

A REPORT FOR
STORMWATER MANAGEMENT

Enclave 78th Street

Bloomington, MN

NOVEMBER 14, 2023

PREPARED FOR:

Enclave Development

West Fargo, ND

PREPARED BY:

Westwood

Westwood

Stormwater Management Plan Report

Enclave 78th Street

Bloomington, MN

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Project Number: 0043990.00
Date: November 14, 2023

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1.0 Introduction

1.1 Project Description

This report summarizes the stormwater management design for the proposed Enclave 78th Street multi-family and commercial development at the former Lifetime Fitness Center site located at 6701 78th Street W., Bloomington, MN.

The property area is 7.07 acres with a proposed disturbance of 5.18-acres associated with the project. The proposed development will include the removal of utilities and building materials remaining from the old fitness center site, and the construction of a multi-family apartment building, commercial building, parking lots, entrance drives, retaining walls, and sidewalks. The existing southeast pond will be excavated to remove accumulated sediment and expanded.

As directed by city staff, site conditions prior to the 2010 demolition of the fitness center were used in the analysis of the existing conditions.

The site was modeled in HydroCAD to analyze existing and proposed conditions (Appendix A and B). Atlas 14 rainfall depths for Hennepin County were used in this analysis.

1.2 Regulatory Requirements

The proposed project site falls under the jurisdiction of the City of Bloomington and Nine Mile Creek Watershed District. The following Watershed regulations apply:

RULE 2 – FLOODPLAIN MANAGEMENT

1. Compensatory flood storage needs to be provided at the same elevation +/- 1 foot for fill in the floodplain of a watercourse.

RULE 3 – WETLAND MANAGEMENT

2. Buffer, setbacks vary depending on value/quality of wetland (high, medium, low)
 - a. High = average 60', minimum 30'
 - b. Medium = average 40', minimum 20'
 - c. Low = average 20', minimum 10'

RULE 4 – STORMWATER MANAGEMENT

1. Rate Control – Limit peak runoff flow rates to existing conditions for 2, 10, and 100 year storms (nested 24-hr rainfall distribution).
2. Volume Reduction – Retain 1.1" of runoff from on-site from applicable impervious surface (provide pretreatment of runoff for infiltration or filtration systems, 48 hour drawdown levels, volume retention sequencing available in rules).
3. Water Quality – Remove at least 60% of total phosphorus and 90% of total suspended solids annually from site runoff.

2.0 Existing Site and Drainage Conditions

For this analysis, the existing condition of the site is its pre-2010 condition, when the site was developed as a fitness center. The site included a ~85,000 square foot building, surface parking, a parking ramp, and a wet pond on the south side of the site. Nine Mile Creek is located in the West/southwest portion of the property.

A majority of the site drained to the southern pond, via private storm sewer or overland flow. This pond overflows west into Nine Mile creek. There is currently no outlet structure from this pond. Areas west of the surface parking drained directly overland to Nine Mile Creek, which flows south under Interstate Highway No. 494.

See Exhibit 1: Existing Conditions Map

3.0 Soil Conditions

Per the geotechnical report prepared by WSB, dated 12/19/2016, fills on site are a mixture of lean clay, silty sand, and sands, with buried topsoil below fill present at one boring.

Below the fills and buried topsoil, WSB “encountered deposits consisting of sands and silty sands, lean clays and to a lesser extent fat clays. These soils were generally brown to gray in color and ranged from moist to saturated or waterbearing.”

See Appendix D – Geotechnical Engineering Report.

4.0 Proposed Stormwater Management System Design

The proposed development plan includes construction of a multi-family apartment building, commercial building, parking lots, entrance drives, retaining walls, and sidewalks. Stormwater management will include construction of two underground stormwater chamber systems and expansion of the existing detention pond to provide the required volume abstraction and water quality.

Stormwater runoff from the proposed commercial building, north parking and driveways, and westerly portion of the multi-family building (1S) will be routed to an underground storm chamber system (11P) to provide rate control, volume control and water quality.

Stormwater runoff from the south-central parking lot and driveways (2S) will be routed to an underground storm chamber system (12P) to provide rate control, volume control and water quality.

Sump manhole structures will provide initial pretreatment of discharge to the underground storm chambers, with additional sediment removal via the storm chamber isolator row system. The storm chamber systems are designed to contain sediment and floatable debris withing the isolator row, which can then be removed as needed.

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Stormwater runoff from the westerly portion of the development area (3S) will consist of grass slopes (100% pervious) and will flow west to Nine Mile Creek, similar to the existing condition.

Stormwater runoff from the easterly portion of the multi-family building (4S) will discharge south to the existing/expanded pond (13P). The existing pond will be dredged to remove accumulated sediment and will be expanded to provide for additional water quality treatment.

The storm chamber systems (11P and 12P) will discharge to the expanded pond for additional water quality treatment.

Comparison of the existing and proposed conditions cover within the disturbed are shown in Table 1.

Table 1: Proposed Conditions Cover

Cover	Existing Conditions	Proposed Conditions
	Area [ac]	Area [ac]
Impervious	3.463 (67%)	3.756 (72.5%)
Pervious	1.717	1.426
Total	5.18	5.18

5.0 Stormwater Management

5.1 Rate Control

The stormwater management system was designed to achieve no net increase in peak discharges for the proposed development from existing conditions for the 2, 10 and 100 yr storm events. The total peak discharge rates to Nine Mile Creek are shown below in Table 2.

Table 2: Peak Discharge Rates

Storm Event	Existing Discharge Rate [cfs]	Proposed Discharge Rate [cfs]
2-year	11.32	0.69
10-year	19.97	2.84
100-year	40.43	12.21

5.2 Volume Abstraction

The volume reduction equal to 1.1-inch of runoff from the site's new and reconstructed impervious surface is 14,998 cf.

Stormwater runoff from 1S will be directed to an underground storm chamber system (11P). The proposed outlet pipe is 3.2 feet above the bottom of the 60" chamber. Using an infiltration rate

is 0.8 inches per hour, the volume will draw down in less 48 hours. Stormwater runoff from 2S will be directed to an underground chamber system (12). The proposed outlet will be at the bottom of the chamber system and abstraction volume will be detained within the 6" rock section below the chamber system. Using an infiltration rate is 0.06 inches per hour, the volume will draw down in 48 hours. See Table 3 for a summary of the required and provided abstraction volume.

Table 3: Volume Abstraction

Catchment Area	Impervious Area [ac]	Required Volume (1.1") [cf]	Volume Abstraction Provided [cf]
Area 1S to 11P	1.741	6,952	12,480
Area 2S to 12P	1.204	4,808	2,610
Area 4S to 13P	0.811	3,238	0
Total	3.756	14,998	15,090

5.3 Water Quality

Water quality measures for the proposed development are met through a combination of infiltration, filtration, and retention. The two underground chamber systems provide abstraction for 1.1 inches of new and reconstructed impervious. The chamber systems utilize isolator rows to provide additional filtration of TSS and particulate phosphorous. In MIDS, removal percentages for the isolator row were identified from water quality performance studies. Additional water quality treatment is provided by the expanded stormwater pond. The proposed stormwater BMPs were modeled in MIDS to show a TSS annual reduction of 92% and a TP annual reduction of 76%. See Table 5 below for a summary of the MIDS modeling results and Appendix C for additional MIDS modeling information.

Table 5: MIDS modeling results

	TSS Inflow [lbs/yr]	TSS Removed [lbs/yr]	TSS Load Reduction	TP Inflow [lbs/yr]	TP Removed [lbs/yr]	TP Load Reduction
Total	1,333.6	1,232.4	92%	7.342	5.576	76%

6.0 Conclusions

The proposed Enclave Apartment development and its stormwater management facilities have been designed to meet the requirements of the City of Bloomington, Nine Mile Creek Watershed, and the MPCA NPDES permit.

Exhibit 1: Existing Drainage Area Map

Exhibit 2: Proposed Cover Conditions Map

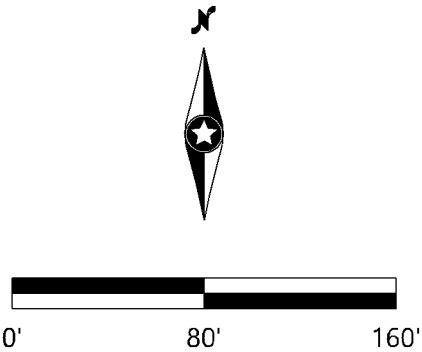
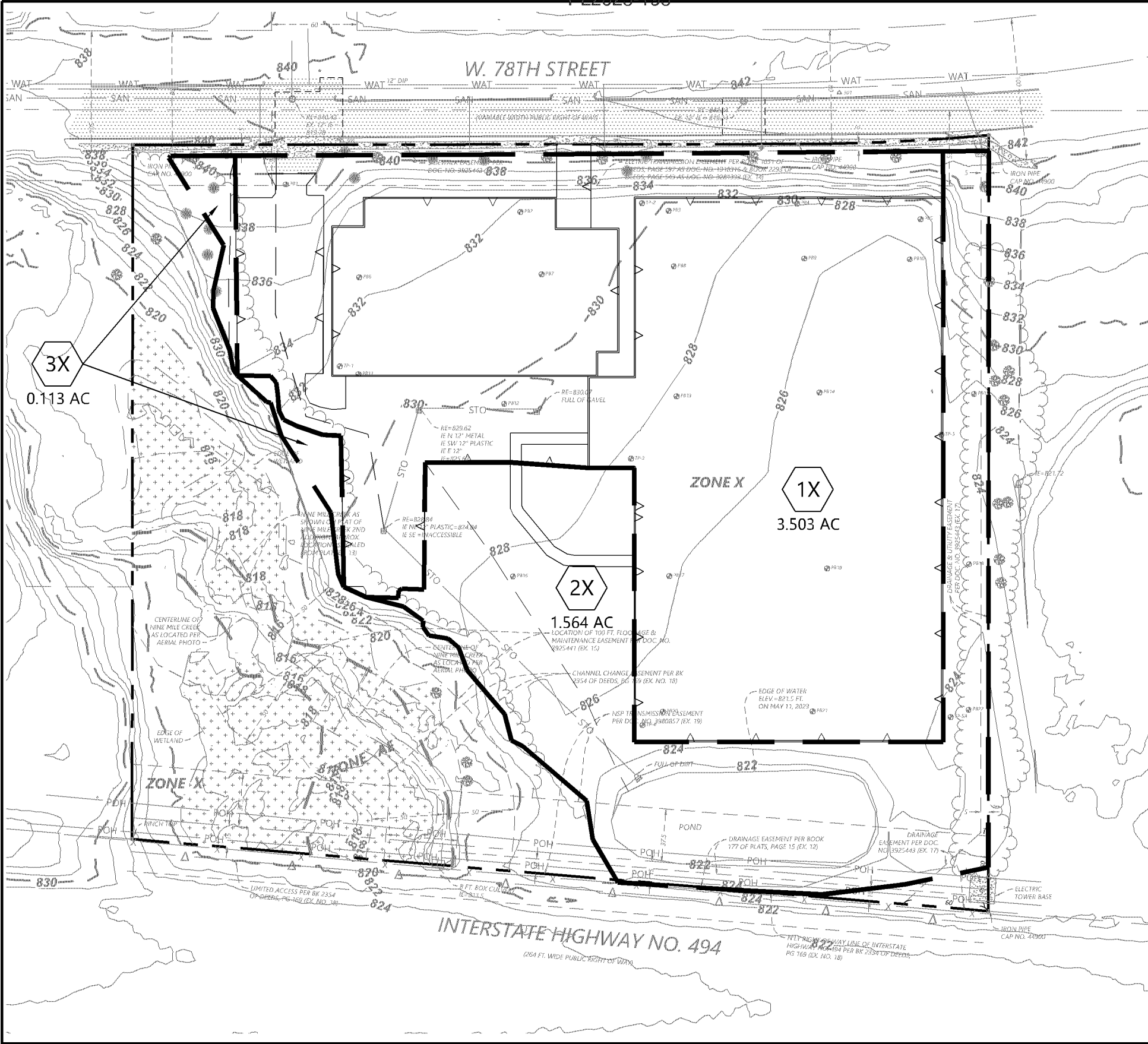
Appendix A: HydroCAD Model – Existing Conditions

Appendix B: HydroCAD Model – Proposed Conditions

Appendix C: MIDS Reuse Calculator

Appendix D: Geotechnical Engineering Report

Exhibit 1: Existing Drainage Area Map



ENCLAVE BLOOMINGTON 78TH STREET

DESIGNED:	SSA
CHECKED:	SSA
DRAWN:	AKW
FIELD CREW:	
FIELD WORK DATE:	

PREPARED FOR:

ENCLAVE DEVELOPMENT

300 23RD AVE E, SUITE 300
FARGO, ND 58078

ENCLAVE BLOOMINGTON 78TH
STREET

BLOOMINGTON, MN

Westwood

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Westwood Professional Services, Inc.

EXISTING DRAINAGE AREA
MAP

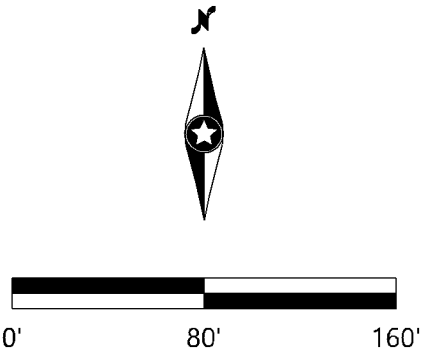
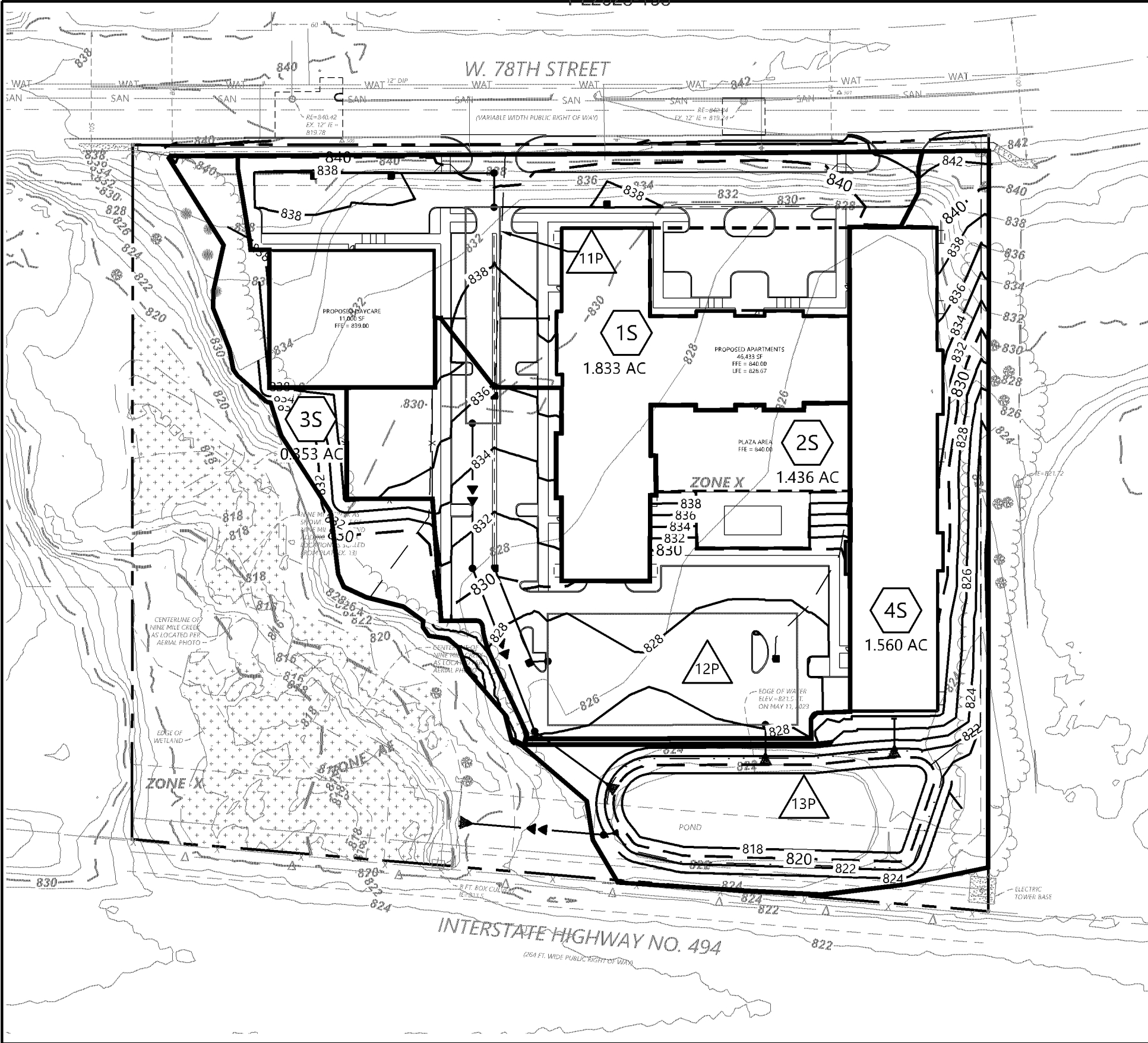
SHEET NUMBER:

1

DATE: 11/14/2023

PROJECT NUMBER: 0043990.00

Exhibit 2: Proposed Cover Conditions Map



DESIGNED:	SSA
CHECKED:	SSA
DRAWN:	AKW
FIELD CREW:	
FIELD WORK DATE:	

PREPARED FOR:

ENCLAVE DEVELOPMENT

300 23RD AVE E, SUITE 300
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ENCLAVE BLOOMINGTON 78TH STREET

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PROPOSED DRAINAGE AREA MAP

PROJECT NUMBER: 0043990.00

SHEET NUMBER:

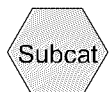
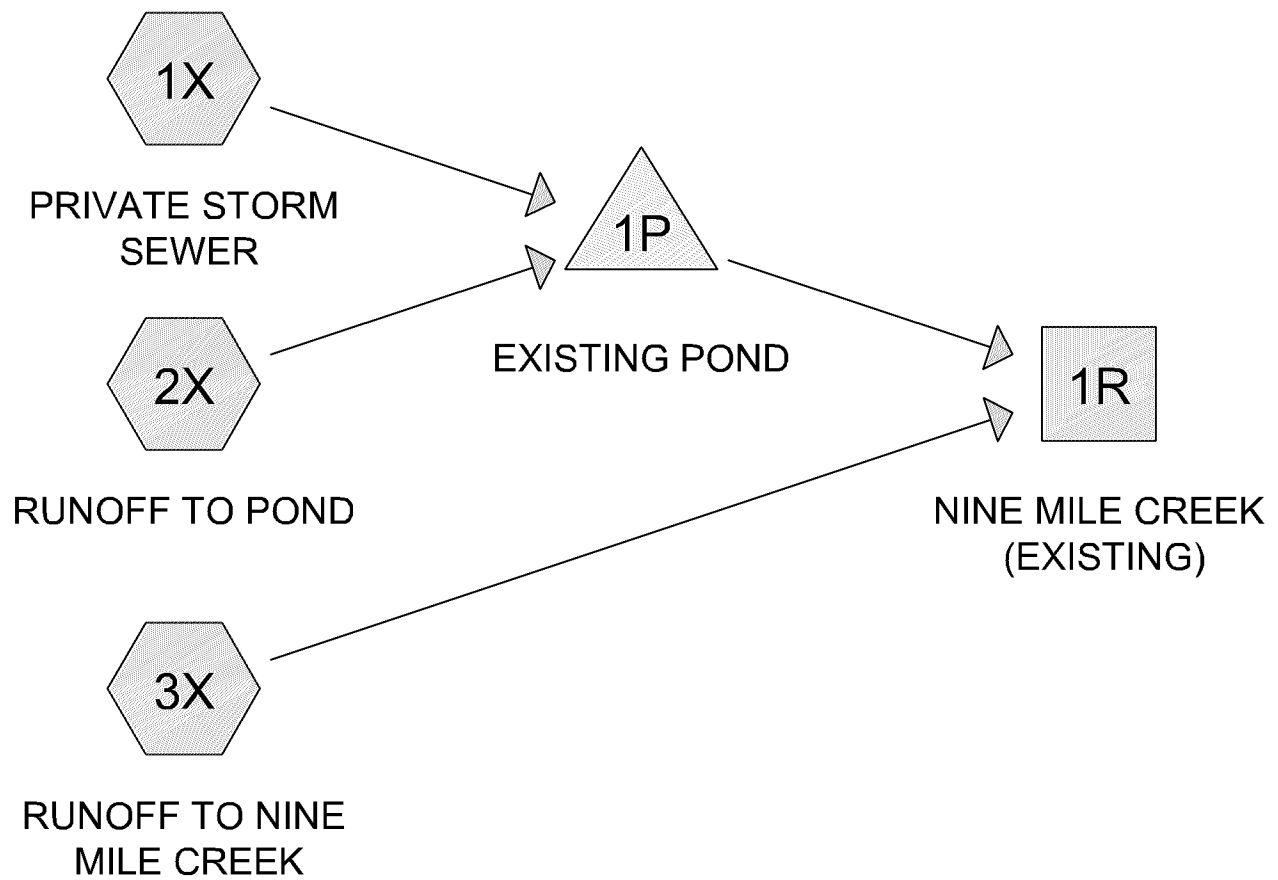
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DATE: 11/14/2023

ENCLAVE BLOOMINGTON 78TH STREET

Appendix A: HydroCAD Model – Existing Conditions

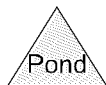
Existing Conditions



Subcat



Reach



Pond



Link

Routing Diagram for Bloomington Enclave 494 HydroCAD - V4

Prepared by j, Printed 11/14/2023

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Bloomington Enclave 494 HydroCAD - V4

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Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.717	74	>75% Grass cover, Good, HSG C (1X, 2X, 3X)
3.220	98	Paved parking, HSG A (1X, 2X)
0.243	98	Water Surface, HSG C (2X)
5.180	90	TOTAL AREA

Bloomington Enclave 494 HydroCAD - V4

MSE 24-hr 3 2-Year Rainfall=2.86"

Prepared by j

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Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1X: PRIVATE STORM Runoff Area=3.503 ac 88.32% Impervious Runoff Depth=2.31"
Flow Length=299' Slope=0.0390 '/' Tc=3.4 min CN=95 Runoff=15.20 cfs 0.675 af

Subcatchment 2X: RUNOFF TO POND Runoff Area=1.564 ac 23.59% Impervious Runoff Depth=1.15"
Flow Length=272' Slope=0.0276 '/' Tc=6.7 min CN=80 Runoff=3.23 cfs 0.149 af

Subcatchment 3X: RUNOFF TO NINE MILE Runoff Area=0.113 ac 0.00% Impervious Runoff Depth=0.82"
Flow Length=154' Slope=0.0552 '/' Tc=3.6 min CN=74 Runoff=0.19 cfs 0.008 af

Reach 1R: NINE MILE CREEK (EXISTING) Inflow=11.32 cfs 0.832 af
Outflow=11.32 cfs 0.832 af

Pond 1P: EXISTING POND Peak Elev=823.96' Storage=60,066 cf Inflow=18.04 cfs 0.825 af
Outflow=11.20 cfs 0.825 af

Total Runoff Area = 5.180 ac Runoff Volume = 0.832 af Average Runoff Depth = 1.93"
33.15% Pervious = 1.717 ac 66.85% Impervious = 3.463 ac

Bloomington Enclave 494 HydroCAD - V4

MSE 24-hr 3 2-Year Rainfall=2.86"

Prepared by j

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Summary for Subcatchment 1X: PRIVATE STORM SEWER

Runoff = 15.20 cfs @ 12.11 hrs, Volume= 0.675 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.86"

Area (ac)	CN	Description
3.094	98	Paved parking, HSG A
0.409	74	>75% Grass cover, Good, HSG C
3.503	95	Weighted Average
0.409		11.68% Pervious Area
3.094		88.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	299	0.0390	1.45		Lag/CN Method,

Summary for Subcatchment 2X: RUNOFF TO POND

Runoff = 3.23 cfs @ 12.14 hrs, Volume= 0.149 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.86"

Area (ac)	CN	Description
0.126	98	Paved parking, HSG A
1.195	74	>75% Grass cover, Good, HSG C
0.243	98	Water Surface, HSG C
1.564	80	Weighted Average
1.195		76.41% Pervious Area
0.369		23.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	272	0.0276	0.67		Lag/CN Method,

Summary for Subcatchment 3X: RUNOFF TO NINE MILE CREEK

Runoff = 0.19 cfs @ 12.12 hrs, Volume= 0.008 af, Depth= 0.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.86"

Area (ac)	CN	Description
0.113	74	>75% Grass cover, Good, HSG C
0.113		100.00% Pervious Area

Bloomington Enclave 494 HydroCAD - V4

MSE 24-hr 3 2-Year Rainfall=2.86"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	154	0.0552	0.71		Lag/CN Method,

Summary for Reach 1R: NINE MILE CREEK (EXISTING)

Inflow Area = 5.180 ac, 66.85% Impervious, Inflow Depth = 1.93" for 2-Year event
 Inflow = 11.32 cfs @ 12.16 hrs, Volume= 0.832 af
 Outflow = 11.32 cfs @ 12.16 hrs, Volume= 0.832 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: EXISTING POND

Inflow Area = 5.067 ac, 68.34% Impervious, Inflow Depth = 1.95" for 2-Year event
 Inflow = 18.04 cfs @ 12.11 hrs, Volume= 0.825 af
 Outflow = 11.20 cfs @ 12.16 hrs, Volume= 0.825 af, Atten= 38%, Lag= 2.9 min
 Primary = 11.20 cfs @ 12.16 hrs, Volume= 0.825 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Starting Elev= 823.50' Surf.Area= 16,383 sf Storage= 52,196 cf

Peak Elev= 823.96' @ 12.16 hrs Surf.Area= 17,586 sf Storage= 60,066 cf (7,871 cf above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)

Center-of-Mass det. time= 24.4 min (803.8 - 779.4)

Volume	Invert	Avail.Storage	Storage Description
#1	818.00'	78,393 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
818.00	2,182	0	0
819.00	5,348	3,765	3,765
820.00	7,917	6,633	10,398
821.00	10,588	9,253	19,650
822.00	11,842	11,215	30,865
823.00	15,085	13,464	44,329
824.00	17,681	16,383	60,712
825.00	17,681	17,681	78,393

Device	Routing	Invert	Outlet Devices
#1	Primary	823.50'	10.0' long (Profile 9) Broad-Crested Rectangular Weir Head (feet) 1.97 2.46 2.95 3.94 4.92 Coef. (English) 3.55 3.55 3.57 3.60 3.66

Primary OutFlow Max=11.20 cfs @ 12.16 hrs HW=823.96' TW=0.00' (Dynamic Tailwater)↑ **1=Broad-Crested Rectangular Weir** (Weir Controls 11.20 cfs @ 2.42 fps)

Bloomington Enclave 494 HydroCAD - V4

MSE 24-hr 3 10-Year Rainfall=4.26"

Prepared by j

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Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1X: PRIVATE STORM Runoff Area=3.503 ac 88.32% Impervious Runoff Depth=3.69"
Flow Length=299' Slope=0.0390 '/' Tc=3.4 min CN=95 Runoff=23.44 cfs 1.076 af

Subcatchment 2X: RUNOFF TO POND Runoff Area=1.564 ac 23.59% Impervious Runoff Depth=2.26"
Flow Length=272' Slope=0.0276 '/' Tc=6.7 min CN=80 Runoff=6.36 cfs 0.294 af

Subcatchment 3X: RUNOFF TO NINE MILE Runoff Area=0.113 ac 0.00% Impervious Runoff Depth=1.79"
Flow Length=154' Slope=0.0552 '/' Tc=3.6 min CN=74 Runoff=0.42 cfs 0.017 af

Reach 1R: NINE MILE CREEK (EXISTING) Inflow=19.97 cfs 1.388 af
Outflow=19.97 cfs 1.388 af

Pond 1P: EXISTING POND Peak Elev=824.18' Storage=63,806 cf Inflow=29.17 cfs 1.371 af
Outflow=19.69 cfs 1.371 af

Total Runoff Area = 5.180 ac Runoff Volume = 1.388 af Average Runoff Depth = 3.21"
33.15% Pervious = 1.717 ac 66.85% Impervious = 3.463 ac

Bloomington Enclave 494 HydroCAD - V4

MSE 24-hr 3 10-Year Rainfall=4.26"

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Summary for Subcatchment 1X: PRIVATE STORM SEWER

Runoff = 23.44 cfs @ 12.11 hrs, Volume= 1.076 af, Depth= 3.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

Area (ac)	CN	Description
3.094	98	Paved parking, HSG A
0.409	74	>75% Grass cover, Good, HSG C
3.503	95	Weighted Average
0.409		11.68% Pervious Area
3.094		88.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	299	0.0390	1.45		Lag/CN Method,

Summary for Subcatchment 2X: RUNOFF TO POND

Runoff = 6.36 cfs @ 12.14 hrs, Volume= 0.294 af, Depth= 2.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

Area (ac)	CN	Description
0.126	98	Paved parking, HSG A
1.195	74	>75% Grass cover, Good, HSG C
0.243	98	Water Surface, HSG C
1.564	80	Weighted Average
1.195		76.41% Pervious Area
0.369		23.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	272	0.0276	0.67		Lag/CN Method,

Summary for Subcatchment 3X: RUNOFF TO NINE MILE CREEK

Runoff = 0.42 cfs @ 12.12 hrs, Volume= 0.017 af, Depth= 1.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

Area (ac)	CN	Description
0.113	74	>75% Grass cover, Good, HSG C
0.113		100.00% Pervious Area

Bloomington Enclave 494 HydroCAD - V4

MSE 24-hr 3 10-Year Rainfall=4.26"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	154	0.0552	0.71		Lag/CN Method,

Summary for Reach 1R: NINE MILE CREEK (EXISTING)

Inflow Area = 5.180 ac, 66.85% Impervious, Inflow Depth = 3.21" for 10-Year event
 Inflow = 19.97 cfs @ 12.15 hrs, Volume= 1.388 af
 Outflow = 19.97 cfs @ 12.15 hrs, Volume= 1.388 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: EXISTING POND

Inflow Area = 5.067 ac, 68.34% Impervious, Inflow Depth = 3.25" for 10-Year event
 Inflow = 29.17 cfs @ 12.11 hrs, Volume= 1.371 af
 Outflow = 19.69 cfs @ 12.16 hrs, Volume= 1.371 af, Atten= 33%, Lag= 2.6 min
 Primary = 19.69 cfs @ 12.16 hrs, Volume= 1.371 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Starting Elev= 823.50' Surf.Area= 16,383 sf Storage= 52,196 cf

Peak Elev= 824.18' @ 12.16 hrs Surf.Area= 17,681 sf Storage= 63,806 cf (11,611 cf above start)

Plug-Flow detention time= 554.6 min calculated for 0.173 af (13% of inflow)

Center-of-Mass det. time= 20.9 min (792.0 - 771.1)

Volume	Invert	Avail.Storage	Storage Description
#1	818.00'	78,393 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
818.00	2,182	0	0
819.00	5,348	3,765	3,765
820.00	7,917	6,633	10,398
821.00	10,588	9,253	19,650
822.00	11,842	11,215	30,865
823.00	15,085	13,464	44,329
824.00	17,681	16,383	60,712
825.00	17,681	17,681	78,393

Device	Routing	Invert	Outlet Devices
#1	Primary	823.50'	10.0' long (Profile 9) Broad-Crested Rectangular Weir Head (feet) 1.97 2.46 2.95 3.94 4.92 Coef. (English) 3.55 3.55 3.57 3.60 3.66

Primary OutFlow Max=19.66 cfs @ 12.16 hrs HW=824.17' TW=0.00' (Dynamic Tailwater)

↑1=Broad-Crested Rectangular Weir (Weir Controls 19.66 cfs @ 2.92 fps)

Bloomington Enclave 494 HydroCAD - V4

MSE 24-hr 3 100-Year Rainfall=7.32"

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Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1X: PRIVATE STORM Runoff Area=3.503 ac 88.32% Impervious Runoff Depth=6.72"
Flow Length=299' Slope=0.0390 '/' Tc=3.4 min CN=95 Runoff=41.21 cfs 1.963 af

Subcatchment 2X: RUNOFF TO POND Runoff Area=1.564 ac 23.59% Impervious Runoff Depth=4.99"
Flow Length=272' Slope=0.0276 '/' Tc=6.7 min CN=80 Runoff=13.65 cfs 0.650 af

Subcatchment 3X: RUNOFF TO NINE MILE Runoff Area=0.113 ac 0.00% Impervious Runoff Depth=4.32"
Flow Length=154' Slope=0.0552 '/' Tc=3.6 min CN=74 Runoff=0.99 cfs 0.041 af

Reach 1R: NINE MILE CREEK (EXISTING) Inflow=40.43 cfs 2.654 af
Outflow=40.43 cfs 2.654 af

Pond 1P: EXISTING POND Peak Elev=824.58' Storage=70,931 cf Inflow=53.74 cfs 2.613 af
Outflow=39.73 cfs 2.613 af

Total Runoff Area = 5.180 ac Runoff Volume = 2.654 af Average Runoff Depth = 6.15"
33.15% Pervious = 1.717 ac 66.85% Impervious = 3.463 ac

Bloomington Enclave 494 HydroCAD - V4

MSE 24-hr 3 100-Year Rainfall=7.32"

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Summary for Subcatchment 1X: PRIVATE STORM SEWER

Runoff = 41.21 cfs @ 12.11 hrs, Volume= 1.963 af, Depth= 6.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=7.32"

Area (ac)	CN	Description
3.094	98	Paved parking, HSG A
0.409	74	>75% Grass cover, Good, HSG C
3.503	95	Weighted Average
0.409		11.68% Pervious Area
3.094		88.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	299	0.0390	1.45		Lag/CN Method,

Summary for Subcatchment 2X: RUNOFF TO POND

Runoff = 13.65 cfs @ 12.14 hrs, Volume= 0.650 af, Depth= 4.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=7.32"

Area (ac)	CN	Description
0.126	98	Paved parking, HSG A
1.195	74	>75% Grass cover, Good, HSG C
0.243	98	Water Surface, HSG C
1.564	80	Weighted Average
1.195		76.41% Pervious Area
0.369		23.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	272	0.0276	0.67		Lag/CN Method,

Summary for Subcatchment 3X: RUNOFF TO NINE MILE CREEK

Runoff = 0.99 cfs @ 12.11 hrs, Volume= 0.041 af, Depth= 4.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=7.32"

Area (ac)	CN	Description
0.113	74	>75% Grass cover, Good, HSG C
0.113		100.00% Pervious Area

Bloomington Enclave 494 HydroCAD - V4

MSE 24-hr 3 100-Year Rainfall=7.32"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	154	0.0552	0.71		Lag/CN Method,

Summary for Reach 1R: NINE MILE CREEK (EXISTING)

Inflow Area = 5.180 ac, 66.85% Impervious, Inflow Depth = 6.15" for 100-Year event
 Inflow = 40.43 cfs @ 12.15 hrs, Volume= 2.654 af
 Outflow = 40.43 cfs @ 12.15 hrs, Volume= 2.654 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: EXISTING POND

Inflow Area = 5.067 ac, 68.34% Impervious, Inflow Depth = 6.19" for 100-Year event
 Inflow = 53.74 cfs @ 12.11 hrs, Volume= 2.613 af
 Outflow = 39.73 cfs @ 12.15 hrs, Volume= 2.613 af, Atten= 26%, Lag= 2.3 min
 Primary = 39.73 cfs @ 12.15 hrs, Volume= 2.613 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Starting Elev= 823.50' Surf.Area= 16,383 sf Storage= 52,196 cf

Peak Elev= 824.58' @ 12.15 hrs Surf.Area= 17,681 sf Storage= 70,931 cf (18,735 cf above start)

Plug-Flow detention time= 179.7 min calculated for 1.415 af (54% of inflow)

Center-of-Mass det. time= 17.1 min (778.0 - 760.9)

Volume	Invert	Avail.Storage	Storage Description
#1	818.00'	78,393 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

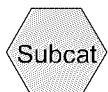
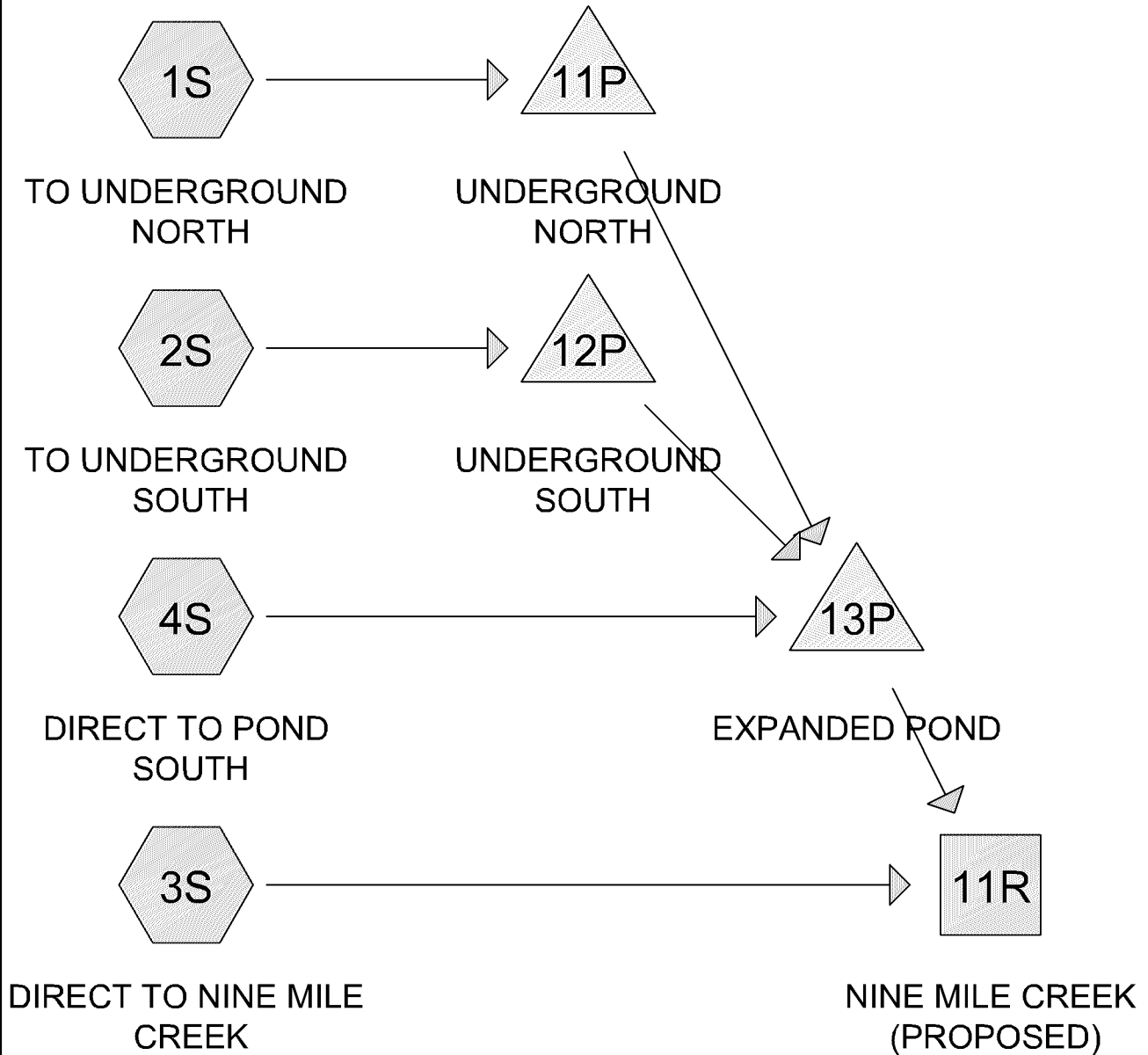
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
818.00	2,182	0	0
819.00	5,348	3,765	3,765
820.00	7,917	6,633	10,398
821.00	10,588	9,253	19,650
822.00	11,842	11,215	30,865
823.00	15,085	13,464	44,329
824.00	17,681	16,383	60,712
825.00	17,681	17,681	78,393

Device	Routing	Invert	Outlet Devices
#1	Primary	823.50'	10.0' long (Profile 9) Broad-Crested Rectangular Weir Head (feet) 1.97 2.46 2.95 3.94 4.92 Coef. (English) 3.55 3.55 3.57 3.60 3.66

Primary OutFlow Max=39.73 cfs @ 12.15 hrs HW=824.58' TW=0.00' (Dynamic Tailwater)↑ **1=Broad-Crested Rectangular Weir** (Weir Controls 39.73 cfs @ 3.69 fps)

Appendix B: HydroCAD Model – Proposed Conditions

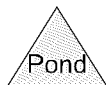
Proposed Conditions



Subcat



Reach



Pond



Link

Routing Diagram for Bloomington Enclave 494 HydroCAD - V4

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Bloomington Enclave 494 HydroCAD - V4

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Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.426	74	>75% Grass cover, Good, HSG C (1S, 2S, 3S, 4S)
2.004	98	Paved parking, HSG C (1S, 2S)
0.575	98	Roof - Apartment (1S)
0.258	98	Roof - Daycare (1S)
0.491	98	Roofs, HSG C (4S)
0.320	98	Water Surface, HSG C (4S)
0.108	98	play area (1S)
5.182	91	TOTAL AREA

Bloomington Enclave 494 HydroCAD - V4

MSE 24-hr 3 2-Year Rainfall=2.86"

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Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: TO UNDERGROUND Runoff Area=1.833 ac 94.98% Impervious Runoff Depth=2.52"
Flow Length=160' Slope=0.0250 '/' Tc=2.3 min CN=97 Runoff=8.45 cfs 0.385 af

Subcatchment 2S: TO UNDERGROUND Runoff Area=1.436 ac 83.84% Impervious Runoff Depth=2.21"
Flow Length=141' Slope=0.0887 '/' Tc=1.3 min CN=94 Runoff=6.24 cfs 0.265 af

Subcatchment 3S: DIRECT TO NINE MILE Runoff Area=0.353 ac 0.00% Impervious Runoff Depth=0.82"
Flow Length=187' Slope=0.0535 '/' Tc=4.3 min CN=74 Runoff=0.58 cfs 0.024 af

Subcatchment 4S: DIRECT TO POND Runoff Area=1.560 ac 51.99% Impervious Runoff Depth=1.54"
Flow Length=514' Slope=0.0388 '/' Tc=7.8 min CN=86 Runoff=4.13 cfs 0.201 af

Reach 11R: NINE MILE CREEK (PROPOSED) Inflow=0.69 cfs 0.338 af
Outflow=0.69 cfs 0.338 af

Pond 11P: UNDERGROUND NORTH Peak Elev=830.21' Storage=12,538 cf Inflow=8.45 cfs 0.385 af
Discarded=0.08 cfs 0.385 af Primary=0.00 cfs 0.000 af Outflow=0.08 cfs 0.385 af

Pond 12P: UNDERGROUND SOUTH Peak Elev=823.54' Storage=0.149 af Inflow=6.24 cfs 0.265 af
Discarded=0.06 cfs 0.145 af Primary=0.46 cfs 0.120 af Outflow=0.52 cfs 0.265 af

Pond 13P: EXPANDED POND Peak Elev=821.86' Storage=28,690 cf Inflow=4.41 cfs 0.321 af
Outflow=0.65 cfs 0.314 af

Total Runoff Area = 5.182 ac Runoff Volume = 0.875 af Average Runoff Depth = 2.03"
27.52% Pervious = 1.426 ac 72.48% Impervious = 3.756 ac

Bloomington Enclave 494 HydroCAD - V4

MSE 24-hr 3 2-Year Rainfall=2.86"

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Summary for Subcatchment 1S: TO UNDERGROUND NORTH

Runoff = 8.45 cfs @ 12.10 hrs, Volume= 0.385 af, Depth= 2.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.86"

Area (ac)	CN	Description
* 0.258	98	Roof - Daycare
0.800	98	Paved parking, HSG C
0.092	74	>75% Grass cover, Good, HSG C
* 0.575	98	Roof - Apartment
* 0.108	98	play area
1.833	97	Weighted Average
0.092		5.02% Pervious Area
1.741		94.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	160	0.0250	1.14		Lag/CN Method,

Summary for Subcatchment 2S: TO UNDERGROUND SOUTH

Runoff = 6.24 cfs @ 12.10 hrs, Volume= 0.265 af, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.86"

Area (ac)	CN	Description
0.000	98	Roofs, HSG C
1.204	98	Paved parking, HSG C
0.232	74	>75% Grass cover, Good, HSG C
1.436	94	Weighted Average
0.232		16.16% Pervious Area
1.204		83.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	141	0.0887	1.80		Lag/CN Method,

Summary for Subcatchment 3S: DIRECT TO NINE MILE CREEK

Runoff = 0.58 cfs @ 12.12 hrs, Volume= 0.024 af, Depth= 0.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.86"

Bloomington Enclave 494 HydroCAD - V4

MSE 24-hr 3 2-Year Rainfall=2.86"

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Area (ac)	CN	Description
0.000	98	Paved parking, HSG C
0.353	74	>75% Grass cover, Good, HSG C
0.353	74	Weighted Average
0.353		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	187	0.0535	0.73		Lag/CN Method,

Summary for Subcatchment 4S: DIRECT TO POND SOUTH

Runoff = 4.13 cfs @ 12.15 hrs, Volume= 0.201 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.86"

Area (ac)	CN	Description
0.749	74	>75% Grass cover, Good, HSG C
0.320	98	Water Surface, HSG C
0.491	98	Roofs, HSG C
1.560	86	Weighted Average
0.749		48.01% Pervious Area
0.811		51.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.8	514	0.0388	1.11		Lag/CN Method,

Summary for Reach 11R: NINE MILE CREEK (PROPOSED)

Inflow Area = 5.182 ac, 72.48% Impervious, Inflow Depth > 0.78" for 2-Year event
 Inflow = 0.69 cfs @ 12.13 hrs, Volume= 0.338 af
 Outflow = 0.69 cfs @ 12.13 hrs, Volume= 0.338 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 11P: UNDERGROUND NORTH

Inflow Area = 1.833 ac, 94.98% Impervious, Inflow Depth = 2.52" for 2-Year event
 Inflow = 8.45 cfs @ 12.10 hrs, Volume= 0.385 af
 Outflow = 0.08 cfs @ 17.52 hrs, Volume= 0.385 af, Atten= 99%, Lag= 325.2 min
 Discarded = 0.08 cfs @ 9.75 hrs, Volume= 0.385 af
 Primary = 0.00 cfs @ 17.52 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 830.21' @ 17.52 hrs Surf.Area= 4,342 sf Storage= 12,538 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 1,381.7 min (2,139.8 - 758.1)

Bloomington Enclave 494 HydroCAD - V4

MSE 24-hr 3 2-Year Rainfall=2.86"

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Volume	Invert	Avail.Storage	Storage Description
#1A	826.25'	7,029 cf	28.50'W x 152.37'L x 6.75'H Field A 29,312 cf Overall - 11,738 cf Embedded = 17,574 cf x 40.0% Voids
#2A	827.00'	11,738 cf	ADS_StormTech MC-4500 b +Cap x 108 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.02'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 108 Chambers in 3 Rows Cap Storage= +39.5 cf x 2 x 3 rows = 237.0 cf
		18,767 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	830.20'	24.0" Round Culvert L= 295.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 830.20' / 823.21' S= 0.0237 ' S= 0.0237 ' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf
#2	Discarded	826.25'	0.800 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.08 cfs @ 9.75 hrs HW=826.32' (Free Discharge)↑ **2=Exfiltration** (Exfiltration Controls 0.08 cfs)**Primary OutFlow** Max=0.00 cfs @ 17.52 hrs HW=830.21' TW=821.72' (Dynamic Tailwater)↑ **1=Culvert** (Inlet Controls 0.00 cfs @ 0.32 fps)**Summary for Pond 12P: UNDERGROUND SOUTH**

Inflow Area =	1.436 ac, 83.84% Impervious, Inflow Depth = 2.21" for 2-Year event
Inflow =	6.24 cfs @ 12.10 hrs, Volume= 0.265 af
Outflow =	0.52 cfs @ 12.53 hrs, Volume= 0.265 af, Atten= 92%, Lag= 25.9 min
Discarded =	0.06 cfs @ 10.73 hrs, Volume= 0.145 af
Primary =	0.46 cfs @ 12.53 hrs, Volume= 0.120 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Peak Elev= 823.54' @ 12.53 hrs Surf.Area= 0.299 ac Storage= 0.149 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)

Center-of-Mass det. time= 373.1 min (1,146.4 - 773.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	822.67'	0.208 af	74.83'W x 174.08'L x 2.33'H Field A 0.698 af Overall - 0.179 af Embedded = 0.519 af x 40.0% Voids
#2A	823.17'	0.179 af	ADS_StormTech SC-310 +Cap x 528 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 528 Chambers in 22 Rows
		0.386 af	Total Available Storage

Storage Group A created with Chamber Wizard

Bloomington Enclave 494 HydroCAD - V4

MSE 24-hr 3 2-Year Rainfall=2.86"

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Device	Routing	Invert	Outlet Devices
#1	Primary	823.17'	12.0" Round Culvert L= 30.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 823.17' / 822.96' S= 0.0070 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#2	Discarded	822.67'	0.06 cfs Exfiltration at all elevations

Discarded OutFlow Max=0.06 cfs @ 10.73 hrs HW=822.69' (Free Discharge)↑**2=Exfiltration** (Exfiltration Controls 0.06 cfs)**Primary OutFlow** Max=0.46 cfs @ 12.53 hrs HW=823.54' TW=821.82' (Dynamic Tailwater)↑**1=Culvert** (Barrel Controls 0.46 cfs @ 2.58 fps)**Summary for Pond 13P: EXPANDED POND**

Inflow Area = 4.829 ac, 77.78% Impervious, Inflow Depth = 0.80" for 2-Year event
 Inflow = 4.41 cfs @ 12.15 hrs, Volume= 0.321 af
 Outflow = 0.65 cfs @ 13.37 hrs, Volume= 0.314 af, Atten= 85%, Lag= 73.2 min
 Primary = 0.65 cfs @ 13.37 hrs, Volume= 0.314 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Starting Elev= 821.50' Surf.Area= 16,416 sf Storage= 22,751 cf

Peak Elev= 821.86' @ 13.37 hrs Surf.Area= 17,016 sf Storage= 28,690 cf (5,939 cf above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)

Center-of-Mass det. time= 247.4 min (1,080.1 - 832.8)

Volume	Invert	Avail.Storage	Storage Description
#1	820.00'	70,645 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
820.00	13,936	0	0
821.00	15,572	14,754	14,754
822.00	17,260	16,416	31,170
823.00	19,009	18,135	49,305
824.00	23,671	21,340	70,645

Device	Routing	Invert	Outlet Devices
#1	Primary	823.00'	10.0' long (Profile 9) Broad-Crested Rectangular Weir Head (feet) 1.97 2.46 2.95 3.94 4.92 Coef. (English) 3.55 3.55 3.57 3.60 3.66
#2	Primary	821.50'	18.0" Round Culvert L= 100.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 821.50' / 820.50' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=0.65 cfs @ 13.37 hrs HW=821.86' TW=0.00' (Dynamic Tailwater)↑**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)↑**2=Culvert** (Inlet Controls 0.65 cfs @ 2.03 fps)

Bloomington Enclave 494 HydroCAD - V4

MSE 24-hr 3 10-Year Rainfall=4.26"

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Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: TO UNDERGROUND Runoff Area=1.833 ac 94.98% Impervious Runoff Depth=3.91"
Flow Length=160' Slope=0.0250 '/' Tc=2.3 min CN=97 Runoff=12.77 cfs 0.597 af

Subcatchment 2S: TO UNDERGROUND Runoff Area=1.436 ac 83.84% Impervious Runoff Depth=3.58"
Flow Length=141' Slope=0.0887 '/' Tc=1.3 min CN=94 Runoff=9.70 cfs 0.428 af

Subcatchment 3S: DIRECT TO NINE MILE Runoff Area=0.353 ac 0.00% Impervious Runoff Depth=1.79"
Flow Length=187' Slope=0.0535 '/' Tc=4.3 min CN=74 Runoff=1.28 cfs 0.053 af

Subcatchment 4S: DIRECT TO POND Runoff Area=1.560 ac 51.99% Impervious Runoff Depth=2.78"
Flow Length=514' Slope=0.0388 '/' Tc=7.8 min CN=86 Runoff=7.31 cfs 0.362 af

Reach 11R: NINE MILE CREEK (PROPOSED) Inflow=2.84 cfs 0.867 af
Outflow=2.84 cfs 0.867 af

Pond 11P: UNDERGROUND NORTH Peak Elev=830.84' Storage=14,391 cf Inflow=12.77 cfs 0.597 af
Discarded=0.08 cfs 0.407 af Primary=2.34 cfs 0.190 af Outflow=2.42 cfs 0.597 af

Pond 12P: UNDERGROUND SOUTH Peak Elev=823.89' Storage=0.225 af Inflow=9.70 cfs 0.428 af
Discarded=0.06 cfs 0.159 af Primary=1.44 cfs 0.269 af Outflow=1.50 cfs 0.428 af

Pond 13P: EXPANDED POND Peak Elev=822.27' Storage=35,894 cf Inflow=9.42 cfs 0.821 af
Outflow=2.73 cfs 0.814 af

Total Runoff Area = 5.182 ac Runoff Volume = 1.440 af Average Runoff Depth = 3.33"
27.52% Pervious = 1.426 ac 72.48% Impervious = 3.756 ac

Bloomington Enclave 494 HydroCAD - V4

MSE 24-hr 3 10-Year Rainfall=4.26"

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Summary for Subcatchment 1S: TO UNDERGROUND NORTH

Runoff = 12.77 cfs @ 12.10 hrs, Volume= 0.597 af, Depth= 3.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

Area (ac)	CN	Description
* 0.258	98	Roof - Daycare
0.800	98	Paved parking, HSG C
0.092	74	>75% Grass cover, Good, HSG C
* 0.575	98	Roof - Apartment
* 0.108	98	play area
1.833	97	Weighted Average
0.092		5.02% Pervious Area
1.741		94.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	160	0.0250	1.14		Lag/CN Method,

Summary for Subcatchment 2S: TO UNDERGROUND SOUTH

Runoff = 9.70 cfs @ 12.10 hrs, Volume= 0.428 af, Depth= 3.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

Area (ac)	CN	Description
0.000	98	Roofs, HSG C
1.204	98	Paved parking, HSG C
0.232	74	>75% Grass cover, Good, HSG C
1.436	94	Weighted Average
0.232		16.16% Pervious Area
1.204		83.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	141	0.0887	1.80		Lag/CN Method,

Summary for Subcatchment 3S: DIRECT TO NINE MILE CREEK

Runoff = 1.28 cfs @ 12.12 hrs, Volume= 0.053 af, Depth= 1.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

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MSE 24-hr 3 10-Year Rainfall=4.26"

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Area (ac)	CN	Description
0.000	98	Paved parking, HSG C
0.353	74	>75% Grass cover, Good, HSG C
0.353	74	Weighted Average
0.353		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	187	0.0535	0.73		Lag/CN Method,

Summary for Subcatchment 4S: DIRECT TO POND SOUTH

Runoff = 7.31 cfs @ 12.15 hrs, Volume= 0.362 af, Depth= 2.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

Area (ac)	CN	Description
0.749	74	>75% Grass cover, Good, HSG C
0.320	98	Water Surface, HSG C
0.491	98	Roofs, HSG C
1.560	86	Weighted Average
0.749		48.01% Pervious Area
0.811		51.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.8	514	0.0388	1.11		Lag/CN Method,

Summary for Reach 11R: NINE MILE CREEK (PROPOSED)

Inflow Area = 5.182 ac, 72.48% Impervious, Inflow Depth > 2.01" for 10-Year event
 Inflow = 2.84 cfs @ 12.83 hrs, Volume= 0.867 af
 Outflow = 2.84 cfs @ 12.83 hrs, Volume= 0.867 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 11P: UNDERGROUND NORTH

Inflow Area = 1.833 ac, 94.98% Impervious, Inflow Depth = 3.91" for 10-Year event
 Inflow = 12.77 cfs @ 12.10 hrs, Volume= 0.597 af
 Outflow = 2.42 cfs @ 12.33 hrs, Volume= 0.597 af, Atten= 81%, Lag= 13.7 min
 Discarded = 0.08 cfs @ 8.56 hrs, Volume= 0.407 af
 Primary = 2.34 cfs @ 12.33 hrs, Volume= 0.190 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 830.84' @ 12.33 hrs Surf.Area= 4,342 sf Storage= 14,391 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 960.7 min (1,711.3 - 750.6)

Bloomington Enclave 494 HydroCAD - V4

MSE 24-hr 3 10-Year Rainfall=4.26"

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Volume	Invert	Avail.Storage	Storage Description
#1A	826.25'	7,029 cf	28.50'W x 152.37'L x 6.75'H Field A 29,312 cf Overall - 11,738 cf Embedded = 17,574 cf x 40.0% Voids
#2A	827.00'	11,738 cf	ADS_StormTech MC-4500 b +Cap x 108 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.02'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 108 Chambers in 3 Rows Cap Storage= +39.5 cf x 2 x 3 rows = 237.0 cf
		18,767 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	830.20'	24.0" Round Culvert L= 295.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 830.20' / 823.21' S= 0.0237 ' / Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf
#2	Discarded	826.25'	0.800 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.08 cfs @ 8.56 hrs HW=826.32' (Free Discharge)↑**2=Exfiltration** (Exfiltration Controls 0.08 cfs)**Primary OutFlow** Max=2.33 cfs @ 12.33 hrs HW=830.84' TW=822.10' (Dynamic Tailwater)↑**1=Culvert** (Inlet Controls 2.33 cfs @ 2.72 fps)**Summary for Pond 12P: UNDERGROUND SOUTH**

Inflow Area =	1.436 ac, 83.84% Impervious, Inflow Depth = 3.58" for 10-Year event
Inflow =	9.70 cfs @ 12.10 hrs, Volume= 0.428 af
Outflow =	1.50 cfs @ 12.34 hrs, Volume= 0.428 af, Atten= 85%, Lag= 14.2 min
Discarded =	0.06 cfs @ 9.55 hrs, Volume= 0.159 af
Primary =	1.44 cfs @ 12.34 hrs, Volume= 0.269 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Peak Elev= 823.89' @ 12.34 hrs Surf.Area= 0.299 ac Storage= 0.225 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)

Center-of-Mass det. time= 278.9 min (1,042.9 - 764.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	822.67'	0.208 af	74.83'W x 174.08'L x 2.33'H Field A 0.698 af Overall - 0.179 af Embedded = 0.519 af x 40.0% Voids
#2A	823.17'	0.179 af	ADS_StormTech SC-310 +Cap x 528 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 528 Chambers in 22 Rows
		0.386 af	Total Available Storage

Storage Group A created with Chamber Wizard

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MSE 24-hr 3 10-Year Rainfall=4.26"

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Device	Routing	Invert	Outlet Devices
#1	Primary	823.17'	12.0" Round Culvert L= 30.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 823.17' / 822.96' S= 0.0070 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#2	Discarded	822.67'	0.06 cfs Exfiltration at all elevations

Discarded OutFlow Max=0.06 cfs @ 9.55 hrs HW=822.69' (Free Discharge)↑**2=Exfiltration** (Exfiltration Controls 0.06 cfs)**Primary OutFlow** Max=1.44 cfs @ 12.34 hrs HW=823.89' TW=822.11' (Dynamic Tailwater)↑**1=Culvert** (Barrel Controls 1.44 cfs @ 3.34 fps)**Summary for Pond 13P: EXPANDED POND**

Inflow Area = 4.829 ac, 77.78% Impervious, Inflow Depth = 2.04" for 10-Year event
 Inflow = 9.42 cfs @ 12.16 hrs, Volume= 0.821 af
 Outflow = 2.73 cfs @ 12.85 hrs, Volume= 0.814 af, Atten= 71%, Lag= 41.1 min
 Primary = 2.73 cfs @ 12.85 hrs, Volume= 0.814 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Starting Elev= 821.50' Surf.Area= 16,416 sf Storage= 22,751 cf

Peak Elev= 822.27' @ 12.85 hrs Surf.Area= 17,732 sf Storage= 35,894 cf (13,143 cf above start)

Plug-Flow detention time= 513.7 min calculated for 0.292 af (36% of inflow)

Center-of-Mass det. time= 146.8 min (964.8 - 818.0)

Volume	Invert	Avail.Storage	Storage Description
#1	820.00'	70,645 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
820.00	13,936	0	0
821.00	15,572	14,754	14,754
822.00	17,260	16,416	31,170
823.00	19,009	18,135	49,305
824.00	23,671	21,340	70,645

Device	Routing	Invert	Outlet Devices
#1	Primary	823.00'	10.0' long (Profile 9) Broad-Crested Rectangular Weir Head (feet) 1.97 2.46 2.95 3.94 4.92 Coef. (English) 3.55 3.55 3.57 3.60 3.66
#2	Primary	821.50'	18.0" Round Culvert L= 100.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 821.50' / 820.50' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=2.73 cfs @ 12.85 hrs HW=822.27' TW=0.00' (Dynamic Tailwater)↑**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)↑**2=Culvert** (Inlet Controls 2.73 cfs @ 2.99 fps)

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MSE 24-hr 3 100-Year Rainfall=7.32"

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Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: TO UNDERGROUND Runoff Area=1.833 ac 94.98% Impervious Runoff Depth=6.96"
Flow Length=160' Slope=0.0250 '/' Tc=2.3 min CN=97 Runoff=22.13 cfs 1.063 af

Subcatchment 2S: TO UNDERGROUND Runoff Area=1.436 ac 83.84% Impervious Runoff Depth=6.61"
Flow Length=141' Slope=0.0887 '/' Tc=1.3 min CN=94 Runoff=17.14 cfs 0.791 af

Subcatchment 3S: DIRECT TO NINE MILE Runoff Area=0.353 ac 0.00% Impervious Runoff Depth=4.32"
Flow Length=187' Slope=0.0535 '/' Tc=4.3 min CN=74 Runoff=3.02 cfs 0.127 af

Subcatchment 4S: DIRECT TO POND Runoff Area=1.560 ac 51.99% Impervious Runoff Depth=5.67"
Flow Length=514' Slope=0.0388 '/' Tc=7.8 min CN=86 Runoff=14.34 cfs 0.738 af

Reach 11R: NINE MILE CREEK (PROPOSED) Inflow=12.21 cfs 2.109 af
Outflow=12.21 cfs 2.109 af

Pond 11P: UNDERGROUND NORTH Peak Elev=832.65' Storage=18,158 cf Inflow=22.13 cfs 1.063 af
Discarded=0.08 cfs 0.426 af Primary=18.21 cfs 0.638 af Outflow=18.29 cfs 1.063 af

Pond 12P: UNDERGROUND SOUTH Peak Elev=824.96' Storage=0.381 af Inflow=17.14 cfs 0.791 af
Discarded=0.06 cfs 0.177 af Primary=4.16 cfs 0.613 af Outflow=4.22 cfs 0.791 af

Pond 13P: EXPANDED POND Peak Elev=823.21' Storage=53,337 cf Inflow=36.02 cfs 1.989 af
Outflow=11.66 cfs 1.982 af

Total Runoff Area = 5.182 ac Runoff Volume = 2.719 af Average Runoff Depth = 6.30"
27.52% Pervious = 1.426 ac 72.48% Impervious = 3.756 ac

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MSE 24-hr 3 100-Year Rainfall=7.32"

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Summary for Subcatchment 1S: TO UNDERGROUND NORTH

Runoff = 22.13 cfs @ 12.10 hrs, Volume= 1.063 af, Depth= 6.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=7.32"

	Area (ac)	CN	Description
*	0.258	98	Roof - Daycare
	0.800	98	Paved parking, HSG C
	0.092	74	>75% Grass cover, Good, HSG C
*	0.575	98	Roof - Apartment
*	0.108	98	play area
	1.833	97	Weighted Average
	0.092		5.02% Pervious Area
	1.741		94.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	160	0.0250	1.14		Lag/CN Method,

Summary for Subcatchment 2S: TO UNDERGROUND SOUTH

Runoff = 17.14 cfs @ 12.09 hrs, Volume= 0.791 af, Depth= 6.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=7.32"

	Area (ac)	CN	Description
	0.000	98	Roofs, HSG C
	1.204	98	Paved parking, HSG C
	0.232	74	>75% Grass cover, Good, HSG C
	1.436	94	Weighted Average
	0.232		16.16% Pervious Area
	1.204		83.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	141	0.0887	1.80		Lag/CN Method,

Summary for Subcatchment 3S: DIRECT TO NINE MILE CREEK

Runoff = 3.02 cfs @ 12.12 hrs, Volume= 0.127 af, Depth= 4.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=7.32"

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MSE 24-hr 3 100-Year Rainfall=7.32"

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Area (ac)	CN	Description
0.000	98	Paved parking, HSG C
0.353	74	>75% Grass cover, Good, HSG C
0.353	74	Weighted Average
0.353		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	187	0.0535	0.73		Lag/CN Method,

Summary for Subcatchment 4S: DIRECT TO POND SOUTH

Runoff = 14.34 cfs @ 12.15 hrs, Volume= 0.738 af, Depth= 5.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=7.32"

Area (ac)	CN	Description
0.749	74	>75% Grass cover, Good, HSG C
0.320	98	Water Surface, HSG C
0.491	98	Roofs, HSG C
1.560	86	Weighted Average
0.749		48.01% Pervious Area
0.811		51.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.8	514	0.0388	1.11		Lag/CN Method,

Summary for Reach 11R: NINE MILE CREEK (PROPOSED)

Inflow Area = 5.182 ac, 72.48% Impervious, Inflow Depth > 4.88" for 100-Year event
 Inflow = 12.21 cfs @ 12.39 hrs, Volume= 2.109 af
 Outflow = 12.21 cfs @ 12.39 hrs, Volume= 2.109 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 11P: UNDERGROUND NORTH

Inflow Area = 1.833 ac, 94.98% Impervious, Inflow Depth = 6.96" for 100-Year event
 Inflow = 22.13 cfs @ 12.10 hrs, Volume= 1.063 af
 Outflow = 18.29 cfs @ 12.12 hrs, Volume= 1.063 af, Atten= 17%, Lag= 1.6 min
 Discarded = 0.08 cfs @ 5.59 hrs, Volume= 0.426 af
 Primary = 18.21 cfs @ 12.12 hrs, Volume= 0.638 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 832.65' @ 12.12 hrs Surf.Area= 4,342 sf Storage= 18,158 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 575.6 min (1,317.8 - 742.2)

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MSE 24-hr 3 100-Year Rainfall=7.32"

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Volume	Invert	Avail.Storage	Storage Description
#1A	826.25'	7,029 cf	28.50'W x 152.37'L x 6.75'H Field A 29,312 cf Overall - 11,738 cf Embedded = 17,574 cf x 40.0% Voids
#2A	827.00'	11,738 cf	ADS_StormTech MC-4500 b +Cap x 108 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.02'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 108 Chambers in 3 Rows Cap Storage= +39.5 cf x 2 x 3 rows = 237.0 cf
		18,767 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	830.20'	24.0" Round Culvert L= 295.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 830.20' / 823.21' S= 0.0237 ' S= 0.0237 ' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf
#2	Discarded	826.25'	0.800 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.08 cfs @ 5.59 hrs HW=826.32' (Free Discharge)↑**2=Exfiltration** (Exfiltration Controls 0.08 cfs)**Primary OutFlow** Max=18.16 cfs @ 12.12 hrs HW=832.64' TW=822.57' (Dynamic Tailwater)↑**1=Culvert** (Inlet Controls 18.16 cfs @ 5.78 fps)**Summary for Pond 12P: UNDERGROUND SOUTH**

Inflow Area =	1.436 ac, 83.84% Impervious, Inflow Depth = 6.61" for 100-Year event
Inflow =	17.14 cfs @ 12.09 hrs, Volume= 0.791 af
Outflow =	4.22 cfs @ 12.22 hrs, Volume= 0.791 af, Atten= 75%, Lag= 7.8 min
Discarded =	0.06 cfs @ 7.10 hrs, Volume= 0.177 af
Primary =	4.16 cfs @ 12.22 hrs, Volume= 0.613 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Peak Elev= 824.96' @ 12.22 hrs Surf.Area= 0.299 ac Storage= 0.381 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)

Center-of-Mass det. time= 195.2 min (948.2 - 753.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	822.67'	0.208 af	74.83'W x 174.08'L x 2.33'H Field A 0.698 af Overall - 0.179 af Embedded = 0.519 af x 40.0% Voids
#2A	823.17'	0.179 af	ADS_StormTech SC-310 +Cap x 528 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 528 Chambers in 22 Rows
		0.386 af	Total Available Storage

Storage Group A created with Chamber Wizard

Bloomington Enclave 494 HydroCAD - V4

MSE 24-hr 3 100-Year Rainfall=7.32"

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Device	Routing	Invert	Outlet Devices
#1	Primary	823.17'	12.0" Round Culvert L= 30.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 823.17' / 822.96' S= 0.0070 '/ Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#2	Discarded	822.67'	0.06 cfs Exfiltration at all elevations

Discarded OutFlow Max=0.06 cfs @ 7.10 hrs HW=822.69' (Free Discharge)↑**2=Exfiltration** (Exfiltration Controls 0.06 cfs)**Primary OutFlow** Max=4.16 cfs @ 12.22 hrs HW=824.96' TW=823.03' (Dynamic Tailwater)↑**1=Culvert** (Barrel Controls 4.16 cfs @ 5.30 fps)**Summary for Pond 13P: EXPANDED POND**

Inflow Area = 4.829 ac, 77.78% Impervious, Inflow Depth = 4.94" for 100-Year event
 Inflow = 36.02 cfs @ 12.13 hrs, Volume= 1.989 af
 Outflow = 11.66 cfs @ 12.40 hrs, Volume= 1.982 af, Atten= 68%, Lag= 16.0 min
 Primary = 11.66 cfs @ 12.40 hrs, Volume= 1.982 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Starting Elev= 821.50' Surf.Area= 16,416 sf Storage= 22,751 cf

Peak Elev= 823.21' @ 12.40 hrs Surf.Area= 19,973 sf Storage= 53,337 cf (30,586 cf above start)

Plug-Flow detention time= 213.4 min calculated for 1.459 af (73% of inflow)

Center-of-Mass det. time= 95.0 min (894.6 - 799.5)

Volume	Invert	Avail.Storage	Storage Description
#1	820.00'	70,645 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
820.00	13,936	0	0
821.00	15,572	14,754	14,754
822.00	17,260	16,416	31,170
823.00	19,009	18,135	49,305
824.00	23,671	21,340	70,645

Device	Routing	Invert	Outlet Devices
#1	Primary	823.00'	10.0' long (Profile 9) Broad-Crested Rectangular Weir Head (feet) 1.97 2.46 2.95 3.94 4.92 Coef. (English) 3.55 3.55 3.57 3.60 3.66
#2	Primary	821.50'	18.0" Round Culvert L= 100.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 821.50' / 820.50' S= 0.0100 '/ Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=11.66 cfs @ 12.40 hrs HW=823.21' TW=0.00' (Dynamic Tailwater)↑**1=Broad-Crested Rectangular Weir** (Weir Controls 3.34 cfs @ 1.61 fps)↑**2=Culvert** (Inlet Controls 8.32 cfs @ 4.71 fps)

Appendix C: MIDS Reuse Calculator

Project Information

Calculator Version:	Version 4: July 2020
Project Name:	Bloomington Enclave
User Name / Company Name:	WPS/BKC
Date:	2023-11-14
Project Description:	Proposed MIDS conditions for Bloomington Enclave
Construction Permit?:	No

Site Information

Retention Requirement (inches):	1.1
Site's Zip Code:	55439
Annual Rainfall (inches):	30.9
Phosphorus EMC (mg/l):	0.3
TSS EMC (mg/l):	54.5

Total Site Area

Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)
Forest/Open Space - Undisturbed, protected forest/open space or reforested land					0
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed			1.426		1.426
			Impervious Area (acres)		3.756
			Total Area (acres)		5.182

Site Areas Routed to BMPs

Land Cover	A Soils (acres)	B Soils (acres)	C Soils (acres)	D Soils (acres)	Total (acres)
Forest/Open Space - Undisturbed, protected forest/open space or reforested land					0
Managed Turf - disturbed, graded for yards or other turf to be mowed/managed			1.073		1.073
			Impervious Area (acres)		3.756
			Total Area (acres)		4.829

Summary Information

Performance Goal Requirement

Performance goal volume retention requirement:	14998	ft ³
Volume removed by BMPs towards performance goal:	9562	ft ³
Percent volume removed towards performance goal	64	%

Annual Volume and Pollutant Load Reductions

Post development annual runoff volume	8.9964	acre-ft
Annual runoff volume removed by BMPs:	4.6651	acre-ft
Percent annual runoff volume removed:	52	%

Post development annual particulate P load:	4.0376	lbs
Annual particulate P removed by BMPs:	3.746	lbs
Post development annual dissolved P load:	3.304	lbs
Annual dissolved P removed by BMPs:	1.83	lbs
Total P removed by BMPs	5.576	lbs
Percent annual total phosphorus removed:	76	%

Post development annual TSS load:	1333.6	lbs
Annual TSS removed by BMPs:	1232.4	lbs
Percent annual TSS removed:	92	%

BMP Summary

Performance Goal Summary

BMP Name	BMP Volume Capacity (ft ³)	Volume Recieved (ft ³)	Volume Retained (ft ³)	Volume Outflow (ft ³)	Percent Retained (%)
11P - Underground North	12480	6952	6952	0	100
12P- Underground South	2610	4808	2610	2198	54
13P - Expanded Pond	0	5436	0	5436	0
Isolator Row	0	4808	0	4808	0

Annual Volume Summary

BMP Name	Volume From Direct Watershed (acre-ft)	Volume From Upstream BMPs (acre-ft)	Volume Retained (acre-ft)	Volume outflow (acre-ft)	Percent Retained (%)
11P - Underground North	3.8799	0	3.8394	0.0405000000	99
12P- Underground South	0	2.769	0.8257	1.9433	30
13P - Expanded Pond	2.1674	1.9838	0	4.1512	0
Isolator Row	2.769	0	0	2.769	0

Particulate Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
11P - Underground North	1.7413	0	1.7231	0.0182	99
12P- Underground South	0	0.1367	0.0408	0.0959	30
13P - Expanded Pond	0.9727	0.1141	0.8764	0.2104	81
Isolator Row	1.2427	0	1.106	0.1367	89

Dissolved Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
11P - Underground North	1.4247	0	1.4098	0.0149	99
12P- Underground South	0	1.0168	0.3032	0.7136	30
13P - Expanded Pond	0.7959	0.7285	0.1171	1.4073	8
Isolator Row	1.0168	0	0	1.0168	0

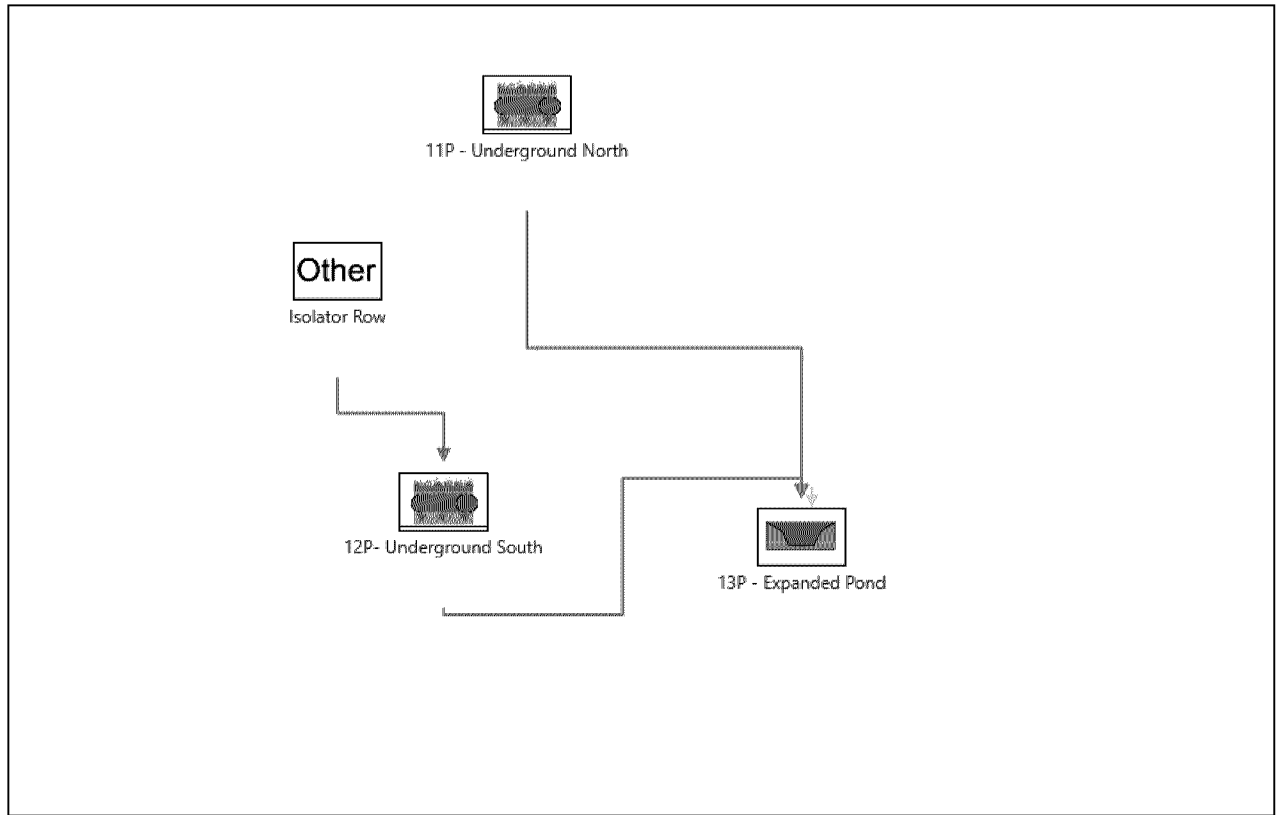
Total Phosphorus Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
11P - Underground North	3.166	0	3.1329	0.0331	99
12P- Underground South	0	1.1535	0.344	0.8095	30
13P - Expanded Pond	1.7686	0.8426	0.9935	1.6177	44
Isolator Row	2.2595	0	1.106	1.1535	44

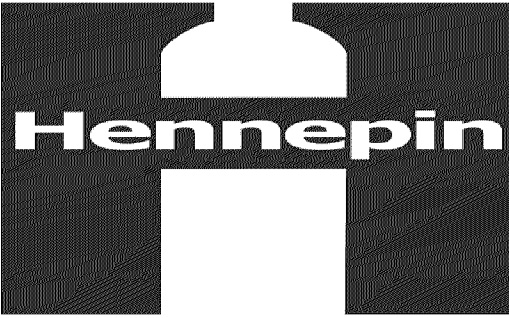
TSS Summary

BMP Name	Load From Direct Watershed (lbs)	Load From Upstream BMPs (lbs)	Load Retained (lbs)	Outflow Load (lbs)	Percent Retained (%)
11P - Underground North	575.16	0	569.15	6.0099999999	99
12P- Underground South	0	82.1	24.48	57.62	30
13P - Expanded Pond	321.29	63.63	310.4	74.52	81
Isolator Row	410.48	0	328.38	82.1	80

BMP Schematic



Appendix D: Geotechnical Engineering Report



Hennepin

PRELIMINARY GEOTECHNICAL REPORT

HENNEPIN COUNTY MEDICAL EXAMINERS SITE

BLOOMINGTON, MN

DECEMBER 19, 2016

Prepared for:
Hennepin County Public Works
701 Fourth Avenue South, Suite 700
Minneapolis, MN 55415

WSB PROJECT NO. 03392-010



PRELIMINARY GEOTECHNICAL REPORT

**PROPOSED HENNEPIN COUNTY MEDICAL EXAMINERS BUILDING
6701 WEST 78TH STREET
BLOOMINGTON, MINNESOTA**

**FOR
HENNEPIN COUNTY**

December 19, 2016

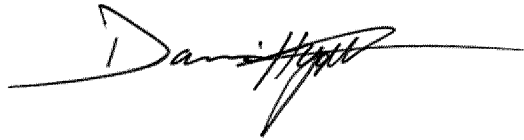
Prepared by:

The logo for WSB & Associates, Inc. is a large, stylized, three-dimensional 'WSB' in a light gray, textured font. It is centered on the page and serves as a background for the contact information.

**WSB & Associates, Inc.
540 Gateway Boulevard
Burnsville, MN 55337
(952)-737-4660**

CERTIFICATION

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.



Darin E. Hyatt, PE

Date: December 19, 2016

Lic. No. 41316



540 Gateway Boulevard | Suite 100 | Burnsville, MN 55337 | (952) 737-4660

December 19, 2016

Ms. Brianna D. Boos
Hennepin County Public Works
Environment and Energy Department
Land and Water, Contaminated Lands Unit
701 Fourth Avenue South, Suite 700
Minneapolis, MN 55415-1842

Re: Preliminary Geotechnical Report
Hennepin County Medical Examiners Site
6701 West 78th Street
Bloomington, MN
WSB Project No. 03392-010

Dear Ms. Boos:

We have conducted a preliminary geotechnical subsurface exploration program for the above referenced project. This report contains our soil boring logs, an evaluation of the conditions encountered in the borings and our preliminary recommendations for suitable foundation type, a range of allowable soil bearing pressures for footing design, and other geotechnical related design and construction considerations.

If you have any questions concerning this report or our preliminary recommendations please call us at (952) 737-4660.

Sincerely,

WSB & Associates, Inc.

A handwritten signature in black ink, appearing to read "Darin Hyatt", with a long horizontal flourish extending to the right.

Darin Hyatt, PE
Senior Geotechnical Engineer

A handwritten signature in black ink, appearing to read "Joe Carlson", with a long horizontal flourish extending to the right.

Joe Carlson, EIT
Graduate Geotechnical Engineer

Attachment
Preliminary Geotechnical Report

DEH/tmw

TABLE OF CONTENTS

TITLE SHEET

CERTIFICATION SHEET

LETTER OF TRANSMITTAL

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Appendix A

Boring Location Map

Test Pit Map

Logs of Penetration Test Borings

Symbols and Terminology on Test Boring Log

Notice to Report Users Boring Log Information

Unified Soil Classification Sheet (USCS)

1. INTRODUCTION

1.1 Project Location

This site is located at 6701 West 78th Street in Bloomington, Minnesota. The boring locations can be seen on the map in **Appendix A**.

The area was a vacant lot at the time of drilling with sporadic shrubs throughout. Nine Mile Creek runs along the western end of the site and there is a pond located at the south end of the site. It is our understanding that a structure that previously occupied this land was demolished and removed from the site.

1.2 Project Description

Very little design information is available at this time, however, we understand the building at this site will generally be less than three (3) stories, slab-on-grade structure with a finished floor elevation within about two feet (2') of existing grades. We have assumed wall loads will be less than 12 kips per linear foot and column loads will be less than 250 kips each. It is also assumed, underground utilities will have invert elevations within fifteen feet (15') of existing grades.

WSB has developed preliminary foundation recommendations for this project. When the architect and/or structural engineer develops additional information about final design column loadings, building configuration, or other significant factors, the recommendations presented herein may no longer apply. We anticipate that additional soil borings and a final geotechnical report will be completed when the final design information is completed. We recommend the additional soil borings be performed within the planned building and pavement areas to better characterize the subsurface conditions at this site.

1.3 Purpose and Project Scope of Services

Ms. Brianna Boos with the Hennepin County Public Works authorized our proposal. In order to assist the City in evaluating this site for potential development, we have completed a subsurface exploration program and prepared a preliminary geotechnical report for the referenced site. This stated purpose was a significant factor in determining the scope and level of service provided. Should the purpose of the report change the report immediately ceases to be valid and use of it without WSB's prior review and written authorization shall be at the user's sole risk.

Our authorized scope of work has been limited to:

1. Mobilization / Demobilization of a Truck Mounted Drill Rig.
2. Clearing underground utilities utilizing the Gopher State One Call.
3. Drilling 22 standard penetration borings to depths of about 25 feet.
4. Sealing the borings per Minnesota Department of Health procedures.
5. Perform soil classification and analysis.
6. Review of readily available project information and geologic data.
7. Providing this preliminary geotechnical report containing:
 - A. Summary of our initial findings.
 - B. Discussion of subsurface soil and groundwater conditions and how they may affect potential future construction.
 - C. Estimated range of allowable bearing capacities of the soils.
 - D. Preliminary recommendations for foundations.
 - E. A discussion of soils for use as structural fill and site fill.

2. PROCEDURES

2.1 Boring Layout and Soil Sampling Procedures

Hennepin County Public Works requested we complete 22 soil borings at this site, recommended the boring depths and selected the desired locations. The boring locations were staked using existing site features as guides and elevated by our drilling crew. Bore hole elevations were referenced to the top of the top nut of a hydrant located on West 78th Street near the western entrance to the site. The elevation of that benchmark was indicated as 842.73 on a site plan provided to us.

We drilled the borings on November 17, 18, 21 and 22, 2016, with a truck-mounted CME-55 drill rig operated by a two-person crew. The drill crew advanced the borings using continuous hollow stem augers. Drilling methods, crew chief, depths, sampling interval, casing usage, groundwater observations, test data and other drilling information are indicated on the boring logs.

Generally, the drill crew sampled the soil in advance of the auger tip at two and one-half (2½) foot intervals of depth to fifteen feet (15') and at five foot (5') intervals thereafter. The soil samples were obtained using a split-barrel sampler which was driven into the ground during standard penetration tests in accordance with ASTM D 1586, Standard Method of Penetration Test and Split-Barrel Sampling of Soils.

The materials encountered were described on field logs and representative samples were containerized, and transported to our laboratory for further examination and testing.

The samples were visually examined to estimate the distribution of grain sizes, plasticity, consistency, moisture condition, color, presence of lenses and seams, and apparent geologic origin. We classified the soils according to type using the Unified Soil Classification System (USCS). A chart describing the Unified Soil Classification System is included in **Appendix A**.

2.2 Groundwater Measurements and Borehole Abandonment

The drill crew observed the borings for free groundwater while drilling and after completion. These observations and measurements are noted on the boring logs. The crew backfilled the borings with soil cuttings; to comply with Minnesota Department of Health regulations.

2.3 Boring Log Procedures and Qualifications

The subsurface conditions encountered by the test borings are illustrated on the attached boring logs. Similar soils were grouped into the strata shown on the boring logs, and the appropriate estimated USCS classification symbols were also added. The depths and thickness of the subsurface strata indicated on the boring logs were estimated from the drilling results.

The transition between materials (horizontal and vertical) is approximate and is usually far more gradual than shown. Information on actual subsurface conditions exists only at the specific locations indicated and is relevant only to the time exploration was performed. Subsurface conditions and groundwater levels at other locations may differ from conditions found at the indicated locations. The nature and extent of which would not become evident until exposed by construction excavation. These stratification lines were used for our analytical purposes and, due to the aforementioned limitations, should not be used as a basis of design or construction cost estimates.

3. EXPLORATION RESULTS

3.1 Site and Geology

At the time of drilling, the site was an undeveloped lot with sporadic shrubs.

Based on review of online topographic maps, this site appears to gently slope to the southeast. Nine Mile Creek traverses the western side of the site.

The Hennepin County Geologic Atlas indicates the surficial geology of the area is mostly organic deposits much of which have been drained and filled.

3.2 Subsurface Soil and Groundwater Conditions

Soil Borings

The boring profile generally consisted of fill overlying alluvial and glacially deposited soils.

The fills encountered ranged from about 2 to 12 feet below grade and consisted of a mixture of lean clay, silty sand and sands. Below the fill in Boring PB-15, buried topsoil was encountered to a depth of about 5 feet.

Below the fills and buried topsoil, we encountered deposits consisting of sands and silty sands, lean clays and to a lesser extent fat clays. These soils were generally brown to gray in color and ranged from moist to saturated or waterbearing.

The soils encountered were generally similar to the soils described in the Geologic Atlas.

Test Pits

Six test pits were excavated to better evaluate environmental contamination concerns. Similar to the soil borings the test pits encountered fill soils consisting of silty sand and sand to depths of about 2 to 7 ½ feet. It should be noted that the native soils below the fill in test pit 1 was dark in color. An organic test on that material indicated it had about 3 percent organic material classifying it as slightly organic. Underlying the fill naturally deposited soils consisting of silty sand, sand and silt were encountered.

3.3 Strength Characteristics

The penetration resistance N-values of the materials encountered were recorded during drilling and are indicated as blows per foot (BPF). Those values provide an indication of soil strength characteristics and are located on the boring log sheets. Also, visual-manual classification techniques and apparent moisture contents were also utilized to make an engineering judgment of the consistency of the materials. The following table presents a summary of the penetration resistances in the soils and remarks regarding the material strengths of the soils.

Table 1: Penetration Resistances

Soil Type	Classification	Penetration Resistances	Remarks
Fill	Mixed Soils	3 - 28 BPF, average 13 BPF	Variable compaction
Coarse Alluvium	SP, SM	3 to 20 BPF	Very loose to medium dense
Fine Alluvium	CL, CH	1 to 12 BPF	Very soft to firm
Till	CL	6 to 22 BPF	Soft to hard

The preceding is a generalized description of soil conditions at this site. Variations from the generalized profile exist and should be assessed from the boring logs, the normal geologic character of the deposits, and the soils uncovered during site excavation.

3.4 Groundwater Conditions

WSB took groundwater level readings in the exploratory borings, reviewed the data obtained, and discussed its interpretation of the data in the text of the report. Note that groundwater levels may fluctuate due to seasonal variations, e.g. precipitation, snowmelt and rainfall, and/or other factors not evident at the time of measurement.

Our borings were only left open for a short period of time; as such, groundwater levels may not have had sufficient time to stabilize at their hydrostatic level.

Table 2 below is a summary of the estimated water levels at our borings.

Table 2: Groundwater Measurements

Boring No.	Ground Surface Elevation	Depth to Groundwater after Drilling	Estimated Groundwater Elevation
PB-1	839.4	15	824 ½
PB-2	831.6	23	809
PB-3	829.6	23	807
PB-4	826.4	NE	---
PB-5	825.9	8	818
PB-6	832.2	18 ½	814
PB-7	830.8	15	816
PB-8	828.8	22	807
PB-9	826.1	25	801 ½
PB-10	825.1	9	816 ½
PB-11	830.9	18 ½	812 ½
PB-12	829.8	12	818
PB-13	828.0	8	820
PB-14	825.7	8	818
PB-15	825.4	9	816 ½
PB-16	828.1	15 ½	813
PB-17	826.8	9 ½	817 ½
PB-18	825.9	11 ½	814 ½
PB-19	824.3	22	802 ½
PB-20	825.7	18	808
PB-21	825.1	11	814 ½
PB-22	824.4	19	805 ½

Groundwater Depths and Elevations are rounded to the highest ½ foot. NE – indicates groundwater not encountered during drilling and sampling.

As can be seen in the table above, water levels observed during drilling varied widely from about elevation 801 ½ to 824 1/2. Piezometers would allow for a more long term monitoring of water levels. Piezometer installation was beyond the scope of this evaluation. Based on information provided on a survey provided to us, the pond on the south side of the site had a water elevation of 820.5 feet in July of 2014. That same survey indicated a delineated wetland adjacent to Nine Mile Creek had a limit of about 820 feet in July of 2014. It is our opinion that the hydrostatic water level at this site will be near that of the pond and Nine Mile Creek.

4. PRELIMINARY ENGINEERING ANALYSIS AND RECOMMENDATIONS

The existing fills were mostly composed of sands with silt and silty sands and in a few instances clayey soils were noted. In some of the fill we noted pieces of wood, limestone, cobbles, and pieces of concrete or bituminous. It is likely these fills were placed following removal of organic soils. With the exception of Boring PB-15, the borings did not encounter any materials containing appreciable organic matter within or beneath the fill. Given the site was occupied by a previous structure it is possible that some of the fill, at least within previous building footprints was placed as a structural fill. However, it is unknown what occurred during and following demolition of the previous structure. Variable blows per foot (BPF) were also encountered within the fill, we are uncertain of the exact footprint of previous buildings or the magnitude of previous structural loadings, no observation or compaction testing documentation was made available to us and in one boring buried topsoil was encountered. As such, the existing fill is considered undocumented. It is our opinion, placing a building of the magnitude proposed on or within the existing fill would have a high risk of detrimental settlement.

Flexible (bituminous paved) parking lots are lightly loaded and more tolerant of movement compared to a building. Therefore consideration can be given to leaving the existing fill in place beneath proposed parking lots. However, with this approach the owner would need to accept a slight risk of increased long-term settlement.

In general, the native soils underlying the fill appear suitable for support of potential structures but they too would need to be further evaluated, especially where very soft and soft clayey soils exist.

Consideration could also be given to supporting proposed structures on deep or intermediate foundations such as driven pile or Geopiers®. These options would not require the removal of the existing fill.

It is our opinion that groundwater could be encountered by excavations at this site. Dewatering should be anticipated.

4.1 Preliminary Building Area Preparation

Unless information regarding the placement and compaction of the existing fill is provided to us for evaluation, we recommend the existing fill be removed from beneath the new building and an appropriate oversize area, and be replaced with compacted backfill.

Table 3 indicates the approximate minimum excavation depths to remove existing fill soils based on the findings of our soil borings. Excavation depths and bottom elevations were rounded to the lowest 1/2 foot/elevation. Those depths will likely vary and should be observed and adjusted during construction. Furthermore, it may be necessary to extend excavations to include partial removal of the soft natural clays depending on footing elevations, structural loads and condition of the clays at the time of construction.

Table 3. Approximate Minimum Excavation Depths at the Boring Locations

Boring	Ground Surface Elevation	Approximate Min. Excavation Depth*, feet	Approximate Bottom Elevation
PB-1	839.4	12	827
PB-2	831.6	7	824
PB-3	829.6	7	822 ½
PB-4	826.8	9	817 ½
PB-5	825.9	7	818 ½
PB-6	832.2	7	825
PB-7	830.8	9	821 ½
PB-8	828.8	10	818 ½
PB-9	826.6	11	815 ½
PB-10	825.1	7	818
PB-11	830.9	12	818 ½
PB-12	829.8	9	820 ½
PB-13	828.0	7	821
PB-14	825.7	7	818 ½
PB-15	825.4	5	821
PB-16	828.1	7 ½	820 ½
PB-17	826.8	9	817 ½
PB-18	825.9	7	818 ½
PB-19	824.3	9	815
PB-20	825.7	7	818 ½
PB-21	825.1	7	818
PB-22	824.1	5	819

* - Excavation depths may vary depending on the condition of the exposed soils at the time of construction and on final design grades and loads.

4.2 Preliminary Foundation Recommendations

It is our opinion that the buildings may be supported on conventional spread footings bearing on naturally occurring firm clays or medium dense sands or structural fill if it is determined to have been engineered. It is our opinion the footings throughout may be designed for net allowable soil bearing pressures ranging from 2,000 to 3,500 pounds per square foot (psf), depending on building plans and site preparation.

4.3 Preliminary Pavement Recommendations

We recommend any organic soils be removed from within 3 feet of the top of subgrade elevation. Surface compaction of the pavement areas should then be completed. The surface compaction should be observed and tested.

4.3 Additional Soil Borings and Recommendations

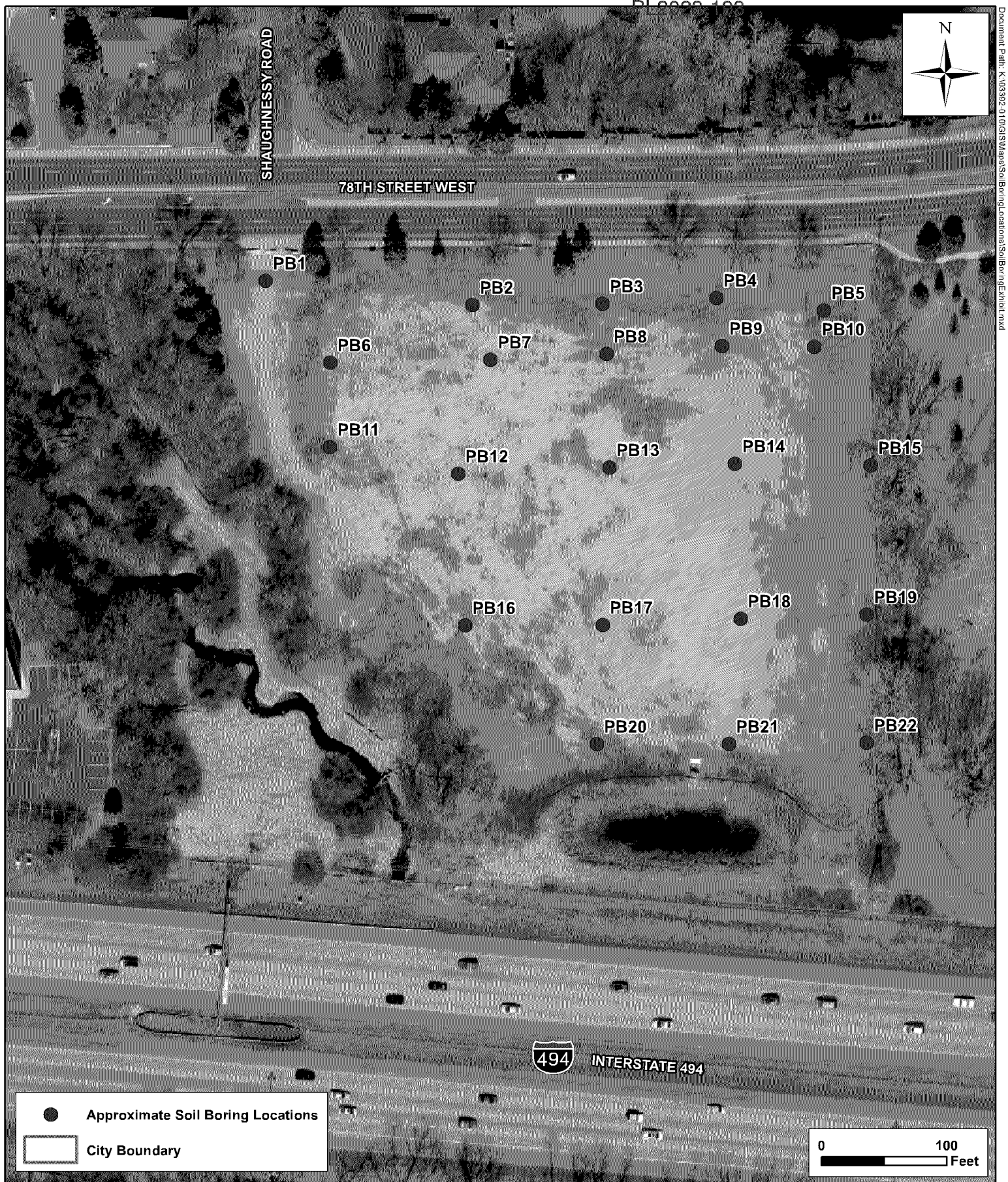
Given the size of the site, the spacing of our borings and the lack of specific design information, we recommend additional soil borings be performed once building locations and structural loadings have been established, to further evaluate the site. When a final geotechnical report is prepared, we will provide more detailed recommendations and discuss other geotechnical related items including construction safety, field observations and testing, and plan review and remarks.

5. STANDARD OF CARE

The preliminary recommendations and opinions contained in this report are based on our professional judgment. The soil testing and geotechnical engineering services performed for this project have been performed with the level of skill and diligence ordinarily exercised by reputable members of the same profession under similar circumstances, at the same time and in the same or a similar locale. No warranty, either express or implied, is made.

APPENDIX A

Boring Location Map
Test Pit Map
Logs of Penetration Test Borings
Symbols and Terminology on Test Boring Log
Notice to Report Users Boring Log Information
Unified Soil Classification Sheet (USCS)



Soil Boring Location Sketch
Preliminary Geotechnical Report
Proposed Hennepin County Medical Examiners Building
6701 W. 78th Street
Bloomington, MN





Test Pit Location
Preliminary Geotechnical Report
Proposed Hennepin County Medical Examiners Building
6701 West 78th Street
Bloomington, MN 55439





LOG OF TEST BORING

PROJECT NAME: HCPW - 6701 W 78th Street
CLIENT/WSB #: 03392-010

PROJECT LOCATION: Bloomington, MN
SURFACE ELEVATION: 839.4 ft

BORING NUMBER PB 1

PAGE 1 OF 1

DEPTH (ft)	ELEV. (ft)	DESCRIPTION OF MATERIAL	USCS	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS				
							No.	TYPE	MC (%)	DD (pcf)	LL (%)	PL (%)	
1	838	 CRUSHED ROCK 0 - 4" CLAYEY SAND WITH A LITTLE GRAVEL, brown, moist, firm to hard to firm to hard	SC	Fill Fill	14		1	HSA					
2	837						2	SB					
3	836						3	SB					
4	835						4	SB					
5	834						5	SB					
6	833						6	SB					
7	832						7	SB					
8	831						8	SB					
9	830						9	SB					
10	829						10	SB					
11	828						11	SB					
12	827						 LEAN CLAY WITH SAND AND LITTLE GRAVEL, brown, moist, firm	CL	Glacial Till	9		6	SB
13	826	7	SB										
14	825	 SAND, fine grained, brown, water bearing, medium dense	SP	Coarse Alluvium	18		7	SB					
15	824						8	SB					
16	823						9	SB					
17	822						10	SB					
18	821						11	SB					
19	820						12	SB					
20	819						13	SB					
21	818						14	SB					
22	817						15	SB					
23	816						16	SB					
24	815						17	SB					
25	814						End of Boring 25.0 ft.			7		9	SB
26	813												
WATER LEVEL MEASUREMENTS				START: 11/17/2016				END: 11/17/2016					
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER DEPTH	WATER ELEVATION	METHOD	Crew Chief:		Logged By:			
								J. Tatro		DAJ			
11/17/2016	10:00 am	25	24.5		14.6	824.8	3 1/4" HSA 0' - 24.5'	Notes:					

WSB BORING LOG - WSB.GDT - 12/7/16 08:00 - K:\03392-010\GEOTECH-CMT\HCPW - 6701 W 78TH ST. BLOOMINGTON MN.GPJ



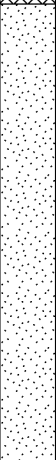
LOG OF TEST BORING

PROJECT NAME: HCPW - 6701 W 78th Street
CLIENT/WSB #: 03392-010

PROJECT LOCATION: Bloomington, MN
SURFACE ELEVATION: 831.6 ft

BORING NUMBER PB 2

PAGE 1 OF 1

DEPTH (ft)	ELEV. (ft)	DESCRIPTION OF MATERIAL				USCS	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS					
										No.	TYPE	MC (%)	DD (pcf)	LL (%)	PL (%)		
1	831		FILL, mostly Silty Sand, a little Lean Clay, brown, dark brown					Fill	13		1	HSA					
2	830																
3	829																
4	828																
5	827																
6	826																
7	825		SAND WITH GRAVEL, fine to medium grained, brown, moist, medium dense				SP	Coarse Alluvium	18		4	SB					
8	824																
9	823																
10	822																
11	821																
12	820																
13	819																
14	818																
15	817		LEAN CLAY WITH SAND AND A LITTLE GRAVEL, dark gray, moist, firm to hard, a few lenses of water bearing sand				CL	Glacial Till	12		7	SB					
16	816																
17	815																
18	814																
19	813																
20	812																
21	811																
22	810																
23	809																
24	808																
25	807	End of Boring 25.0 ft.						22		9	SB						
26	806																
WATER LEVEL MEASUREMENTS							START: 11/22/2016					END: 11/22/2016					
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER DEPTH	WATER ELEVATION	METHOD	Crew Chief:		Logged By:							
								J. Tatro		DAJ							
11/22/2016	11:45 am	25	24.5		23.0	808.6	3 1/4" HSA 0' - 24.5'	Notes:									

WSB BORING LOG - WSB.GDT - 12/7/16 08:00 - K:\03392-010\GEOTECH-CMT\HCPW - 6701 W 78TH ST. BLOOMINGTON MN.GPJ



LOG OF TEST BORING

PROJECT NAME: HCPW - 6701 W 78th Street
CLIENT/WSB #: 03392-010

PROJECT LOCATION: Bloomington, MN
SURFACE ELEVATION: 829.6 ft

BORING NUMBER PB 3

PAGE 1 OF 1

DEPTH (ft)	ELEV. (ft)	DESCRIPTION OF MATERIAL	USCS	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS					
							No.	TYPE	MC (%)	DD (pcf)	LL (%)	PL (%)		
1	829	FILL, mostly Silty Sand, a little Sand and Gravel, brown, a few Cobbles		Fill	4	50/3	1	HSA						
2	828						2	SB						
3	827						3	SB						
4	826						4	SB						
5	825	LEAN CLAY WITH SAND AND A LITTLE GRAVEL, brown, moist, soft	CL	Glacial Till	7		5	SB						
6	824						6	SB						
7	823						7	SB						
8	822						8	SB						
9	821	SAND WITH GRAVEL, fine to medium grained, brown, moist to water bearing at 23', loose	SP	Coarse Alluvium	6	▽	9	SB						
10	820						10	SB						
11	819						11	SB						
12	818						12	SB						
13	817						13	SB						
14	816						14	SB						
15	815						15	SB						
16	814						16	SB						
17	813						17	SB						
18	812						18	SB						
19	811						19	SB						
20	810						20	SB						
21	809						21	SB						
22	808						22	SB						
23	807						23	SB						
24	806						24	SB						
25	805	End of Boring 25.0 ft.			8		9	SB						
26	804													
WATER LEVEL MEASUREMENTS					START: 11/22/2016				END: 11/22/2016					
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER DEPTH	WATER ELEVATION	METHOD	Crew Chief:		Logged By:				
								J. Tatro		DAJ				
11/22/2016	1:30 pm	25	24.5		23.0	806.6	3 1/4" HSA 0' - 24.5'	Notes:						

WSB BORING LOG - WSB.GDT - 12/7/16 08:00 - K:\03392-010\GEOTECH-CMTHCPW - 6701 W 78TH ST. BLOOMINGTON MN.GPJ



LOG OF TEST BORING

PROJECT NAME: HCPW - 6701 W 78th Street
CLIENT/WSB #: 03392-010

PROJECT LOCATION: Bloomington, MN
SURFACE ELEVATION: 826.8 ft

BORING NUMBER PB 4

PAGE 1 OF 1

DEPTH (ft)	ELEV. (ft)	DESCRIPTION OF MATERIAL	USCS	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS				
							No.	TYPE	MC (%)	DD (pcf)	LL (%)	PL (%)	
1	826	FILL, mostly Sand, a little Silty Sand and Gravel, dark brown, brown		Fill	9		1	HSA					
2	825						2	SB					
3	824						3	SB					
4	823						4	SB					
5	822						5	SB					
6	821						6	SB					
7	820						7	SB					
8	819						8	SB					
9	818						9	SB					
10	817	LEAN CLAY WITH SAND AND A LITTLE GRAVEL, dark gray, moist, firm to soft to firm	CL	Glacial Till	11		5	SB					
11	816						6	SB					
12	815						7	SB					
13	814						8	SB					
14	813						9	SB					
15	812						10	SB					
16	811						11	SB					
17	810						12	SB					
18	809						13	SB					
19	808						14	SB					
20	807						15	SB					
21	806						16	SB					
22	805	SAND, fine grained, gray, wet, loose	SP	Coarse Alluvium	7		8	SB					
23	804						9	SB					
24	803						10	SB					
25	802	End of Boring 25.0 ft.					7		9	SB			
26	801												
WATER LEVEL MEASUREMENTS					START: 11/22/2016				END: 11/22/2016				
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER DEPTH	WATER ELEVATION	METHOD	Crew Chief:		Logged By:			
								J. Tatro		DAJ			
11/22/2016	11:00 am	25	24.5		None		3 1/4" HSA 0' - 24.5'	Notes:					

WSB BORING LOG - WSB.GDT - 12/7/16 08:00 - K:\03392-010\GEOTECH-CMT\HCPW - 6701 W 78TH ST. BLOOMINGTON MN.GPJ



LOG OF TEST BORING

 PROJECT NAME: HCPW - 6701 W 78th Street
 CLIENT/WSB #: 03392-010

 PROJECT LOCATION: Bloomington, MN
 SURFACE ELEVATION: 825.9 ft

BORING NUMBER PB 5

PAGE 1 OF 1

DEPTH (ft)	ELEV. (ft)	DESCRIPTION OF MATERIAL				USCS	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS					
										No.	TYPE	MC (%)	DD (pcf)	LL (%)	PL (%)		
1	825		FILL, mostly Sand, a little Gravel, dark brown, brown					Fill	18		1	HSA					
2	824																
3	823										2	SB					
4	822																
5	821																
6	820										3	SB					
7	819		SAND WITH GRAVEL, medium to fine grained, brown, wet to water bearing at 8', loose to medium dense				SP	Coarse Alluvium	10		4	SB					
8	818																
9	817																
10	816																
11	815										5	SB					
12	814																
13	813																
14	812										6	SB					
15	811																
16	810										SAND, fine to medium grained, brown, water bearing, medium dense				SP	Coarse Alluvium	16
17	809																
18	808																
19	807																
20	806		SAND WITH GRAVEL, medium to fine grained, brown, water bearing, medium dense				SP	Coarse Alluvium	16		8	SB					
21	805																
22	804																
23	803																
24	802																
25	801		LEAN CLAY WITH SAND AND A LITTLE GRAVEL, dark gray, moist, firm				CL	Glacial Till	9		9	SB					
26	800		End of Boring 25.0 ft.														
WATER LEVEL MEASUREMENTS							START: 11/22/2016					END: 11/22/2016					
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER DEPTH	WATER ELEVATION	METHOD	Crew Chief:		Logged By:							
								J. Tatro		DAJ							
11/22/2016	2:15 pm	25	24.5		8.0	817.9	3 1/4" HSA 0' - 24.5'	Notes:									

WSB BORING LOG - WSB.GDT - 12/7/16 08:00 - K:\03392-010\GEOTECH-CMT\HCPW - 6701 W 78TH ST. BLOOMINGTON MN.GPJ



LOG OF TEST BORING

PROJECT NAME: HCPW - 6701 W 78th Street
CLIENT/WSB #: 03392-010

PROJECT LOCATION: Bloomington, MN
SURFACE ELEVATION: 832.2 ft

BORING NUMBER PB 6

PAGE 1 OF 1

DEPTH (ft)	ELEV. (ft)	DESCRIPTION OF MATERIAL	USCS	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS				
							No.	TYPE	MC (%)	DD (pcf)	LL (%)	PL (%)	
1	831	CRUSHED LIMESTONE 0 - 4" FILL, a mixture of Sand, Silty Sand, a little Gravel		Fill Fill	15		1	HSA					
2	830												
3	829						2	SB					
4	828												
5	827												
6	826						3	SB					
7	825	LEAN CLAY WITH SAND AND A LITTLE GRAVEL, brown, moist, soft	CL	Glacial Till	6								
8	824						4	SB	11	121			
9	823												
10	822	LEAN CLAY WITH SAND AND A LITTLE GRAVEL, dark gray, wet, firm to soft to firm dense	CL	Glacial Till	9								
11	821						5	SB					
12	820												
13	819						6	SB					
14	818												
15	817												
16	816						7	SB					
17	815												
18	814												
19	813												
20	812				10								
21	811						8	SB					
22	810												
23	809												
24	808	SAND WITH A LITTLE GRAVEL, fine to medium grained, gray, water bearing, medium dense	SP	Coarse Alluvium	14								
25	807						9	SB					
26	806	End of Boring 25.0 ft.											

WATER LEVEL MEASUREMENTS

START: 11/17/2016

END: 11/17/2016

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER DEPTH	WATER ELEVATION	METHOD	Crew Chief:	Logged By:
11/17/2016	12:05 pm	25	24.5		18.5	813.7	3 1/4" HSA 0' - 24.5'	J. Tatro	DAJ

WSB BORING LOG - WSB.GDT - 12/7/16 08:00 - K:\03392-010\GEOTECH-CMT\HCPW - 6701 W 78TH ST. BLOOMINGTON MN.GPJ

Notes:



LOG OF TEST BORING

PROJECT NAME: HCPW - 6701 W 78th Street
CLIENT/WSB #: 03392-010

PROJECT LOCATION: Bloomington, MN
SURFACE ELEVATION: 830.8 ft

BORING NUMBER PB 7

PAGE 1 OF 1

DEPTH (ft)	ELEV. (ft)	DESCRIPTION OF MATERIAL	USCS	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS						
							No.	TYPE	MC (%)	DD (pcf)	LL (%)	PL (%)			
1	830		FILL, mostly Sand, a little Silty Sand, a little Lean Clay, brown, dark brown, a few Cobbles		Fill	14		1	HSA						
2	829							2	SB						
3	828							3	SB						
4	827							4	SB						
5	826							5	SB						
6	825							6	SB						
7	824							7	SB						
8	823							8	SB						
9	822							9	SB						
10	821		SAND WITH GRAVEL, fine to medium grained, brown, moist, loose to medium dense	SP	Coarse Alluvium	9		5	SB						
11	820							6	SB						
12	819							7	SB						
13	818							8	SB						
14	817							9	SB						
15	816							10	SB						
16	815							11	SB						
17	814							12	SB						
18	813							13	SB						
19	812		SAND, fine to medium grained, brown, water bearing, medium dense	SP	Coarse Alluvium	13	▽	7	SB						
20	811							8	SB						
21	810							9	SB						
22	809							10	SB						
23	808							11	SB						
24	807							12	SB						
25	806							13	SB						
26	805							14	SB						
27	804							15	SB						
28	803	16	SB												
29	802	17	SB												
30	801	18	SB												
31	800	19	SB												
32	799	20	SB												
33	798	21	SB												
34	797	22	SB												
35	796	23	SB												
36	795	24	SB												
37	794	25	SB												
38	793	26	SB												
39	792	27	SB												
40	791	28	SB												
41	790	29	SB												
42	789	30	SB												
43	788	31	SB												
44	787	32	SB												
45	786	33	SB												
46	785	34	SB												
47	784	35	SB												
48	783	36	SB												
49	782	37	SB												
50	781	38	SB												
51	780	39	SB												
52	779	40	SB												
53	778	41	SB												
54	777	42	SB												
55	776	43	SB												
56	775	44	SB												
57	774	45	SB												
58	773	46	SB												
59	772	47	SB												
60	771	48	SB												
61	770	49	SB												
62	769	50	SB												
63	768	51	SB												
64	767	52	SB												
65	766	53	SB												
66	765	54	SB												
67	764	55	SB												
68	763	56	SB												
69	762	57	SB												
70	761	58	SB												
71	760	59	SB												
72	759	60	SB												
73	758	61	SB												
74	757	62	SB												
75	756	63	SB												
76	755	64	SB												
77	754	65	SB												
78	753	66	SB												
79	752	67	SB												
80	751	68	SB												
81	750	69	SB												
82	749	70	SB												
83	748	71	SB												
84	747	72	SB												
85	746	73	SB												
86	745	74	SB												
87	744	75	SB												
88	743	76	SB												
89	742	77	SB												
90	741	78	SB												
91	740	79	SB												
92	739	80	SB												
93	738	81	SB												
94	737	82	SB												
95	736	83	SB												
96	735	84	SB												
97	734	85	SB												
98	733	86	SB												
99	732	87	SB												
100	731	88	SB												
101	730	89	SB												
102	729	90	SB												
103	728	91	SB												
104	727	92	SB												
105	726	93	SB												
106	725	94	SB												
107	724	95	SB												
108	723	96	SB												
109	722	97	SB												
110	721	98	SB												
111	720	99	SB												
112	719	100	SB												
113	718	101	SB												
114	717	102	SB												
115	716	103	SB												
116	715	104	SB												
117	714	105	SB												
118	713	106	SB												
119	712	107	SB												
120	711	108	SB												
121	710	109	SB												
122	709	110	SB												
123	708	111	SB												
124	707	112	SB												
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126	705	114	SB												
127	704	115	SB												
128	703	116	SB												
129	702	117	SB												
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131	700	119	SB												
132	699	120	SB												
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143	688	131	SB												
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148	683	136	SB												
149	682	137	SB												
150	681	138	SB												
151	680	139	SB												
152	679	140	SB												
153	678	141	SB												
154	677	142	SB												
155	676	143	SB												
156	675	144	SB												
157	674	145	SB												
158	673	146	SB												
159	672	147	SB												
160	671	148	SB												
161	670	149	SB												
162	669	150	SB												
163	668	151	SB												
164	667	152	SB												
165	666	153	SB												
166	665	154	SB												
167	664	155	SB												
168	663	156	SB												
169	662	157	SB												
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176	655	164	SB												
177	654	165	SB												
178	653	166	SB												
179	652	167	SB												
180	651	168	SB												
181	650	169	SB												
182	649	170	SB												
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194	637	182	SB												
195	636	183	SB												
196	635	184	SB												
197	634	185	SB												
198	633	186	SB												
199	632	187	SB												
200	631	188	SB												
201	630	189	SB												
202	629	190	SB												
203	628	191	SB												
204	627	192	SB												
205	626	193	SB												
206	625	194	SB												
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208	623	196	SB												
209	622	197	SB												
210	621	198	SB												
211	620	199	SB												
212	619	200	SB												
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261	570	249	SB												
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263	568	251	SB												
264	567	252	SB												
265	566	253	SB												
266	565	254	SB												
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350	481	338	SB												
351	480	339	SB												
352	479	340	SB												
353	478	341	SB												
354	477														

WSB BORING LOG - WSB.GDT - 12/7/16 08:00 - K:\03392-010\GEOTECH\CMTHCPW - 6701 W 78TH ST. BLOOMINGTON MN.GPJ



LOG OF TEST BORING

PROJECT NAME: HCPW - 6701 W 78th Street
CLIENT/WSB #: 03392-010

PROJECT LOCATION: Bloomington, MN
SURFACE ELEVATION: 828.8 ft

BORING NUMBER PB 8

PAGE 1 OF 1

DEPTH (ft)	ELEV. (ft)	DESCRIPTION OF MATERIAL	USCS	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS				
							No.	TYPE	MC (%)	DD (pcf)	LL (%)	PL (%)	
1	828	FILL, mostly Sand with Gravel, a little Silty Sand, brown		Fill	16		1	HSA					
2	827												
3	826						2	SB					
4	825												
5	824												
6	823						3	SB					
7	822												
8	821						4	SB					
9	820												
10	819	LEAN CLAY, gray, moist, firm	CL	Fine Alluvium	12		5	SB					
11	818												
12	817	SAND WITH GRAVEL, fine to medium grained, brown, wet, loose	SP	Coarse Alluvium	10								
13	816						6	SB					
14	815												
15	814	LEAN CLAY, dark gray, wet, soft	CL	Fine Alluvium	6		7	SB					
16	813												
17	812	SAND WITH GRAVEL, fine to medium grained, brown, wet to water bearing at 22', medium dense	SP	Coarse Alluvium	20	▽							
18	811												
19	810												
20	809						8	SB					
21	808												
22	807												
23	806												
24	805												
25	804						9	SB					
26	803	End of Boring 25.0 ft.			16								

WATER LEVEL MEASUREMENTS

START: 11/22/2016

END: 11/22/2016

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER DEPTH	WATER ELEVATION	METHOD	Crew Chief:	Logged By:
11/22/2016	8:05 am	25	24.5		22.0	806.8	3 1/4" HSA 0' - 24.5'	J. Tatro	DAJ

WSB BORING LOG - WSB.GDT - 12/7/16 08:00 - K:\03392-010\GEOTECH-CMT\HCPW - 6701 W 78TH ST. BLOOMINGTON MN.GPJ

Notes:



LOG OF TEST BORING

PROJECT NAME: HCPW - 6701 W 78th Street
CLIENT/WSB #: 03392-010

PROJECT LOCATION: Bloomington, MN
SURFACE ELEVATION: 826.1 ft

BORING NUMBER PB 9

PAGE 1 OF 1

DEPTH (ft)	ELEV. (ft)	DESCRIPTION OF MATERIAL				USCS	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS					
										No.	TYPE	MC (%)	DD (pcf)	LL (%)	PL (%)		
1	825		FILL, mostly Sand, Sand with Gravel, brown					Fill	12		1	HSA					
2	824										2	SB					
3	823										3	SB					
4	822										4	SB					
5	821										5	SB					
6	820										6	SB					
7	819										7	SB					
8	818										8	SB					
9	817										9	SB					
10	816										10	SB					
11	815		LEAN CLAY WITH SAND AND A LITTLE GRAVEL, dark gray, moist to wet, firm to hard to firm to soft				CL	Glacial Till	14		6	SB					
12	814										7	SB					
13	813										8	SB					
14	812										9	SB					
15	811										10	SB					
16	810										11	SB					
17	809										12	SB					
18	808										13	SB					
19	807										14	SB					
20	806										15	SB					
21	805										16	SB					
22	804										17	SB					
23	803										18	SB					
24	802										19	SB					
25	801										20	SB					
26	800	21	SB														
End of Boring 25.0 ft.																	
WATER LEVEL MEASUREMENTS							START: 11/22/2016			END: 11/22/2016							
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER DEPTH	WATER ELEVATION	METHOD	Crew Chief:		Logged By:							
								J. Tatro		DAJ							
11/22/2016	8:50 am	25	24.5		25.0	801.1	3 1/4" HSA 0' - 24.5'	Notes:									

WSB BORING LOG - WSB.GDT - 12/7/16 08:00 - K:\03392-010\GEOTECH-CMT\HCPW - 6701 W 78TH ST. BLOOMINGTON MN.GPJ



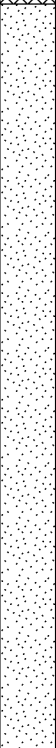
LOG OF TEST BORING

PROJECT NAME: HCPW - 6701 W 78th Street
CLIENT/WSB #: 03392-010

PROJECT LOCATION: Bloomington, MN
SURFACE ELEVATION: 825.1 ft

BORING NUMBER PB 10

PAGE 1 OF 1

DEPTH (ft)	ELEV. (ft)	DESCRIPTION OF MATERIAL				USCS	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS					
										No.	TYPE	MC (%)	DD (pcf)	LL (%)	PL (%)		
1	824		FILL, a mixture of Sand, Sand with Silt and Gravel, brown, dark brown					Fill	27		1	HSA					
2	823																
3	822										2	SB					
4	821																
5	820																
6	819										3	SB					
7	818		SAND WITH A LITTLE GRAVEL, fine to medium grained, brown, wet to water bearing at 9', medium dense				SP	Coarse Alluvium	12		4	SB					
8	817																
9	816																
10	815																
11	814																
12	813																
13	812																
14	811																
15	810																
16	809																
17	808																
18	807																
19	806																
20	805											LEAN CLAY WITH SAND AND A LITTLE GRAVEL, dark gray, moist, hard				CL	Glacial Till
21	804																
22	803																
23	802																
24	801																
25	800																
26	799		End of Boring 25.0 ft.						18		9	SB					
WATER LEVEL MEASUREMENTS							START: 11/21/2016					END: 11/21/2016					
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER DEPTH	WATER ELEVATION	METHOD	Crew Chief:		Logged By:							
								J. Tatro		DAJ							
11/21/2016	2:00 pm	25	24.5		9.0	816.1	3 1/4" HSA 0' - 24.5'	Notes:									

WSB BORING LOG - WSB.GDT - 12/7/16 08:00 - K:\03392-010\GEOTECH-CMT\HCPW - 6701 W 78TH ST. BLOOMINGTON MN.GPJ



LOG OF TEST BORING

PROJECT NAME: HCPW - 6701 W 78th Street
CLIENT/WSB #: 03392-010

PROJECT LOCATION: Bloomington, MN
SURFACE ELEVATION: 830.9 ft

BORING NUMBER PB 11

PAGE 1 OF 1

DEPTH (ft)	ELEV. (ft)	DESCRIPTION OF MATERIAL	USCS	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS				
							No.	TYPE	MC (%)	DD (pcf)	LL (%)	PL (%)	
1	830	CRUSHED LIMESTONE 0 - 13"		Fill			1	HSA					
2	829	FILL, a mixture of Silty Sand, Lean Clay, a few pieces of Limestone, a few pieces of Wood		Fill			2	SB					
3	828				14		3	SB					
4	827						4	SB					
5	826				3		5	SB					
6	825						6	SB					
7	824				7		7	SB					
8	823						8	SB					
9	822				4		9	SB					
10	821												
11	820												
12	819	LEAN CLAY, gray, wet, very soft	CL	Fine Alluvium									
13	818				1		6	SB					
14	817												
15	816	FAT CLAY, dark gray, saturated, very soft	CH	Fine Alluvium									
16	815				2		7	SB					
17	814												
18	813												
19	812												
20	811	LEAN CLAY, dark gray, wet, very soft	CL	Fine Alluvium									
21	810				3		8	SB					
22	809												
23	808												
24	807	SAND WITH A LITTLE GRAVEL, brown, water bearing, loose	SP	Coarse Alluvium									
25	806	End of Boring 25.0 ft.			9		9	SB					
26	805												
WATER LEVEL MEASUREMENTS							START: 11/17/2016			END: 11/17/2016			
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER DEPTH	WATER ELEVATION	METHOD		Crew Chief:		Logged By:		
11/17/2016	1:35 pm	25	24.5		18.5	812.4	3 1/4" HSA 0' - 24.5'		J. Tatro		DAJ		
											Notes:		

WSB BORING LOG - WSB.GDT - 12/7/16 08:00 - K:\03392-010\GEOTECH-CMT\HCPW - 6701 W 78TH ST. BLOOMINGTON MN.GPJ



LOG OF TEST BORING

BORING NUMBER PB 12

PROJECT NAME: HCPW - 6701 W 78th Street

PROJECT LOCATION: Bloomington, MN

CLIENT/WSB #: 03392-010

SURFACE ELEVATION: 829.8 ft

PAGE 1 OF 1

DEPTH (ft)	ELEV. (ft)	DESCRIPTION OF MATERIAL	USCS	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS				
							No.	TYPE	MC (%)	DD (pcf)	LL (%)	PL (%)	
1	829	FILL, a mostly Sand with Gravel, a few pieces of Limestone, brown, dark brown		Fill	8		1	HSA					
2	828												
3	827						2	SB					
4	826												
5	825												
6	824						3	SB					
7	823												
8	822						4	SB					
9	821	LEAN CLAY, gray, moist to wet, soft	CL	Fine Alluvium	8	▽							
10	820						5	SB					
11	819												
12	818												
13	817	SAND WITH A LITTLE GRAVEL, medium to fine grained, brown, water bearing, loose	SP	Coarse Alluvium	5		6	SB					
14	816												
15	815												
16	814						7	SB					
17	813												
18	812												
19	811												
20	810												
21	809	SAND WITH A LITTLE GRAVEL, fine to medium grained, gray, water bearing, loose	SP	Coarse Alluvium	7		8	SB					
22	808												
23	807												
24	806												
25	805	End of Boring 25.0 ft.			9		9	SB					
26	804												
WATER LEVEL MEASUREMENTS					START: 11/21/2016				END: 11/21/2016				
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER DEPTH	WATER ELEVATION	METHOD	Crew Chief:		Logged By:			
								J. Tatro		DAJ			
11/21/2016	11:20 am	25	24.5		12.0	817.8	3 1/4" HSA 0' - 24.5'	Notes:					

WSB BORING LOG - WSB.GDT - 12/7/16 08:00 - K:\03392-010\GEOTECH-CMT\HCPW - 6701 W 78TH ST. BLOOMINGTON MN.GPJ



LOG OF TEST BORING

PROJECT NAME: HCPW - 6701 W 78th Street
CLIENT/WSB #: 03392-010

PROJECT LOCATION: Bloomington, MN
SURFACE ELEVATION: 828 ft

BORING NUMBER PB 13

PAGE 1 OF 1

DEPTH (ft)	ELEV. (ft)	DESCRIPTION OF MATERIAL	USCS	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS				
							No.	TYPE	MC (%)	DD (pcf)	LL (%)	PL (%)	
1	827	FILL, a mixture of Sand, Sand with Silt, a little Gravel, brown		Fill	10		1	HSA					
2	826						2	SB					
3	825						3	SB					
4	824						4	SB					
5	823						5	SB					
6	822						6	SB					
7	821	SAND WITH A LITTLE GRAVEL, fine to medium grained, brown, wet to water bearing, very loose to loose	SP	Coarse Alluvium	9	▽	7	SB					
8	820						8	SB					
9	819						9	SB					
10	818						10	SB					
11	817						11	SB					
12	816						12	SB					
13	815	SAND WITH A LITTLE GRAVEL, medium to fine grained, brown, water bearing, loose	SP	Coarse Alluvium	8		13	SB					
14	814						14	SB					
15	813						15	SB					
16	812						16	SB					
17	811						17	SB					
18	810						18	SB					
19	809	SANDY LEAN CLAY WITH A LITTLE GRAVEL, gray, wet, firm	CL	Glacial Till	11		19	SB					
20	808						20	SB					
21	807						21	SB					
22	806						22	SB					
23	805						23	SB					
24	804						24	SB					
25	803	SAND, fine to medium grained, brown, water bearing, medium dense	SP	Coarse Alluvium	20		9	SB					
26	802	End of Boring 25.0 ft.											

WATER LEVEL MEASUREMENTS

START: 11/21/2016

END: 11/21/2016

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER DEPTH	WATER ELEVATION	METHOD	Crew Chief:	Logged By:
11/21/2016	1:00 pm	25	24.5		8.0	820	3 1/4" HSA 0' - 24.5'	J. Tatro	DAJ

WSB BORING LOG - WSB.GDT - 12/7/16 08:00 - K:\03392-010\GEO\TECH\CMTHCPW - 6701 W 78TH ST. BLOOMINGTON MN.GPJ

Notes:



LOG OF TEST BORING

PROJECT NAME: HCPW - 6701 W 78th Street
CLIENT/WSB #: 03392-010

PROJECT LOCATION: Bloomington, MN
SURFACE ELEVATION: 825.7 ft

BORING NUMBER PB 14

PAGE 1 OF 1

DEPTH (ft)	ELEV. (ft)	DESCRIPTION OF MATERIAL	USCS	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS					
							No.	TYPE	MC (%)	DD (pcf)	LL (%)	PL (%)		
1	825		FILL, a mixture of Sand, Sand with Silt, a little Gravel, brown		Fill	16		1	HSA					
2	824							2	SB					
3	823							3	SB					
4	822													
5	821													
6	820													
7	819		SAND, fine to medium grained, brown, wet to water bearing at 8', loose	SP	Coarse Alluvium	8	▽	4	SB					
8	818													
9	817													
10	816													
11	815													
12	814													
13	813		SAND WITH A LITTLE GRAVEL, medium to fine grained, brown, water bearing, very loose	SP	Coarse Alluvium	2		6	SB					
14	812													
15	811													
16	810													
17	809													
18	808													
19	807		SAND, fine to medium grained, brown, water bearing, loose to medium dense	SP	Coarse Alluvium	6		7	SB					
20	806													
21	805													
22	804													
23	803													
24	802													
25	801		SAND WITH GRAVEL, fine to medium grained, brown, water bearing, medium dense	SP	Coarse Alluvium	12		9	SB					
26	800													
WATER LEVEL MEASUREMENTS					START: 11/21/2016				END: 11/21/2016					
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER DEPTH	WATER ELEVATION	METHOD	Crew Chief:		Logged By:				
								J. Tatro		DAJ				
11/21/2016	2:00 pm	25	24.5		8.0	817.7	3 1/4" HSA 0' - 24.5'	Notes:						

WSB BORING LOG - WSB.GDT - 12/7/16 08:00 - K:\03392-010\GEOTECH-CMT\HCPW - 6701 W 78TH ST. BLOOMINGTON MN.GPJ



LOG OF TEST BORING

BORING NUMBER PB 15

PROJECT NAME: HCPW - 6701 W 78th Street

PROJECT LOCATION: Bloomington, MN

CLIENT/WSB #: 03392-010

SURFACE ELEVATION: 825.4 ft

PAGE 1 OF 1

DEPTH (ft)	ELEV. (ft)	DESCRIPTION OF MATERIAL				USCS	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS					
										No.	TYPE	MC (%)	DD (pcf)	LL (%)	PL (%)		
1	824		FILL, mostly Silty Sand with Gravel, brown, moist					Fill			1	HSA					
2	823		ORGANIC CLAY, black, a few Roots, moist, firm				OL	Topsoil	10		2	SB					
3	822																
4	821																
5	820		SILTY SAND WITH A LITTLE GRAVEL, gray, wet, loose				SM	Coarse Alluvium	7		3	SB					
6	819																
7	818																
8	817		SAND, fine to medium grained, brown, wet to water bearing, loose				SP	Coarse Alluvium	10	▽	4	SB					
9	816																
10	815																
11	814		SAND WITH GRAVEL, medium to coarse grained, brown, water bearing, medium dense to loose to medium dense				SP	Coarse Alluvium	11		5	SB					
12	813																
13	812																
14	811								7		6	SB					
15	810																
16	809																
17	808								10		7	SB					
18	807																
19	806																
20	805								12		8	SB					
21	804																
22	803																
23	802																
24	801																
25	800																
26	799		End of Boring 25.0 ft.						12		9	SB					
WATER LEVEL MEASUREMENTS							START: 11/21/2016					END: 11/21/2016					
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER DEPTH	WATER ELEVATION	METHOD		Crew Chief:		Logged By:						
11/21/2016	3:00 pm	25	24.5		8.8	816.6	3 1/4" HSA 0' - 24.5'		J. Tatro		DAJ						
									Notes:								

WSB BORING LOG - WSB.GDT - 12/7/16 08:00 - K:\03392-010\GEOTECH-CMT\HCPW - 6701 W 78TH ST. BLOOMINGTON MN.GPJ

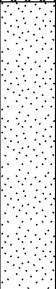
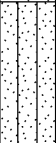


LOG OF TEST BORING

BORING NUMBER PB 16

PROJECT NAME: HCPW - 6701 W 78th Street
CLIENT/WSB #: 03392-010PROJECT LOCATION: Bloomington, MN
SURFACE ELEVATION: 828.1 ft

PAGE 1 OF 1

DEPTH (ft)	ELEV. (ft)	DESCRIPTION OF MATERIAL				USCS	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS					
										No.	TYPE	MC (%)	DD (pcf)	LL (%)	PL (%)		
1	827		FILL, mostly Silty Sand, crushed Limestone at grade, gray, brown					Fill	12		1	HSA					
2	826										2	SB					
3	825										3	SB					
4	824																
5	823																
6	822																
7	821																
8	820		SAND WITH A LITTLE GRAVEL, fine to medium grained, brown, wet, very loose to loose				SP	Coarse Alluvium	3		4	SB					
9	819																
10	818										5	SB					
11	817																
12	816		SILTY SAND WITH A LITTLE GRAVEL, gray, wet, loose				SM	Coarse Alluvium	7		6	SB					
13	815																
14	814																
15	813		SAND WITH A LITTLE GRAVEL, fine to medium grained, gray, water bearing 15 1/2', loose to very loose to loose				SP	Coarse Alluvium	5		7	SB					
16	812																
17	811																
18	810																
19	809																
20	808																
21	807										8	SB					
22	806																
23	805																
24	804																
25	803																
26	802		End of Boring 25.0 ft.						9		9	SB					
WATER LEVEL MEASUREMENTS							START: 11/17/2016			END: 11/17/2016							
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER DEPTH	WATER ELEVATION	METHOD		Crew Chief:		Logged By:						
									J. Tatro		DAJ						
11/17/2016	2:45 pm	25	24.5		15.5	812.6	3 1/4" HSA 0' - 24.5'		Notes:								

WSB BORING LOG - WSB.GDT - 12/7/16 08:00 - K:\03392-010\GEOTECH-CMT\HCPW - 6701 W 78TH ST. BLOOMINGTON MN.GPJ



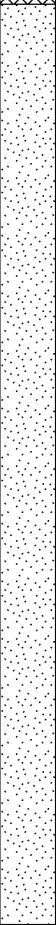
LOG OF TEST BORING

PROJECT NAME: HCPW - 6701 W 78th Street
CLIENT/WSB #: 03392-010

PROJECT LOCATION: Bloomington, MN
SURFACE ELEVATION: 826.8 ft

BORING NUMBER PB 17

PAGE 1 OF 1

DEPTH (ft)	ELEV. (ft)	DESCRIPTION OF MATERIAL	USCS	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS									
							No.	TYPE	MC (%)	DD (pcf)	LL (%)	PL (%)						
1	826	 FILL, mostly Sand, a little Sand with Silt, a little Gravel, brown		Fill	14		1	HSA										
2	825						2	SB										
3	824						3	SB										
4	823						4	SB										
5	822						5	SB										
6	821						6	SB										
7	820						7	SB										
8	819						8	SB										
9	818						 SAND WITH A LITTLE GRAVEL, fine to medium grained, brown, water bearing at 9.5', loose	SP	Coarse Alluvium	7		9	SB					
10	817	10	SB															
11	816	11	SB															
12	815	12	SB															
13	814	13	SB															
14	813	14	SB															
15	812	SAND, fine to medium grained, brown, water bearing, loose	SP	Coarse Alluvium	5							15	SB					
16	811											16	SB					
17	810											17	SB					
18	809						18	SB										
19	808						19	SB										
20	807						20	SB										
21	806						21	SB										
22	805						22	SB										
23	804						23	SB										
24	803	24	SB															
25	802	End of Boring 25.0 ft.			14		9	SB										
26	801																	
WATER LEVEL MEASUREMENTS					START: 11/21/2016				END: 11/21/2016									
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER DEPTH	WATER ELEVATION	METHOD	Crew Chief:		Logged By:								
								J. Tatro		DAJ								
11/21/2016	10:30 am	25	24.5		9.5	817.3	3 1/4" HSA 0' - 24.5'	Notes:										

WSB BORING LOG - WSB.GDT - 12/7/16 08:00 - K:\03392-010\GEOTECH-CMT\HCPW - 6701 W 78TH ST. BLOOMINGTON MN.GPJ



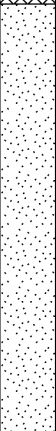
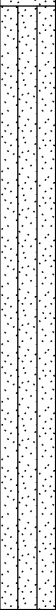
LOG OF TEST BORING

PROJECT NAME: HCPW - 6701 W 78th Street
CLIENT/WSB #: 03392-010

PROJECT LOCATION: Bloomington, MN
SURFACE ELEVATION: 825.9 ft

BORING NUMBER PB 18

PAGE 1 OF 1

DEPTH (ft)	ELEV. (ft)	DESCRIPTION OF MATERIAL				USCS	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS					
										No.	TYPE	MC (%)	DD (pcf)	LL (%)	PL (%)		
1	825		FILL, mostly Silty Sand, a few pieces of Limestone, brown					Fill	12		1	HSA					
2	824										2	SB					
3	823										3	SB					
4	822																
5	821																
6	820																
7	819		SAND WITH A LITTLE GRAVEL, fine to medium grained, brown, wet to water bearing at 11.5', loose				SP	Coarse Alluvium	6		4	SB					
8	818										5	SB					
9	817																
10	816										6	SB					
11	815																
12	814																
13	813																
14	812		SILTY SAND WITH GRAVEL, gray, water bearing, medium dense				SM	Coarse Alluvium	9		7	SB					
15	811																
16	810																
17	809																
18	808																
19	807																
20	806																
21	805																
22	804																
23	803																
24	802																
25	801		End of Boring 25.0 ft.						14		9	SB					
26	800																
WATER LEVEL MEASUREMENTS							START: 11/18/2016					END: 11/18/2016					
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER DEPTH	WATER ELEVATION	METHOD	Crew Chief:		Logged By:							
								J. Tatro		DAJ							
11/18/2016	2:30 pm	25	24.5		11.5	814.4	3 1/4" HSA 0' - 24.5'	Notes:									

WSB BORING LOG - WSB.GDT - 12/7/16 08:00 - K:\03392-010\GEOTECH-CMT\HCPW - 6701 W 78TH ST. BLOOMINGTON MN.GPJ



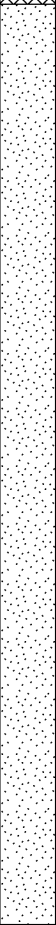
LOG OF TEST BORING

PROJECT NAME: HCPW - 6701 W 78th Street
CLIENT/WSB #: 03392-010

PROJECT LOCATION: Bloomington, MN
SURFACE ELEVATION: 824.3 ft

BORING NUMBER PB 19

PAGE 1 OF 1

DEPTH (ft)	ELEV. (ft)	DESCRIPTION OF MATERIAL	USCS	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS									
							No.	TYPE	MC (%)	DD (pcf)	LL (%)	PL (%)						
1	823			Fill	8		1	HSA										
2	822																	
3	821						2	SB										
4	820																	
5	819																	
6	818						3	SB										
7	817																	
8	816						4	SB										
9	815		SP	Coarse Alluvium	12													
10	814						5	SB										
11	813																	
12	812																	
13	811						6	SB										
14	810																	
15	809																	
16	808						7	SB										
17	807																	
18	806																	
19	805						SAND WITH GRAVEL, fine to medium grained, gray, wet to water bearing at 22', loose	SP	Coarse Alluvium	5	▽							
20	804											8	SB					
21	803																	
22	802																	
23	801	SILTY SAND, brown, water bearing, loose	SP	Coarse Alluvium	6													
24	800																	
25	799																	
26	798	End of Boring 25.0 ft.					9	SB										
WATER LEVEL MEASUREMENTS							START: 11/18/2016			END: 11/18/2016								
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER DEPTH	WATER ELEVATION	METHOD	Crew Chief:		Logged By:								
								J. Tatro		DAJ								
11/18/2016	1:45 pm	25	24.5		22.0	802.3	3 1/4" HSA 0' - 24.5'	Notes:										

WSB BORING LOG - WSB.GDT - 12/7/16 08:00 - K:\03392-010\GEOTECH-CMT\HCPW - 6701 W 78TH ST. BLOOMINGTON MN.GPJ



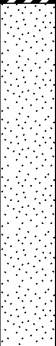
LOG OF TEST BORING

PROJECT NAME: HCPW - 6701 W 78th Street
CLIENT/WSB #: 03392-010

PROJECT LOCATION: Bloomington, MN
SURFACE ELEVATION: 825.7 ft

BORING NUMBER PB 20

PAGE 1 OF 1

DEPTH (ft)	ELEV. (ft)	DESCRIPTION OF MATERIAL	USCS	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS				
							No.	TYPE	MC (%)	DD (pcf)	LL (%)	PL (%)	
1	825	 FILL, a mixture of Silty Sand, Sand, a little Gravel, a few pieces of Limestone, dark brown, brown		Fill	8		1	HSA					
2	824						2	SB					
3	823						3	SB					
4	822												
5	821	 LEAN CLAY, gray, wet, very soft	CL	Fine Alluvium	2		4	SB	21	91			
6	820												
7	819						5	SB					
8	818												
9	817	 FAT CLAY, gray, wet, soft	CH	Fine Alluvium	2		6	SB					
10	816												
11	815						7	SB					
12	814												
13	813	 SILTY SAND WITH A LITTLE GRAVEL, gray, water bearing, loose, a few lenses of Clay	SP	Coarse Alluvium	5		8	SB					
14	812												
15	811												
16	810												
17	809	 End of Boring 25.0 ft.			8		9	SB					
18	808												
19	807												
20	806												
21	805												
22	804												
23	803												
24	802												
25	801												
26	800												

WATER LEVEL MEASUREMENTS							START: 11/18/2016		END: 11/18/2016		
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER DEPTH	WATER ELEVATION	METHOD	Crew Chief:		Logged By:	
								J. Tatro		DAJ	
11/18/2016	9:45 am	25	24.5		18.0	807.7	3 1/4" HSA 0' - 24.5'	Notes:			

WSB BORING LOG - WSB.GDT - 12/7/16 08:00 - K:\03392-010\GEOTECH-CMT\HCPW - 6701 W 78TH ST. BLOOMINGTON MN.GPJ



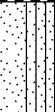
LOG OF TEST BORING

PROJECT NAME: HCPW - 6701 W 78th Street
CLIENT/WSB #: 03392-010

PROJECT LOCATION: Bloomington, MN
SURFACE ELEVATION: 825.1 ft

BORING NUMBER PB 21

PAGE 1 OF 1

DEPTH (ft)	ELEV. (ft)	DESCRIPTION OF MATERIAL	USCS	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS				
							No.	TYPE	MC (%)	DD (pcf)	LL (%)	PL (%)	
1	824	 FILL, a mixture of Sand, Silty Sand, Sand with Silt, a little Gravel, a few pieces of Limestone, brown		Fill	13		1	HSA					
2	823						2	SB					
3	822						3	SB					
4	821						4	SB					
5	820	 FAT CLAY, dark gray, wet, very soft	CH	Fine Alluvium	3		4	SB	23	95			
6	819						5	SB					
7	818	 SAND WITH SILT, fine to medium grained, gray, water bearing, loose	SP-SM	Coarse Alluvium	7	▽	6	SB					
8	817						7	SB					
9	816	 FAT CLAY, dark gray, wet, firm	CH	Fine Alluvium	10		8	SB					
10	815						9	SB					
11	814	 SAND WITH GRAVEL, fine to medium grained, gray, water bearing, loose	SP	Coarse Alluvium	8		9	SB					
12	813						10	SB					
13	812						11	SB					
14	811						12	SB					
15	810						13	SB					
16	809						14	SB					
17	808						15	SB					
18	807						16	SB					
19	806						17	SB					
20	805						18	SB					
21	804	 SAND WITH GRAVEL, fine grained, brown, water bearing, loose	SP	Coarse Alluvium	7		19	SB					
22	803						20	SB					
23	802						21	SB					
24	801	End of Boring 25.0 ft.											
25	800												
26	799												

WATER LEVEL MEASUREMENTS

START: 11/18/2016

END: 11/18/2016

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER DEPTH	WATER ELEVATION	METHOD	Crew Chief:	Logged By:
11/18/2016	11:45 am	25	24.5		11.0	814.1	3 1/4" HSA 0' - 24.5'	J. Tatro	DAJ

WSB BORING LOG - WSB.GDT - 12/7/16 08:00 - K:\03392-010\GEOTECH-CMT\HCPW - 6701 W 78TH ST. BLOOMINGTON MN.GPJ

Notes:



LOG OF TEST BORING

PROJECT NAME: HCPW - 6701 W 78th Street
CLIENT/WSB #: 03392-010

PROJECT LOCATION: Bloomington, MN
SURFACE ELEVATION: 824.4 ft

BORING NUMBER PB 22

PAGE 1 OF 1

DEPTH (ft)	ELEV. (ft)	DESCRIPTION OF MATERIAL	USCS	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS				
							No.	TYPE	MC (%)	DD (pcf)	LL (%)	PL (%)	
1	823			Fill	16		1	HSA					
2	822												
3	821						2	SB					
4	820												
5	819		SP-SM	Coarse Alluvium	8		3	SB					
6	818												
7	817												
8	816						4	SB					
9	815		CL	Fine Alluvium	6		5	SB					
10	814												
11	813												
12	812							CH	Fine Alluvium	2	▽	6	SB
13	811												
14	810												
15	809	7	SB										
16	808												
17	807												
18	806												
19	805												
20	804	8	SB										
21	803												
22	802												
23	801												
24	800												
25	799	End of Boring 25.0 ft.			2		9	SB					
26	798												
WATER LEVEL MEASUREMENTS				START: 11/18/2016				END: 11/18/2016					
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER DEPTH	WATER ELEVATION	METHOD	Crew Chief:		Logged By:			
								J. Tatro		DAJ			
11/18/2016	12:30 pm	25	24.5		19.0	805.4	3 1/4" HSA 0' - 24.5'	Notes:					

WSB BORING LOG - WSB.GDT - 12/7/16 08:00 - K:\03392-010\GEOTECH-CMT\HCPW - 6701 W 78TH ST. BLOOMINGTON MN.GPJ

SYMBOLS AND TERMINOLOGY ON TEST BORING LOG

SYMBOLS			
Drilling and Sampling		Laboratory Testing	
<u>Symbol</u>	<u>Description</u>	<u>Symbol</u>	<u>Description</u>
HSA	3-1/4" LD. Hollow stem auger	W	Water content, % (ASTM** D2216)
_FA	4", 6" or 10" diameter flight auger	D	Dry density, pcf
_HA	2", 4", or 6" hand auger	LL	Liquid limit (ASTM D4318)
_DC	2-1/2", 4", 5", or 6" steel drive casing	PL	Plastic limit (ASTM D4318)
_RC	Size A, B or N rotary casing		
PD	Pipe drill or cleanout tube		-Inserts in last column (Qu or RQD)-
CS	Continuous split barrel sampling	Qu	Unconfined compressive strength, psf (ASTM D2166)
DM	Drilling mud	Pq	Penetrometer reading, tsf (ASTM D1558)
JW	Jetting water	Ts	Torvane reading, tsf
SB	2" O.D. split barrel sampling	G	Specific gravity (ASTM D854)
_L	2-1/2" or 3-1/2" O.D. SB liner sampler	SL	Shrinkage limits (ASTM D427)
_T	2" or 3" thin walled tube sample	OC	Organic content-combustion method (ASTM D2974)
3TP	3" thin walled tube using pitcher sampler	SP	Swell pressure, tsf (ASTM D4546)
_TO	2" or 3" thin walled tube using Osterberg sampler	PS	Percent swell under pressure (ASTM D4546)
W	Wash sample	FS	Free swell, % (ASTM D4546)
B	Bag sample	SS	Shrink swell, % (ASTM D4546)
P	Test pit sample	pH	Hydrogen ion content-Meter Method (ASTM D4972)
_Q	BQ, NQ, or PQ wire line system	SC	Sulfate content, parts/million or mg/l
_X	AX, BX, or NX double tube barrel	CC	Chloride content, parts/million or mg/l
N	Standard penetration test, blows per foot	C*	One dimensional consolidation (ASTM D2435)
CR	Core recovery, percent	Qc*	Triaxial compression (ASSTM D2850 and D4767)
WL	Water level	D.S.*	Direct Shear (ASTM D3080)
▼	Water level	K*	Coefficient of permeability, cm/sec (ASTM D2434)
NMR	No measurement recorded, primarily due to presence of drilling or coring fluid.	P*	Pinhole test (ASTM D4647)
		DH*	Double hydrometer (ASTM D4221)
		MA*	Particle size analysis (ASTM D422)
		R	Laboratory electrical resistivity, ohm-cm (ASTM G57)
		E*	Pressuremeter deformation modulus, tsf (ASTM D4719)
		PM*	Pressuremeter test (ASTM D4719)
		VS*	Field vane shear (ASTM D2573)
		IR*	Infiltrimeter test (ASTM D3385)
		RQD	Rock quality designation, percent
			*Results shown on attached data sheet or graph
			**ASTM designates American Society for Testing and Materials

TERMINOLOGY							
Particle Sizes				Soil layering and Moisture			
<u>Type</u>	<u>Size Range</u>	<u>Term</u>	<u>Visual Observation</u>				
Boulders	> 12"	Lamination	Up to 1/4" thick stratum				
Cobbles	3" – 12"	Varved	Altering laminations of any combination of clay, silt, fine sand, or colors				
Coarse gravel	3/4" – 3"	Lenses	Small pockets of different soils in a soil mass				
Fine gravel	#4 sieve – 3/4"	Stratified	Altering layers of varying materials or colors				
Coarse sand	#4 - #10 sieve	Layer	1/4" to 12" thick stratum				
Medium sand	#10-#40 sieve	Dry	Powdery, no noticeable water				
Fine sand	#40-#200 sieve	Moist	Damp, below saturation				
Silt	100% passing #200 sieve and > 0.005mm	Waterbearing	Pervious soil below water				
Clay	100% passing #200 sieve and < 0.005mm	Wet	Saturated, above liquid limit				
Gravel Content				Standard Penetration Resistance			
Coarse-Grained Soils		Fine-Grained Soils		Cohesionless Soils		Cohesive Soils	
<u>% Gravel</u>	<u>Description</u>	<u>% Gravel</u>	<u>Description</u>	<u>N-Value</u>	<u>Relative Density</u>	<u>N-Value</u>	<u>Consistency</u>
2-15	A little gravel	< 5	Trace of gravel	0-4	Very loose	0-4	Very soft
16-49	With gravel	5-15	A little gravel	5-10	Loose	5-8	Soft
		16-30	With gravel	11-30	Medium dense	9-15	Firm
		31-49	Gravelly	31-50	Dense	16-30	Hard
				> 50	Very dense	> 30	Very hard



NOTICE TO REPORT USERS BORING LOG INFORMATION

Subsurface Profiles

The subsurface stratification lines on the graphic representation of the test borings show an approximate boundary between soil types or rock. The transition between materials is approximate and is usually far more gradual than shown. Estimating excavation depths, soil volumes and other computations relying on the subsurface strata may not be possible to any degree of accuracy.

Water Level

WSB & Associates, Inc. took groundwater level readings in the exploratory borings, reviewed the data obtained, and discussed its interpretation of the data in the text of this report. The groundwater level may fluctuate due to seasonal variations caused by precipitation, snowmelt, rainfalls, construction or remediation activities, and/or other factors not evident at the time of measurement.

The actual determination of the subsurface water level is an interpretative process. Subsurface water level may not be accurately depicted by the levels indicated on the boring logs. Normally, a subsurface exploration obtains general information regarding subsurface features for design purposes. An accurate determination of subsurface water levels is not possible with a typical scope of work. The use of the subsurface water level information provided for estimating purposes or other site review can present a moderate to high risk of error.

The following information is obtained in the field and noted under "Water Level Measurements" at the bottom of the log.

Sampled Depth: The lowest depth of soil sampling at the time a water level measurement is taken.

Casing Depth: The depth to the bottom of the casing or hollow-stem auger at the time of water level measurement.

Cave-In Depth: The depth at which the measuring tape stops in the bore hole.

Water Level: The point in the bore hole at which free-standing water is encountered by a measuring tape dropped from the surface inside the casing.

Drilling Fluid Level: Similar to the water level, except the liquid in the bore hole is a drilling fluid.

Obstruction Depths

Obstructions and/or obstruction depths may be noted on the boring logs. Obstruction indicates the sampling equipment encountered resistance to penetration. It must be realized that continuation of drilling, the use of other drilling equipment or further exploration may provide information other than that depicted on the logs. The correlation of obstruction depths on the log with construction features such as rock excavation, foundation depths, or buried debris cannot normally be determined with any degree of accuracy. For example, penetration of weathered rock by soil sampling equipment may not correlate with removal by certain types of construction equipment. Using this information for estimating purposes often results in a high degree of misinterpretation.

Accurately identifying the obstruction or estimating depths where hard rock is present over the site requires a scope of service beyond the normal geotechnical exploration program. The risk of using the information noted on the boring logs for estimating purposes must be understood.



UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)		
Clean Gravels (Less than 5% fines)		
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
	GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)	
	GM	Silty gravels, gravel-sand-silt mixtures
	GC	Clayey gravels, gravel-sand-clay mixtures
Clean Sands (Less than 5% fines)		
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	SW	Well-graded sands, gravelly sands, little or no fines
	SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	
	SM	Silty sands, sand-silt mixtures
	SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)		
SILTS AND CLAYS Liquid limit less than 50%	ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
	OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
	CH	Inorganic clays of high plasticity, fat clays
	OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS	PT	Peat and other highly organic soils

LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with P.I. greater than 7	
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for GW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
SC	Atterberg limits above "A" line with P.I. greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent GW, GP, SW, SP
More than 12 percent GM, GC, SM, SC
5 to 12 percent Borderline cases requiring dual symbols

PLASTICITY CHART

