.38	0.37
16.700	0.37	0.37	0.36	0.36	0.36
16.950	0.35	0.35	0.35	0.34	0.34
17.200	0.34	0.33	0.33	0.33	0.32
17.450	0.32	0.32	0.32	0.31	0.31
17.700	0.31	0.30	0.30	0.29	0.28
17.950	0.26	0.25	0.24	0.23	0.22
18.200	0.22	0.21	0.20	0.20	0.19
18.450	0.19	0.18	0.18	0.18	0.17
18.700	0.17	0.17	0.16	0.16	0.16
18.950	0.16	0.15	0.15	0.15	0.15
19.200	0.15	0.14	0.14	0.14	0.14
19.450	0.14	0.14	0.14	0.13	0.13
19.700	0.13	0.13	0.13	0.13	0.13
19.950	0.13	0.12	0.12	0.12	0.12
20.200	0.12	0.12	0.12	0.12	0.12
20.450	0.12	0.12	0.12	0.12	0.11
20.700	0.11	0.11	0.11	0.11	0.11
20.950	0.11	0.11	0.11	0.11	0.11
21.200	0.11	0.11	0.11	0.11	0.11
21.450	0.11	0.11	0.11	0.11	0.11
21.700	0.11	0.11	0.11	0.11	0.11
21.950	0.11	0.11	0.11	0.11	0.11
22.200	0.11	0.11	0.11	0.11	0.11

Subsection: Pond Infiltration Hydrograph
Label: North Detention Pond (INF)

Return Event: 100 years
Storm Event: 100 Year Storm

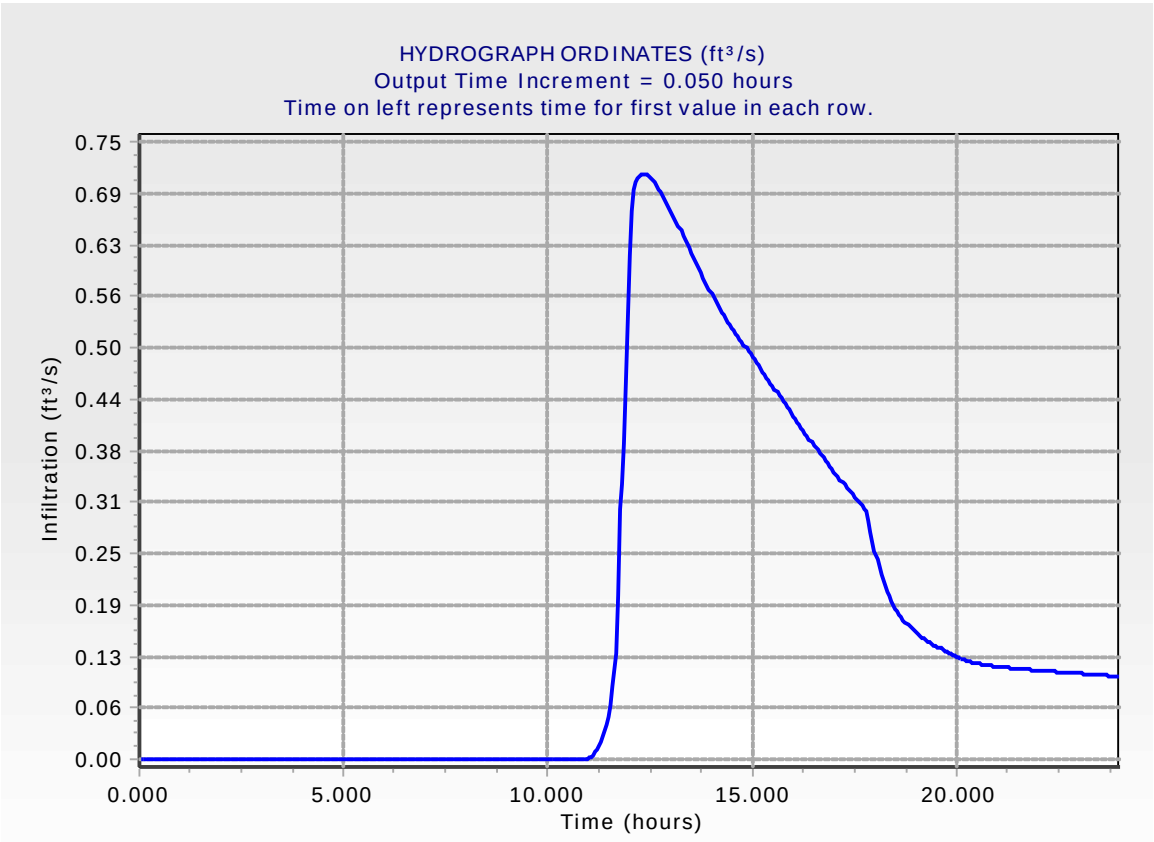
HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
22.450	0.11	0.11	0.11	0.11	0.11
22.700	0.11	0.11	0.10	0.10	0.10
22.950	0.10	0.10	0.10	0.10	0.10
23.200	0.10	0.10	0.10	0.10	0.10
23.450	0.10	0.10	0.10	0.10	0.10
23.700	0.10	0.10	0.10	0.10	0.10
23.950	0.10	0.10	(N/A)	(N/A)	(N/A)

NPT Transition Station #6

Subsection: Pond Infiltration Hydrograph
Label: North Detention Pond (INF)

Return Event: 100 years
Storm Event: 100 Year Storm



Subsection: Pond Routed Hydrograph (total out) Return Event: 2 years
Label: North Detention Pond (OUT) Storm Event: 2 Year Storm

Peak Discharge	0.00 ft³/s
Time to Peak	8.000 hours
Hydrograph Volume	0.000 ft³

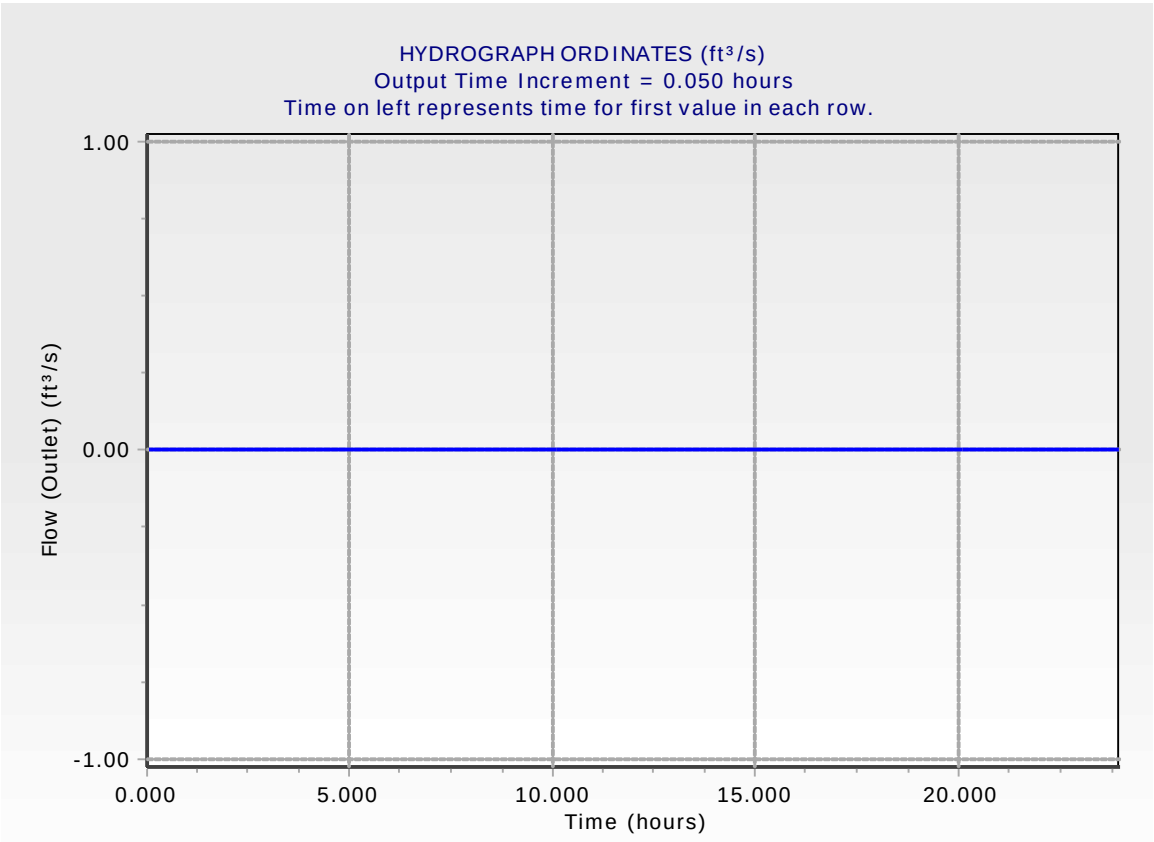
HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	0.00	(N/A)	(N/A)	(N/A)

NPT Transition Station #6

Subsection: Pond Routed Hydrograph (total out) | Return Event: 2 years

Label: North Detention Pond (OUT) | Storm Event: 2 Year Storm



Subsection: Pond Routed Hydrograph (total out) Return Event: 10 years
Label: North Detention Pond (OUT) Storm Event: 10 Year Storm

Peak Discharge	0.00 ft³/s
Time to Peak	8.000 hours
Hydrograph Volume	0.000 ft³

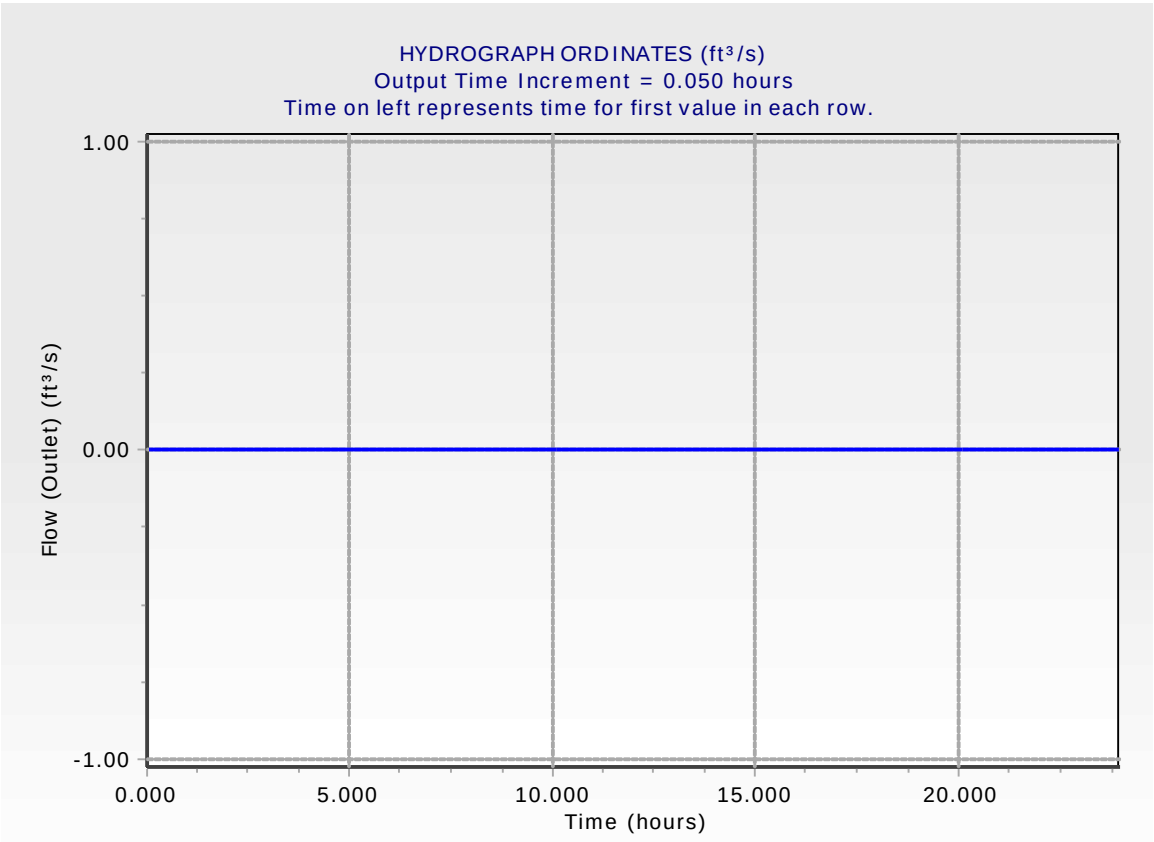
HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	0.00	(N/A)	(N/A)	(N/A)

NPT Transition Station #6

Subsection: Pond Routed Hydrograph (total out) | Return Event: 10 years

Label: North Detention Pond (OUT) | Storm Event: 10 Year Storm



Subsection: Pond Routed Hydrograph (total out) Return Event: 50 years
Label: North Detention Pond (OUT) Storm Event: 50 Year Storm

Peak Discharge	0.12 ft³/s
Time to Peak	12.350 hours
Hydrograph Volume	388.338 ft³

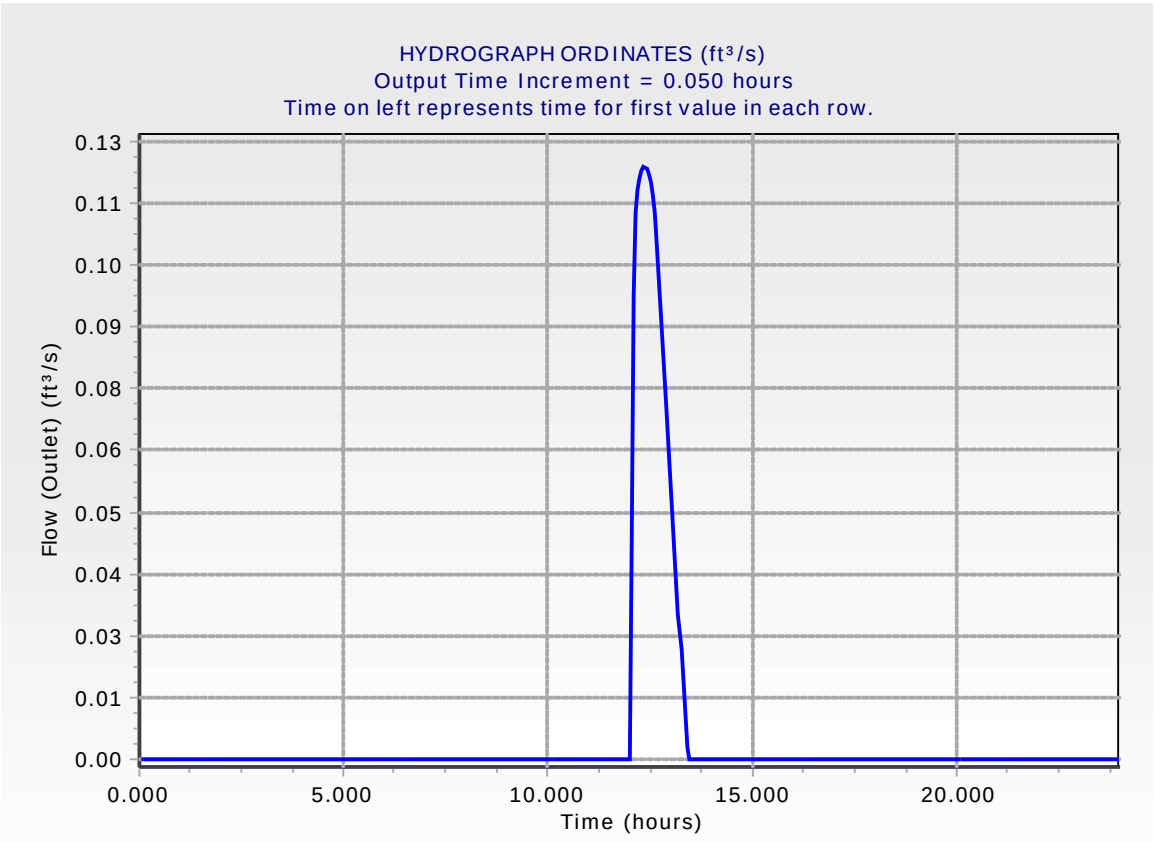
HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
12.000	0.00	0.05	0.09	0.11	0.12
12.250	0.12	0.12	0.12	0.12	0.12
12.500	0.12	0.11	0.11	0.10	0.10
12.750	0.09	0.08	0.08	0.07	0.06
13.000	0.06	0.05	0.04	0.04	0.03
13.250	0.02	0.02	0.01	0.00	0.00

NPT Transition Station #6

Subsection: Pond Routed Hydrograph (total out) | Return Event: 50 years

Label: North Detention Pond (OUT) | Storm Event: 50 Year Storm



Subsection: Pond Routed Hydrograph (total out) Return Event: 100 years
Label: North Detention Pond (OUT) Storm Event: 100 Year Storm

Peak Discharge	0.25 ft³/s
Time to Peak	12.350 hours
Hydrograph Volume	1,547.793 ft³

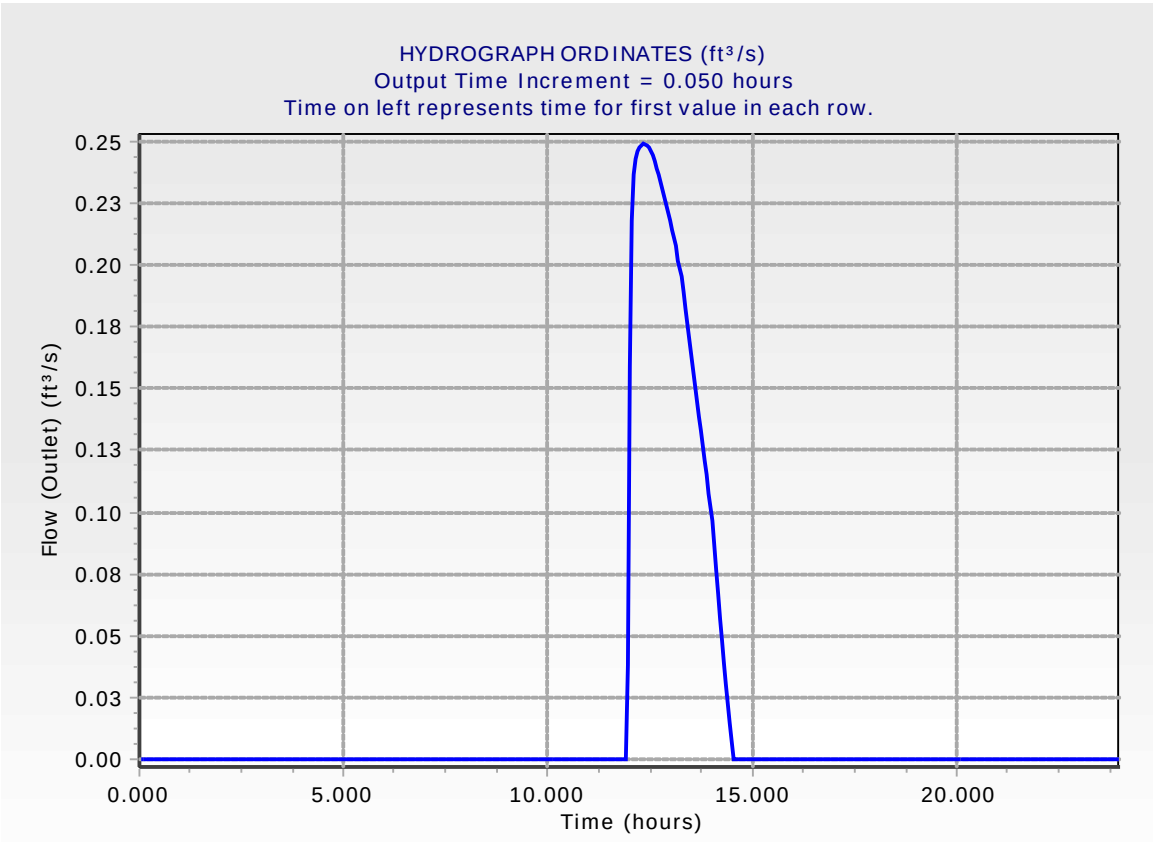
HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
11.900	0.00	0.04	0.16	0.22	0.24
12.150	0.24	0.25	0.25	0.25	0.25
12.400	0.25	0.25	0.25	0.24	0.24
12.650	0.24	0.24	0.23	0.23	0.23
12.900	0.22	0.22	0.22	0.21	0.21
13.150	0.21	0.20	0.20	0.19	0.18
13.400	0.18	0.17	0.16	0.16	0.15
13.650	0.15	0.14	0.13	0.13	0.12
13.900	0.12	0.11	0.10	0.09	0.08
14.150	0.07	0.06	0.05	0.04	0.03
14.400	0.02	0.01	0.01	0.00	(N/A)

NPT Transition Station #6

Subsection: Pond Routed Hydrograph (total out) | Return Event: 100 years

Label: North Detention Pond (OUT) | Storm Event: 100 Year Storm



Subsection: Level Pool Pond Routing Summary
Label: South Detention Pond (IN)

Return Event: 2 years
Storm Event: 2 Year Storm

Infiltration	
Infiltration Method (Computed)	Average Infiltration Rate
Infiltration Rate (Average)	1.2000 in/h

Initial Conditions	
Elevation (Water Surface, Initial)	480.65 ft
Volume (Initial)	0.000 ft³
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	0.00 ft³/s	Time to Peak (Flow, In)	0.000 hours
Infiltration (Peak)	0.00 ft³/s	Time to Peak (Infiltration)	0.000 hours
Flow (Peak Outlet)	0.00 ft³/s	Time to Peak (Flow, Outlet)	0.000 hours

Elevation (Water Surface, Peak)	480.65 ft
Volume (Peak)	0.000 ft³

Mass Balance (ft³)	
Volume (Initial)	0.000 ft³
Volume (Total Inflow)	0.000 ft³
Volume (Total Infiltration)	0.000 ft³
Volume (Total Outlet Outflow)	0.000 ft³
Volume (Retained)	0.000 ft³
Volume (Unrouted)	0.000 ft³
Error (Mass Balance)	0.0 %

Subsection: Level Pool Pond Routing Summary
Label: South Detention Pond (IN)

Return Event: 10 years
Storm Event: 10 Year Storm

Infiltration	
Infiltration Method (Computed)	Average Infiltration Rate
Infiltration Rate (Average)	1.2000 in/h

Initial Conditions	
Elevation (Water Surface, Initial)	480.65 ft
Volume (Initial)	0.000 ft³
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	0.00 ft³/s	Time to Peak (Flow, In)	24.000 hours
Infiltration (Peak)	0.00 ft³/s	Time to Peak (Infiltration)	24.000 hours
Flow (Peak Outlet)	0.00 ft³/s	Time to Peak (Flow, Outlet)	0.000 hours

Elevation (Water Surface, Peak)	480.66 ft
Volume (Peak)	5.131 ft³

Mass Balance (ft³)	
Volume (Initial)	0.000 ft³
Volume (Total Inflow)	7.000 ft³
Volume (Total Infiltration)	1.000 ft³
Volume (Total Outlet Outflow)	0.000 ft³
Volume (Retained)	5.000 ft³
Volume (Unrouted)	-1.000 ft³
Error (Mass Balance)	8.6 %

Subsection: Level Pool Pond Routing Summary
Label: South Detention Pond (IN)

Return Event: 50 years
Storm Event: 50 Year Storm

Infiltration	
Infiltration Method (Computed)	Average Infiltration Rate
Infiltration Rate (Average)	1.2000 in/h

Initial Conditions	
Elevation (Water Surface, Initial)	480.65 ft
Volume (Initial)	0.000 ft³
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	0.04 ft³/s	Time to Peak (Flow, In)	12.900 hours
Infiltration (Peak)	0.02 ft³/s	Time to Peak (Infiltration)	24.000 hours
Flow (Peak Outlet)	0.00 ft³/s	Time to Peak (Flow, Outlet)	0.000 hours

Elevation (Water Surface, Peak)	481.95 ft
Volume (Peak)	625.518 ft³

Mass Balance (ft³)	
Volume (Initial)	0.000 ft³
Volume (Total Inflow)	1,264.000 ft³
Volume (Total Infiltration)	633.000 ft³
Volume (Total Outlet Outflow)	0.000 ft³
Volume (Retained)	622.000 ft³
Volume (Unrouted)	-8.000 ft³
Error (Mass Balance)	0.6 %

Subsection: Level Pool Pond Routing Summary
Label: South Detention Pond (IN)

Return Event: 100 years
Storm Event: 100 Year Storm

Infiltration	
Infiltration Method (Computed)	Average Infiltration Rate
Infiltration Rate (Average)	1.2000 in/h

Initial Conditions	
Elevation (Water Surface, Initial)	480.65 ft
Volume (Initial)	0.000 ft³
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	0.39 ft³/s	Time to Peak (Flow, In)	12.050 hours
Infiltration (Peak)	0.02 ft³/s	Time to Peak (Infiltration)	15.450 hours
Flow (Peak Outlet)	0.05 ft³/s	Time to Peak (Flow, Outlet)	15.450 hours

Elevation (Water Surface, Peak)	482.40 ft
Volume (Peak)	940.306 ft³

Mass Balance (ft³)	
Volume (Initial)	0.000 ft³
Volume (Total Inflow)	2,772.000 ft³
Volume (Total Infiltration)	869.000 ft³
Volume (Total Outlet Outflow)	1,033.000 ft³
Volume (Retained)	866.000 ft³
Volume (Unrouted)	-5.000 ft³
Error (Mass Balance)	0.2 %

Subsection: Pond Infiltration Hydrograph
Label: South Detention Pond (INF)

Return Event: 2 years
Storm Event: 2 Year Storm

Peak Discharge	0.00 ft³/s
Time to Peak	8.000 hours
Hydrograph Volume	0.000 ft³

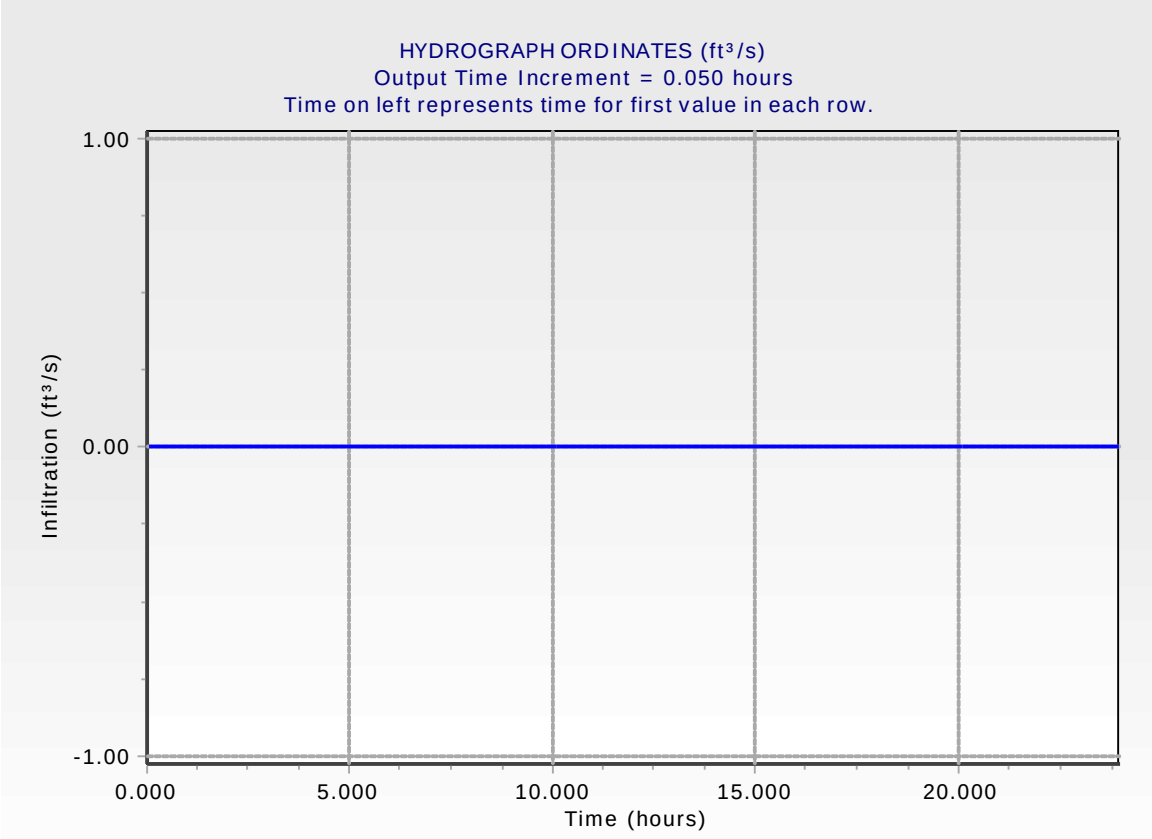
HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	0.00	(N/A)	(N/A)	(N/A)

NPT Transition Station #6

Subsection: Pond Infiltration Hydrograph
Label: South Detention Pond (INF)

Return Event: 2 years
Storm Event: 2 Year Storm



Subsection: Pond Infiltration Hydrograph
Label: South Detention Pond (INF)

Return Event: 10 years
Storm Event: 10 Year Storm

Peak Discharge	0.00 ft³/s
Time to Peak	24.000 hours
Hydrograph Volume	0.000 ft³

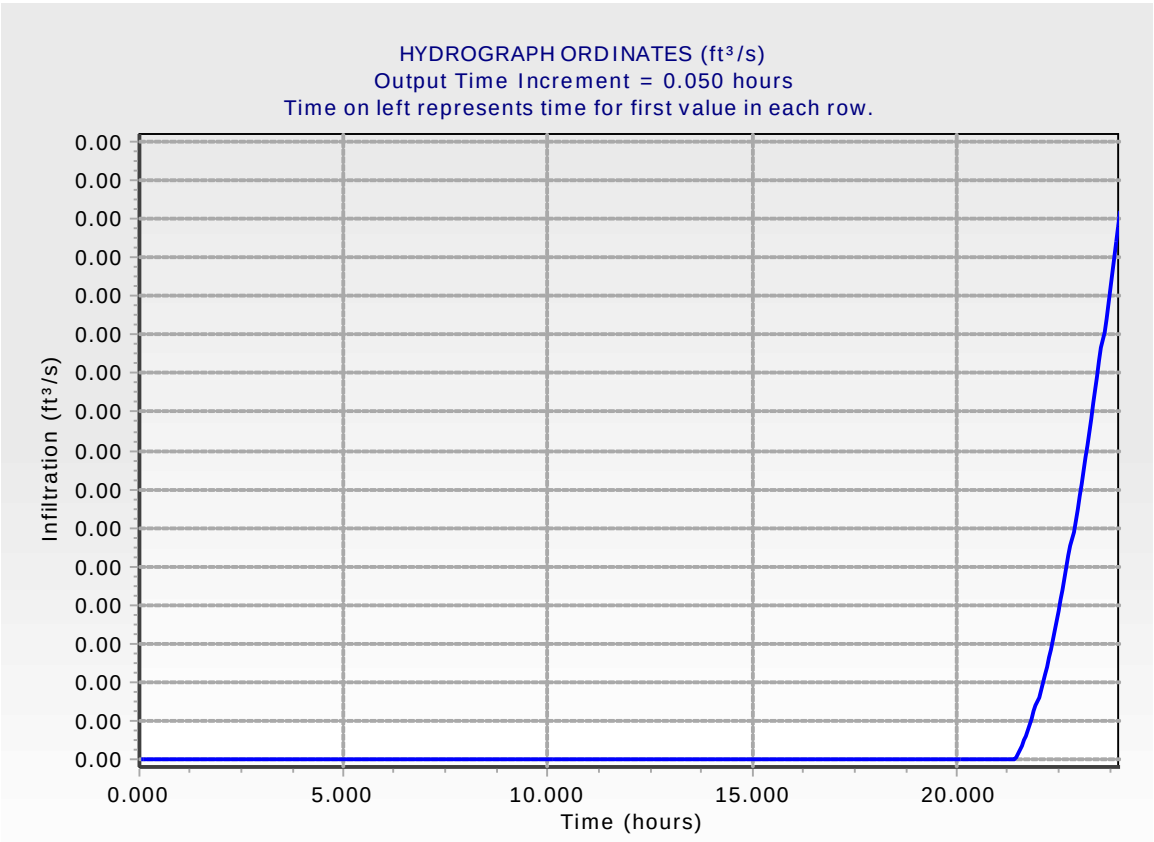
HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	0.00	(N/A)	(N/A)	(N/A)

NPT Transition Station #6

Subsection: Pond Infiltration Hydrograph
Label: South Detention Pond (INF)

Return Event: 10 years
Storm Event: 10 Year Storm



Subsection: Pond Infiltration Hydrograph
Label: South Detention Pond (INF)

Return Event: 50 years
Storm Event: 50 Year Storm

Peak Discharge	0.02 ft³/s
Time to Peak	24.000 hours
Hydrograph Volume	629.825 ft³

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
12.300	0.00	0.00	0.00	0.00	0.00
12.550	0.00	0.00	0.00	0.00	0.00
12.800	0.01	0.01	0.01	0.01	0.01
13.050	0.01	0.01	0.01	0.01	0.01
13.300	0.01	0.01	0.01	0.01	0.01
13.550	0.01	0.01	0.01	0.01	0.01
13.800	0.01	0.01	0.01	0.01	0.01
14.050	0.01	0.01	0.01	0.01	0.01
14.300	0.01	0.01	0.01	0.01	0.01
14.550	0.01	0.01	0.01	0.01	0.01
14.800	0.01	0.01	0.01	0.01	0.01
15.050	0.01	0.01	0.01	0.01	0.01
15.300	0.01	0.01	0.01	0.01	0.01
15.550	0.01	0.01	0.01	0.01	0.01
15.800	0.01	0.01	0.01	0.01	0.01
16.050	0.01	0.01	0.01	0.01	0.02
16.300	0.02	0.02	0.02	0.02	0.02
16.550	0.02	0.02	0.02	0.02	0.02
16.800	0.02	0.02	0.02	0.02	0.02
17.050	0.02	0.02	0.02	0.02	0.02
17.300	0.02	0.02	0.02	0.02	0.02
17.550	0.02	0.02	0.02	0.02	0.02
17.800	0.02	0.02	0.02	0.02	0.02
18.050	0.02	0.02	0.02	0.02	0.02
18.300	0.02	0.02	0.02	0.02	0.02
18.550	0.02	0.02	0.02	0.02	0.02
18.800	0.02	0.02	0.02	0.02	0.02
19.050	0.02	0.02	0.02	0.02	0.02
19.300	0.02	0.02	0.02	0.02	0.02
19.550	0.02	0.02	0.02	0.02	0.02
19.800	0.02	0.02	0.02	0.02	0.02
20.050	0.02	0.02	0.02	0.02	0.02
20.300	0.02	0.02	0.02	0.02	0.02
20.550	0.02	0.02	0.02	0.02	0.02
20.800	0.02	0.02	0.02	0.02	0.02
21.050	0.02	0.02	0.02	0.02	0.02
21.300	0.02	0.02	0.02	0.02	0.02
21.550	0.02	0.02	0.02	0.02	0.02
21.800	0.02	0.02	0.02	0.02	0.02
22.050	0.02	0.02	0.02	0.02	0.02
22.300	0.02	0.02	0.02	0.02	0.02
22.550	0.02	0.02	0.02	0.02	0.02
22.800	0.02	0.02	0.02	0.02	0.02
23.050	0.02	0.02	0.02	0.02	0.02
23.300	0.02	0.02	0.02	0.02	0.02
23.550	0.02	0.02	0.02	0.02	0.02

Subsection: Pond Infiltration Hydrograph
Label: South Detention Pond (INF)

Return Event: 50 years
Storm Event: 50 Year Storm

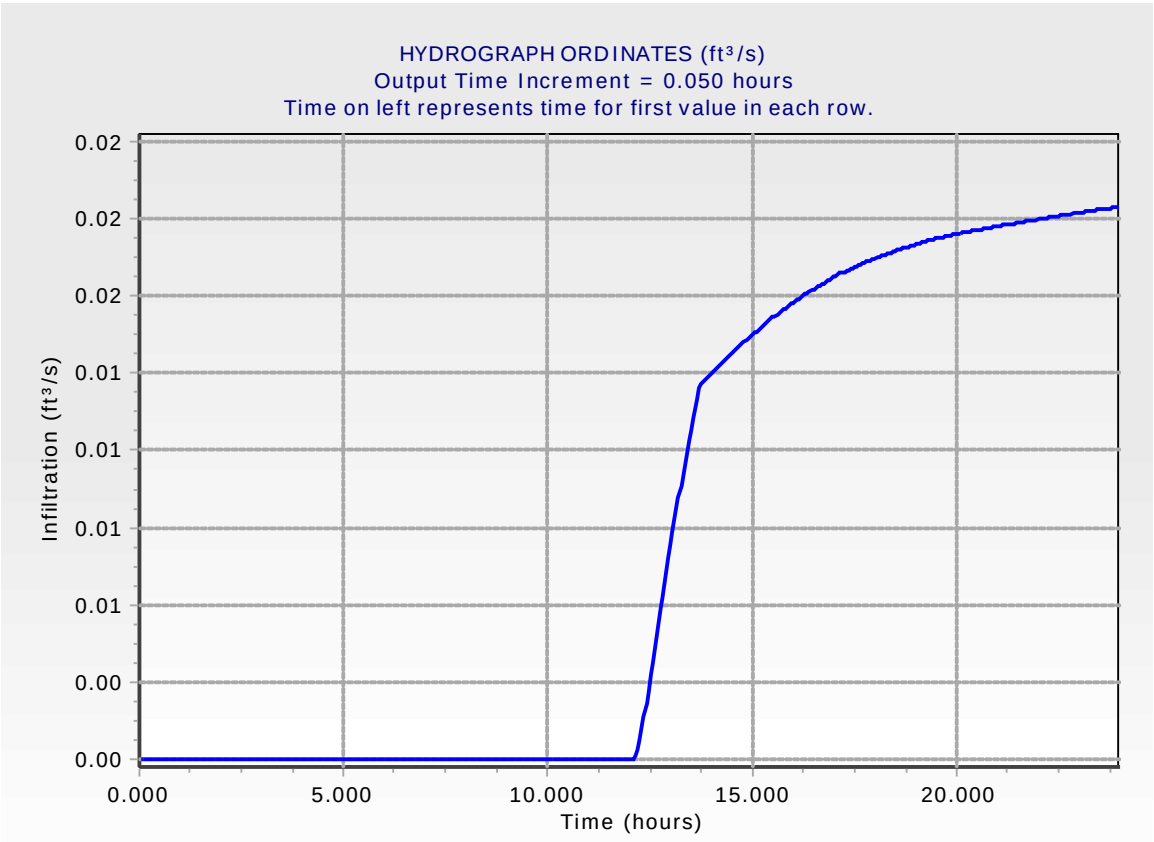
HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
23.800	0.02	0.02	0.02	0.02	0.02

NPT Transition Station #6

Subsection: Pond Infiltration Hydrograph
Label: South Detention Pond (INF)

Return Event: 50 years
Storm Event: 50 Year Storm



Subsection: Pond Infiltration Hydrograph
Label: South Detention Pond (INF)

Return Event: 100 years
Storm Event: 100 Year Storm

Peak Discharge	0.02 ft³/s
Time to Peak	15.450 hours
Hydrograph Volume	865.157 ft³

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
11.950	0.00	0.00	0.01	0.01	0.01
12.200	0.01	0.01	0.01	0.01	0.01
12.450	0.01	0.01	0.02	0.02	0.02
12.700	0.02	0.02	0.02	0.02	0.02
12.950	0.02	0.02	0.02	0.02	0.02
13.200	0.02	0.02	0.02	0.02	0.02
13.450	0.02	0.02	0.02	0.02	0.02
13.700	0.02	0.02	0.02	0.02	0.02
13.950	0.02	0.02	0.02	0.02	0.02
14.200	0.02	0.02	0.02	0.02	0.02
14.450	0.02	0.02	0.02	0.02	0.02
14.700	0.02	0.02	0.02	0.02	0.02
14.950	0.02	0.02	0.02	0.02	0.02
15.200	0.02	0.02	0.02	0.02	0.02
15.450	0.02	0.02	0.02	0.02	0.02
15.700	0.02	0.02	0.02	0.02	0.02
15.950	0.02	0.02	0.02	0.02	0.02
16.200	0.02	0.02	0.02	0.02	0.02
16.450	0.02	0.02	0.02	0.02	0.02
16.700	0.02	0.02	0.02	0.02	0.02
16.950	0.02	0.02	0.02	0.02	0.02
17.200	0.02	0.02	0.02	0.02	0.02
17.450	0.02	0.02	0.02	0.02	0.02
17.700	0.02	0.02	0.02	0.02	0.02
17.950	0.02	0.02	0.02	0.02	0.02
18.200	0.02	0.02	0.02	0.02	0.02
18.450	0.02	0.02	0.02	0.02	0.02
18.700	0.02	0.02	0.02	0.02	0.02
18.950	0.02	0.02	0.02	0.02	0.02
19.200	0.02	0.02	0.02	0.02	0.02
19.450	0.02	0.02	0.02	0.02	0.02
19.700	0.02	0.02	0.02	0.02	0.02
19.950	0.02	0.02	0.02	0.02	0.02
20.200	0.02	0.02	0.02	0.02	0.02
20.450	0.02	0.02	0.02	0.02	0.02
20.700	0.02	0.02	0.02	0.02	0.02
20.950	0.02	0.02	0.02	0.02	0.02
21.200	0.02	0.02	0.02	0.02	0.02
21.450	0.02	0.02	0.02	0.02	0.02
21.700	0.02	0.02	0.02	0.02	0.02
21.950	0.02	0.02	0.02	0.02	0.02
22.200	0.02	0.02	0.02	0.02	0.02
22.450	0.02	0.02	0.02	0.02	0.02
22.700	0.02	0.02	0.02	0.02	0.02
22.950	0.02	0.02	0.02	0.02	0.02
23.200	0.02	0.02	0.02	0.02	0.02

Subsection: Pond Infiltration Hydrograph
Label: South Detention Pond (INF)

Return Event: 100 years
Storm Event: 100 Year Storm

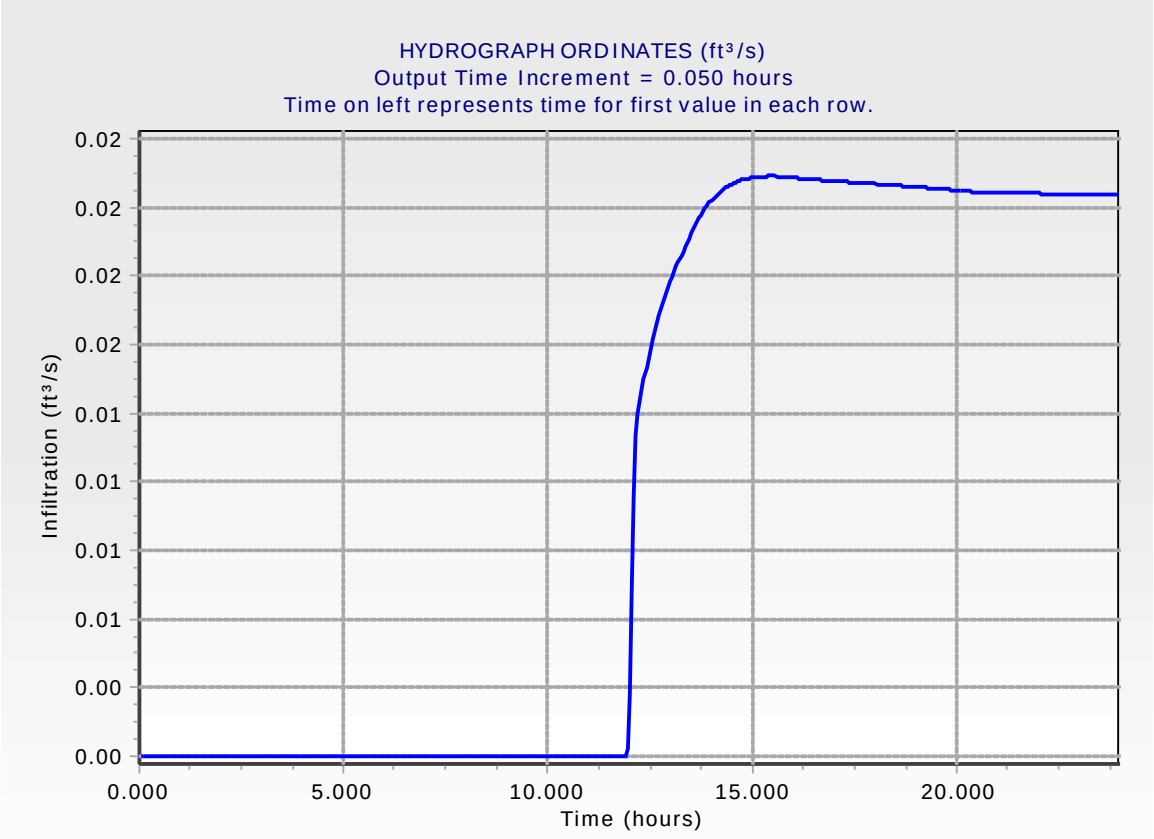
HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
23.450	0.02	0.02	0.02	0.02	0.02
23.700	0.02	0.02	0.02	0.02	0.02
23.950	0.02	0.02	(N/A)	(N/A)	(N/A)

NPT Transition Station #6

Subsection: Pond Infiltration Hydrograph
Label: South Detention Pond (INF)

Return Event: 100 years
Storm Event: 100 Year Storm



Subsection: Pond Routed Hydrograph (total out) Return Event: 2 years
Label: South Detention Pond (OUT) Storm Event: 2 Year Storm

Peak Discharge	0.00 ft³/s
Time to Peak	8.000 hours
Hydrograph Volume	0.000 ft³

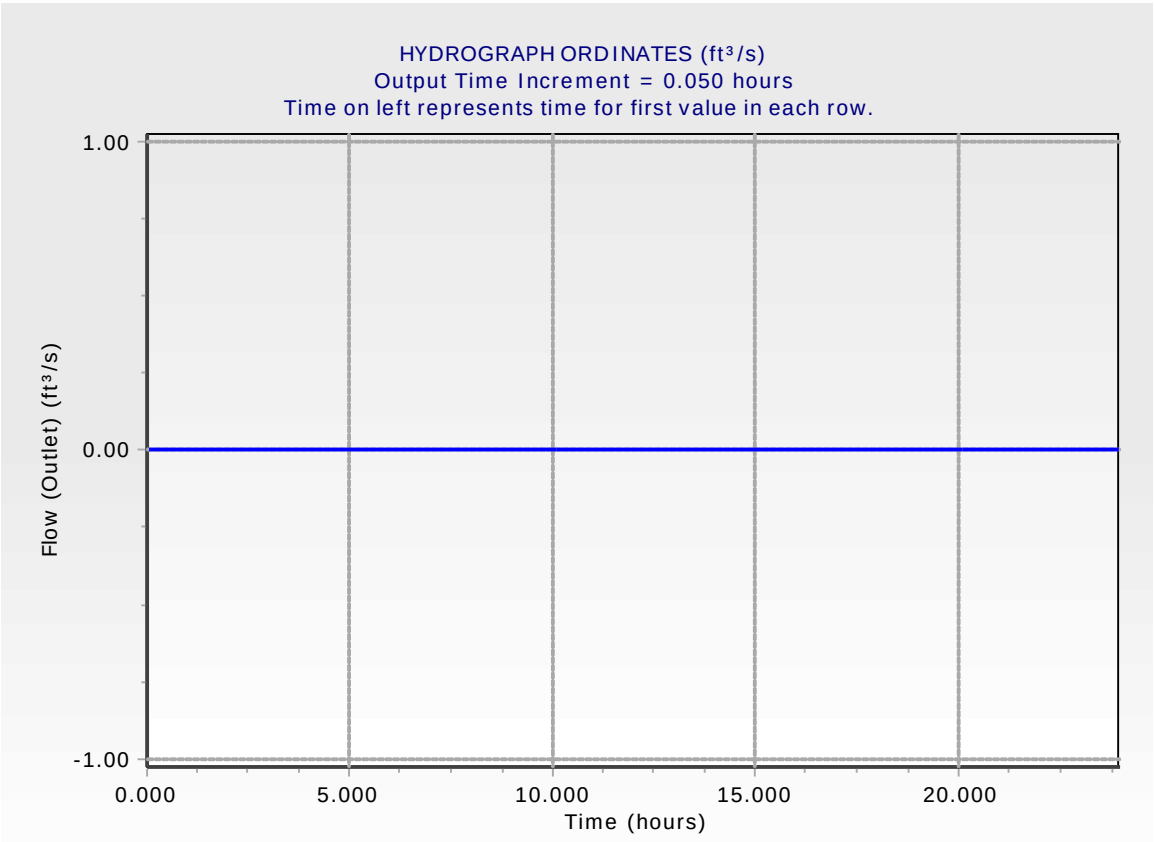
HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	0.00	(N/A)	(N/A)	(N/A)

NPT Transition Station #6

Subsection: Pond Routed Hydrograph (total out) | Return Event: 2 years

Label: South Detention Pond (OUT) | Storm Event: 2 Year Storm



Subsection: Pond Routed Hydrograph (total out) Return Event: 10 years
Label: South Detention Pond (OUT) Storm Event: 10 Year Storm

Peak Discharge	0.00 ft³/s
Time to Peak	8.000 hours
Hydrograph Volume	0.000 ft³

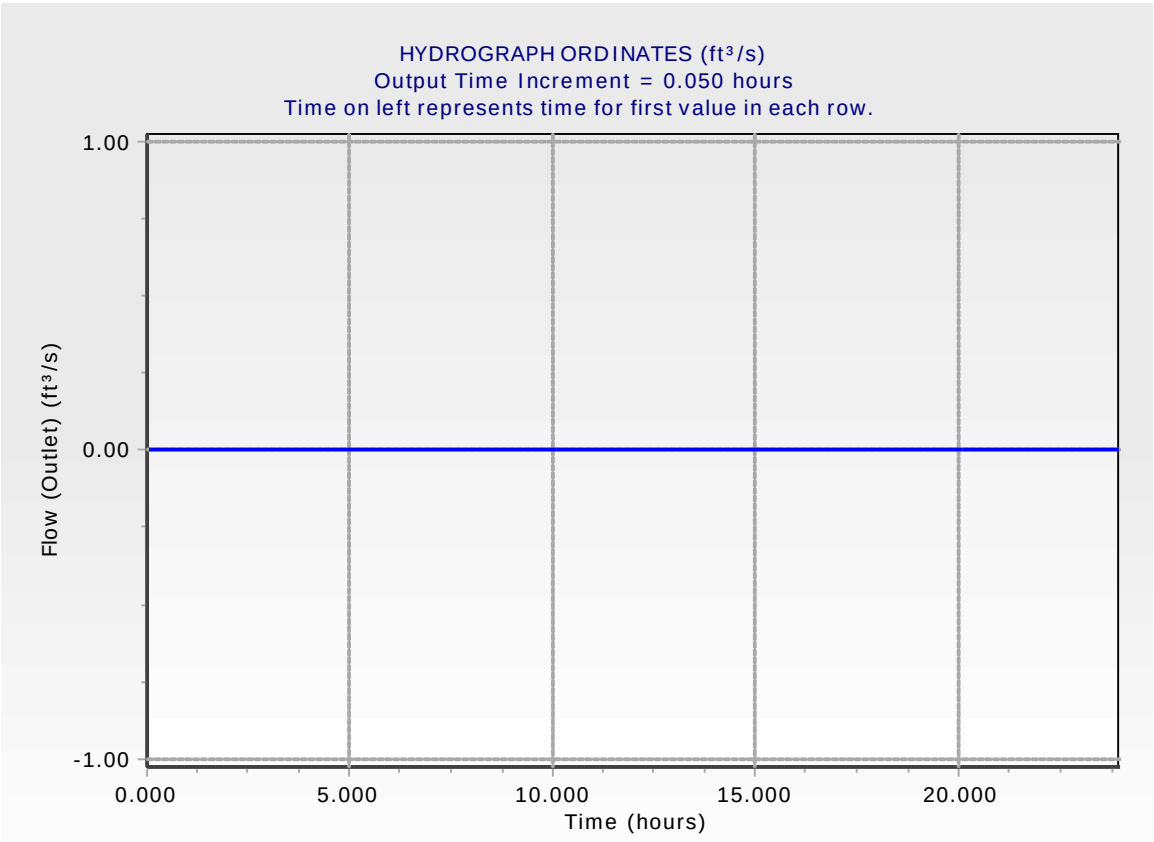
HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	0.00	(N/A)	(N/A)	(N/A)

NPT Transition Station #6

Subsection: Pond Routed Hydrograph (total out) | Return Event: 10 years

Label: South Detention Pond (OUT) | Storm Event: 10 Year Storm



Subsection: Pond Routed Hydrograph (total out) Return Event: 50 years
Label: South Detention Pond (OUT) Storm Event: 50 Year Storm

Peak Discharge	0.00 ft³/s
Time to Peak	8.000 hours
Hydrograph Volume	0.000 ft³

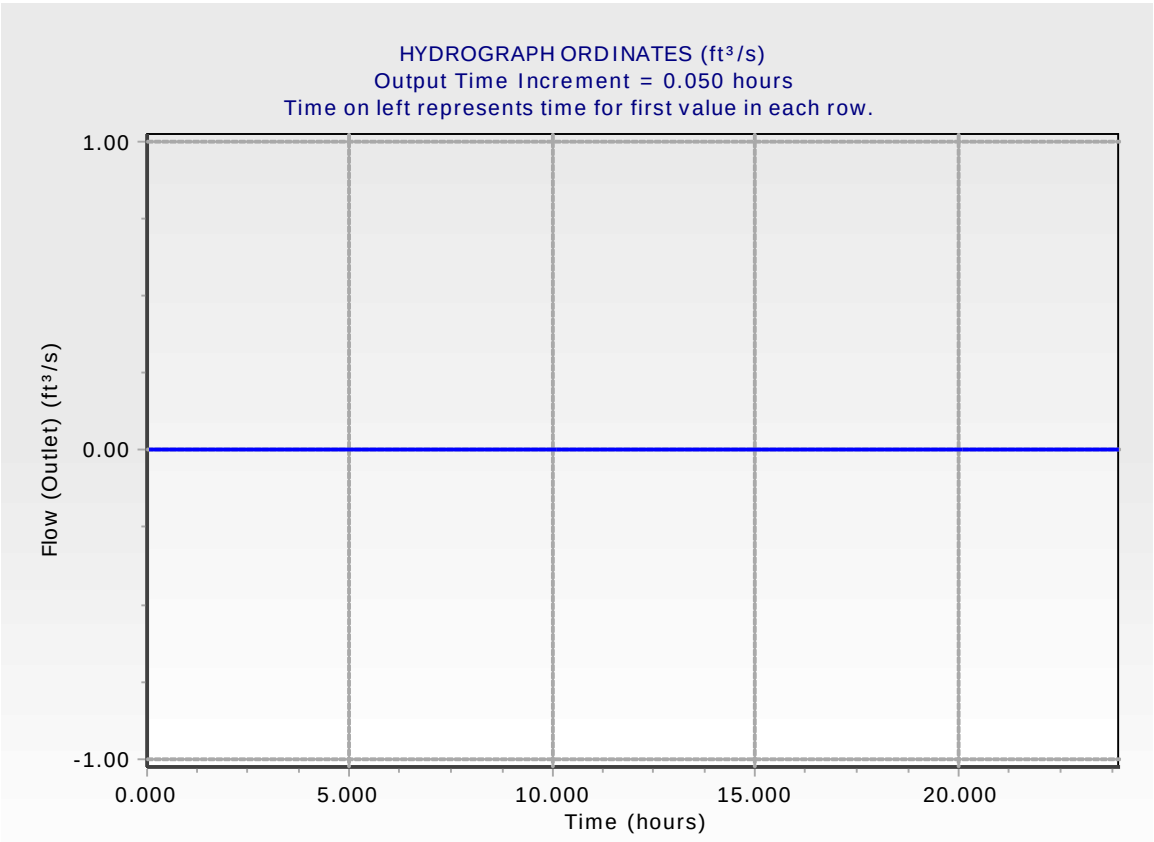
HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	0.00	(N/A)	(N/A)	(N/A)

NPT Transition Station #6

Subsection: Pond Routed Hydrograph (total out) | Return Event: 50 years

Label: South Detention Pond (OUT) | Storm Event: 50 Year Storm



Subsection: Pond Routed Hydrograph (total out) Return Event: 100 years
Label: South Detention Pond (OUT) Storm Event: 100 Year Storm

Peak Discharge	0.05 ft³/s
Time to Peak	15.450 hours
Hydrograph Volume	1,032.645 ft³

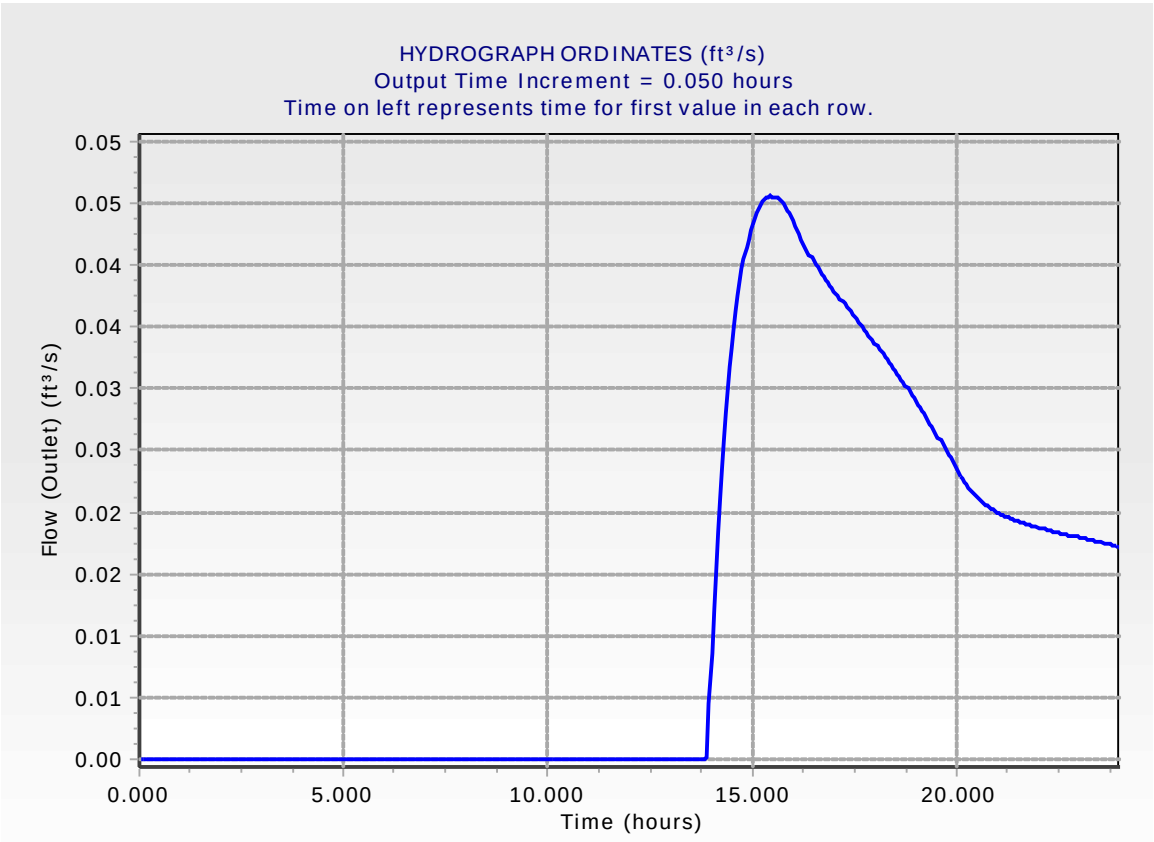
HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
13.900	0.00	0.00	0.01	0.01	0.02
14.150	0.02	0.02	0.02	0.03	0.03
14.400	0.03	0.03	0.03	0.03	0.04
14.650	0.04	0.04	0.04	0.04	0.04
14.900	0.04	0.04	0.04	0.04	0.04
15.150	0.04	0.04	0.05	0.05	0.05
15.400	0.05	0.05	0.05	0.05	0.05
15.650	0.05	0.05	0.04	0.04	0.04
15.900	0.04	0.04	0.04	0.04	0.04
16.150	0.04	0.04	0.04	0.04	0.04
16.400	0.04	0.04	0.04	0.04	0.04
16.650	0.04	0.04	0.04	0.04	0.04
16.900	0.04	0.04	0.04	0.04	0.04
17.150	0.04	0.04	0.04	0.04	0.04
17.400	0.04	0.04	0.04	0.04	0.04
17.650	0.04	0.03	0.03	0.03	0.03
17.900	0.03	0.03	0.03	0.03	0.03
18.150	0.03	0.03	0.03	0.03	0.03
18.400	0.03	0.03	0.03	0.03	0.03
18.650	0.03	0.03	0.03	0.03	0.03
18.900	0.03	0.03	0.03	0.03	0.03
19.150	0.03	0.03	0.03	0.03	0.03
19.400	0.03	0.03	0.03	0.03	0.03
19.650	0.03	0.03	0.02	0.02	0.02
19.900	0.02	0.02	0.02	0.02	0.02
20.150	0.02	0.02	0.02	0.02	0.02
20.400	0.02	0.02	0.02	0.02	0.02
20.650	0.02	0.02	0.02	0.02	0.02
20.900	0.02	0.02	0.02	0.02	0.02
21.150	0.02	0.02	0.02	0.02	0.02
21.400	0.02	0.02	0.02	0.02	0.02
21.650	0.02	0.02	0.02	0.02	0.02
21.900	0.02	0.02	0.02	0.02	0.02
22.150	0.02	0.02	0.02	0.02	0.02
22.400	0.02	0.02	0.02	0.02	0.02
22.650	0.02	0.02	0.02	0.02	0.02
22.900	0.02	0.02	0.02	0.02	0.02
23.150	0.02	0.02	0.02	0.02	0.02
23.400	0.02	0.02	0.02	0.02	0.02
23.650	0.02	0.02	0.02	0.02	0.02
23.900	0.02	0.02	0.02	(N/A)	(N/A)

NPT Transition Station #6

Subsection: Pond Routed Hydrograph (total out) | Return Event: 100 years

Label: South Detention Pond (OUT) | Storm Event: 100 Year Storm



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NPT Transition Station #6

APPENDIX C – HYDRAULIC AND STABILITY CALCULATIONS

Worksheet for Swale A - 10-Year

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00500	ft/ft
Left Side Slope	9.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	2.00	ft
Discharge	1.60	ft^3/s

Results

Normal Depth	0.32	ft
Flow Area	1.28	ft^2
Wetted Perimeter	5.95	ft
Hydraulic Radius	0.21	ft
Top Width	5.88	ft
Critical Depth	0.22	ft
Critical Slope	0.02472	ft/ft
Velocity	1.25	ft/s
Velocity Head	0.02	ft
Specific Energy	0.35	ft
Froude Number	0.47	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.32	ft
Critical Depth	0.22	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.02472	ft/ft

Worksheet for Swale A - 100-Year

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00500	ft/ft
Left Side Slope	9.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	2.00	ft
Discharge	6.43	ft^3/s

Results

Normal Depth	0.62	ft
Flow Area	3.56	ft^2
Wetted Perimeter	9.59	ft
Hydraulic Radius	0.37	ft
Top Width	9.45	ft
Critical Depth	0.45	ft
Critical Slope	0.02025	ft/ft
Velocity	1.81	ft/s
Velocity Head	0.05	ft
Specific Energy	0.67	ft
Froude Number	0.52	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.62	ft
Critical Depth	0.45	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.02025	ft/ft

Worksheet for Swale B - 10-Year

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00500	ft/ft
Left Side Slope	12.00	ft/ft (H:V)
Right Side Slope	100.00	ft/ft (H:V)
Bottom Width	0.00	ft
Discharge	1.60	ft^3/s

Results

Normal Depth	0.20	ft
Flow Area	2.15	ft^2
Wetted Perimeter	21.95	ft
Hydraulic Radius	0.10	ft
Top Width	21.94	ft
Critical Depth	0.14	ft
Critical Slope	0.03195	ft/ft
Velocity	0.74	ft/s
Velocity Head	0.01	ft
Specific Energy	0.20	ft
Froude Number	0.42	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.20	ft
Critical Depth	0.14	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.03195	ft/ft

Worksheet for Swale B - 100-Year

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00500	ft/ft
Left Side Slope	12.00	ft/ft (H:V)
Right Side Slope	100.00	ft/ft (H:V)
Bottom Width	0.00	ft
Discharge	6.43	ft^3/s

Results

Normal Depth	0.33	ft
Flow Area	6.10	ft^2
Wetted Perimeter	36.98	ft
Hydraulic Radius	0.16	ft
Top Width	36.97	ft
Critical Depth	0.24	ft
Critical Slope	0.02655	ft/ft
Velocity	1.05	ft/s
Velocity Head	0.02	ft
Specific Energy	0.35	ft
Froude Number	0.46	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.33	ft
Critical Depth	0.24	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.02655	ft/ft

Worksheet for Swale C - 100-Year

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00460	ft/ft
Left Side Slope	10.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	0.00	ft
Discharge	0.39	ft^3/s

Results

Normal Depth	0.26	ft
Flow Area	0.45	ft^2
Wetted Perimeter	3.49	ft
Hydraulic Radius	0.13	ft
Top Width	3.43	ft
Critical Depth	0.19	ft
Critical Slope	0.02958	ft/ft
Velocity	0.86	ft/s
Velocity Head	0.01	ft
Specific Energy	0.28	ft
Froude Number	0.42	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.26	ft
Critical Depth	0.19	ft
Channel Slope	0.00460	ft/ft
Critical Slope	0.02958	ft/ft

Worksheet for Swale D - 100-Year

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00310	ft/ft
Left Side Slope	20.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	0.00	ft
Discharge	0.39	ft^3/s

Results

Normal Depth	0.23	ft
Flow Area	0.60	ft^2
Wetted Perimeter	5.31	ft
Hydraulic Radius	0.11	ft
Top Width	5.26	ft
Critical Depth	0.15	ft
Critical Slope	0.03156	ft/ft
Velocity	0.65	ft/s
Velocity Head	0.01	ft
Specific Energy	0.24	ft
Froude Number	0.34	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.23	ft
Critical Depth	0.15	ft
Channel Slope	0.00310	ft/ft
Critical Slope	0.03156	ft/ft

Worksheet for Swale E - 100-Year

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.02120	ft/ft
Left Side Slope	10.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	0.00	ft
Discharge	0.39	ft^3/s

Results

Normal Depth	0.20	ft
Flow Area	0.26	ft^2
Wetted Perimeter	2.62	ft
Hydraulic Radius	0.10	ft
Top Width	2.58	ft
Critical Depth	0.19	ft
Critical Slope	0.02955	ft/ft
Velocity	1.53	ft/s
Velocity Head	0.04	ft
Specific Energy	0.23	ft
Froude Number	0.85	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.20	ft
Critical Depth	0.19	ft
Channel Slope	0.02120	ft/ft
Critical Slope	0.02955	ft/ft

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Poseyville, Indiana 47633
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Erosion Control Materials Design Software
Version 5.0

Project Name: TS#6 SWA
Project Number: 107029
Project Location: Bethlehem, New Hampshire
Channel Name: SW-A

Discharge	1.60
Peak Flow Period	12
Channel Slope	0.005
Channel Bottom Width	2
Left Side Slope	9
Right Side Slope	3
Low Flow Liner	
Retardance Class	B
Vegtation Type	Mix (Sod & Bunch)
Vegetation Density	Good 75-95%
Soil Type	Sandy Loam

Unreinforced Vegetation - Class B - Mix (Sod & Bunch) - Good 75-95%

Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissible Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
Unreinforced Vegetation	Straight	1.6 cfs	0.22 ft/s	0.95 ft	0.318	5.73 lbs/ft2	0.3 lbs/ft2	19.32	STABLE	--
Underlying Substrate	Straight	1.6 cfs	0.22 ft/s	0.95 ft	--	0.04 lbs/ft2	0 lbs/ft2	196.26	STABLE	--

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Erosion Control Materials Design Software
Version 5.0

Project Name: TS#6 SWA
Project Number: 107029
Project Location: Bethlehem, New Hampshire
Channel Name: SW-B

Discharge	1.60
Peak Flow Period	12
Channel Slope	0.005
Channel Bottom Width	0
Left Side Slope	12
Right Side Slope	100
Low Flow Liner	
Retardance Class	B
Vegtation Type	Mix (Sod & Bunch)
Vegetation Density	Good 75-95%
Soil Type	Sandy Loam

Unreinforced Vegetation - Class B - Mix (Sod & Bunch) - Good 75-95%

Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissible Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
Unreinforced Vegetation	Straight	1.6 cfs	0.13 ft/s	0.48 ft	0.318	5.73 lbs/ft2	0.15 lbs/ft2	38.66	STABLE	--
Underlying Substrate	Straight	1.6 cfs	0.13 ft/s	0.48 ft	--	0.04 lbs/ft2	0 lbs/ft2	392.8	STABLE	--

Tensar International Corporation
5401 St. Wendel-Cynthiana Road
Poseyville, Indiana 47633
Tel. 800.772.2040
Fax 812.867.0247
www.nagreen.com

Erosion Control Materials Design Software
Version 5.0

Project Name: Transition Station #6
Project Number: 70535
Project Location: Bethlehem, New Hampshire
Channel Name: North Emergency Spillway

Discharge	1.9
Peak Flow Period	0
Channel Slope	0.33
Channel Bottom Width	2
Left Side Slope	3
Right Side Slope	3
Low Flow Liner	
Retardance Class	C
Vegtation Type	Mix (Sod & Bunch)
Vegetation Density	Good 75-95%
Soil Type	Sandy Loam

Rock Riprap - Class C - Mix (Sod & Bunch) - Good 75-95%

Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissible Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
Rock Riprap Unvegetated	Straight	1.9 cfs	6.12 ft/s	0.13 ft	0.032	4 lbs/ft2	2.67 lbs/ft2	1.5	STABLE	--

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Erosion Control Materials Design Software
Version 5.0

Project Name: Transition Station #6
Project Number: 70535
Project Location: Bethlehem, New Hampshire
Channel Name: South Emergency Spillway

Discharge	1.9
Peak Flow Period	0
Channel Slope	0.33
Channel Bottom Width	2
Left Side Slope	3
Right Side Slope	3
Low Flow Liner	
Retardance Class	C
Vegtation Type	Mix (Sod & Bunch)
Vegetation Density	Good 75-95%
Soil Type	Sandy Loam

Rock Riprap - Class C - Mix (Sod & Bunch) - Good 75-95%

Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissible Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
Rock Riprap Unvegetated	Straight	1.9 cfs	6.12 ft/s	0.13 ft	0.032	4 lbs/ft2	2.67 lbs/ft2	1.5	STABLE	--

Worksheet for North Emergency Spillway

Project Description

Solve For	Discharge

Input Data

Headwater Elevation		487.50	ft
Crest Elevation		487.00	ft
Tailwater Elevation		480.00	ft
Crest Surface Type	Gravel		
Crest Breadth		12.00	ft
Crest Length		2.00	ft

Results

Discharge	1.90	ft^3/s
Headwater Height Above Crest	0.50	ft
Tailwater Height Above Crest	-7.00	ft
Weir Coefficient	2.69	US
Submergence Factor	1.00	
Adjusted Weir Coefficient	2.69	US
Flow Area	1.00	ft^2
Velocity	1.90	ft/s
Wetted Perimeter	3.00	ft
Top Width	2.00	ft

Worksheet for South Emergency Spillway

Project Description

Solve For	Discharge

Input Data

Headwater Elevation		483.65	ft
Crest Elevation		483.15	ft
Tailwater Elevation		480.00	ft
Crest Surface Type	Gravel		
Crest Breadth		12.00	ft
Crest Length		2.00	ft

Results

Discharge	1.90	ft^3/s
Headwater Height Above Crest	0.50	ft
Tailwater Height Above Crest	-3.15	ft
Weir Coefficient	2.69	US
Submergence Factor	1.00	
Adjusted Weir Coefficient	2.69	US
Flow Area	1.00	ft^2
Velocity	1.90	ft/s
Wetted Perimeter	3.00	ft
Top Width	2.00	ft

Culvert Calculator Report
Drainline A - 10-Year

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	486.00	ft	Headwater Depth/Height	0.58	
Computed Headwater Eleva	484.11	ft	Discharge	1.60	cfs
Inlet Control HW Elev.	484.07	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	484.11	ft	Control Type	Entrance Control	

Grades					
Upstream Invert	483.38	ft	Downstream Invert	483.00	ft
Length	38.00	ft	Constructed Slope	0.010000	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	0.41	ft
Slope Type	Steep		Normal Depth	0.41	ft
Flow Regime	Supercritical		Critical Depth	0.50	ft
Velocity Downstream	4.62	ft/s	Critical Slope	0.004553	ft/ft

Section				
Section Shape	Circular	Mannings Coefficient	0.012	
Section Material	Corrugated HDPE (Smooth Interior)	Span	1.25	ft
Section Size	15 inch	Rise	1.25	ft
Number Sections	1			

Outlet Control Properties					
Outlet Control HW Elev.	484.11	ft	Upstream Velocity Head	0.19	ft
Ke	0.20		Entrance Loss	0.04	ft

Inlet Control Properties					
Inlet Control HW Elev.	484.07	ft	Flow Control	Unsubmerged	
Inlet Type	Beveled ring, 33.7° bevels		Area Full	1.2	ft²
K	0.00180		HDS 5 Chart	3	
M	2.50000		HDS 5 Scale	B	
C	0.02430		Equation Form	1	
Y	0.83000				

Culvert Calculator Report
Drainline A - 100-Year

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	486.00	ft	Headwater Depth/Height	1.36	
Computed Headwater Eleva	485.08	ft	Discharge	6.43	cfs
Inlet Control HW Elev.	485.08	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	485.07	ft	Control Type	Inlet Control	

Grades					
Upstream Invert	483.38	ft	Downstream Invert	483.00	ft
Length	38.00	ft	Constructed Slope	0.010000	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	0.95	ft
Slope Type	Steep		Normal Depth	0.94	ft
Flow Regime	Supercritical		Critical Depth	1.02	ft
Velocity Downstream	6.46	ft/s	Critical Slope	0.008476	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	Corrugated HDPE (Smooth Interior)		Span	1.25	ft
Section Size	15 inch		Rise	1.25	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	485.07	ft	Upstream Velocity Head	0.56	ft
Ke	0.20		Entrance Loss	0.11	ft

Inlet Control Properties					
Inlet Control HW Elev.	485.08	ft	Flow Control	Submerged	
Inlet Type	Beveled ring, 33.7° bevels		Area Full	1.2	ft²
K	0.00180		HDS 5 Chart	3	
M	2.50000		HDS 5 Scale	B	
C	0.02430		Equation Form	1	
Y	0.83000				

Culvert Calculator Report
Drainline A - 25-Year

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	486.00	ft	Headwater Depth/Height	0.82	
Computed Headwater Eleva	484.40	ft	Discharge	2.94	cfs
Inlet Control HW Elev.	484.36	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	484.40	ft	Control Type	Entrance Control	

Grades					
Upstream Invert	483.38	ft	Downstream Invert	483.00	ft
Length	38.00	ft	Constructed Slope	0.010000	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	0.57	ft
Slope Type	Steep		Normal Depth	0.57	ft
Flow Regime	Supercritical		Critical Depth	0.69	ft
Velocity Downstream	5.40	ft/s	Critical Slope	0.005103	ft/ft

Section				
Section Shape	Circular	Mannings Coefficient	0.012	
Section Material	Corrugated HDPE (Smooth Interior)	Span	1.25	ft
Section Size	15 inch	Rise	1.25	ft
Number Sections	1			

Outlet Control Properties					
Outlet Control HW Elev.	484.40	ft	Upstream Velocity Head	0.28	ft
Ke	0.20		Entrance Loss	0.06	ft

Inlet Control Properties					
Inlet Control HW Elev.	484.36	ft	Flow Control	N/A	
Inlet Type	Beveled ring, 33.7° bevels		Area Full	1.2	ft²
K	0.00180		HDS 5 Chart	3	
M	2.50000		HDS 5 Scale	B	
C	0.02430		Equation Form	1	
Y	0.83000				

Culvert Calculator Report
Drainline C - 100-Year

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	483.00	ft	Headwater Depth/Height	0.28	
Computed Headwater Eleva	481.19	ft	Discharge	0.39	cfs
Inlet Control HW Elev.	481.17	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	481.19	ft	Control Type	Entrance Control	

Grades					
Upstream Invert	480.85	ft	Downstream Invert	480.65	ft
Length	25.00	ft	Constructed Slope	0.008000	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	0.21	ft
Slope Type	Steep		Normal Depth	0.21	ft
Flow Regime	Supercritical		Critical Depth	0.24	ft
Velocity Downstream	2.84	ft/s	Critical Slope	0.004583	ft/ft

Section				
Section Shape	Circular	Mannings Coefficient	0.012	
Section Material	Corrugated HDPE (Smooth Interior)	Span	1.25	ft
Section Size	15 inch	Rise	1.25	ft
Number Sections	1			

Outlet Control Properties					
Outlet Control HW Elev.	481.19	ft	Upstream Velocity Head	0.08	ft
Ke	0.20		Entrance Loss	0.02	ft

Inlet Control Properties					
Inlet Control HW Elev.	481.17	ft	Flow Control	Unsubmerged	
Inlet Type	Beveled ring, 33.7° bevels		Area Full	1.2	ft²
K	0.00180		HDS 5 Chart	3	
M	2.50000		HDS 5 Scale	B	
C	0.02430		Equation Form	1	
Y	0.83000				

Culvert Calculator Report
Drainline C - 25-Year

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	483.00	ft	Headwater Depth/Height	0.00	
Computed Headwater Eleva	480.85	ft	Discharge	0.00	cfs
Inlet Control HW Elev.	480.85	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	480.85	ft	Control Type	Inlet Control	

Grades					
Upstream Invert	480.85	ft	Downstream Invert	480.65	ft
Length	25.00	ft	Constructed Slope	0.008000	ft/ft

Hydraulic Profile					
Profile	Dry		Depth, Downstream	0.00	ft
Slope Type	Dry		Normal Depth	0.00	ft
Flow Regime	Subcritical		Critical Depth	0.00	ft
Velocity Downstream	0.00	ft/s	Critical Slope	0.000000	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	Corrugated HDPE (Smooth Interior)		Span	1.25	ft
Section Size	15 inch		Rise	1.25	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	480.85	ft	Upstream Velocity Head	0.00	ft
Ke	0.20		Entrance Loss	0.00	ft

Inlet Control Properties					
Inlet Control HW Elev.	480.85	ft	Flow Control	N/A	
Inlet Type	Beveled ring, 33.7° bevels		Area Full	1.2	ft²
K	0.00180		HDS 5 Chart	3	
M	2.50000		HDS 5 Scale	B	
C	0.02430		Equation Form	1	
Y	0.83000				

Worksheet for Drainline B - 100-Year

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.012	
Channel Slope	0.00500	ft/ft
Diameter	1.25	ft
Discharge	0.25	ft^3/s

Results

Normal Depth	0.19	ft
Flow Area	0.12	ft^2
Wetted Perimeter	1.00	ft
Hydraulic Radius	0.12	ft
Top Width	0.90	ft
Critical Depth	0.19	ft
Percent Full	15.3	%
Critical Slope	0.00480	ft/ft
Velocity	2.11	ft/s
Velocity Head	0.07	ft
Specific Energy	0.26	ft
Froude Number	1.02	
Maximum Discharge	5.32	ft^3/s
Discharge Full	4.95	ft^3/s
Slope Full	0.00001	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	15.28	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.19	ft
Critical Depth	0.19	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.00480	ft/ft

Worksheet for Underdrain - 10-year

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.00660	ft/ft
Diameter	0.66	ft
Discharge	0.26	ft^3/s

Results

Normal Depth	0.20	ft
Flow Area	0.09	ft^2
Wetted Perimeter	0.78	ft
Hydraulic Radius	0.12	ft
Top Width	0.61	ft
Critical Depth	0.24	ft
Percent Full	31.0	%
Critical Slope	0.00385	ft/ft
Velocity	2.87	ft/s
Velocity Head	0.13	ft
Specific Energy	0.33	ft
Froude Number	1.31	
Maximum Discharge	1.34	ft^3/s
Discharge Full	1.24	ft^3/s
Slope Full	0.00029	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	31.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.20	ft
Critical Depth	0.24	ft
Channel Slope	0.00660	ft/ft
Critical Slope	0.00385	ft/ft

Worksheet for Underdrain - 25-year

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.00660	ft/ft
Diameter	0.66	ft
Discharge	0.61	ft^3/s

Results

Normal Depth	0.33	ft
Flow Area	0.17	ft^2
Wetted Perimeter	1.03	ft
Hydraulic Radius	0.16	ft
Top Width	0.66	ft
Critical Depth	0.37	ft
Percent Full	49.5	%
Critical Slope	0.00443	ft/ft
Velocity	3.62	ft/s
Velocity Head	0.20	ft
Specific Energy	0.53	ft
Froude Number	1.26	
Maximum Discharge	1.34	ft^3/s
Discharge Full	1.24	ft^3/s
Slope Full	0.00159	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	49.45	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.33	ft
Critical Depth	0.37	ft
Channel Slope	0.00660	ft/ft
Critical Slope	0.00443	ft/ft

Worksheet for Underdrain - 100-year

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.00660	ft/ft
Diameter	0.66	ft
Discharge	0.83	ft^3/s

Results

Normal Depth	0.39	ft
Flow Area	0.21	ft^2
Wetted Perimeter	1.17	ft
Hydraulic Radius	0.18	ft
Top Width	0.65	ft
Critical Depth	0.43	ft
Percent Full	59.8	%
Critical Slope	0.00503	ft/ft
Velocity	3.89	ft/s
Velocity Head	0.24	ft
Specific Energy	0.63	ft
Froude Number	1.19	
Maximum Discharge	1.34	ft^3/s
Discharge Full	1.24	ft^3/s
Slope Full	0.00295	ft/ft
Flow Type	SuperCritical	

GVF Input Data

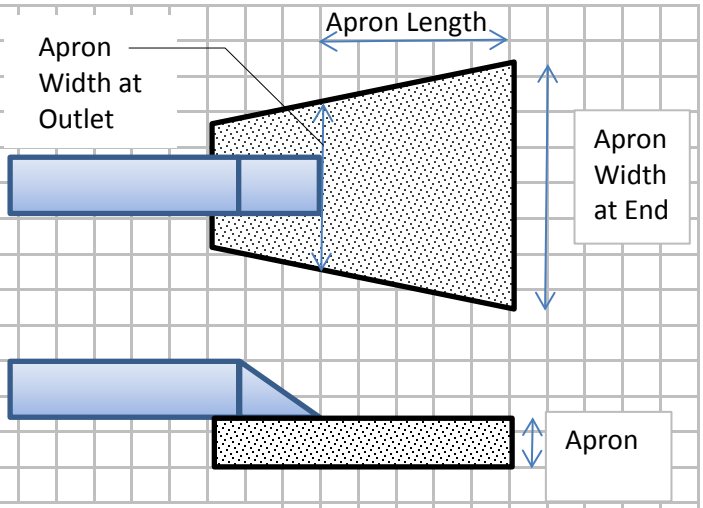
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	59.78	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.39	ft
Critical Depth	0.43	ft
Channel Slope	0.00660	ft/ft
Critical Slope	0.00503	ft/ft

Source:

New Hampshire Stormwater Manual, Volume 2
Post-Construction Best Management Practices
Selection & Design, Dec 2008, Section 4.6.6



Apron Width at Outlet:	Width =	3 x Pipe Dia. (or width of channel)	
Apron Length:	Length=	(1.8 x Q) / (Dia. ^1.5) + 7 x Dia.	if Tw depth is < 1/2 dia.
	Length=	(3.0 x Q) / (Dia. ^1.5) + 7 x Dia.	if Tw depth is >= 1/2 dia.
Apron Width at End:	Width = 3 x Dia + Apron Length		if Tw depth is < 1/2 dia.
	Width = 3 x Dia + 0.4 x Apron Length		if Tw depth is >= 1/2 dia.
	or apron width = channel width if a well defined channel exists		
Rock Riprap:	Median Diameter =	(0.2 x Q ^4/3) / Tw x Dia	
	Depth = 18" or 1.5 x largest stone dia.		

Design Element	DL-A	DL-C
Design Storm (YR)	25-yr	25-yr
Defined Channel (yes/no)	Yes	Yes
Channel Width (ft)	3.5	3.5
Pipe Dia (in)	15	15
Tail Water (ft)	0.56	0.07
	TW<0.5D	TW<0.5D
Flow (Q), cfs	2.94	0.01
Apron Width (outlet) ft	3.5	3.5
Apron Length, ft	12.54	8.76
Apron Width (end) ft	16.29	12.51
Apron Width, (channel), ft	3.5	3.5
Median Stone dia. (D50), inches	6	6
Apron Depth, inches	18	18

APPENDIX D – NH DES WORKSHEETS

INFILTRATION PRACTICE DESIGN CRITERIA (Env-Wq 1508.05)

Type/Node Name: **North Infiltration Basin**

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

Yes		Have you reviewed Env-Wq 1508.05(a) to ensure that infiltration is allowed?	
2.09	ac	A = Area draining to the practice	
0.25	ac	A_I = Impervious area draining to the practice	
0.12	decimal	I = percent impervious area draining to the practice, in decimal form	
0.16	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
0.33	ac-in	WQV= 1" x Rv x A	
1,195	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
299	cf	25% x WQV (check calc for sediment forebay volume)	
Sediment Forebay		Method of pretreatment? (not required for clean or roof runoff)	
532	cf	V_{SED} = sediment forebay volume, if used for pretreatment	← **≥ 25%WQV**
2,916	cf	V = volume[1] (attach a stage-storage table)	← **≥ WQV**
876	sf	A_{SA} = surface area of the bottom of the pond	
12.00	iph	I_{DESIGN} = design infiltration rate[2]	
3.3	hours	T_{DRAIN} = drain time = V / (A_{SA} * I_{DESIGN})	← **≤ 72-hrs**
483.00	feet	E_{BTM} = elevation of the bottom of the practice	
477.00	feet	E_{SHWT} = elevation of SHWT (if none found, enter the lowest elevation of the test pit)	
474.80	feet	E_{ROCK} = elevation of bedrock (if none found, enter the lowest elevation of the test pit)	
6.00	feet	D_{SHWT} = separation from SHWT[3]	← **≥ *[3]**
8.2	feet	D_{ROCK} = separation from bedrock[3]	← **≥ *[3]**
	ft	D_T = depth of trench, if trench proposed	← **4 - 10 ft**
No	Yes/No	If a trench or underground system is proposed, observation well provided	
N/A		If a trench is proposed, material in trench	
6" Coarse Sand		If a basin is proposed, basin floor material	
Yes	Yes/No	If a basin is proposed, the perimeter should be curvilinear.	
3.0	:1	If a basin is proposed, pond side slopes	← **≥3:1**
483.88	ft	Peak elevation of the 10-year storm event (infiltration can be used in analysis)	
485.54	ft	Peak elevation of the 50-year storm event (infiltration can be used in analysis)	
488.00	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?	← **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. See NH Stormwater Manual, Vol.2, Ch.2-4, for guidance on determining the infiltration rate
3. 1' separation if treatment not required; 4' for treatment in GPAs & WSIPAs; & 3' in all other areas.

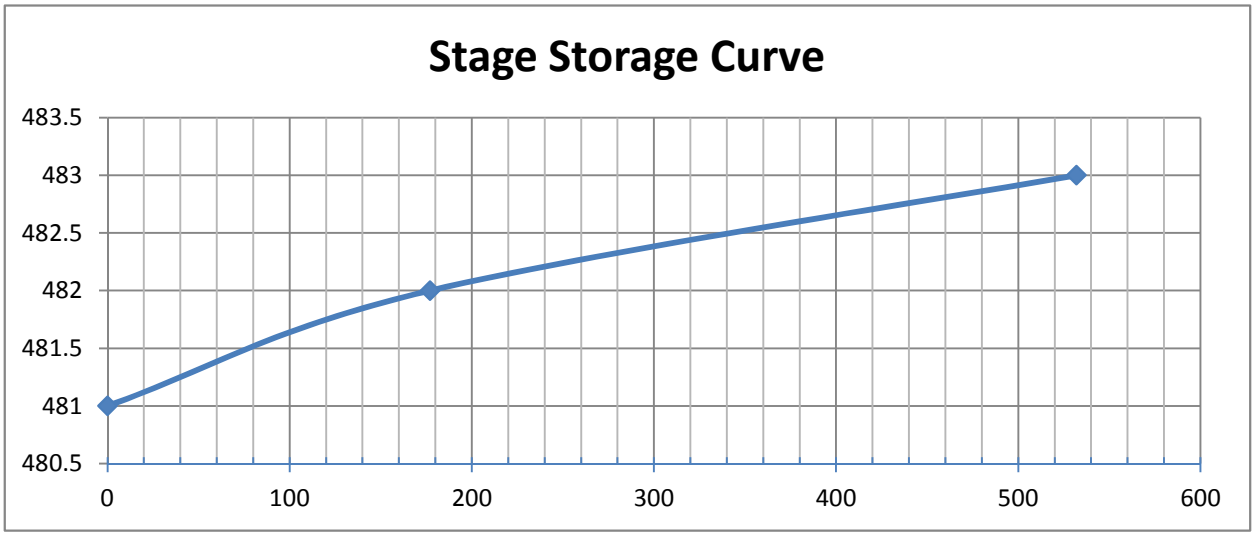
Designer's Notes:

Client	*Eversource*	Page	of
Project	*Northern Pass* Date 07/02/15	Made By	*J. Sirhall*
	Transition Station #6 - North Sediment Forebay	Checked By	
	Sediment Forebay - Stage-Storage Table	Preliminary	Final

Stage/Storage Table

ELEV (FT.)	AREA (S.F.)	AVERAGE AREA (S.F.)	DIFFERENCE IN ELEVATION (FT.)	STORAGE VOLUME		
				INCREMENTAL	TOTAL (CF)	Total Ac-Ft
481	102			0	0	0
482	252	177	1	177	177	0.0041
483	458	355	1	355	532	0.0122

Stage Storage Curve

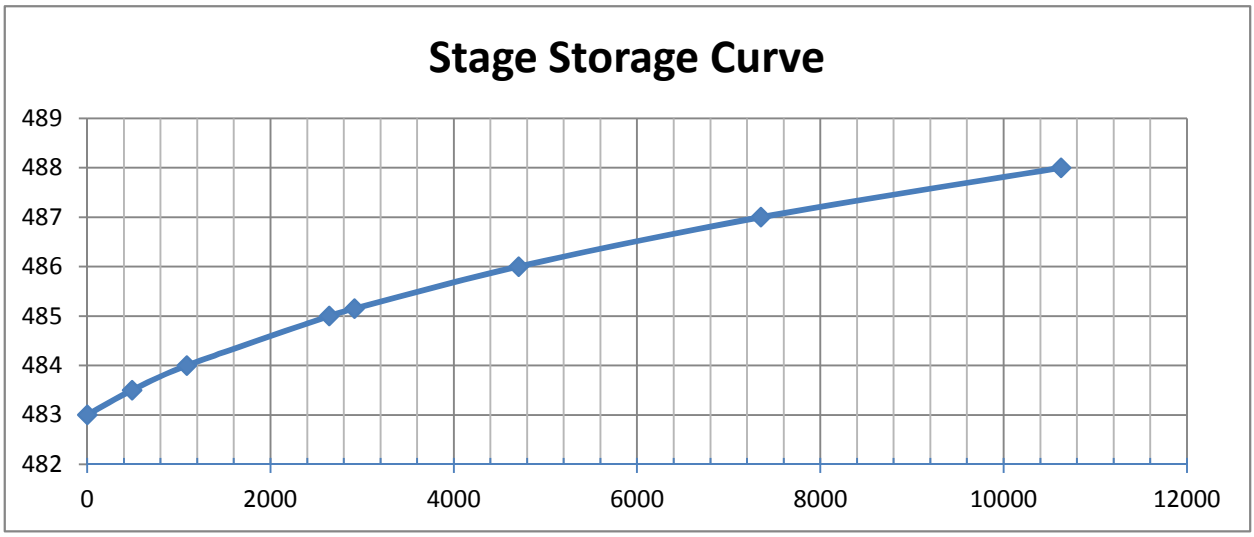


Client	*Eversource*	Page	of
Project	*Northern Pass* Date 07/02/15	Made By	*J. Sirhall*
	Transition Station #6 - North Infiltration Basin	Checked By	
	Infiltration Basin - Stage-Storage Table	Preliminary	Final

Stage/Storage Table

ELEV (FT.)	AREA (S.F.)	AVERAGE AREA (S.F.)	DIFFERENCE IN ELEVATION (FT.)	STORAGE VOLUME		
				INCREMENTAL	TOTAL (CF)	Total Ac-Ft
483	876			0	0	0
483.5	1085	980.5	0.5	490	490	0.0113
484	1308	1196.5	0.5	598	1089	0.0250
485	1797	1552.5	1	1553	2641	0.0606
485.15	1875	1836	0.15	275	2916	0.0670
486	2342	2108.5	0.85	1792	4709	0.1081
487	2945	2643.5	1	2644	7352	0.1688
488	3603	3274	1	3274	10626	0.2439

Stage Storage Curve



INFILTRATION PRACTICE DESIGN CRITERIA (Env-Wq 1508.05)

Type/Node Name: **South Infiltration Basin**

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

Yes		Have you reviewed Env-Wq 1508.05(a) to ensure that infiltration is allowed?	
2.10	ac	A = Area draining to the practice	
0.12	ac	A_I = Impervious area draining to the practice	
0.06	decimal	I = percent impervious area draining to the practice, in decimal form	
0.10	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
0.21	ac-in	WQV= 1" x Rv x A	
772	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
193	cf	25% x WQV (check calc for sediment forebay volume)	
Sediment Forebay		Method of pretreatment? (not required for clean or roof runoff)	
229	cf	V_{SED} = sediment forebay volume, if used for pretreatment	← **≥ 25%WQV**
827	cf	V = volume[1] (attach a stage-storage table)	← **≥ WQV**
329	sf	A_{SA} = surface area of the bottom of the pond	
1.20	iph	I_{DESIGN} = design infiltration rate[2]	
25.1	hours	T_{DRAIN} = drain time = V / (A_{SA} * I_{DESIGN})	← **≤ 72-hrs**
480.65	feet	E_{BTM} = elevation of the bottom of the practice	
474.00	feet	E_{SHWT} = elevation of SHWT (if none found, enter the lowest elevation of the test pit)	
467.80	feet	E_{ROCK} = elevation of bedrock (if none found, enter the lowest elevation of the test pit)	
6.65	feet	D_{SHWT} = separation from SHWT[3]	← **≥ *[3]**
12.9	feet	D_{ROCK} = separation from bedrock[3]	← **≥ *[3]**
	ft	D_T = depth of trench, if trench proposed	← **4 - 10 ft**
No	Yes/No	If a trench or underground system is proposed, observation well provided	
N/A		If a trench is proposed, material in trench	
6" Coarse Sand		If a basin is proposed, basin floor material	
Yes	Yes/No	If a basin is proposed, the perimeter should be curvilinear.	
3.0	:1	If a basin is proposed, pond side slopes	← **≥3:1**
480.66	ft	Peak elevation of the 10-year storm event (infiltration can be used in analysis)	
481.95	ft	Peak elevation of the 50-year storm event (infiltration can be used in analysis)	
484.15	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?	← **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. See NH Stormwater Manual, Vol.2, Ch.2-4, for guidance on determining the infiltration rate
3. 1' separation if treatment not required; 4' for treatment in GPAs & WSIPAs; & 3' in all other areas.

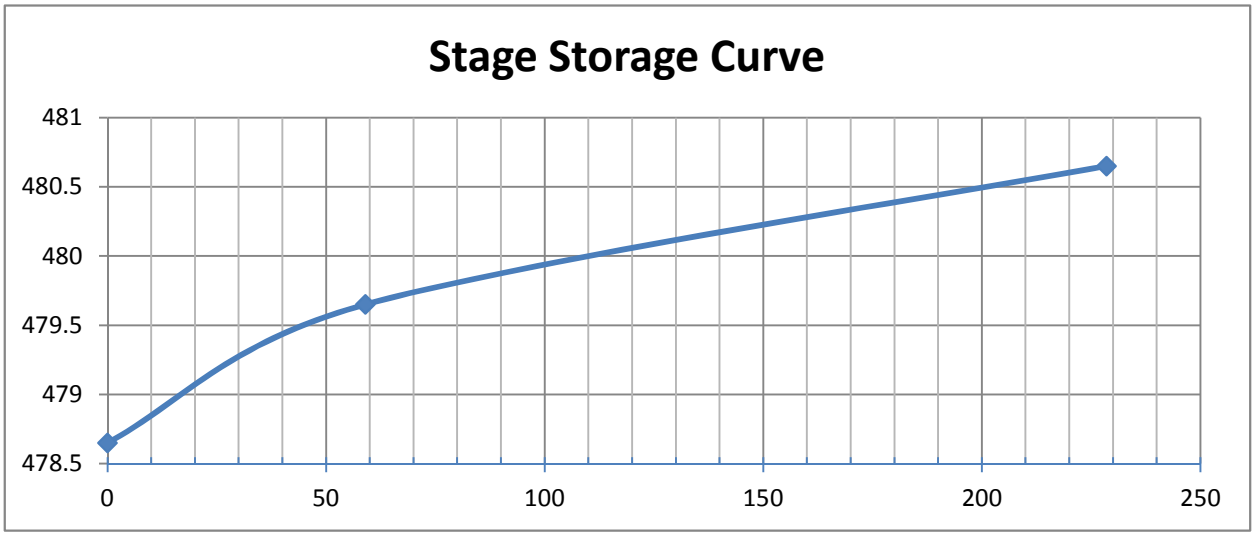
Designer's Notes:

Client	*Eversource*	Page	of
Project	*Northern Pass* Date 06/10/15	Made By	*J. Sirhall*
	Transition Station #6 - South Sediment Forebay	Checked By	
	Sediment Forebay - Stage-Storage Table	Preliminary	Final

Stage/Storage Table

ELEV (FT.)	AREA (S.F.)	AVERAGE AREA (S.F.)	DIFFERENCE IN ELEVATION (FT.)	STORAGE VOLUME		
				INCREMENTAL	TOTAL (CF)	Total Ac-Ft
478.65	18			0	0	0
479.65	100	59	1	59	59	0.0014
480.65	239	169.5	1	169.5	228.5	0.0052

Stage Storage Curve

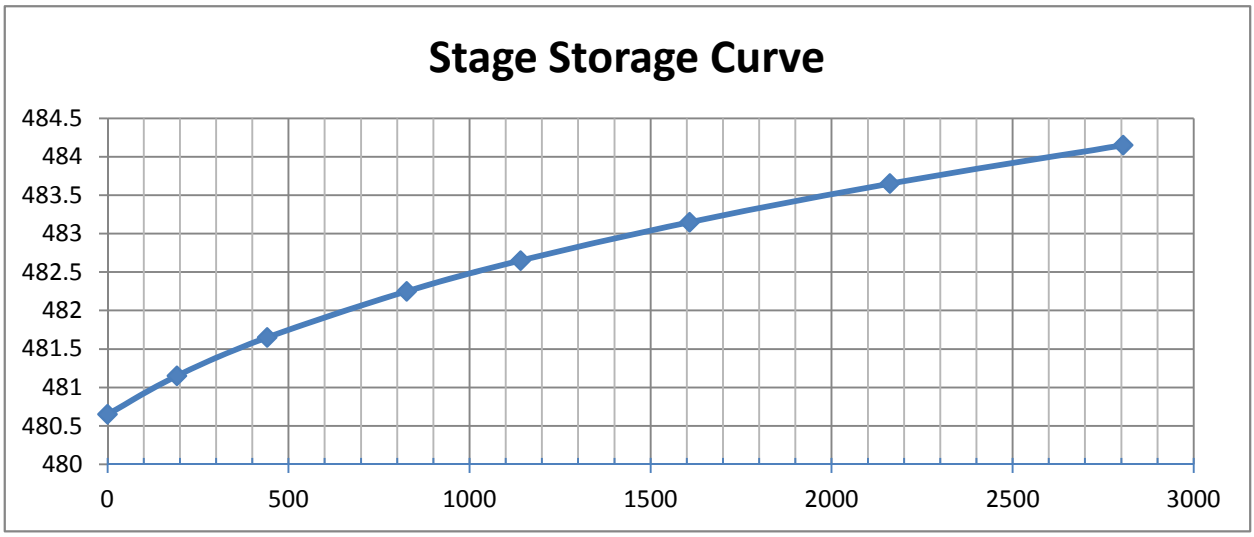


Client	*Eversource*	Page	of
Project	*Northern Pass* Date 06/10/15	Made By	*J. Sirhall*
	Transition Station #6 - South Infiltration Basin	Checked By	
	Infiltration Basin - Stage-Storage Table	Preliminary	Final

Stage/Storage Table

ELEV (FT.)	AREA (S.F.)	AVERAGE AREA (S.F.)	DIFFERENCE IN ELEVATION (FT.)	STORAGE VOLUME		
				INCREMENTAL	TOTAL (CF)	Total Ac-Ft
480.65	329			0	0	0
481.15	437	383	0.5	192	192	0.0044
481.65	560	498.5	0.5	249	441	0.0101
482.25	726	643	0.6	386	827	0.0190
482.65	848	787	0.4	315	1141	0.0262
483.15	1018	933	0.5	467	1608	0.0369
483.65	1193	1105.5	0.5	553	2161	0.0496
484.15	1386	1289.5	0.5	645	2805	0.0644

Stage Storage Curve



Groundwater Recharge Volume (GRV) Calculation

	ac	Area of HSG A soil that was replaced by impervious cover	0.40"
	ac	Area of HSG B soil that was replaced by impervious cover	0.25"
0.01	ac	Area of HSG C soil that was replaced by impervious cover	0.10"
	ac	Area of HSG D soil or impervious cover that was replaced by impervious cover	0.0"
0.10	inches	Rd = weighted groundwater recharge depth	
0.0011	ac-in	GRV = AI * Rd	
4	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):

Ground Water Recharge requirements will be met with the north infiltration basin

APPENDIX E – OPERATIONS AND MAINTENANCE PLAN

Northern Pass Transmission Project
Transition Station #6

Stormwater System Operations and Maintenance Plan

General Overview
Eversource has established an operations and maintenance (O&M) plan for the station post-construction stormwater management system in accordance with the New Hampshire Department of Environmental Services Stormwater Manual (2008) and will be implemented upon completion of construction as outlined below. Any required post construction stormwater management permits will be obtained and implemented by Eversource.

The station is located on Eversource owned property on Daniel Webster Highway, Bridgewater, NH 03264

Purpose & Goals
The purpose of this O&M Plan is to provide guidance for the implementation and documentation process of the station site stormwater management system to help conform with the corresponding regulatory agency approvals and permits. The guidance provided herein is the minimum required. The primary goal is to inform all the property managers about how the system operates and what maintenance items are necessary to protect the downstream storm drain system and waters. The secondary goal is to provide a practical, efficient means of maintenance planning and record keeping to verify permit compliance.

Responsible Parties
Eversource will be responsible for implementing the O&M Plan.

Eversource
13 Legends Drive
Hooksett, NH 03106

Maintenance Logs and Checklists
Eversource will keep a record of all maintenance procedures performed, date of inspection/ cleanings, etc. Copies of inspection reports and maintenance records shall be kept on site.

Forms
The following forms will be developed for annual maintenance. Copies of the forms will be kept on-site as part of the Post-Construction Stormwater Management Plan.

- Annual Checklist
- Quarterly Checklist
- Monthly Checklist

Training

Responsible operations and maintenance workers and contractors will be trained with a basic description of the purpose and function of the onsite stormwater management system as well as safety protocol and procedures, with annual up-dates, to provide that the workers tasked with maintaining the station site do so in accordance with the approved permit conditions. All workers that have maintenance duties will be adequately informed of their responsibilities. All sub-contractors (Vactor, landscaping, snowplowing, etc.) will be informed of special requirements and responsibilities.

Stormwater Management System

The onsite stormwater management system has several components that are shown on the Site Development Plans and they perform various functions in conveying and treating stormwater runoff. Refer to the Site Development Plans for locations and details for each of the stormwater system components. Regular operations and maintenance is critical to the long term success of the stormwater management system components. The stormwater system components are:

Stormwater Swales:

Onsite stormwater swales collect and convey stormwater runoff and are either lined with vegetation or riprap. The following is recommended for regular maintenance twice annually unless otherwise noted:

- Inspect for erosion, sediment accumulation, vegetation loss, and presence of invasive species.
- Perform periodic mowing; frequency depends on location and type of grass. Do not cut shorter than Water Quality Flow depth (maximum 4-inches).
- Remove debris and accumulated sediment, based on inspection.
- Removal of woody vegetation from embankments.
- Repair eroded areas, remove invasive species and dead vegetation, and reseed with applicable grass mix as warranted by inspection.
- For riprap lined swales, inspect and repair for erosion, displaced riprap, and remove accumulated sediment.
- Periodic mowing of vegetated swales.

Culverts:

Culverts convey stormwater runoff under driveways and consists of an open pipe end upstream and a flared end section downstream. It is typical that stormwater swales are located both upstream and downstream of the culvert and may have riprap outlet protection. The following is recommended for regular maintenance twice annually unless otherwise noted:

- Remove any accumulated sediment and debris in the culvert and also at the upstream and downstream ends that may be restricting flow though.
- Inspect and repair any damage and deterioration to the upstream and downstream swales and outlet protection.

Underdrains:
Onsite underdrains are located along the west perimeter of the transition station and turnaround pads. These underdrains discharge to a swale north of the transition station. Cleanouts are provided on the underdrains to provide access. The following is recommended for regular maintenance twice annually unless otherwise noted:

- Remove any accumulated sediment and debris in the underdrains through the cleanouts and outlets.
- Inspect and Repair any damage and deterioration to the outlet protection and downstream areas.

Storm Drainage System:
Onsite storm drainage system including conveyance pipes and flared end sections convey stormwater. The following is recommended for regular maintenance twice annually unless otherwise noted:

- Remove any accumulated sediment or debris at the outfalls.
- Inspect and repair any damage and deterioration to the conveyance pipes, catch basins, and riprap outlet protection.

Outfalls:
Storm drainage outfalls are the point stormwater discharges from pipe outlets and consist of a flared end section and riprap outlet protection. The following is recommended for regular maintenance twice annually unless otherwise noted:

- Remove any accumulated sediment or debris at the outfalls.
- Inspect and repair any damage and deterioration to riprap outlet protection.

Infiltration Basins:
The infiltration basins attenuate stormwater, provide water quality and groundwater recharge and consist of numerous components including a sediment forebay, outlet control structure, trash rack, outlet pipe, emergency spillway, anti-seep collar, etc. The following is recommended for regular maintenance twice annually unless otherwise noted:

- Remove any trash and debris.
- Periodic mowing of embankments.
- Removal of woody vegetation from embankments.
- Removal of debris from outlet structures. Removal of accumulated sediment.
- Inspection and repair of embankments, outlet structures, and appurtenances.
- Inspect for erosion, sediment accumulation, vegetation loss, and presence of invasive species
- Inspection of infiltration basin components at least twice annually, and following any rainfall event exceeding 2.5 inches in a 24 hour period, with maintenance or rehabilitation conducted as warranted by such inspection.
- Inspection of pretreatment measures at least twice annually and removal of accumulated sediment as warranted by inspection, but no less than once annually.

Station Yard Stone:
The station yard stone within the station yard can become compacted and eroded over time. The following is recommended for regular maintenance twice annually unless otherwise noted:

- Inspect for and repair any erosion in the yard, on access roads, and at the perimeter of the gravel areas.
- As the gravel areas become compacted, scrape off top layer to subgrade elevation and install new gravel surfacing layer at design elevation and pitch.

Spill Control
Eversource will have a spill control program. That program will be updated annually and incorporated into the employee-training program.

Disposal:
For all removed sediment, debris, trash, etc. from the stormwater management system during operations and maintenance shall be disposed of properly and legally by a New Hampshire Licensed hauler. Road sand may be reused for winter sanding, but may not be stored on-site.

Pesticides:
Northern Pass anticipates that vegetation management activities will be performed by Eversource. Work will be performed in accordance with Eversource's vegetation management program, which currently employs only mechanical means for controlling vegetation within the Eversource rights of way. Eversource does not currently plan to use herbicides as part of its vegetation management program, and as indicated in the Northern Pass application for a Presidential Permit (at page 52), all vegetation management and maintenance will be carried out in accordance with the New Hampshire Division of Forest and Lands Best Management Practice for utility maintenance. Herbicides will not be used before or during construction of the Northern Pass.

* * * * *

APPENDIX F – FEMA FLOOD INSURANCE RATE MAP

drainage boundaries or small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' National Geodetic Vertical Datum of 1929 (NGVD 29). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations tables in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations tables should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was New Hampshire State Plane 2800. The **horizontal datum** was NAD 83, GRS80 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the National Geodetic Vertical Datum of 1929. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

Spatial Reference System Division
National Geodetic Survey, NOAA
Silver Spring Metro Center
1315 East-West Highway
Silver Spring, Maryland 20910
(301) 713-3191

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from U.S. Geological Survey Digital Orthophoto Quadrangles produced at a scale of 1:12,000 from photography dated 1998 or later. These images were recast by the New Hampshire Geographically Referenced Analysis and Information Transfer System (NH GRANIT) onto the New Hampshire State Plane coordinate system.

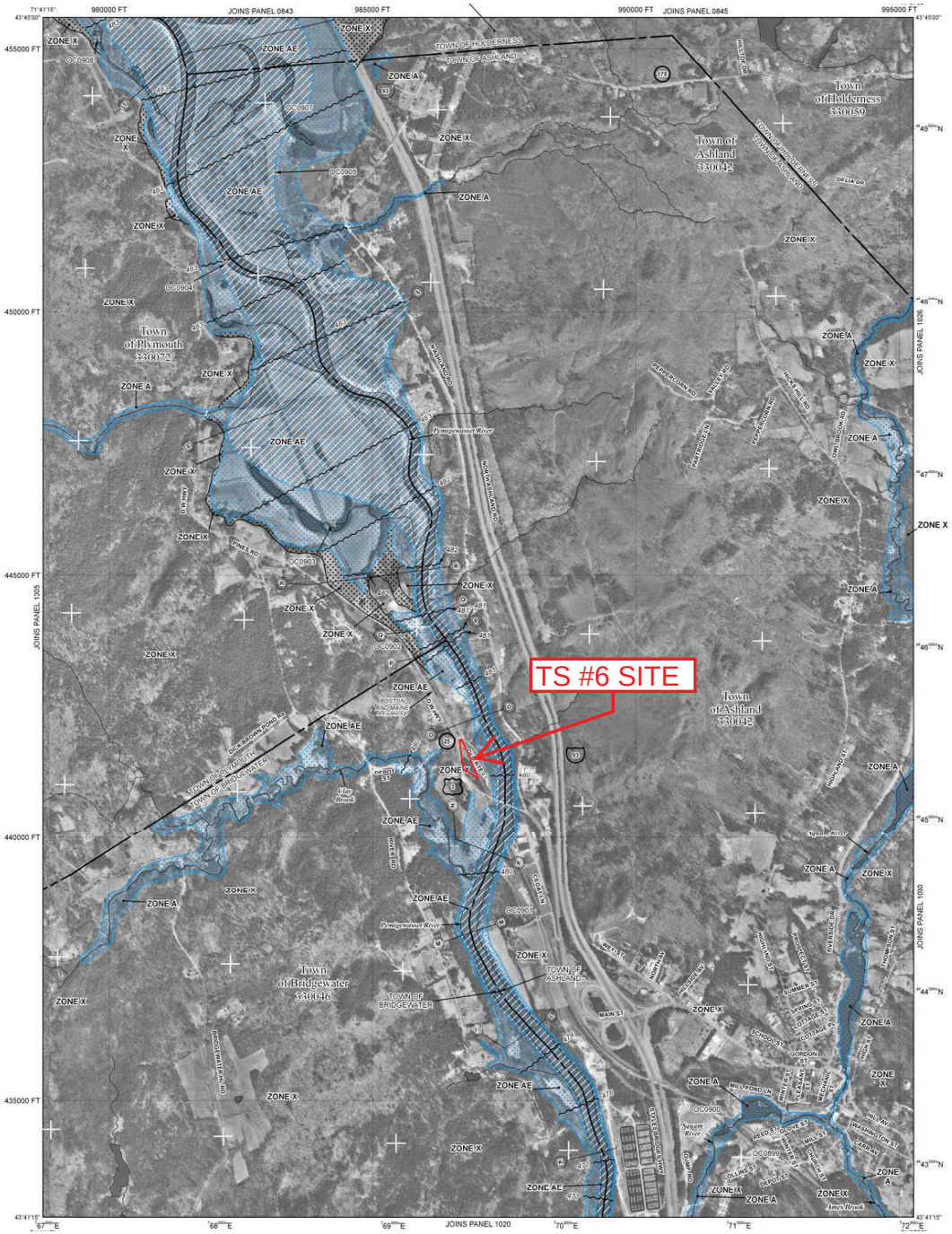
This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov.



The 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X — Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X — Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D — Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary

0.2% annual chance floodplain boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

~~~ 513 ~~~ Base Flood Elevation line and value; elevation in feet*

(EL 987) Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the National Geodetic Vertical Datum of 1929

(A)———(A) Cross section line

(23)- - - - - -(23) Transect line

87°07'45", 32°22'30" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere

7076000 N 1000-meter Universal Transverse Mercator grid values, zone 18

600000 FT 5000-foot grid ticks: New Hampshire State Plane coordinate system, FIPSZONE 2800, Transverse Mercator projection

DX5510 × Bench mark (see explanation in Notes to Users section of this FIRM panel)

● M1.5 River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
FEBRUARY 20, 2008

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1010E

FIRM

FLOOD INSURANCE RATE MAP

GRAFTON COUNTY, NEW HAMPSHIRE
(ALL JURISDICTIONS)

PANEL 1010 OF 1185

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ASHLAND, TOWN OF	330042	1010	E
BRIDGEWATER, TOWN OF	330046	1010	E
HOLDERNESS, TOWN OF	330059	1010	E
PLYMOUTH, TOWN OF	330072	1010	E

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
33009C1010E

EFFECTIVE DATE
FEBRUARY 20, 2008
~~~

APPENDIX G – SOIL SURVEY REPORTS (BY OTHERS)

Northern Pass Transmission Project

Site-Specific Soil Survey Report for the Bethlehem and Bridgewater Transition Stations

Prepared For:
Northern Pass Transmission, LLC

Submitted On:
June 9, 2015

Prepared By:
Normandeau Associates, Inc.
25 Nashua Road
Bedford, NH 03110

www.normandeau.com

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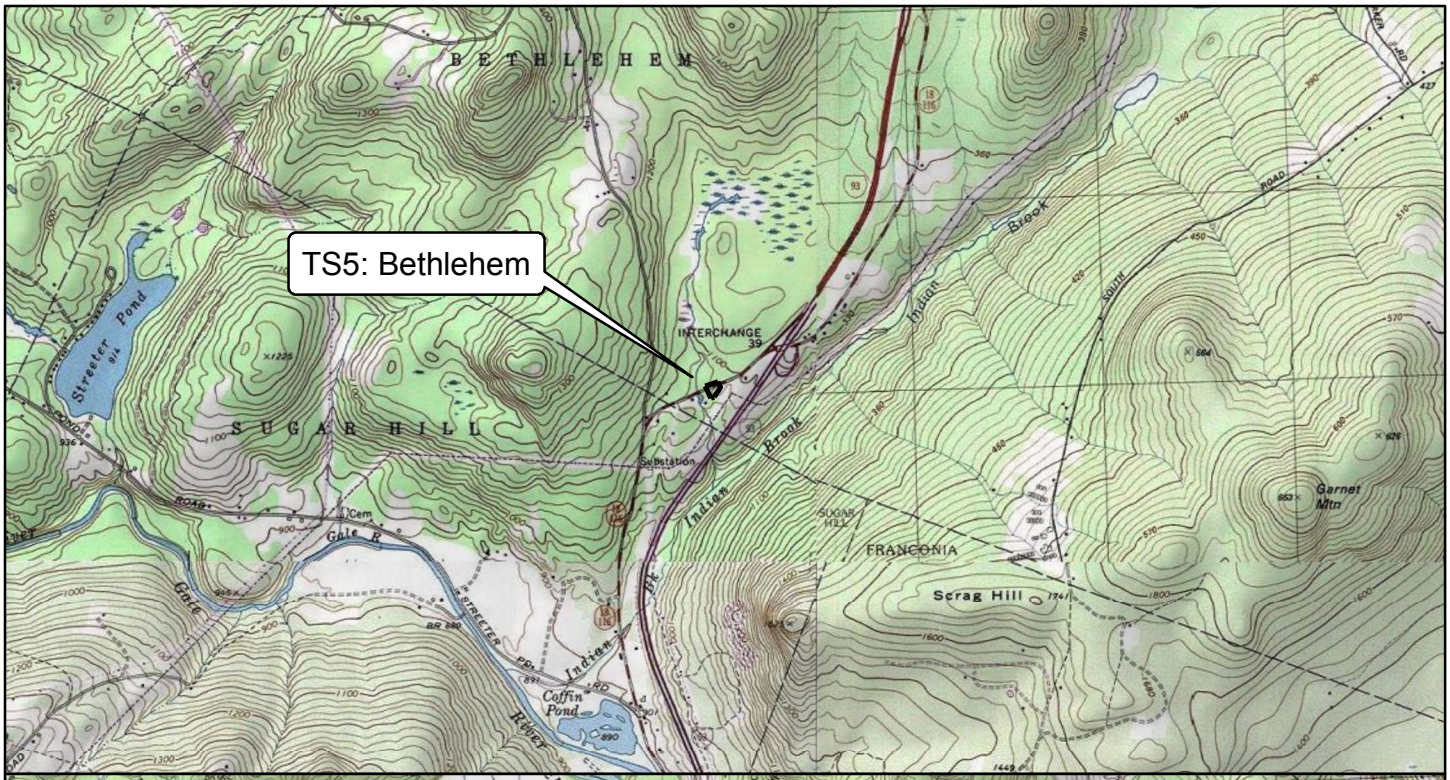
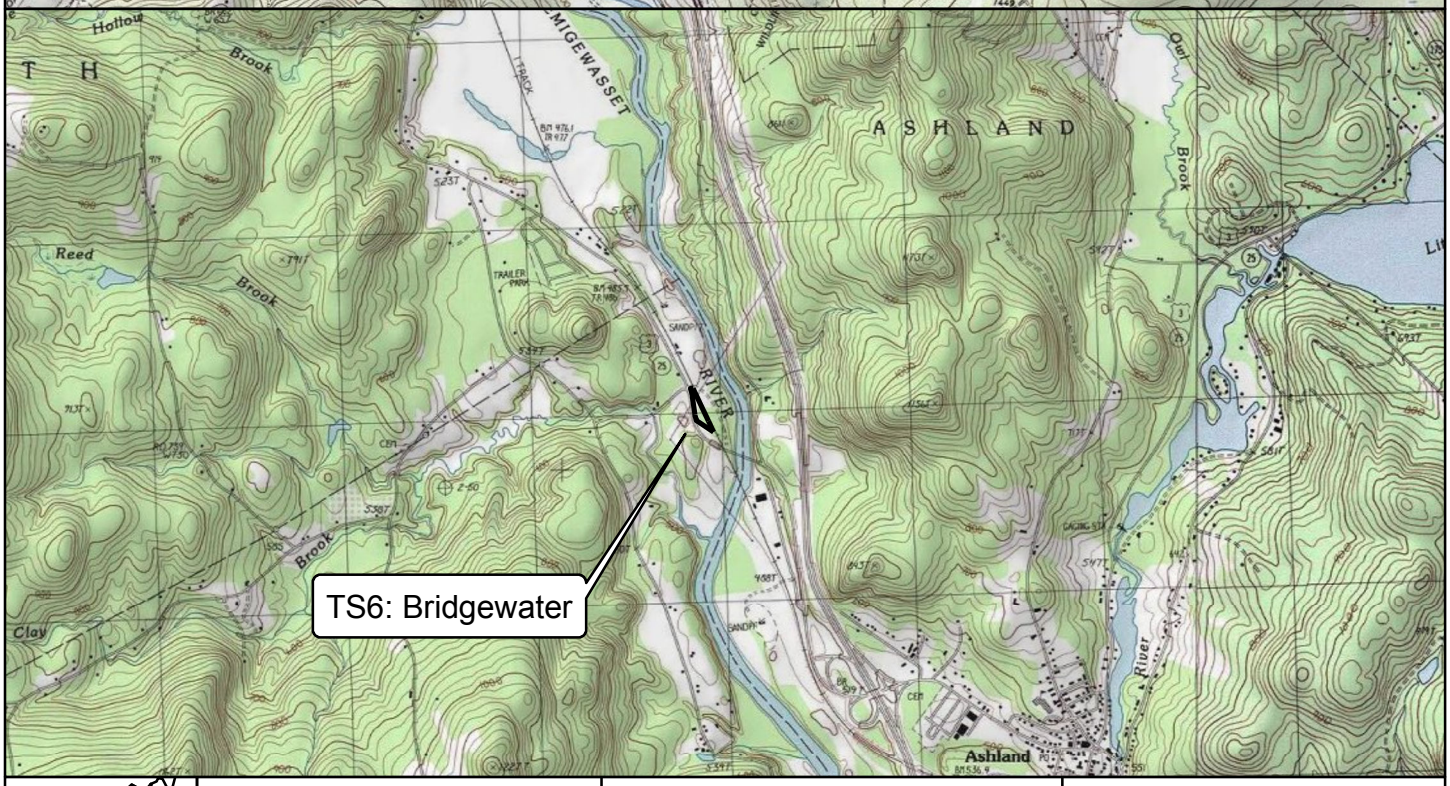
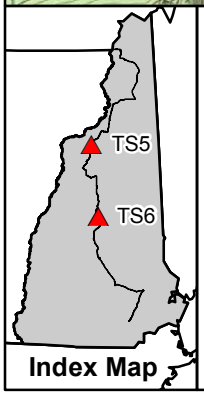
1.0 Introduction

Normandeau Associates, Inc. (Normandeau) has reviewed and mapped the soils in two areas under consideration for four proposed Transition Stations located in Bethlehem, NH and Bridgewater, NH (Figure 1) associated with the Northern Pass Transmission (NPT) project. This report is summarizes the soil surveys completed at each site.

These sites were previously surveyed for wetlands by Normandeau wetland scientists this year. Information obtained during the soil surveys indicates that wetland boundaries were consistent with hydric soil boundaries.







N

Data Provided By: Cornerstone Energy Inc.
ESRI & GRANIT

1:40,000

0 0.5 1 Kilometers

0 0.5 1 Miles

TS5 & TS6 SOIL SURVEY SITE LOCATION

Bethlehem & Bridgewater, NH

STATE OF MAINE
IAN BROADWATER
NO. 305
CERTIFIED
SOIL SCIENTIST

EVERSOURCE ENERGY

NORMANDEAU environmental consultants

G:\Projects\GIS_Projects_2015\SunEdison_Somerset\PreliminaryGIS\MXD\NP_T5_T6_SiteLocation_060515.mxd

2.0 Purpose

The purpose of the soil survey is to provide a soil map of each site showing limitations to development, including hydric soil boundaries where observed, for inclusion in an Alteration of Terrain Permit application that is anticipated to be filed for the project. This survey is appropriate for use in planning site design for stormwater runoff and erosion control. Information is also provided regarding limitations to the potential for site development including roads, shallow excavations, and stormwater detention. It is important to note that soils considered appropriate (non-limiting) for one use may be considered limiting for another use. Soil map units described in this report have been influenced by the intended use of the soil map; consequently, the information provided may not be adequate for uses other than for those for which the soil map was originally developed.

This soil narrative and accompanying soil survey map have been completed in accordance with the *Site Specific Standards for New Hampshire and Vermont* (SSSNNE 2011). No other warranty, expressed or implied, is made. This map product is within the technical standards of the National Cooperative Soil Survey. It is a special purpose product, intended for the assessment of site limitations to development of the site. It was produced by professional soil scientists, and is not the product of the USDA Natural Resources Conservation Service (NRCS). There are maps for each site that accompany this report.

Data provided on soil series are based on interpretation of published information by the NRCS. Due to the complexity of the glaciated landscape in New Hampshire, variations in subsurface conditions may exist that were not evident during the project review. Should significant variations in subsurface conditions become evident during site development, re-evaluation of site conditions may be warranted based on the present findings of this report.

3.0 Methodology

3.1 Field Procedures

Certified Soil Scientists conducted the field reviews at the various sites. Ian Broadwater, a Maine-Certified Soil Scientist, with reciprocity to practice in New Hampshire, completed the fieldwork. Field observations were made using borings advanced by hand with a dutch auger and test pits dug with an excavator. Soil observations were made to either bedrock or to 60 inches, where feasible.

The general field procedures used to make this soil map follow those of the National Cooperative Soil Survey (Schoeneberger et al. 1998). The soils mapped are either established soil series used in the State of New Hampshire by the NRCS (USDA NRCS 2011) or are classified according to the NRCS classification system described in the *Disturbed Soil Mapping Unit Supplement for New Hampshire, DES AoT Site Specific Soil Maps* (SSSNNE 2011). Map unit descriptions are provided in Appendix A.

Soil test pit logs were completed for each test pit excavation. Soil test pit logs are provided in Appendix B. Test pits were located with a Trimble® GPS, which is capable of submeter accuracy. Soil map unit boundaries are approximate, as their placement is based on a combination of field observations and surveyed site topography.

3.2 Soil Map Units

The soil map units used for this survey are either consociations or complexes. Consociations are dominated by a single soil series and similar soils. Complexes consist of two or more dissimilar components that cannot be mapped separately and the named components are sufficiently different in either morphology or behavior that the unit cannot be considered a consociation. Map unit symbols in this survey are from the State Numerical Legend along with the soil series name. Slope phases are designated as a letter in the map unit symbol - A, B, C, D, and E - refers to slope class (Table 3-1).

Table 3-1. Slope Class

Slope Symbol	Standard Range
A	0-3%
B	3-8%
C	8-15%
D	15-25%
E	25-50%

The soil interpretations provided are based on information in the soil series descriptions and technical information provided by the NRCS web soil survey (Soil Survey Staff 2014a). All limitations and constraints invoked by the NRCS for such interpretations also apply to this soil survey.

The map units observed are described in Appendix A. These descriptions are within the NRCS range for each official Soil Series Description; however, they provide more detail as they are based on site-specific observations. Each map unit description includes information on soil taxonomic classification, general description, morphology, physical characteristics, inclusions, use, and management. The taxonomic classification follows Keys to Soil Taxonomy (Soil Survey Staff 2014a). Information on soil morphology and physical characteristics were obtained from the NRCS (Soil Survey Staff 2014b).

Disturbed soil map units were classified according to the New Hampshire State-Wide Numerical Soils Legend (NRCS 2011). Additional information on each map unit is provided according to criteria outlined in the disturbed soil supplement created by SSSNNE (2011), which utilizes the definition of disturbed land, including excavated and filled land, as defined by RSA 485 485-A:6, VIII; RSA 485-A: 17; and NHDES Env-Wq 1500. The map symbol for disturbed soil consists of two parts separated by a forward slash (/). The first part consists of the NRCS Disturbed Map Unit symbol (NRCS 2011) and a capital letter designating slope. The second part consists of symbols of the Disturbed Soil Supplement (SSSNNE 2011) and is composed of 5 lower case letters, which describe drainage class, parent material, restrictive/impervious layers, estimated Ksat, and estimated hydrologic soil group.

Consociation map units, in accordance with the standards, will have a minimum of 75% of the named soil or similar soils within that unit. The named soil will be the most common of all similar soils. The total number of dissimilar soils in any one mapping unit for either consociations or complexes should not exceed 25% of the map unit of which no more than 15%

is limiting. Similar soils are alike in most properties and share similar limitations such as depth to water table or content of organic matter. Dissimilar soils do not share limits of some important diagnostic properties of the named soil and may have different use or management requirements for a particular land use. It is important to note that some dissimilar soils are more limiting in their use than the named soil. For instance, an inclusion of somewhat poorly drained soils can occur within a well-drained soil map unit. A summary of potential inclusions of similar and dissimilar soils is provided for each map unit.

The hydrologic group identifies soils having the same runoff potential under similar storm conditions. Soil properties that influence runoff are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. Infiltration rate is the rate at which water enters the soil at the surface and is controlled by surface conditions. Transmission rate is the rate at which water moves in the soil and is controlled by soil properties.

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. Ksat values are based on soil characteristics in the field, particularly structure, consistence, porosity and texture (SSSNNE 2009). The Ksat values provided are from the typical pedon from the county that best reflected the soil and/or had the most acres of that soil. The data represents the range within the B and C horizons (SSSNNE 2009).

3.3 Hydric Soils

Hydric soils refer to those soil series the NRCS considers to be either poorly or very poorly drained. The NRCS (Soil Survey Staff, 2014b) defines hydric soil as "a soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part". The hydric soil boundary corresponds with the wetland boundary in the areas observed for this project. The hydric soil boundary was located with a Trimble® GPS unit and post processed for submeter accuracy. Impacts to wetlands come under the jurisdiction of the U.S. Army Corps of Engineers and New Hampshire Department of Environmental Services.

4.0 Summary of Findings

The following summarizes the results of the soil surveys at the seven sites. Soil map unit descriptions are provided in Appendix A; representative soil logs in Appendix B; NRCS soil series descriptions in Appendix C, and soil maps in Appendix D.

4.1 Bethlehem LL 3173

Overview

The proposed Bethlehem transition site is located off Route 18 west of the White Mountains. A majority of the site is a developed residential lot with a house and detached garage with woods along the perimeter. A portion of the site also encompasses a portion of an existing electrical transmission right-of-way (ROW) on the southeast side of the site.

The site slopes from the high point near the southwest corner down to the south and east. Slopes range from moderate (8 to 15%) to nearly level, where the house and garage are positioned. No bedrock was noted in any of the explorations. within 48 inches from the soil

surface. Wetlands were noted within the existing ROW, where previous disturbance has compacted or modified the soil structure, decreasing the infiltration rate.

Soil Mapping Results

Normandeau conducted a field review of the Bethlehem site on May 12, 2015 and May 21, 2015. The final survey area was 0.98 acres. Five map units were identified within the site. The natural soil series mapped that were mapped were formed within glacial-fluvial parent material. Table 4-1 summarizes the map units and their physical characteristics that were identified within the project site. Slope phases are not provided in Table 4-1 but are included in the site-specific soil maps in Appendix D.

A total of 4 test pits were evenly distributed across the site and located with a Trimble® GPS. The wetland boundary had been previously flagged and located in the field by Normandeau Associates, Inc.

Table 4-1. Bethlehem Transition Site - Summary of Soil Physical Characteristics

Map Unit	Hydrologic Group	Seasonal Water Table (SWT) Depth[1] (Inches)	Depth to Bedrock (Inches)	Drainage Class[2]	Ksat (in/hr)	Limitations
59-Waumbek fine sandy loam	B	>40	>60	MW	2.0-20.0	None[4]
255-Monodnock and Hermon Complex	B	>40	>60	W-SWE	0.6-6.0	None[4]
299-Udorthents, smoothed	Variable	4-40+	>60	MW- Well	NM/NR	None[4]

1. Seasonal water table ranges are provided from the NRCS. On-site conditions are expected to fall within these ranges based on test pit observations.
2. Drainage Classes:
   P- poorly drained; SP- somewhat poorly drained; MW- moderately well drained
   W- well drained; SE- somewhat excessively drained.
3. NM-not measured; NR-not reported.
4. See the summary at the end of this section for additional information.

Waumbek, Monodnock and Hermon soil are all derived from glacio-fluvial deposits. Hermon and Monodnock soils are somewhat excessively and well drained, respectively. Waumbek fine sandy loam is moderately well drained and was found downslope of the Hermon/Monodnock complex.

The lawn area of the parcel as well as the associated driveway were mapped as a Udorthent in a moderately to well drained condition. The A horizon in the lawn area was thicker in many places than the surrounding wooded area. Erosion from the lawn area was observed deposited above the native soil at TP-2. The Udorthent map units on the parcel are summarized in Table 4-1A.

Table 4-1A. Bethlehem Transition Site – Characteristics Summary of Disturbed Soil Map Units (Estimated Physical Characteristics[1])

Characteristic	299B/cbaaa	299C/cbaaa
Drainage Class	c- estimated to be well drained.	c- estimated to be well drained.
Parent Material	b-glacial-fluvial deposits	b-glacial-fluvial deposits
Restrictive/Impervious layer	a- none	a-none
Estimated ksat	a- high	a-high
Hydrologic Group	d- Group A	c- Group A

1. Society of Soil Scientists of Northern New England. 2011. Site-Specific Soil Mapping Standards for New Hampshire and Vermont. Version 4.0. SSSNNNE Special Publication No. 3. Durham, NH.

Summary

Limitations to development within the site consist of moderate-steep slopes near the eastern property line. Course fragments within the C horizon can make these soils difficult to excavate without properly sized machines. Wetlands are also present to the north, south, and east of the parcel on adjacent lands and may present constraints to development.

4.2 Bridgewater LL 5805

Overview

The site is located west of the Pemigewasset River. The site is accessed from Siding Road, which is off US Route 3. The site is fairly level. It appears that one portion of the site was mined for borrow and another portion was filled with top soil, most likely during the construction of Route 3. The site is bordered by a railroad bed along the east side and Route 3 on the west side. Siding Road is located on the north side of the site while forested area is present on the southern half of the site and continues to the south.

Soil Mapping Results

Normandeau conducted an evaluation of soils at the site on May 12, 2015. A second site visit was conducted to complete test pits on May 21, 2015. The final survey area was approximately 2.21acres in size. Four test pits were dug and numerous soil borings were completed with a dutch auger throughout the site. Four soil map units have been identified within the site and with all but Adams loamy fine sand wereanthropogenic soil map units.

Two areas of Udorthents were mapped with slightly different characteristics. The northern-most Udorthent map unit had 11 inches of fill over the native soil. The fill consisted of fine sandy loam with 5% course fragments as gravel and cobbles. This map unit also includes portions of the elevated road bed along the west side of the site. The road bed was constructed of fill or borrow.

The second Udorthent map unit consisted of 20 inches to 29 inches of non-native (fill) soil over the natural soil profile (Adams loamy fine sand). The fill was observed to be typical of an A horizon in a glacio-fluvial derived soil. It is theorized that the A horizon was removed from the road footprint for construction and was deposited in this area that that time.

The fourth map unit was a man-made Udipsammet. The area designated as the Udipsammet Unit (300B) appears to have been used in the past a borrow pit and is several feet below the surrounding landscape. The original A and B soil horizons are generally absent. Consequently, the water table was observed at 28 inches below ground surface at TP-2. Test pit walls collapsed during the excavation of TP-2 due to the lack of fines and structure in the profile.

Table 4-2 summarizes the map units and their physical characteristics within the project site. Slope phases are not provided but are included in the detailed summary on each map unit provided in Appendix A.

Table 4-2. Bridgewater Transition Station- Summary of Soil Physical Characteristics

Map Unit	Hydrologic Group	Seasonal Water Table Depth[1] (Inches)	Depth to Bedrock (Inches)	Drainage Class[2]	Ksat (in/hr)	Limitations
36- Adams	A	>40	>60	SE	6-100	None
299-Udorthent/ bbaaa[3]	A[4]	>40	>60	SE-W	NM/NR	None
299/Udorthent/cbaaa[3]	A[4]	>40	>60	SE-W	NM/NR	None
300/Udipsammet/bbaab[3]	B[4]	16-40	>60	MW	NM/NR	Lack of structure

1. Seasonal water table ranges are provided from the NRCS. On-site conditions are expected to fall within these ranges based on test pit observations.
2. Drainage Classes:
   P- poorly drained; SP- somewhat poorly drained; MW- moderately well drained
   W- well drained; SE- somewhat excessively drained; E- excessively drained.
3. NM-not measured; NR-not reported.
4. Physical characteristics of disturbed land are estimated.

The Udorthent map units on the parcel are summarized in Table 4-2A.

Table 4-2A. Bridgewater Transition Site – Characteristics Summary of Disturbed Soil Map Units (Estimated Physical Characteristics[1])

Characteristic	299A/bbhaa	299B/cbaaa	300B/dbaab
Drainage Class	b- estimated to be somewhat excessively drained.	c- estimated to be well drained.	d-estimated to be moderately well drained.
Parent Material	b-glacial fluvial deposits	b-glacial fluvial deposits	b-glacial fluvial deposits
Restrictive/Impervious layer	h- man-made impervious surface	a- none	a- none
Estimated ksat	a- high	a-high	a-high
Hydrologic Group	a- Group A	a- Group A	b- Group B~~A~~

1. Society of Soil Scientists of Northern New England. 2011. Site-Specific Soil Mapping Standards for New Hampshire and Vermont. Version 4.0. SSSNNNE Special Publication No. 3. Durham, NH.
2. Physical characteristics of disturbed land are estimated.

Summary

Adams loamy fine sand is excessively to somewhat excessively drained. The northern Udorthent map unit (299A) is likely somewhat excessively drained to well drained as the surface of the area has compacted from use as vehicle parking and course fill composes the top horizon on the unit. The compaction of the fill likely results in most water leaving the unit via sheet flow. With the exception of the Udipsammet map unit, any plantings in the other units (299A, 299B, and Adams) would need to be watered on a regular basis to survive the drainage conditions of these units.

The lack of fines and structure in the Udipsammet map unit may cause issues with construction of foundations as wall collapse was observed during test pit completion in the unit. These characteristics should be considered during the design of any buildings with foundations on the Udipsammet map unit (300B).

5.0 References

Schoeneberger, P.J., Wysocki, D.A., Benham, E.C., and Broderson, W.D. 1998. Field book for describing and sampling soils. Natural Resources Conservation Service, USDA, National Soil Survey Center, Lincoln, NE.

Society of Soil Scientists of Northern New England. 2009. Ksat Values for New Hampshire Soils. SSSNNE Special Publication No. 5. September, 2009. Durham, NH.

Society of Soil Scientists of Northern New England. 2011. Site-Specific Soil Mapping Standards for New Hampshire and Vermont. Version 4.0. SSSNNNE Special Publication No. 3. Durham, NH.

Soil Survey Staff. 2014a. Keys to Soil Taxonomy, 12th ed. USDA-Natural Resources Conservation Service, Washington, DC.

Soil Survey Staff. 2014b. Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Accessed July and August 2014.Available online at http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm.

USDA Natural Resources Conservation Service. 2011. New Hampshire State-Wide Numerical Soils Legend. Issue #10. Durham, NH.

Appendix A

Map Unit Descriptions

36B—Adams loamy sand, 3 to 8 percent slopes.

This soil is very deep, gently sloping, and excessively drained. It is on sandy terraces and outwash plains along streams and rivers. The areas are mainly long and narrow and range from 5 to 25 acres in size (fig. 18).

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer: 0 to 6 inches, dark brown loamy sand

Subsoil: 6 to 10 inches, strong brown loamy sand 10 to 26 inches, light yellowish brown sand

Substratum: 26 to 65 inches, pale yellow sand

Some areas of this Adams soil have a gravelly surface layer or a surface layer of fine sandy loam. Inclusions Included with this soil in mapping are small depressions or drainageways of moderately well drained Croghan soils or poorly drained Kinsman soils. Areas of excessively drained Colton soils and well drained Groveton soils are throughout this unit. Also included are small areas with slopes of less than 3 percent or more than 8 percent and areas with surface stones and boulders 5 to 30 feet apart. Included soils make up less than 15 percent of this unit.

Major properties of the Adams soil Permeability: Rapid in the surface layer and subsoil; very rapid in the substratum Available water capacity:

Very low Depth to bedrock: More than 65 inches

Depth to dense basal till: More than 65 inches

Depth to water table: More than 6 feet Potential frost action: Low Flood hazard: None Most areas of this soil were farmed, but many have reverted to woodland. A few areas are farmed or are used for residential and industrial development.

59C—Waumbek loamy sand, 8 to 15 percent slopes, very stony

This soil is very deep, strongly sloping or rolling, and moderately well drained. It is on glaciated valleys and hilltops. The areas are irregular in shape and range from 5 to 50 acres in size. Stones are generally 5 to 30 feet apart and cover from less than 1 percent to 3 percent of the surface.

The typical sequence, depth, and composition of the layers of this soil are as follows— Surface layer: 1 inch to 0, slightly decomposed needles, moss, leaves, and twigs 0 to 4 inches, black partially decomposed herbaceous and woody material

4 to 9 inches, light brownish gray loamy sand

Subsoil: 9 to 10 inches, dark reddish brown loamy sand 10 to 13 inches, dark reddish brown cobbly loamy sand 13 to 20 inches, strong brown very cobbly loamy sand

20 to 25 inches, dark yellowish brown very cobbly loamy sand with gray mottles

Substratum: 25 to 41 inches, dark grayish brown very cobbly loamy sand 41 to 65 inches, grayish brown very cobbly loamy sand. Some areas of this unit have a surface layer of loamy fine sand.

Inclusions Included with this unit are low mounds or ridges of somewhat excessively drained Hermon soils, nearly level areas of poorly drained Lyme and Moosilauke soils in depressions and along narrow drainageways, and small areas with slopes of less than 8 percent or more than 15 percent. Also included are a few areas that have been cleared of surface stones for farming. A few areas have surface stones less than 5 feet apart. The included soils make up about 15 percent of this unit.

Major properties of the Waumbek soil

Permeability: Moderately rapid to rapid in the surface layer and subsoil; rapid in the substratum Available water capacity: Very low

Depth to bedrock: More than 65 inches

Depth to dense basal till: More than 65 inches Depth to water table: 1.5 to 2.5 feet from November through May

Potential frost action: Moderate

Flood hazard: None

Most areas of this soil are forested. A few areas have been cleared for farming, but many of these are reverting to woodland. Other areas have been used for residential or commercial developments.

255C—Monadnock and Hermon soils, 8 to 15 percent slopes, very stony This unit is on very deep, rolling glaciated hilltops and mountainsides. It consists of well drained Monadnock soils and somewhat excessively drained Hermon soils. The areas are irregular in shape and range from 5 to 125 acres in size. Stones and boulders are 5 to 30 feet apart and cover from less than 1 percent to 3 percent of the surface. Some areas are mainly Monadnock soils, some areas are mainly Hermon soils, and some are both soils. The Monadnock and Hermon soils were mapped together because they have no major differences in use and management. The total acreage of the unit is about 45 percent Monadnock soils, 40 percent Hermon soils, and 15 percent other soils.

The typical sequence, depth, and composition of the layers of the Monadnock soil are as follows—
Surface layer: 0 to 4 inches, dark grayish brown fine sandy loam; 4 to 6 inches, gray fine sandy loam

Subsoil: 6 to 10 inches, yellowish red fine sandy loam 10 to 18 inches, yellowish brown very fine sandy loam 18 to 23 inches, light olive brown fine sandy loam

Substratum: 23 to 65 inches, pale olive loamy sand

The typical sequence, depth, and composition of the layers of the Hermon soil are as follows—

Surface layer: 0 to 5 inches, dark grayish brown fine sandy loam 5 to 7 inches, light gray fine sandy loam Subsoil: 7 to 15 inches, dark yellowish brown gravelly fine sandy loam 15 to 22 inches, light olive brown gravelly loamy sand

Substratum: 22 to 65 inches, grayish brown very gravelly loamy sand

Some areas of Hermon soils have a surface layer of loamy sand. Inclusions Included with this unit are small areas with slopes of less than 8 percent or more than 15 percent. In depressions and along narrow drainageways are moderately well drained Waumbek soils and poorly drained Lyme or Moosilauke soils. Some areas have surface stones less than 5 feet apart. The included soils make up about 15 percent of this unit.

Major properties of the Monadnock soil

Permeability: Moderate in the surface layer and subsoil; moderately rapid in the substratum

Available water capacity: Moderate Depth to bedrock: More than 65 inches Depth to dense basal till: More than 65 inches

Depth to water table: More than 6 feet

Potential frost action: Low Flood hazard: None

Major properties of the Hermon soil

Permeability: Rapid throughout Available water capacity: Low

Depth to bedrock: More than 65 inches

Depth to dense basal till: More than 65 inches Depth to water table: More than 6 feet

Potential frost action: Low Flood hazard: None

Most areas of this unit are forested. A few areas are used as pasture, and some areas have been used for residential development.

All map unit descriptions were obtained from the Soil Conservation Services Grafton County Soil Survey, 1998. See Appendix C.

Disturbed Soil Map Units[1]

299- Udorthents, smoothed
300- Udipsamments
399- Rock Outcrop
400- Udorthents, sand or gravelly

1 USDA Natural Resources Conservation Service. 2011. New Hampshire State-Wide Numerical Soils Legend. Issue #10. Durham, NH.

500- Udorthents, loamy
727- Rubble land
799A - Urban land-Canton Complex

299- Udorthents, smoothed: land that has been cut and filled to create large level or nearly level areas such as building lots and roads. Soil material making up this area are generally from the surrounding area.

300- Udipsamments: soils are characterized by textures of loamy fine sand to sand and gravel. Commonly a sand pit. Inclusions: Udorthents, smoothed; Udorthents, sand or gravelly; rubble land

399- Rock outcrop: exposed bedrock.

400- Udorthents, sand or gravelly: soils include very gravelly sand, very gravelly loamy sand, sand or loamy sand that may have lenses of loamy very fine sand or finer. These soils that have been excavated for sand and gravel. Seasonal water table is generally greater than 40”. Inclusions: rubble land, Udorthents, smoothed, Udorthents loamy, Udipsamments.

500- Udorthents, loamy: soils have textures that are sandy loam, loam or silt loam. The areas have been excavated down to the loamy underlying material. Inclusions: Udipsamments, Udorthents sand or gravelly, Udorthents smoothed, rubble land.

727- Rubble land: stones, boulders and soil have been sorted and piled within excavated gravel pit or adjacent to made land.

Appendix B

Appendix B-1

Bethlehem Transition Station Test Pit Logs

Soil Observation Logs Abbreviations			
Abbreviation	**Soil Texture**	**Consistence**	**Miscellaneous**
S	Sandy		
FS	Fine Sand		
FSL	Fine Sandy Loam		
VFSL	Very Fine Sandy Loam		
CS	Coarse Sand		
GRY	Gravelly		
L	Loam		
SL	Sandy Loam		
FR		Friable	
EOE			Extent of Excavation

Cat 307C

Town, City, Plantation	Street, Road, Subdivision	Owner or Applicant Name
Bethlehem	1082 Profile Road	Northern Pass

SOIL PROFILE DESCRIPTION AND CLASSIFICATION (Location of Observation Holes Shown Above)

Observation Hole # TP-1 ☑ Test Pit ☐ Boring

1" Depth of organic horizon above mineral soil

Depth below mineral soil surface (inches)	Texture	Consistency	Color	Mottling
0–6		Organic		
6–12	F.S.L	V. friable	10YR 3/2	none
12–18	S.L.	friable	10YR 5/6	none
18–24	S.L. 5% C.f.s	dense	2.5Y 5/4	none
24–30	S.L. w/ 10% C.f.s as gravel, cobble, boulders	dense; massive structure	2.5Y 6/2	few conc. of 7.5YR 5/6
30–36				
36–42				
42–48		BOE @ 50" bgs		

Soil Profile	Classification Condition	Slope Percent	Limiting Factor Depth	☐ Groundwater ☑ Restrictive Layer ☐ Bedrock
		4	43"	

Soil Series Name: | Hydrologic Group:

Observation Hole # 2 ☐ Test Pit ☐ Boring

1" Depth of organic horizon above mineral soil

Depth below mineral soil surface (inches)	Texture	Consistency	Color	Mottling
0–6		Organic		
6–12	fsl	V. friable	10YR 3/2	none
12–18	fsl	" "	10YR 5/6	none
18–24	f.s.l.	friable	10YR 4/6	
24–30	L.S.	friable	2.5Y 5/6	
30–36	L.S. w/ 10% C.f.s	dense massive	2.5Y 6/2	few conc. of 10YR 5/6
36–42		@ 32" lense of fine sand and silt partially cemented		
42–48		BOE @ 51" bgs		

Soil Profile	Classification Condition	Slope Percent	Limiting Factor Depth	☐ Groundwater ☑ Restrictive Layer ☐ Bedrock
		8	26"	

Soil Series Name: | Hydrologic Group:

Observation Hole # 3 ☑ Test Pit ☐ Boring

2" Depth of organic horizon above mineral soil

Depth below mineral soil surface (inches)	Texture	Consistency	Color	Mottling
0–6		Organic matter		
6–12	F.S.L	V. friable	10YR 3/2	none
12–18	L.S.	friable	7.5YR 4/6	none
18–24	L.S w/ 10% C.f.s as gravel cobbles, boulders	dense	2.5Y 5/6	few conc. of 10YR 5/6
24–30				
30–36				
36–42				
42–48		BOE is @ 49" bgs		

Soil Profile	Classification Condition	Slope Percent	Limiting Factor Depth	☐ Groundwater ☐ Restrictive Layer ☐ Bedrock
			"	

Soil Series Name: | Hydrologic Group:

Observation Hole # 4 ☑ Test Pit ☐ Boring

2" Depth of organic horizon above mineral soil

Depth below mineral soil surface (inches)	Texture	Consistency	Color	Mottling
0–6	f.s.l	Organic matter		
6–12		V. friable	10YR 3/2	none
12–18	f.s.l.	" "	7.5YR 4/6	none
18–24	f.s.l.	friable	10YR 5/4	none
24–30	L.S. w/ 5% C.f.s as gravel, cobbles	dense massive	2.5Y 6/2	none
30–36	Med. Sand	loose; single grain	2.5Y 5/1	Mg+/Fe+ stainy in bands 44" bgs discontinuous
36–42				
42–48		BOE @ 48" bgs		

Soil Profile	Classification Condition	Slope Percent	Limiting Factor Depth	☐ Groundwater ☐ Restrictive Layer ☐ Bedrock
			"	

Soil Series Name: | Hydrologic Group:

Soil Scientist/Site Evaluator Signature: [signature] | CSS/LSE#: ME 305/230 | Date: 5/20/15

Appendix B-2

Bridgewater Transition Station Test Pit Logs

Town, City, Plantation	Street, Road, Subdivision	Owner or Applicant Name
Bridgewater	John Jenness Rd.	Northern R&S

SOIL PROFILE DESCRIPTION AND CLASSIFICATION

(Location of Observation Holes Shown Above)

Observation Hole # 1 ☑ Test Pit ☐ Boring

0" Depth of organic horizon above mineral soil

Depth below mineral soil surface (inches)	Texture	Consistency	Color	Mottling
0–6	L.S. (fill)	V. friable	10YR 5/3	none
6–12	F.L.S. *	friable	2.5Y 5/4	none
12–18	Med. sand	loose; single grained	2.5Y 4/4	none
18–24	fine sand (no c.f.s)	loose; single grained	2.5Y 5/2	none
30–42		* - 5% c.f.s as gravel and cobbles (fill)		
48		BOE @ 54"		

Soil Profile	Classification Condition	Slope 2 Percent	Limiting Factor ____" Depth	☐ Groundwater ☐ Restrictive Layer ☐ Bedrock

Soil Series Name: Filled area

Hydrologic Group:

Observation Hole # 2 ☑ Test Pit ☐ Boring

0" Depth of organic horizon above mineral soil

Depth below mineral soil surface (inches)	Texture	Consistency	Color	Mottling
0–6	f.l.s.	V. friable	10YR 5/2	none
6–12	f.l.s.	V. friable	10YR 5/4	none
12–18	m. sand (no c.f.s)	loose; single grained	10YR 6/3	none
30–42				Few redox of 7.5YR 5/6 @ 20" - 22" bgs
48		BOE @ 54" bgs		

Soil Profile	Classification Condition	Slope 3 Percent	Limiting Factor None Depth	☐ Groundwater ☐ Restrictive Layer ☐ Bedrock

Soil Series Name: Excavated area

Hydrologic Group:

Observation Hole # 3 ☑ Test Pit ☐ Boring

____" Depth of organic horizon above mineral soil

Depth below mineral soil surface (inches)	Texture	Consistency	Color	Mottling
0–6	f.s.l.	V. friable	10YR 3/2	none
6–12	s.l.	V. friable	10YR 5/6	none
12–18	L.S.	loose; single grained	10YR 6/6	none
30–48	L.S.	loose; massive	2.5Y 6/4 left bands starting @ 30" bgs (silt mound 1/2" wide, shattered)	
48	BOE @ 64" bgs	= 1/2 @ 34" 1/2 @ 64"		

Soil Profile	Classification Condition	Slope 2 Percent	Limiting Factor None Depth	☐ Groundwater ☐ Restrictive Layer ☐ Bedrock

Soil Series Name: Adams

Hydrologic Group:

Observation Hole # 4 ☑ Test Pit ☐ Boring

1" Depth of organic horizon above mineral soil

Depth below mineral soil surface (inches)	Texture	Consistency	Color	Mottling
0–1		organic		
1–6	f.l.s.	V. friable	10YR 3/2	none
6–12	f.l.s.	" "	10YR 6/5	none
12–18	m. sand (no c.f.s)	loose; single grained	2.5Y 6/4	
24–30	fine sand (no c.f.s)	loose; massive	2.5Y 6/3	none

Soil Profile	Classification Condition	Slope Percent	Limiting Factor none Depth	☐ Groundwater ☐ Restrictive Layer ☐ Bedrock

Soil Series Name: Adams

Hydrologic Group:

Soil Scientist/Site Evaluator Signature

ME 305/230
CSS/LSE#

5/20/15
Date

Town, City, Plantation	Street, Road, Subdivision	Owner or Applicant Name
Bridgewater	John Jenness Road	NP

SOIL PROFILE DESCRIPTION AND CLASSIFICATION
(Location of Observation Holes Shown Above)

Observation Hole # B-1 ☐ Test Pit ☑ Boring

/ " Depth of organic horizon above mineral soil

Depth below mineral soil surface (inches)

Depth	Texture	Consistency	Color	Mottling
0				
6				
	f.s.l. (fill)	v. friable	10YR3/2	none
12				
18				
24				
	*f.s.l.	friable	10YR3/2	none
30	l.s.		10YR5/6	
36			2.5Y4/2	
42			BOE @	38"
48				

Soil Profile	Classification Condition	Slope Percent	Limiting Factor Depth	
		4	none "	☐ Groundwater ☐ Restrictive Layer ☐ Bedrock

Soil Series Name	Hydrologic Group

* natural soil profile begins @ 24"

Observation Hole # ______ ☐ Test Pit ☐ Boring

______ " Depth of organic horizon above mineral soil

Depth below mineral soil surface (inches)

Depth	Texture	Consistency	Color	Mottling
0				
6				
12				
18				
24				
30				
36				
42				
48				

Soil Profile	Classification Condition	Slope Percent	Limiting Factor Depth	
			"	☐ Groundwater ☐ Restrictive Layer ☐ Bedrock

Soil Series Name	Hydrologic Group

Observation Hole # ______ ☐ Test Pit ☐ Boring

______ " Depth of organic horizon above mineral soil

Depth below mineral soil surface (inches)

Depth	Texture	Consistency	Color	Mottling
0				
6				
12				
18				
24				
30				
36				
42				
48				

Soil Profile	Classification Condition	Slope Percent	Limiting Factor Depth	
			"	☐ Groundwater ☐ Restrictive Layer ☐ Bedrock

Soil Series Name	Hydrologic Group

Observation Hole # ______ ☐ Test Pit ☐ Boring

______ " Depth of organic horizon above mineral soil

Depth below mineral soil surface (inches)

Depth	Texture	Consistency	Color	Mottling
0				
6				
12				
18				
24				
30				
36				
42				
48				

Soil Profile	Classification Condition	Slope Percent	Limiting Factor Depth	
			"	☐ Groundwater ☐ Restrictive Layer ☐ Bedrock

Soil Series Name	Hydrologic Group

Soil Scientist/Site Evaluator Signature	CSS/LSE#	Date
	ME305/230	5/20/15

Appendix C

NRCS Soil Series Descriptions

LOCATION WAUMBEK NH+ME NY

Established Series
Rev. HRM-SALP-CAW
6/98

WAUMBEK SERIES

The Waumbek series consists of very deep, moderately well drained soils formed in stony, sandy till. They are on glaciated uplands. Permeability is moderately rapid or rapid in the solum and rapid in the substratum. Mean annual precipitation is about 40 inches, and mean annual temperature is about 44 degrees F.

TAXONOMIC CLASS: Sandy-skeletal, isotic, frigid Aquic Haplorthods

TYPICAL PEDON: Waumbek fine sandy loam - in a very stony, forested area. (Colors are for moist soil.)

0e--0 to 1 inch; hemic material with lesser amounts of sapric material.

Ap--1 to 8 inches; very dark grayish brown (10YR 3/2) fine sandy loam; weak fine granular structure; friable; many fine and medium roots; 5 percent rock fragments; very strongly acid; abrupt smooth boundary. (5 to 8 inches thick)

E--8 to 11 inches; gray (10YR 5/1) loamy fine sand; weak fine granular structure; friable; common fine and medium roots; 5 percent rock fragments; very strongly acid; abrupt broken boundary. (0 to 3 inches thick)

Bh--11 to 14 inches; black (5YR 2/1) fine sandy loam; moderate medium granular structure; friable; common fine and medium roots; 7 percent rock fragments; very strongly acid; abrupt broken boundary. (0 to 4 inches thick)

Bs1--14 to 20 inches; dark red (2.5YR 3/6) gravelly fine sandy loam; moderate medium granular structure; 60 percent friable and 40 percent weakly cemented (ortstein); common fine roots; 10 percent gravel, 10 percent cobbles, and 3 percent stones; very strongly acid; abrupt smooth boundary.

Bs2--20 to 27 inches; yellowish red (5YR 5/8) very gravelly loamy fine sand; weak fine granular structure; friable; few fine roots; 15 percent gravel, 15 percent cobbles, and 10 percent stones; common medium distinct light gray (10YR 6/1) iron depletions; very strongly acid; clear wavy boundary. (Combined thickness of the Bs horizon is 5 to 18 inches.)

C1--27 to 41 inches; light yellowish brown (10YR 6/4) very cobbly loamy sand; massive; friable; 30 percent cobbles, 10 percent gravel, and 5 percent stones; common medium distinct (2.5YR 5/8) masses of iron accumulation; strongly acid; clear smooth boundary. (0 to 30 inches thick)

C2--41 to 66 inches; light brownish gray (2.5Y 6/2) very cobbly loamy sand; massive; friable; 30 percent cobbles, 15 percent gravel, and 5 percent stones; strongly acid.

TYPE LOCATION: Carroll County, New Hampshire; town of Chatham in White Mountain National

Forest along Burnt Knoll Trail, about 400 feet from the intersection of Burnt Knoll Trail and Province Brook Trail. USGS North Conway, New Hampshire - Maine, 15 minute Quadrangle; latitude 44 degrees 9 minutes 13 seconds N. and longitude 71 degrees 2 minutes 28 seconds W., NAD 27.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 14 to 33 inches. Rock fragments range from 5 to 50 percent by volume in the solum and 35 to 70 percent in the substratum. Surface stoniness ranges from almost stone-free in cleared areas to very stony in other areas. Reaction of the solum and substratum ranges from very strongly acid through moderately acid.

The Ap horizon has hue of 10YR, value of 2 to 4, and chroma of 2 or 3. Undisturbed areas have an A horizon that has hue of 10YR, value of 2 to 3, and chroma of 1 or 2. Texture of the A or Ap horizon is fine sandy loam, sandy loam, loamy sand, and their gravelly or very gravelly analogues.

The E horizon, where present, is neutral or has hue of 7.5YR to 5Y, value of 4 to 6, and chroma of 0 to 2. Texture is sandy loam, fine sandy loam, loamy sand, or loamy fine sand and their gravelly or very gravelly analogues.

The Bh or Bhs horizons, where present, have hue of 2.5YR or 5YR, value of 2, 2.5, or 3, and chroma of 1 to 3.

The Bs horizon has hue of 2.5YR to 10YR, value and chroma of 3 to 8. Texture of the B ranges from fine sandy loam to coarse sand or their gravelly or very gravelly and cobbly or very cobbly analogues. Consistence is friable or very friable, but includes weakly cemented ortstein in less than half of each pedon.

The BC horizon, where present, has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 3 to 8. Texture and consistence is the same as the B horizons.

The C horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 to 4. Texture is dominantly the very gravelly, extremely gravelly, very cobbly, or extremely cobbly analogues of loamy sand or loamy fine sand, but ranges to coarse sand. Consistence ranges from loose to firm in place, but is friable on removal. Rock fragments commonly have silt coatings on their upper surfaces.

COMPETING SERIES: There are currently no other series in this family. The Acton, Becket, Duane, Hermon, Skerry, and Sunapee series are in related families. Acton soils are mesic. Becket and Skerry soils have firm compact substrata. Duane soils have a higher content of sand and less silt and formed in water sorted materials. Hermon soils do not have redoximorphic features. Sunapee soils have less rock fragments in the solum.

GEOGRAPHIC SETTING: Waumbek soils are on nearly level to moderately steep positions glaciated uplands. Slope ranges from 0 to 25 percent. The soils formed in stony, sandy glacial till derived mostly from granitic and schistose rocks. The climate is cool temperate and humid. The mean annual temperature ranges from 40 to 45 degrees F., mean annual precipitation ranges from 30 to 50 inches, and the frost-free season ranges from 90 to 140 days.

GEOGRAPHICALLY ASSOCIATED SOILS: The somewhat excessively drained Hermon soils are in a drainage sequence with Waumbek soils. The moderately well drained Sunapee soils are in similar landscape positions but contain fewer rock fragments. The poorly drained Lyme soils are in drainageways. Other common associated soils are the Adams, Colton, and Duane, which developed on adjacent water sorted sands and gravel deposits.

DRAINAGE AND PERMEABILITY: Moderately well drained. Permeability is moderately rapid or

rapid in the solum and rapid in the substratum.

USE AND VEGETATION: Mainly used for forestry. Principal species include eastern white pine, white spruce, red spruce, balsam fir, sugar maple, and paper birch. Areas cleared of surface stones are used mostly for hay and pasture.

DISTRIBUTION AND EXTENT: Maine, New Hampshire, and New York; MLRAs 143 and 144B. The series is of small extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts.

SERIES ESTABLISHED: Coos County, New Hampshire, 1937.

REMARKS: 1. Classification is updated to Sandy-skeletal, isotic, frigid Aquic Haplorthods with this revision.
2. Diagnostic horizons and features recognized in this pedon are:

a. Ochric epipedon - the zone from 0 to 8 inches (Oe and Ap horizons).
b. Albic horizon - the zone from 8 to 11 inches (E horizon).
c. Spodic horizons - the zone from 11 to 27 inches (Bh, Bs1, and Bs2 horizons).
d. Aquic feature - redoximorphic features in the zone from 20 to 41 inches (Bs2 and C1 horizons).

National Cooperative Soil Survey
U.S.A.

LOCATION HERMON ME+NH NY

Established Series
Rev. NRK-KJL-WDH
05/2013

HERMON SERIES

The Hermon series consists of very deep, somewhat excessively drained soils on upland till plains, hills and ridges. These soils formed in glacial till. Estimated saturated hydraulic conductivity is high or very high throughout the mineral soil. Slope ranges from 0 through 60 percent. Mean annual temperature is about 42 degrees F, and mean annual precipitation is about 40 inches at the type location.

TAXONOMIC CLASS: Sandy-skeletal, isotic, frigid Typic Haplorthods

TYPICAL PEDON: Hermon sandy loam, on a 20 percent south-facing slope in a very stony wooded area. (Colors are for moist soil.)

Oa -- 0 to 2 inches; black (5YR 2/1) sapric material; weak fine granular structure; very friable; many very fine and fine roots; extremely acid; abrupt wavy boundary. (Combined thickness of the O horizons is 0 to 6 inches.)

E -- 2 to 3 inches; pinkish gray (5YR 6/2) sandy loam; weak fine granular structure; friable; many very fine, fine and common medium roots; 10 percent rock fragments; extremely acid; abrupt wavy boundary. (0 to 6 inches thick.)

Bhs -- 3 to 9 inches; dark reddish brown (5YR 3/3) sandy loam; moderate fine granular structure; friable; common very fine and coarse roots; 10 percent rock fragments; strongly acid; abrupt wavy boundary. (0 to 7 inches thick.)

Bs1 -- 9 to 16 inches; strong brown (7.5YR 5/6) very gravelly sandy loam; moderate fine and medium granular structure; friable; common very fine, fine and medium roots; 35 percent rock fragments; strongly acid; clear wavy boundary.

Bs2 -- 16 to 32 inches; dark yellowish brown (10YR 4/6) extremely gravelly loamy sand; weak fine granular structure; very friable; few very fine and fine roots; 60 percent rock fragments; strongly acid; clear wavy boundary. (Combined thickness of the Bs horizon is 7 to 26 inches.)

C -- 32 to 65 inches; light olive brown (2.5Y 5/4) very gravelly coarse sand; single grain; loose; 45 percent rock fragments; moderately acid.

TYPE LOCATION: Oxford County, Maine; Town of Bethel; 1 mile north-northeast of Northwest Bethel and 1 mile east of the intersection of Chapman Brook and the Newry-Bethel town line; USGS Bethel topographic quadrangle; lat. 44 degrees 26 minutes 22 seconds N. and long. 70 degrees 50 minutes 18 seconds W., NAD 27.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 14 through 38 inches. Depth

to bedrock is more than 60 inches. Rock fragment content in individual horizons of the particle-size control section ranges from 15 through 75 percent, but the weighted average ranges from 35 to 65 percent. The rock fragments are typically about 1/3 cobbles and stones and 2/3 gravel. Some pedons have stones and boulders throughout the profile. The rock fragment content of the upper 10 inches of the mineral soil ranges from 5 through 50 percent. Stones and boulders cover from 0 through 15 percent of the surface. The surface and subsurface horizons range from extremely acid through strongly acid, the subsoil from extremely acid through moderately acid, and the substratum is strongly acid or moderately acid.

The O horizon is neutral or has hue of 2.5YR through 10YR, value of 2 through 3 and chroma of 0 through 2. It has weak very fine, fine, or medium granular structure. Consistence is very friable or friable. It is slightly through highly decomposed plant material (sapric, hemic, or fibric).

The Ap horizon, where present, has hue of 10YR, value of 3 or 4 and chroma of 2 or 3. Some pedons have an A horizon that can be 5 inches thick with hue of 10YR, value of 2 or 3 and chroma of 1 through 3. The A horizon is sandy loam, fine sandy loam, or coarse sandy loam in the fine-earth fraction. It has weak very fine through medium granular structure. Consistence is very friable or friable.

The E horizon has hue of 5YR through 2.5Y, value of 5 through 7, and chroma of 1 or 2. It is sandy loam, fine sandy loam, coarse sandy loam, loamy fine sand, or loamy sand in the fine-earth fraction. It has weak very fine through medium granular or subangular blocky structure, or it is weak thin or medium platy. Consistence is very friable or friable.

The Bhs horizon has hue of 2.5YR through 7.5YR, value of 2 through 3 and chroma of 1 through 3.

The Bh horizon, where present, has hue of 2.5YR through 7.5YR, value of 2 through 5 and chroma of 1 through 6.

The Bs horizon has hue of 5YR through 10YR, value of 3 through 6, and chroma of 3 through 8. A value or chroma of 3 is allowed in the Bs, but not both value and chroma of 3. They are fine sandy loam, sandy loam, coarse sandy loam, loamy sand, loamy coarse sand, sand, or coarse sand in the fine-earth fraction. The B horizons have weak through moderate, very fine through medium, granular or subangular blocky structure or are single grain or massive where cemented. Consistence ranges from loose through friable, but some pedons have discontinuous cementation.

The BC horizon, where present, has hue of 10YR or 2.5Y, value of 4 through 6 and chroma of 3 through 6. It is sandy loam, coarse sandy loam, loamy sand, loamy coarse sand, sand, or coarse sand in the fine-earth fraction. It has weak very fine through medium granular or platy structure or is single grain or massive. Consistence is loose through firm, but some pedons have discontinuous cementation.

The C horizon has hue of 10YR through 5Y, value of 4 through 7 and chroma of 1 through 4. It is loamy sand, loamy coarse sand, sand, or coarse sand in the fine-earth fraction. It has weak thin or medium platy structure, or it is single grain or massive. Consistence is loose through firm.

COMPETING SERIES: These are the Colton, Masardis, and Stetson series in the same family. Colton, Masardis, and Stetson soils have stratification in the lower part of the pedon.

GEOGRAPHIC SETTING: Hermon soils are on glaciated upland plains, hills, and ridges. Slope is dominantly 3 through 25 percent, but ranges from 0 through 60 percent. The soils formed in till derived mainly from granite and gneiss. The climate is humid and cool temperate. The mean annual precipitation

ranges from 34 through 50 inches, and mean annual temperature ranges from 38 through 46 degrees F. The frost-free season ranges from 90 through 160 days. Elevation ranges from 5 through 2800 feet above mean sea level.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Adams, Becket, Berkshire, Canaan, Colton, Monadnock, Stetson, Sunapee, and Waumbek soils. Adams soils are on sandy plains and have fine and medium sand throughout and have less rock fragments. Becket and Berkshire soils have less than 35 percent rock fragments and are in similar landscape positions. Canaan soils formed in similar material and are in higher landscape positions, but depth to bedrock is less than 20 inches. Colton and Stetson soils have stratification in the lower part of the pedon, and are in similar positions on the landscape. Monadnock soils have finer textured surface layers and are in similar positions on the landscape. Sunapee and Waumbek soils are moderately well drained and are in lower positions on the landscape.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Somewhat excessively drained. Estimated saturated hydraulic conductivity is high or very high throughout the mineral soil.

USE AND VEGETATION: Mainly used for forestry. Common tree species include beech, sugar maple, yellow birch, paper birch, gray birch, hemlock, white pine, red spruce, white spruce, and balsam fir. Some cleared areas have had stones removed and are used for pasture, hay, lowbush blueberries, and row crops. Other areas have been cleared of trees, but not stones, and are used for lowbush blueberries.

DISTRIBUTION AND EXTENT: Maine, New Hampshire, and northern New York (MLRAs 142, 143, and 144B). The series is of large extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts.

SERIES ESTABLISHED: Berkshire County, Massachusetts, 1923.

REMARKS: 1. This soil was previously classified in a loamy-skeletal family.
2. Diagnostic horizons and features recognized in this pedon are:
a. Albic horizon - the zone from 2 to 3 inches (E horizon).
b. Spodic horizon - the zone from 3 to 9 inches (Bhs and Bs1 horizons).

ADDITIONAL DATA: Source of data used in establishing taxonomic class and range in characteristics is Maine Agricultural Experiment Station, Technical Bulletin 46, 1971.

Soil Interpretation Record Numbers for the Hermon series are: Hermon, ME001; Hermon, bouldery, ME0091; Hermon, stony, ME0002.

National Cooperative Soil Survey
U.S.A.

LOCATION MONADNOCK NH MA ME NY VT

Established Series
Rev. HRM-SALP-SHG
03/2011

MONADNOCK SERIES

The Monadnock series consists of very deep, well drained soils that formed in a loamy mantle overlying sandy till on upland hills, plains, and mountain sideslopes. Saturated hydraulic conductivity is moderately high or high in the mineral solum and high or very high in the substratum. Slope ranges from 0 through 60 percent. Mean annual precipitation is about 40 inches, and mean annual temperature is about 45 degrees F.

TAXONOMIC CLASS: Coarse-loamy over sandy or sandy-skeletal, isotic over mixed, frigid Typic Haplorthods

TYPICAL PEDON: Monadnock fine sandy loam, on a 6 percent northeast facing slope in a wooded area. (Colors are for moist soil.)

A -- 0 to 3 inches; brown (10YR 4/3) fine sandy loam; weak fine granular structure; very friable; many fine roots; 2 percent gravel; very strongly acid; abrupt wavy boundary. (0 to 6 inches thick.)

E -- 3 to 5 inches; light brownish gray (10YR 6/2) sandy loam; weak fine granular structure; very friable; many fine roots; 2 percent gravel; very strongly acid; abrupt wavy boundary. (0 to 5 inches thick.)

Bs1 -- 5 to 14 inches; reddish brown (5YR 4/4) fine sandy loam; weak fine granular structure; very friable; common fine and few medium roots; 3 percent gravel, 5 percent cobbles; very strongly acid; clear wavy boundary.

Bs2 -- 14 to 23 inches; yellowish brown (10YR 5/6) fine sandy loam; weak fine granular structure; very friable; common fine and few medium roots; 8 percent gravel, 5 percent cobbles; strongly acid; abrupt wavy boundary. (Combined thickness of the Bh, Bhs, and Bs horizons is 7 to 30 inches.)

2C -- 23 to 65 inches; olive (5Y 5/3) gravelly loamy sand; massive; friable; few fine roots extending to depth of 42 inches; 15 percent gravel, 5 percent cobbles, 5 percent stones; lenses and pockets of light yellowish brown (2.5Y 6/4) sand; strongly acid.

TYPE LOCATION: Cheshire County, New Hampshire; Town of Jaffrey, 50 feet south of Bryant Road, 150 feet west of Old Peterborough Road. USGS Monadnock, NH topographic quadrangle; Latitude 42 degrees, 50 minutes, 36 seconds N., and Longitude 72 degrees, 00 minutes, 38 seconds W., NAD 1983.

RANGE IN CHARACTERISTICS: Thickness of the mineral solum ranges from 15 through 30 inches. Rock fragments range from 0 through 35 percent in the mineral solum and from 5 through 60 percent in the substratum. Stones range from 0 through 20 percent in the surface layer, 0 through 15 percent in the subsoil, and 0 through 25 percent in the substratum. Cobbles range from 0 through 35 percent in the surface layer, 0 through 15 percent in the subsoil, and 0 through 20 percent in the substratum. Gravel

ranges from 0 through 20 percent in the surface layer, 0 through 20 percent in the subsoil, and 0 through 45 percent in the substratum. Reaction ranges from extremely acid through moderately acid.

Some pedons have an O horizon that is neutral or has hue of 2.5YR through 10YR, value of 2 through 3 and chroma of 0 through 2. It is highly, moderately, or slightly decomposed plant (fibric, hemic or sapric) material and is up to 5 inches thick.

The A horizon has hue of 7.5YR or 10YR, value of 2 through 4, and chroma of 1 through 3. Texture is silt loam, loam, very fine sandy loam, fine sandy loam, or sandy loam in the fine-earth fraction.

Some pedons have an Ap horizon that has hue of 10YR and value and chroma of 2 through 4.

The E horizon has hue of 5YR through 2.5Y, value of 4 through 7, and chroma of 1 or 2. Texture range is the same as the A horizon.

Some pedons have a Bhs horizon that has hue of 2.5YR through 7.5YR, value and chroma of 3 or less. Some pedons have a Bh horizon that has hue of 7.5YR through 10YR, value and chroma of 3 or less. The Bhs and Bh horizons are dominantly fine sandy loam, but include loam and very fine sandy loam in the fine-earth fraction.

The Bs horizon has hue of 2.5YR through 2.5Y, value of 3 through 6, and chroma of 3 through 8. The Bs horizons are loam, very fine sandy loam, fine sandy loam, sandy loam, or coarse sandy loam in the fine-earth fraction.

Some pedons have a BC, or 2BC, horizon that has hue of 7.5YR through 5Y, value of 4 through 6, and chroma of 3 through 8. Texture is loam, fine sandy loam, sandy loam, loamy fine sand, loamy sand, or loamy coarse sand in the fine-earth fraction. It is 0 through 18 inches thick.

Some pedons have a thin C horizon overlying a contrasting 2C horizon. Texture is fine sandy loam or sandy loam in the fine-earth fraction.

The 2C horizon has hue of 10YR through 5Y, value of 4 through 7, and chroma of 2 through 4. Texture is loamy coarse sand, loamy sand, or loamy fine sand in the fine-earth fraction. Less typically, some pedons may range to sand. It has weak thick platy structure or it is massive or single grain. Consistence ranges from loose through firm. Some pedons have lenses or pockets of sand.

COMPETING SERIES: There are no other series in the same family.

The Allagash and Highmarket (T) series are in related families. Allagash soils have fewer rock fragments in the particle size control section. Highmarket (T) soils are derived from sedimentary materials.

GEOGRAPHIC SETTING: Monadnock soils are gently sloping through very steep soils of the glaciated uplands. Slope ranges from 0 through 60 percent. The soils formed in a loamy mantle underlain by acid, sandy till of Wisconsin age derived mainly from schist, granite, gneiss, and quartzite. The till generally contains stones and/or boulders. The mean annual precipitation ranges from 34 through 50 inches, and the mean annual temperature ranges from 38 through 46 degrees F. The annual growing season ranges from 90 through 150 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Adams, Becket, Berkshire, Colton, Croghan, Hermon, Kinsman, Lyman, Lyme, Marlow, Success, Sunapee, and Tunbridge soils. The

Monadnock soils are in a drainage sequence with the moderately well drained Sunapee soils and the poorly drained Lyme soils. The somewhat excessively drained Hermon and Success soils and the well drained Berkshire soils are on similar landscape positions. Berkshire soils have finer textures in the substratum. Hermon and Success soils have coarser textures in the solum. The well drained Becket and Marlow soils and the moderately well drained Skerry and Peru soils are on smooth sloped landforms. Becket, Marlow, Peru, and Skerry soils formed in compact dense till. The somewhat excessively drained Lyman soils and well drained Tunbridge soils are on bedrock controlled landforms. Lyman soils are shallow to bedrock and Tunbridge soils are moderately deep to bedrock. The somewhat excessively drained Adams, excessively drained Colton, moderately well drained Croghan, and poorly drained Kinsman soils are on kames, terraces, and eskers. They are coarser textured in the solum.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Well drained. Runoff ranges from medium to rapid and internal drainage is medium. Estimated saturated hydraulic conductivity is moderately high or high in the mineral solum and high or very high in the substratum.

USE AND VEGETATION: Most of these soils are forested. Common forest species are northern red oak, eastern white pine, paper birch, American beech, eastern hemlock, and red pine. Some areas have been cleared of surface stones and are used for crops and pasture.

DISTRIBUTION AND EXTENT: New Hampshire, Maine, and Vermont. MLRA's 143 and 144B. The series is extensive.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts.

SERIES ESTABLISHED: Sullivan County, New Hampshire, 1981.

Diagnostic horizons and features recognized in this pedon are:
a. Ochric epipedon - the zone from 0 to 5 inches (A and E horizons).
b. Spodic horizon - the zone from 5 to 14 inches (Bs1 horizon).
c. Strongly contrasting particle-size class - the abrupt change from coarse-loamy texture to sandy texture at a depth of 23 inches.

National Cooperative Soil Survey
U.S.A.

LOCATION ADAMS NY+MA ME NH VT

Established Series
Rev. JDV-ANL-BWH
04/2013

ADAMS SERIES

The Adams series consists of very deep, excessively and somewhat excessively drained soils formed in glacial-fluvial or glacio-lacustrine sand. They are on outwash plains, deltas, lake plains, moraines, terraces, and eskers. Saturated hydraulic conductivity is high or very high. Slope ranges from 0 through 70 percent. Mean annual temperature is 6 degrees C. and mean annual precipitation is 970 millimeters.

TAXONOMIC CLASS: Sandy, isotic, frigid Typic Haplorthods

TYPICAL PEDON: Adams loamy fine sand, on a 1 percent slope in a forested area. (Colors are for moist soil unless otherwise noted.)

Oi -- 0 to 1 cm; very dark brown (7.5YR 2.5/2); slightly decomposed plant material; massive; very friable; many very fine, common fine and few medium roots throughout; extremely acid (pH 4.2), 1:2 calcium chloride; abrupt smooth boundary.

Oa -- 1 to 3 cm; black (10YR 2/1); highly decomposed plant material; weak fine and medium granular structure; very friable; many very fine, common fine and few medium roots throughout; extremely acid (pH 4.2); abrupt wavy boundary. (Combined thickness of the O horizons is 0 to 15 cm thick.)

E -- 3 to 10 cm; 60 percent reddish gray (5YR 5/2) and 40 percent gray (7.5YR 6/1); loamy fine sand; weak fine subangular blocky structure; very friable; common very fine, many fine and few medium and coarse roots throughout; extremely acid (pH 4.0); abrupt wavy boundary. (0 to 20 cm thick.)

Bh -- 10 to 17 cm; very dusky red (2.5YR 2.5/2); loamy fine sand; weak medium subangular blocky structure; friable; common very fine and few fine, medium and coarse roots throughout; extremely acid (pH 4.2); abrupt wavy boundary.

Bhs -- 17 to 34 cm; dark reddish brown (5YR 3/3); loamy fine sand; weak medium subangular blocky structure; very friable; common very fine and few fine, medium and coarse roots throughout; very strongly acid (pH 5.0); clear wavy boundary.

Bs -- 34 to 43 cm; 60 percent strong brown (7.5YR 4/6) and 40 percent brown (7.5YR 4/4); loamy fine sand; weak medium subangular blocky structure; very friable; few very fine and common fine and medium roots throughout; 1 percent gravel; strongly acid (pH 5.2); clear wavy boundary. (Combined thickness of the Bh, Bhs and Bs horizons is 10 to 60 cm)

BC -- 43 to 61 cm; yellowish brown (10YR 5/4) sand; weak medium subangular blocky structure; very friable; common very fine, fine and medium roots throughout; 2 percent gravel; strongly acid (pH 5.2); gradual wavy boundary. (10 to 60 cm thick.)

C1 -- 61 to 88 cm; brown (10YR 5/3) sand; single grain; loose; few very fine roots throughout; 2 percent gravel; strongly acid (pH 5.2); clear wavy boundary.

C2 -- 88 to 145 cm; light yellowish brown (10YR 6/4) sand; single grain; loose; few very fine roots throughout; 4 percent gravel; strongly acid (pH 5.2); clear smooth boundary.

C3 -- 145 to 190 cm; brown (10YR 5/3) sand; single grain; loose; 5 percent gravel; strongly acid (pH 5.4).

TYPE LOCATION: Lewis County, New York; East end of Auctor Road; USGS Crystal Dale, NY topographic quadrangle, Latitude 43 degrees, 51 minutes, 49.97 seconds N., and Longitude 75 degrees, 15 minutes, 59.8 seconds W.; NAD 1927.

RANGE IN CHARACTERISTICS: Thickness of the solum ranges from 40 through 90 centimeters. Depth to bedrock is more than 183 centimeters. Rock fragments, mostly gravel, range from 0 through 10 percent above a depth of 51 centimeters and, from 0 through 20 percent below 51 centimeters. Some pedons have contrasting very gravelly deposits below a depth of 100 centimeters. The sand fraction is dominantly medium and fine. Adams soils are dry for less than 20 consecutive days following the summer solstice and moist within 91 centimeters of the soil surface during the month of August in normal years.

The O horizon, where present, is neutral or has hue of 2.5YR through 10YR, value of 2 through 3, and chroma of 0 through 3. It is fibric, hemic or sapric material.

Some pedons have an A or Ap horizon that has hue of 5YR through 10YR, value of 2 through 5, and chroma of 1 through 4. Texture is loamy fine sand, loamy sand, fine sand, or sand. Structure is weak or moderate fine or medium granular or it is single-grain. Consistence is friable or very friable. Unless limed, reaction is extremely acid through moderately acid.

The E horizon, where present, has hue of 5YR through 10YR, value of 4 through 7, and chroma of 1 through 3. Texture is loamy fine sand, loamy sand, fine sand, or sand. In some pedons texture is fine sandy loam. Structure is granular or weak subangular blocky in some pedons, but most pedons are single-grain. Consistence is friable through loose. Reaction is extremely acid through moderately acid.

The Bhs or Bh horizon, where present, has hue of 2.5YR through 7.5YR, value of 2 through 3, and chroma of 1 through 4. Texture is loamy fine sand, loamy sand, fine sand, or sand. Structure is weak or moderate fine or medium granular or weak subangular blocky, or the horizon is single-grained or massive. Consistence is very friable or friable. Massive, cemented bodies, 1 to 20 centimeters across, range from 0 through 30 percent of the exposed surface area of the horizon. Reaction is extremely acid through moderately acid.

The Bs horizon has hue of 5YR through 10YR, value of 3 through 6, and chroma of 3 through 8. Texture is loamy fine sand, loamy sand, fine sand, or sand in the fine-earth fraction. Structure is weak granular or subangular blocky, or the horizon is single-grain or massive. Consistence is very friable or loose. Massive, cemented bodies range from 0 through 30 percent of the exposed surface area of the Bs horizon. Reaction is very strongly acid through moderately acid.

The BC horizon has hue of 7.5YR through 5Y, value of 4 through 6, and chroma of 2 through 6. The texture is fine sand to coarse sand in the fine-earth fraction. Some pedons have texture of loamy sand or loamy fine sand. Consistence is very friable or loose. Cemented bodies range up to 20 percent of the

exposed surface area in some pedons. Reaction is very strongly acid through moderately acid.

The C horizon has hue of 5YR through 5Y, value of 4 through 7, and chroma of 2 through 6. Texture is fine sand to coarse sand in the fine-earth fraction. Some pedons have strata of loamy fine sand in the lower part. Reaction is very strongly acid through slightly acid.

COMPETING SERIES: These are the Cusino, Duxbury, Fishcreek (T), Kalkaska, Liminga, Pence, and Stutts series. All except Duxbury and Fishcreek occur outside region 12. Duxbury soils have a thicker loamy mantle and higher rock fragment content in the substratum. The Cusino, Kalkaska, and Liminga soils have dry soil moisture status within 91 centimeters of the soil surface in the month of August. The Duxbury, Pence, and Stutts soils have combined content of silt plus clay greater than 15 percent in the A, E, Bhs, and Bs horizons. Fishcreek (T) soils are formed in sandy glaciofluvial or glaciolacustrine deposits derived from predominantly sedimentary source material.

The Sheddenbrook series is in a related family. Sheddenbrook soils have bedrock within a depth of 100 centimeters and have redoximorphic features within a depth of 75 centimeters from the surface.

GEOGRAPHIC SETTING: Adams soils are on nearly level to very steep sand plains, kames, moraines, benches, eskers, deltas, and terraces. Slope ranges from 0 through 70 percent. These soils formed in sandy glaciofluvial or glaciolacustrine deposits from predominantly crystalline rock or meta-sandstone. Mean annual temperature ranges from 3 to 8 degrees C., mean annual precipitation ranges from 760 to 1270 millimeters, and mean annual frost-free period ranges from 70 to 160 days. Elevation ranges from 91 to 915 meters above sea level.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Allagash, Becket, Berkshire, Colton, Croghan, Duxbury, Hermon, and Naumburg soils. Allagash, Colton, and Duxbury soils are on similar landscapes. Allagash and Duxbury soils are loamy in the upper part. Colton soils have an average rock fragment content of at least 35 percent between depths of 25 and 100 centimeters. Becket, Berkshire, and Hermon soils are on surrounding uplands in till deposits. The moderately well drained Croghan soils and somewhat poorly drained and poorly drained Naumburg soils are on low lying areas of sand plains and terraces.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Somewhat excessively drained. Runoff is very slow to medium. Saturated hydraulic conductivity is high or very high in the mineral surface layer and upper part of the subsoil and very high in the lower part of the subsoil and substratum.

USE AND VEGETATION: Extensive areas are idle and support aspen, birch, and pine seedlings or sweet fern, spirea, and brambles. Uncleared areas support maple, beech, spruce, and pine. Farmed areas are used mainly for hay or pasture with limited acreages of corn and small grain.

DISTRIBUTION AND EXTENT: Northern New York and New England; MLRA's 142, 143, 144A, and 144B. The series is of large extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts.

SERIES ESTABLISHED: Jefferson County, New York, 1911.

REMARKS: 1. Adams soils are no longer maintained in MLRA's 93 and 94B. Series have been proposed which better represent the previously correlated phases of the Adams series in these MLRA'S when these areas are updated.

2. Adams soils will not be recognized in MLRA 144A because of soil temperature when these areas are updated.

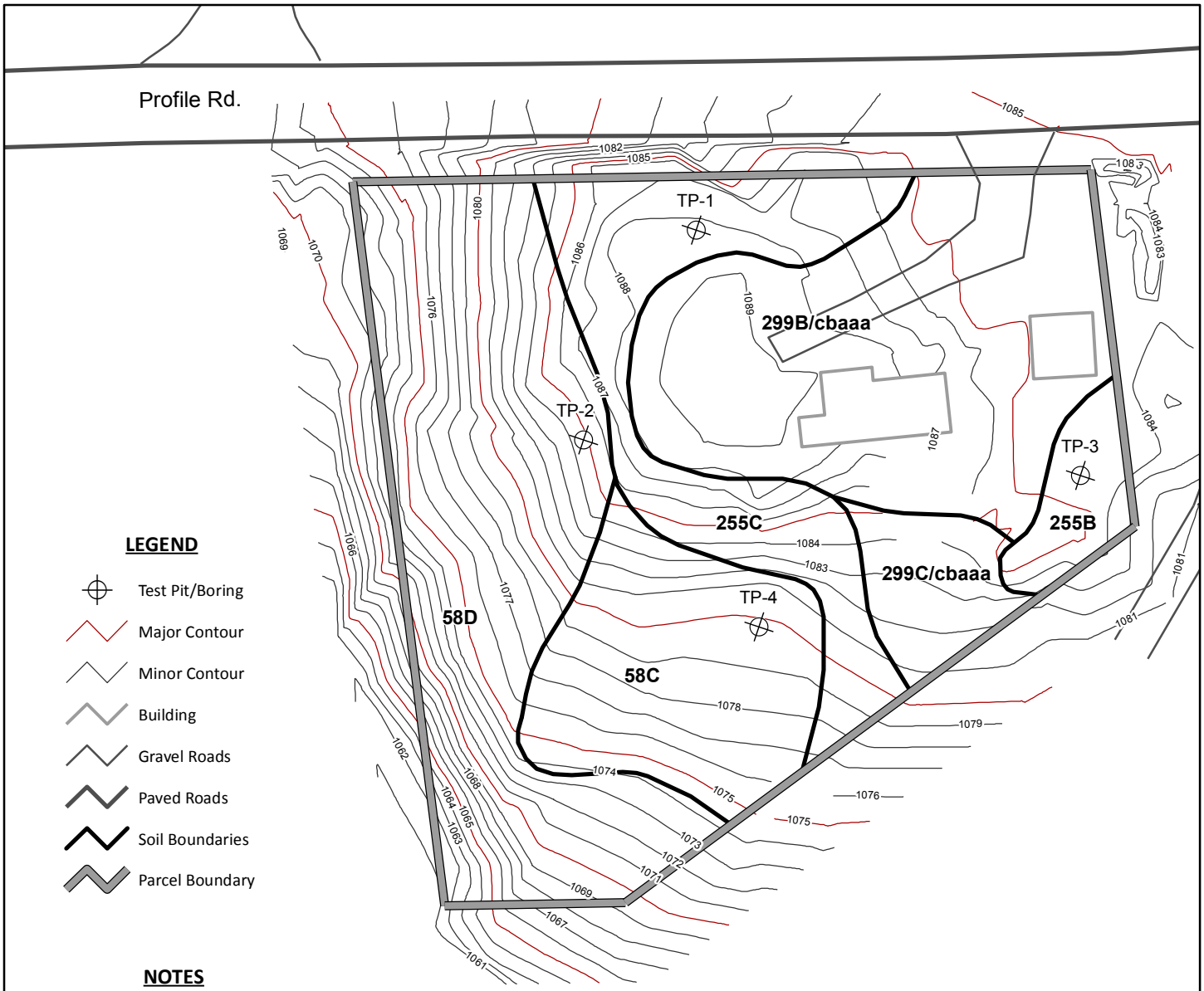
3. Adams soils are made up of mainly parent material from metamorphic and igneous sources and will be replaced in MLRA 141 by Fishcreek and other series that are derived from parent material of mostly sedimentary rock.

4. Diagnostic horizons and features recognized in the typical pedon are:
a.) Albic horizon - from 3 to 10 cm (E horizon).
b.) Spodic horizon - from 10 to 43 cm (Bh, Bhs, and Bs horizons).

National Cooperative Soil Survey
U.S.A.

Appendix D

Soil Survey Maps



LEGEND

- Test Pit/Boring
- Major Contour
- Minor Contour
- Building
- Gravel Roads
- Paved Roads
- Soil Boundaries
- Parcel Boundary

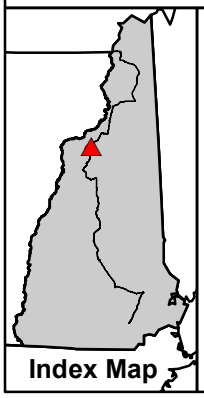
NOTES

1. This detailed Site-Specific Soil Map conforms to the standards of SSSNNE Publication No. 3, as amended, "Site-Specific Soil Mapping Standards for NH and VT".

2. This map has been prepared to comply with soil mapping requirements of RSA 485 A: 17 and NHDES Env-Wq 1500, Alteration of Terrain.

3. See accompanying narrative report for methodology, map symbol legend, and interpretations.

Map Symbol	Map Unit	Slope (%)	Hydrologic Group
58C	Waumbek fine sandy loam	8-15	B
58D	Waumbek fine sandy loam	8-15	B
299B/cbaaa	Udorthents, smoothed	3-8	A
299C/cbaaa	Udorthents, smoothed	8-15	A
255C	Hermon-Monodnock Complex	8-15	A/B
255B	Hermon-Monodnock Complex	3-8	A/B



Data Provided By: Cornerstone Energy Inc. & GRANIT

N

1 inch = 50 feet

0 5 10 20 Meters

0 25 50 100 Feet

TS5 SOIL SURVEY OVERVIEW

Bethlehem, NH

STATE OF MAINE
IAN BROADWATER
NO. 305
CERTIFIED
SOIL SCIENTIST

EVERSOURCE ENERGY

NORMANDEAU environmental consultants

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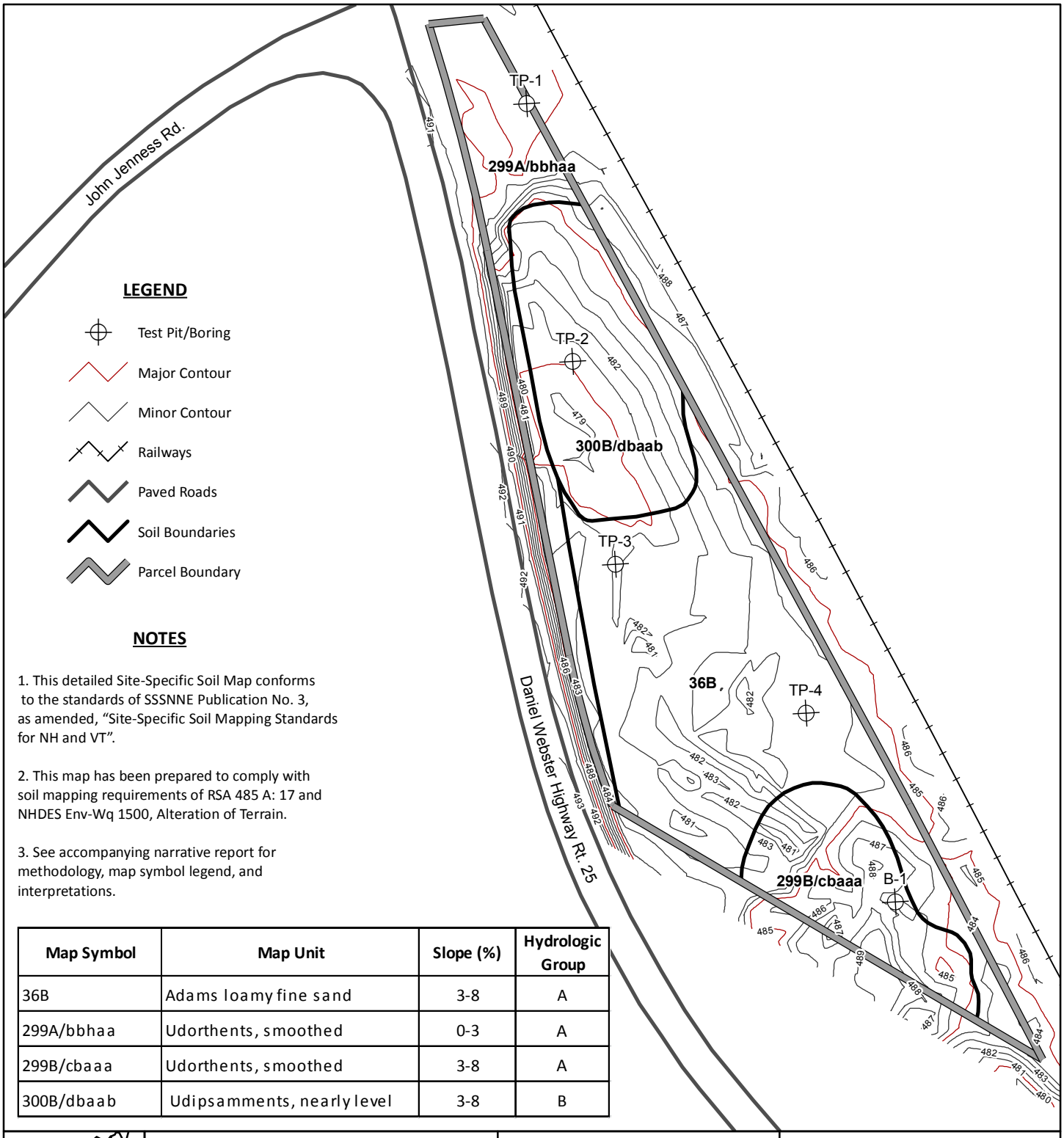


LEGEND

- Test Pit/Boring
- Major Contour
- Minor Contour
- Railways
- Paved Roads
- Soil Boundaries
- Parcel Boundary

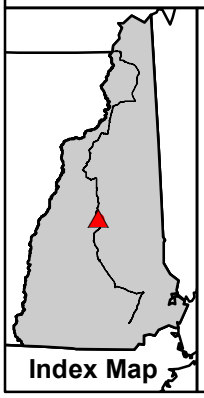
NOTES

1. This detailed Site-Specific Soil Map conforms to the standards of SSSNNE Publication No. 3, as amended, "Site-Specific Soil Mapping Standards for NH and VT".

2. This map has been prepared to comply with soil mapping requirements of RSA 485 A: 17 and NHDES Env-Wq 1500, Alteration of Terrain.

3. See accompanying narrative report for methodology, map symbol legend, and interpretations.

Map Symbol	Map Unit	Slope (%)	Hydrologic Group
36B	Adams loamy fine sand	3-8	A
299A/bbhaa	Udorthents, smoothed	0-3	A
299B/cbaaa	Udorthents, smoothed	3-8	A
300B/dbaab	Udipsamments, nearly level	3-8	B



Data Provided By: Cornerstone Energy Inc. & GRANIT

N

1 inch = 100 feet

Meters: 0 10 20 40

Feet: 0 50 100 200

TS6 SOIL SURVEY OVERVIEW

Bridgewater, NH

STATE OF MAINE
IAN BROADWATER
NO. 305
CERTIFIED
SOIL SCIENTIST

EVERSOURCE ENERGY

NORMANDEAU environmental consultants

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United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Grafton County, New Hampshire

Transition Station #6

May 7, 2015

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

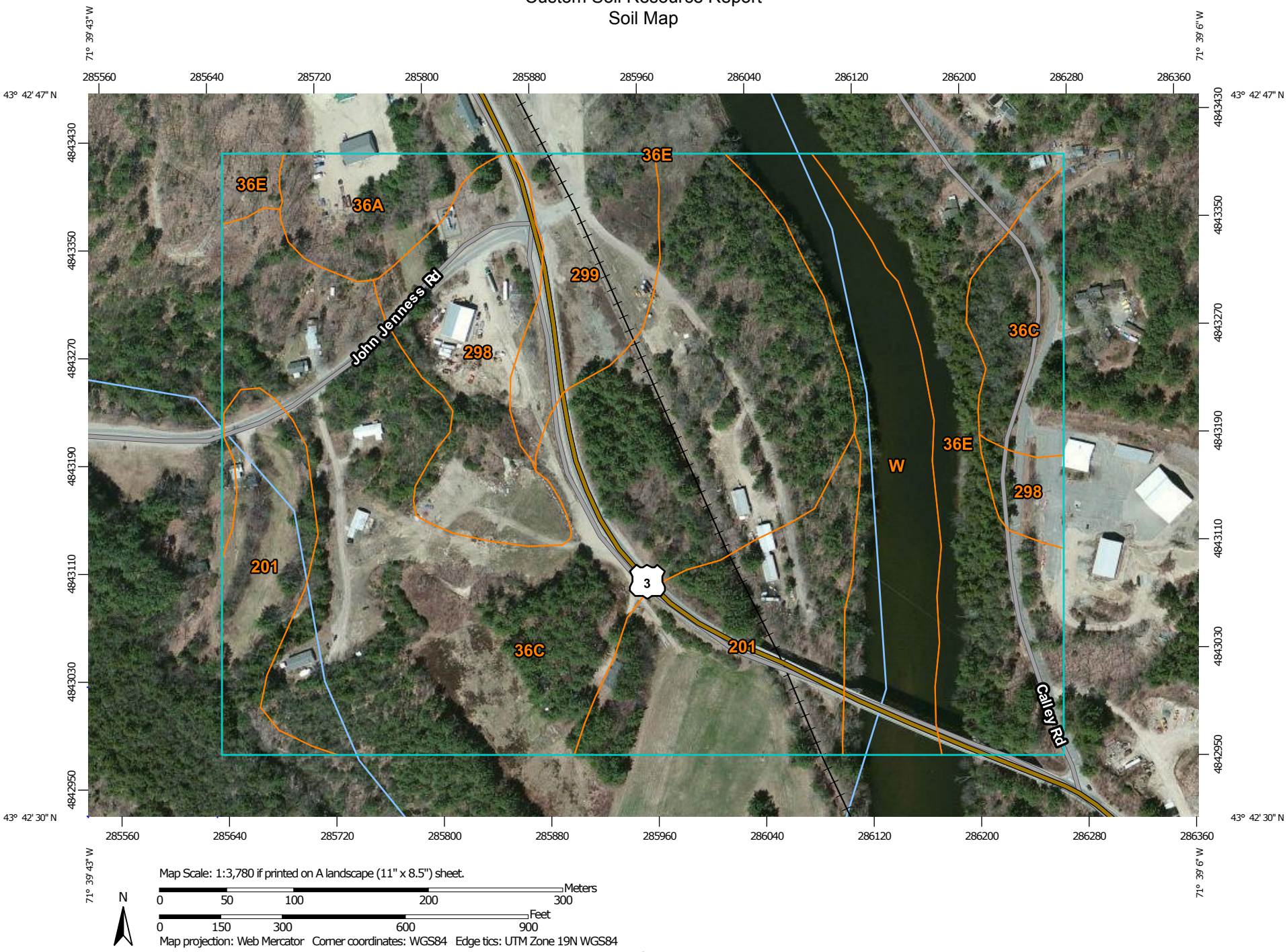
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:3,780 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

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 1:24,000.

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: http://websoilsurvey.nrcs.usda.gov
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: Grafton County, New Hampshire
Survey Area Data: Version 17, Sep 12, 2014

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

Date(s) aerial images were photographed: Apr 8, 2011—May 1, 2011

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.

Map Unit Legend

Grafton County, New Hampshire (NH009)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
36A	Adams loamy sand, 0 to 3 percent slopes	2.6	3.7%
36C	Adams loamy sand, 8 to 15 percent slopes	29.9	43.1%
36E	Adams loamy sand, 15 to 60 percent slopes	9.0	13.0%
201	Ondawa fine sandy loam, 0 to 3 percent slopes, occasionally flooded	10.4	15.0%
298	Pits, gravel	6.6	9.5%
299	Udorthents, smoothed	4.0	5.8%
W	Water	6.9	9.9%
Totals for Area of Interest		**69.4**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially

where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Grafton County, New Hampshire

36A—Adams loamy sand, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 9fj8
Elevation: 10 to 2,200 feet
Mean annual precipitation: 30 to 50 inches
Mean annual air temperature: 37 to 46 degrees F
Frost-free period: 70 to 160 days
Farmland classification: Farmland of local importance

Map Unit Composition

Adams and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Adams

Setting

Parent material: Sandy outwash derived mainly from granite, gneiss and schist

Typical profile

H1 - 0 to 6 inches: loamy sand
H2 - 6 to 26 inches: sand
H3 - 26 to 65 inches: sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A

Minor Components

Colton

Percent of map unit: 3 percent

Groveton

Percent of map unit: 3 percent

Kinsman

Percent of map unit: 3 percent
Landform: Outwash terraces

Croghan
Percent of map unit: 3 percent

Not named
Percent of map unit: 3 percent

36C—Adams loamy sand, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 9fjb
Elevation: 10 to 2,200 feet
Mean annual precipitation: 30 to 50 inches
Mean annual air temperature: 37 to 46 degrees F
Frost-free period: 70 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Adams and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Adams

Setting

Parent material: Sandy outwash derived mainly from granite, gneiss and schist

Typical profile

H1 - 0 to 6 inches: loamy sand
H2 - 6 to 26 inches: sand
H3 - 26 to 65 inches: sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A

Minor Components

Kinsman
Percent of map unit: 3 percent
Landform: Outwash terraces

Colton
Percent of map unit: 3 percent

Not named
Percent of map unit: 3 percent

Groveton
Percent of map unit: 3 percent

Croghan
Percent of map unit: 3 percent

36E—Adams loamy sand, 15 to 60 percent slopes

Map Unit Setting
National map unit symbol: 9fjc
Elevation: 150 to 2,200 feet
Mean annual precipitation: 30 to 50 inches
Mean annual air temperature: 37 to 46 degrees F
Frost-free period: 70 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition
Adams and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Adams

Setting
Parent material: Sandy outwash derived mainly from granite, gneiss and schist

Typical profile
H1 - 0 to 6 inches: loamy sand
H2 - 6 to 26 inches: sand
H3 - 26 to 65 inches: sand

Properties and qualities
Slope: 15 to 60 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None

Frequency of ponding: None
Available water storage in profile: Low (about 3.3 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A

Minor Components

Not named
Percent of map unit: 5 percent

Croghan
Percent of map unit: 4 percent

Pillsbury
Percent of map unit: 3 percent
Landform: Ravines

Kinsman
Percent of map unit: 3 percent
Landform: Depressions

201—Ondawa fine sandy loam, 0 to 3 percent slopes, occasionally flooded

Map Unit Setting
National map unit symbol: 2qgvy
Elevation: 0 to 1,800 feet
Mean annual precipitation: 31 to 95 inches
Mean annual air temperature: 27 to 54 degrees F
Frost-free period: 80 to 160 days
Farmland classification: All areas are prime farmland

Map Unit Composition
Ondawa and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ondawa

Setting
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-loamy alluvium derived from schist and/or coarse-loamy alluvium derived from quartzite and/or coarse-loamy alluvium derived from granite and gneiss

Typical profile
Ap - 0 to 9 inches: fine sandy loam

Bw - 9 to 30 inches: fine sandy loam
C - 30 to 65 inches: loamy fine sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B

Minor Components

Podunk

Percent of map unit: 8 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Microfeatures of landform position: Closed depressions
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave

Sunday

Percent of map unit: 3 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

Rumney

Percent of map unit: 3 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Microfeatures of landform position: Closed depressions
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave

Adams

Percent of map unit: 1 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Microfeatures of landform position: Rises
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex

298—Pits, gravel

Map Unit Composition

Pits: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

299—Udorthents, smoothed

Map Unit Composition

Udorthents: 90 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Minor Components

Miscellaneous areas

Percent of map unit: 10 percent

W—Water

Map Unit Composition

Water: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

Memorandum

Friday, January 23, 2015

TO: Derrick Bradstreet
FROM: William McCloy
SUBJECT: NPT Project – LL# 5805 Parcel – Desktop Review of Natural Resources

---

Per your request, Normandeau has reviewed existing natural and cultural resources mapping for the transmission station site located on parcel LL # 5805, Bridgewater, New Hampshire.

Existing Land Use

A review of existing aerial photography indicates that parcel LL# 5805 is undeveloped. The area surrounding the parcel is a mix of commercial, industrial, and residential development. There are do not appear to be any structures located on the parcel. A existing electrical transmission ROW crosses the northern half of the parcel, while the southern half of the parcel consists of mixed forest. A railroad runs the length of the eastern boundary of the parcel and Route 3 is located along the western side.

Soils

Soil mapping by the NRCS were reviewed. The soils within the existing ROW are mapped as smoothed udorthents. These soils have had the natural soil stripped and the remaining surface has been smoothed. They are not classified as hydric or prime farmland. The remainder of the parcel is identified as Adams loamy sand on 8 to 15 percent slopes. These soils are not prime farmland and are partially hydric and excessively drained.

Wetlands

Field delineations by Normandeu Associates (Normandeau) within the ROW adjacent and overlapping with this parcel identified no wetlands. No NWI

wetlands are listed for the area and a review of aerial photography and topographic maps suggests limited potential for other wetland areas.

Streams, Floodplains and Aquifers

No streams were identified during field delineations on the ROW. The National Hydrography Dataset (NHD) does not identify any streams within the parcel. A floodplain is identified by FEMA along the shores of the Pemigewasset River to the northeast of the parcel, but no floodplains are mapped within the parcel itself.

The entire parcel is mapped as an aquifer with over 2,000 feet of transmissivity per day. This is likely due to the sandy soils and proximity to the Pemigewasset River.

Wildlife

The parcel is not mapped as highest ranked or as supporting habitat for wildlife species. The undeveloped areas to the northwest of the parcel are mapped as highest ranked habitat. The area is generally mapped as pitch pine and hemlock hardwood pine forest, and parts are mapped as unfragmented habitat. The relatively small size of the forest patch on the property, as well the industrial surrounding land use, suggests that this area is of low value to wildlife.

RTE

A review of known element occurrences of RTE species indicated that no known populations exist on or in the vicinity of this parcel.

Conserved Lands

The parcel is not protected and does not abut any other conserved, protected or public lands, according to statewide mapping.

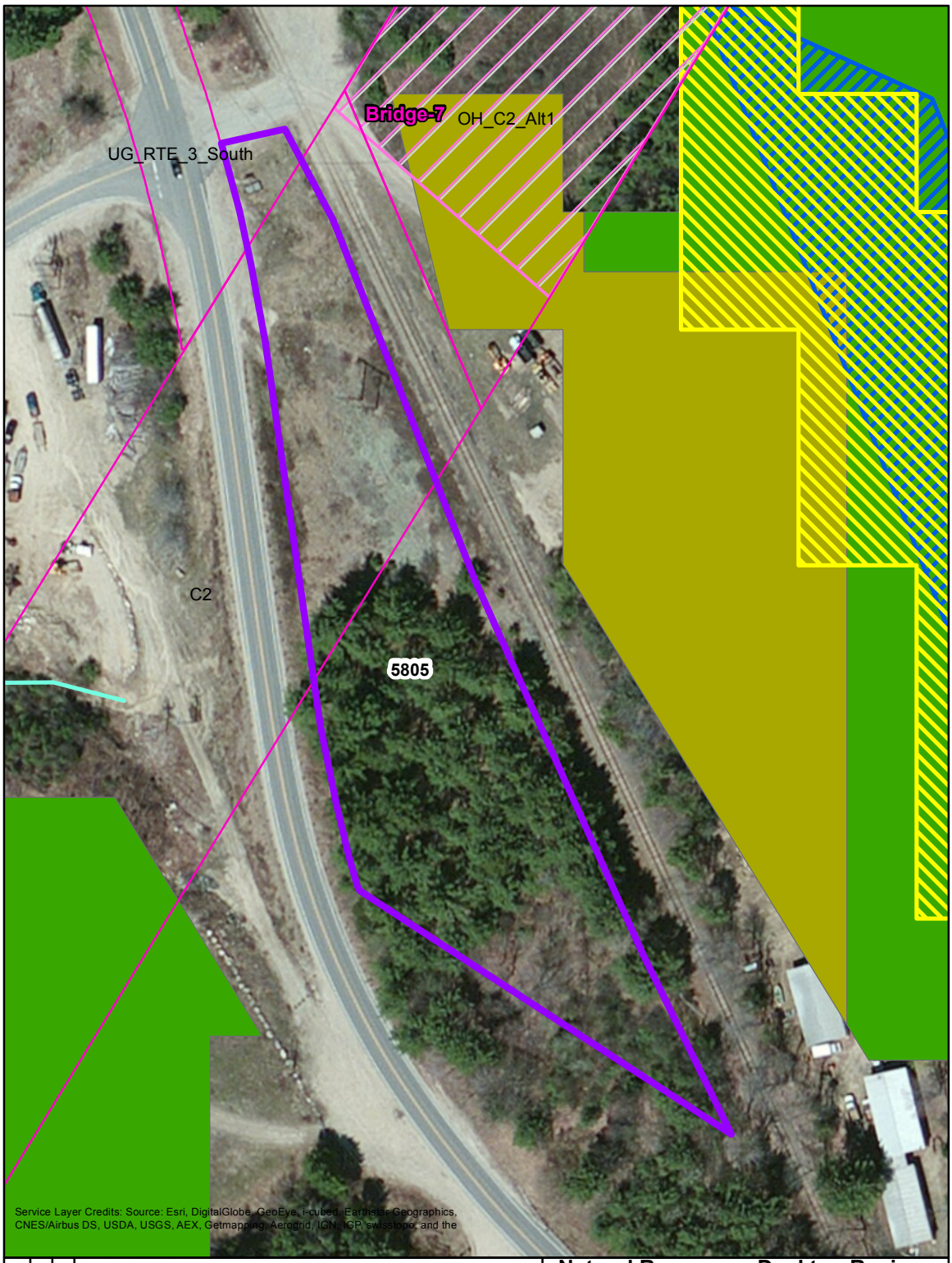
Archeology

The portion of the ROW to the northeast of the property is mapped for archaeological sensitivity (ID: Bridge-7). The segment of the ROW within the property boundary was not mapped as sensitive, and it is unlikely the remainder of the parcel would be identified as having archaeological sensitivity.

Summary

In general, this parcel does not appear to present any significant siting or regulatory challenges based on the available mapping and on field observations from the surrounding area. No resources or structures are visible within the parcel.

Attachment A: Resource Map



Project No: 86753.09

Drawn By: bgriffith

Date: 1/21/2015

Legend

- Parcel Boundary
- Right of Way
- Stream
- Archaeological Sensitivity
- Unfragmented
- Floodplain
- Pitch Pine Forest
- Hemlock-Hardwood Pine Forest

N

0 25 50 Feet

Natural Resources Desktop Review
Parcel LL #5805
Northern Pass Transmission Project
Bridgewater, USA

NORMANDEAU
environmental consultants
25 Nashua Road Bedford, NH 03110
(603) 472-5191 www.normandeau.com

Path: J:\CAD\JOBS\HVDC_NH\21812\MXD\NP_Transition_LL3173_0116151_v10-2.mxd

APPENDIX H – GEOTECHNICAL REPORT (BY OTHERS)

Geotechnical Engineering Report

Transition Station #6 Project
Northern Pass Transmission Line
Bridgewater, New Hampshire

December 9, 2016
QS Project No. 16004

Prepared for:
PAR Electrical Contractors, Inc.
60 Fuller Road
Chicopee, Massachusetts 01020

Prepared by:
Quanta Subsurface
307 W. Main Street
Radford, Virginia 24141

QUANTA SUBSURFACE
Engineering + Construction

December 9, 2016

PAR Electrical Contractors, Inc.
60 Fuller Road
Chicopee, Massachusetts 01020

Attention: Ms. Stephanie Labbe
Project Manager

Re: Geotechnical Engineering Report
Transition Station #6 – Northern Pass Transmission Line
Bridgewater, New Hampshire
QS Project No. 16004

Dear Ms. Labbe,

The purpose of this report is to present the results of the subsurface exploration program and geotechnical engineering analyses undertaken by Quanta Subsurface (QS) associated with the above referenced project. Our services were provided in general accordance with QS's proposal dated August 22, 2016 as approved by PAR Electrical Contractors' (PAR) Limited Notice to Proceed (LNTP) #4 dated August 26, 2016. The attached report presents our understanding of the project, the findings of the subsurface exploration program, and our geotechnical conclusions and recommendations.

Sincerely,

Quanta Subsurface

STATE OF NEW HAMPSHIRE
JAY T. McGINNIS
No. 14656
LICENSED
PROFESSIONAL ENGINEER

12/9/16

Sean Kearney, P.G.
Project Engineering Geologist

J.T. McGinnis, P.E.
Geotechnical Department Manager

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EXECUTIVE SUMMARY

This Executive Summary is provided as a brief overview of our geotechnical engineering conclusions and recommendations for the project and is not intended to replace more detailed information contained elsewhere in this report. As an overview, this summary inherently omits details that could be very important to the proper application of the provided geotechnical design recommendations. This report should be read in its entirety.

- QS's geotechnical field exploration program consisted of nine (9) Standard Penetration Test (SPT) borings, drilled to a maximum depth of approximately 22 feet, and associate laboratory testing at the Transition Station #6 site.
- Four infiltration test borings were conducted to characterize the subsurface conditions to a depth of approximately 5 feet below the planned basin bottom. Following completion of each INF test boring, field infiltration tests were performed at each location.
- The subsurface conditions encountered at the site generally included a layer of topsoil underlain by terrace deposit sands.
- Bedrock was not encountered in the test borings performed by Quanta Subsurface.
- Groundwater was not encountered/measured in any of the borings performed at site. However, the project site is located approximately 0.1 mile west of the Pemigewasset River. Based on estimates made using Google Earth, the river appears to exist at an elevation of about 20 to 25 feet below the project site.
- In general, the subsurface conditions encountered at the site are suitable for the proposed construction with considerations presented herein.
- Based on the subsurface conditions encountered in boring performed within the station pad, foundation support of the bus support structures (and ancillary poles) can be support by drilled shafts, driven piles, or helical piles.
- Controlled structural fill and/or the onsite soils will provide suitable support for the transformer pad designed to transmit an approximate uniform bearing pressure of up to 500 psf and structures supported by shallow foundation designed with a maximum allowable bearing pressure of 3,000 psf.
- The onsite soils will generally have a low shrink-swell potential. Accordingly, no design modifications relative to the potential for shrink-swell soils are recommended.
- Frost depth should be anticipated to be 4 feet below the lowest adjacent grade.
- A Seismic Site Class Definition of "D" is recommended for design.
- Laboratory corrosivity testing performed on samples collected from the site indicated that the soils are non-aggressive.
- We anticipate that the planned fill slopes will exhibit a factor of safety (FoS) of 1.3 or greater for global stability.

1.0 PROJECT INFORMATION

The Northern Pass project consists of a 192-mile long transmission line that will convey 1,090 megawatts of energy from hydroelectric facilities in Canada to New England via a corridor than traverses north-to-south through New Hampshire (see Site Vicinity Map – Figure 1). In addition to construction of new transmission line, the project also includes the construction of three (3) new substations and six (6) new transition stations along the corridor. In general, the new transition stations (designated Transition Stations #1 through #6) are located along the northern and central portions of the corridor while the three new substations (designated Franklin Substation, Deerfield Substation and Scobie Pond Substation) are located along the southern portion of the corridor. The information presented herein is for the Transition Station #6 located approximately 1.5 miles northwest of Ashland, New Hampshire (see Site Location Map - Figure 2).

The Transition Station #6 site is located between US Highway 3 to the west and the former Boston & Maine Railroad to the north and east; the southern extent of the site is undeveloped and wooded. Within the transition station footprint, the ground surface elevations generally range from 479 feet to 485 feet. Maximum fills of approximately 9 feet, will be required to develop the planned finished grade ranging from approximately 488 feet to 491 feet. Development will include construction of fill slopes with a planned configuration of 3 (Horizontal) to 1 (Vertical) along the south, east, and west sides of the site and an infiltration basin in the north and south corners of the project site. The south corner of the entrance ramp side has a segment of the fill slope that is planned with a configuration of 1.5 (Horizontal) to 1 (Vertical) and a rip-rap face. No retaining walls are planned.

New structures within the transition station footprint are anticipated to consist of a transformer pad, a bus support structure, and possibly single-story structures designed to house electrical equipment. Quanta Subsurface (QS) has assumed the following regarding loading and foundation support of the new structures: 1) the bus structure will require deep foundation support to resist shear and overturning loads, 2) the transformer pad will consist of slab-on-grade support designed for a maximum bearing pressure of 500 psf, and 3) single-story structures designed to house equipment will be lightly loaded with shallow foundation support.

2.0 PROVIDED DOCUMENTS AND PREVIOUS EXPLORATION DATA

Multiple documents were provided to QS by PAR Electrical Contractors (PAR) for consideration during our geotechnical exploration and engineering evaluation. The provided geotechnical report documents were developed by others and presented information at various locations along the transmission line corridor. Upon review of the provided data, no test borings originating from these reports were performed within the Transition Station #6 footprint; however, one document provided GIS information in the area of the Transition Station #6 site. The specific document included as reference by QS herein is listed below.

- Terracon Consultants Inc.; *Report of Expected Geotechnical Conditions*: Northern Pass Project; July 10, 2015

Although data from this document was not specifically used in development of the recommendations presented in Section 6.0 of this report, selected information was used as reference in support of the site specific data obtained by QS. Specific citations are noted below.

3.0 PURPOSE AND SCOPE OF SERVICE

QS's scope of work was developed based on information provided by PAR that included requested field investigations for civil works from Burns & McDonnell (*Subsurface Exploration and Geotechnical Engineering Report*: Technical Guidelines; Northern Pass Transmission Stations, New Hampshire, provided to QS on July 11, 2016) as well as requested investigations for planned structures from others. The purposes of our involvement on Transition Station #6 phase of the project were as follows: 1) provide general descriptions of the subsurface conditions encountered at the transition station site; 2) provide geotechnical design parameters for use by others in analysis and design of site grading and permanent slopes; 3) provide geotechnical foundation design recommendations for support of the transition station structures; and 4) comment on geotechnical aspects of the proposed construction. In order to accomplish the above objectives, QS undertook the following scope of services:

1) reviewed available subsurface and geologic information relative to the project site;
2) supervised a subsurface exploration program consisting of nine (9) geotechnical borings within the area of the proposed transition station;
3) procured field infiltration testing services at four (4) locations within the proposed infiltration basins;
4) supervised a laboratory testing program on selected soil samples obtained during the drilling program;
5) evaluated the findings of the test borings and laboratory tests relative to foundation support of planned structures and other geotechnical aspects of the project;
6) and prepared this written report summarizing our services for the project, providing descriptions of the subsurface conditions encountered, laboratory test results, and design recommendations, as well as geotechnical considerations for construction. Copies of the QS boring logs, laboratory test results, infiltration test results, summary of geotechnical design parameters, and slope stability analyses ouputs are provided in Appendices A through E.

QS's scope of services did not include a survey of boring locations and elevations, quantity estimates, preparation of plans or specifications, pavement design, infiltration/retention basin design, blasting recommendations, identification of environmental impacts or aspects related to the project and/or site, or other services not specified above.

4.0 EXPLORATION AND TESTING PROCEDURES

4.1 SUBSURFACE EXPLORATION

QS's geotechnical field exploration program consisted of nine (9) Standard Penetration Test (SPT) borings performed at the approximate locations shown on the attached Boring Location Plan (see Figure 3) and summarized in Table 1 below. The test boring locations were staked in the field by others using surveying methods; ground surface elevations at the boring locations were derived from topographic data included within an ACAD site plan document (labeled *NPTT904-C101-Geotech.dwg*) using latitude and longitude data provided by PAR.

Table 1 - As-Drilled SPT Borehole Depths and Coordinates

Boring Designation	Total Depth (ft)	Ground Surface Elevation (ft)	Latitude	Longitude
BH 901	22.0	479.0	43.71161004	-71.65742196
BH 902	22.0	483.7	43.71168396	-71.65711502
BH 903	22.0	480.5	43.71151398	-71.65718199
BH 904	22.0	482.0	43.71090897	-71.65728802
BH 905	22.0	483.1	43.71102598	-71.65686498
INF 901	14.0	489.7	43.71212603	-71.65749203
INF 902	14.0	488.8	43.71206199	-71.65746496
INF 903	14.0	482.3	43.71082096	-71.65694998
INF 904	14.0	481.8	43.71077201	-71.65694998

Note: Elevations information is NAVD88

Test borings were performed by S.W. Cole Engineering, Inc. (S.W. Cole) utilizing a CME 850 drill rig equipped with a 140-lb automatic drop hammer falling 30 inches. The drilling methods utilized for this investigation consisted of solid stem augers, hollow stem augers, and rotary drive and wash. Standard penetration testing was performed in general accordance with ASTM D1586 and pocket penetrometer testing (where applicable) was conducted at approximate 2-foot intervals to a depth of 10 feet and at 5-foot intervals thereafter. The number of hammer blows required to advance the sample for successive 6-inch intervals is recorded, and the total number of blows required to drive the sampler from 6 to 18 inches is referred to as the SPT "N-value". The N-value provides a general indication of in-situ soil density/consistency and has been correlated with certain engineering properties of soils. Soil samples were collected with a standard split-spoon sampler (2-in OD) and in bulk samples from auger cuttings for laboratory testing.

In some soils it is not always practical to drive a split-spoon sampler the full four consecutive 6-inch increments. Whenever more than 50 blows are required to drive the sampler over a 6-inch increment, or the sampler is observed not to penetrate after 50 blows, the condition is referred to as split-spoon refusal. The SPT N-value for split-spoon refusal conditions is typically estimated as greater than 100 blows per foot (bpf). Where the sampler is observed not to penetrate after 50 blows, the N-value is reported as 50/0. Otherwise, the depth of penetration after 50 blows is reported in inches (i.e. 50/5, 50/2, etc.).

The test borings were extended to the planned termination depth; no rock coring was performed as part of the Transition Station #6 drilling program. The subsurface materials encountered at each boring location were visually classified by QS personnel in the field in accordance with ASTM D2488. In addition to visual classification of the materials in the field, the boring logs incorporate both driller and field inspector observations and comments as well as modifications based on laboratory test results. QS's boring logs are presented in Appendix A. SPT samples were collected in Ziploc bags and bulk samples were collected in 5-gallon buckets.

4.2 LABORATORY TESTING

QS selected various bulk and SPT samples for laboratory testing. Laboratory testing on soil samples was performed by S.W. Cole in their Londonderry and Manchester laboratories or via subcontract with Absolute Resource Associates (sulfate and chloride testing). Table 2 provides a summary of the laboratory testing performed for the Transition Station #6 project. A summary of the laboratory testing results and accompanying laboratory test data reports are provided in Appendix B.

Table 2 – Laboratory Test Summary

Test	ASTM/AASHTO	No. of Test Performed
Moisture Content	D2216	14
Percent Passing No. 200 Sieve	D1140	7
pH of Soil	G51	2
Soluble Chloride	--	2
Soluble Sulfate	--	2
Resistivity	T188	2

4.3 FIELD INFILTRATION TESTING

Four infiltration (INF) test borings were conducted (designated INF 901, INF 902, INF 903, and INF 904) to characterize the subsurface conditions to a depth of approximately 5 feet below the planned basin bottom. Each boring was sampled continuously (every 2 feet) from ground surface to termination depth. Following completion of each INF test boring an offset borehole was drilled and PVC casing was installed for field infiltration testing. At some time following completion of drilling, field infiltration tests were performed by S.W. Cole. The results of S.W. Cole's field infiltration tests are provided in Appendix C. The installation, preparation, and testing procedures followed were in general accordance with Table 2-3 of the *New Hampshire Department of Environmental Services Stormwater Manual*, Volume 2 (2008).

5.0 GEOLOGY AND SUBSURFACE CONDITIONS

5.1 GENERAL

The overburden soils at the project site are derived from several episodes of advancing and retreating glacial ice. Subsurface materials encountered within the borings are consistent with the geologic setting of the area. The following sections describe the regional geology and site specific subsurface conditions.

5.2 REGIONAL GEOLOGY

The surficial geology of the White Mountains in New Hampshire is derived from the erosional and depositional processes of the continental and mountain glaciers of the Wisconsin Glacial Episode during the late Pleistocene Epoch. The dominant glacial soils that are found in this region are glacial till, glaciofluvial/outwash deposits, and glacio-lacustrine deposits. Younger post glacial deposits formed from the numerous rivers, streams, and lakes that dominate the landscape; these include alluvium and stream terrace deposits. The surficial soil in the area of the Transition Station #6 site is mapped as Stream Terrace Deposit (Figure 4; Surficial Geologic Map).

Bedrock in the White Mountains are comprised of folded and faulted Paleozoic sedimentary and volcanic rocks that have been regionally metamorphosed and intruded by large and small bodies of plutonic rocks. The grade of metamorphism ranges from the chlorite zone at one extreme to the sillimanite zone at the other (Billings, 1980). The majority of the rocks mapped in this region consist of schist, phyllites, limestone, and quartzite. Based on Terracon Exhibit A2-3 (Bedrock Geology Map), the bedrock underlying the Transition Station #6 site is mapped as the Perry Mountain Formation described primarily as quartzite.

5.3 SITE SUBSURFACE CONDITIONS

The subsurface conditions encountered in the test borings generally included a layer of topsoil in the portion of the site covered by tress and vegetation and stream terrace deposits. A summary of the subsurface materials encountered in the exploration described herein is provided below and in Table 3, and specific data are shown on the boring logs provided in Appendix A.

<u>Topsoil</u>

Material described as topsoil was encountered at the ground surface in seven test borings (all borings except BH 904 and INF 904). The thickness of the topsoil ranged from about 1 to 2 feet where encountered and described as poorly graded SAND (SP) and silty SAND (SM) with trace organics. Laboratory testing was not performed to determine the organic content or horticultural properties of the topsoil. Therefore, the term “topsoil” is not intended to indicate suitability for landscaping and/or other purposes.

<u>Stream Terrace Deposits</u>

Stream terrace deposits are glaciofluvial and fluvial terraces formed by post-glacial erosion deposition of glacial sediments transported and left along the flanks of a stream, river, or in fluvial valleys. The sedimentation of fluvial deposits is often variable in both particle size and layer thickness. Stream terrace deposit materials were encountered in each test boring to its termination depth and were generally described as poorly graded SAND (SP), poorly graded

SAND with silt (SP-SM), and silty SAND (SM); isolated lenses of SILT (ML) were also encountered. Field N-values obtained within the stream terrace deposit material ranged from 2 to 53 bpf with a typical N-value range of 7 to 21 bpf.

Groundwater

Groundwater was not encountered/measured in any of the borings performed at Transition Station #6. Transition Station #6 is located approximately 0.1 mile west of the Pemigewasset River. Based on estimates made using Google Earth, the river appears to exist at an elevation of about 20 to 25 feet below the Transition Station #6 site. Fluctuations in subsurface water levels and soil moisture should be anticipated with changes in precipitation, run-off and moisture.

Table 3 – Encountered Subsurface Conditions Summary

Boring No.	Ground Elevation (ft)	Depth to Groundwater[1] (ft)	Boring Termination Condition	Depth (ft)	Material Origin	Encountered Material	Field N-Value[2]
BH 901	479.0	N.E.	BT	0 - 1	Topsoil	SM	-
				1 - 4	Terrace Deposits	SP	3 - 5
				4 - 22		SP	10 - 34
BH 902	483.7	N.E.	BT	0 - 2	Topsoil	SP	4
				2 - 4	Terrace Deposits	SP	7
				4 - 22		SP	10 - 19
BH 903	480.5	N.E.	BT	0 - 2	Topsoil	SP	2
				2 - 6	Terrace Deposits	SP	7 - 9
				6 - 22		SP	11 - 22
BH 904	482.0	N.E.	BT	0 - 4	Terrace Deposits	SP-SM/SP	4 - 9
				4 - 22		SP	10 - 23
BH 905	483.1	N.E.	BT	0 - 1	Topsoil	SP-SM	-
				1 - 8	Terrace Deposits	SP	2 - 9
				8 - 22		SP	16 - 32
INF 901	489.7	N.E.	BT	0 - 1	Topsoil	SM	-
				1 - 14	Terrace Deposits	SP	10 – 18
INF 902	488.8	N.E.	BT	0 - 1.5	Topsoil	SM	4
				1.5 - 6	Terrace Deposits	SP	8 - 9
				6 - 14		SP	10 - 15
INF 903	482.3	N.E.	BT	0 - 1	Topsoil	SM	-
				1 - 4	Terrace Deposits	SP-SM	4 - 9
				4 - 14		SP-SM	10 - 15
INF 904	481.8	N.E.	BT	0 - 2	Terrace Deposits	SM	5
				2 - 12		SP/ML	12 - 25
				12 - 14		SP	53

[1] Reported groundwater levels were measured at completion of drilling.
[2] Field N-Value is an uncorrected blow count value measured in the field.
BT = Boring Termination (at or near the planned depth)

6.0 DESIGN AND CONSTRUCTION RECOMMENDATIONS

6.1 GENERAL

The following sections present our geotechnical recommendations for design and construction of the transition station. In general, the subsurface conditions encountered at the site are suitable for the proposed construction with considerations presented in the following subsections.

6.2 SITE PREPARATION

Before proceeding with construction, any topsoil, roots, foundation remnants, pavements, and any other deleterious non-soil materials should be stripped or removed from the proposed construction area. During the clearing and stripping operations, positive surface drainage should be maintained to prevent the accumulation of water.

After stripping, areas intended to support new fill, gravel roadways, slabs, and foundations should be carefully evaluated by an experienced geotechnical engineer or engineering geologist. Based on the boring data across the project site, approximate 2 to 4 feet of existing material (topsoil an loose soil) should be expected to require removal and replacement with controlled structural fill. Where noted on the borings logs and where located within 3 to 4 feet of new fill, roadways, slabs, and foundations, soils that exhibit SPT N-values of 6 bpf or less should be removed and replaced with controlled structural fill placed in accordance with recommendations presented in Section 6.3. Based on the boring data across the project site, approximate 2 to 4 feet of existing material (topsoil and loose soil) should be expected to require removal and replacement with controlled structural fill prior to new fill placement.

The geotechnical engineer/geologist may also require scarification and compaction (per Section 6.3) of the upper 6 inches of the exposed surface and/or proofrolling of the subgrade with a 20- to 30-ton loaded dump truck or other pneumatic tired vehicle of similar size and weight. Proofrolling should be performed during a time of good weather and not while the site is wet, frozen, or severely desiccated. The purpose of the proofrolling is to locate soft, weak, or excessively wet soils present at the time of construction and provide an opportunity for the geotechnical engineer/geologist to locate inconsistencies intermediate of the boring locations.

Depending on how the near surface materials respond during proofrolling operations, some in-place densification, undercutting, or in-place stabilization may be required. The extent of densification, undercutting, and/or in-place stabilization required across the site can best be determined by a geotechnical engineer/geologist at the time of construction. Once the site has been properly prepared, at-grade construction may proceed.

6.3 CONTROLLED STRUCTURAL FILL

The majority of the project site will require excavation/cut to achieve the planned finished grades. Where required, controlled structural fill required to develop the station pad and access road areas may consist of the non-organic, on-site terrace deposit soils. Based on laboratory testing on bulk samples obtained from other transition stations and substations sites along the transmission line corridor, we anticipate that off-site borrow material will consist of sandy silt, silty sand, or sand with a USCS classification of ML, SM, or SP. Other materials may be suitable for use as controlled

structural fill and should be individually evaluated by the geotechnical engineer; in general the structural fill should have a USCS classification of CL, ML, SM, or SC. Controlled structural fill should be free of boulders, organic matter, debris, or other deleterious materials and should have a maximum particle size no greater than 3 inches.

Fill materials should be placed in horizontal lifts with maximum height of 8 inches loose measure. New fill should be adequately keyed into stripped and scarified subgrade soils and should, where applicable, be benched into the existing slopes. During fill operations, positive surface drainage should be maintained to prevent the accumulation of water. We recommend that structural fill (soil and crushed stone) be compacted to a minimum of 95 percent of the maximum dry density and within two (2) percentage points of the optimum moisture content determined by the modified Proctor density test (ASTM D1557). In confined areas such as utility trenches, portable compaction equipment and thin lifts of 3 to 4 inches may be required to achieve specified degrees of compaction. Each lift of fill should be tested in order to confirm that the recommended degree of compaction is attained.

6.4 SLOPE STABILITY

6.4.1 General

We recommend that cut and fill slopes have a minimum factor of safety of 1.3 for global stability. Proposed structures on the Transition Station #6 site should be located a minimum distance of 10 feet and 15 feet from the crest and toe of slopes, respectively. In addition, we recommend that roadways be designed with a minimum setback of 5 feet from both the crest and toe of slopes.

Drainage from nearby structures and/or surface runoff should be directed away from the crest and toe of both planned cut and fill slopes. We note that diversion of surface water away from the slope crest and face is critical to reducing the potential of surface erosion and shallow failures. For erosion protection, a protective cover of grass or other vegetation should be established on permanent soil slopes as soon as possible.

6.4.2 New Slope Stability

New slopes constructed to develop the planned finished grade of the transition station pad will generally consist of fill slopes with a configuration of 3 (Horizontal) to 1 (Vertical) and a maximum height of less than 10 feet. In addition, a short section of new fill slope with a configuration of 1.5(H) to 1 (V), a height of about 8 feet, and a protective layer of rip-rap is planned on the southern side of the entrance to the station pad from Highway 3.

Using the computer program SLIDE 7.0 (RocScience), stability analyses were performed on a fill slope assuming a configuration of 3 (H) to 1 (V) and a height of 10 feet. Based on the results of the SLIDE analyses (see Appendix E – Output 1), we anticipate that planned 3 (H) to 1(V) fill slopes will exhibit a factor of safety (FoS) of 1.5 or greater for global stability if constructed in accordance with the recommendations presented herein.

Stability analyses were also performed on the small fill slope (with a protective layer of rip-rap) planned adjacent to Highway 3. Based on the results of the analyses (see Appendix E – Output 2), we anticipate that the planned 1.5(H) to 1(V) slope with rip-rap will exhibit a factor of safety (FoS) of 1.3 for global stability if constructed in accordance with the recommendations presented herein.

We recommend that the protective rip-rap layer have a minimum thickness of 2 feet, be underlain by a separation geotextile to minimum soil intrusion into the rip-rap, and be keyed into the subgrade at the slope's toe a minimum of 2 feet. The separation geotextile fabric used should have an equivalent opening size of equal to or greater than the US No 50 sieve, a minimum tensile strength at 20 percent strain of 30 pounds/linear inch, and a minimum puncture strength of 80 pounds.

6.5 GROUNDWATER CONDITIONS

6.5.1 General

Based on the data obtained during our exploration program, we generally anticipate that groundwater will not be encountered during expected earthwork or in shallow foundation excavations at the site. However, due to the proximity to the Pemigewasset River, we anticipate groundwater exists at a depth of 20 to 25 feet below existing site grades. Therefore, if drilled shafts are utilized on the project, the contractor should anticipate encountering groundwater should excavations extend deeper than 25 feet.

6.5.2 Infiltration Basin Estimated Seasonal High Water Table (ESHWT)

Borings INF 901 through INF 904 were performed to characterize the subsurface conditions to a depth of approximately 5 feet below the planned basin bottom and provide information necessary to estimate the seasonal high water table within the basin footprint. Subsurface data recorded in the infiltration test borings are shown on the respective logs included in Appendix A, and the results of infiltration tests performed immediately adjacent to each boring are provided in Appendix C. Table 4 below presents a summary of the interpreted ESHWT at each boring location as well as pertinent information required for design of the basins.

Table 4 –Basin Summary Information

Description	Boring INF 901	Boring INF 902	Boring INF 903	Boring INF 904
Infiltration Planned Bottom Elev. (ft)	483	483	480.7	480.7
Encountered Very Dense/Very Hard Soil Elev. (ft)	N.E.	N.E.	N.E.	N.E.
Encountered Bedrock Elev. (ft)	N.E.	N.E.	N.E.	N.E.
Encountered Groundwater Elev. (ft)	N.E.	N.E.	N.E.	N.E.
Highest Elevation of Observed Redox Features	N.E.	N.E.	N.E.	N.E.
USDA Textural Class (with 5 ft of Basin Bottom)	Sand	Sand	Sand	Silt Loam
Estimated Seasonal High Water Table (ESHWT) Elev. (ft)	Below 477	Below 477	Below 474	Below 474
Infiltration Test Elevation (ft)	483	482	475	474
Average Infiltration Rate at Test Elevation (in/hr)	24.0	24.0	11.4	2.4

Notes:
1) Borings generally extended about 5 feet below the planned depth of each respective basin unless where refusal and/or bedrock was encountered.
2) N.E. = Not Encountered
3) Very Dense/Very Hard Soil is defined as material exhibiting an SPT N-Value of greater than 50 blows per foot (bpf).
4) Very dense material encountered in INF 904 at 13 feet is due to cobbles and thus not reported on the table.
5) Noted elevations are estimates and should be considered approximate.
6) The average infiltration rate presented is based on field measurements; a factor of safety has not been applied.
7) Drilling contractor flushed the infiltration test boreholes with water following test casing installation. The water level measurements obtained at INF 903 and 904 at the time of the infiltration testing is not anticipated to represent the stabilized groundwater level. See the INF 903 and 904 boring logs for the appropriate groundwater levels.

6.6 GEOTECHNICAL DESIGN STRENGTH PARAMETERS

Recommended geotechnical strength parameters are provided for the subsurface conditions encountered in each test boring (not including infiltration test borings) in Appendix D. The recommended soil strength parameters were developed with consideration of lab test results and established correlations with SPT data.

6.7 BUS SUPPORT STRUCTURE/POLE FOUNDATION DESIGN AND CONSTRUCTION

6.7.1 General

Foundation support for the bus support structure (including ancillary pole structures) is anticipated to require deep foundations to resist shear and overturning loads. Although cobbles were noted in one boring performed at the site, they were encountered in the area of an infiltration basin. Based on the subsurface conditions encountered in boring performed within the station pad, we anticipate that drilled shafts, driven piles, and helical piles are suitable for support of the bus structure. The deep foundation design parameters provided in the subsections below are based on the subsurface conditions encountered in the area of BH 903, the planned finished grade elevations of 488 feet, and the general site preparation recommendations presented in subsequent sections of this report. Total settlement of deep foundations designed per the recommendations provided below is estimated to be less than 1 inch.

We recommend that proposed drilled shaft, driven pile, and helical pile construction equipment, methods, procedures and planned, and quality control testing and inspection during construction be reviewed by a qualified geotechnical engineer prior to the start of shaft construction. In addition, design of multiple pile foundations should include a minimum center-to-center spacing of three (3) times the maximum pile diameter/width for all deep foundations.

6.7.2 General Lateral Analyses Parameters for Deep Foundation Design

Table 5 provide the lateral design parameters for geotechnical evaluation of deep foundations installed at the Transition Station #6 site.

Table 5 – Recommended Lateral Design Parameters (LPILE)

Sublayer Description	Sublayer Depth (ft) Top	Sublayer Depth (ft) Bot.	Material Description	Effective Unit Weight (pcf)	Soil Effective Friction Angle (deg)	Soil Modulus Constant (k) (pci)	Unconfined Comp. Strength (psi)	m_i	Poisson's Ratio	Geologic Strength Index (GSI)	Rock Mass Modulus (psi)
New Controlled Fill	0	4.0	SM/ML	125	30	48	-	-	-	-	-
	4.0	9.5	SM/ML	125	30	48	-	-	-	-	-
Terrace Deposits	9.5	17.5	SP	115	30	48	-	-	-	-	-
	17.5	30.0	SP	120	34	122	-	-	-	-	-
	30.0+	-	SP	67.6	34	75	-	-	-	-	-

Note:
1) Use of the Reese (Sand) constitutive model is recommended for each sublayer.
2) Design profile assumes placement of 9.5ft of new controlled fill.
3) Design profile assumes encountering groundwater approximately 20-25ft below current ground elevation.

6.7.3 Drilled Shaft Foundations

<u>Axial Design Parameters</u>

We recommend the allowable axial capacities shown in Table 6 below be used for drilled shaft design.

Table 6 – Recommended Drilled Shaft Axial Design Parameters

Sublayer Description	Sublayer Depth (ft) Top	Sublayer Depth (ft) Bottom	Material Description	Allowable Skin Friction (Comp.) (psf)	Allowable Skin Friction (Uplift) (psf)	Allowable End Bearing (psf)
New Controlled Fill	0	4.0	SM/ML	IGNORE		
	4.0	9.5	SM/ML	75	60	-
Terrace Deposits	9.5	17.5	SP	250	210	-
	17.5	30.0	SP	350	290	10,400
	30.0+	-	SP	700	580	10,400

Notes:
1) Approximately 9.5 feet of new controlled structural fill is anticipated in the area of BH 903 (1 foot of undercut and replacement of topsoil and 5 additional feet to bring the area to the planned finished grade of 1308 feet).
2) Ultimate skin friction and end bearing capacities determined per methods prescribed in FHWA GEC 10: *Drilled Shaft: Construction Procedures and LRFD Design Methods* (2010).
3) Allowable capacities for skin (comp), skin (uplift), and end-bearing determined by applying a factor of safety of 2.5, 3.0 and 3.0, respectively.
4) Design assumes encountering groundwater approximately 20 - 25ft below current ground elevation.

Additional Drilled Shaft Design Recommendations

- Due to strain incompatibilities, drilled shaft design based entirely on skin friction or end bearing is recommended.
- A minimum shaft length (below the ground surface) of 20 feet is recommended to adequately resist uplift created due to adfreeze forces within the frost zone.
- A minimum shaft diameter of 30 inches is recommended.

Drilled Shaft Construction

Temporary wall support through the use of temporary casing will be required to prevent loss of sidewall support. The use of slurry for side wall support is not recommended. We recommend that the proposed drilled shaft construction equipment, methods, procedures, and planned quality control testing and inspection during construction be reviewed by a qualified geotechnical engineer prior to the start of shaft construction.

The ability of a drilled shaft to provide the end bearing resistances and associated settlements described herein is directly related to the construction methods and procedures used to provide a clean shaft bottom condition. Drilled shaft excavation and clean out methods shall result in bases/bottoms that are free of loose, soft, or disturbed material. Cleaning of the shaft excavations shall result in a maximum of 1 inch of loose, soft, or disturbed material on the shaft bottom at the time of concrete placement. Should concrete placement within the shaft not occur immediately following excavation and clean out, the condition of the excavation bottom shall be verified to confirm that no more than 1 inch of loose, soft, or disturbed material is present in the bottom of the excavation prior to concrete placement. Inspection of the installation methods and materials by an individual qualified and experienced in drilled shaft construction is recommended.

Placement of concrete via free-fall methods is acceptable assuming placement is directed vertically downward avoiding impact with reinforcement and that the height of groundwater on the bottom of the shaft does not exceed 3 inches at the time of placement. Should the level of water at the bottom of the excavation not be maintained at less than 3 inches, concrete placement via tremmie methods will be required.

6.7.4 Driven Pile Foundations

Axial Design Parameters

We recommend the allowable axial capacities shown in Table 7 below be used for driven pile design.

Additional Driven Pile Design Recommendations

- We recommend ignoring end-bearing resistance for the slender driven piles.
- A minimum pile embedment length (below the ground surface) of 25 feet is recommended to adequately resist uplift created due to adfreeze forces within the frost zone.

Table 7 – Recommended Driven Pile Axial Design Parameters

Sublayer Description	Sublayer Depth (ft)		Material Description	Allowable Skin Friction (Comp.) (psf)	Allowable Skin Friction (Uplift) (psf)
	Top	Bottom			
New Controlled Fill	0	4.0	SM/ML	IGNORE	
	4.0	9.5	SM/ML	100	80
Terrace Deposits	9.5	17.5	SP	200	165
	17.5	30.0	SP	475	395
	30.0+	-	SP	700	580

1) Approximately 9.5 feet of new controlled structural fill is anticipated in the area of BH 203 (1 foot of undercut and replacement of topsoil and 5 additional feet to bring the area to the planned finished grade of 1308 feet).
2) Ultimate skin friction capacities determined per methods prescribed in FHWA-NHI-16-010: *Design and Construction of Drive Pile Foundations* – Vol 1 (2016).
3) Allowable capacities for skin (comp) and skin (uplift) determined by applying a factor of safety of 2.5 and 3.0, respectively.
4) Design assumes encountering groundwater approximately 20 - 25ft below current ground elevation.

Driven Pile Construction

The ability of a driven pile to provide the capacities and associated settlements described herein is directly related to the construction methods and procedures. The capacity of piles may be assessed by the average penetration of the pile for the last 12 inches of driven length or the last ten blows. Initial driving criteria should be established based on WEAP analyses using the hammer types and specifications that will be used to install the piles. Inspection of the installation methods and materials by an individual qualified and experience in driven pile shaft construction is recommended.

All piles shall be driven to the depth specified on the drawings, or to refusal, whichever comes first, in accordance with the recommendations of the geotechnical reports and/or the requirements of the project documents. Hammer impacts shall be delivered concentrically and in direct alignment with the pile. Care shall be taken to avoid forcing the pile laterally or bending the pile. Steel HP piles shall be driven with flanges in the correct orientation as shown on the design drawings.

Helical Pile Foundations

We recommend the allowable axial capacities shown in Table 8 below be used for driven pile design.

Table 8 – Recommended Helical Pile Axial Design Parameters

Sublayer Description	Sublayer Depth (ft)		Material Description	Allowable End Bearing (Comp.) (psf)	Allowable End Bearing (Uplift) (psf)
	Top	Bottom			
New Controlled Fill	0	4.0	SM/ML	IGNORE	
	4.0	9.5	SM/ML		
Terrace Deposits	9.5	17.5	SP		
	17.5	30.0	SP	20,000	17,500
	30.0+	-	SP	20,000	17,500

1) Approximately 9.5 feet of new controlled structural fill is anticipated in the area of BH 203 (1 foot of undercut and replacement of topsoil and 5 additional feet to bring the area to the planned finished grade of 1308 feet).
2) Ultimate end bearing capacities were based *Helical Piles, A Practical Guide to Design and Installation* (2009).
3) Allowable capacities for bearing capacity determined by applying a factor of safety of 2 for both compression and uplift.

Helical Pile Construction

Helical piles shall be installed to the torque required as determined by the design engineer. Where refusal is met before the required minimum embedment is reached, the design engineer shall be notified immediately to decide if capacities will be adequate. If bedrock or refusal is encountered and the pile cannot gain adequate penetration to resist design uplift forces, the design engineer must review and approve the piles. Torque-load relationships shall be based on the results of pile load testing, where the torque values are achieved prior to the minimum embedment length being obtained, the piling operation shall cease and further direction shall be requested from the engineer.

The torque applied by the installation equipment shall be continuously monitored throughout the entire installation and the achieved values shall be recorded for each helical pile. Helical piles shall be installed continuously without interruption to the embedment depth indicated. Installation shall be executed in a smooth and continuous manner with a rate of advancement matching the pitch on the pile to minimize disturbance to the soil during installation. Sufficient downward pressure shall be applied as to aid the advancement of the helical pile into the ground. Under no circumstances shall the helical pile be pushed directly into the soil.

Helical piles shall be positioned as indicated on the construction drawings (either vertical or battered), in order to establish proper angular alignment at the start of installation. Helical piles shall be held securely and accurately in position during installation to ensure they are within specified tolerances. Safe and secure connections shall be provided to helical piles and extensions.

6.8 SHALLOW FOUNDATION DESIGN AND CONSTRUCTION

6.8.1 Transformer Pad

Where planned (vicinity of BH 903), we anticipate that approximately 8 additional feet of controlled structural fill will be required to developed the planned final grades in the area of the transformer pad. Therefore, we expect the transformer pad to be supported on newly placed, controlled structural fill. The source of the new fill was unknown at the time this report was prepared. However, testing on materials from other transition/substation locations indicates that the fill material will likely be susceptible to frost action. If the transformer equipment and ancillary connections are susceptible to vertical movement resulting from frost action, then the new fill material below the transformer pad (and to a distance of 2 foot laterally beyond the pad edges) should consist of clean sand or gravel meeting the requirements of NHDOT Standard Specification Section 209.

6.8.2 Single-Story Equipment Structures

Should single-story buildings be required to house equipment operated at the transition station, they may be supported on shallow foundations bearing on approved terrace deposit sands or new, controlled structural fill material placed in accordance with recommendations provided herein. We recommend that building foundations be designed for a maximum allowable bearing pressure of 3,000 pound per square feet (psf) for foundations bearing on approved subgrades. To reduce the possibility of localized shear failures, spread and strip footings should be a minimum of 3 feet and 1.5 feet wide, respectively.

The soils encountered at the site should react elastically to structure loads; settlements induced by foundation loads should occur soon after the load is applied. For single-story structures designed for a maximum allowable bearing pressure of 3,000 psf and approved terrace deposit soils or new controlled structural fill, we estimate total settlement of less than 1 inch with differential settlements of 1/2 to 2/3 the total estimated settlement.

6.8.3 Shrink-Swell and Frost Depth Considerations

Based on the soil materials observed in the test boring samples and the laboratory test results, the on-site soils will generally have a low shrink-swell potential. Accordingly, we do not recommend any foundation design modifications relative to the potential for shrink swell soils.

Frost depth should be anticipated to be 4 feet below the lowest adjacent grade. Therefore, foundations and utilities that are susceptible to frost action should bear a minimum of 4 feet below adjacent grades.

6.8.4 Shallow Foundation Construction

All foundation subgrades should be observed, evaluated, and verified for the design bearing pressure by a representative of the geotechnical engineer after excavation and prior to reinforcement steel placement. If low density/consistency soils are encountered at the foundation subgrade during construction, localized undercutting and/or in-place stabilization of foundation

subgrades may be required. The actual need for, and extent of, undercutting or in-place stabilization should be based on field observations made by a representative of the geotechnical engineer at the time of construction.

Excavations for footings should be made in such a way as to provide bearing surfaces that are firm and free of loose, soft, wet, or otherwise disturbed soils. Foundation concrete should not be placed on frozen or saturated subgrades. If such materials are allowed to remain below foundations, settlements will increase. Foundation excavations should be concreted as soon as practical after they are excavated. If an excavation is left open for an extended period, a thin mat of lean concrete should be placed over the bottom to minimize damage to the bearing surface from weather or construction activities. Water should not be allowed to pond in any excavation.

6.9 EARTHQUAKE CONSIDERATIONS

6.9.1 Seismic Site Class Definition

The following recommendations are based Chapter 20 of the ASCE 7-10. ASCE 7-10 provides a methodology for interpretation of SPT resistance values (N-values) to determine a Site Class Definition; however, this method requires averaging N-values over the top 100 feet of the subsurface profile. We note that the test borings for this project were extended to a maximum depth of about 22 feet below existing site grades.

The available subsurface data from our exploration indicates an N-value range of about 3 to 53 bpf within the upper 22 feet below existing site grades. In general accordance with ASCE 7-10 and considering the boring data and planned grading, we recommend that a Site Class Definition “D” be used for design.

6.9.2 Liquefaction

Liquefaction of saturated, fine grained sands and silty sands is not anticipated to be a design concern for the Transition Station #6 site.

6.10 KARST GEOLOGY

Karst topography occurs from the dissolution of soluble bedrock (such as limestone, dolomite, or gypsum) which creates karst features (sinkholes and caves) within the subsurface. Karst conditions were not encountered during the exploration reported herein. Karst features/conditions are not anticipated to be a design or construction concern for the Transition Station #6 site.

6.11 CORROSION CONSIDERATIONS

Two bulk samples obtained in borings BH 902 and BH 905 were tested in the laboratory to determine pH, water soluble sulfate and chloride, and resistivity. The results of the lab tests are summarized in Table 8 below.

Table 8 – Laboratory Corrosivity Test Results

Boring No.	Sample Type & Depth (ft)	pH	Chloride (ug/g)	Sulfate (ug/g)	Electrical Resistivity (ohm-cm)
BH 902	BULK (5 - 10)	5.6	< 5.2	11	160,000
BH 905	BULK (5 - 10)	5.4	< 5.2	8.1	98,000

In general, soils that exhibit a resistivity of greater than 5,000 ohm-cm are considered non-aggressive (FHWA, 2010). Therefore, based on the results of the laboratory test performed on samples collected from the Transition Station #6, the onsite soil should be considered as non-aggressive. Laboratory tests performed on samples collected at other transition and substation sites to date have yielded similar non-aggressive results. However, should the borrow source used to develop the Transition Station #6 site originate from a location other than one of the transition or substation sites, corrosivity testing on representative soil samples from the source is recommended prior to onsite delivery to confirm that the soil is non-aggressive.

7.0 LIMITATIONS

This report has been prepared for the exclusive use of PAR Electrical Contractors, Inc. or their agent, for specific application to the Transition Station #6 project near Bridgewater, New Hampshire. The conclusions and recommendations presented herein are based on design information furnished to us, the data obtained from the previously described subsurface exploration programs, and generally accepted geotechnical engineering practice. The conclusions and recommendations do not reflect variations in subsurface conditions which could exist intermediate of the boring locations or in unexplored areas of the site. Should such variations become apparent during construction, it will be necessary to re-evaluate our conclusions and recommendations based upon on-site observations of the conditions.

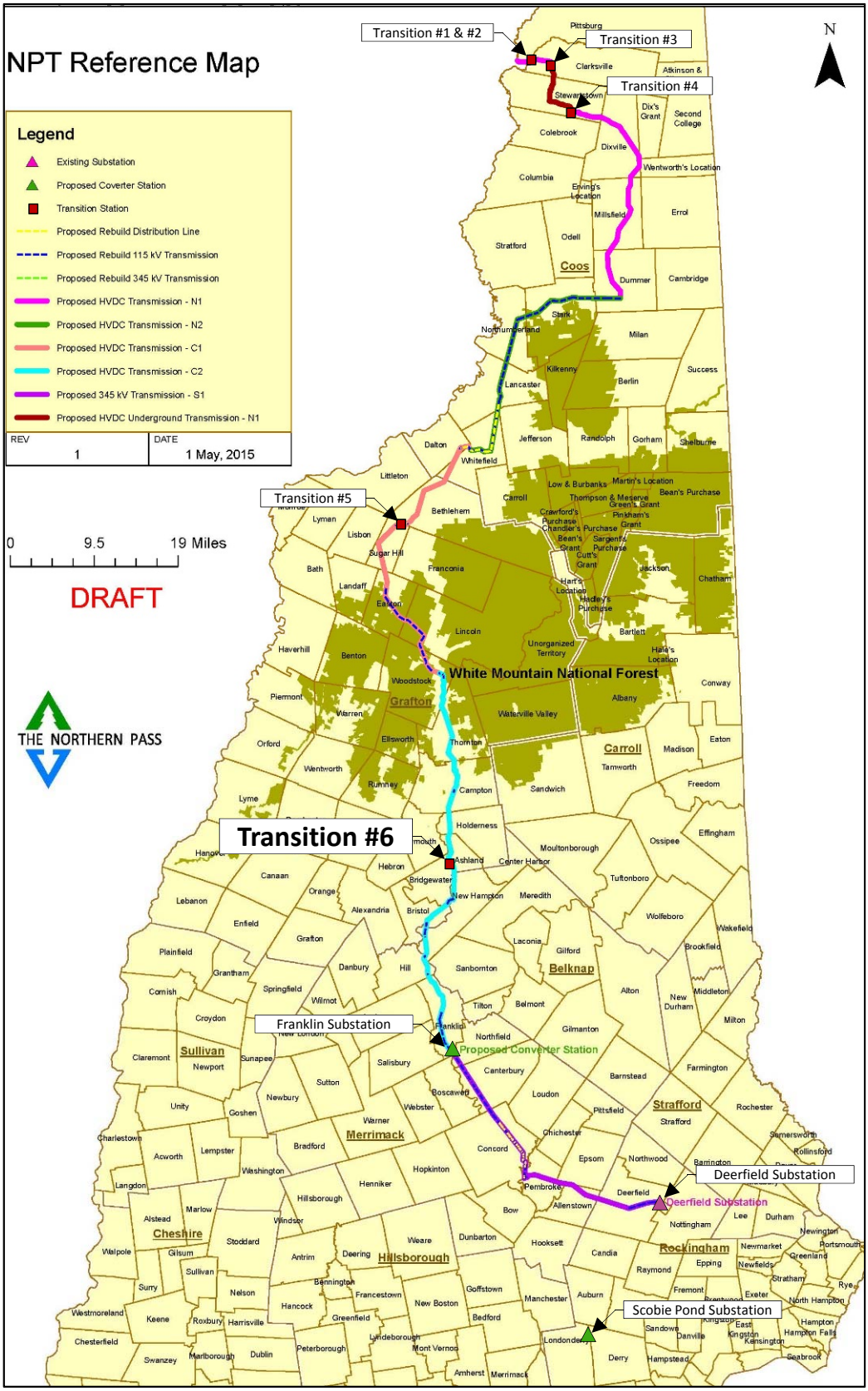
The soil and rock descriptions/classifications and the strata breaks shown on the boring logs attached to this report are based primarily on visual observation and should be considered approximate. Regardless of the thoroughness of a subsurface exploration, there is the possibility that conditions between borings will differ from those at the boring locations, that conditions are not as anticipated by the designers, or that the construction process has altered the soil conditions. Therefore, experienced geotechnical engineers or engineering geologists should evaluate earthwork and foundation construction to verify that the conditions anticipated in design actually exist.

In the event that changes are made in the design or location of the project, the recommendations presented in the report shall not be considered valid unless the changes are reviewed by Quanta Subsurface and conclusions of this report modified and/or verified in writing. If this report is copied or transmitted to a third party, it must be copied or transmitted in its entirety, including text, attachments, and enclosures. Interpretations based on only a part of this report may not be valid.

8.0 REFERENCES

- New Hampshire Department of Environmental Services: New Hampshire Stormwater Manual; *Post-Construction Best Management Practices Selection & Design*; Volume 2; December 2008.
- New Hampshire Geological Survey; *Geologic Map and Structure Sections of the Ashland Quadrangle New Hampshire*; Scale 1:24,000; *2001*.
- New Hampshire Department of Transportation; *Standard Specifications for Road and Bridge Construction*; Section 209 Granular Backfill; 2016
- Terracon Consultants' Inc.; *Report of Expected Geotechnical Conditions*: Northern Pass Project; July 10, 2015.
- U.S Department of Transportation Federal Highway Administration (FHWA); *Drilled Shafts: Construction Procedures and LRFD Design Methods*; FHWA-NHI-10-016; May 2010.
- U.S Department of Transportation Federal Highway Administration (FHWA); *Design and Construction of Driven Pile Foundations*; FHWA-NHI-16-010; September 2016.
- McGregor, J and J.M. Duncan; Virginia Polytechnic Institute and State University - Center for Geotechnical Practice and Research; *Performance and Use of the Standard Penetration Test in Geotechnical Engineering Practice*; October 1998
- Perko, H; *Helical Piles, A Practical Guide to Design and Installation*; 2009

Figures



Project No.: 16004 Date: December 2016

Figure 1

Site Vicinity Location Plan

QUANTA SUBSURFACE Engineering – Construction

Northern Pass TL – Transition Station #6
Geotechnical Investigation

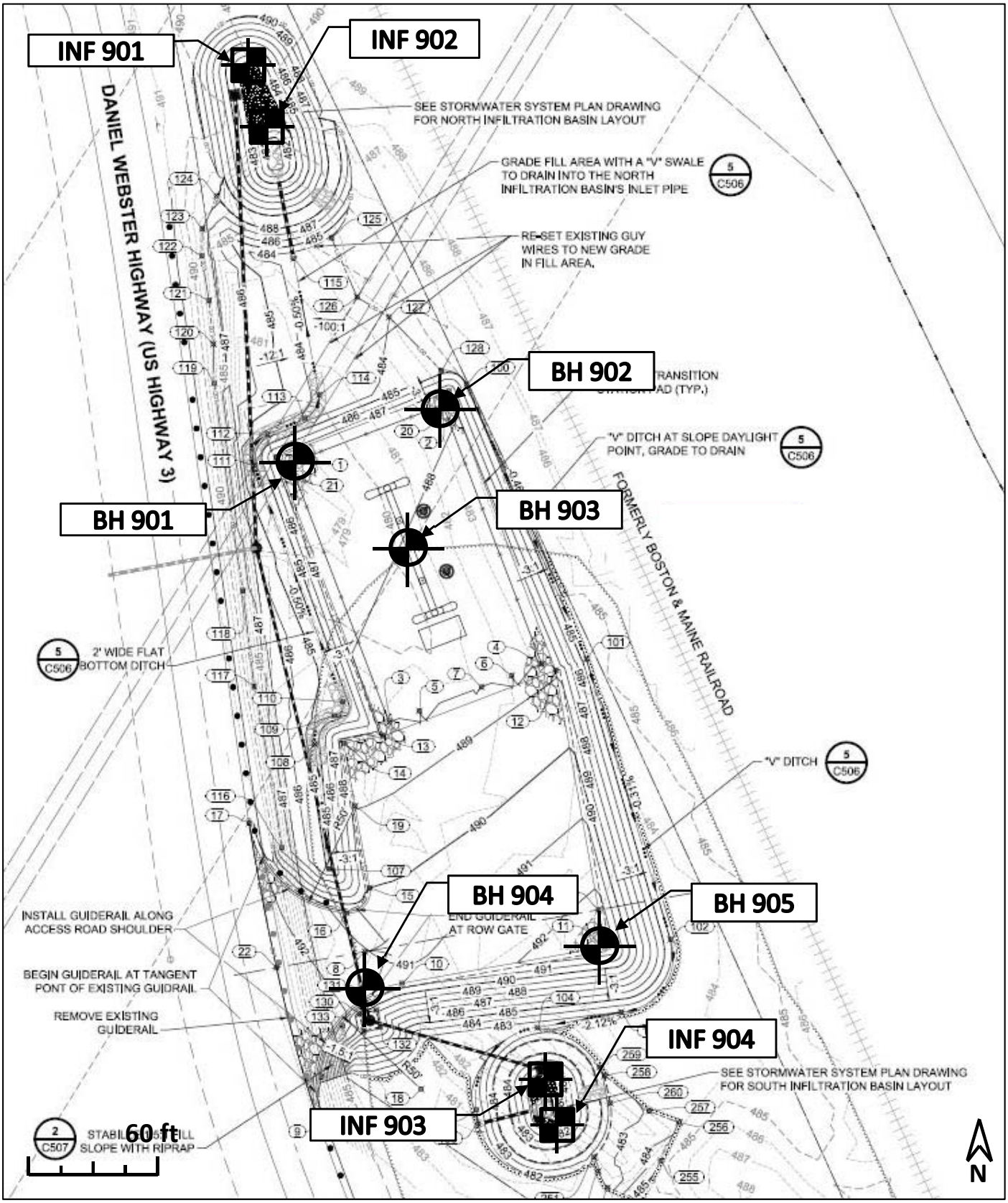
Base Map: Google Earth, 2016.

Figure 2
Site Vicinity Map

Project No.: 16004 Date: December 2016

QUANTA SUBSURFACE
Engineering – Construction

Northern Pass TL – Transition Station #6
Geotechnical Investigation



Base Map: Transition Station #6: NPTT904-C101-Geotech.dwg

Quanta Subsurface Boring Location, August/September 2016

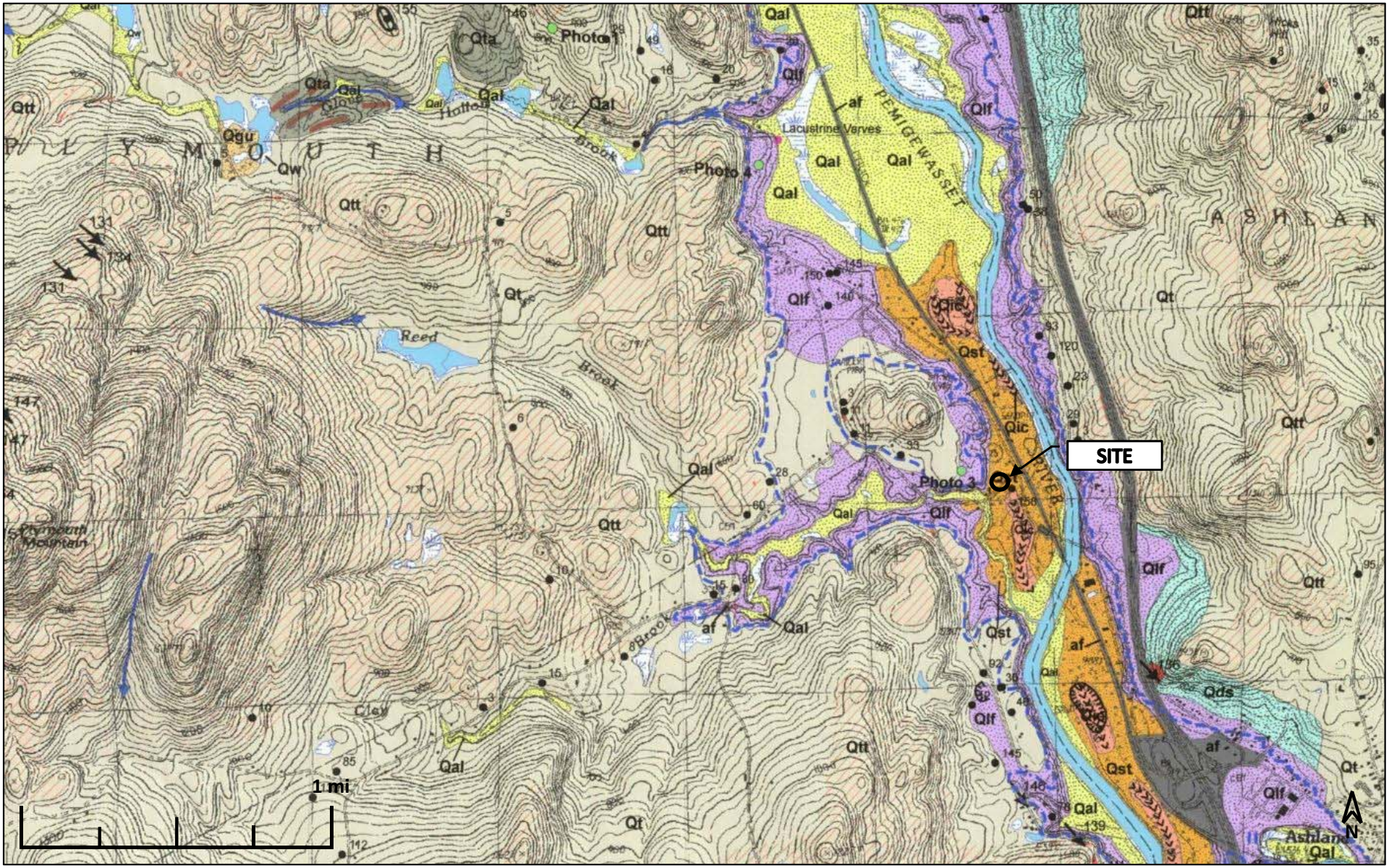
Quanta Subsurface Infiltration Location, August/September 2016

Project No.: 16004 Date: December 2016

Figure 3
Boring Location Plan

QUANTA SUBSURFACE
Engineering – Construction

Northern Pass TL – Transition Station #6
Geotechnical Investigation



Base Map: New Hampshire Geological Survey, *Geologic Map and Structure Sections of the Ashland Quadrangle New Hampshire (2001)*

Legend:

Qt	Till	Qal	Alluvium	af	Artificial Till
Qtt	Thin Till	Qic	Glaciofluvial Deposit	Qds	Eolian Deposit
Qst	Stream Terrace Deposit	Qlf	Glacial Lake Deposits		Wetland Deposit

Figure 4

Surficial Geologic Map

Project No.: 16004 Date: December 2016

QUANTA SUBSURFACE

Northern Pass TL – Transition Station #6
Geotechnical Investigation

Appendix A
QS Boring Logs

QUANTA SUBSURFACE Engineering + Construction
Quanta Subsurface
4308 N Barker RD
Spokane Valley, WA 99027
Telephone: 509-892-9409

BORING NUMBER BH 901

CLIENT PAR Electrical Contractors
PROJECT NAME Northern Pass TL - Transition Station #6
PROJECT NUMBER 16004
PROJECT LOCATION Bridgewater, New Hampshire
DATE STARTED 8/29/16 **COMPLETED** 8/29/16
GROUND ELEVATION 479.0 ft **HOLE SIZE** 6"
DRILLING CONTRACTOR SW Cole
LATITUDE 43.71161004 **LONGITUDE** -71.65742196
DRILLING METHOD Hollow Stem Auger
DRILLING EQUIPMENT CME 850 **SPT HAMMER** Automatic
LOGGED BY S. Laing **CHECKED BY** J.T. McGinnis
GROUND WATER LEVEL:
NOTES
AT END OF DRILLING Not Encountered

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	GRAPHIC LOG	MATERIAL DESCRIPTION	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0	SPT 1	58	1-1-2-2 (3)			TOPSOIL: Silty SAND (SM), trace organics, moderate brown, dry, very loose, fine grained sand	5.1			
							TERRACE DEPOSITS: Poorly Graded SAND (SP), trace fine gravel, trace silt, yellowish orange, dry, very loose to dense, fine grained sand, subrounded				
		SPT 2	67	2-2-3-5 (5)				5.0			
475											
	5	SPT 3	67	4-4-6-6 (10)			- fine to medium grained sand from 4 to 14 feet				
		SPT 4	79	5-5-6-7 (11)							
470		SPT 5	79	5-6-6-6 (12)							
	10	SPT 6	75	6-6-7-10 (13)			- slighlty micaceous from 10 to 19 feet				
465											
	15	SPT 7	67	7-9-13-15 (22)			- grayish orange from 14 to 22 feet				
460											
	20	SPT 8		13-17-17-16 (34)							

Bottom of Borehole at 22.0 feet

QUANTA SUBSURFACE Engineering + Construction
Quanta Subsurface
4308 N Barker RD
Spokane Valley, WA 99027
Telephone: 509-892-9409

BORING NUMBER BH 902

CLIENT PAR Electrical Contractors
PROJECT NAME Northern Pass TL - Transition Station #6
PROJECT NUMBER 16004
PROJECT LOCATION Bridgewater, New Hampshire
DATE STARTED 8/29/16 **COMPLETED** 8/29/16
GROUND ELEVATION 483.7 ft **HOLE SIZE** 6"
DRILLING CONTRACTOR SW Cole
LATITUDE 43.71168396 **LONGITUDE** -71.65711502
DRILLING METHOD Hollow Stem Auger
DRILLING EQUIPMENT CME 850 **SPT HAMMER** Automatic
LOGGED BY S. Laing **CHECKED BY** J.T. McGinnis
GROUND WATER LEVEL:
NOTES
AT END OF DRILLING Not Encountered

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	GRAPHIC LOG	MATERIAL DESCRIPTION	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	REMARKS
	0	SPT 1	13	3-2-2-3 (4)			TOPSOIL: Poorly Graded SAND (SP), trace silt, trace organics, moderate brown, moist, loose, fine grained sand	9.0			4.3	
480		SPT 2	96	4-3-4-4 (7)			TERRACE DEPOSITS: Poorly Graded SAND (SP), trace silt, grayish orange, dry, loose to medium dense, fine grained sand					
	5	SPT 3	100	4-4-6-7 (10)			- yellowish orange from 4 to 22 feet	4.1				A bulk samples was obtained from 5 to 10 feet. % fines = 2.1% Resistivity = 160,000 ohm-cm pH = 5.6
		SPT 4	88	5-5-6-7 (11)								
475		SPT 5	100	6-7-8-10 (15)								
	10	SPT 6	92	8-9-10-12 (19)								
470							- fine to medium grained sand from 14 to 22 feet					
	15	SPT 7	75	5-6-8-7 (14)								
465												
	20	SPT 8	75	7-7-10-10 (17)								

Bottom of Borehole at 22.0 feet

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BORING NUMBER BH 903

CLIENT PAR Electrical Contractors
PROJECT NAME Northern Pass TL - Transition Station #6
PROJECT NUMBER 16004
PROJECT LOCATION Bridgewater, New Hampshire
DATE STARTED 8/29/16 **COMPLETED** 8/29/16
GROUND ELEVATION 480.5 ft **HOLE SIZE** 6"
DRILLING CONTRACTOR SW Cole
LATITUDE 43.71151398 **LONGITUDE** -71.65718199
DRILLING METHOD Hollow Stem Auger
DRILLING EQUIPMENT CME 850 **SPT HAMMER** Automatic
LOGGED BY S. Laing **CHECKED BY** J.T. McGinnis
GROUND WATER LEVEL:
NOTES
AT END OF DRILLING Not Encountered

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	GRAPHIC LOG	MATERIAL DESCRIPTION	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
480	0	SPT 1	67	1-1-1-2 (2)			TOPSOIL: Poorly Graded SAND (SP), trace silt, trace organics, moderate brown, dry, very loose, fine grained sand	5.2			1.7
		SPT 2	67	3-4-3-5 (7)			TERRACE DEPOSITS: Poorly Graded SAND (SP), trace silt, yellowish orange, moist, loose to medium dense, fine grained sand				
475	5	SPT 3	63	3-4-5-7 (9)				7.8			
		SPT 4	54	3-4-7-8 (11)			- fine to medium grained sand from 6 to 22 feet				
	10	SPT 5	58	6-6-6-9 (12)							
470		SPT 6	83	6-8-12-12 (20)							
	15										
465		SPT 7	83	7-9-13-13 (22)							
	20										
460		SPT 8	88	8-8-12-13 (20)							

Bottom of Borehole at 22.0 feet

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BORING NUMBER BH 904

CLIENT PAR Electrical Contractors
PROJECT NAME Northern Pass TL - Transition Station #6
PROJECT NUMBER 16004
PROJECT LOCATION Bridgewater, New Hampshire
DATE STARTED 8/29/16 **COMPLETED** 8/29/16
GROUND ELEVATION 482.0 ft **HOLE SIZE** 6"
DRILLING CONTRACTOR SW Cole
LATITUDE 43.71090897 **LONGITUDE** -71.65728802
DRILLING METHOD Hollow Stem Auger
DRILLING EQUIPMENT CME 850 **SPT HAMMER** Automatic
LOGGED BY S. Laing **CHECKED BY** J.T. McGinnis
GROUND WATER LEVEL:
NOTES
AT END OF DRILLING Not Encountered

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	GRAPHIC LOG	MATERIAL DESCRIPTION	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
	0						TERRACE DEPOSITS: Poorly Graded SAND with silt (SP-SM), reddish brown, moist, loose, fine grained sand				
		SPT 1	58	2-2-2-3 (4)			Poorly Graded SAND (SP), trace silt, yellowish orange, dry, loose to medium dense, fine to medium grained sand	11.6			
480											
		SPT 2	46	3-4-5-5 (9)							
	5	SPT 3	67	5-4-6-8 (10)			- fine to coarse grained sand from 4 to 6 feet	5.0			
475											
		SPT 4	54	7-7-8-8 (15)							
		SPT 5	75	8-8-8-9 (16)							
	10										
		SPT 6	67	6-8-8-7 (16)							
470											
							- moist and fine grained sand from 14 to 22 feet				
	15										
		SPT 7	63	6-5-7-8 (12)							
465											
	20										
		SPT 8	92	10-10-13-12 (23)							
460											

Bottom of Borehole at 22.0 feet

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BORING NUMBER BH 905

CLIENT PAR Electrical Contractors
PROJECT NAME Northern Pass TL - Transition Station #6
PROJECT NUMBER 16004
PROJECT LOCATION Bridgewater, New Hampshire
DATE STARTED 8/29/16 **COMPLETED** 8/29/16
GROUND ELEVATION 483.1 ft **HOLE SIZE** 6"
DRILLING CONTRACTOR SW Cole
LATITUDE 43.71102598 **LONGITUDE** -71.65686498
DRILLING METHOD Hollow Stem Auger
DRILLING EQUIPMENT CME 850 **SPT HAMMER** Automatic
LOGGED BY S. Laing **CHECKED BY** J.T. McGinnis
GROUND WATER LEVEL:
NOTES
AT END OF DRILLING Not Encountered

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	GRAPHIC LOG	MATERIAL DESCRIPTION	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	REMARKS
	0	SPT 1	54	1-0-2-2 (2)			TOPSOIL: Poorly Graded SAND with silt (SP-SM), trace organics, yellowish brown, moist, very loose, fine grained sand	6.8				
							TERRACE DEPOSITS: Poorly Graded SAND (SP), trace silt, grayish orange, dry, loose to dense, fine to medium grained sand					
480		SPT 2	71	2-2-3-3 (5)			- yellowish orange from 2 to 8 feet					
	5	SPT 3	67	4-5-4-5 (9)			- slightly micaceous from 4 to 8 feet	3.6				A bulk samples was obtained from 5 to 10 feet. % fines = 1.3% Resistivity = 98,000 ohm-cm pH = 5.4
		SPT 4	75	4-4-4-5 (8)								
475		SPT 5	79	6-8-8-9 (16)			- moist and fine grained sand from 8 to 22 feet					
	10	SPT 6	79	7-8-10-11 (18)								
470												
	15	SPT 7	83	8-8-9-11 (17)								
465												
	20	SPT 8	96	11-11-21-22 (32)								

Bottom of Borehole at 22.0 feet

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BORING NUMBER INF 901

CLIENT PAR Electrical Contractors
PROJECT NAME Northern Pass TL - Transition Station #6
PROJECT NUMBER 16004
PROJECT LOCATION Bridgewater, New Hampshire
DATE STARTED 8/30/16 **COMPLETED** 8/30/16
GROUND ELEVATION 489.7 ft **HOLE SIZE** 6"
DRILLING CONTRACTOR SW Cole
LATITUDE 43.71212603 **LONGITUDE** -71.65749203
DRILLING METHOD Hollow Stem Auger
DRILLING EQUIPMENT CME 850 **SPT HAMMER** Automatic
LOGGED BY S. Laing **CHECKED BY** J.T. McGinnis
GROUND WATER LEVEL:
NOTES
AT END OF DRILLING Not Encountered

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	GRAPHIC LOG	MATERIAL DESCRIPTION	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	REMARKS
	0	SPT 1	33	4-5-7-8 (12)			TOPSOIL: Silty SAND (SM), trace organics, moderate brown, dry, loose, fine grained sand					Infiltration test casing installed in an adjacent borehole to a depth of approximately 7 feet.
							TERRACE DEPOSITS: Poorly Graded SAND (SP), trace silt, dark yellowish orange, dry, loose to medium dense, fine to medium grained sand					
		SPT 2	67	6-6-6-7 (12)								
485	5	SPT 3	75	4-4-6-6 (10)			- grayish orange from 4 to 14 feet					
		SPT 4	67	5-5-7-7 (12)								
480	10	SPT 5	75	5-5-5-6 (10)				3.2			0.7	
		SPT 6	75	5-7-8-10 (15)			- trace subangular fine gravel from 10 to 12 feet					
		SPT 7	75	8-8-10-10 (18)								The ESHWT is at a depth below 14 feet.

Bottom of Borehole at 14.0 feet

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BORING NUMBER INF 902

CLIENT PAR Electrical Contractors
PROJECT NAME Northern Pass TL - Transition Station #6
PROJECT NUMBER 16004
PROJECT LOCATION Bridgewater, New Hampshire
DATE STARTED 8/30/16 **COMPLETED** 8/30/16
GROUND ELEVATION 488.8 ft **HOLE SIZE** 6"
DRILLING CONTRACTOR SW Cole
LATITUDE 43.71206199 **LONGITUDE** -71.65746496
DRILLING METHOD Hollow Stem Auger
DRILLING EQUIPMENT CME 850 **SPT HAMMER** Automatic
LOGGED BY S. Laing **CHECKED BY** J.T. McGinnis
GROUND WATER LEVEL:
NOTES
AT END OF DRILLING Not Encountered

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	GRAPHIC LOG	MATERIAL DESCRIPTION	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	REMARKS
	0	SPT 1	25	2-2-2-3 (4)			TOPSOIL: Silty SAND (SM), trace organics, moderate brown, dry, loose, fine grained sand					Infiltration test casing installed in an adjacent borehole to a depth of approximately 6 feet.
		SPT 2	33	4-4-4-5 (8)			TERRACE DEPOSITS: Poorly Graded SAND (SP), trace silt, dark yellowish orange, dry, loose to medium dense, fine to medium grained sand	3.7				
485	5	SPT 3	67	3-4-5-5 (9)								
		SPT 4	75	4-5-5-6 (10)								
480	10	SPT 5	75	5-5-7-7 (12)			- grayish orange from 8 to 14 feet					
		SPT 6	75	5-6-7-8 (13)								
475		SPT 7	79	7-7-8-9 (15)								The ESHWT is at a depth below 14 feet.

Bottom of Borehole at 14.0 feet

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BORING NUMBER INF 903

CLIENT PAR Electrical Contractors
PROJECT NAME Northern Pass TL - Transition Station #6
PROJECT NUMBER 16004
PROJECT LOCATION Bridgewater, New Hampshire
DATE STARTED 8/29/16 **COMPLETED** 8/29/16
GROUND ELEVATION 482.3 ft **HOLE SIZE** 6"
DRILLING CONTRACTOR SW Cole
LATITUDE 43.71082096 **LONGITUDE** -71.65694998
DRILLING METHOD Hollow Stem Auger
DRILLING EQUIPMENT CME 850 **SPT HAMMER** Automatic
LOGGED BY S. Laing **CHECKED BY** J.T. McGinnis
GROUND WATER LEVEL:
NOTES
AT END OF DRILLING Not Encountered

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	GRAPHIC LOG	MATERIAL DESCRIPTION	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	REMARKS
	0						TOPSOIL: Silty SAND (SM), trace organics, moderate brown, dry, loose, fine grained sand					Infiltration test casing installed in an adjacent borehole to a depth of approximately 8 feet.
		SPT 1	58	1-2-2-2 (4)			TERRACE DEPOSITS: Poorly Graded SAND with silt (SP-SM), grayish orange, dry, loose to medium dense, fine grained sand					
480		SPT 2	63	4-4-5-6 (9)			- little silt from 2.5 to 4.5 feet	4.6			11.3	
	5	SPT 3	79	6-7-8-12 (15)			- yellowish orange from 4.5 to to 5.5 feet - little silt from 5.5 to 6.5 feet					
475		SPT 4	75	9-8-7-6 (15)			- moderate yellowish brown from 6.5 to 14 feet					
		SPT 5	83	5-5-5-7 (10)								
	10											
		SPT 6	92	5-6-6-7 (12)								
470		SPT 7	50	5-7-7-6 (14)			- little fine subangular gravel below 13.5 feet					The ESHWT is at a depth below 14 feet.

Bottom of Borehole at 14.0 feet

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Quanta Subsurface
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Spokane Valley, WA 99027
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BORING NUMBER INF 904

CLIENT PAR Electrical Contractors
PROJECT NAME Northern Pass TL - Transition Station #6
PROJECT NUMBER 16004
PROJECT LOCATION Bridgewater, New Hampshire
DATE STARTED 8/29/16 **COMPLETED** 8/29/16
GROUND ELEVATION 481.8 ft **HOLE SIZE** 6"
DRILLING CONTRACTOR SW Cole
LATITUDE 43.71077201 **LONGITUDE** -71.65694998
DRILLING METHOD Hollow Stem Auger
DRILLING EQUIPMENT CME 850 **SPT HAMMER** Automatic
LOGGED BY S. Laing **CHECKED BY** J.T. McGinnis
GROUND WATER LEVEL:
NOTES
AT END OF DRILLING Not Encountered

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	GRAPHIC LOG	MATERIAL DESCRIPTION	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	REMARKS
	0											
480		SPT 1	75	1-2-3-3 (5)			TERRACE DEPOSITS: Silty SAND (SM), grayish orange, dry, loose, fine grained sand					Infiltration test casing installed in an adjacent borehole to a depth of approximately 8 feet.
		SPT 2	75	4-6-6-6 (12)			Poorly Graded SAND (SP), trace silt, grayish orange, dry, medium dense, fine grained sand					
	5	SPT 3	75	8-9-10-13 (19)			SILT with sand (ML), dark yellowish brown, moist, very stiff, fine grained sand	12.8			71.8	
475		SPT 4	58	9-11-14-14 (25)								
		SPT 5	63	6-6-6-6 (12)			Poorly Graded SAND with gravel (SP), trace silt, moderate yellowish brown, moist, medium dense, fine to coarse grained gravel, fine to medium grained sand, subrounded					
	10	SPT 6	75	6-6-7-9 (13)								
470		SPT 7	79	17-43-10-10 (53)			- cobble encountered at 13 feet					The ESHWT is at a depth below 14 feet.

Bottom of Borehole at 14.0 feet

Appendix B
QS Laboratory Test Results

SUMMARY OF LAB TESTING RESULTS

NORTHERN PASS TRANSMISSION LINE PROJECT

TRANSITION STATION #6
PROJECT NO.: 16004

SAMPLE INFORMATION			LAB TEST RESULTS																
BOREHOLE No.	FIELD SAMPLE ID	DEPTH (ft)	MOISTURE CONTENT (ASTM D2216) (%)	ORGANIC CONTENT OF SOIL (ASTM D2794) (%)	Sieve Analysis (ASTM D422)				% PASSING NO. 200 SEIVE (ASTM D1140)	ATTERBERG LIMITS (ASTM D4318)			MODIFIED PROCTOR (ASTM D1557)		UNCONFINED COMPRESSIVE STRENGTH OF ROCK (ASTM D7102) (psi)	SOIL CHEMISTRY			
					% Gravel	% Sand	% Silt	% Clay		LL	PL	PI	Max. Dry Density (pcf)	Optimum Moisture Content (%)		SO_4 (ASTM D516) (ug/g)	CHLORIDE (ASTM D512) (ug/g)	pH (ASTM G51)	RESISTIVITY (AASHTO T288) (ohm-cm)
BH 901	S1	0-2	5.1																
BH 901	S2	2-4	5.0																
BH 902	S1	0-2	9.0						4.3										
BH 902	BULK	5-10							2.1							11[A]	< 5.2[A]	5.6	160,000
BH-902	S4	4-6	4.1																
BH 903	S1	0-2	5.2						1.7										
BH 903	S3	4-6	7.8																
BH 904	S1	0-2	11.6																
BH 904	S3	4-6	5.0																
BH 905	S1	0-2	6.8																
BH 905	S3	4-6	3.6																
BH 905	BULK	5-10							1.3							8.1[A]	< 5.2[A]	5.4	98,000
INF 901	S5	8-10	3.2						0.7										
INF 902	S2	2-4	3.7																
INF 903	S2	2-4	4.6						11.3										
INF 904	S3	4-6	12.8						71.8										

NOTES:
General - Testing performed by S.W. Cole unless otherwise noted.
A - Testing performed by Absolute Resource Associates as a subcontractor to S.W. Cole.

Report of Moisture Content of Soil and Rock

ASTM D2216-10

Project Name:	Northern Pass Transmission Line	**Project Number:**	16-0600
Project Location:	Various, NH	**Lab ID:**	Multiple
Client:	Quanta Subsurface	**Date Received:**	09/13/16
Material Description:	Multiple	**Date Completed:**	09/15/16
Material Source:	Transition Station 6	**Tested By:**	BLG

Lab ID	Nominal Maximum Aggregate Size	Material Description	Moisture Content
15075S	⅜"	TS-6, BH-901, S1, 0-2'	5.1%
15076S	⅜"	TS-6, BH-901, S2, 2-4'	5.0%
15077S	⅜"	TS-6, BH-902, S1, 0-2'	9.0%
15078S	⅜"	TS-6, BH-902, S4, 4-6'	4.1%
15079S	⅜"	TS-6, BH-903, S1, 0-2'	5.2%
15080S	⅜"	TS-6, BH-903, S3, 4-6'	7.8%
15081S	⅜"	TS-6, BH-904, S1, 0-2'	11.6%
15082S	⅜"	TS-6, BH-904, S3, 4-6'	5.0%
15083S	⅜"	TS-6, BH-905, S1, 0-2'	6.8%
15084S	⅜"	TS-6, BH-905, S3, 4-6'	3.6%

Comments:

Reviewed By: CBM

Report of Moisture Content of Soil and Rock

ASTM D2216-10

Project Name:	Northern Pass Transmission Line	**Project Number:**	16-0600
Project Location:	Various, NH	**Lab ID:**	Multiple
Client:	Quanta Subsurface	**Date Received:**	09/13/16
Material Description:	Multiple	**Date Completed:**	09/15/16
Material Source:	Transition Station 6	**Tested By:**	BLG

Lab ID	Nominal Maximum Aggregate Size	Material Description	Moisture Content
15085S	⅜"	TS-6, INF-901, S5, 8-10'	3.2%
15086S	⅜"	TS-6, INF-902, S2, 2-4'	3.7%
15087S	⅜"	TS-6, INF-903, S2, 2-4'	4.6%
15088S	⅜"	TS-6, INF-904, S3, 4-6'	12.8%

Comments:

Reviewed By: CBM

S.W.COLE ENGINEERING, INC.

Percent Finer than No. 200 ASTM D1143

Project Number: 16-0600
Project Name: Northern Pass Transmission

Sample ID:	15077S
Sample Source:	TS-6, BH-902, S1, 0-2'
Client Sample Description:	SP
% Passing # 200:	4.3

Sample ID:	15079S
Sample Source:	TS-6, BH-903, S1, 0-2'
Client Sample Description:	SP
% Passing # 200:	1.7

Sample ID:	15085S
Sample Source:	TS-6, INF-901, S5, 8-10'
Client Sample Description:	SP
% Passing # 200:	0.7

Sample ID:	15087S
Sample Source:	TS-6, INF-903, S2, 2-4'
Client Sample Description:	SM
% Passing # 200:	11.3

Sample ID:	15088S
Sample Source:	TS-6, INF-904, S3, 4-6'
Client Sample Description:	ML
% Passing # 200:	71.8

note: interbedded silt seams in sand sample

S.W.COLE ENGINEERING, INC.

Percent Finer than No. 200 ASTM D1143

Project Number: 16-0600
Project Name: Northern Pass Transmission Line

Sample ID:	15218S
Sample Source:	TS-6, BH-902, BULK, 5-10'
Client Sample Description:	SP
% Passing # 200:	2.1

Sample ID:	15219S
Sample Source:	TS-6, BH-905, BULK, 5-10'
Client Sample Description:	SP
% Passing # 200:	1.3

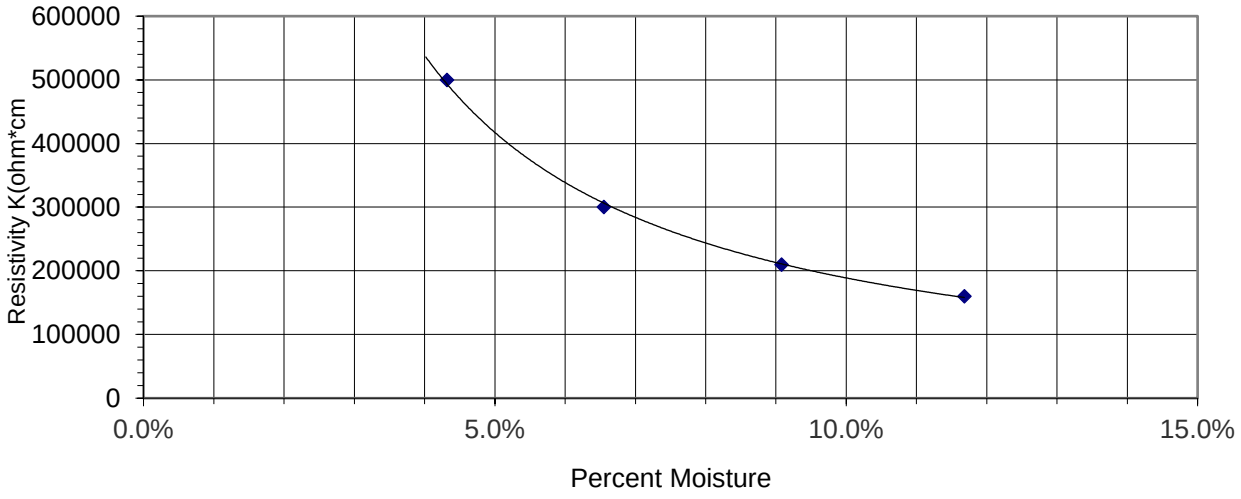
Report of Soil Resistivity

AASHTO T288

Project Name:	Northern Pass Transmission Line	**Project Number:**	16-0600
Project Location:	Various, NH	**Lab ID:**	15218S
Client:	SWCOLE Explorations, LLC	**Date Received:**	10/17/16
Material Description:	SP	**Date Completed:**	10/27/16
Material Source:	TS-6, BH-902, BULK, 5-10'	**Tested By:**	BLG

Minimum Soil Resistivity 160,000 ohm-cm

Soil Temperature 20.5 °C



Comments:

Reviewed By: CBM

10 Centre Road, Somersworth, NH 03878-2926 • P: (603) 692.0088 • F: (603) 692.0044 • E: infosomersworth@swcole.com

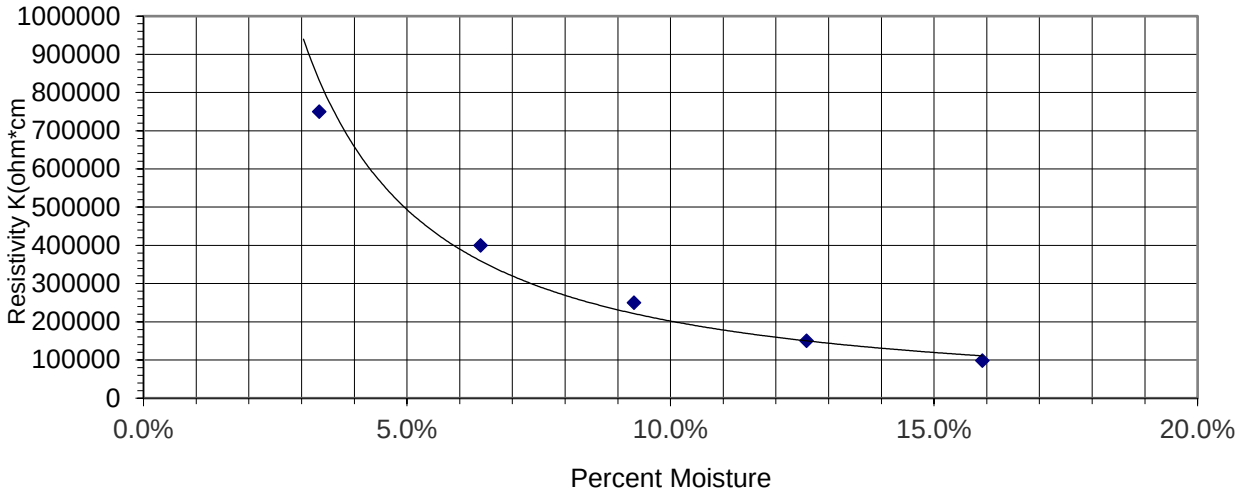
Report of Soil Resistivity

AASHTO T288

Project Name:	Northern Pass Transmission Line	**Project Number:**	16-0600
Project Location:	Various, NH	**Lab ID:**	15219S
Client:	SWCOLE Explorations, LLC	**Date Received:**	10/17/16
Material Description:	SP	**Date Completed:**	10/27/16
Material Source:	TS-6, BH-905, BULK, 5-10'	**Tested By:**	BLG

Minimum Soil Resistivity 98,000 ohm-cm

Soil Temperature 20.5 °C



Comments:

Reviewed By: CBM

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Project ID: NPT 16-0600
Job ID: 38207

Sample#: 38207-001
Sample ID: BH-204, 5-10'
Matrix: Solid Percent Dry: 90.9% Results expressed on a dry weight basis.
Sampled: 10/17/16 11:00

Parameter	Result	Reporting Limit	Units	Instr Dil'n Factor	Analyst	Prep Date	Batch	Analysis Date	Analysis Time	Reference
Chloride	< 5.5	5.5	ug/g	1	JZL		1602921	10/25/16	15:21	E300.0A
Sulfate	**7.8**	5.5	ug/g	1	JZL		1602921	10/25/16	15:21	E300.0A
pH	**6.3**		pH	1	APA		1602861	10/21/16	4:15	SW9045C

Sample#: 38207-002
Sample ID: MF-201, 5-10'
Matrix: Solid Percent Dry: 91.8% Results expressed on a dry weight basis.
Sampled: 10/17/16 11:00

Parameter	Result	Reporting Limit	Units	Instr Dil'n Factor	Analyst	Prep Date	Batch	Analysis Date	Analysis Time	Reference
Chloride	< 5.5	5.5	ug/g	1	JZL		1602921	10/25/16	15:38	E300.0A
Sulfate	**21**	5.5	ug/g	1	JZL		1602921	10/25/16	15:38	E300.0A
pH	**7.0**		pH	1	APA		1602861	10/21/16	4:20	SW9045C

Sample#: 38207-003
Sample ID: BH-309, 1-6'
Matrix: Solid Percent Dry: 92.9% Results expressed on a dry weight basis.
Sampled: 10/17/16 11:00

Parameter	Result	Reporting Limit	Units	Instr Dil'n Factor	Analyst	Prep Date	Batch	Analysis Date	Analysis Time	Reference
Chloride	< 5.4	5.4	ug/g	1	JZL		1602921	10/25/16	15:54	E300.0A
Sulfate	**20**	5.4	ug/g	1	JZL		1602921	10/25/16	15:54	E300.0A
pH	**7.5**		pH	1	APA		1602861	10/21/16	4:25	SW9045C

Sample#: 38207-004
Sample ID: BH-304, 4-6.5'
Matrix: Solid Percent Dry: 91.4% Results expressed on a dry weight basis.
Sampled: 10/17/16 11:00

Parameter	Result	Reporting Limit	Units	Instr Dil'n Factor	Analyst	Prep Date	Batch	Analysis Date	Analysis Time	Reference
Chloride	< 5.5	5.5	ug/g	1	JZL		1602921	10/25/16	16:11	E300.0A
Sulfate	**11**	5.5	ug/g	1	JZL		1602921	10/25/16	16:11	E300.0A
pH	**6.0**		pH	1	APA		1602861	10/21/16	4:30	SW9045C

Sample#: 38207-005
Sample ID: BH-404, 1-10'
Matrix: Solid Percent Dry: 92.9% Results expressed on a dry weight basis.
Sampled: 10/17/16 11:00

Parameter	Result	Reporting Limit	Units	Instr Dil'n Factor	Analyst	Prep Date	Batch	Analysis Date	Analysis Time	Reference
Chloride	< 5.4	5.4	ug/g	1	JZL		1602921	10/25/16	16:27	E300.0A
Sulfate	< 5.4	5.4	ug/g	1	JZL		1602921	10/25/16	16:27	E300.0A
pH	**6.2**		pH	1	APA		1602861	10/21/16	4:35	SW9045C

Absolute Resource associates

Project ID: NPT 16-0600
Job ID: 38207

Sample#: 38207-006
Sample ID: BH-405, 2-4.75'
Matrix: Solid Percent Dry: 91% Results expressed on a dry weight basis.
Sampled: 10/17/16 11:00

Parameter	Result	Reporting Limit	Units	Instr Dil'n Factor	Analyst	Prep Date	Batch	Analysis Date	Analysis Time	Reference
Chloride	< 5.5	5.5	ug/g	1	JZL		1602921	10/25/16	16:44	E300.0A
Sulfate	**13**	5.5	ug/g	1	JZL		1602921	10/25/16	16:44	E300.0A
pH	**5.3**		pH	1	APA		1602861	10/21/16	4:40	SW9045C

Sample#: 38207-007
Sample ID: BH-902, 5-10'
Matrix: Solid Percent Dry: 96.9% Results expressed on a dry weight basis.
Sampled: 10/17/16 11:00

Parameter	Result	Reporting Limit	Units	Instr Dil'n Factor	Analyst	Prep Date	Batch	Analysis Date	Analysis Time	Reference
Chloride	< 5.2	5.2	ug/g	1	JZL		1602921	10/25/16	17:00	E300.0A
Sulfate	**11**	5.2	ug/g	1	JZL		1602921	10/25/16	17:00	E300.0A
pH	**5.6**		pH	1	APA		1602861	10/21/16	4:45	SW9045C

Sample#: 38207-008
Sample ID: BH-905, 5-10'
Matrix: Solid Percent Dry: 97.1% Results expressed on a dry weight basis.
Sampled: 10/17/16 11:00

Parameter	Result	Reporting Limit	Units	Instr Dil'n Factor	Analyst	Prep Date	Batch	Analysis Date	Analysis Time	Reference
Chloride	< 5.2	5.2	ug/g	1	JZL		1602921	10/25/16	17:16	E300.0A
Sulfate	**8.1**	5.2	ug/g	1	JZL		1602921	10/25/16	17:16	E300.0A
pH	**5.4**		pH	1	APA		1602861	10/21/16	4:50	SW9045C

Absolute Resource associates

Appendix C
Infiltration Field Test Results

Borehole Infiltration Test

Project Name:	Northern Pass	Test Date:	9/21/2016
Project No.:	16-0600	Tested By:	NMC
Client:	Quanta Subsurface	Reviewed By:	CBM
Test Location:	INF-901, Transition Station #6		

Trial #1		Trial #2		Trial #3		Trial #4	
Time Elapsed (min)	Depth to Water (ft)	Time Elapsed (min)	Depth to Water (ft)	Time Elapsed (min)	Depth to Water (ft)	Time Elapsed (min)	Depth to Water (ft)
0	6.9	0	5.5	0	6.3	0	5.6
2	8.6	2	7.6	2	8.1	2	7.7
4	9.3	4	8.9	4	9.3	4	8.9
		6	9.3			6	9.3
(ft/hr)	2.0	(ft/hr)	2.0	(ft/hr)	2.0	(ft/hr)	2.0
(in/hr)	24.0 Note 3	(in/hr)	24.0	(in/hr)	24.0	(in/hr)	24.0

Test Summary

Average Infiltration Rate (in/hr)	**24.0**
Pre-Soak Performed 9/19/2016 1:47 pm	
Hole Depth from Top of Casing (ft)	9.3
Casing Stick-up from Ground Surface (ft)	2.9
Pre-Infiltration Test Water Depth (ft)	no water

Notes:

1) Testing was performed in accordance with guidelines presented in the Nhew Hampshire Stormwater Manual (Vol 2; Table 2-3).

2) The Average Infiltration Rate (in/hr) presented is base don field measurements; a safety factor has not been applied.

3) 24 inches of water infiltrated in less than 1 hour

2) The Average Infiltration Rate (in/hr) presented is based on field measurements; a safety factor has not been applie

Borehole Infiltration Test

Project Name:	Northern Pass	Test Date:	9/21/2016
Project No.:	16-0600	Tested By:	NMC
Client:	Quanta Subsurface	Reviewed By:	CBM
Test Location:	INF-902, Transition Station #6		

Trial #1		Trial #2		Trial #3		Trial #4	
Time Elapsed (min)	Depth to Water (ft)	Time Elapsed (min)	Depth to Water (ft)	Time Elapsed (min)	Depth to Water (ft)	Time Elapsed (min)	Depth to Water (ft)
0	4.9	0	7.0	0	7.3	0	7.3
2	6.8	2	8.0	2	8.3	2	8.3
4	8.1	4	8.8	4	9.0	4	8.9
6	8.9	6	9.4	6	9.4	6	9.4
8	9.4						
(ft/hr)	2.0	(ft/hr)	2.0	(ft/hr)	2.0	(ft/hr)	2.0
(in/hr)	24.0 Note 3	(in/hr)	24.0	(in/hr)	24.0	(in/hr)	24.0

Test Summary

Average Infiltration Rate (in/hr)	**24.0**
Pre-Soak Performed 9/19/2016 1:47 pm	
Hole Depth from Top of Casing (ft)	9.4
Casing Stick-up from Ground Surface (ft)	3.0
Pre-Infiltration Test Water Depth (ft)	no water

Notes:

1) Testing was performed in accordance with guidelines presented in the Nhew Hampshire Stormwater Manual (Vol 2; Table 2-3).

2) The Average Infiltration Rate (in/hr) presented is base don field measurements; a safety factor has not been applied.

3) 24 inches of water infiltrated in less than 1 hour

2) The Average Infiltration Rate (in/hr) presented is based on field measurements; a safety factor has not been applie

Borehole Infiltration Test

Project Name:	Northern Pass	Test Date:	9/21/2016
Project No.:	16-0600	Tested By:	NMC
Client:	Quanta Subsurface	Reviewed By:	CBM
Test Location:	INF-903, Transition Station #6		

Trial #1		Trial #2		Trial #3		Trial #4	
Time Elapsed (min)	Depth to Water (ft)	Time Elapsed (min)	Depth to Water (ft)	Time Elapsed (min)	Depth to Water (ft)	Time Elapsed (min)	Depth to Water (ft)
0	6.6	0	6.7	0	6.7	0	7.0
2	6.7	2	6.7	2	6.7	2	7.1
4	6.7	4	6.7	4	6.8	4	7.2
6	6.8	6	6.8	6	6.8	6	7.3
8	6.8	8	6.8	8	6.9	8	7.3
10	6.9	10	6.9	10	7.0	10	7.4
15	6.9	15	6.9	15	7.1	15	7.4
20	7.0	20	7.0	20	7.1	20	7.5
25	7.1	25	7.0	25	7.2	25	7.5
30	7.2	30	7.1	30	7.3	30	7.6
35	7.3	35	7.1	35	7.3	35	7.6
40	7.4	40	7.2	40	7.4	40	7.7
45	7.5	45	7.3	45	7.4	45	7.8
50	7.6	50	7.3	50	7.5	50	7.8
55	7.6	55	7.4	55	7.5	55	7.9
60	7.7	60	7.5	60	7.6	60	8.0
(ft/hr)	1.1	(ft/hr)	0.8	(ft/hr)	0.9	(ft/hr)	1.0
(in/hr)	13.2	(in/hr)	9.6	(in/hr)	10.8	(in/hr)	12.0

Test Summary

Average Infiltration Rate (in/hr)	**11.4**
Pre-Soak Performed 9/19/2016 2:04 pm	
Hole Depth from Top of Casing (ft)	8.7
Casing Stick-up from Ground Surface (ft)	0.9
Pre-Infiltration Test Water Depth (ft)	6.6

Notes:

1) Testing was performed in accordance with guidelines presented in the Nhew Hampshire Stormwater Manual (Vol 2; Table 2-3).

2) The Average Infiltration Rate (in/hr) presented is base don field measurements; a safety factor has not been applied.

2) The Average Infiltration Rate (in/hr) presented is based on field measurements; a safety factor has not been applied.

Borehole Infiltration Test

Project Name:	Northern Pass	Test Date:	9/21/2016
Project No.:	16-0600	Tested By:	NMC
Client:	Quanta Subsurface	Reviewed By:	CBM
Test Location:	INF-904, Transition Station #6		

Trial #1		Trial #2		Trial #3		Trial #4	
Time Elapsed (min)	Depth to Water (ft)	Time Elapsed (min)	Depth to Water (ft)	Time Elapsed (min)	Depth to Water (ft)	Time Elapsed (min)	Depth to Water (ft)
0	7.0	0	7.2	0	7.0	0	7.2
2	7.0	2	7.2	2	7.0	2	7.2
4	7.0	4	7.2	4	7.0	4	7.2
6	7.1	6	7.2	6	7.0	6	7.2
8	7.1	8	7.3	8	7.1	8	7.2
10	7.1	10	7.3	10	7.1	10	7.3
15	7.1	15	7.3	15	7.1	15	7.3
20	7.1	20	7.3	20	7.1	20	7.3
25	7.1	25	7.3	25	7.1	25	7.3
30	7.1	30	7.3	30	7.1	30	7.3
35	7.1	35	7.3	35	7.1	35	7.3
40	7.1	40	7.3	40	7.1	40	7.3
45	7.1	45	7.3	45	7.1	45	7.3
50	7.1	50	7.3	50	7.2	50	7.3
55	7.2	55	7.4	55	7.2	55	7.3
60	7.2	60	7.4	60	7.2	60	7.4
(ft/hr)	0.2	(ft/hr)	0.2	(ft/hr)	0.2	(ft/hr)	0.2
(in/hr)	2.4	(in/hr)	2.4	(in/hr)	2.4	(in/hr)	2.4

Test Summary

Average Infiltration Rate (in/hr)	**2.4**
Pre-Soak Performed 9/19/2016 2:07 pm	
Hole Depth from Top of Casing (ft)	9.2
Casing Stick-up from Ground Surface (ft)	0.9
Pre-Infiltration Test Water Depth (ft)	7.0

Notes:

1) Testing was performed in accordance with guidelines presented in the Nhew Hampshire Stormwater Manual (Vol 2; Table 2-3).

2) The Average Infiltration Rate (in/hr) presented is base don field measurements; a safety factor has not been applied.

2) The Average Infiltration Rate (in/hr) presented is based on field measurements; a safety factor has not been applied.

Appendix D
Summary of Geotechnical Design Parameters

Summary of Geotechnical Design Parameters
Transition Station #6

Boring BH 901

Sublayer Description	Sublayer Depth (ft) Top	Sublayer Depth (ft) Bot.	Material Description	Average N_{60}	Soil Effective Unit Weight (pcf)	Soil Friction Angle (deg)	Undrained Strength (psf)	Bedrock (Rock Mass Equivalent Mohr-Coulomb Fit) Friction Angle (deg)	Bedrock (Rock Mass Equivalent Mohr-Coulomb Fit) Cohesion (psf)
Topsoil	0	1	REMOVE AND REPLACE WITH CONTROLLED STRUCTURAL FILL						
Terrace Deposits	1	4							
	4	14	SP	14	115	31	-	-	-
	14	22	SP	35	125	35	-	-	-

Boring BH 902

Sublayer Description	Sublayer Depth (ft) Top	Sublayer Depth (ft) Bot.	Material Description	Average N_{60}	Soil Effective Unit Weight (pcf)	Soil Friction Angle (deg)	Undrained Strength (psf)	Bedrock (Rock Mass Equivalent Mohr-Coulomb Fit) Friction Angle (deg)	Bedrock (Rock Mass Equivalent Mohr-Coulomb Fit) Cohesion (psf)
Topsoil	0	2	REMOVE AND REPLACE WITH CONTROLLED STRUCTURAL FILL						
Terrace Deposits	2	8	SP	12	115	30	-	-	-
	8	22	SP	20	120	32	-	-	-

Boring BH 903

Sublayer Description	Sublayer Depth (ft) Top	Sublayer Depth (ft) Bot.	Material Description	Average N_{60}	Soil Effective Unit Weight (pcf)	Soil Friction Angle (deg)	Undrained Strength (psf)	Bedrock (Rock Mass Equivalent Mohr-Coulomb Fit) Friction Angle (deg)	Bedrock (Rock Mass Equivalent Mohr-Coulomb Fit) Cohesion (psf)
Topsoil	0	2	REMOVE AND REPLACE WITH CONTROLLED STRUCTURAL FILL						
Terrace Deposits	2	10	SP	12	115	30	-	-	-
	10	22	SP	26	120	34	-	-	-

Summary of Geotechnical Design Parameters (cont)
Transition Station #6

Boring BH 904

Sublayer Description	Sublayer Depth (ft)		Material Description	Average N_{60}	Soil Effective Unit Weight (pcf)	Soil Friction Angle (deg)	Undrained Strength (psf)	Bedrock (Rock Mass Equivalent Mohr-Coulomb Fit)	
	Top	Bot.						Friction Angle (deg)	Cohesion (psf)
Terrace Deposits	0	2	REMOVE AND REPLACE WITH CONTROLLED STRUCTURAL FILL						
	2	6	SP	12	115	30	-	-	-
	6	18	SP	18	115	32	-	-	-
	18	22	SP	29	125	34	-	-	-

Boring BH 905

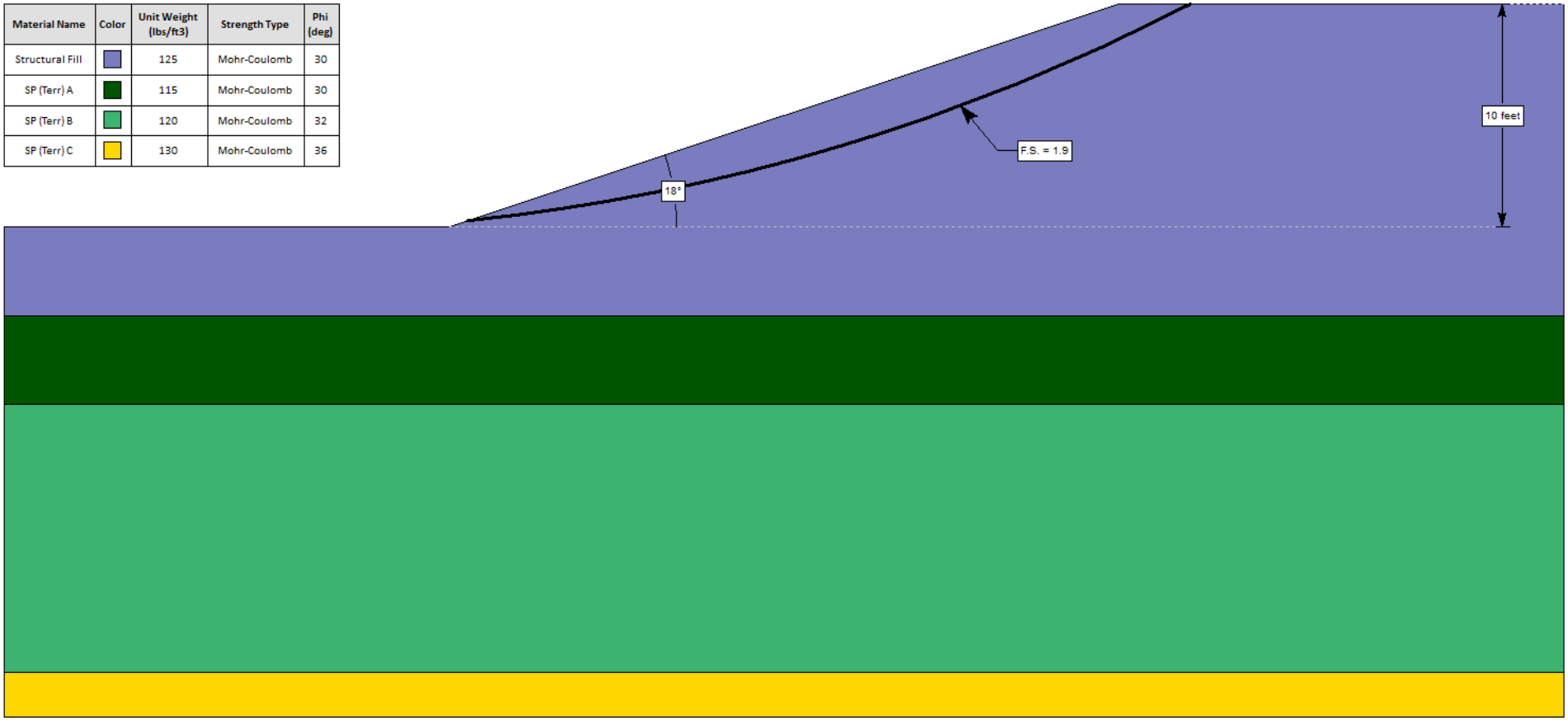
Sublayer Description	Sublayer Depth (ft)		Material Description	Average N_{60}	Soil Effective Unit Weight (pcf)	Soil Friction Angle (deg)	Undrained Strength (psf)	Bedrock (Rock Mass Equivalent Mohr-Coulomb Fit)	
	Top	Bot.						Friction Angle (deg)	Cohesion (psf)
Topsoil	0	1	REMOVE AND REPLACE WITH CONTROLLED STRUCTURAL FILL						
Terrace Deposits	1	4							
	4	8	SP	11	115	30	-	-	-
	8	20	SP	21	120	32	-	-	-
	20	22	SP	40	130	36	-	-	-

Controlled Structural Fill

Sublayer Description	Sublayer Depth (ft)		Material Description	Average N_{60}	Soil Effective Unit Weight (pcf)	Soil Friction Angle (deg)	Undrained Strength (psf)	Bedrock (Rock Mass Equivalent Mohr-Coulomb Fit)	
	Top	Bot.						Friction Angle (deg)	Cohesion (psf)
Structural Fill	-	-	SM/ML	-	125	30	-	-	-

Appendix E
SLIDE 7.0 Stability Outputs

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Phi (deg)
Structural Fill		125	Mohr-Coulomb	30
SP (Terr) A		115	Mohr-Coulomb	30
SP (Terr) B		120	Mohr-Coulomb	32
SP (Terr) C		130	Mohr-Coulomb	36



Base Map: Slide 7.0.

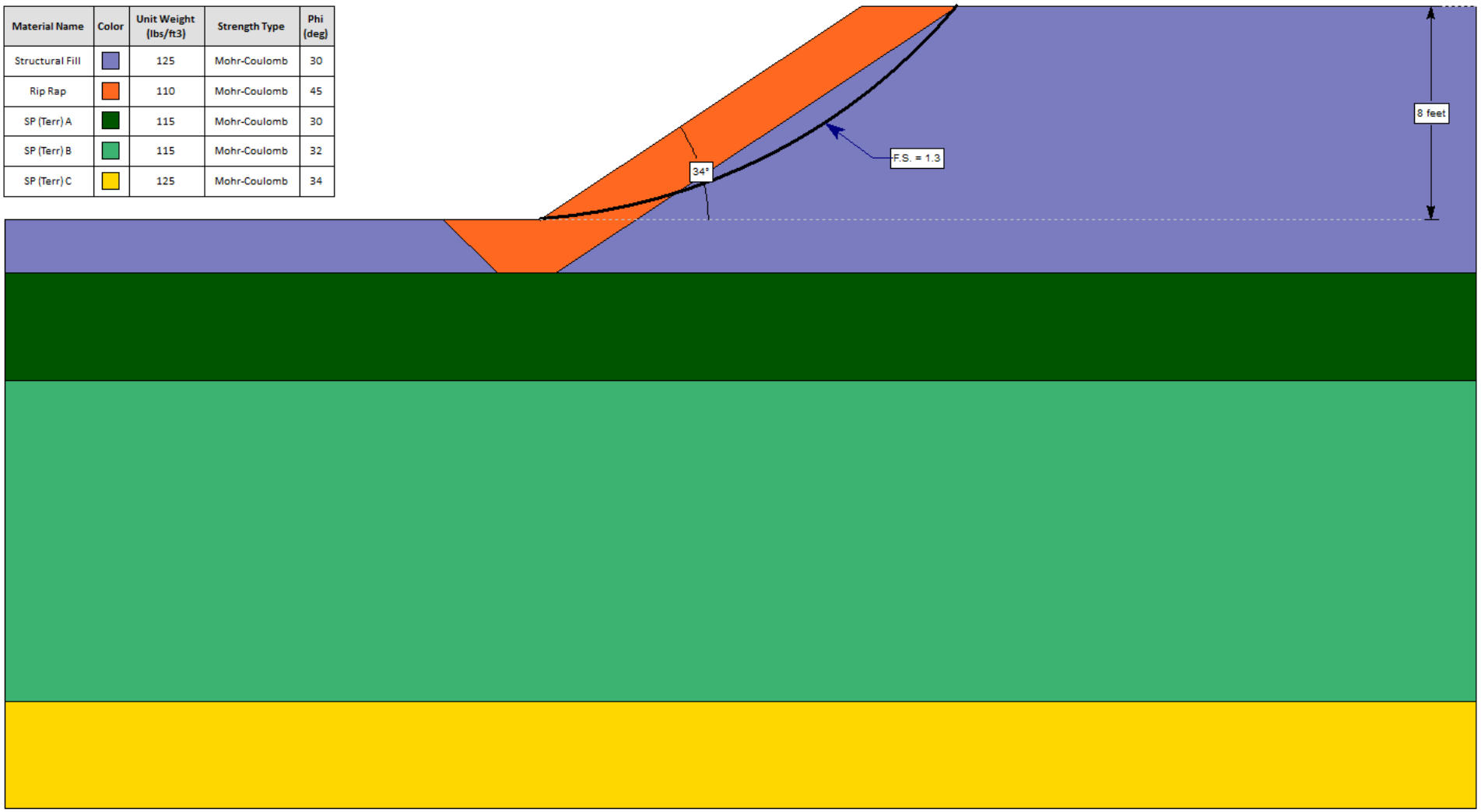
Project No.: 16004 Date: December 2016

Output 1 - BH 905 3 (H) to 1 (V)

QUANTA SUBSURFACE
Engineering – Construction

Northern Pass TL – Transition Station #6
Slope Stability Analysis

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Phi (deg)
Structural Fill		125	Mohr-Coulomb	30
Rip Rap		110	Mohr-Coulomb	45
SP (Terr) A		115	Mohr-Coulomb	30
SP (Terr) B		115	Mohr-Coulomb	32
SP (Terr) C		125	Mohr-Coulomb	34



Base Map: Slide 7.0.

Date: December 2016

Project No.: 16004

Output 2 - BH 904 1.5 (H) to 1 (V)

QUANTA SUBSURFACE
Engineering – Construction

Northern Pass TL – Transition Station #6
Slope Stability Analysis

INFILTRATION FEASIBILITY REPORT

Transition Station #6
Bridgewater, NH
December 15, 2016

TABLE OF CONTENTS:

The project proposes two systems that require infiltration to function property. These two systems are identified on the plans as North Infiltration Basin and South Infiltration Basin.

I. Location of the practices

North Infiltration Basin – this basin is located north of the proposed transition station yard, adjacent to Daniel Webster Highway (US Highway 3).

South Infiltration Basin – this basin is located south of the proposed transition station yard turnaround area.

II. Existing topography at the location of the practices

North Infiltration Basin – the existing topography within the area of the infiltration basin is relatively flat with grassed cover. A portion of the basin (south end) is sloped at approximately 3H:1V.

South Infiltration Basin – the existing topography within the area of the infiltration basin is relatively flat with a forested cover.

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.

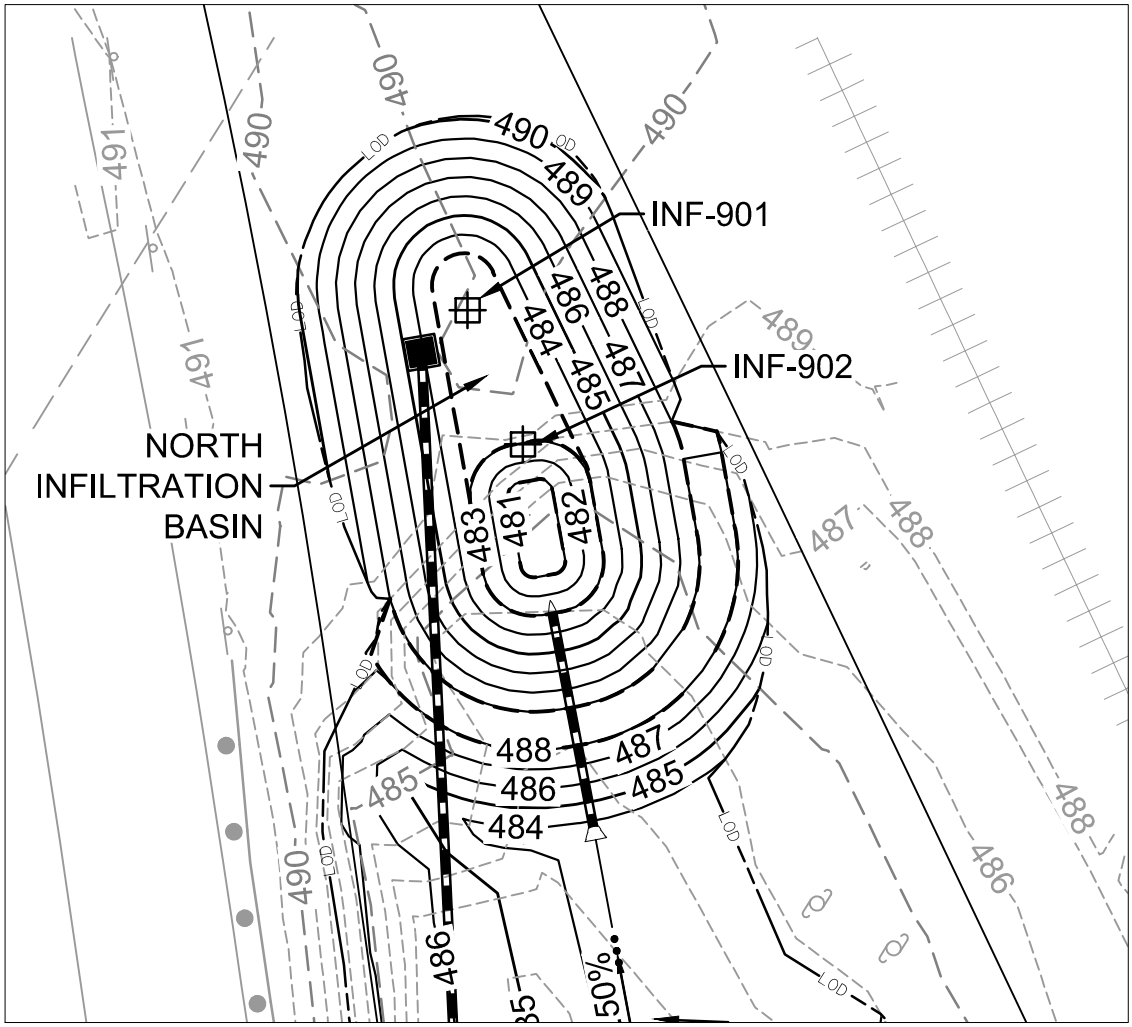
North Infiltration Basin – this basin is 880 square feet in area. Two borehole infiltration tests were performed in the location of this practice. The test locations, identified as INF-901 and INF-902, are shown on the attached boring location plan.

South Infiltration Basin – this basin is 330 square feet in area. Two borehole infiltration tests were performed in the location of this practice. The test locations, identified as INF-903 and INF-904, are shown on the attached boring location plan.

THE NORTHERN PASS

TRANSITION STATION #6
NORTH INFILTRATION BASIN
BORING LOCATION PLAN

NORTH



PROPOSED LEGEND:

490	MAJOR CONTOUR
489	MINOR CONTOUR
⌖	BOREHOLE INFILTRATION TEST LOCATION

EXISTING LEGEND:

490	MAJOR CONTOUR
489	MINOR CONTOUR

0 30' 60'

SCALE IN FEET

NOTES:

1. BACKGROUND INFORMATION TAKEN FROM "EXISTING CONDITIONS PLAN" FOR TRANSITION STATION #6, DANIEL WEBSTER HIGHWAY, BRIDGEWATER, NH. PREPARED BY CHA, CONSULTING, INC. DATED MAY 19, 2015. LAST REVISED MAY 19, 2015. WETLAND FLAGS SHOWN ARE BASED ON LOCATIONS PROVIDED BY NORMANDEAU, WETLAND FLAGS WERE DELINEATED BY NORMANDEAU IN 2015.

2. NEW HAMPSHIRE STATE PLANE COORDINATE SYSTEM
   HORIZONTAL DATUM - NAD83
   VERTICAL DATUM - NAVD88

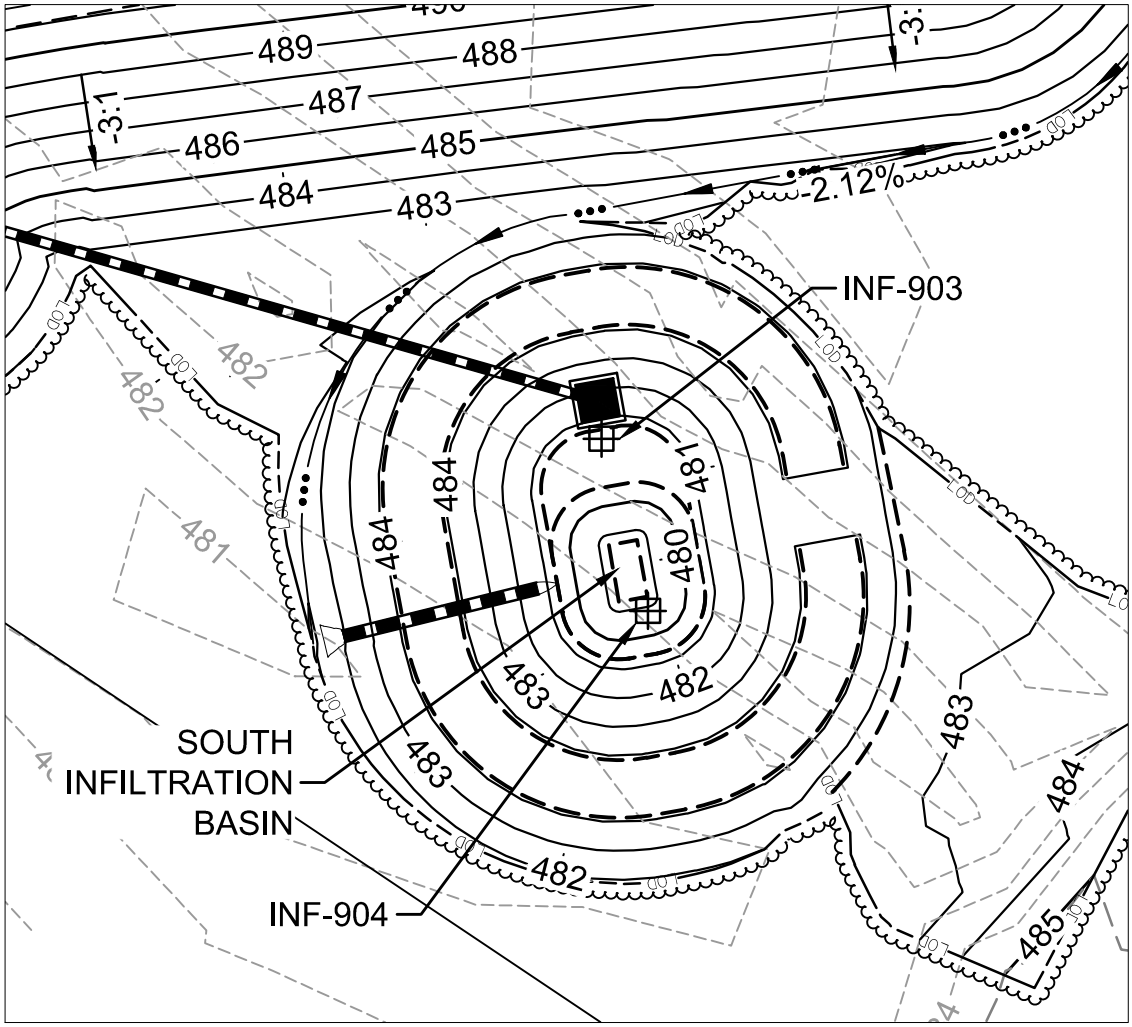
3. PROPOSED CONTOURS AND SPOT ELEVATIONS INDICATED REFER TO TOP OF FINISH SURFACE.

4. ALL FILL AND CUT SLOPES ARE 3-FT HORIZONTAL TO 1-FT VERTICAL (3:1) UNLESS NOTED OTHERWISE.

THE NORTHERN PASS

TRANSITION STATION #6
SOUTH INFILTRATION BASIN
BORING LOCATION PLAN

NORTH



PROPOSED LEGEND:

490	MAJOR CONTOUR
489	MINOR CONTOUR
⌖	BOREHOLE INFILTRATION TEST LOCATION

EXISTING LEGEND:

490	MAJOR CONTOUR
489	MINOR CONTOUR

0 10' 20' 40'

SCALE IN FEET

NOTES:

1. BACKGROUND INFORMATION TAKEN FROM "EXISTING CONDITIONS PLAN" FOR TRANSITION STATION #6, DANIEL WEBSTER HIGHWAY, BRIDGEWATER, NH. PREPARED BY CHA, CONSULTING, INC. DATED MAY 19, 2015. LAST REVISED MAY 19, 2015. WETLAND FLAGS SHOWN ARE BASED ON LOCATIONS PROVIDED BY NORMANDEAU, WETLAND FLAGS WERE DELINEATED BY NORMANDEAU IN 2015.

2. NEW HAMPSHIRE STATE PLANE COORDINATE SYSTEM
   HORIZONTAL DATUM - NAD83
   VERTICAL DATUM - NAVD88

3. PROPOSED CONTOURS AND SPOT ELEVATIONS INDICATED REFER TO TOP OF FINISH SURFACE.

4. ALL FILL AND CUT SLOPES ARE 3-FT HORIZONTAL TO 1-FT VERTICAL (3:1) UNLESS NOTED OTHERWISE.

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

The following borehole test data was collected on August 29, 2016 and August 30, 2016.

North Infiltration Basin:

Bottom of Basin Elevation = 483.0

INF-901: Existing Surface Elevation of Borehole = 489.7
SHWT = Below 477.0
BEDROCK = not found
Deepest Elevation of Borehole = 475.7

INF-902: Existing Surface Elevation of Borehole = 488.8
SHWT = Below 477.0
BEDROCK = not found
Deepest Elevation of Borehole = 474.8

South Infiltration Basin:

Bottom of Basin Elevation = 480.65

INF-903: Existing Surface Elevation of Borehole = 482.3
SHWT = Below 474.0
BEDROCK = not found
Deepest Elevation of Borehole = 468.3

INF-904: Existing Surface Elevation of Borehole = 481.8
SHWT = Below 474.0
BEDROCK = not found
Deepest Elevation of Borehole = 467.8

V. Profile descriptions

Refer to attached boring logs for soil profile descriptions at INF-901, INF-902, INF-903 and INF-904 boreholes.

Quanta Subsurface
4308 N Barker RD
Spokane Valley, WA 99027
Telephone: 509-892-9409

BORING NUMBER INF 901

CLIENT PAR Electrical Contractors
PROJECT NAME Northern Pass TL - Transition Station #6
PROJECT NUMBER 16004
PROJECT LOCATION Bridgewater, New Hampshire
DATE STARTED 8/30/16 **COMPLETED** 8/30/16
GROUND ELEVATION 489.7 ft **HOLE SIZE** 6"
DRILLING CONTRACTOR SW Cole
LATITUDE 43.71212603 **LONGITUDE** -71.65749203
DRILLING METHOD Hollow Stem Auger
DRILLING EQUIPMENT CME 850 **SPT HAMMER** Automatic
LOGGED BY S. Laing **CHECKED BY** J.T. McGinnis
GROUND WATER LEVEL:
NOTES
AT END OF DRILLING Not Encountered

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	GRAPHIC LOG	MATERIAL DESCRIPTION	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	REMARKS
	0	SPT 1	33	4-5-7-8 (12)			TOPSOIL: Silty SAND (SM), trace organics, moderate brown, dry, loose, fine grained sand					Infiltration test casing installed in an adjacent borehole to a depth of approximately 7 feet.
							TERRACE DEPOSITS: Poorly Graded SAND (SP), trace silt, dark yellowish orange, dry, loose to medium dense, fine to medium grained sand					
		SPT 2	67	6-6-6-7 (12)								
485	5	SPT 3	75	4-4-6-6 (10)			- grayish orange from 4 to 14 feet					
		SPT 4	67	5-5-7-7 (12)								
480	10	SPT 5	75	5-5-5-6 (10)				3.2			0.7	
		SPT 6	75	5-7-8-10 (15)			- trace subangular fine gravel from 10 to 12 feet					
		SPT 7	75	8-8-10-10 (18)								The ESHWT is at a depth below 14 feet.

Bottom of Borehole at 14.0 feet

Quanta Subsurface
4308 N Barker RD
Spokane Valley, WA 99027
Telephone: 509-892-9409

BORING NUMBER INF 902

CLIENT PAR Electrical Contractors
PROJECT NAME Northern Pass TL - Transition Station #6
PROJECT NUMBER 16004
PROJECT LOCATION Bridgewater, New Hampshire
DATE STARTED 8/30/16 **COMPLETED** 8/30/16
GROUND ELEVATION 488.8 ft **HOLE SIZE** 6"
DRILLING CONTRACTOR SW Cole
LATITUDE 43.71206199 **LONGITUDE** -71.65746496
DRILLING METHOD Hollow Stem Auger
DRILLING EQUIPMENT CME 850 **SPT HAMMER** Automatic
LOGGED BY S. Laing **CHECKED BY** J.T. McGinnis
GROUND WATER LEVEL:
NOTES
AT END OF DRILLING Not Encountered

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	GRAPHIC LOG	MATERIAL DESCRIPTION	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	REMARKS
	0	SPT 1	25	2-2-2-3 (4)			TOPSOIL: Silty SAND (SM), trace organics, moderate brown, dry, loose, fine grained sand					Infiltration test casing installed in an adjacent borehole to a depth of approximately 6 feet.
		SPT 2	33	4-4-4-5 (8)			TERRACE DEPOSITS: Poorly Graded SAND (SP), trace silt, dark yellowish orange, dry, loose to medium dense, fine to medium grained sand	3.7				
485	5	SPT 3	67	3-4-5-5 (9)								
		SPT 4	75	4-5-5-6 (10)								
480	10	SPT 5	75	5-5-7-7 (12)			- grayish orange from 8 to 14 feet					
		SPT 6	75	5-6-7-8 (13)								
475		SPT 7	79	7-7-8-9 (15)								The ESHWT is at a depth below 14 feet.

Bottom of Borehole at 14.0 feet

Quanta Subsurface
4308 N Barker RD
Spokane Valley, WA 99027
Telephone: 509-892-9409

BORING NUMBER INF 903

CLIENT PAR Electrical Contractors
PROJECT NAME Northern Pass TL - Transition Station #6
PROJECT NUMBER 16004
PROJECT LOCATION Bridgewater, New Hampshire
DATE STARTED 8/29/16 **COMPLETED** 8/29/16
GROUND ELEVATION 482.3 ft **HOLE SIZE** 6"
DRILLING CONTRACTOR SW Cole
LATITUDE 43.71082096 **LONGITUDE** -71.65694998
DRILLING METHOD Hollow Stem Auger
DRILLING EQUIPMENT CME 850 **SPT HAMMER** Automatic
LOGGED BY S. Laing **CHECKED BY** J.T. McGinnis
GROUND WATER LEVEL:
NOTES
AT END OF DRILLING Not Encountered

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	GRAPHIC LOG	MATERIAL DESCRIPTION	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	REMARKS
	0						TOPSOIL: Silty SAND (SM), trace organics, moderate brown, dry, loose, fine grained sand					Infiltration test casing installed in an adjacent borehole to a depth of approximately 8 feet.
		SPT 1	58	1-2-2-2 (4)			TERRACE DEPOSITS: Poorly Graded SAND with silt (SP-SM), grayish orange, dry, loose to medium dense, fine grained sand					
480		SPT 2	63	4-4-5-6 (9)			- little silt from 2.5 to 4.5 feet	4.6			11.3	
	5	SPT 3	79	6-7-8-12 (15)			- yellowish orange from 4.5 to to 5.5 feet - little silt from 5.5 to 6.5 feet					
475		SPT 4	75	9-8-7-6 (15)			- moderate yellowish brown from 6.5 to 14 feet					
		SPT 5	83	5-5-5-7 (10)								
	10											
		SPT 6	92	5-6-6-7 (12)								
470		SPT 7	50	5-7-7-6 (14)			- little fine subangular gravel below 13.5 feet					The ESHWT is at a depth below 14 feet.

Bottom of Borehole at 14.0 feet

QUANTA SUBSURFACE Engineering + Construction
Quanta Subsurface
4308 N Barker RD
Spokane Valley, WA 99027
Telephone: 509-892-9409

BORING NUMBER INF 904

CLIENT PAR Electrical Contractors
PROJECT NAME Northern Pass TL - Transition Station #6
PROJECT NUMBER 16004
PROJECT LOCATION Bridgewater, New Hampshire
DATE STARTED 8/29/16 **COMPLETED** 8/29/16
GROUND ELEVATION 481.8 ft **HOLE SIZE** 6"
DRILLING CONTRACTOR SW Cole
LATITUDE 43.71077201 **LONGITUDE** -71.65694998
DRILLING METHOD Hollow Stem Auger
DRILLING EQUIPMENT CME 850 **SPT HAMMER** Automatic
LOGGED BY S. Laing **CHECKED BY** J.T. McGinnis
GROUND WATER LEVEL:
NOTES
AT END OF DRILLING Not Encountered

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	GRAPHIC LOG	MATERIAL DESCRIPTION	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	REMARKS
	0											
480		SPT 1	75	1-2-3-3 (5)			TERRACE DEPOSITS: Silty SAND (SM), grayish orange, dry, loose, fine grained sand					Infiltration test casing installed in an adjacent borehole to a depth of approximately 8 feet.
		SPT 2	75	4-6-6-6 (12)			Poorly Graded SAND (SP), trace silt, grayish orange, dry, medium dense, fine grained sand					
	5	SPT 3	75	8-9-10-13 (19)			SILT with sand (ML), dark yellowish brown, moist, very stiff, fine grained sand	12.8			71.8	
475		SPT 4	58	9-11-14-14 (25)								
		SPT 5	63	6-6-6-6 (12)			Poorly Graded SAND with gravel (SP), trace silt, moderate yellowish brown, moist, medium dense, fine to coarse grained gravel, fine to medium grained sand, subrounded					
	10	SPT 6	75	6-6-7-9 (13)								
470		SPT 7	79	17-43-10-10 (53)			- cobble encountered at 13 feet					The ESHWT is at a depth below 14 feet.

Bottom of Borehole at 14.0 feet

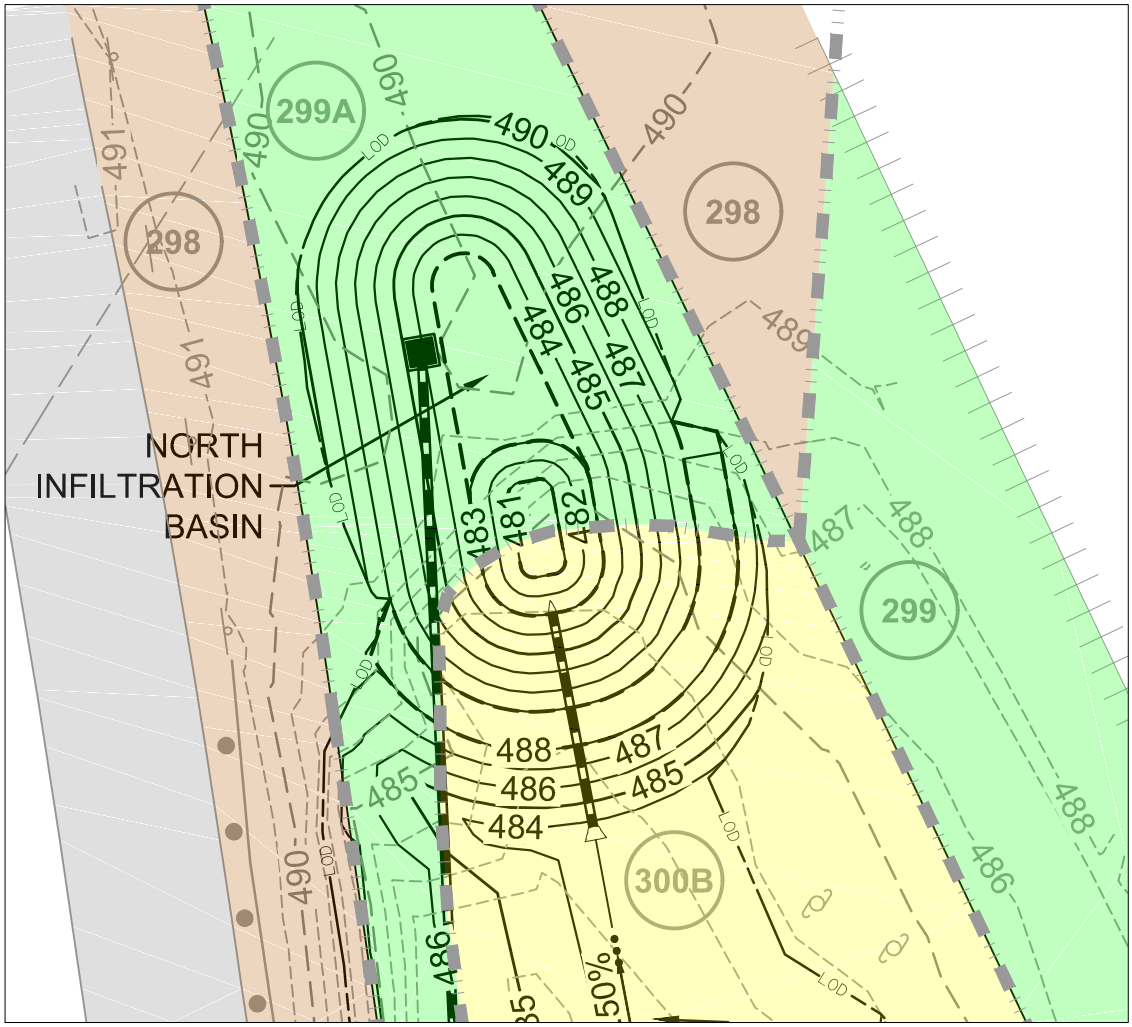
VI. Soil plan in the area of the proposed practices

Refer to attached plans for a delineation of soil series near the North Infiltration Basin and South Infiltration Basin, as determined by a soil survey report prepared by Normandeau Associates, Inc. The report is entitled “Northern Pass Transmission Project, Soil Survey Report for Transition Stations, Substation Expansions and Converter Terminal” dated February 6, 2015.

THE NORTHERN PASS

TRANSITION STATION #6
NORTH INFILTRATION BASIN
SOIL SERIES PLAN

NORTH



SOIL LEGEND:

APPROXIMATE SOIL BOUNDARY

298 — PITS, GRAVEL
HSG UNKNOWN (A)

299 — UDORTHENTS, SMOOTHED
HSG UNKNOWN (A)

299A — UDORTHENTS, SMOOTHED
0 TO 3 PERCENT SLOPES
HSG UNKNOWN (A)

300B — UDIPSAMMENTS, NEARLY LEVEL
3 TO 8 PERCENT SLOPES, HSG B

0 30' 60'
SCALE IN FEET

NOTES:

1. SOIL INFORMATION TAKEN FROM "NORTHERN PASS TRANSMISSION PROJECT, SOIL SURVEY REPORT FOR TRANSITION STATIONS, SUBSTATION EXPANSIONS, AND CONVERTER TERMINAL" PREPARED BY NORMANDEAU ENVIRONMENTAL CONSULTANTS, DATED FEBRUARY 6, 2015.

2. NEW HAMPSHIRE STATE PLANE COORDINATE SYSTEM
   HORIZONTAL DATUM - NAD83
   VERTICAL DATUM - NAVD88

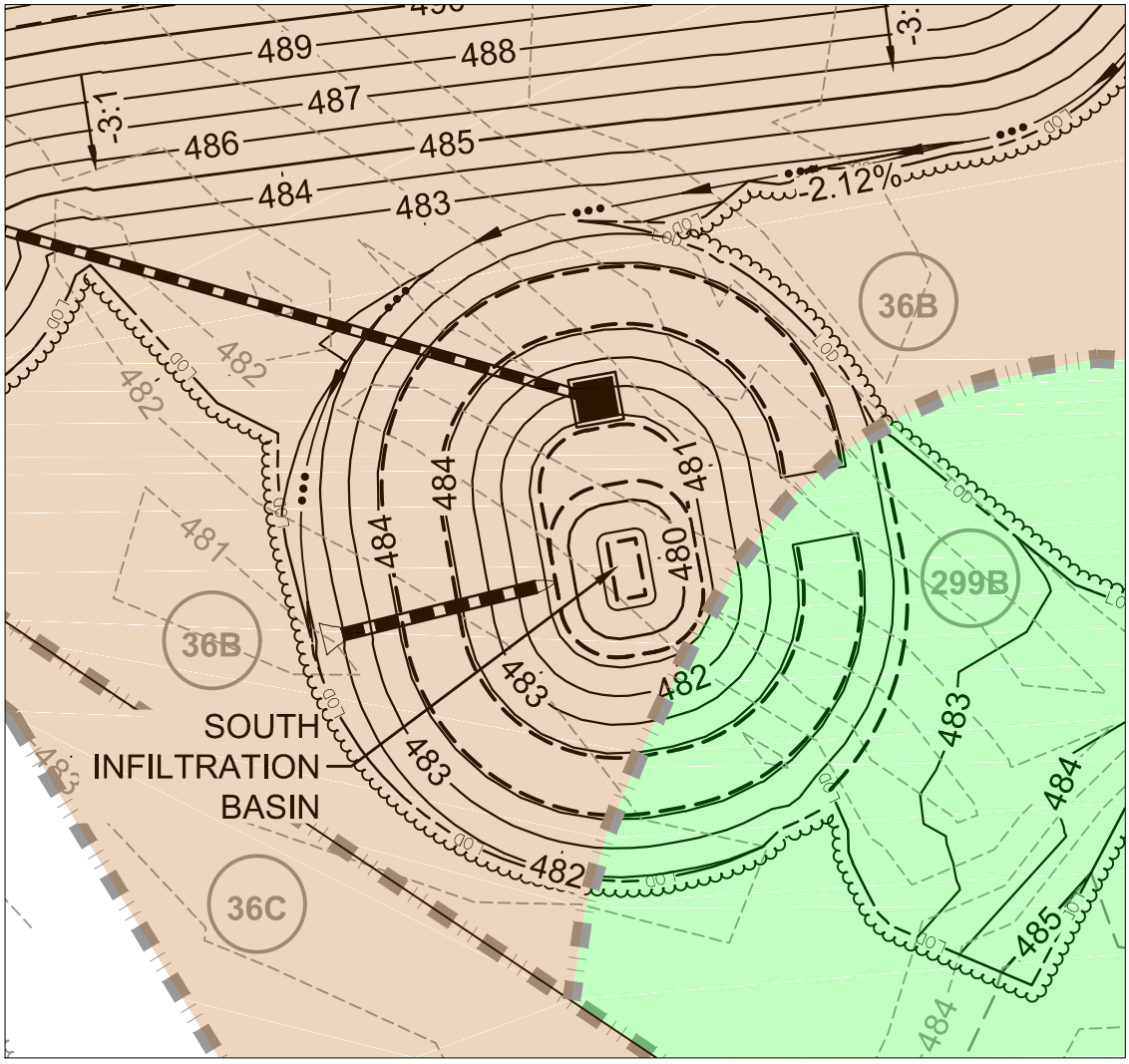
3. PROPOSED CONTOURS AND SPOT ELEVATIONS INDICATED REFER TO TOP OF FINISH SURFACE.

4. ALL FILL AND CUT SLOPES ARE 3-FT HORIZONTAL TO 1-FT VERTICAL (3:1) UNLESS NOTED OTHERWISE.

THE NORTHERN PASS

TRANSITION STATION #6
SOUTH INFILTRATION BASIN
SOIL SERIES PLAN

NORTH



SOIL LEGEND:

APPROXIMATE SOIL BOUNDARY

36B — ADAMS LOAMY SAND
3 TO 8 PERCENT SLOPES, HSG A

36C — ADAMS LOAMY SAND
8 TO 15 PERCENT SLOPES, HSG A

299B — UDORTHENTS, SMOOTHED
3 TO 8 PERCENT SLOPES, HSG A

0 10' 20' 40'
SCALE IN FEET

NOTES:

1. SOIL INFORMATION TAKEN FROM "NORTHERN PASS TRANSMISSION PROJECT, SOIL SURVEY REPORT FOR TRANSITION STATIONS, SUBSTATION EXPANSIONS, AND CONVERTER TERMINAL" PREPARED BY NORMANDEAU ENVIRONMENTAL CONSULTANTS, DATED FEBRUARY 6, 2015.

2. NEW HAMPSHIRE STATE PLANE COORDINATE SYSTEM
   HORIZONTAL DATUM - NAD83
   VERTICAL DATUM - NAVD88

3. PROPOSED CONTOURS AND SPOT ELEVATIONS INDICATED REFER TO TOP OF FINISH SURFACE.

4. ALL FILL AND CUT SLOPES ARE 3-FT HORIZONTAL TO 1-FT VERTICAL (3:1) UNLESS NOTED OTHERWISE.

VII. Summary of Field Testing data used to determine the infiltration rate

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

The Ksat was measured with a Borehole Infiltration Test.

INF-901: The average Ksat of the tests was 24 inches per hour.
INF-902: The average Ksat of the tests was 24 inches per hour.

After applying a factor of safety, the design rate used in the drainage analysis is 12 inches per hour.

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

The Ksat was measured with a Borehole Infiltration Test.

INF-903: The average Ksat of the tests was 11.4 inches per hour.
INF-904: The average Ksat of the tests was 2.4 inches per hour.

After applying a factor of safety, the design rate used in the drainage analysis is 1.2 inches per hour.

Refer to attached field infiltration test results for additional information.

Borehole Infiltration Test

Project Name:	Northern Pass	Test Date:	9/21/2016
Project No.:	16-0600	Tested By:	NMC
Client:	Quanta Subsurface	Reviewed By:	CBM
Test Location:	INF-901, Transition Station #6		

Trial #1		Trial #2		Trial #3		Trial #4	
Time Elapsed (min)	Depth to Water (ft)	Time Elapsed (min)	Depth to Water (ft)	Time Elapsed (min)	Depth to Water (ft)	Time Elapsed (min)	Depth to Water (ft)
0	6.9	0	5.5	0	6.3	0	5.6
2	8.6	2	7.6	2	8.1	2	7.7
4	9.3	4	8.9	4	9.3	4	8.9
		6	9.3			6	9.3
(ft/hr)	2.0	(ft/hr)	2.0	(ft/hr)	2.0	(ft/hr)	2.0
(in/hr)	24.0 Note 3	(in/hr)	24.0	(in/hr)	24.0	(in/hr)	24.0

Test Summary

Average Infiltration Rate (in/hr)	**24.0**
Pre-Soak Performed 9/19/2016 1:47 pm	
Hole Depth from Top of Casing (ft)	9.3
Casing Stick-up from Ground Surface (ft)	2.9
Pre-Infiltration Test Water Depth (ft)	no water

Notes:

1) Testing was performed in accordance with guidelines presented in the Nhew Hampshire Stormwater Manual (Vol 2; Table 2-3).

2) The Average Infiltration Rate (in/hr) presented is base don field measurements; a safety factor has not been applied.

3) 24 inches of water infiltrated in less than 1 hour

2) The Average Infiltration Rate (in/hr) presented is based on field measurements; a safety factor has not been applie

Borehole Infiltration Test

Project Name:	Northern Pass	Test Date:	9/21/2016
Project No.:	16-0600	Tested By:	NMC
Client:	Quanta Subsurface	Reviewed By:	CBM
Test Location:	INF-902, Transition Station #6		

Trial #1		Trial #2		Trial #3		Trial #4	
Time Elapsed (min)	Depth to Water (ft)	Time Elapsed (min)	Depth to Water (ft)	Time Elapsed (min)	Depth to Water (ft)	Time Elapsed (min)	Depth to Water (ft)
0	4.9	0	7.0	0	7.3	0	7.3
2	6.8	2	8.0	2	8.3	2	8.3
4	8.1	4	8.8	4	9.0	4	8.9
6	8.9	6	9.4	6	9.4	6	9.4
8	9.4						
(ft/hr)	2.0	(ft/hr)	2.0	(ft/hr)	2.0	(ft/hr)	2.0
(in/hr)	24.0 Note 3	(in/hr)	24.0	(in/hr)	24.0	(in/hr)	24.0

Test Summary

Average Infiltration Rate (in/hr)	**24.0**
Pre-Soak Performed 9/19/2016 1:47 pm	
Hole Depth from Top of Casing (ft)	9.4
Casing Stick-up from Ground Surface (ft)	3.0
Pre-Infiltration Test Water Depth (ft)	no water

Notes:

1) Testing was performed in accordance with guidelines presented in the Nhew Hampshire Stormwater Manual (Vol 2; Table 2-3).

2) The Average Infiltration Rate (in/hr) presented is base don field measurements; a safety factor has not been applied.

3) 24 inches of water infiltrated in less than 1 hour

2) The Average Infiltration Rate (in/hr) presented is based on field measurements; a safety factor has not been applie

Borehole Infiltration Test

Project Name:	Northern Pass	Test Date:	9/21/2016
Project No.:	16-0600	Tested By:	NMC
Client:	Quanta Subsurface	Reviewed By:	CBM
Test Location:	INF-903, Transition Station #6		

Trial #1		Trial #2		Trial #3		Trial #4	
Time Elapsed (min)	Depth to Water (ft)	Time Elapsed (min)	Depth to Water (ft)	Time Elapsed (min)	Depth to Water (ft)	Time Elapsed (min)	Depth to Water (ft)
0	6.6	0	6.7	0	6.7	0	7.0
2	6.7	2	6.7	2	6.7	2	7.1
4	6.7	4	6.7	4	6.8	4	7.2
6	6.8	6	6.8	6	6.8	6	7.3
8	6.8	8	6.8	8	6.9	8	7.3
10	6.9	10	6.9	10	7.0	10	7.4
15	6.9	15	6.9	15	7.1	15	7.4
20	7.0	20	7.0	20	7.1	20	7.5
25	7.1	25	7.0	25	7.2	25	7.5
30	7.2	30	7.1	30	7.3	30	7.6
35	7.3	35	7.1	35	7.3	35	7.6
40	7.4	40	7.2	40	7.4	40	7.7
45	7.5	45	7.3	45	7.4	45	7.8
50	7.6	50	7.3	50	7.5	50	7.8
55	7.6	55	7.4	55	7.5	55	7.9
60	7.7	60	7.5	60	7.6	60	8.0
(ft/hr)	1.1	(ft/hr)	0.8	(ft/hr)	0.9	(ft/hr)	1.0
(in/hr)	13.2	(in/hr)	9.6	(in/hr)	10.8	(in/hr)	12.0

Test Summary

Average Infiltration Rate (in/hr)	**11.4**
Pre-Soak Performed 9/19/2016 2:04 pm	
Hole Depth from Top of Casing (ft)	8.7
Casing Stick-up from Ground Surface (ft)	0.9
Pre-Infiltration Test Water Depth (ft)	6.6

Notes:

1) Testing was performed in accordance with guidelines presented in the Nhew Hampshire Stormwater Manual (Vol 2; Table 2-3).

2) The Average Infiltration Rate (in/hr) presented is base don field measurements; a safety factor has not been applied.

2) The Average Infiltration Rate (in/hr) presented is based on field measurements; a safety factor has not been applied.

Borehole Infiltration Test

Project Name:	Northern Pass	Test Date:	9/21/2016
Project No.:	16-0600	Tested By:	NMC
Client:	Quanta Subsurface	Reviewed By:	CBM
Test Location:	INF-904, Transition Station #6		

Trial #1		Trial #2		Trial #3		Trial #4	
Time Elapsed (min)	Depth to Water (ft)	Time Elapsed (min)	Depth to Water (ft)	Time Elapsed (min)	Depth to Water (ft)	Time Elapsed (min)	Depth to Water (ft)
0	7.0	0	7.2	0	7.0	0	7.2
2	7.0	2	7.2	2	7.0	2	7.2
4	7.0	4	7.2	4	7.0	4	7.2
6	7.1	6	7.2	6	7.0	6	7.2
8	7.1	8	7.3	8	7.1	8	7.2
10	7.1	10	7.3	10	7.1	10	7.3
15	7.1	15	7.3	15	7.1	15	7.3
20	7.1	20	7.3	20	7.1	20	7.3
25	7.1	25	7.3	25	7.1	25	7.3
30	7.1	30	7.3	30	7.1	30	7.3
35	7.1	35	7.3	35	7.1	35	7.3
40	7.1	40	7.3	40	7.1	40	7.3
45	7.1	45	7.3	45	7.1	45	7.3
50	7.1	50	7.3	50	7.2	50	7.3
55	7.2	55	7.4	55	7.2	55	7.3
60	7.2	60	7.4	60	7.2	60	7.4
(ft/hr)	0.2	(ft/hr)	0.2	(ft/hr)	0.2	(ft/hr)	0.2
(in/hr)	2.4	(in/hr)	2.4	(in/hr)	2.4	(in/hr)	2.4

Test Summary

Average Infiltration Rate (in/hr)	**2.4**
Pre-Soak Performed 9/19/2016 2:07 pm	
Hole Depth from Top of Casing (ft)	9.2
Casing Stick-up from Ground Surface (ft)	0.9
Pre-Infiltration Test Water Depth (ft)	7.0

Notes:

1) Testing was performed in accordance with guidelines presented in the Nhew Hampshire Stormwater Manual (Vol 2; Table 2-3).

2) The Average Infiltration Rate (in/hr) presented is base don field measurements; a safety factor has not been applied.

2) The Average Infiltration Rate (in/hr) presented is based on field measurements; a safety factor has not been applied.

APPENDIX I – WETLAND DELINEATION REPORT (BY OTHERS)

WETLANDS REPORT INFORMATION INCLUDED UNDER SEPARATE COVER

APPENDIX J – POLLUTANT LOADING CALCULATIONS

Condition	Point of Analysis (PoA) Number	Sub-Area Number	Area Description	Land Use	BMP	Is the Impervious Area Disconnected in accordance with Chapter 6, Volume 1 of the NH Stormwater Manual or is the BMP an Infiltration BMP designed in accordance with Alteration of Terrain regulations (Env-Wq 1500)?	Pervious Undisturbed (i.e, forest, meadow, etc.)	Pervious Disturbed (i.e. lawn or other area that will be fertilized regularly)	Pervious Pavement that filters and infiltrates all stormwater (no underdrains)	Pervious Disturbed Other	Description of Pervious Disturbed Other	Pervious Total	Pervious Pavement that filters but does not infiltrate all stormwater (has underdrains)	Impervious Roof	Impervious Road	Impervious Parking and Drives	Impervious Sidewalks	Impervious Surface Water	Impervious Other	Description of Impervious Other	Impervious Total (prior to Disconnection or Infiltration BMP Credit)	Total Area	Composite % Impervious (without disconnection or Infiltration credit)	Composite % Impervious (with disconnection or Infiltration credit)
							Acres	Acres	Acres	Acres		Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres		Acres	Acres		
Pre-Development	Pre 1	Pre 1	Existing Site	Forest/Rural Open		NO	1.71	0.00	0.00	2.11	grass, no fertilizer	3.82	0.00	0.00	0.36	0.00	0.00	0.00	0.00		0.36	4.18	8.59%	8.59%
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		
Pre-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00		

Condition	Point of Analysis (PoA) Number	Sub-Area Number	Area Description	Land Use	BMP	Is the Impervious Area Disconnected in accordance with Chapter 6, Volume 1 of the NH Stormwater Manual or is the BMP an Infiltration BMP designed in accordance with Alteration of Terrain regulations (Env-Wq 1500)?	Pervious Undisturbed (i.e, forest, meadow, etc.)	Pervious Disturbed (i.e. lawn or other area that will be fertilized annually)	Pervious Pavement that filters and infiltrates all stormwater (no underdrains)	Pervious Disturbed Other	Description of Pervious Disturbed Other	Pervious Total	Pervious Pavement that filters but does not infiltrate all stormwater (has underdrains)	Impervious Roof	Impervious Road	Impervious Parking and Drives	Impervious Sidewalks	Impervious Surface Water	Impervious Other	Description of Impervious Other	Impervious Total (Prior to Disconnection or Infiltration BMP Credit)	Total Area	Composite % Impervious (without disconnection or Infiltration credit)	Composite % Impervious (with disconnection or Infiltration credit)	Percent that is Pervious Disturbed (i.e. lawn or other area that will be fertilized annually)
							Acres	Acres	Acres	Acres		Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres		Acres	Acres			%
Post-Development	Post 1	Post 1	Developed Area	Industrial (general)	Infiltration Basin 1	NO	0.00	0.00	0.62	1.15	grass, no fertilizer	1.77	0.00	0.01	0.24	0.00	0.00	0.07	0.00		0.32	2.09	15.41%	15.41%	0.0%
Post-Development	Post 1	Post 2	Developed Area	Industrial (general)	Infiltration Basin 2	NO	0.95	0.00	0.00	1.00	grass, no fertilizer	1.95	0.00	0.00	0.12	0.00	0.00	0.03	0.00		0.15	2.10	7.05%	7.05%	0.0%
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			
Post-Development						NO	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00			

Date (MM/DD/YYYY):	**11/22/2016**
Project Name:	**Northern Pass Transmission - Transition Site #6**
Town/City:	**Bridgewater (Nearest Town)**
Impacted Surface Waters:	**Pemigewasset River**
Applicant:	**Northern Pass Transmission, LLC.**
DES File #:	

Average Annual Precipitation P	**47.75**	**inches**
Fraction of Annual Runoff events that produce runoff	**0.90**	**(usually 0.9)**

ONLY INPUT VALUES IN BLUE SHADED CELLS

Credit for Using Low Nutrient Fertilizer: If there are managed turf areas under post development conditions that are to be fertilized annually, reductions in post development nutrient (TP and TN) loadings can be realized by by providing enforceable documents (i.e., deed restrictions) requiring land owners to use low nutrient fertilizer. To get low nutrient fertilizer pollutant reductions input the proposed reduced fertilizer application rates for post development development for TP and TN in the table below. Low nutrient fertilizers must have application rates less than the standard fertilizer application rate shown in the table. Then input the percent of each land use in each post development sub-area that is managed turf that is fertilzed annually.

	Fertilizer Reduction Calculator	
	TP	**TN**
STANDARD FERTILIZER APPLICATION RATE (lbs/acre/year)	15.0	150.0
PROPOSED REDUCED FERTILIZER APPLICATION RATES FOR POST-DEVELOPMENT (lbs/acre/year)	**15.0**	**150.0**
INITIAL PERCENT REDUCTION	0.0%	0.0%
PERCENT OF CITIZENS THAT WILL COMPLY WITH REDUCED APPLICATION RATES	50%	50%
PERCENT OF APPLIED FERTILIZER THAT IS LOST TO RUNOFF OR PERCOLATION	75%	75%
FINAL PERCENT FERTILIZER REDUCTION WITH COMPLIANCE AND RUNOFF RATES APPLIED (%FR)	**0.0%**	**0.0%**
MINIMUM ASSUMED EMC = EMC_{MIN} (mg/L)	0.11	1.74

Used to reduce EMCs for Post TP and Post TN for each land use in each Sub Area depending on percent of area that is managed turf that is fertilized annually

PRE-DEVELOPMENT CONDITIONS

	Area	**Impervious Area**
Total Area (All Sub-Areas) (acres)	**4.18**	**0.36**

Insert information for 1st sub-area below

Sub_Area_ID	**1- PRE**	
Point of Analysis (PoA) Number	**Pre 1**	
Total Area for Sub-Area (acres)	**4.18**	**0.36**

Land Use	**Area**	**Ia**
	(acres)	(% Impervious)
From HWG		
Residential Roof	0.00	0.00%
Commercial Roof	0.00	0.00%
Commercial/Res Parking	0.00	0.00%
Residential Street	0.00	0.00%
Urban Highway	0.00	100.00%
Lawns	0.00	0.00%
Driveway	0.00	0.00%
Residential (general)	0.00	0.00%
Commercial (general)	0.00	0.00%
Industrial (general)	4.18	8.59%
From CDM		
Agriculture and Pasture	0.00	0.00%
Commercial	0.00	0.00%
Forest/Rural Open	0.00	0.00%
Highway	0.00	0.00%
Industrial	0.00	0.00%
Medium Density Residential	0.00	0.00%
Urban Open	0.00	0.00%
Water/Wetland	0.00	0.00%

POST-DEVELOPMENT CONDITIONS

	Area	**Impervious Area**	**Area Fertilized Annually**
Total Area (All Sub-Areas) (acres)	**4.19**	**0.47**	**0.00**

Sub_Area_ID	**1-POST**		
Point of Analysis (PoA) Number	**Post 1**		
Total Area in Sub-Area (acres)	**2.09**	**0.32**	**0.00**

Land Use	**Total Area for each Land Use**	**Ia**	**Percent of Area that is managed turf (i.e., fertilized annually)**	**Post-TP EMC**	**Post-TN EMC**
	(acres)	(% Impervious)	%	mg/L	mg/L
From HWG					
Residential Roof	0.00	0.00%	0.0%	0.11	1.50
Commercial Roof	0.00	0.00%	0.0%	0.14	2.10
Commercial/Res Parking	0.00	0.00%	0.0%	0.15	1.90
Residential Street	0.00	0.00%	0.0%	0.55	1.40
Urban Highway	0.00	0.00%	0.0%	0.32	3.00
Lawns	0.00	0.00%	0.0%	2.10	9.10
Driveway	0.00	0.00%	0.0%	0.56	2.10
Residential (general)	0.00	0.00%	0.0%	0.40	2.20
Commercial (general)	0.00	0.00%	0.0%	0.20	2.00
Industrial (general)	2.09	15.41%	0.0%	0.40	2.50
From CDM					
Agriculture and Pasture	0.00	0.00%	0.0%	0.37	5.98
Commercial	0.00	0.00%	0.0%	0.33	2.97
Forest/Rural Open	0.00	0.00%	0.0%	0.11	1.74
Highway	0.00	0.00%	0.0%	0.43	2.65
Industrial	0.00	0.00%	0.0%	0.32	3.97
Medium Density Residential	0.00	0.00%	0.0%	0.52	5.15
Urban Open	0.00	0.00%	0.0%	0.11	1.74
Water/Wetland	0.00	0.00%	0.0%	0.08	1.38

Insert information for 2nd sub-area below

Sub_Area_ID	**2-PRE**	
Point of Analysis (PoA) Number		
Total Area for Sub-Area (acres)	**0.00**	**0.00**

Land Use	Area (acres)	Ia (% Impervious)
From HWG		
Residential Roof	0.00	0.00%
Commercial Roof	0.00	0.00%
Commercial/Res Parking	0.00	0.00%
Residential Street	0.00	0.00%
Urban Highway	0.00	0.00%
Lawns	0.00	0.00%
Driveway	0.00	0.00%
Residential (general)	0.00	0.00%
Commercial (general)	0.00	0.00%
Industrial (general)	0.00	0.00%
From CDM		
Agriculture and Pasture	0.00	0.00%
Commercial	0.00	0.00%
Forest/Rural Open	0.00	0.00%
Highway	0.00	0.00%
Industrial	0.00	0.00%
Medium Density Residential	0.00	0.00%
Urban Open	0.00	0.00%
Water/Wetland	0.00	0.00%

Sub_Area_ID	**2-POST**		
Point of Analysis (PoA) Number	**Post 1**		
Total Area in Sub-Area (acres)	**2.10**	**0.15**	**0.00**

Land Use	Area (acres)	Ia (% Impervious)	Percent of Area that is managed turf (i.e., fertilized annually) %	Post-TP EMC mg/L	Post-TN EMC mg/L
From HWG					
Residential Roof	0.00	0.00%	0.0%	0.11	1.50
Commercial Roof	0.00	0.00%	0.0%	0.14	2.10
Commercial/Res Parking	0.00	0.00%	0.0%	0.15	1.90
Residential Street	0.00	0.00%	0.0%	0.55	1.40
Urban Highway	0.00	0.00%	0.0%	0.32	3.00
Lawns	0.00	0.00%	0.0%	2.10	9.10
Driveway	0.00	0.00%	0.0%	0.56	2.10
Residential (general)	0.00	0.00%	0.0%	0.40	2.20
Commercial (general)	0.00	0.00%	0.0%	0.20	2.00
Industrial (general)	2.10	7.05%	0.0%	0.40	2.50
From CDM					
Agriculture and Pasture	0.00	0.00%	0.0%	0.37	5.98
Commercial	0.00	0.00%	0.0%	0.33	2.97
Forest/Rural Open	0.00	0.00%	0.0%	0.11	1.74
Highway	0.00	0.00%	0.0%	0.43	2.65
Industrial	0.00	0.00%	0.0%	0.32	3.97
Medium Density Residential	0.00	0.00%	0.0%	0.52	5.15
Urban Open	0.00	0.00%	0.0%	0.11	1.74
Water/Wetland	0.00	0.00%	0.0%	0.08	1.38

Insert information for 3rd sub-area below

Sub_Area_ID		
Point of Analysis (PoA) Number		
Total Area for Sub-Area (acres)	**0.00**	**0.00**

Land Use	Area (acres)	Ia (% Impervious)
From HWG		
Residential Roof	0.00	0.00%
Commercial Roof	0.00	0.00%
Commercial/Res Parking	0.00	0.00%
Residential Street	0.00	0.00%
Urban Highway	0.00	0.00%
Lawns	0.00	0.00%
Driveway	0.00	0.00%
Residential (general)	0.00	0.00%
Commercial (general)	0.00	0.00%
Industrial (general)	0.00	0.00%
From CDM		
Agriculture and Pasture	0.00	0.00%
Commercial	0.00	0.00%
Forest/Rural Open	0.00	0.00%
Highway	0.00	0.00%
Industrial	0.00	0.00%
Medium Density Residential	0.00	0.00%
Urban Open	0.00	0.00%
Water/Wetland	0.00	0.00%

Sub_Area_ID			
Point of Analysis (PoA) Number			
Total Area in Sub-Area (acres)	**0.00**	**0.00**	**0.00**

Land Use	Area (acres)	Ia (% Impervious)	Percent of Area that is managed turf (i.e., fertilized annually) %	Post-TP EMC mg/L	Post-TN EMC mg/L
From HWG					
Residential Roof	0.00	0.00%	0.0%	0.11	1.50
Commercial Roof	0.00	0.00%	0.0%	0.14	2.10
Commercial/Res Parking	0.00	0.00%	0.0%	0.15	1.90
Residential Street	0.00	0.00%	0.0%	0.55	1.40
Urban Highway	0.00	0.00%	0.0%	0.32	3.00
Lawns	0.00	0.00%	0.0%	2.10	9.10
Driveway	0.00	0.00%	0.0%	0.56	2.10
Residential (general)	0.00	0.00%	0.0%	0.40	2.20
Commercial (general)	0.00	0.00%	0.0%	0.20	2.00
Industrial (general)	0.00	0.00%	0.0%	0.40	2.50
From CDM					
Agriculture and Pasture	0.00	0.00%	0.0%	0.37	5.98
Commercial	0.00	0.00%	0.0%	0.33	2.97
Forest/Rural Open	0.00	0.00%	0.0%	0.11	1.74
Highway	0.00	0.00%	0.0%	0.43	2.65
Industrial	0.00	0.00%	0.0%	0.32	3.97
Medium Density Residential	0.00	0.00%	0.0%	0.52	5.15
Urban Open	0.00	0.00%	0.0%	0.11	1.74
Water/Wetland	0.00	0.00%	0.0%	0.08	1.38

Date (MM/DD/YYYY): 11/22/2016
Project Name: Northern Pass Transmission - Transition Site #6
Town/City: Bridgewater (Nearest Town)
Impacted Surface Waters: Pemigewasset River
Applicant: Northern Pass Transmission, LLC.
DES File #:

ONLY CHANGE VALUES SHADED IN BLUE

PRE DEVELOPMENT

Sub-Area	INPUT BMP DESCRIPTIONS		INPUT OVERALL REMOVAL EFFICIENCIES (%) FOR POLLUTANTS OF CONCERN TSS	TP	TN
1- PRE			0%	0%	0%
2-PRE			0%	0%	0%
0.00			0%	0%	0%
0.00			0%	0%	0%
0.00			0%	0%	0%
0.00			0%	0%	0%
0.00			0%	0%	0%
0.00			0%	0%	0%
0.00			0%	0%	0%
0.00			0%	0%	0%
0.00			0%	0%	0%
12-PRE			0%	0%	0%
13-PRE			0%	0%	0%
14-PRE			0%	0%	0%
15-PRE			0%	0%	0%
16-PRE			0%	0%	0%
17-PRE			0%	0%	0%
18-PRE			0%	0%	0%
19-PRE			0%	0%	0%
20-PRE			0%	0%	0%
21-PRE			0%	0%	0%
22-PRE			0%	0%	0%
23-PRE			0%	0%	0%
24-PRE			0%	0%	0%
25-PRE			0%	0%	0%

POST DEVELOPMENT

Sub-Area	INPUT BMP DESCRIPTIONS		TSS	TP	TN
1-POST	Infiltration Basin 1 (>= 75ft from surface water)		90%	65%	60%
2-POST	Infiltration Basin 2 (>= 75ft from surface water)		90%	65%	60%
0.00			0%	0%	0%
0.00			0%	0%	0%
0.00			0%	0%	0%
0.00			0%	0%	0%
0.00			0%	0%	0%
0.00			0%	0%	0%
0.00			0%	0%	0%
0.00			0%	0%	0%
0.00			0%	0%	0%
12-POST			0%	0%	0%
13-POST			0%	0%	0%
14-POST			0%	0%	0%
15-POST			0%	0%	0%
16-POST			0%	0%	0%
17-POST			0%	0%	0%
18-POST			0%	0%	0%
19-POST			0%	0%	0%
20-POST			0%	0%	0%
21-POST			0%	0%	0%
22-POST			0%	0%	0%
23-POST			0%	0%	0%
24-POST			0%	0%	0%
25-POST			0%	0%	0%

Date (MM/DD/YYYY):	**11/22/2016**
Project Name:	**Northern Pass Transmission - Transition Site #6**
Town/City:	**Bridgewater (Nearest Town)**
Impacted Surface Waters:	**Pemigewasset River**
Applicant:	**Northern Pass Transmission, LLC.**
DES File #:	

TOTAL PRE -DEVELOPMENT (PRE-DEV) AREA (ACRES) =	**4.18**
TOTAL PRE-DEV EFFECTIVE IMPERVIOUS AREA (ACRES) =	**0.36**
TOTAL PRE-DEV PERCENT EFFECTIVE IMPERVIOUS (%) =	**8.6%**
TOTAL POST DEVELOPMENT (POST-DEV) AREA (ACRES) =	**4.19**
TOTAL POST-DEV EFFECTIVE IMPERVIOUS AREA (ACRES) =	**0.47**
TOTAL POST-DEV PERCENT EFFECTIVE IMPERVIOUS (%) =	**11.2%**
TOTAL POST-DEV AREA THAT IS FERTILIZED ANNUALLY (ACRES) =	**0.00**
TOTAL POST-DEV PERCENT OF AREA THAT IS FERTILIZED ANNUALLY (%) =	**0.0%**

	TSS (LBS/YR)	**TP (LBS/YR)**	**TN (LBS/YR)**
PRE DEVELOPMENT LOADS (NO BMPS)	**620.1**	**2.1**	**12.9**
PRE DEVELOPMENT LOADS (WITH BMPS)	**620.1**	**2.1**	**12.9**
PRE DEVELOPMENT LOAD REDUCTION DUE TO BMPS	**0.0**	**0.0**	**0.0**
PROPOSED PERCENT REDUCTION IN FERTILIZER APPLICATION RATE	**NA**	**0.0%**	**0.0%**
POST DEVELOPMENT LOADS (NO BMPS)	**737.1**	**2.5**	**15.4**
POST DEVELOPMENT LOADS (WITH BMPS)	**73.7**	**0.9**	**6.1**
POST DEVELOPMENT LOAD REDUCTION DUE TO BMPS	**663.3**	**1.6**	**9.2**
POST DEVELOPMENT - PRE DEVELOPMENT (SHOULD BE 0 OR NEGATIVE)	**-546.4**	**-1.2**	**-6.8**
% DIFFERENCE FROM PRE DEVELOMENT LOADS (SHOULD BE 0 OR NEGATIVE)	**-88.1%**	**-58.4%**	**-52.5%**
TOTAL REMOVAL EFFICIENCY NEEDED TO MEET PRE-DEVELOPMENT LOAD	**15.9%**	**15.9%**	**15.9%**
CURRENTLY PROPOSED REMOVAL EFFICIENCY	**90.0%**	**65.0%**	**60.0%**
REMAINING REMOVAL EFFICIENCY NECESSARY TO MEET PRE-DEVELOPMENT LOAD	**-74.1%**	**-49.1%**	**-44.1%**

Date (MM/DD/YYYY):	**11/22/2016**
Project Name:	**Northern Pass Transmission - Transition Site #6**
Town/City:	**Bridgewater (Nearest Town)**
Impacted Surface Waters:	**Pemigewasset River**
Applicant:	**Northern Pass Transmission, LLC.**
DES File #:	

TOTAL POST DEVELOPMENT - PRE DEVELOPMENT (SHOULD BE 0 OR NEGATIVE) (lbs/yr)	-546.4
% DIFFERENCE FROM PRE DEVELOMENT LOADS (SHOULD BE 0 OR NEGATIVE)	-88.1%
TOTAL REMOVAL EFFICIENCY NEEDED TO MEET PRE-DEVELOPMENT LOAD	15.9%
CURRENTLY PROPOSED REMOVAL EFFICIENCY	90.0%
REMAINING REMOVAL EFFICIENCY NECESSARY TO MEET PRE-DEVELOPMENT LOAD	-74.1%

PRE-DEVELOPMENT

PRE OR POST - DEV	SUB-AREA	POINT OF ANALYSIS NUMBER	AREA (acres)	Effective Impervious Area (acres)	Area Fertilized Annually (acres)	POLLUTANT	PERCENT REDUCTION IN FERTILIZER APPLICATION RATE	BMPS	LOAD (NO BMPS) (lbs/yr)	LOAD (WITH BMPS) (lbs/yr)	LOAD REDUCTION DUE TO BMPS (lbs/yr)	PERCENT REMOVAL
PRE	1- PRE	Pre 1	4.18	0.36	NA	TSS	NA		620.1	620.1	0.0	0.0%
PRE	2-PRE		0.00	0.00	NA	TSS	NA		0.0	0.0	0.0	0.0%
PRE	0.00		0.00	0.00	NA	TSS	NA		0.0	0.0	0.0	0.0%
PRE	0.00		0.00	0.00	NA	TSS	NA		0.0	0.0	0.0	0.0%
PRE	0.00		0.00	0.00	NA	TSS	NA		0.0	0.0	0.0	0.0%
PRE	0.00		0.00	0.00	NA	TSS	NA		0.0	0.0	0.0	0.0%
PRE	0.00		0.00	0.00	NA	TSS	NA		0.0	0.0	0.0	0.0%
PRE	0.00		0.00	0.00	NA	TSS	NA		0.0	0.0	0.0	0.0%
PRE	0.00		0.00	0.00	NA	TSS	NA		0.0	0.0	0.0	0.0%
PRE	0.00		0.00	0.00	NA	TSS	NA		0.0	0.0	0.0	0.0%
PRE	0.00		0.00	0.00	NA	TSS	NA		0.0	0.0	0.0	0.0%
PRE	12-PRE		0.00	0.00	NA	TSS	NA		0.0	0.0	0.0	0.0%
PRE	13-PRE		0.00	0.00	NA	TSS	NA		0.0	0.0	0.0	0.0%
PRE	14-PRE		0.00	0.00	NA	TSS	NA		0.0	0.0	0.0	0.0%
PRE	15-PRE		0.00	0.00	NA	TSS	NA		0.0	0.0	0.0	0.0%
PRE	16-PRE		0.00	0.00	NA	TSS	NA		0.0	0.0	0.0	0.0%
PRE	17-PRE		0.00	0.00	NA	TSS	NA		0.0	0.0	0.0	0.0%
PRE	18-PRE		0.00	0.00	NA	TSS	NA		0.0	0.0	0.0	0.0%
PRE	19-PRE		0.00	0.00	NA	TSS	NA		0.0	0.0	0.0	0.0%
PRE	20-PRE		0.00	0.00	NA	TSS	NA		0.0	0.0	0.0	0.0%
PRE	21-PRE		0.00	0.00	NA	TSS	NA		0.0	0.0	0.0	0.0%
PRE	22-PRE		0.00	0.00	NA	TSS	NA		0.0	0.0	0.0	0.0%
PRE	23-PRE		0.00	0.00	NA	TSS	NA		0.0	0.0	0.0	0.0%
PRE	24-PRE		0.00	0.00	NA	TSS	NA		0.0	0.0	0.0	0.0%
PRE	25-PRE		0.00	0.00	NA	TSS	NA		0.0	0.0	0.0	0.0%
		TOTAL	4.18	0.36				TOTAL	620.1	620.1	0.0	0.0%

Date (MM/DD/YYYY):	**11/22/2016**
Project Name:	**Northern Pass Transmission - Transition Site #6**
Town/City:	**Bridgewater (Nearest Town)**
Impacted Surface Waters:	**Pemigewasset River**
Applicant:	**Northern Pass Transmission, LLC.**
DES File #:	

TOTAL POST DEVELOPMENT - PRE DEVELOPMENT (SHOULD BE 0 OR NEGATIVE) (lbs/yr)	-546.4
% DIFFERENCE FROM PRE DEVELOMENT LOADS (SHOULD BE 0 OR NEGATIVE)	-88.1%
TOTAL REMOVAL EFFICIENCY NEEDED TO MEET PRE-DEVELOPMENT LOAD	15.9%
CURRENTLY PROPOSED REMOVAL EFFICIENCY	90.0%
REMAINING REMOVAL EFFICIENCY NECESSARY TO MEET PRE-DEVELOPMENT LOAD	-74.1%

POST-DEVELOPMENT

PRE OR POST - DEV	SUB-AREA	POINT OF ANALYSIS NUMBER	AREA (acres)	Effective Impervious Area (acres)	Area Fertilized Annually (acres)	POLLUTANT	PERCENT REDUCTION IN FERTILIZER APPLICATION RATE	BMPS	LOAD (NO BMPS) (lbs/yr)	LOAD (WITH BMPS) (lbs/yr)	LOAD REDUCTION DUE TO BMPS (lbs/yr)	PERCENT REMOVAL
POST	1-POST	Post 1	2.09	0.32	0.00	TSS	NA	Infiltration Basin 1 (>= 75ft from surface water)	459.5	46.0	413.6	90.0%
POST	2-POST	Post 1	2.10	0.15	0.00	TSS	NA	Infiltration Basin 2 (>= 75ft from surface water)	277.5	27.8	249.8	90.0%
POST	0.00		0.00	0.00	0.00	TSS	NA		0.0	0.0	0.0	0.0%
POST	0.00		0.00	0.00	0.00	TSS	NA		0.0	0.0	0.0	0.0%
POST	0.00		0.00	0.00	0.00	TSS	NA		0.0	0.0	0.0	0.0%
POST	0.00		0.00	0.00	0.00	TSS	NA		0.0	0.0	0.0	0.0%
POST	0.00		0.00	0.00	0.00	TSS	NA		0.0	0.0	0.0	0.0%
POST	0.00		0.00	0.00	0.00	TSS	NA		0.0	0.0	0.0	0.0%
POST	0.00		0.00	0.00	0.00	TSS	NA		0.0	0.0	0.0	0.0%
POST	0.00		0.00	0.00	0.00	TSS	NA		0.0	0.0	0.0	0.0%
POST	0.00		0.00	0.00	0.00	TSS	NA		0.0	0.0	0.0	0.0%
POST	12-POST		0.00	0.00	0.00	TSS	NA		0.0	0.0	0.0	0.0%
POST	13-POST		0.00	0.00	0.00	TSS	NA		0.0	0.0	0.0	0.0%
POST	14-POST		0.00	0.00	0.00	TSS	NA		0.0	0.0	0.0	0.0%
POST	15-POST		0.00	0.00	0.00	TSS	NA		0.0	0.0	0.0	0.0%
POST	16-POST		0.00	0.00	0.00	TSS	NA		0.0	0.0	0.0	0.0%
POST	17-POST		0.00	0.00	0.00	TSS	NA		0.0	0.0	0.0	0.0%
POST	18-POST		0.00	0.00	0.00	TSS	NA		0.0	0.0	0.0	0.0%
POST	19-POST		0.00	0.00	0.00	TSS	NA		0.0	0.0	0.0	0.0%
POST	20-POST		0.00	0.00	0.00	TSS	NA		0.0	0.0	0.0	0.0%
POST	21-POST		0.00	0.00	0.00	TSS	NA		0.0	0.0	0.0	0.0%
POST	22-POST		0.00	0.00	0.00	TSS	NA		0.0	0.0	0.0	0.0%
POST	23-POST		0.00	0.00	0.00	TSS	NA		0.0	0.0	0.0	0.0%
POST	24-POST		0.00	0.00	0.00	TSS	NA		0.0	0.0	0.0	0.0%
POST	25-POST		0.00	0.00	0.00	TSS	NA		0.0	0.0	0.0	0.0%
		TOTAL	4.19	0.47	0.00			TOTAL	737.1	73.7	663.3	90.0%

Date (MM/DD/YYYY):	**11/22/2016**
Project Name:	**Northern Pass Transmission - Transition Site #6**
Town/City:	**Bridgewater (Nearest Town)**
Impacted Surface Waters:	**Pemigewasset River**
Applicant:	**Northern Pass Transmission, LLC.**
DES File #:	

TOTAL POST DEVELOPMENT - PRE DEVELOPMENT (SHOULD BE 0 OR NEGATIVE) (lbs/yr)	-1.2
% DIFFERENCE FROM PRE DEVELOMENT LOADS (SHOULD BE 0 OR NEGATIVE)	-58.4%
TOTAL REMOVAL EFFICIENCY NEEDED TO MEET PRE-DEVELOPMENT LOAD	15.9%
CURRENTLY PROPOSED REMOVAL EFFICIENCY	65.0%
REMAINING REMOVAL EFFICIENCY NECESSARY TO MEET PRE-DEVELOPMENT LOAD	-49.1%

PRE-DEVELOPMENT

PRE OR POST - DEV	SUB-AREA	POINT OF ANALYSIS NUMBER	AREA (acres)	Effective Impervious Area (acres)	Area Fertilized Annually (acres)	POLLUTANT	PERCENT REDUCTION IN FERTILIZER APPLICATION RATE	BMPS	LOAD (NO BMPS) (lbs/yr)	LOAD (WITH BMPS) (lbs/yr)	LOAD REDUCTION DUE TO BMPS (lbs/yr)	PERCENT REMOVAL
PRE	1- PRE	Pre 1	4.18	0.36	NA	TP	NA		2.1	2.1	0.0	0.0%
PRE	2-PRE		0.00	0.00	NA	TP	NA		0.0	0.0	0.0	0.0%
PRE	0.00		0.00	0.00	NA	TP	NA		0.0	0.0	0.0	0.0%
PRE	0.00		0.00	0.00	NA	TP	NA		0.0	0.0	0.0	0.0%
PRE	0.00		0.00	0.00	NA	TP	NA		0.0	0.0	0.0	0.0%
PRE	0.00		0.00	0.00	NA	TP	NA		0.0	0.0	0.0	0.0%
PRE	0.00		0.00	0.00	NA	TP	NA		0.0	0.0	0.0	0.0%
PRE	0.00		0.00	0.00	NA	TP	NA		0.0	0.0	0.0	0.0%
PRE	0.00		0.00	0.00	NA	TP	NA		0.0	0.0	0.0	0.0%
PRE	0.00		0.00	0.00	NA	TP	NA		0.0	0.0	0.0	0.0%
PRE	0.00		0.00	0.00	NA	TP	NA		0.0	0.0	0.0	0.0%
PRE	12-PRE		0.00	0.00	NA	TP	NA		0.0	0.0	0.0	0.0%
PRE	13-PRE		0.00	0.00	NA	TP	NA		0.0	0.0	0.0	0.0%
PRE	14-PRE		0.00	0.00	NA	TP	NA		0.0	0.0	0.0	0.0%
PRE	15-PRE		0.00	0.00	NA	TP	NA		0.0	0.0	0.0	0.0%
PRE	16-PRE		0.00	0.00	NA	TP	NA		0.0	0.0	0.0	0.0%
PRE	17-PRE		0.00	0.00	NA	TP	NA		0.0	0.0	0.0	0.0%
PRE	18-PRE		0.00	0.00	NA	TP	NA		0.0	0.0	0.0	0.0%
PRE	19-PRE		0.00	0.00	NA	TP	NA		0.0	0.0	0.0	0.0%
PRE	20-PRE		0.00	0.00	NA	TP	NA		0.0	0.0	0.0	0.0%
PRE	21-PRE		0.00	0.00	NA	TP	NA		0.0	0.0	0.0	0.0%
PRE	22-PRE		0.00	0.00	NA	TP	NA		0.0	0.0	0.0	0.0%
PRE	23-PRE		0.00	0.00	NA	TP	NA		0.0	0.0	0.0	0.0%
PRE	24-PRE		0.00	0.00	NA	TP	NA		0.0	0.0	0.0	0.0%
PRE	25-PRE		0.00	0.00	NA	TP	NA		0.0	0.0	0.0	0.0%
		TOTAL	4.18	0.36				TOTAL	2.1	2.1	0.0	0.0%

Date (MM/DD/YYYY):	**11/22/2016**
Project Name:	**Northern Pass Transmission - Transition Site #6**
Town/City:	**Bridgewater (Nearest Town)**
Impacted Surface Waters:	**Pemigewasset River**
Applicant:	**Northern Pass Transmission, LLC.**
DES File #:	

POST-DEVELOPMENT

PRE OR POST - DEV	SUB-AREA	POINT OF ANALYSIS NUMBER	AREA (acres)	Effective Impervious Area (acres)	Area Fertilized Annually (acres)	POLLUTANT	PERCENT REDUCTION IN FERTILIZER APPLICATION RATE	BMPS	LOAD (NO BMPS) (lbs/yr)	LOAD (WITH BMPS) (lbs/yr)	LOAD REDUCTION DUE TO BMPS (lbs/yr)	PERCENT REMOVAL
POST	1-POST	Post 1	2.09	0.32	0.00	TP	0.0%	Infiltration Basin 1 (>= 75ft from surface water)	1.5	0.5	1.0	65.0%
POST	2-POST	Post 1	2.10	0.15	0.00	TP	0.0%	Infiltration Basin 2 (>= 75ft from surface water)	0.9	0.3	0.6	65.0%
POST	0.00		0.00	0.00	0.00	TP	0.0%		0.0	0.0	0.0	0.0%
POST	0.00		0.00	0.00	0.00	TP	0.0%		0.0	0.0	0.0	0.0%
POST	0.00		0.00	0.00	0.00	TP	0.0%		0.0	0.0	0.0	0.0%
POST	0.00		0.00	0.00	0.00	TP	0.0%		0.0	0.0	0.0	0.0%
POST	0.00		0.00	0.00	0.00	TP	0.0%		0.0	0.0	0.0	0.0%
POST	0.00		0.00	0.00	0.00	TP	0.0%		0.0	0.0	0.0	0.0%
POST	0.00		0.00	0.00	0.00	TP	0.0%		0.0	0.0	0.0	0.0%
POST	0.00		0.00	0.00	0.00	TP	0.0%		0.0	0.0	0.0	0.0%
POST	0.00		0.00	0.00	0.00	TP	0.0%		0.0	0.0	0.0	0.0%
POST	12-POST		0.00	0.00	0.00	TP	0.0%		0.0	0.0	0.0	0.0%
POST	13-POST		0.00	0.00	0.00	TP	0.0%		0.0	0.0	0.0	0.0%
POST	14-POST		0.00	0.00	0.00	TP	0.0%		0.0	0.0	0.0	0.0%
POST	15-POST		0.00	0.00	0.00	TP	0.0%		0.0	0.0	0.0	0.0%
POST	16-POST		0.00	0.00	0.00	TP	0.0%		0.0	0.0	0.0	0.0%
POST	17-POST		0.00	0.00	0.00	TP	0.0%		0.0	0.0	0.0	0.0%
POST	18-POST		0.00	0.00	0.00	TP	0.0%		0.0	0.0	0.0	0.0%
POST	19-POST		0.00	0.00	0.00	TP	0.0%		0.0	0.0	0.0	0.0%
POST	20-POST		0.00	0.00	0.00	TP	0.0%		0.0	0.0	0.0	0.0%
POST	21-POST		0.00	0.00	0.00	TP	0.0%		0.0	0.0	0.0	0.0%
POST	22-POST		0.00	0.00	0.00	TP	0.0%		0.0	0.0	0.0	0.0%
POST	23-POST		0.00	0.00	0.00	TP	0.0%		0.0	0.0	0.0	0.0%
POST	24-POST		0.00	0.00	0.00	TP	0.0%		0.0	0.0	0.0	0.0%
POST	25-POST		0.00	0.00	0.00	TP	0.0%		0.0	0.0	0.0	0.0%
		TOTAL	4.19	0.47	0.00			TOTAL	2.5	0.9	1.6	65.0%

Date (MM/DD/YYYY):	**11/22/2016**
Project Name:	**Northern Pass Transmission - Transition Site #6**
Town/City:	**Bridgewater (Nearest Town)**
Impacted Surface Waters:	**Pemigewasset River**
Applicant:	**Northern Pass Transmission, LLC.**
DES File #:	

TOTAL POST DEVELOPMENT - PRE DEVELOPMENT (SHOULD BE 0 OR NEGATIVE) (lbs/yr)	-6.8
% DIFFERENCE FROM PRE DEVELOMENT LOADS (SHOULD BE 0 OR NEGATIVE)	-52.5%
TOTAL REMOVAL EFFICIENCY NEEDED TO MEET PRE-DEVELOPMENT LOAD	15.9%
CURRENTLY PROPOSED REMOVAL EFFICIENCY	60.0%
REMAINING REMOVAL EFFICIENCY NECESSARY TO MEET PRE-DEVELOPMENT LOAD	-44.1%

PRE-DEVELOPMENT

PRE OR POST - DEV	SUB-AREA	POINT OF ANALYSIS NUMBER	AREA (acres)	Effective Impervious Area (acres)	Area Fertilized Annually (acres)	POLLUTANT	PERCENT REDUCTION IN FERTILIZER APPLICATION RATE	BMPS	LOAD (NO BMPS) (lbs/yr)	LOAD (WITH BMPS) (lbs/yr)	LOAD REDUCTION DUE TO BMPS (lbs/yr)	PERCENT REMOVAL
PRE	1- PRE	Pre 1	4.18	0.36	NA	TN	NA		12.9	12.9	0.0	0.0%
PRE	2-PRE		0.00	0.00	NA	TN	NA		0.0	0.0	0.0	0.0%
PRE	0.00		0.00	0.00	NA	TN	NA		0.0	0.0	0.0	0.0%
PRE	0.00		0.00	0.00	NA	TN	NA		0.0	0.0	0.0	0.0%
PRE	0.00		0.00	0.00	NA	TN	NA		0.0	0.0	0.0	0.0%
PRE	0.00		0.00	0.00	NA	TN	NA		0.0	0.0	0.0	0.0%
PRE	0.00		0.00	0.00	NA	TN	NA		0.0	0.0	0.0	0.0%
PRE	0.00		0.00	0.00	NA	TN	NA		0.0	0.0	0.0	0.0%
PRE	0.00		0.00	0.00	NA	TN	NA		0.0	0.0	0.0	0.0%
PRE	0.00		0.00	0.00	NA	TN	NA		0.0	0.0	0.0	0.0%
PRE	0.00		0.00	0.00	NA	TN	NA		0.0	0.0	0.0	0.0%
PRE	12-PRE		0.00	0.00	NA	TN	NA		0.0	0.0	0.0	0.0%
PRE	13-PRE		0.00	0.00	NA	TN	NA		0.0	0.0	0.0	0.0%
PRE	14-PRE		0.00	0.00	NA	TN	NA		0.0	0.0	0.0	0.0%
PRE	15-PRE		0.00	0.00	NA	TN	NA		0.0	0.0	0.0	0.0%
PRE	16-PRE		0.00	0.00	NA	TN	NA		0.0	0.0	0.0	0.0%
PRE	17-PRE		0.00	0.00	NA	TN	NA		0.0	0.0	0.0	0.0%
PRE	18-PRE		0.00	0.00	NA	TN	NA		0.0	0.0	0.0	0.0%
PRE	19-PRE		0.00	0.00	NA	TN	NA		0.0	0.0	0.0	0.0%
PRE	20-PRE		0.00	0.00	NA	TN	NA		0.0	0.0	0.0	0.0%
PRE	21-PRE		0.00	0.00	NA	TN	NA		0.0	0.0	0.0	0.0%
PRE	22-PRE		0.00	0.00	NA	TN	NA		0.0	0.0	0.0	0.0%
PRE	23-PRE		0.00	0.00	NA	TN	NA		0.0	0.0	0.0	0.0%
PRE	24-PRE		0.00	0.00	NA	TN	NA		0.0	0.0	0.0	0.0%
PRE	25-PRE		0.00	0.00	NA	TN	NA		0.0	0.0	0.0	0.0%
		TOTAL	4.18	0.36				TOTAL	12.9	12.9	0.0	0.0%

Date (MM/DD/YYYY):	**11/22/2016**
Project Name:	**Northern Pass Transmission - Transition Site #6**
Town/City:	**Bridgewater (Nearest Town)**
Impacted Surface Waters:	**Pemigewasset River**
Applicant:	**Northern Pass Transmission, LLC.**
DES File #:	

POST-DEVELOPMENT

PRE OR POST - DEV	SUB-AREA	POINT OF ANALYSIS NUMBER	AREA (acres)	Effective Impervious Area (acres)	Area Fertilized Annually (acres)	POLLUTANT	PERCENT REDUCTION IN FERTILIZER APPLICATION RATE	BMPS	LOAD (NO BMPS) (lbs/yr)	LOAD (WITH BMPS) (lbs/yr)	LOAD REDUCTION DUE TO BMPS (lbs/yr)	PERCENT REMOVAL
POST	1-POST	Post 1	2.09	0.32	0.00	TN	0.0%	Infiltration Basin 1 (>= 75ft from surface water)	9.6	3.8	5.7	60.0%
POST	2-POST	Post 1	2.10	0.15	0.00	TN	0.0%	Infiltration Basin 2 (>= 75ft from surface water)	5.8	2.3	3.5	60.0%
POST	0.00		0.00	0.00	0.00	TN	0.0%		0.0	0.0	0.0	0.0%
POST	0.00		0.00	0.00	0.00	TN	0.0%		0.0	0.0	0.0	0.0%
POST	0.00		0.00	0.00	0.00	TN	0.0%		0.0	0.0	0.0	0.0%
POST	0.00		0.00	0.00	0.00	TN	0.0%		0.0	0.0	0.0	0.0%
POST	0.00		0.00	0.00	0.00	TN	0.0%		0.0	0.0	0.0	0.0%
POST	0.00		0.00	0.00	0.00	TN	0.0%		0.0	0.0	0.0	0.0%
POST	0.00		0.00	0.00	0.00	TN	0.0%		0.0	0.0	0.0	0.0%
POST	0.00		0.00	0.00	0.00	TN	0.0%		0.0	0.0	0.0	0.0%
POST	0.00		0.00	0.00	0.00	TN	0.0%		0.0	0.0	0.0	0.0%
POST	12-POST		0.00	0.00	0.00	TN	0.0%		0.0	0.0	0.0	0.0%
POST	13-POST		0.00	0.00	0.00	TN	0.0%		0.0	0.0	0.0	0.0%
POST	14-POST		0.00	0.00	0.00	TN	0.0%		0.0	0.0	0.0	0.0%
POST	15-POST		0.00	0.00	0.00	TN	0.0%		0.0	0.0	0.0	0.0%
POST	16-POST		0.00	0.00	0.00	TN	0.0%		0.0	0.0	0.0	0.0%
POST	17-POST		0.00	0.00	0.00	TN	0.0%		0.0	0.0	0.0	0.0%
POST	18-POST		0.00	0.00	0.00	TN	0.0%		0.0	0.0	0.0	0.0%
POST	19-POST		0.00	0.00	0.00	TN	0.0%		0.0	0.0	0.0	0.0%
POST	20-POST		0.00	0.00	0.00	TN	0.0%		0.0	0.0	0.0	0.0%
POST	21-POST		0.00	0.00	0.00	TN	0.0%		0.0	0.0	0.0	0.0%
POST	22-POST		0.00	0.00	0.00	TN	0.0%		0.0	0.0	0.0	0.0%
POST	23-POST		0.00	0.00	0.00	TN	0.0%		0.0	0.0	0.0	0.0%
POST	24-POST		0.00	0.00	0.00	TN	0.0%		0.0	0.0	0.0	0.0%
POST	25-POST		0.00	0.00	0.00	TN	0.0%		0.0	0.0	0.0	0.0%
		TOTAL	4.19	0.47	0.00			TOTAL	15.4	6.1	9.2	60.0%

http://ofmpub.epa.gov/waters10/attains_waterbody.control?p_list_id=NHRIV700010404-03&p_report_type=T&p_cycle=2008
Last updated on 9/2/2015

Watershed Assessment, Tracking & Environmental ResultS

You are here: EPA Home Water WATERS Water Quality Assessment and TMDL Information Waterbody Quality Assessment Report

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On This Page

- Causes of Impairment
- TMDLs That Apply to This Waterbody
- Previous Causes of Impairment Now Attaining All Uses

2008 Waterbody Report for Clay Brook

State: New Hampshire
Waterbody ID: NHRIV700010404-03
Location: 010700010404, Clay Brook, Unknown Fishery
State Waterbody Type: River
EPA Waterbody Type: Rivers and Streams
Water Size: 8.83
Units: miles
Watershed Name: Pemigewasset

Click on the waterbody for an interactive map

Waterbody History Report

Data are also available for these years: 2010 2006 2004 2002

Features

- About This Database (Integrated Report)
- Assessing Water Quality (Questions and Answers)
- Integrated Reporting Guidance
- Previous National Water Quality Reports
- EnviroMapper for Water
- AskWATERS
- EPA WATERS Homepage
- Exchange Network
- Assessment Database
- Statewide Statistical Surveys
- *How's My Waterway* Local Search tool
- Pollution Categories Summary Document
- Nitrogen and Phosphorus Pollution Data Access Tool (NPDAT)

Causes of Impairment for Reporting Year 2008

Description of this table

Cause of Impairment	Cause of Impairment Group	State TMDL Development Status
Mercury	Mercury	TMDL completed
pH	pH/Acidity/Caustic Conditions	TMDL needed

TMDLs That Apply to this waterbody

Description of this table

TMDL Document Name	TMDL Date	TMDL Pollutant Description	TMDL Pollutant Source Type	Cause(s) of Impairment Addressed
Ne Regional Mercury Tmdl	Dec-20-2007	Mercury	Nonpoint Source	Mercury

Previous Causes of Impairments Now Attaining All Uses

No causes of impairment are recorded as attaining all uses for this waterbody.

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