Sciortino, Frank L.

From: Sciortino, Frank L.
Sent: Monday, January 26, 2015 9:26 AM
To: 'jamie.zarczynski@dec.ny.gov'
Subject: National Grid Mohican-Battenkill Project / SWPPP MS4 Review / Town of Moreau

Bill,

On January 20th I met with the Town of Moreau to review an off ROW access proposal from Sisson Road to structures 9 and 10 on our Mohican-Battenkill transmission line. I met with the Town's Building Inspector, Joe Patricke, and the Town's consulting engineer, Garry Robinson. The meeting went well.

Before we adjourned, Garry said that he would most likely contact your office to review and discuss the proposed crossing before he granted MS4 approval. I told Garry that I would send you a copy of the drawings and back up information so that you would have our proposal in front of you when he calls.

The attached information is as follows:

EM&CP Drawing Sheets 19C and 19D
ESS backup calculations for pipe sizing (Memorandum dated January 16, 2015)
Pond Crossing Detail Sheet
Stamped Engineering Plans

Please give me a call if you have any questions.

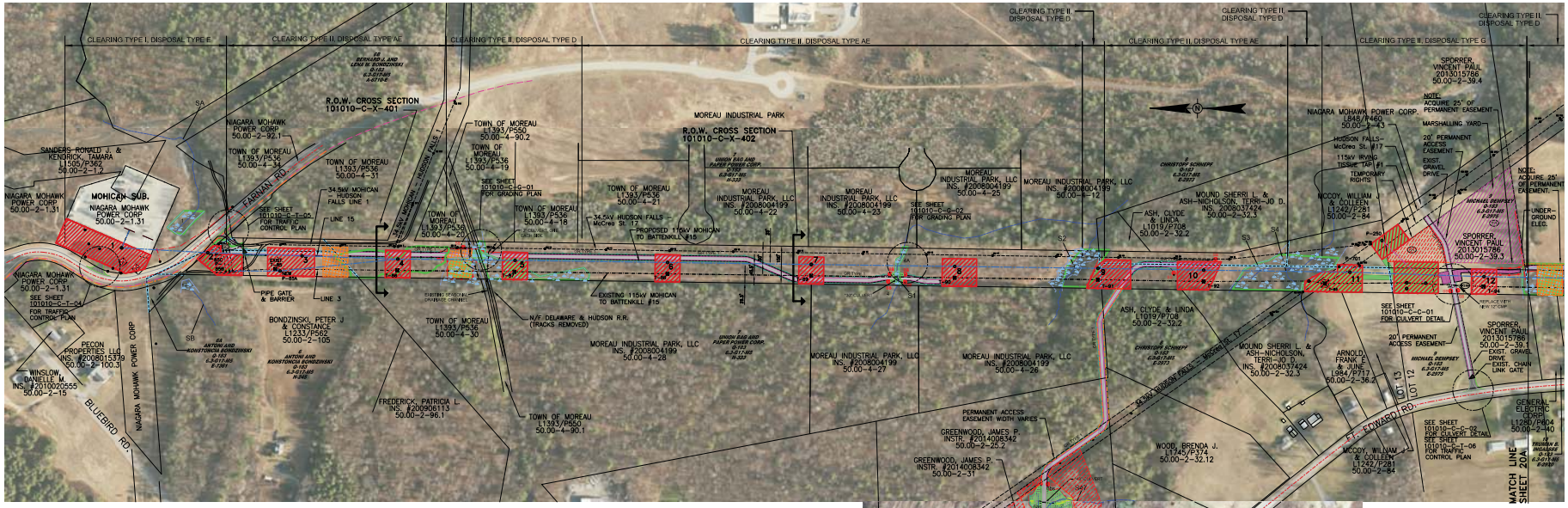
Frank

Frank Sciortino
Environmental Services - Upstate NY
Prin. Env. Eng
SOC, A3
Office 315.428.5075
Cell 315.447.8095
Frank.sciortino@nationalgrid.com

TOWN OF MOREAU, COUNTY OF SARATOGA, T.D. # 8022

PLAN VIEW

SCALE 1:200



CLEARING METHODS

TYPE I - TYPE I CLEARING CONSISTS OF CLEARING THE DESIGNATED AREAS OF ALL WOODY PLANTS, INCLUDING DESIRABLE SPECIES. ALL CONSTRUCTION WORK PADS, PULLING PADS, TIMBER MAT ROADS, GRAVEL ROADS, AND OTHER DESIGNATED WORK AREAS AND ACCESS ROUTES WILL HAVE TYPE I CLEARING.
TYPE II - TYPE II CLEARING CONSISTS OF CLEARING THE DESIGNATED AREAS OF ANY WOODY PLANT SPECIES WHICH HAVE THE POTENTIAL TO VIOLATE MINIMUM CLEARANCE DISTANCE.

WOOD/SLASH DISPOSAL METHODS

TYPE A - TYPE A WOOD DISPOSAL CONSISTS OF SEPARATING, TREE-LENGHT SKIDDING, AND YARDING THE MERCHANTABLE TIMBER IN DESIGNATED AREAS ALONG THE ROW.
TYPE D - TYPE D WOOD DISPOSAL CONSISTS OF DROPPING AND LOPPING TREES SO THAT THE SLASH LIES AS CLOSE TO THE GROUND AS PRACTICAL, WITH BRANCHES AND LIMB WOOD GENERALLY NOT EXCEEDING AN AVERAGE DEPTH OF 24 INCHES.
TYPE E - TYPE E WOOD DISPOSAL CONSISTS OF CHIPPING SLASH ON SITE IN DESIGNATED AREAS.
TYPE G - TYPE G WOOD DISPOSAL CONSISTS OF REMOVING ALL SLASH FROM THE ROW.

OFF ROW ACCESS ROADS

THE ENTIRE EASEMENT AREA FOR ALL OFF ROW ACCESS ROADS WILL BE CLEARED (HORIZONTALLY AND VERTICALLY) OF ALL VEGETATION AND ALL SLASH WILL BE REMOVED FROM THE EASEMENT PREMISES.

NOTE: REFER TO CLEARING SPECIFICATION FOR FULL REQUIREMENTS ON CLEARING/DISPOSAL TECHNIQUES.

PREPARED FOR FORESTRY AND REAL ESTATE GROUP USE

HOWEVER, THIS SHEET SHOULD NOT BE CONSIDERED THE SOLE SOURCE OF INFORMATION REQUIRED FOR THE CONSTRUCTION OF THAT PORTION OF THE PROJECT DEPICTED ON THIS SHEET AND SHOULD ONLY BE USED IN CONJUNCTION WITH SHEETS OF THE SAME NUMBER CONTAINED IN THIS SET OF PLANS.

Commonwealth associates, inc.
www.caiengr.com

115kV TRANSMISSION LINE
MOHICAN – BATTENKILL #15–#3
COMPOSITE MAPPING
101010-C-R-01A-F

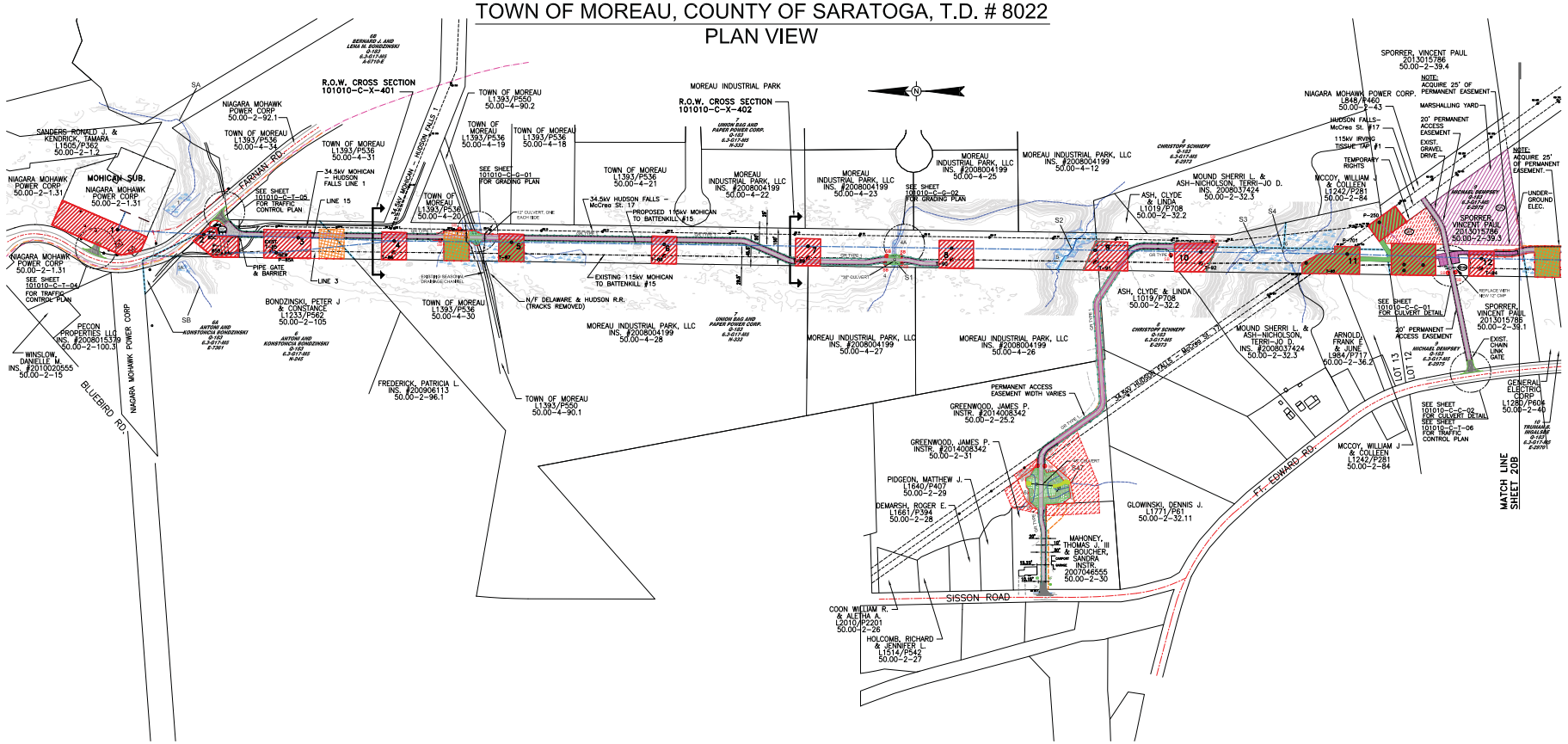
ORIGINAL ISSUE DATE: 08.28.2014
REV.: 6.3–M41–M5
DRAWING NUMBER: D–39339–E
SHEET NO.: 19C

PREPARED BY: nationalgrid

ACCOUNT NUMBER

DATE	DESCRIPTION OF ISSUE OR REVISION	DR.	CK.	APP.
12.30.14	ISSUED FOR MS4	CAI/RSC/KAS	DL CAI	APPROVED
		CAI/RSC/KAS	DL CAI	APPROVED
		CAI/RSC/KAS	DL CAI	APPROVED

TOWN OF MOREAU, COUNTY OF SARATOGA, T.D. # 8022
PLAN VIEW



PREPARED FOR CONSTRUCTION GROUP USE

HOWEVER, THIS SHEET SHOULD NOT BE CONSIDERED THE SOLE SOURCE OF INFORMATION REQUIRED FOR THE CONSTRUCTION OF THAT PORTION OF THE PROJECT DEPICTED ON THIS SHEET AND SHOULD ONLY BE USED IN CONJUNCTION WITH SHEETS OF THE SAME NUMBER CONTAINED IN THIS SET OF PLANS.

HORIZONTAL SCALE 1:200'

VERTICAL SCALE SCALE 1:40

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www.caieng.com

115kV TRANSMISSION LINE
MOHICAN – BATTENKILL #15-#3
COMPOSITE MAPPING
101010-C-R-01A-C

ORIGINAL ISSUE DATE: 08.28.2014
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DRAWING NUMBER: D-39339-E
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PREPARED BY: nationalgrid
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DATE	DESCRIPTION OF ISSUE OR REVISION	DR.	CK.	APP.
12.30.14	ISSUED FOR MS4	DL	CK.	APPROVED

DES: CAI APPROVED
DR. CAI APPROVED
CK. APPROVED

CAI/KSC/CAI/KAS MS/JTF

100 Fifth Avenue, 5th Floor
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p 781.419.7696 f 781.622.2612
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MEMORANDUM

TO:	Frank Sciortino, National Grid	DATE:	January 16, 2015
FROM:	Lauren Caputo, P.E., ESS Group Roger Hill, Senior Designer, ESS Group	ESS PROJECT NO.:	N461-001
SUBJECT:	Flood Analysis at Greenwood Pond / Sisson Road Off-ROW Access		
COPY TO:	Jess Farrell, National Grid Steve Wood, ESS Group		
ATTACHMENTS:	Figure 1 – Watershed Delineation and Time of Concentration N461-001 – HydroCAD Report – Greenwood Pond N461-001 – HydroCAD Report – Greenwood Pond Sensitivity Analysis		

INTRODUCTION

National Grid plans to replace an existing permanent stream crossing downstream of Greenwood Pond (James Greenwood, owner) at the Sisson Road Off Right-of-Way Access in Moreau, New York. A desktop analysis was performed to evaluate the existing hydrology of the watershed draining to the pond to determine the feasibility of the culvert replacement. Calculations were performed for the Q2 flood event (24-hour, 2-year storm) and Q50 flood event (24-hour, 50-year storm) in accordance with the *EM&CP Best Management Practices* (2012) procedures to ensure the proper sizing of the replacement structure. The Q100 flood event (24-hour, 100-year storm) was also evaluated in accordance with the *New York Stormwater Management Design Manual* to safely pass this extreme event. ESS created a HydroCAD® model to analyze existing conditions and would like to provide this memo to document the results of the analysis.

HYDROCAD MODEL

HydroCAD® software was used to create an existing conditions model of the watershed draining to Greenwood Pond. HydroCAD® is a computer aided design system for modeling the hydrology and hydraulics of stormwater runoff. The software calculates runoff based on rainfall and watershed characteristics and produces a runoff hydrograph (a runoff rate versus time curve). Hydrographs were generated based on watershed area, cover characteristics, hydrologic soil group (HSG), curve number (CN) values, time of concentration (Tc), and rainfall amount.

The analysis utilized 24-hour rainfall data from the Northeast Regional Climate Center (NRCC) web tool "*Extreme Precipitation in New York and New England*" for Moreau, New York. A value of 2.59 inches for the Q2 flood event, 5.34 inches for the Q50 flood event, and 6.25 inches for the Q100 flood event were used for the hydrologic/hydraulic model.

As provided by the Natural Resources Conservation Service (NRCS) soil survey, soils in the watershed are composed of Windsor Loamy Sand and Deerfield Loamy Fine Sand, both of which have the properties of HSG A. The most up-to-date, available land use cover (2011) for the watershed was downloaded from the Multi-Resolution Land Characteristics Consortium which is based on 30-meter resolution. The weighted CN value for the watershed was calculated in the model by inputting the CN value based on soil group and land use cover in accordance with TR-55 methodology.

The watershed was delineated based on the Hudson-Hoosic Light Detection and Ranging (LiDAR) terrain data at 2-meter resolution captured in 2012 and downloaded from NYS GIS Clearinghouse. No field

investigation was performed to evaluate drainage infrastructure on Sisson Road so it was assumed that the watershed boundaries follow the high points of the topography. Based on topography, the total watershed draining to Greenwood Pond is approximately 33.1 acres. Bathymetric data of Greenwood Pond and existing topographic contours around the pond were used to estimate the pond capacity for the model. Time of concentration flow path was drawn and input into the model. See Figure 1 for the watershed delineation and time of concentration flow path.

MODEL RESULTS

Results from the HydroCAD model show that zero flow reaches Greenwood Pond under the Q2 flood event. Under the Q50 flood event, the pond receives a peak flow of approximately 0.46 cfs and under the Q100 flood event, the pond receives a peak flow of 1.66 cfs. The low flows can be attributed to the highly permeable soils and 100% pervious coverage of the watershed.

SENSITIVITY ANALYSIS AND CULVERT SIZING

The results from the HydroCAD model suggest that a pipe diameter as small as 12 inches would suffice based solely on estimated peak flows. However, a 48-inch diameter pipe should be considered (i.e. to comply with the active channel width minimum of 1.25 times in accordance with *EM&CP Best Management Practices*) and will accommodate future maintenance and inspection to be performed by National Grid.

A sensitivity analysis was performed in HydroCAD to provide further insight into the estimated culvert size using very conservative assumptions on the watershed characteristics. The sensitivity analysis included the following changes to the model:

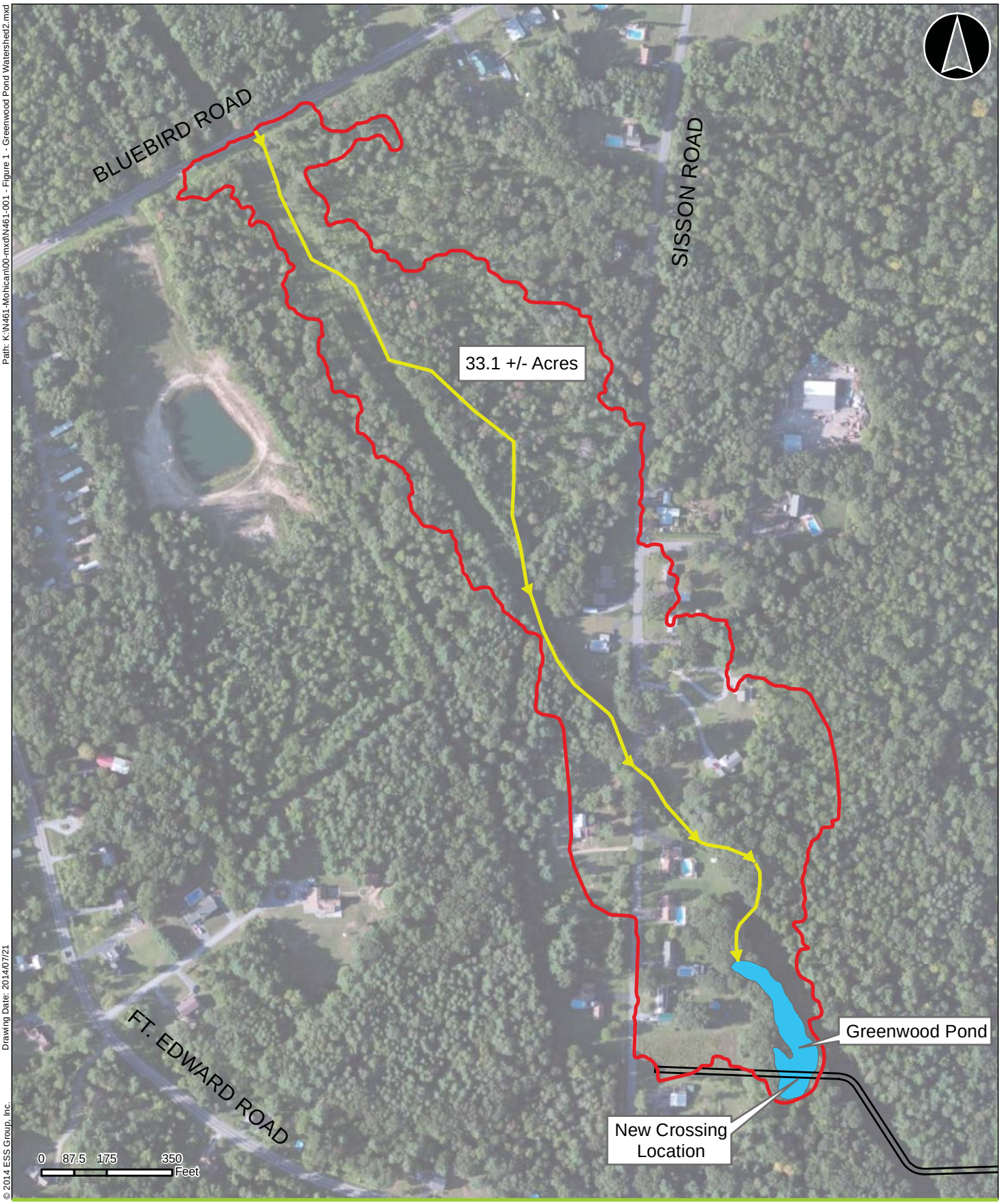
- Doubled the watershed area to 66 acres
- Used HSG B soils instead of HSG A soils which increased the curve numbers

In accordance with *EM&CP Best Management Practices*, the culvert is to be laid flat with 0% slope and buried 20% below the existing stream bed. The culvert will be 100 feet in length and installed at elevation 254.2. The active stream bed was conservatively estimated at 3 feet wide; and therefore, the culvert size is to be 48 inches which is more than 1.25 times the active channel width. The 48-in culvert is to be buried 10” (minimum 20%) into the stream bed so the elevation of flow line will be at 255.0.

Results of the sensitivity analysis show the 48-in culvert instantaneously passes the Q2 storm. Peak inflow into the pipe is 13.6 cfs and peak outflow from the culvert is at 13.5 cfs. Water levels in the pipe rise to elevation 256.8 which provides 1.4 feet of vertical space between the top of pipe and water level.

Results also show that the 48-in culvert safely passes the Q50 event and Q100 event. Water levels rise to elevation 261.6 during the Q50 event and elevation 263.3 during the Q100 event. Proposed contours for the access road over the pond will be at the lowest elevation of 272.5 so neither the Q50 for Q100 storm events will overtop the road.

Using these conservative inputs and assumptions, results from the sensitivity analysis show that a 48-inch diameter culvert would be an appropriate size for the crossing at Greenwood Pond.



Path: K:\N461-Mohican\00-mxd\N461-001 - Figure 1 - Greenwood Pond Watershed2.mxd

Drawing Date: 2014/07/21

ess group
environmental consulting & engineering services

National Grid Mohican Battenkill Project
Moreau, New York
N461-001

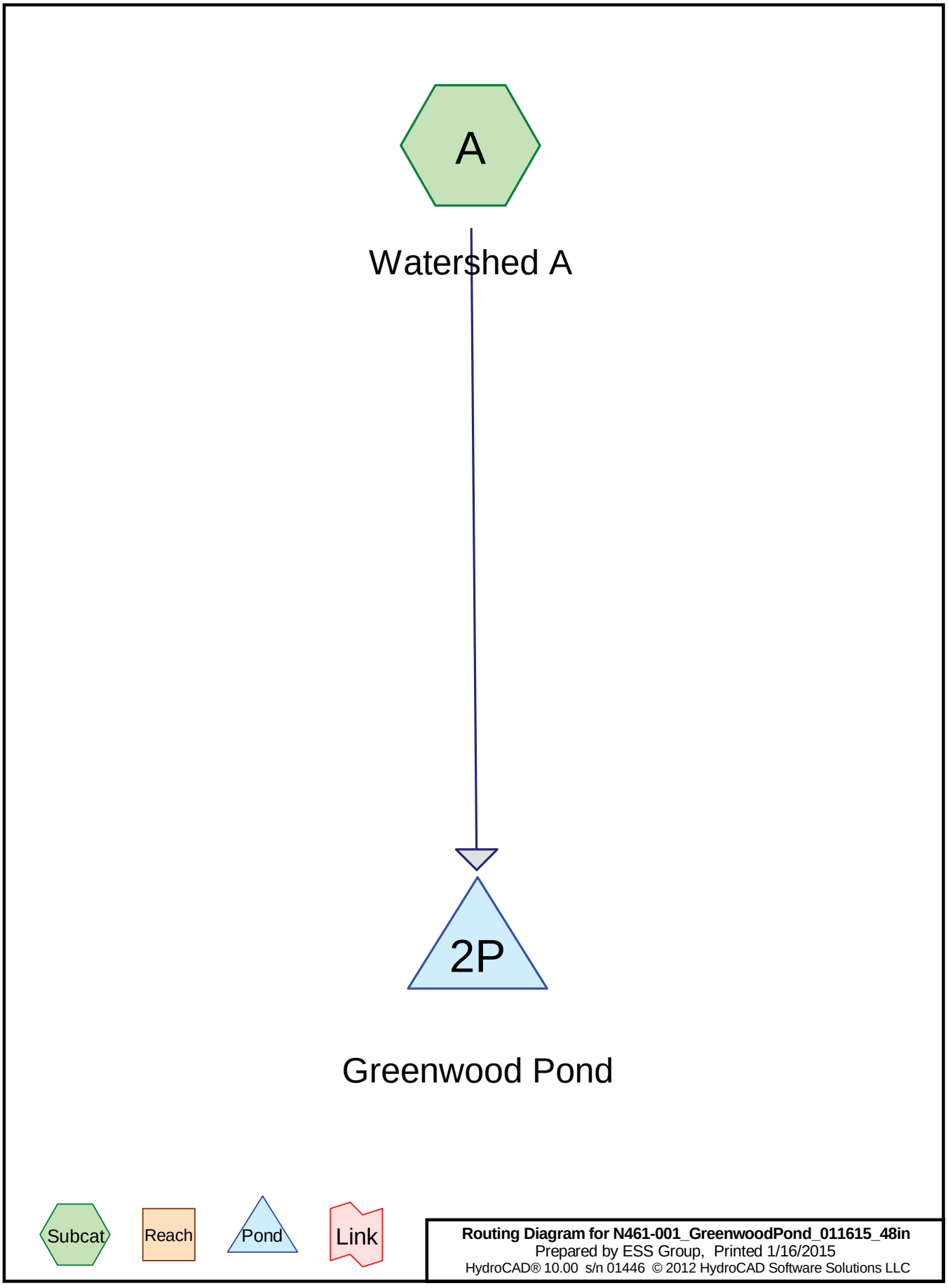
1 inch = 350 feet

Source: 1) MassGIS, Orthophotos, 2013
2) ESS, Watershed and Tc, 2014

Legend
- Time of Concentration
- Watershed
- Access Road
- Greenwood Pond

Greenwood Pond Flood Analysis
Watershed Delineation and Time of Concentration

Figure 1



Routing Diagram for N461-001_GreenwoodPond_011615_48in
Prepared by ESS Group, Printed 1/16/2015
HydroCAD® 10.00 s/n 01446 © 2012 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
10.464	30	Deciduous Forest, HSG A (A)
10.980	30	Evergreen Forest, HSG A (A)
0.537	51	Low Intensity Developed, HSG A (A)
0.013	30	Mixed Forest, HSG A (A)
3.839	68	Open Space Developed, HSG A (A)
6.693	32	Shrub/Scrub, HSG A (A)
0.570	45	Woody Wetlands, HSG A (A)
33.096	**35**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
33.096	HSG A	A
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
33.096		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
10.464	0.000	0.000	0.000	0.000	10.464	Deciduous Forest	A
10.980	0.000	0.000	0.000	0.000	10.980	Evergreen Forest	A
0.537	0.000	0.000	0.000	0.000	0.537	Low Intensity Developed	A
0.013	0.000	0.000	0.000	0.000	0.013	Mixed Forest	A
3.839	0.000	0.000	0.000	0.000	3.839	Open Space Developed	A
6.693	0.000	0.000	0.000	0.000	6.693	Shrub/Scrub	A
0.570	0.000	0.000	0.000	0.000	0.570	Woody Wetlands	A
33.096	**0.000**	**0.000**	**0.000**	**0.000**	**33.096**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	2P	254.20	254.20	100.0	0.0000	0.025	48.0	0.0	10.0

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A: Watershed A Runoff Area=33.096 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=2,534' Tc=49.8 min CN=35 Runoff=0.00 cfs 0.000 af

Pond 2P: Greenwood Pond Peak Elev=255.50' Storage=0 cf Inflow=0.00 cfs 0.000 af
48.0" Round Culvert w/ 10.0" inside fill n=0.025 L=100.0' S=0.0000 '/' Outflow=0.00 cfs 0.000 af

Total Runoff Area = 33.096 ac Runoff Volume = 0.000 af Average Runoff Depth = 0.00"
100.00% Pervious = 33.096 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment A: Watershed A

[45] Hint: Runoff=Zero

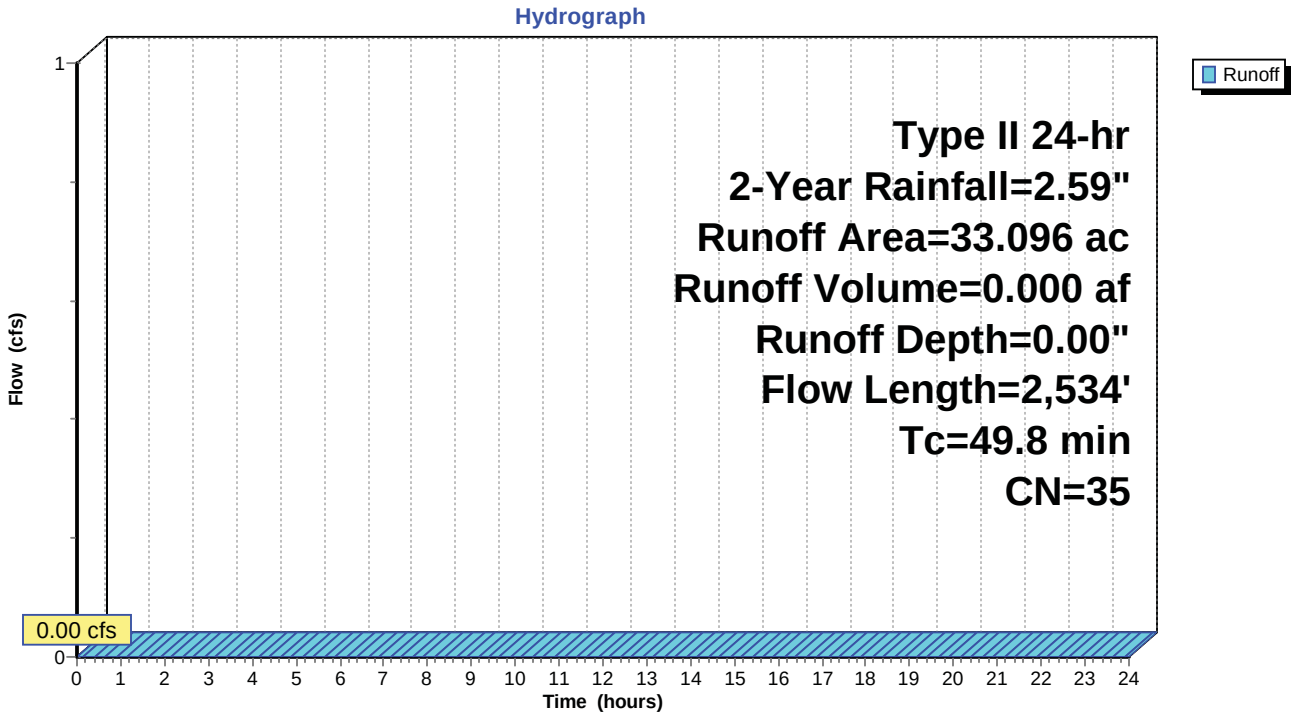
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=2.59"

	Area (ac)	CN	Description
*	10.464	30	Deciduous Forest, HSG A
*	0.537	51	Low Intensity Developed, HSG A
*	3.839	68	Open Space Developed, HSG A
*	10.980	30	Evergreen Forest, HSG A
*	0.013	30	Mixed Forest, HSG A
*	6.693	32	Shrub/Scrub, HSG A
*	0.570	45	Woody Wetlands, HSG A
	33.096	35	Weighted Average
	33.096		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	50	0.1000	0.25		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 2.59"
44.2	1,511	0.0130	0.57		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
1.6	546	0.0147	5.70	15.20	**Parabolic Channel, C-D** W=4.00' D=1.00' Area=2.7 sf Perim=4.6' n= 0.022 Earth, clean & straight
0.4	266	0.0526	10.78	28.76	**Parabolic Channel, D-E** W=4.00' D=1.00' Area=2.7 sf Perim=4.6' n= 0.022 Earth, clean & straight
0.3	161	0.0373	9.08	24.22	**Parabolic Channel, E-F** W=4.00' D=1.00' Area=2.7 sf Perim=4.6' n= 0.022 Earth, clean & straight
49.8	2,534	Total			

Subcatchment A: Watershed A



Summary for Pond 2P: Greenwood Pond

Inflow Area = 33.096 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 255.50' @ 0.00 hrs Surf.Area= 1,440 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no inflow)

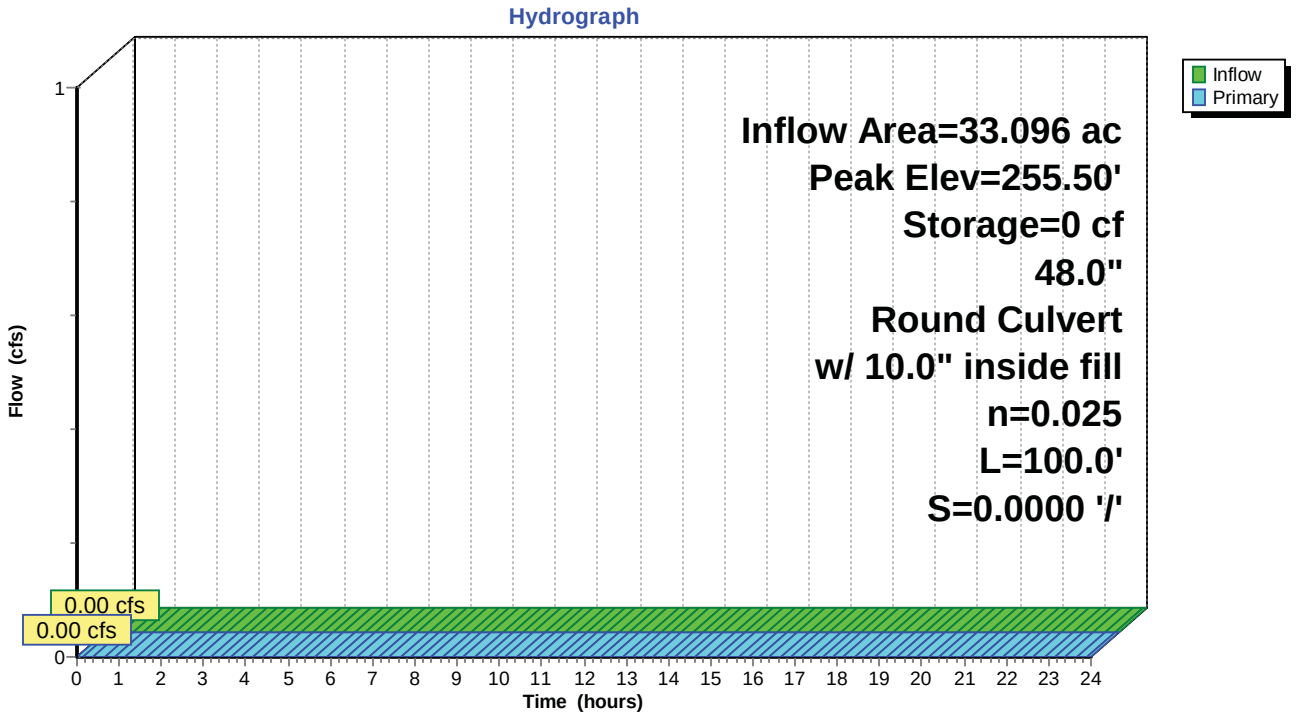
Volume	Invert	Avail.Storage	Storage Description
#1	255.50'	178,295 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
255.50	1,440	168.0	0	0	1,440
262.00	11,209	1,026.0	36,111	36,111	83,056
264.00	20,706	1,183.0	31,433	67,544	110,742
266.00	27,728	1,403.0	48,263	115,807	156,089
268.00	34,897	1,668.0	62,488	178,295	220,923

Device	Routing	Invert	Outlet Devices
#1	Primary	255.03'	**48.0" Round Culvert w/ 10.0" inside fill** L= 100.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 254.20' / 254.20' S= 0.0000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 10.67 sf

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=255.50' (Free Discharge)
1=Culvert (Passes 0.00 cfs of 1.00 cfs potential flow)

Pond 2P: Greenwood Pond



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A: Watershed A Runoff Area=33.096 ac 0.00% Impervious Runoff Depth>0.12"
Flow Length=2,534' Tc=49.8 min CN=35 Runoff=0.46 cfs 0.342 af

Pond 2P: Greenwood Pond Peak Elev=255.54' Storage=52 cf Inflow=0.46 cfs 0.342 af
48.0" Round Culvert w/ 10.0" inside fill n=0.025 L=100.0' S=0.0000 '/' Outflow=0.46 cfs 0.341 af

Total Runoff Area = 33.096 ac Runoff Volume = 0.342 af Average Runoff Depth = 0.12"
100.00% Pervious = 33.096 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment A: Watershed A

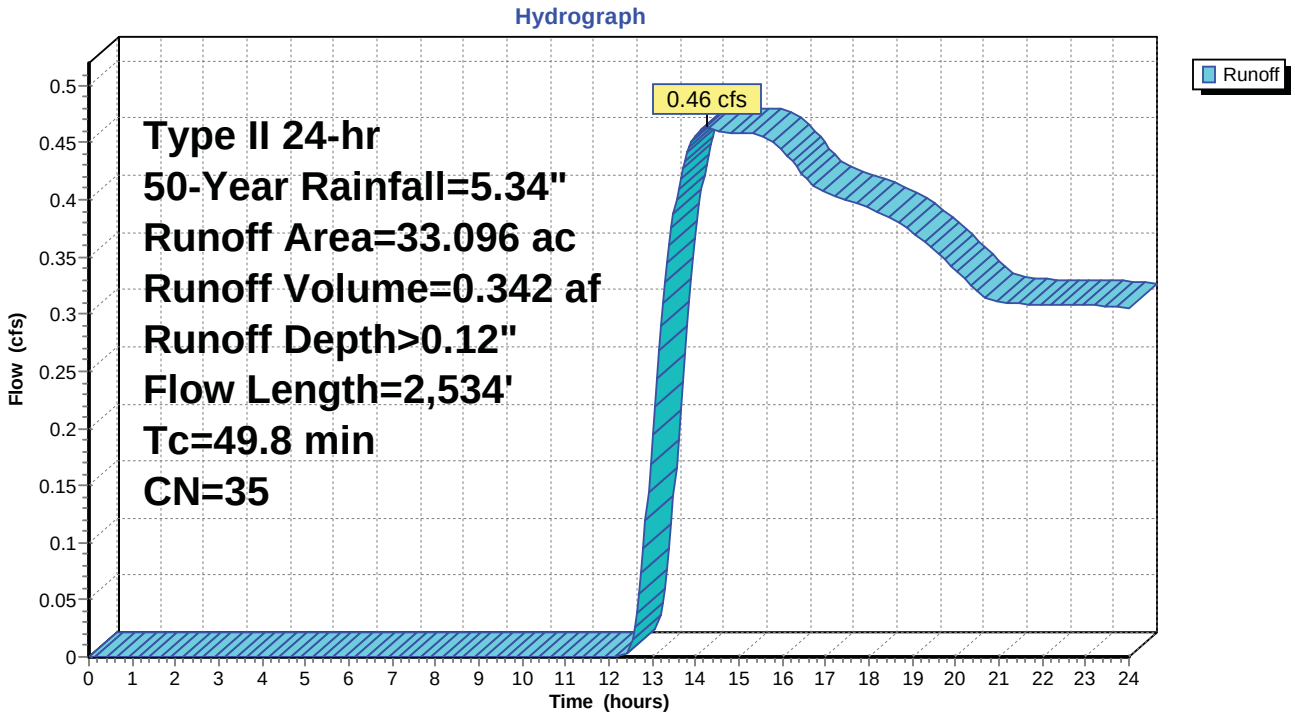
Runoff = 0.46 cfs @ 14.25 hrs, Volume= 0.342 af, Depth> 0.12"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-Year Rainfall=5.34"

	Area (ac)	CN	Description
*	10.464	30	Deciduous Forest, HSG A
*	0.537	51	Low Intensity Developed, HSG A
*	3.839	68	Open Space Developed, HSG A
*	10.980	30	Evergreen Forest, HSG A
*	0.013	30	Mixed Forest, HSG A
*	6.693	32	Shrub/Scrub, HSG A
*	0.570	45	Woody Wetlands, HSG A
	33.096	35	Weighted Average
	33.096		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	50	0.1000	0.25		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 2.59"
44.2	1,511	0.0130	0.57		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
1.6	546	0.0147	5.70	15.20	**Parabolic Channel, C-D** W=4.00' D=1.00' Area=2.7 sf Perim=4.6' n= 0.022 Earth, clean & straight
0.4	266	0.0526	10.78	28.76	**Parabolic Channel, D-E** W=4.00' D=1.00' Area=2.7 sf Perim=4.6' n= 0.022 Earth, clean & straight
0.3	161	0.0373	9.08	24.22	**Parabolic Channel, E-F** W=4.00' D=1.00' Area=2.7 sf Perim=4.6' n= 0.022 Earth, clean & straight
49.8	2,534	Total			

Subcatchment A: Watershed A



Summary for Pond 2P: Greenwood Pond

Inflow Area = 33.096 ac, 0.00% Impervious, Inflow Depth > 0.12" for 50-Year event
Inflow = 0.46 cfs @ 14.25 hrs, Volume= 0.342 af
Outflow = 0.46 cfs @ 14.29 hrs, Volume= 0.341 af, Atten= 0%, Lag= 2.4 min
Primary = 0.46 cfs @ 14.29 hrs, Volume= 0.341 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 255.54' @ 14.29 hrs Surf.Area= 1,469 sf Storage= 52 cf

Plug-Flow detention time= 1.9 min calculated for 0.341 af (100% of inflow)
Center-of-Mass det. time= 1.1 min (1,085.3 - 1,084.2)

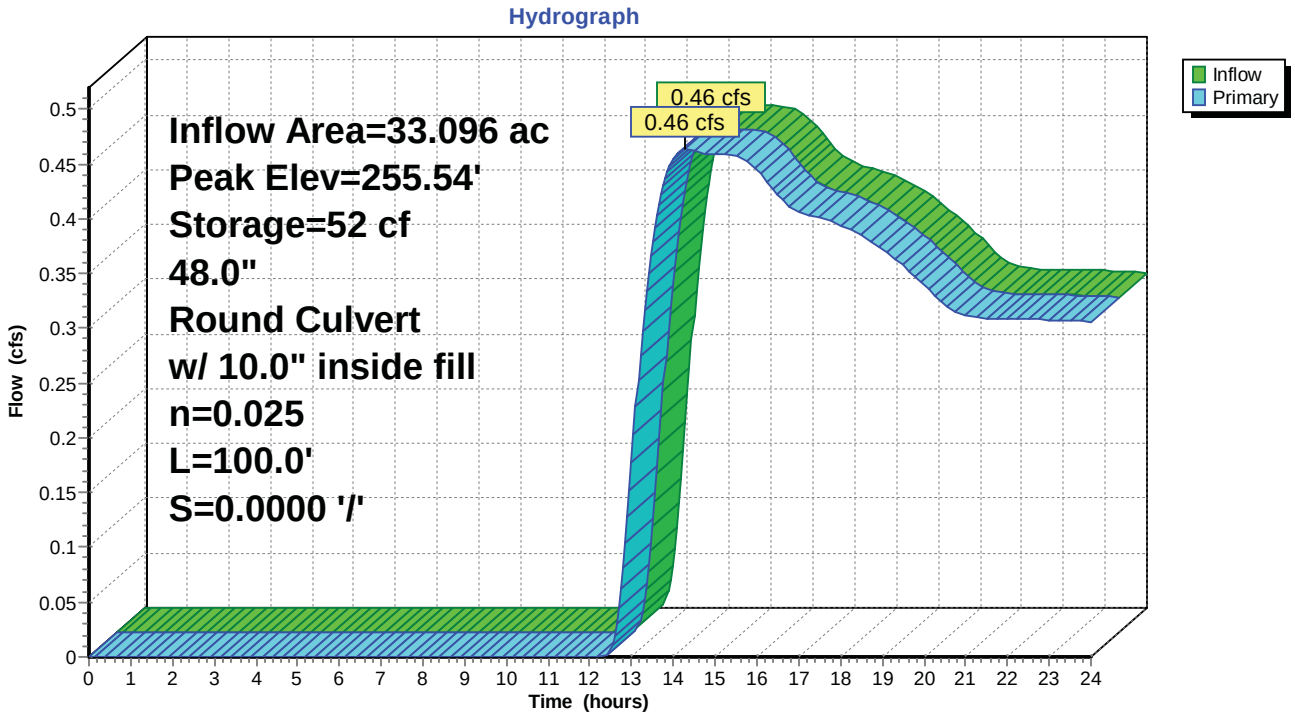
Volume	Invert	Avail.Storage	Storage Description
#1	255.50'	178,295 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
255.50	1,440	168.0	0	0	1,440
262.00	11,209	1,026.0	36,111	36,111	83,056
264.00	20,706	1,183.0	31,433	67,544	110,742
266.00	27,728	1,403.0	48,263	115,807	156,089
268.00	34,897	1,668.0	62,488	178,295	220,923

Device	Routing	Invert	Outlet Devices
#1	Primary	255.03'	**48.0" Round Culvert w/ 10.0" inside fill** L= 100.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 254.20' / 254.20' S= 0.0000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 10.67 sf

Primary OutFlow Max=1.16 cfs @ 14.29 hrs HW=255.54' (Free Discharge)
1=Culvert (Barrel Controls 1.16 cfs @ 0.89 fps)

Pond 2P: Greenwood Pond



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A: Watershed A Runoff Area=33.096 ac 0.00% Impervious Runoff Depth>0.29"
Flow Length=2,534' Tc=49.8 min CN=35 Runoff=1.66 cfs 0.808 af

Pond 2P: Greenwood Pond Peak Elev=255.63' Storage=197 cf Inflow=1.66 cfs 0.808 af
48.0" Round Culvert w/ 10.0" inside fill n=0.025 L=100.0' S=0.0000 '/' Outflow=1.66 cfs 0.807 af

Total Runoff Area = 33.096 ac Runoff Volume = 0.808 af Average Runoff Depth = 0.29"
100.00% Pervious = 33.096 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment A: Watershed A

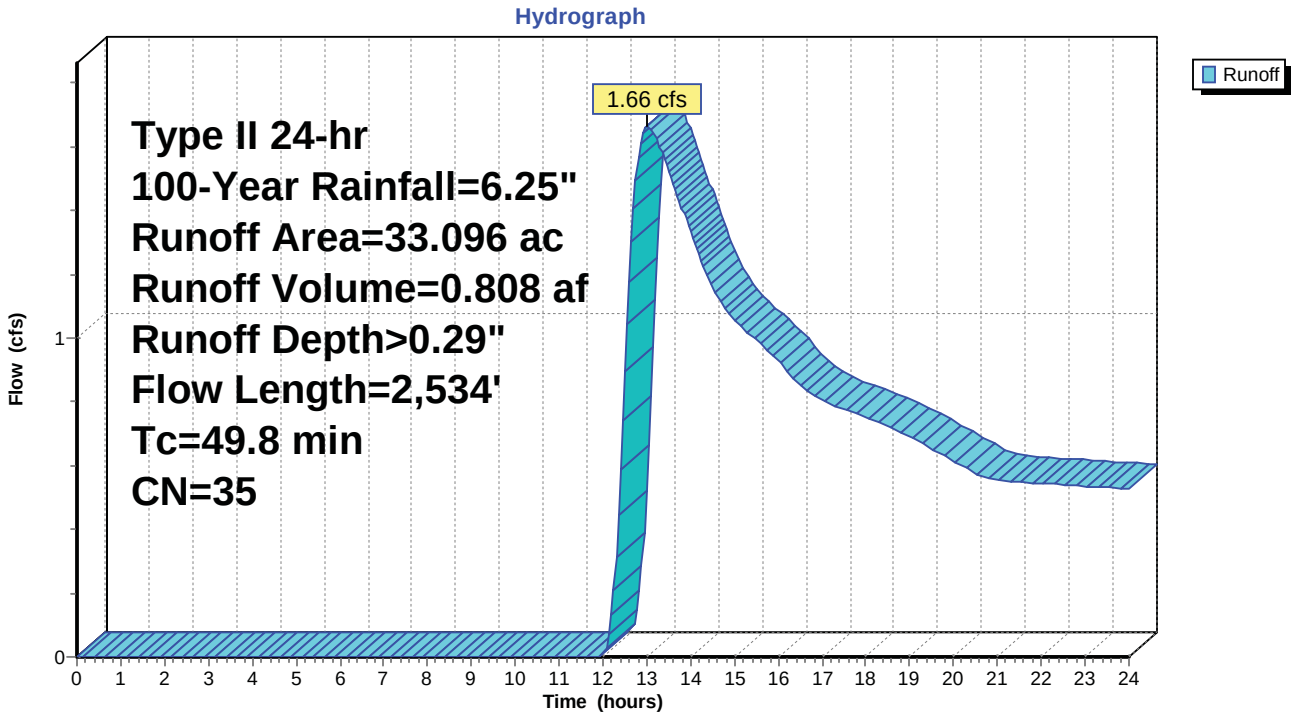
Runoff = 1.66 cfs @ 13.01 hrs, Volume= 0.808 af, Depth> 0.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=6.25"

	Area (ac)	CN	Description
*	10.464	30	Deciduous Forest, HSG A
*	0.537	51	Low Intensity Developed, HSG A
*	3.839	68	Open Space Developed, HSG A
*	10.980	30	Evergreen Forest, HSG A
*	0.013	30	Mixed Forest, HSG A
*	6.693	32	Shrub/Scrub, HSG A
*	0.570	45	Woody Wetlands, HSG A
	33.096	35	Weighted Average
	33.096		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	50	0.1000	0.25		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 2.59"
44.2	1,511	0.0130	0.57		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
1.6	546	0.0147	5.70	15.20	**Parabolic Channel, C-D** W=4.00' D=1.00' Area=2.7 sf Perim=4.6' n= 0.022 Earth, clean & straight
0.4	266	0.0526	10.78	28.76	**Parabolic Channel, D-E** W=4.00' D=1.00' Area=2.7 sf Perim=4.6' n= 0.022 Earth, clean & straight
0.3	161	0.0373	9.08	24.22	**Parabolic Channel, E-F** W=4.00' D=1.00' Area=2.7 sf Perim=4.6' n= 0.022 Earth, clean & straight
49.8	2,534	Total			

Subcatchment A: Watershed A



Summary for Pond 2P: Greenwood Pond

Inflow Area = 33.096 ac, 0.00% Impervious, Inflow Depth > 0.29" for 100-Year event
Inflow = 1.66 cfs @ 13.01 hrs, Volume= 0.808 af
Outflow = 1.66 cfs @ 13.09 hrs, Volume= 0.807 af, Atten= 0%, Lag= 4.8 min
Primary = 1.66 cfs @ 13.09 hrs, Volume= 0.807 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 255.63' @ 13.09 hrs Surf.Area= 1,547 sf Storage= 197 cf

Plug-Flow detention time= 1.9 min calculated for 0.805 af (100% of inflow)
Center-of-Mass det. time= 1.2 min (1,022.2 - 1,021.0)

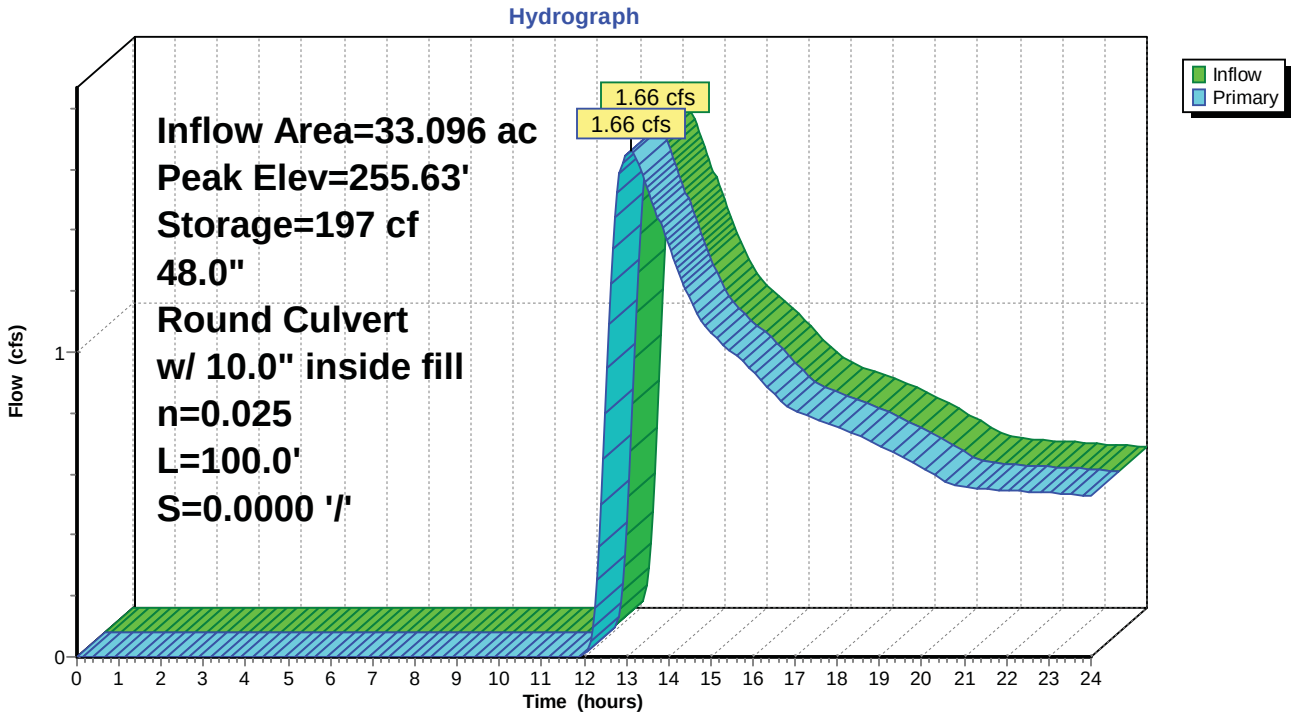
Volume	Invert	Avail.Storage	Storage Description
#1	255.50'	178,295 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

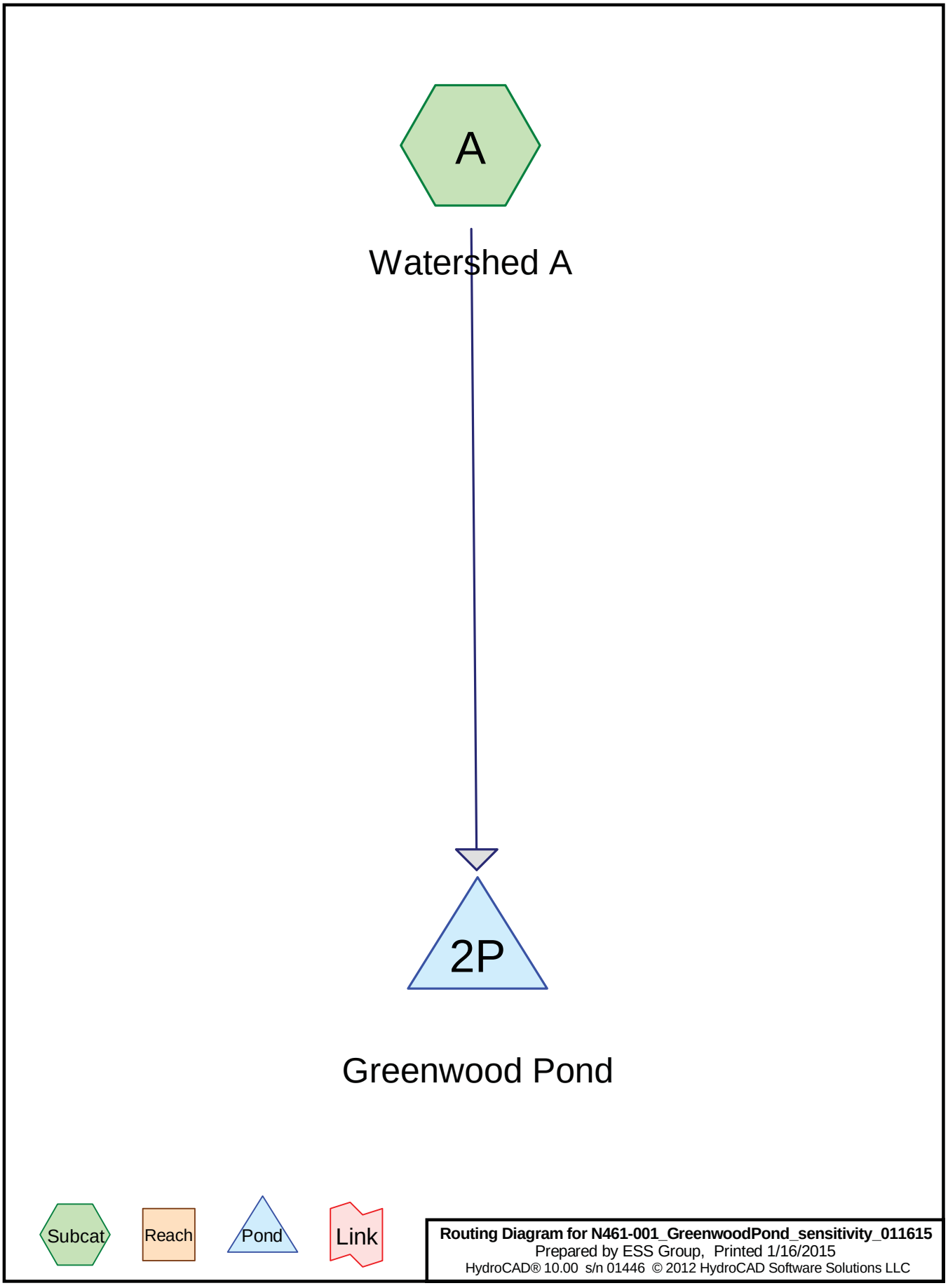
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
255.50	1,440	168.0	0	0	1,440
262.00	11,209	1,026.0	36,111	36,111	83,056
264.00	20,706	1,183.0	31,433	67,544	110,742
266.00	27,728	1,403.0	48,263	115,807	156,089
268.00	34,897	1,668.0	62,488	178,295	220,923

Device	Routing	Invert	Outlet Devices
#1	Primary	255.03'	**48.0" Round Culvert w/ 10.0" inside fill** L= 100.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 254.20' / 254.20' S= 0.0000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 10.67 sf

Primary OutFlow Max=1.65 cfs @ 13.09 hrs HW=255.63' (Free Discharge)
1=Culvert (Barrel Controls 1.65 cfs @ 1.05 fps)

Pond 2P: Greenwood Pond





Routing Diagram for N461-001_GreenwoodPond_sensitivity_011615
Prepared by ESS Group, Printed 1/16/2015
HydroCAD® 10.00 s/n 01446 © 2012 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
10.464	55	Deciduous Forest, HSG B (A)
10.980	55	Evergreen Forest, HSG B (A)
0.537	68	Low Intensity Developed, HSG B (A)
0.013	55	Mixed Forest, HSG B (A)
36.839	79	Open Space Developed, HSG B (A)
6.693	55	Shrub/Scrub, HSG B (A)
0.570	66	Woody Wetlands, HSG B (A)
66.096	**69**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
66.096	HSG B	A
0.000	HSG C	
0.000	HSG D	
0.000	Other	
66.096		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	10.464	0.000	0.000	0.000	10.464	Deciduous Forest	A
0.000	10.980	0.000	0.000	0.000	10.980	Evergreen Forest	A
0.000	0.537	0.000	0.000	0.000	0.537	Low Intensity Developed	A
0.000	0.013	0.000	0.000	0.000	0.013	Mixed Forest	A
0.000	36.839	0.000	0.000	0.000	36.839	Open Space Developed	A
0.000	6.693	0.000	0.000	0.000	6.693	Shrub/Scrub	A
0.000	0.570	0.000	0.000	0.000	0.570	Woody Wetlands	A
0.000	**66.096**	**0.000**	**0.000**	**0.000**	**66.096**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	2P	254.20	254.20	100.0	0.0000	0.025	48.0	0.0	10.0

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A: Watershed A Runoff Area=66.096 ac 0.00% Impervious Runoff Depth>0.45"
Flow Length=2,534' Tc=49.8 min CN=69 Runoff=13.64 cfs 2.492 af

Pond 2P: Greenwood Pond Peak Elev=256.84' Storage=2,719 cf Inflow=13.64 cfs 2.492 af
48.0" Round Culvert w/ 10.0" inside fill n=0.025 L=100.0' S=0.0000 '/' Outflow=13.47 cfs 2.490 af

Total Runoff Area = 66.096 ac Runoff Volume = 2.492 af Average Runoff Depth = 0.45"
100.00% Pervious = 66.096 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment A: Watershed A

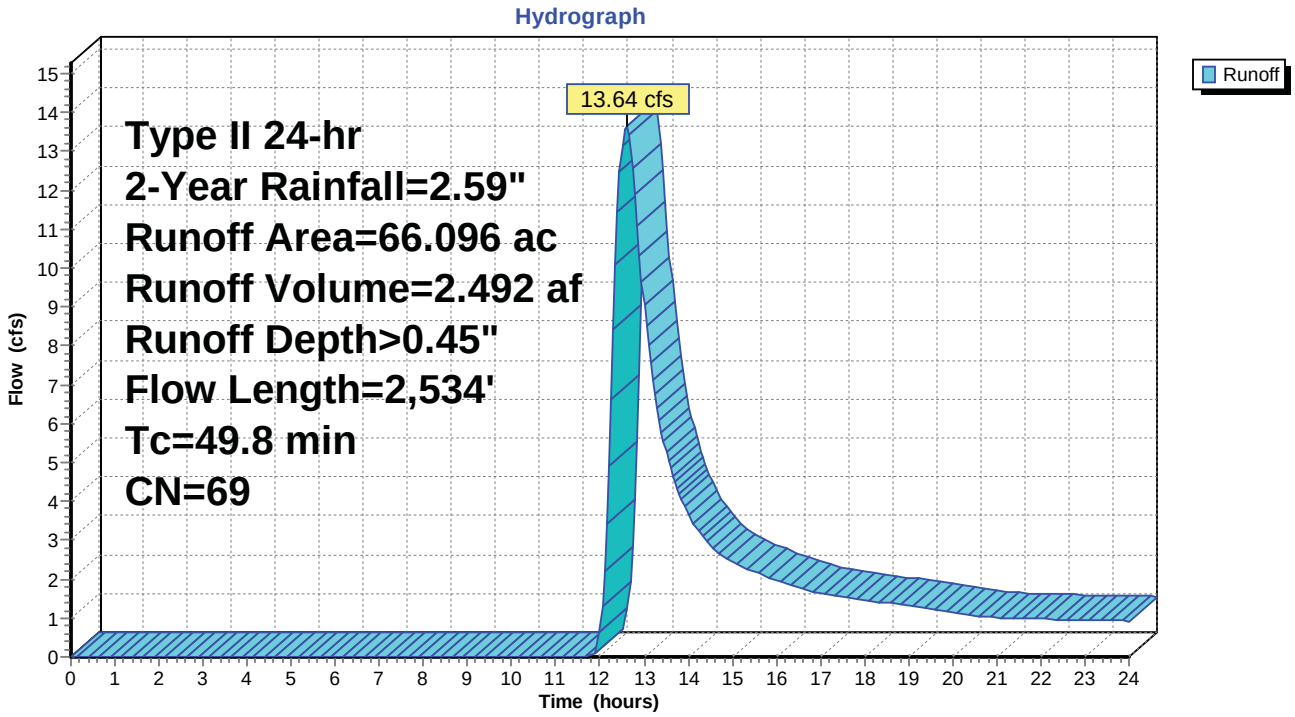
Runoff = 13.64 cfs @ 12.59 hrs, Volume= 2.492 af, Depth> 0.45"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=2.59"

	Area (ac)	CN	Description
*	10.464	55	Deciduous Forest, HSG B
*	0.537	68	Low Intensity Developed, HSG B
*	36.839	79	Open Space Developed, HSG B
*	10.980	55	Evergreen Forest, HSG B
*	0.013	55	Mixed Forest, HSG B
*	6.693	55	Shrub/Scrub, HSG B
*	0.570	66	Woody Wetlands, HSG B
	66.096	69	Weighted Average
	66.096		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	50	0.1000	0.25		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 2.59"
44.2	1,511	0.0130	0.57		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
1.6	546	0.0147	5.70	15.20	**Parabolic Channel, C-D** W=4.00' D=1.00' Area=2.7 sf Perim=4.6' n= 0.022 Earth, clean & straight
0.4	266	0.0526	10.78	28.76	**Parabolic Channel, D-E** W=4.00' D=1.00' Area=2.7 sf Perim=4.6' n= 0.022 Earth, clean & straight
0.3	161	0.0373	9.08	24.22	**Parabolic Channel, E-F** W=4.00' D=1.00' Area=2.7 sf Perim=4.6' n= 0.022 Earth, clean & straight
49.8	2,534	Total			

Subcatchment A: Watershed A



Summary for Pond 2P: Greenwood Pond

Inflow Area = 66.096 ac, 0.00% Impervious, Inflow Depth > 0.45" for 2-Year event
Inflow = 13.64 cfs @ 12.59 hrs, Volume= 2.492 af
Outflow = 13.47 cfs @ 12.65 hrs, Volume= 2.490 af, Atten= 1%, Lag= 3.8 min
Primary = 13.47 cfs @ 12.65 hrs, Volume= 2.490 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 256.84' @ 12.65 hrs Surf.Area= 2,695 sf Storage= 2,719 cf

Plug-Flow detention time= 2.8 min calculated for 2.490 af (100% of inflow)
Center-of-Mass det. time= 2.3 min (927.1 - 924.8)

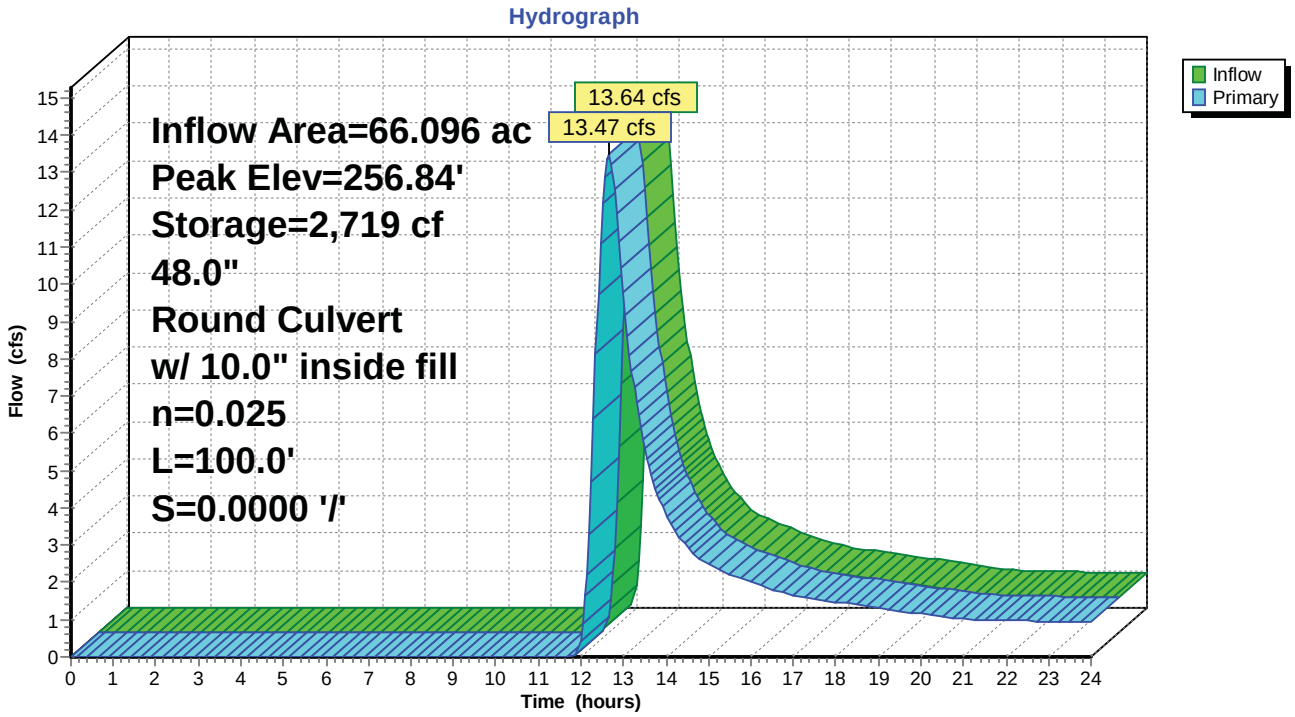
Volume	Invert	Avail.Storage	Storage Description
#1	255.50'	178,295 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
255.50	1,440	168.0	0	0	1,440
262.00	11,209	1,026.0	36,111	36,111	83,056
264.00	20,706	1,183.0	31,433	67,544	110,742
266.00	27,728	1,403.0	48,263	115,807	156,089
268.00	34,897	1,668.0	62,488	178,295	220,923

Device	Routing	Invert	Outlet Devices
#1	Primary	255.03'	**48.0" Round Culvert w/ 10.0" inside fill** L= 100.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 254.20' / 254.20' S= 0.0000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 10.67 sf

Primary OutFlow Max=13.45 cfs @ 12.65 hrs HW=256.84' (Free Discharge)
↑**1=Culvert** (Barrel Controls 13.45 cfs @ 2.62 fps)

Pond 2P: Greenwood Pond



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A: Watershed A Runoff Area=66.096 ac 0.00% Impervious Runoff Depth>2.17"
Flow Length=2,534' Tc=49.8 min CN=69 Runoff=86.07 cfs 11.978 af

Pond 2P: Greenwood Pond Peak Elev=261.56' Storage=31,341 cf Inflow=86.07 cfs 11.978 af
48.0" Round Culvert w/ 10.0" inside fill n=0.025 L=100.0' S=0.0000 '/' Outflow=77.98 cfs 11.966 af

Total Runoff Area = 66.096 ac Runoff Volume = 11.978 af Average Runoff Depth = 2.17"
100.00% Pervious = 66.096 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment A: Watershed A

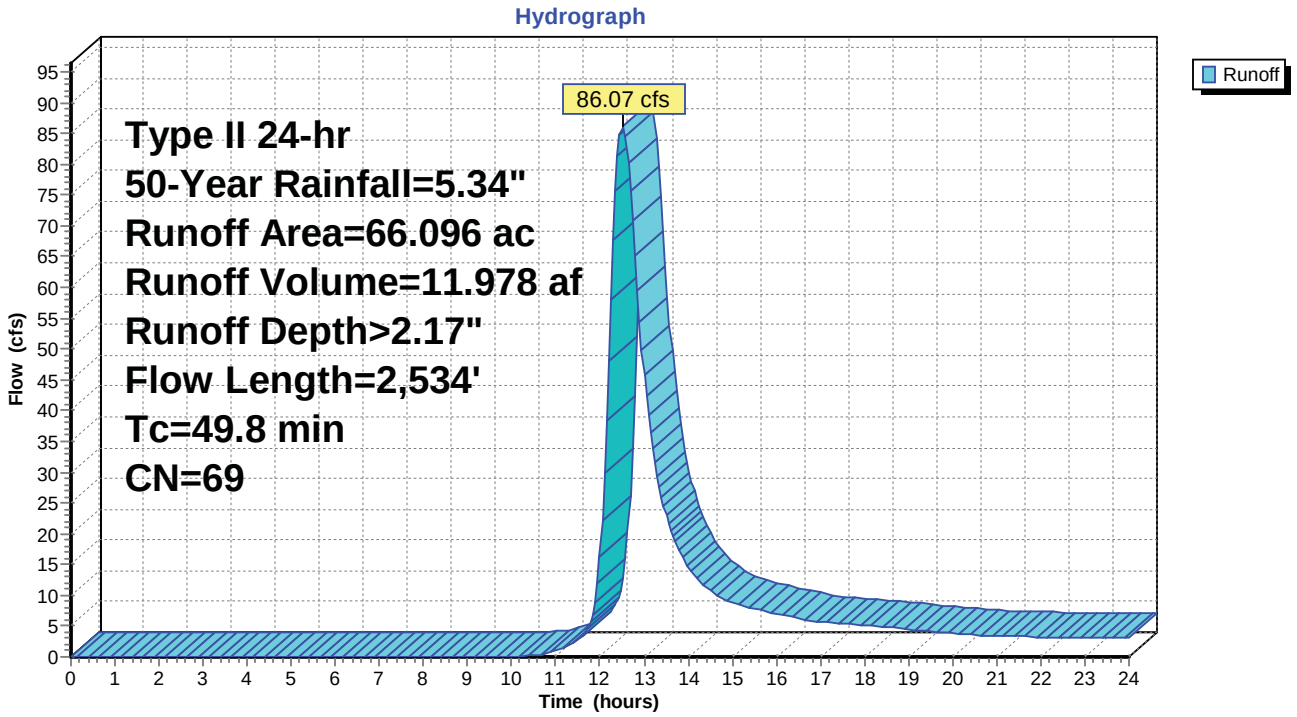
Runoff = 86.07 cfs @ 12.52 hrs, Volume= 11.978 af, Depth> 2.17"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-Year Rainfall=5.34"

	Area (ac)	CN	Description
*	10.464	55	Deciduous Forest, HSG B
*	0.537	68	Low Intensity Developed, HSG B
*	36.839	79	Open Space Developed, HSG B
*	10.980	55	Evergreen Forest, HSG B
*	0.013	55	Mixed Forest, HSG B
*	6.693	55	Shrub/Scrub, HSG B
*	0.570	66	Woody Wetlands, HSG B
	66.096	69	Weighted Average
	66.096		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	50	0.1000	0.25		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 2.59"
44.2	1,511	0.0130	0.57		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
1.6	546	0.0147	5.70	15.20	**Parabolic Channel, C-D** W=4.00' D=1.00' Area=2.7 sf Perim=4.6' n= 0.022 Earth, clean & straight
0.4	266	0.0526	10.78	28.76	**Parabolic Channel, D-E** W=4.00' D=1.00' Area=2.7 sf Perim=4.6' n= 0.022 Earth, clean & straight
0.3	161	0.0373	9.08	24.22	**Parabolic Channel, E-F** W=4.00' D=1.00' Area=2.7 sf Perim=4.6' n= 0.022 Earth, clean & straight
49.8	2,534	Total			

Subcatchment A: Watershed A



Summary for Pond 2P: Greenwood Pond

Inflow Area = 66.096 ac, 0.00% Impervious, Inflow Depth > 2.17" for 50-Year event
Inflow = 86.07 cfs @ 12.52 hrs, Volume= 11.978 af
Outflow = 77.98 cfs @ 12.68 hrs, Volume= 11.966 af, Atten= 9%, Lag= 9.6 min
Primary = 77.98 cfs @ 12.68 hrs, Volume= 11.966 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 261.56' @ 12.68 hrs Surf.Area= 10,246 sf Storage= 31,341 cf

Plug-Flow detention time= 4.4 min calculated for 11.966 af (100% of inflow)
Center-of-Mass det. time= 3.8 min (878.8 - 875.0)

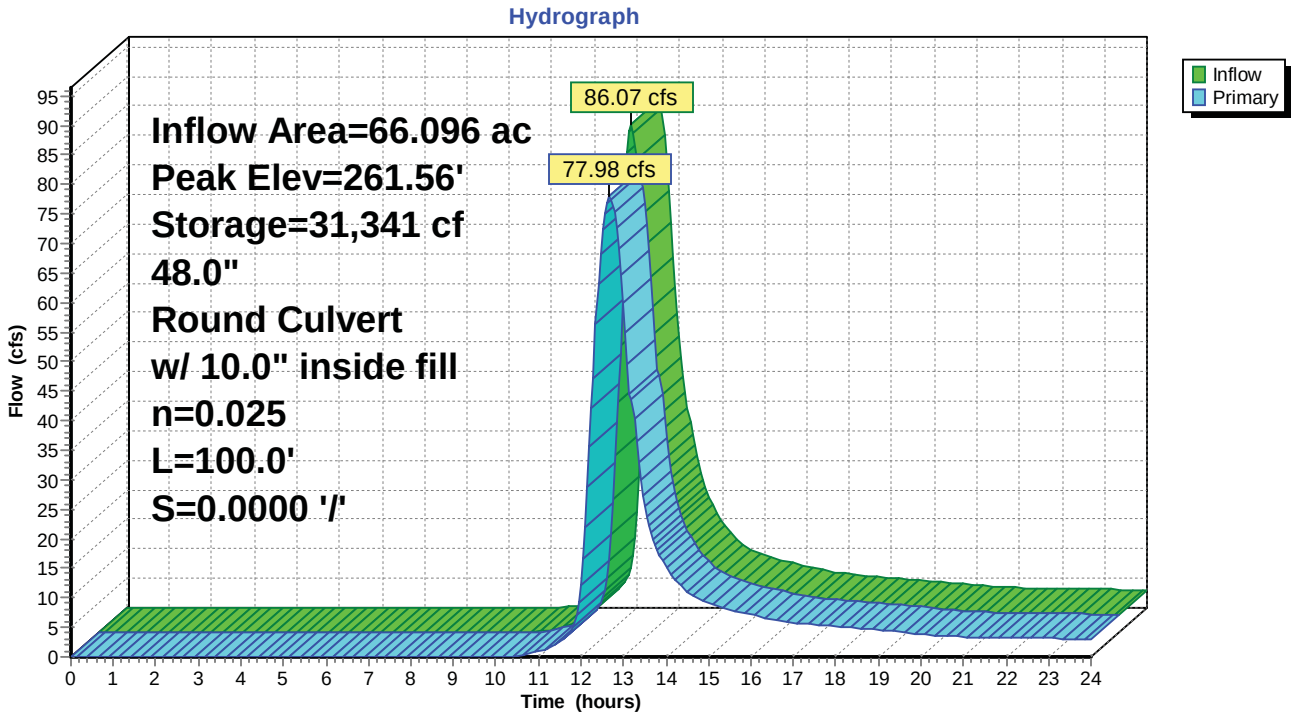
Volume	Invert	Avail.Storage	Storage Description
#1	255.50'	178,295 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
255.50	1,440	168.0	0	0	1,440
262.00	11,209	1,026.0	36,111	36,111	83,056
264.00	20,706	1,183.0	31,433	67,544	110,742
266.00	27,728	1,403.0	48,263	115,807	156,089
268.00	34,897	1,668.0	62,488	178,295	220,923

Device	Routing	Invert	Outlet Devices
#1	Primary	255.03'	**48.0" Round Culvert w/ 10.0" inside fill** L= 100.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 254.20' / 254.20' S= 0.0000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 10.67 sf

Primary OutFlow Max=77.87 cfs @ 12.68 hrs HW=261.55' (Free Discharge)
1=Culvert (Barrel Controls 77.87 cfs @ 7.30 fps)

Pond 2P: Greenwood Pond



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A: Watershed A Runoff Area=66.096 ac 0.00% Impervious Runoff Depth>2.87"
Flow Length=2,534' Tc=49.8 min CN=69 Runoff=115.31 cfs 15.796 af

Pond 2P: Greenwood Pond Peak Elev=263.33' Storage=54,877 cf Inflow=115.31 cfs 15.796 af
48.0" Round Culvert w/ 10.0" inside fill n=0.025 L=100.0' S=0.0000 '/' Outflow=96.43 cfs 15.780 af

Total Runoff Area = 66.096 ac Runoff Volume = 15.796 af Average Runoff Depth = 2.87"
100.00% Pervious = 66.096 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment A: Watershed A

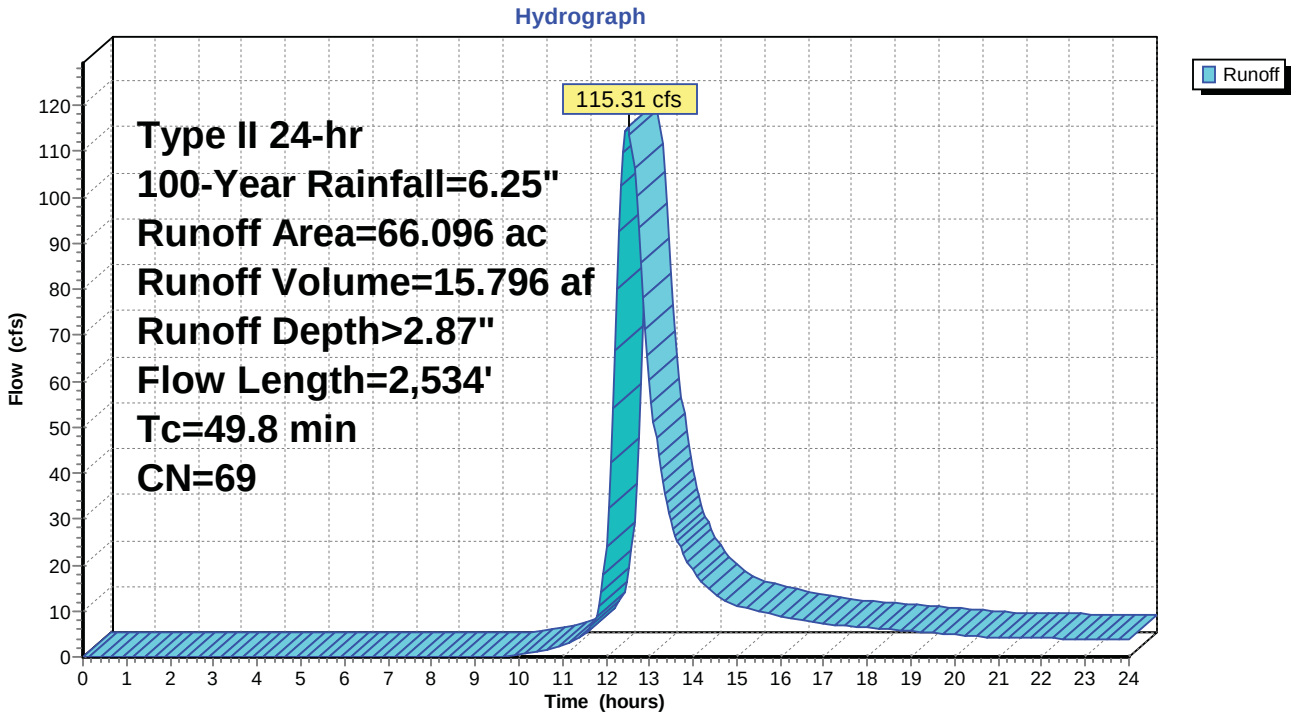
Runoff = 115.31 cfs @ 12.50 hrs, Volume= 15.796 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=6.25"

	Area (ac)	CN	Description
*	10.464	55	Deciduous Forest, HSG B
*	0.537	68	Low Intensity Developed, HSG B
*	36.839	79	Open Space Developed, HSG B
*	10.980	55	Evergreen Forest, HSG B
*	0.013	55	Mixed Forest, HSG B
*	6.693	55	Shrub/Scrub, HSG B
*	0.570	66	Woody Wetlands, HSG B
	66.096	69	Weighted Average
	66.096		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	50	0.1000	0.25		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 2.59"
44.2	1,511	0.0130	0.57		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
1.6	546	0.0147	5.70	15.20	**Parabolic Channel, C-D** W=4.00' D=1.00' Area=2.7 sf Perim=4.6' n= 0.022 Earth, clean & straight
0.4	266	0.0526	10.78	28.76	**Parabolic Channel, D-E** W=4.00' D=1.00' Area=2.7 sf Perim=4.6' n= 0.022 Earth, clean & straight
0.3	161	0.0373	9.08	24.22	**Parabolic Channel, E-F** W=4.00' D=1.00' Area=2.7 sf Perim=4.6' n= 0.022 Earth, clean & straight
49.8	2,534	Total			

Subcatchment A: Watershed A



Summary for Pond 2P: Greenwood Pond

Inflow Area = 66.096 ac, 0.00% Impervious, Inflow Depth > 2.87" for 100-Year event
Inflow = 115.31 cfs @ 12.50 hrs, Volume= 15.796 af
Outflow = 96.43 cfs @ 12.73 hrs, Volume= 15.780 af, Atten= 16%, Lag= 13.4 min
Primary = 96.43 cfs @ 12.73 hrs, Volume= 15.780 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 263.33' @ 12.73 hrs Surf.Area= 17,207 sf Storage= 54,877 cf

Plug-Flow detention time= 5.4 min calculated for 15.747 af (100% of inflow)
Center-of-Mass det. time= 4.8 min (872.2 - 867.4)

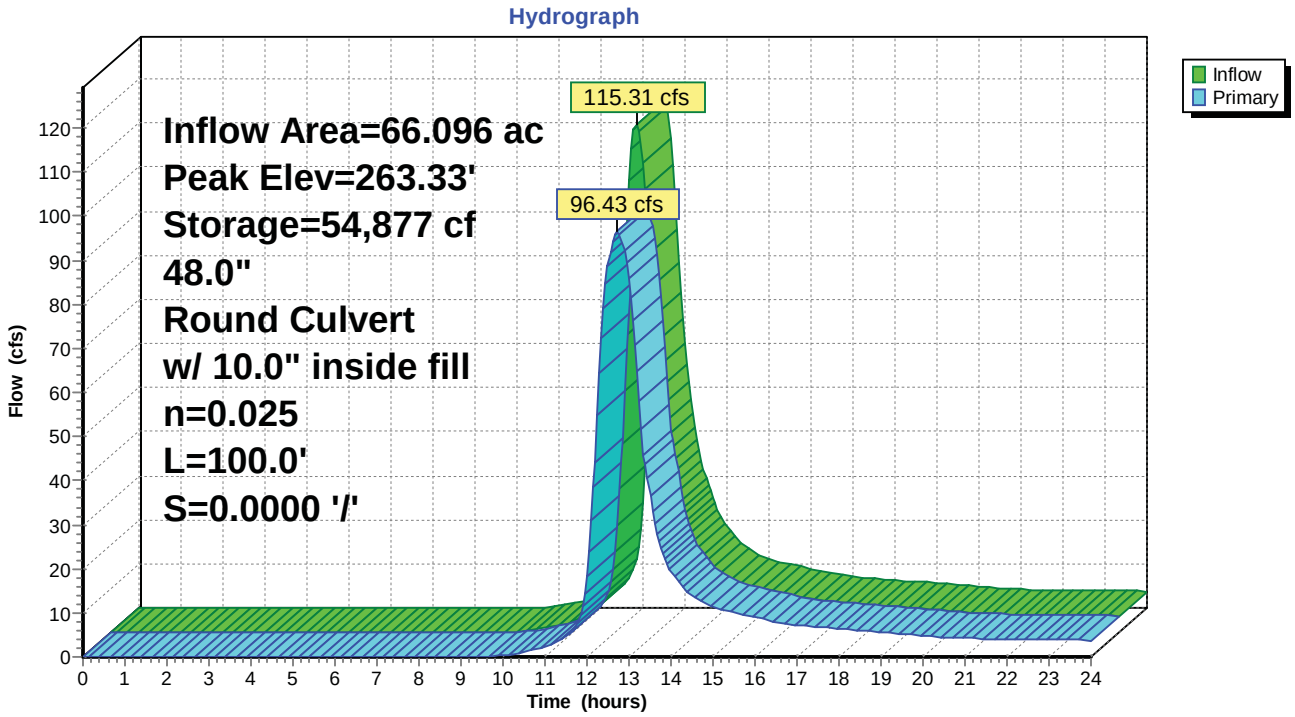
Volume	Invert	Avail.Storage	Storage Description
#1	255.50'	178,295 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

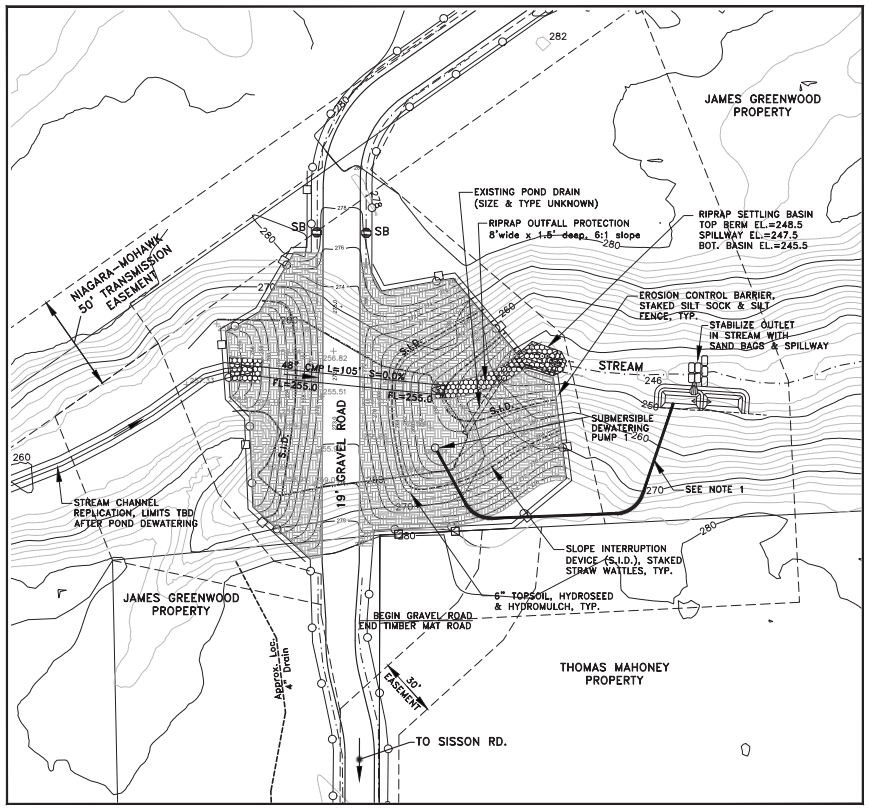
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
255.50	1,440	168.0	0	0	1,440
262.00	11,209	1,026.0	36,111	36,111	83,056
264.00	20,706	1,183.0	31,433	67,544	110,742
266.00	27,728	1,403.0	48,263	115,807	156,089
268.00	34,897	1,668.0	62,488	178,295	220,923

Device	Routing	Invert	Outlet Devices
#1	Primary	255.03'	**48.0" Round Culvert w/ 10.0" inside fill** L= 100.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 254.20' / 254.20' S= 0.0000 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 10.67 sf

Primary OutFlow Max=96.35 cfs @ 12.73 hrs HW=263.32' (Free Discharge)
1=Culvert (Barrel Controls 96.35 cfs @ 9.03 fps)

Pond 2P: Greenwood Pond



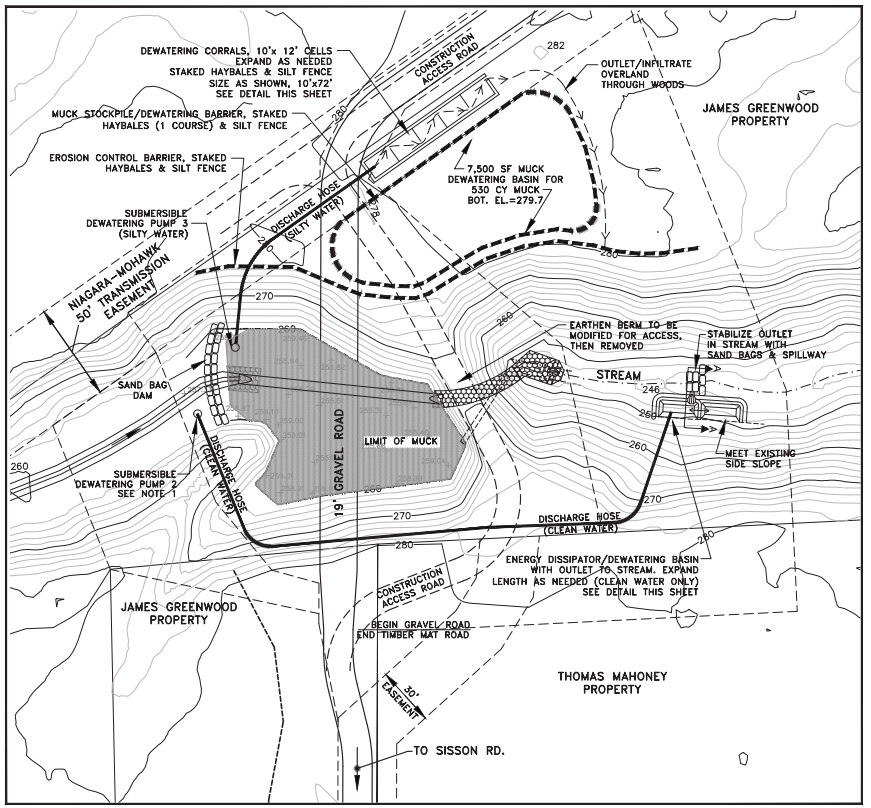


9 SISSON ROAD POND: EROSION CONTROL PLAN

SCALE: 1" = 30'

NOTES:

1. THE POND SHALL BE EMPTIED USING SUBMERSIBLE DEWATERING PUMP 1 PRIOR TO INSTALLING EROSION & SEDIMENTATION CONTROLS AT THE PROPOSED LIMIT OF WORK.
2. IT IS ASSUMED THAT THE POND BY-PASS WATER WILL BE CLEAN AND FREE OF SUSPENDED SEDIMENTS ORIGINATING FROM THE WORK AREA. THE BY-PASS WATER MAY BE RELEASED DIRECTLY INTO THE STREAM BELOW THE EXISTING BERM PROVIDED THAT THE ENERGY DISSIPATOR HAS ADEQUATELY REDUCED THE VELOCITY WITHOUT SCOURING OR ERODING THE EXISTING STREAM CHANNEL.

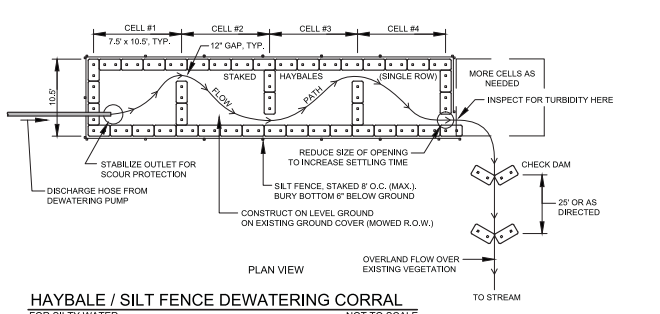


9 SISSON ROAD POND: DEWATERING PLAN

SCALE: 1" = 30'

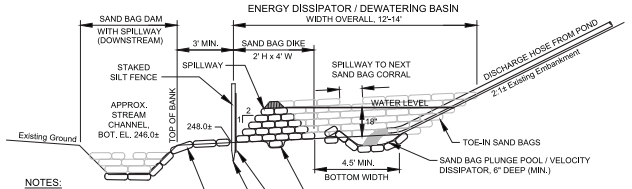
NOTES:

1. THE CLEAN WATER BY-PASS WILL CONTINUE TO BE NECESSARY AS THE STREAM FEEDING THE OLD POND WILL CONTINUE TO FLOW. SUBMERSIBLE DEWATERING PUMP 2 WILL BE LOCATED UPSTREAM OF THE SAND BAG DAM TO PREVENT WATER FROM BECOMING IMPOUNDED UPSTREAM AND FLOODING THE WORK AREA.



HAYBALE / SILT FENCE DEWATERING CORRAL

FOR SILTY WATER NOT TO SCALE



NOTES:

1. THIS IS A TEMPORARY MEASURE FOR DEWATERING THE POND PRIOR TO CONSTRUCTION.
2. LOCATION MAY BE ADJUSTED IN THE FIELD TO AVOID TREE CLEARING. TREES WITHIN THE LIMITS OF THE DEWATERING CORRALS MAY REMAIN.
3. DIMENSIONS SHOWN BASED ON USING WOVEN POLYPROPYLENE SAND BAGS, 4" HIGH x 10" WIDE x 14" LONG.

ENERGY DISSIPATOR / DEWATERING BASIN DETAIL

FOR CLEAN WATER BY-PASS ONLY NOT TO SCALE

115kV TRANSMISSION LINE
MOHICAN – BATTENKILL #15-#3
POND CROSSING DETAILS
101010-C-BMP-09b

DRAWING NO. 08.26.2014
FILE INDEX 6.3-M41-M5
DRAWING NUMBER D-39339-E
SHEET NUMBER 14 OF 31

PREPARED BY: nationalgrid

ACCOUNT NUMBER

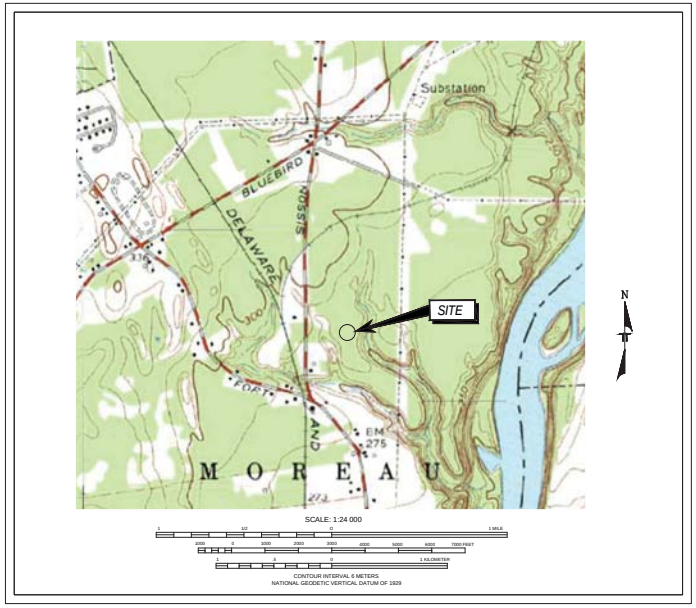
DES.	APPROVED
DR.	APPROVED
CK.	APPROVED
APP.	
CK.	
DR.	

DESCRIPTION OF ISSUE OR REVISION | DATE

DATED: Jan 15, 2015 – 11:13AM
FILENAME: K:\M41 Notrld Mohicn\DMACP Dwgs\M41-Details 9-1-Supplemental.dwg

MOHICAN-BATTENKILL ACCESS ROAD POND CROSSING
9 SISSON ROAD
FORT EDWARD, NEW YORK

SITE LOCATION MAP



SHEET INDEX

REV	DATE	BY	DESCRIPTION

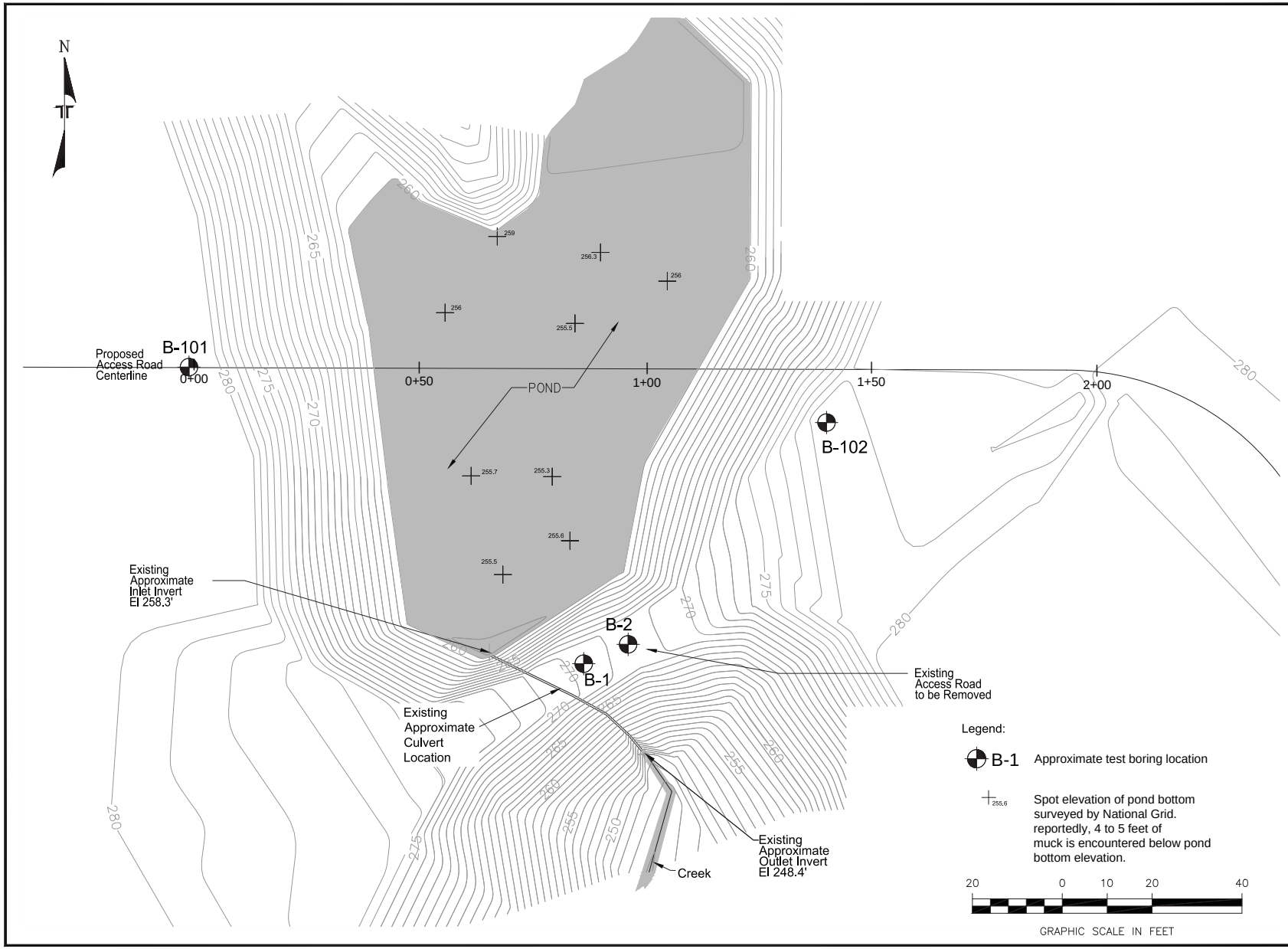
COVER AND TITLE SHEET

MOHICAN-BATTENKILL ACCESS ROAD POND CROSSING
9 SISSON ROAD
FORT EDWARD, NEW YORK

Terracon
77 Sundial Ave. MANCHESTER, NH 03103
PH. (603) 647-9700 FAX (603) 647-4432

SHEET 1

DESIGNED BY:	LJD
DRAWN BY:	MCR
APPVD. BY:	LJD
SCALE:	AS SHOWN
DATE:	November 2014
JOB NO.:	J1145127
ACAD NO.	J1145127 A.dwg
SHEET NO.:	1 OF 10



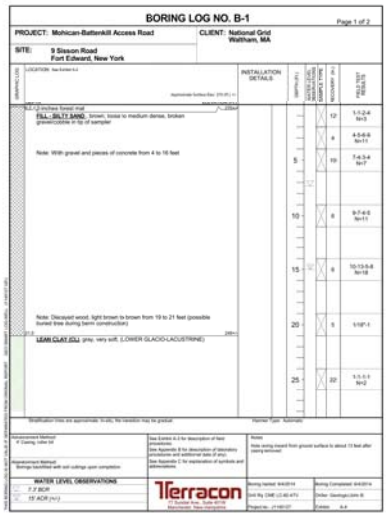
REV	DATE	BY	DESCRIPTION

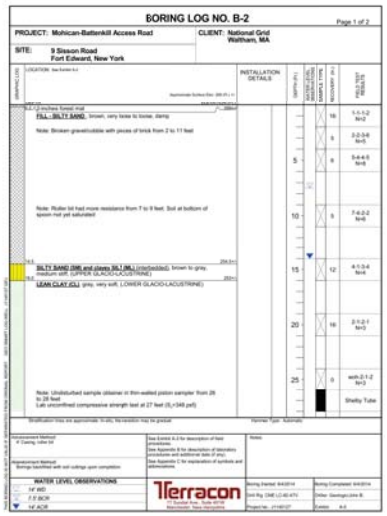
EXISTING CONDITIONS PLAN

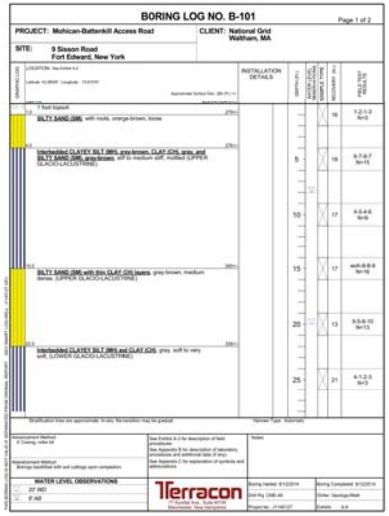
MOHICAN-BATTENKILL ACCESS ROAD POND CROSSING
9 SISSON ROAD
FORT EDWARD, NEW YORK

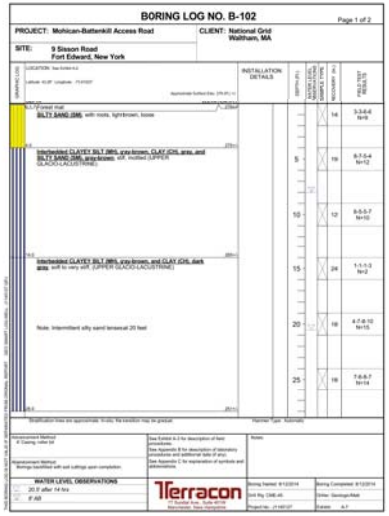
Terracon
77 Sundial Ave. MANCHESTER, NH 03103
PH: (603) 647-9700 FAX (603) 647-4432

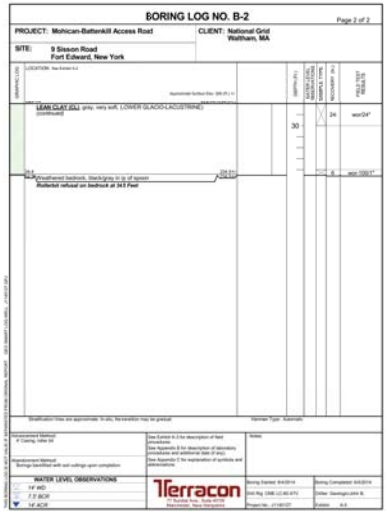
SHEET 2	
DESIGNED BY:	LJD
DRAWN BY:	MCR
APPVD. BY:	LJD
SCALE:	AS SHOWN
DATE:	November 2014
JOB NO.	J1145127
ACAD NO.	J1145127 A.dwg
SHEET NO.:	2 OF 10

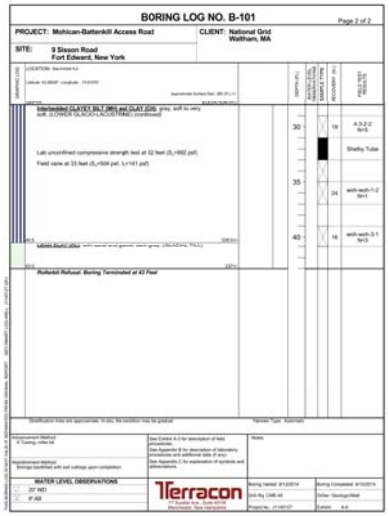


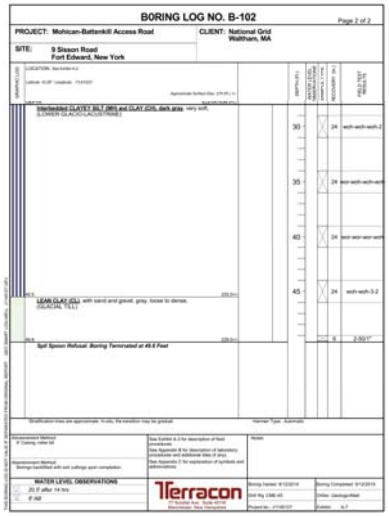












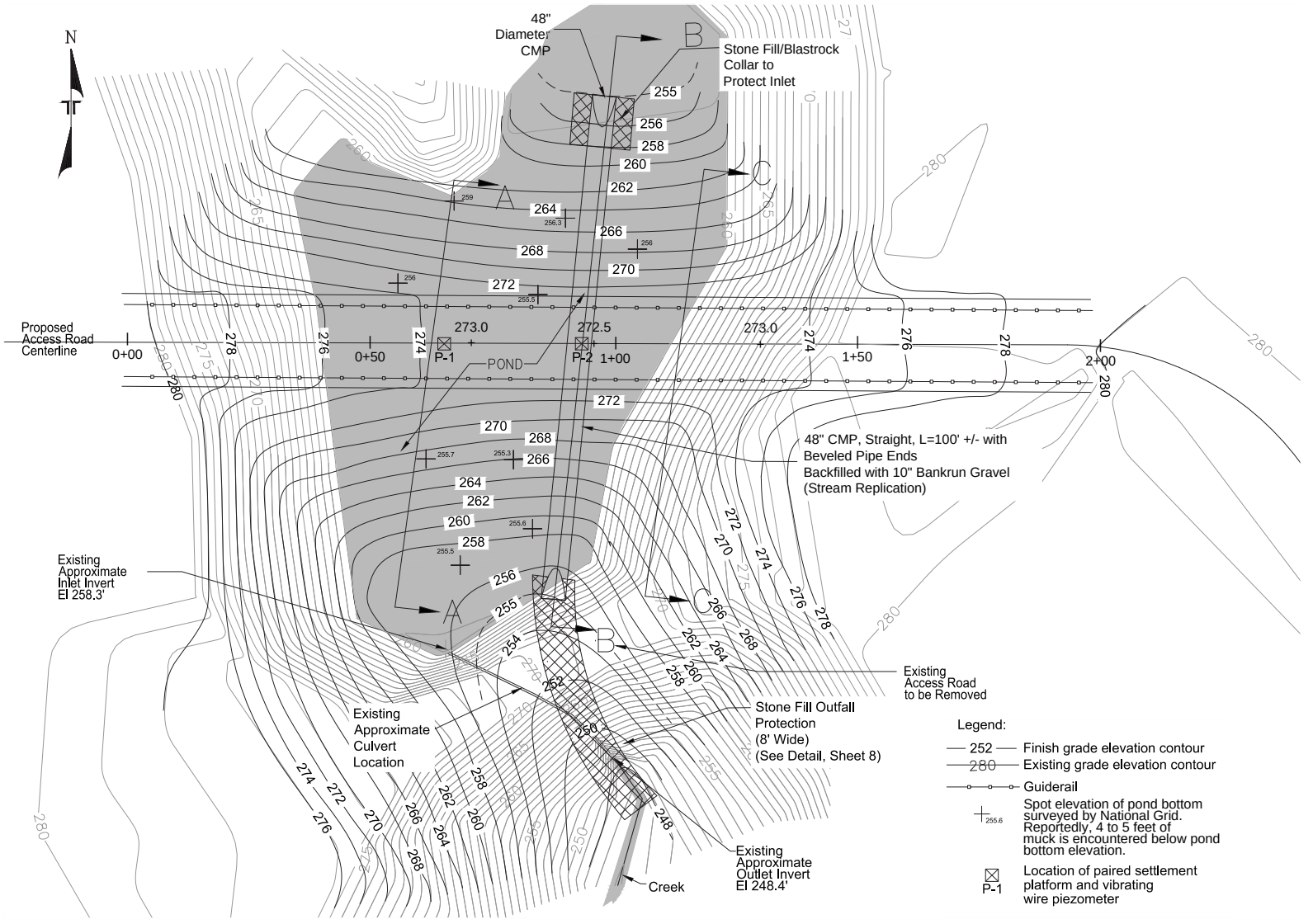
REV	DATE	BY	DESCRIPTION

BORING LOGS
MOHICAN-BATTENKILL ACCESS ROAD POND CROSSING
9 SISSON ROAD
FORT EDWARD, NEW YORK

Terracon
MANCHESTER, NH 03103
FAX (603) 647-4432
77 Sundial Ave.
PH: (603) 647-9700

SHEET 3

DESIGNED BY:	LJD
DRAWN BY:	MCR
APPVD. BY:	LJD
SCALE:	AS SHOWN
DATE:	November 2014
JOB NO.	J1145127
ACAD NO.	J1145127 A.dwg
SHEET NO.:	3 OF 10



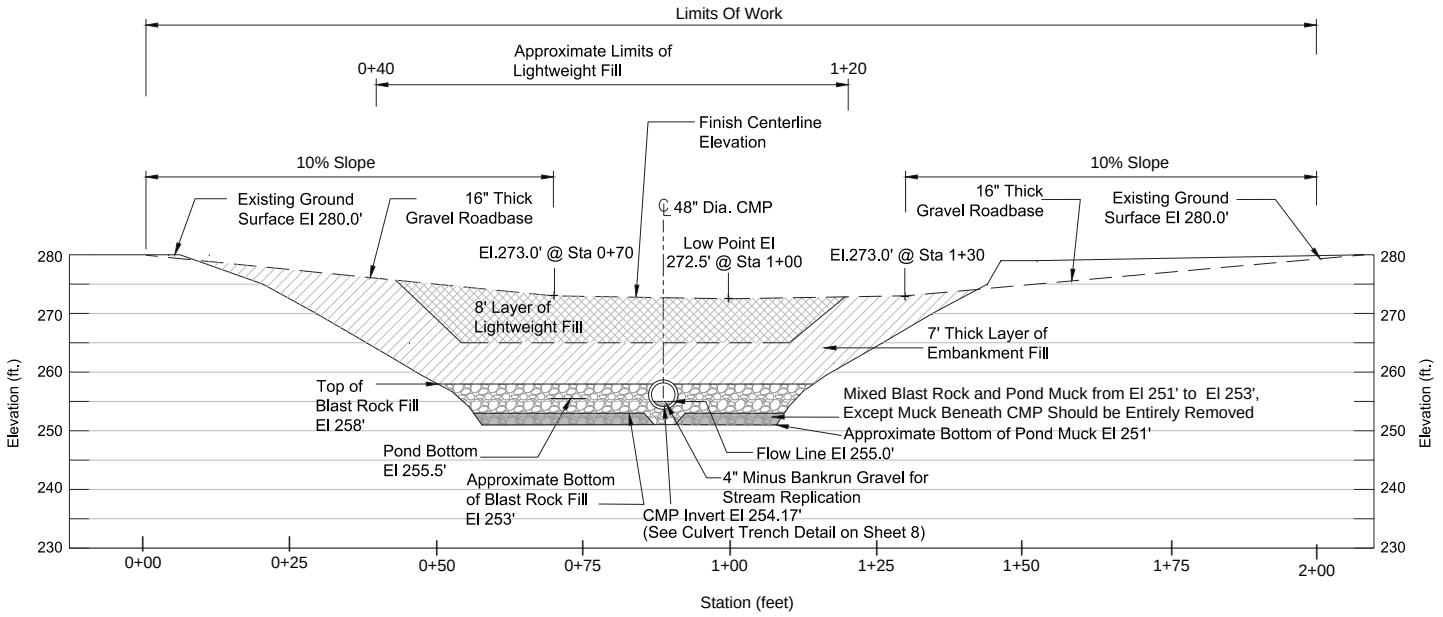
REV	DATE	BY	DESCRIPTION

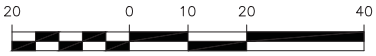
FINISH GRADING PLAN

MOHICAN-BATTENKILL ACCESS ROAD POND CROSSING
9 SISSON ROAD
FORT EDWARD, NEW YORK

Terracon
77 Sundial Ave. MANCHESTER, NH 03103
PH. (603) 647-9700 FAX (603) 647-1422

SHEET 4	
DESIGNED BY:	LJD
DRAWN BY:	MCR
APPVD. BY:	LJD
SCALE:	AS SHOWN
DATE:	November 2014
JOB NO.	J1145127
ACAD NO.	J1145127 A.dwg
SHEET NO.:	4 OF 10





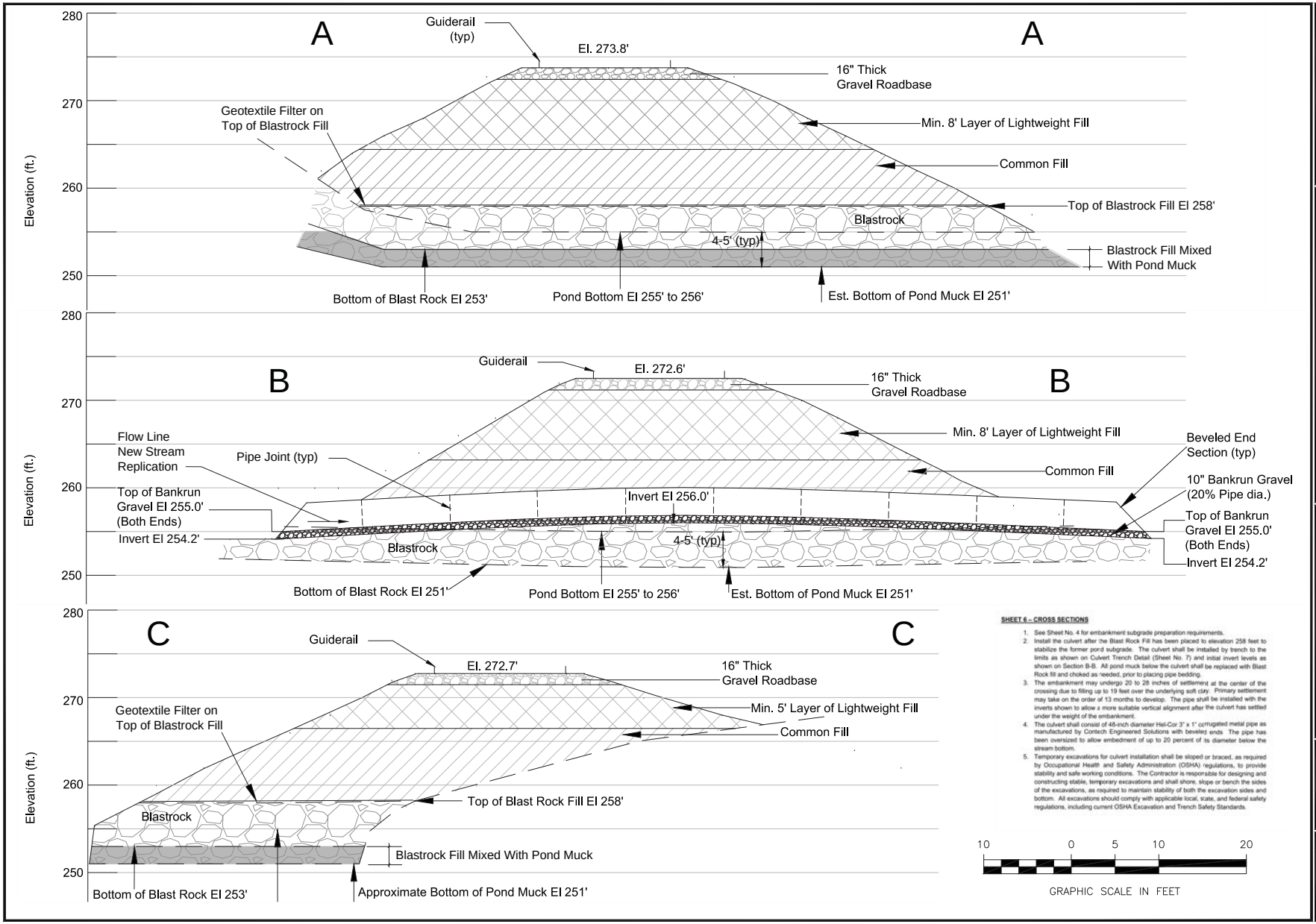
REV	DATE	BY	DESCRIPTION

ACCESS ROAD PROFILE

MOHICAN-BATTENKILL ACCESS ROAD POND CROSSING
9 SISSON ROAD
FORT EDWARD, NEW YORK

Terracon
MANCHESTER, NH 03103
FAX (603) 647-4432
77 Sundial Ave.
PH. (603) 647-9700

SHEET 5	
DESIGNED BY:	LJD
DRAWN BY:	MCR
APP'VD. BY:	LJD
SCALE:	AS SHOWN
DATE:	November 2014
JOB NO.	J1145127
ACAD NO.	J1145127 A.dwg
SHEET NO.:	5 OF 10



SHEET 6 – CROSS SECTIONS

1. See Sheet No. 4 for embankment subgrade preparation requirements.
2. Install the culvert after the Blast Rock Fill has been placed to elevation 258 feet to stabilize the former pond subgrade. The culvert shall be installed by trench to the limits as shown on Culvert Trench Detail (Sheet No. 7) and initial invert levels as shown on Section B-B. All pond muck below the culvert shall be replaced with Blast Rock fill and choked as needed, prior to placing pipe bedding.
3. The embankment may undergo 20 to 28 inches of settlement at the center of the crossing due to filling up to 19 feet over the underlying soft clay. Primary settlement may take on the order of 13 months to develop. The pipe shall be installed with the inverts shown to allow a more suitable vertical alignment after the culvert has settled under the weight of the embankment.
4. The culvert shall consist of 48-inch diameter Hel-Cor 3" x 1" corrugated metal pipe as manufactured by Contech Engineered Solutions with beveled ends. The pipe has been oversized to allow embedment of up to 20 percent of its diameter below the stream bottom.
5. Temporary excavations for culvert installation shall be sloped or braced, as required by Occupational Health and Safety Administration (OSHA) regulations, to provide stability and safe working conditions. The Contractor is responsible for designing and constructing stable, temporary excavations and shall shore, slope or bench the sides of the excavations, as required to maintain stability of both the excavation sides and bottom. All excavations should comply with applicable local, state, and federal safety regulations, including current OSHA Excavation and Trench Safety Standards.

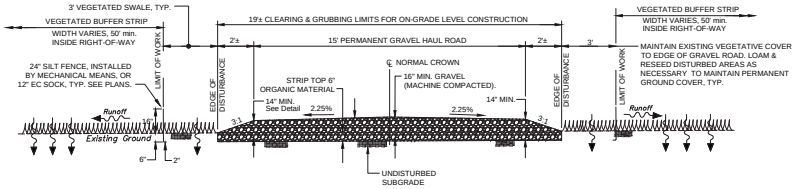
REV	DATE	BY	DESCRIPTION

CROSS SECTIONS

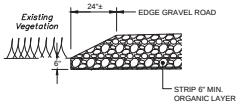
MOHICAN-BATTENKILL ACCESS ROAD POND CROSSING
9 SISSON ROAD
FORT EDWARD, NEW YORK

Terracon
77 Sundial Ave. MANCHESTER, NH 03103
PH. (603) 647-3700 FAX (603) 647-4432

SHEET 6	
DESIGNED BY:	LJD
DRAWN BY:	MCR
APP'VD. BY:	LJD
SCALE:	AS SHOWN
DATE:	November 2014
JOB NO.	J1145127
ACAD NO.	J1145127 A.dwg
SHEET NO.:	6 OF 10



TYPICAL CROSS SECTION



EDGE OF ROAD DETAIL
N.T.S.

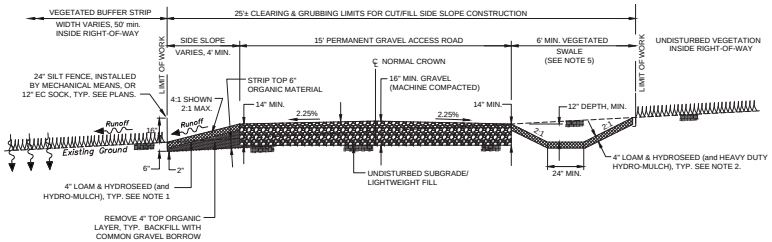
NOTES:

1. PERMANENT EROSION CONTROL / RESTORATION SEED MIXES SHALL BE CHOSEN TO BEST SUIT THE EXISTING SOIL CONDITIONS (dry or moist site).
2. AGGREGATE GRADATION SHALL BE AS SHOWN IN TABLE 1.

TABLE 1: Preferred Fill Gradation	
SIZE	% PASSING
1-1/2 in.	100
3/4 in.	50 - 100
No. 4	25 - 50
No. 40	10 - 20
No. 100	5 - 15
No. 200	less than 10

TABLE 2: Design Parameters	
DESIGN REQUIREMENTS:	
Axle Loads (kips)	30
Tire Pressure (psi)	80
Axle Passes (Each)	100,000
Max. Rut Depth (in.)	1.5
PAVEMENT SOIL PROPERTIES:	
Aggregate Fill CBR (%)	20
Design Subgrade CBR (%)	3.5

- TYPE 1 -
PERMANENT GRAVEL ACCESS ROAD DETAIL
Level Site On-Grade Construction



TYPICAL CROSS SECTION

NOTES:

1. PERMANENT EROSION CONTROL / RESTORATION SEED MIXES SHALL BE CHOSEN TO BEST SUIT THE EXISTING SOIL CONDITIONS (dry or moist site). ADD HYDRO-MULCH ON 2H:1V SLOPES OR STEEPER.
2. VEGETATED SWALES WITH SLOPES OF 8.1% - 20% SHALL BE STABILIZED WITH HEAVY DUTY HYDRO-MULCH ALONG WITH THE HYDROSEED MIX.
3. AGGREGATE GRADATION SHALL BE AS SHOWN IN TABLE 1.
4. ERODED CHANNELS SHALL BE REPAIRED WITH ENKAMAT 7003 (TRM) & FLEXTERRA BFM & SEED MIX

TABLE 1: Preferred Fill Gradation	
SIZE	% PASSING
1-1/2 in.	100
3/4 in.	50 - 100
No. 4	25 - 50
No. 40	10 - 20
No. 100	5 - 15
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TABLE 2: Design Parameters	
DESIGN REQUIREMENTS:	
Axle Loads (kips)	30
Tire Pressure (psi)	80
Axle Passes (Each)	100,000
Max. Rut Depth (in.)	1.5
PAVEMENT SOIL PROPERTIES:	
Aggregate Fill CBR (%)	20
Design Subgrade CBR (%)	3.5

- TYPE 2 -
PERMANENT GRAVEL ACCESS ROAD DETAIL
On-Grade Construction - Cut/Fill Side Slope Condition

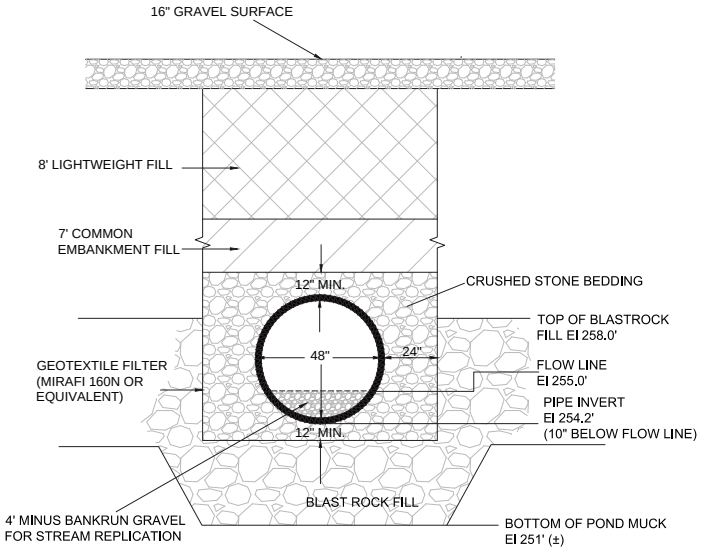
REV	DATE	BY	DESCRIPTION

ROADWAY DETAILS 1

MOHICAN-BATTENKILL ACCESS ROAD POND CROSSING
9 SISSON ROAD
FORT EDWARD, NEW YORK

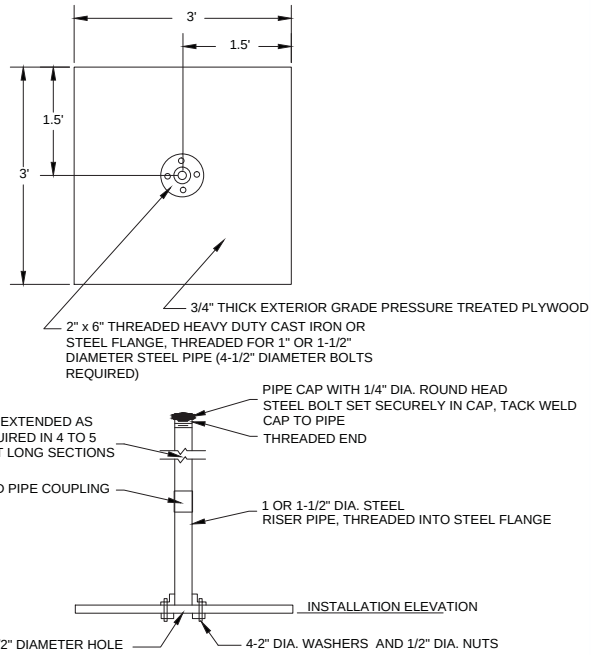
Terracon
77 Sundial Ave. MANCHESTER, NH 03103
PH: (603) 647-9700 FAX (603) 647-4432

SHEET 7	
DESIGNED BY:	LJD
DRAWN BY:	MCR
APPVD. BY:	LJD
SCALE:	AS SHOWN
DATE:	November 2014
JOB NO.:	J1145127
ACAD NO.:	J1145127 A.dwg
SHEET NO.:	7 OF 10

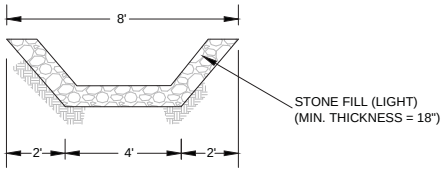


NOTE:
CRUSHED STONE BEDDING SHALL MEET THE GRADATION REQUIREMENTS FOR SIZE 1 AGGREGATE IN TABLE 703-4 OF THE NYSDOT STANDARD SPECIFICATIONS.

CULVERT TRENCH DETAIL
Not to scale



SETTLEMENT PLATFORM DETAIL
Not to scale



STONE FILL OUTFALL DETAIL
Not to scale

REV	DATE	BY	DESCRIPTION

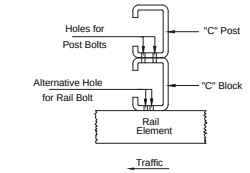
ROADWAY DETAILS 2

MOHICAN-BATTENKILL ACCESS ROAD POND CROSSING
9 SISSON ROAD
FORT EDWARD, NEW YORK

Terracon
MANCHESTER, NH 03103
FAX: (603) 647-4432
77 Sundial Ave.
PH: (603) 647-9700

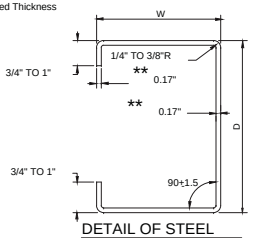
SHEET 8

DESIGNED BY:	LJD
DRAWN BY:	MCR
APP'D. BY:	LJD
SCALE:	AS SHOWN
DATE:	November 2014
JOB NO.:	J1145127
ACAD NO.	J1145127 A.dwg
SHEET NO.:	8 OF 10



PLAN VIEW-SINGLE-FACED,TYPE 1
(CLASS I OR II)GUIDERAIL
("C" Post and Block)

** Ungalvanized Thickness

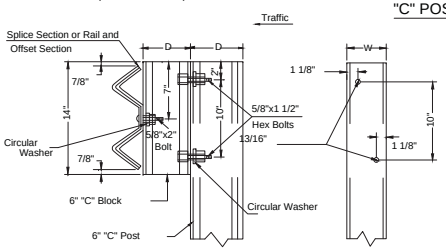


DETAIL OF STEEL
"C" POST AND BLOCK

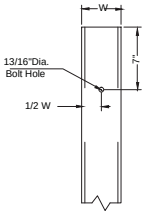
NOTES

Steel "C" post and blocks may be used in place of Steel wideflange post and blocks for all guiderail installations. Mixing of steel post and/or steel block types is not permitted within a particular run of guiderail. Only one type of steelpost and block shall be used.

Steel "C" posts and blocks shall conform to the requirements of ASTM A570 with mechanical properties equal to AASHTO M-183. The weight of galvanizing for posts and blocks shall be two ounces per square foot; galvanizing shall conform to the requirements of AASHTO M-111.



STEEL "C" GUIDERAIL POST
(Steel "C" Block)

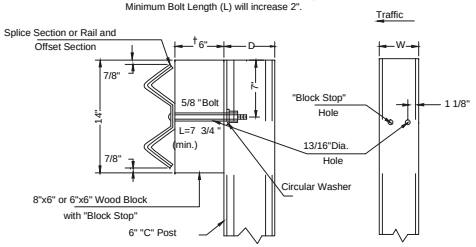


STEEL "C" POST FOR TYPE 1,
CLASS III GUIDERAIL
(No Blocks)

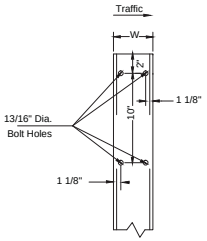
TABLE OF DIMENSIONS AND TOLERANCES FOR STEEL "C" POSTS AND BLOCKS

	DIMENSIONS (INCHES)	TOLERANCES (INCHES)	
		PLUS	MINUS
W	4.340	0.125	0.063
D	5.875	0.125	0.063

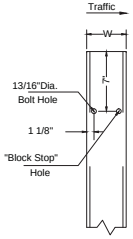
† 8" When 8"x6" Wood Blocks are used. Also, Minimum Bolt Length (L) will increase 2".



STEEL "C" GUIDERAIL POST
(Wood Block)



SECTIONS A-A
STEEL "C" GUIDERAIL POST
(Steel "C" Block)



SECTIONS A-A
STEEL "C" GUIDERAIL POST
(Wood Block)

STEEL GUIDERAIL POST AND BLOCK ("C" TYPE)

Not to scale

REV.	DATE	BY	DESCRIPTION

ROADWAY DETAILS 3

MOHICAN-BATTENKILL ACCESS ROAD POND CROSSING
9 SISSON ROAD
FORT EDWARD, NEW YORK

Terracon
MANCHESTER, NH 03103
FAX: (603) 647-4432
77 Sundial Ave.
PH: (603) 647-9700

SHEET 9

DESIGNED BY:	LJD
DRAWN BY:	MCR
APP'D. BY:	LJD
SCALE:	AS SHOWN
DATE:	November 2014
JOB NO.:	J1145127
ACAD NO.	J1145127 A.dwg
SHEET NO.:	9 OF 10

General Notes

1. Finish grade at each end of the embankment, top of the slope, shall match existing ground surface. Topsoil on side slopes and disturbed areas shall meet requirements of Section 713-01 "Topsoil – Type B" and placed in accordance with Section 613 "Placing Topsoil" as specified in the New York State Department of Transportation (NYSDOT) Standard Specifications – May 2008.
2. Embankment side slopes shall be constructed no steeper than 2H:1V as shown on Sheet 6 – Cross Sections. Maximum approach grades of 10 percent from either end of the crossing shall be constructed as shown on Sheet No. 5 – Access Road Profile.
3. Topsoil and seeding shall be placed over embankment side slopes. Seeding shall comply with Section 713-04 "Seeds" as specified in the NYSDOT Standard Specifications – May 2008.
4. Erosion protection is required on all seeded slopes until vegetation is stabilized. Erosion control matting such as S150 – Straw Erosion Control Blankets, as manufactured by North American Green shall be placed on 2H:1V slopes.
5. The contractor shall prepare an as-built conditions plan of the embankment including the 2H:1V embankment slopes, toe of slope limits, roadway width, centerline alignment, and ground surface elevations at minimum 25 foot intervals and submit to National Grid for review and approval.
6. Design material parameters and assumptions:

Material Type	UnitWeight (pcf)	Internal Friction Angle	Cohesion (psf)
Upper Stiff Clay	110	26	0
Lower Soft Clay	110	20	250
Blast Rock Fill	135	42	0
Common Embankment Fill	125	32	100
Lightweight Fill	62	38	0

7. Minimum factor of safety for slope stability:
   a. Normal Loading > 1.30
   b. Seismic Loading (S_{DI} = 0.090) > 1.10

Embankment Material Specifications

1. **Common Embankment Fill** – Shall have a maximum particle size of 6 inches and no more than 25 percent by weight passing the US No. 200 sieve. Fill shall be free of organic matter and debris. Frozen material should not be used. Fill should not be placed on frozen subgrades.
2. **Lightweight Fill** – Shall consist of expanded shale aggregate, 1-inch minus size as manufactured by Northeast Solite Corporation (http://www.nesolite.com), located in Saugerties, New York or approved equal. Lightweight fill shall have an in-place compacted unit weight of no more than 62 pounds per cubic foot.
3. **Blast Rock** – Shall consist of well graded mixture of fines and 2 to 18-inch size broken rock. Blast Rock shall be used in stabilizing the subgrade in the pond area. Blast Rock must be well-choked.
4. **Filter Stone** – Shall consist of Size 3 Crushed Stone and meet gradation requirements for Coarse Aggregate in Table 703-4 of the NYSDOT Standard Specifications – May 2008. Filter stone shall be used between Blast Rock subgrades and embankment fill if the Blast Rock fill surface has voids, as directed by the Engineer.
5. **Stone Fill (light)** – For use in outfall protection area and pipe ends. Shall consist of hard, durable stone with 50 percent of the stone smaller than 6-inch size. Maximum size stone shall be 12 inches.
6. **Crushed Stone** - For use on wet subgrades, drainage fill, and culvert bedding. Shall be Size 1 angular Crushed Stone and meet gradation requirements for Coarse Aggregate in Table 703-4 of the NYSDOT Standard Specifications – May 2008. Crushed Stone should underlain by a geotextile filter over fine grained soils.
7. **Geotextile Filter** – Shall consist of non-woven polypropylene such as 160N as manufactured by Mirafi or equal.

Embankment Material Placement Requirements

1. **Fill Lift Thickness** – 12 inches or less in loose thickness for minimum 10-ton double drum vibratory roller; 6 inches for portable plate compactors.
2. **Compaction Requirements** – Minimum 92 percent of the maximum dry density - Modified Proctor (ASTM D1557, Method C)
3. **Moisture Content** - Workable moisture levels. Fill shall be tested for moisture content and compaction during placement. If the results of in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test shall be reworked and retested, as required, until the specified moisture and compaction requirements are achieved.
4. **Existing Slopes** – After removing surficial organic soils on existing slopes, exposed subgrades are anticipated to be stable. When fill is placed on the existing slopes, benches should be cut into the slope prior to fill placement. The benches should have a minimum vertical face height of 1 foot and a maximum vertical face height of 3 feet and should be cut wide enough to accommodate the compaction equipment. Benching will provide a positive interlock between the fill and natural soils and reduce the possibility of failure along the fill/natural soil interface.

Embankment Subgrade Construction Sequence

1. **Sedimentation Discharge Area** – A sedimentation discharge area shall be constructed downstream of the existing access road berm in accordance with Sedimentation and Erosion Control plans. Once the sedimentation discharge area is prepared water from the pond shall be pumped and discharged into the sedimentation pond prior to discharge to the stream. Pumping shall continue until the pond is reduced to a running stream. Pumps shall have twice the pumping capacity of the anticipated stream flow.
2. **Embankment Removal** - The existing access road embankment shall be removed once the pond is reduced to a single flowing stream. Sedimentation and erosion control during access road removal shall be in accordance with the Sedimentation and Erosion Control plans.
3. **Temporary Dewatering** - Once the former stream channel is restored, a "Dam and Pump Around Method" as described by New York State Department of Public Service – Environmental Management and Construction Standards and Practices, shall be used to prepare the new embankment and new culvert subgrades. Sedimentation and erosion control during culvert installation shall be in accordance with the Sedimentation and Erosion Control plans.
4. **Pond Muck Removal** - Once the temporary dam and pump system is in place and operational, the organic pond muck, which has reasonably dried due to draining the pond, shall be removed to the extent practical to elevation 253 feet. Soil stabilization measures will need to be implemented.
5. **Blast Rock Stabilization** - Stabilization measures may include use of well graded Blast Rock Fill for the initial lifts of embankment construction to bridge soft areas before applying heavy compaction equipment loads. Well-graded Blast Rock should be placed from either end of the crossing and pushed into and mixed with the remaining pond muck and spread with bulldozers toward the middle of the crossing. Rock Fill should be placed to elevation 258 feet (2 to 3 feet above the former pond bottom) in order to achieve a stabilized subgrade. Depending on how well-graded the Blast Rock is, filter stone may be needed prior to placing common embankment fill. Blast Rock may be used with or without the use of geogrids to improve the initial lift placement.
6. **Use of Filter Stone** - Once the Blast Rock is stable under vibratory rollers and loaded dump trucks, the Blast Rock surface should be reviewed for the presence of voids. If voids are prevalent, as determined by the Engineer, the Contractor shall place a minimum 6-inch thick layer of Filter Stone and compact in place to choke voids within the surface of the Blast Rock fill.
7. **Staged Filling** - Once the Blast Rock Fill surface is approved, Common Embankment Fill shall be placed in stages in order to increase stability over the underlying soft clay deposit. The first stage shall include placing Common Embankment Fill in controlled 12-inch thick compacted lifts up to one third the height of the embankment. Pore water pressure will be measured by the Engineer at the end of the first stage of loading to determine whether pore pressure is dissipating enough to allow subsequent stage filling. Subsequent stage filling will continue or stop at the direction of the Engineer. The rate of pore water pressure dissipation will determine whether less or more lifts of fill may be placed during a single stage of filling. The Contractor should expect delays of 2 to 3 weeks at the end of a staged fill sequence while pore water pressures are measured.

Embankment Instrumentation

1. **Piezometer Type** – Piezometers shall consist of vibrating wire type instruments such as the Model 4500S as manufactured by Geocon of Lebanon, NH with compatible readouts.
2. **Piezometer Installation** - A minimum of two vibrating wire piezometers shall be installed by the Contractor at locations shown on Sheet No. 4, near the middle of the lower soft clay layer (approximately elevation 243 feet). Piezometers shall be installed in boreholes once the pond subgrade has been stabilized with Blast Rock Fill to elevation 258 feet.
3. **Piezometer Readings** - Pore pressure in the soft clay layer will be monitored at the end of each stage of filling in order to evaluate the rate of consolidation and strength gain of the soft clay prior to placing the subsequent stage of fill. Pore pressure readings shall be obtained by the Engineer in each piezometer at least twice per week until the rate of pore pressure drop allows additional filling, at the direction of the Engineer.
4. **Settlement Platforms** - Settlement platforms shall be constructed by the Contractor in general accordance with the detail shown on Sheet No. 8.
5. **Settlement Platform Installation** - A minimum of two settlement platforms shall be installed by the Contractor near the access road centerline at locations shown on Sheet No. 4. Platforms shall be installed as soon as practicable on the stabilized Blast Rock Fill subgrade but no higher than elevation 258 feet.
6. **Settlement Platform Readings** – Settlement of the soft clay layer will be monitored by the Contractor as fill is placed and for at least 6 months after filling is completed. Settlement readings shall be obtained at each platform at least once per week for the duration of filling and monthly for a period of at least 6 months after filling is completed.

REV.	DATE	BY	DESCRIPTION

EARTHWORK NOTES

MOHICAN-BATTENKILL ACCESS ROAD POND CROSSING
9 SISSON ROAD
FORT EDWARD, NEW YORK

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MANCHESTER, NH 03103
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SHEET 10

DESIGNED BY:	LJD
DRAWN BY:	MCR
APP'D. BY:	LJD
SCALE:	AS SHOWN
DATE:	November 2014
JOB NO.:	J1145127
ACAD NO.:	J1145127 A.dwg
SHEET NO.:	10 OF 10