PL202300193
PL2023-193

A REPORT FOR
STORMWATER MANAGEMENT

Enclave 78th Street

Bloomington, MN

NOVEMBER 14, 2023

PREPARED FOR:

Enclave Development

West Fargo, ND

PREPARED BY: Westwood

PL202300193
PL2023-193

Westwood

Stormwater Management Plan Report

Enclave 78th Street

Bloomington, MN

Prepared For:

Enclave Development

300 23rd Ave E, Suite 300

West Fargo, ND 58078

(701) 212-8110

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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 pproject. 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 designd 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

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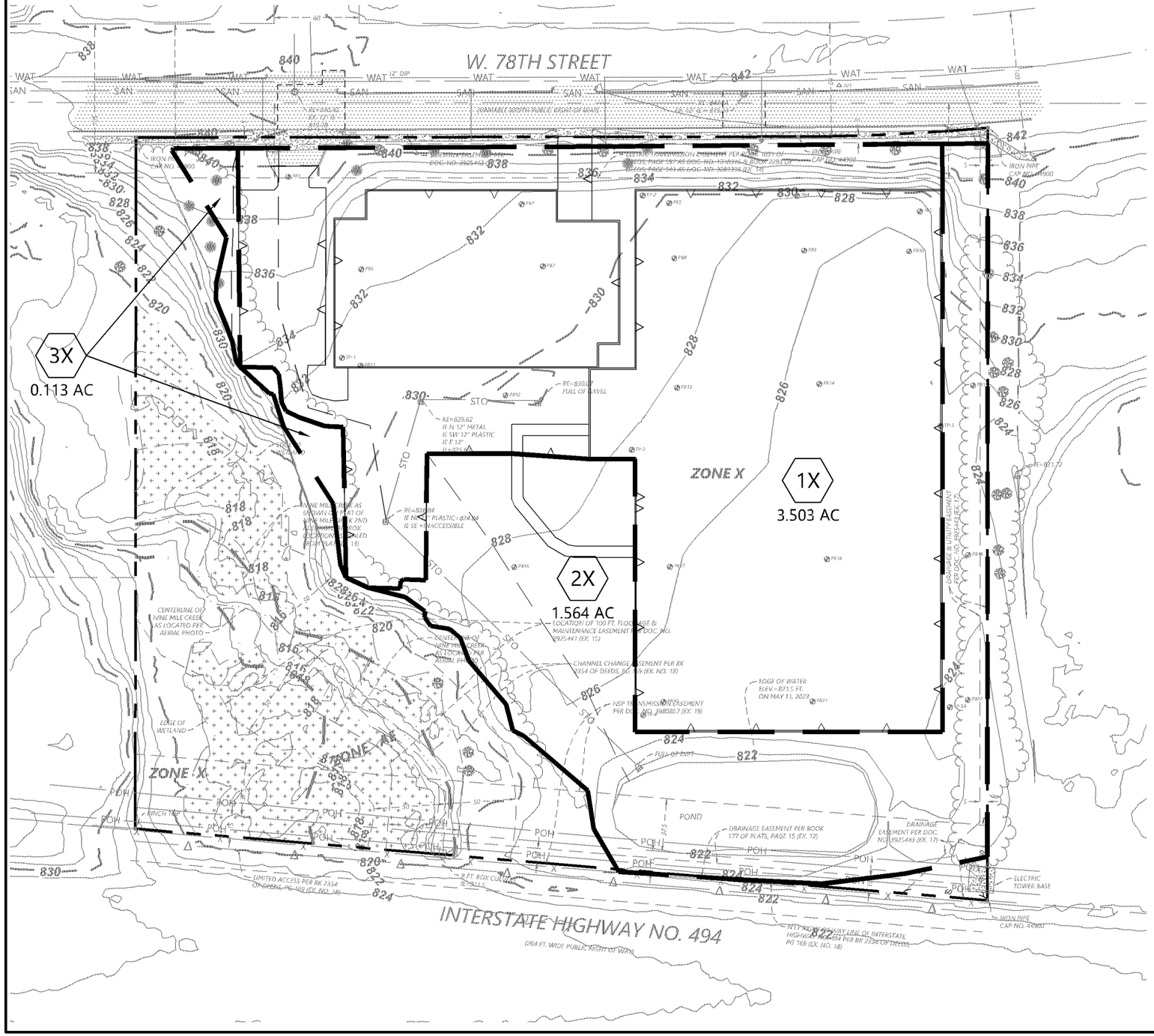
Call 48 Hours before digging:
811 or call811.com
Common Ground Alliance



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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
Phone (952) 937-5150 12701 Whitewater Drive, Suite #300
Fax (952) 937-5822 Minnetonka, MN 55343
Toll Free (888) 937-5150 westwoodps.com
Westwood Professional Services, Inc.

EXISTING DRAINAGE AREA MAP

PROJECT NUMBER: 0043990.00

SHEET NUMBER: 1 OF

DATE: 11/14/2023

Exhibit 2: Proposed Cover Conditions Map

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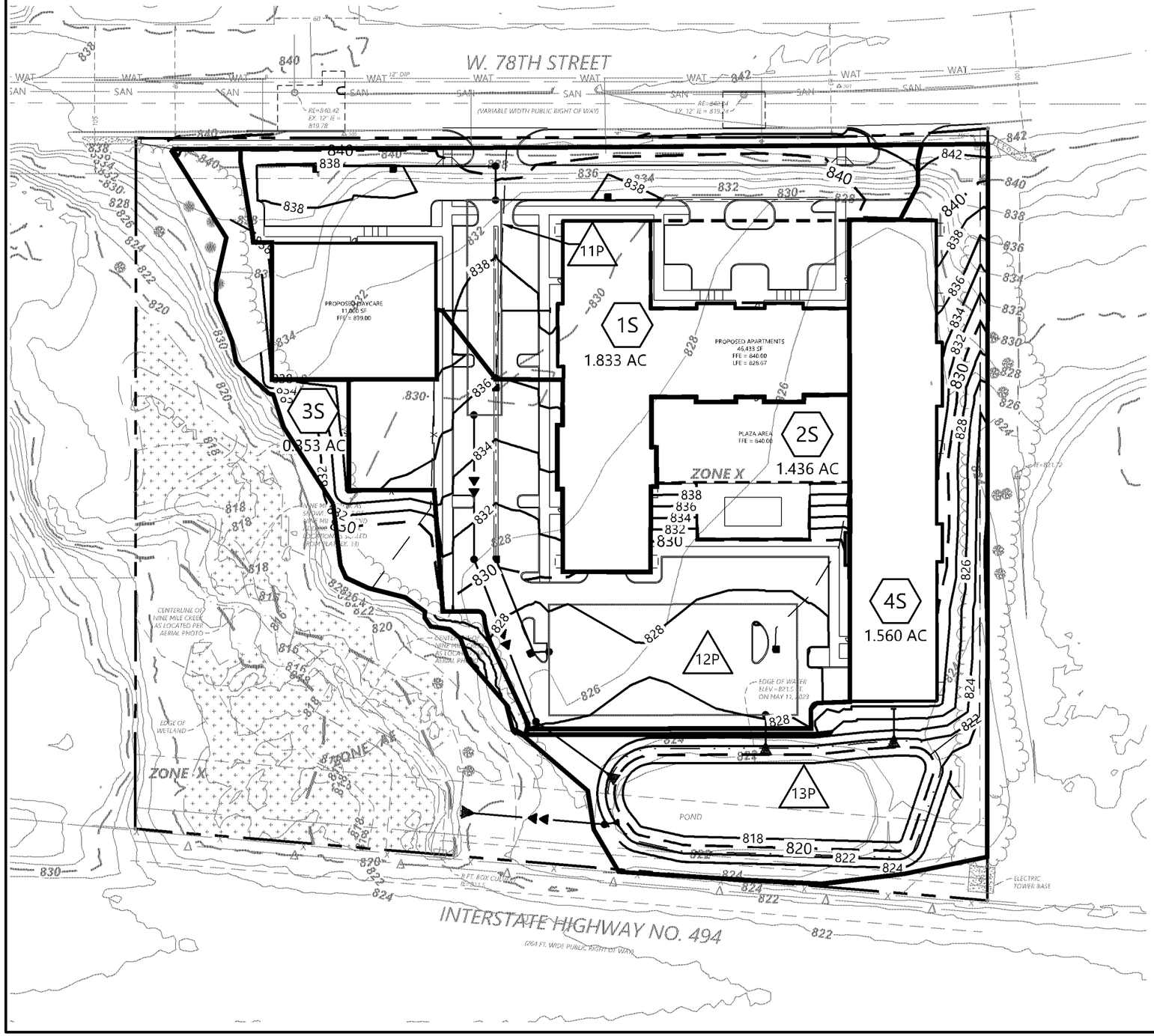
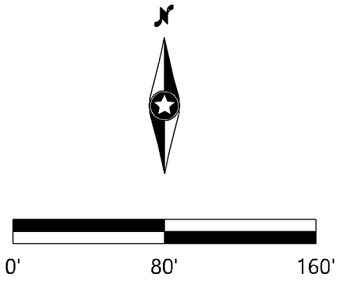
Common Ground Alliance





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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

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BLOOMINGTON, MN

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Westwood Professional Services, Inc.

PROPOSED DRAINAGE AREA MAP

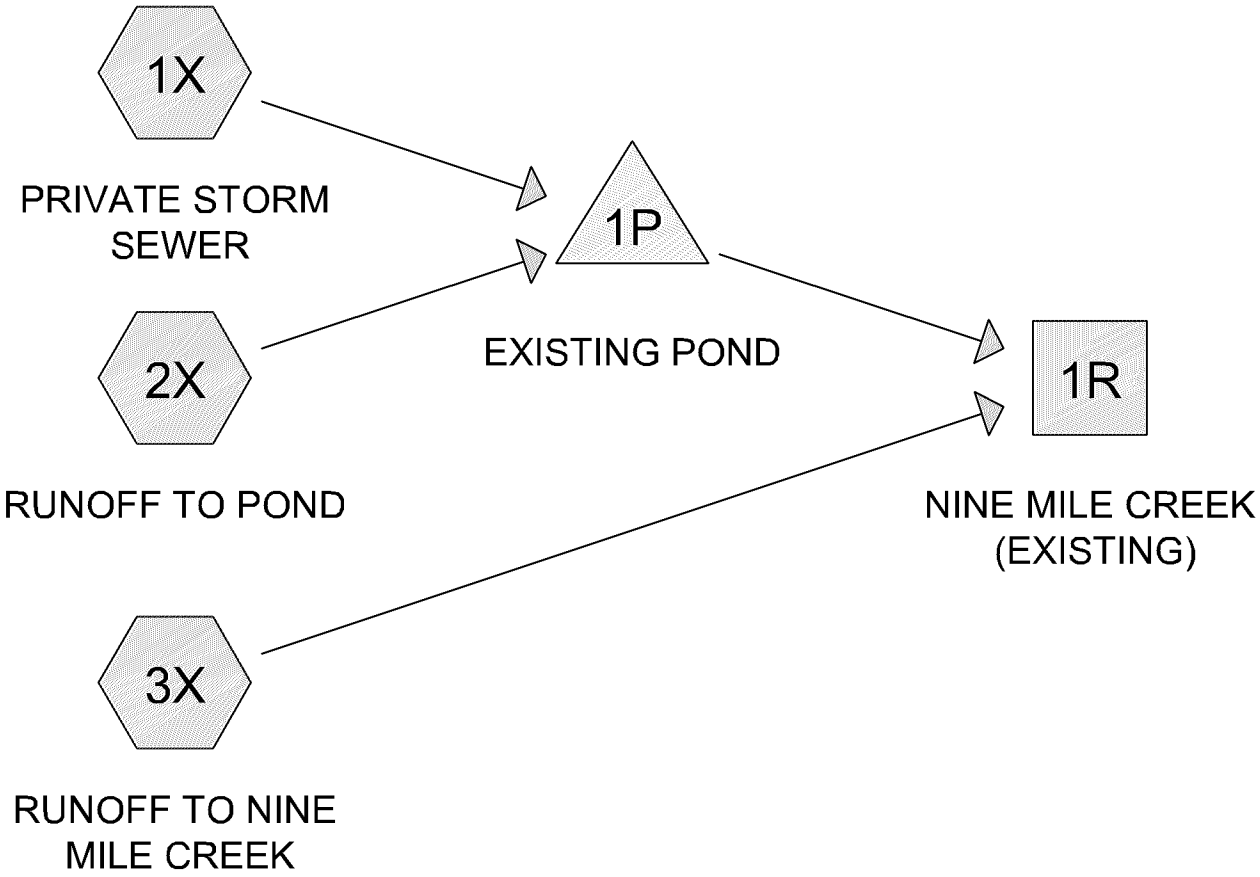
SHEET NUMBER: 2

PROJECT NUMBER: 0043990.00

DATE: 11/14/2023

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

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**

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

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

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)

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

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

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)

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

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

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)

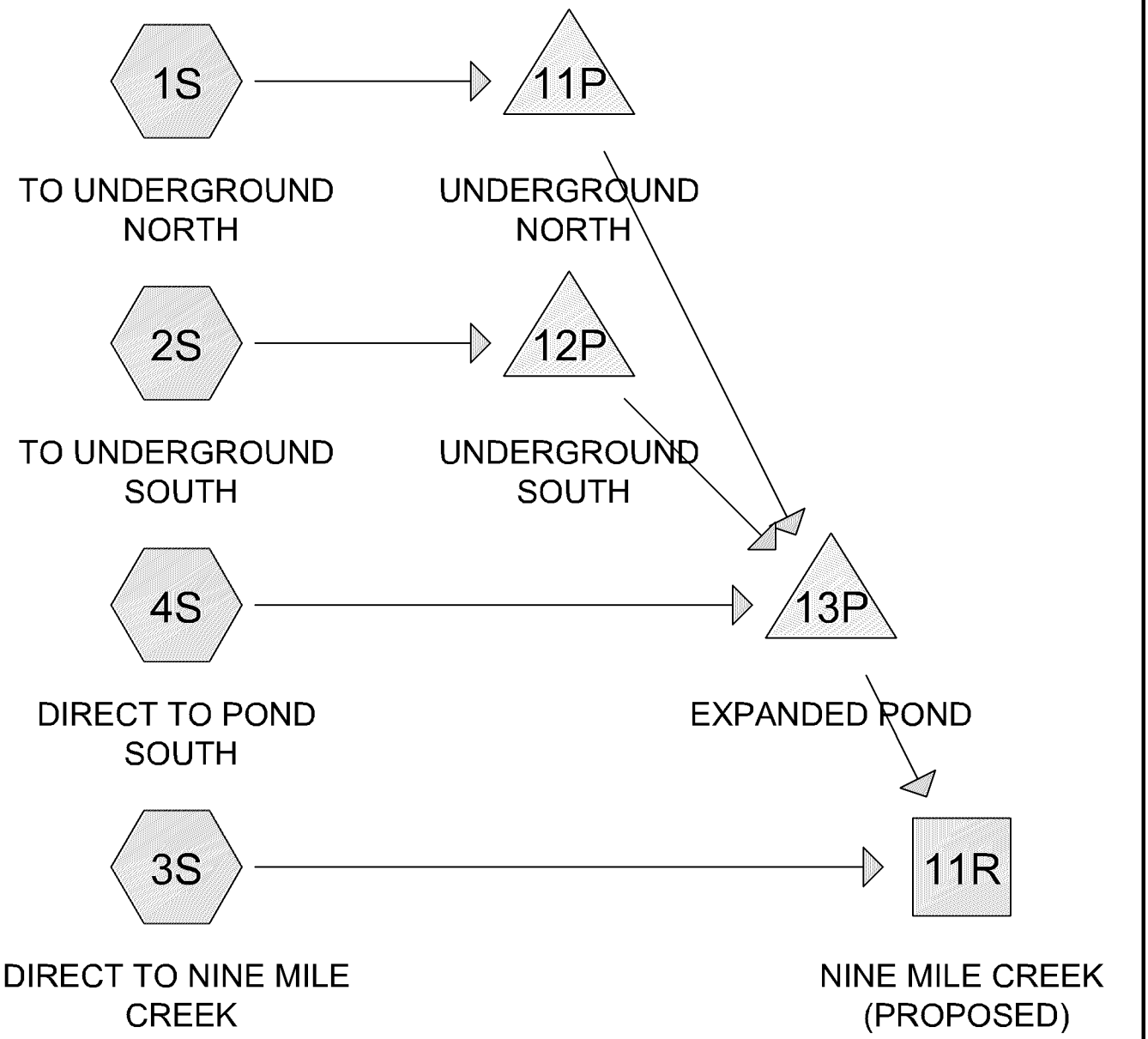
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
818.00	2,182	0	0
819.00	5,348	3,765	3,765
820.00	7,917	6,633	10,398
821.00	10,588	9,253	19,650
822.00	11,842	11,215	30,865
823.00	15,085	13,464	44,329
824.00	17,681	16,383	60,712
825.00	17,681	17,681	78,393

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
Prepared by j, Printed 11/14/2023

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**

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

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"

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)

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 @ 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

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)

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

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"

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)

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

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)

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

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"

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)

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 @ 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

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

PL202300193
PL2023-193

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

PL202300193
PL2023-193

Summary Information

Performance Goal Requirement

Performance goal volume retention requirement:	14998	ft3
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 (ft3)	Volume Recieved (ft3)	Volume Retained (ft3)	Volume Outflow (ft3)	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

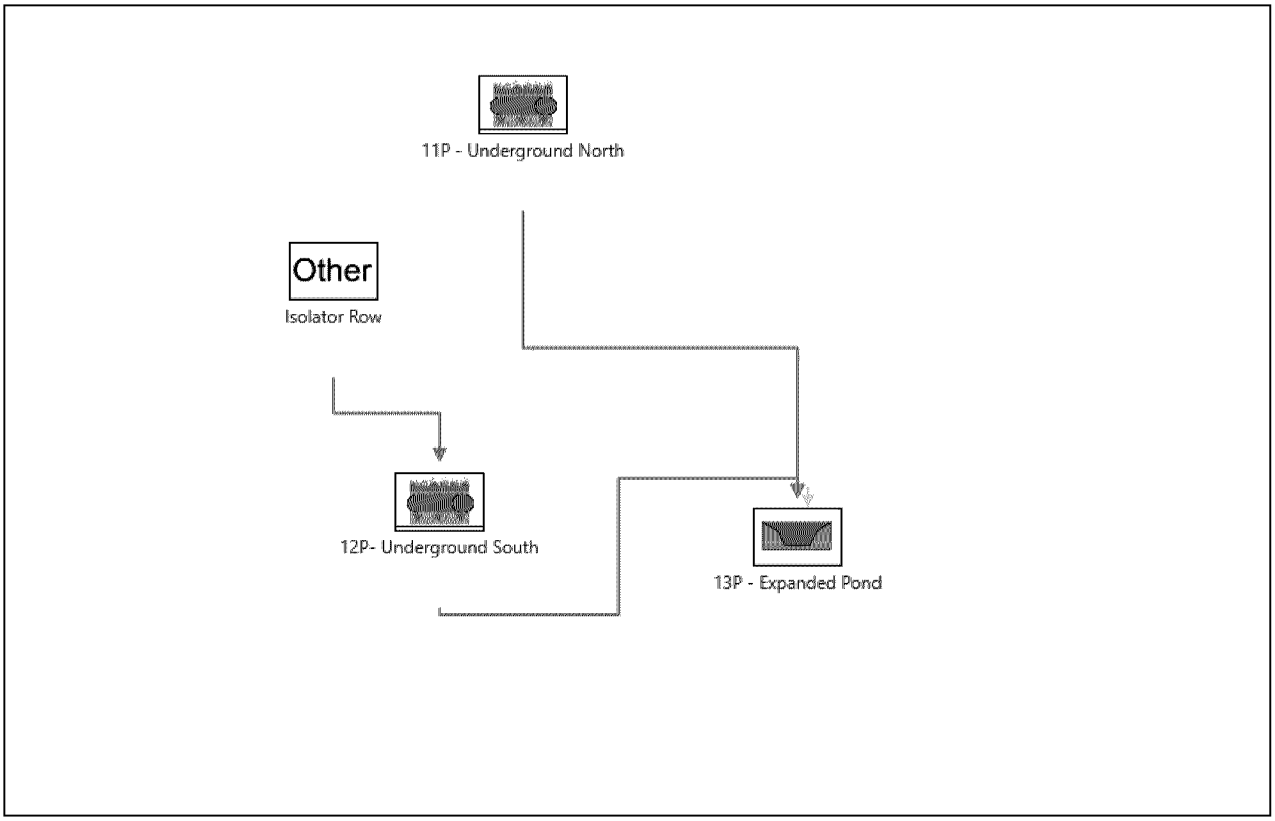
Total Phosphorus Summary

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


11P - Underground North
Other
Isolator Row
12P- Underground South
13P - Expanded Pond

Appendix D: Geotechnical Engineering Report

PL202300193
PL2023-193

PRELIMINARY GEOTECHNICAL REPORT

HENNEPIN COUNTY MEDICAL EXAMINERS SITE

BLOOMINGTON, MN

DECEMBER 19, 2016

Prepared for:
Hennepin County Public Works
701 Fourth Avenue South, Suite700
Minneapolis, MN 55415

WSB PROJECT NO. 03392-010

PL202300193
PL2023-193

PRELIMINARY GEOTECHNICAL REPORT

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

FOR
HENNEPIN COUNTY

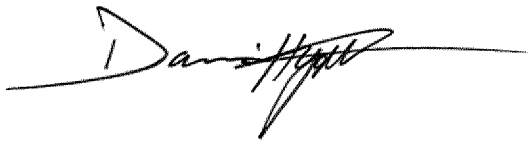
December 19, 2016

Prepared by:

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

PL202300193
PL2023-193

WSB

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.

Darin Hyatt, PE
Senior Geotechnical Engineer

Joe Carlson, EIT
Graduate Geotechnical Engineer

Attachment
Preliminary Geotechnical Report

DEH/tmw

TABLE OF CONTENTS

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

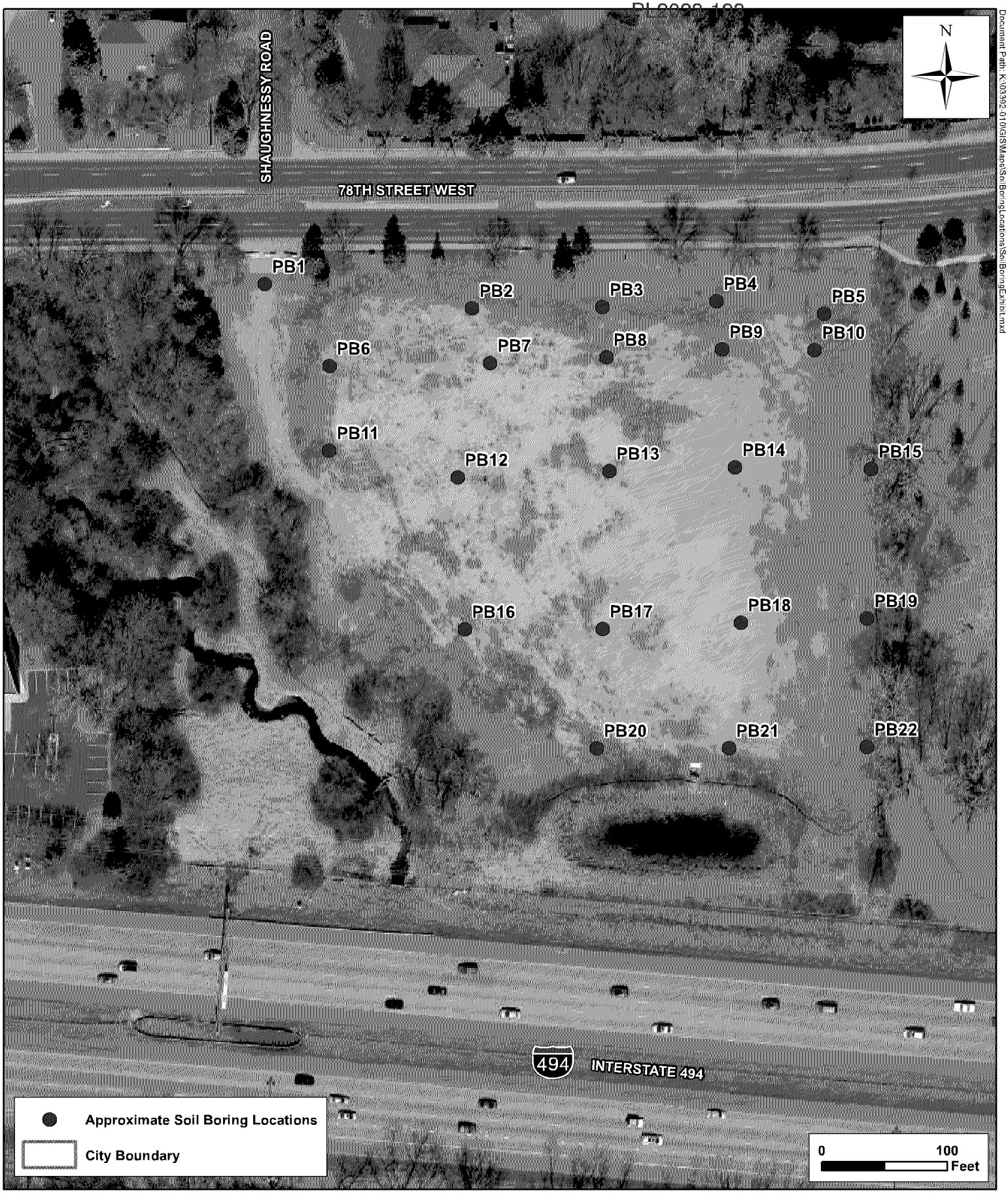
Given the size of the site, the spacing of our borings and the lack of specific design information, we recommend additional soil borings be performed once building locations and structural loadings have been established, to further evaluate the site. When a final geotechnical report is prepared, we will 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

WSB

PL202300193

Document Path: K:\0392-010\GIS\Maps\Limited Phase II ESA\Figure3_TestPitLocation.mxd

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

PL202300193
PL2023-193

WSB & Associates, Inc.

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 No.	SAMPLE TYPE	LAB: MC (%)	LAB: DD (pcf)	LAB: LL (%)	LAB: PL (%)
		CRUSHED ROCK 0 - 4"		Fill								
1	838	CLAYEY SAND WITH A LITTLE GRAVEL, brown, moist, firm to hard to firm to hard	SC	Fill			1	HSA				
2	837											
3	836				14		2	SB				
4	835											
5	834											
6	833				19		3	SB				
7	832											
8	831				14		4	SB				
9	830											
10	829											
11	828				21		5	SB				
12	827	LEAN CLAY WITH SAND AND LITTLE GRAVEL, brown, moist, firm	CL	Glacial Till								
13	826				9		6	SB				
14	825	SAND, fine grained, brown, water bearing, medium dense	SP	Coarse Alluvium		▽						
15	824											
16	823				18		7	SB				
17	822											
18	821											
19	820	SAND WITH A LITTLE GRAVEL, medium to fine grained, brown, water bearing, medium dense to loose	SP	Coarse Alluvium								
20	819											
21	818				18		8	SB				
22	817											
23	816											
24	815											
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

PL202300193
PL2023-193

WSB & Associates, Inc.

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 No.	SAMPLE TYPE	LAB: MC (%)	LAB: DD (pcf)	LAB: LL (%)	LAB: PL (%)
0	831.6	FILL, mostly Silty Sand, a little Lean Clay, brown, dark brown		Fill			1	HSA				
3	829				13		2	SB				
5	827				28		3	SB				
7	825	SAND WITH GRAVEL, fine to medium grained, brown, moist, medium dense	SP	Coarse Alluvium								
8	824				18		4	SB				
10	822				16		5	SB				
13	819						6	SB				
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				
20	812				14		8	SB				
23	809					▽						
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

PL202300193
PL2023-193

WSB & Associates, Inc.

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 No.	SAMPLE TYPE	LAB: MC (%)	LAB: DD (pcf)	LAB: LL (%)	LAB: PL (%)
1	829	FILL, mostly Silty Sand, a little Sand and Gravel, brown, a few Cobbles		Fill			1	HSA				
2	828											
3	827				4		2	SB				
4	826											
5	825											
6	824				50/.3		3	SB				
7	823	LEAN CLAY WITH SAND AND A LITTLE GRAVEL, brown, moist, soft	CL	Glacial Till								
8	822				7		4	SB				
9	821											
10	820	SAND WITH GRAVEL, fine to medium grained, brown, moist to water bearing at 23', loose	SP	Coarse Alluvium								
11	819				7		5	SB				
12	818											
13	817				6		6	SB				
14	816											
15	815											
16	814				8		7	SB				
17	813											
18	812											
19	811											
20	810											
21	809				6		8	SB				
22	808											
23	807					▽						
24	806											
25	805				8		9	SB				
26	804	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	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-CMT\HCPW - 6701 W 78TH ST, BLOOMINGTON MN.GPJ

PL202300193
PL2023-193

WSB & Associates, Inc.

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

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

PL202300193
PL2023-193

WSB & Associates, Inc.

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 No.	SAMPLE TYPE	LAB: MC (%)	LAB: DD (pcf)	LAB: LL (%)	LAB: PL (%)
0	825	FILL, mostly Sand, a little Gravel, dark brown, brown		Fill			1	HSA				
3	823				18		2	SB				
5	821				14		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				
10	816				14		5	SB				
13	813				20		6	SB				
15	811	SAND, fine to medium grained, brown, water bearing, medium dense	SP	Coarse Alluvium	16		7	SB				
19	807	SAND WITH GRAVEL, medium to fine grained, brown, water bearing, medium dense	SP	Coarse Alluvium	16		8	SB				
24	802	LEAN CLAY WITH SAND AND A LITTLE GRAVEL, dark gray, moist, firm	CL	Glacial Till								
25	801	End of Boring 25.0 ft.			9		9	SB				
26	800											

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

PL202300193
PL2023-193

WSB & Associates, Inc.

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 No.	SAMPLE TYPE	LAB MC (%)	LAB DD (pcf)	LAB LL (%)	LAB PL (%)
		CRUSHED LIMESTONE 0 - 4"		Fill								
1	831	FILL, a mixture of Sand, Silty Sand, a little Gravel		Fill			1	HSA				
2	830											
3	829				15		2	SB				
4	828											
5	827				17		3	SB				
6	826											
7	825	LEAN CLAY WITH SAND AND A LITTLE GRAVEL, brown, moist, soft	CL	Glacial Till								
8	824				6		4	SB	11	121		
9	823											
10	822	LEAN CLAY WITH SAND AND A LITTLE GRAVEL, dark gray, wet, firm to soft to firm	CL	Glacial Till	9		5	SB				
11	821											
12	820											
13	819				7		6	SB				
14	818											
15	817				9		7	SB				
16	816											
17	815											
18	814					▽						
19	813											
20	812											
21	811				10		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								
25	807	End of Boring 25.0 ft.			14		9	SB				
26	806											

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	12:05 pm	25	24.5		18.5	813.7	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

PL202300193
PL2023-193

WSB & Associates, Inc.

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 No.	SAMPLE TYPE	LABORATORY TESTS 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			1	HSA				
2	829											
3	828				14		2	SB				
4	827											
5	826											
6	825				11		3	SB				
7	824											
8	823				24		4	SB				
9	822	SAND WITH GRAVEL, fine to medium grained, brown, moist, loose to medium dense	SP	Coarse Alluvium								
10	821				9		5	SB				
11	820											
12	819											
13	818				12		6	SB				
14	817											
15	816	SAND, fine to medium grained, brown, water bearing, medium dense	SP	Coarse Alluvium		▽						
16	815				13		7	SB				
17	814											
18	813											
19	812	SAND WITH GRAVEL, fine to medium grained, brown, water bearing, loose	SP	Coarse Alluvium								
20	811											
21	810				7		8	SB				
22	809	SANDY LEAN CLAY WITH SAND AND A LITTLE GRAVEL, gray, wet, soft	CL	Glacial Till								
23	808											
24	807											
25	806				8		9	SB				
		End of Boring 25.0 ft.										
26	805											

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	9:45 am	25	24.5		15.0	815.8	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

PL202300193
PL2023-193

WSB & Associates, Inc.

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 No.	SAMPLE TYPE	LAB: MC (%)	LAB: DD (pcf)	LAB: LL (%)	LAB: PL (%)
1	828	FILL, mostly Sand with Gravel, a little Silty Sand, brown		Fill			1	HSA				
2	827											
3	826				16		2	SB				
4	825											
5	824											
6	823				18		3	SB				
7	822											
8	821				18		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								
13	816				10		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								
18	811											
19	810											
20	809				20		8	SB				
21	808											
22	807					▽						
23	806											
24	805											
25	804				16		9	SB				
		End of Boring 25.0 ft.										
26	803											

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	8:05 am	25	24.5		22.0	806.8	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

PL202300193
PL2023-193

WSB & Associates, Inc.

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 No.	SAMPLE TYPE	LABORATORY TESTS MC (%)	DD (pcf)	LL (%)	PL (%)
0	826	FILL, mostly Sand, Sand with Gravel, brown		Fill								
1	825						1	HSA				
2	824											
3	823				12		2	SB				
4	822											
5	821											
6	820				14		3	SB				
7	819											
8	818				12		4	SB				
9	817											
10	816											
11	815				10		5	SB				
12	814	LEAN CLAY WITH SAND AND A LITTLE GRAVEL, dark gray, moist to wet, firm to hard to firm to soft	CL	Glacial Till								
13	813				14		6	SB				
14	812											
15	811											
16	810				16		7	SB				
17	809											
18	808											
19	807											
20	806											
21	805				9		8	SB				
22	804											
23	803											
24	802											
25	801				8	▽	9	SB				
		End of Boring 25.0 ft.										
26	800											

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

PL202300193
PL2023-193

WSB & Associates, Inc.

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 No.	SAMPLE TYPE	LABORATORY TESTS MC (%)	DD (pcf)	LL (%)	PL (%)
0	825	FILL, a mixture of Sand, Sand with Silt and Gravel, brown, dark brown		Fill								
1	824						1	HSA				
2	823											
3	822				27		2	SB				
4	821											
5	820											
6	819				28		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								
8	817				12		4	SB				
9	816					▽						
10	815											
11	814				12		5	SB				
12	813											
13	812				16		6	SB				
14	811											
15	810											
16	809				14		7	SB				
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				18		8	SB				
22	803											
23	802											
24	801											
25	800				18		9	SB				
26	799	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:
								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

PL202300193
PL2023-193

WSB & Associates, Inc.

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 No.	SAMPLE TYPE	LABORATORY TESTS MC (%)	DD (pcf)	LL (%)	PL (%)
0	830.9	CRUSHED LIMESTONE 0 - 13"		Fill								
1	830	FILL, a mixture of Silty Sand, Lean Clay, a few pieces of Limestone, a few pieces of Wood		Fill			1	HSA				
2	829											
3	828				14		2	SB				
4	827											
5	826											
6	825				3		3	SB				
7	824											
8	823				7		4	SB				
9	822											
10	821											
11	820				4		5	SB				
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:
								J. Tatro	DAJ
11/17/2016	1:35 pm	25	24.5		18.5	812.4	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

PL202300193
PL2023-193

WSB & Associates, Inc.

LOG OF TEST BORING

PROJECT NAME: HCPW - 6701 W 78th Street
CLIENT/WSB #: 03392-010
PROJECT LOCATION: Bloomington, MN
SURFACE ELEVATION: 829.8 ft

BORING NUMBER PB 12
PAGE 1 OF 1

DEPTH (ft)	ELEV. (ft)	DESCRIPTION OF MATERIAL	USCS	GEOLOGIC ORIGIN	N	WL	SAMPLE No.	SAMPLE TYPE	LAB: MC (%)	LAB: DD (pcf)	LAB: LL (%)	LAB: PL (%)
1	829	FILL, a mostly Sand with Gravel, a few pieces of Limestone, brown, dark brown		Fill			1	HSA				
2	828											
3	827				8		2	SB				
4	826											
5	825											
6	824				12		3	SB				
7	823											
8	822				9		4	SB				
9	821	LEAN CLAY, gray, moist to wet, soft	CL	Fine Alluvium								
10	820											
11	819				8		5	SB				
12	818					▽						
13	817				5		6	SB				
14	816	SAND WITH A LITTLE GRAVEL, medium to fine grained, brown, water bearing, loose	SP	Coarse Alluvium								
15	815											
16	814				6		7	SB				
17	813											
18	812											
19	811											
20	810											
21	809				7		8	SB				
22	808											
23	807											
24	806	SAND WITH A LITTLE GRAVEL, fine to medium grained, gray, water bearing, loose	SP	Coarse Alluvium								
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

PL202300193
PL2023-193

WSB & Associates, Inc.

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 No.	SAMPLE TYPE	LABORATORY TESTS MC (%)	DD (pcf)	LL (%)	PL (%)
0	828	FILL, a mixture of Sand, Sand with Silt, a little Gravel, brown		Fill								
1	827						1	HSA				
2	826											
3	825				10		2	SB				
4	824											
5	823				9		3	SB				
6	822											
7	821	SAND WITH A LITTLE GRAVEL, fine to medium grained, brown, wet to water bearing, very loose to loose	SP	Coarse Alluvium								
8	820				3	▽	4	SB				
9	819											
10	818				9		5	SB				
11	817											
12	816											
13	815				7		6	SB				
14	814											
15	813	SAND WITH A LITTLE GRAVEL, medium to fine grained, brown, water bearing, loose	SP	Coarse Alluvium	8		7	SB				
16	812											
17	811											
18	810											
19	809											
20	808	SANDY LEAN CLAY WITH A LITTLE GRAVEL, gray, wet, firm	CL	Glacial Till	11		8	SB				
21	807											
22	806											
23	805											
24	804	SAND, fine to medium grained, brown, water bearing, medium dense	SP	Coarse Alluvium								
25	803	End of Boring 25.0 ft.			20		9	SB				
26	802											

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	1:00 pm	25	24.5		8.0	820	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

PL202300193
PL2023-193

WSB & Associates, Inc.

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 No.	SAMPLE TYPE	LABORATORY TESTS MC (%)	DD (pcf)	LL (%)	PL (%)
1	825	FILL, a mixture of Sand, Sand with Silt, a little Gravel, brown		Fill			1	HSA				
2	824											
3	823				16		2	SB				
4	822											
5	821				20		3	SB				
6	820											
7	819	SAND, fine to medium grained, brown, wet to water bearing at 8', loose	SP	Coarse Alluvium								
8	818				8	▽	4	SB				
9	817											
10	816				7		5	SB				
11	815											
12	814	SAND WITH A LITTLE GRAVEL, medium to fine grained, brown, water bearing, very loose	SP	Coarse Alluvium								
13	813				2		6	SB				
14	812											
15	811	SAND, fine to medium grained, brown, water bearing, loose to medium dense	SP	Coarse Alluvium								
16	810				6		7	SB				
17	809											
18	808											
19	807											
20	806				20		8	SB				
21	805											
22	804											
23	803	SAND WITH GRAVEL, fine to medium grained, brown, water bearing, medium dense	SP	Coarse Alluvium								
24	802											
25	801	End of Boring 25.0 ft.			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

PL202300193
PL2023-193

WSB & Associates, Inc.

LOG OF TEST BORING

PROJECT NAME: HCPW - 6701 W 78th Street
CLIENT/WSB #: 03392-010
PROJECT LOCATION: Bloomington, MN
SURFACE ELEVATION: 825.4 ft

BORING NUMBER PB 15
PAGE 1 OF 1

DEPTH (ft)	ELEV. (ft)	DESCRIPTION OF MATERIAL	USCS	GEOLOGIC ORIGIN	N	WL	SAMPLE No.	SAMPLE TYPE	LABORATORY TESTS 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								
3	822				10		2	SB				
4	821											
5	820	SILTY SAND WITH A LITTLE GRAVEL, gray, wet, loose	SM	Coarse Alluvium								
6	819				7		3	SB				
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	SAND WITH GRAVEL, medium to coarse grained, brown, water bearing, medium dense to loose to medium dense	SP	Coarse Alluvium								
11	814				11		5	SB				
12	813											
13	812				7		6	SB				
14	811											
15	810											
16	809				10		7	SB				
17	808											
18	807											
19	806											
20	805											
21	804				12		8	SB				
22	803											
23	802											
24	801											
25	800	End of Boring 25.0 ft.			12		9	SB				
26	799											

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	3:00 pm	25	24.5		8.8	816.6	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

PL202300193
PL2023-193

WSB & Associates, Inc.

LOG OF TEST BORING

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

BORING NUMBER PB 16
PAGE 1 OF 1

DEPTH (ft)	ELEV. (ft)	DESCRIPTION OF MATERIAL	USCS	GEOLOGIC ORIGIN	N	WL	SAMPLE No.	SAMPLE TYPE	LABORATORY TESTS MC (%)	DD (pcf)	LL (%)	PL (%)
1	827	FILL, mostly Silty Sand, crushed Limstone at grade, gray, brown		Fill			1	HSA				
2	826											
3	825				12		2	SB				
4	824											
5	823											
6	822				9		3	SB				
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											
11	817				6		5	SB				
12	816											
13	815	SILTY SAND WITH A LITTLE GRAVEL, gray, wet, loose	SM	Coarse Alluvium	7		6	SB				
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				4		8	SB				
22	806											
23	805											
24	804											
25	803				9		9	SB				
26	802	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:
								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

PL202300193
PL2023-193

WSB & Associates, Inc.

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 No.	SAMPLE TYPE	LABORATORY TESTS MC (%)	DD (pcf)	LL (%)	PL (%)
1	826	FILL, mostly Sand, a little Sand with Silt, a little Gravel, brown		Fill			1	HSA				
2	825											
3	824				14		2	SB				
4	823											
5	822				14		3	SB				
6	821											
7	820											
8	819				12		4	SB				
9	818	SAND WITH A LITTLE GRAVEL, fine to medium grained, brown, water bearing at 9.5', loose	SP	Coarse Alluvium		▽						
10	817				7		5	SB				
11	816											
12	815											
13	814				8		6	SB				
14	813											
15	812	SAND, fine to medium grained, brown, water bearing, loose	SP	Coarse Alluvium								
16	811				5		7	SB				
17	810											
18	809											
19	808											
20	807											
21	806				12		8	SB				
22	805											
23	804											
24	803											
25	802				14		9	SB				
26	801	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:
								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

PL202300193
PL2023-193

WSB & Associates, Inc.

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 No.	SAMPLE TYPE	LABORATORY TESTS MC (%)	DD (pcf)	LL (%)	PL (%)
1	825	FILL, mostly Silty Sand, a few pieces of Limstone, brown		Fill			1	HSA				
2	824											
3	823				12		2	SB				
4	822											
5	821				9		3	SB				
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								
8	818				6		4	SB				
9	817											
10	816				7		5	SB				
11	815					▽						
12	814											
13	813				7		6	SB				
14	812											
15	811	SILTY SAND WITH GRAVEL, gray, water bearing, medium dense	SM	Coarse Alluvium								
16	810				9		7	SB				
17	809											
18	808											
19	807											
20	806				16		8	SB				
21	805											
22	804											
23	803											
24	802											
25	801				14		9	SB				
		End of Boring 25.0 ft.										
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

PL202300193
PL2023-193

WSB & Associates, Inc.

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 No.	SAMPLE TYPE	LABORATORY TESTS MC (%)	DD (pcf)	LL (%)	PL (%)
1	823	FILL, a mixture of Sand, Silty Sand, a little Gravel, a few pieces of Limestone		Fill			1	HSA				
2	822											
3	821				8		2	SB				
4	820											
5	819											
6	818				10		3	SB				
7	817											
8	816				12		4	SB				
9	815	SAND WITH GRAVEL, fine to medium grained, brown, wet, medium dense to very loose	SP	Coarse Alluvium								
10	814				12		5	SB				
11	813											
12	812											
13	811				12		6	SB				
14	810											
15	809				4		7	SB				
16	808											
17	807											
18	806											
19	805	SAND WITH GRAVEL, fine to medium grained, gray, wet to water bearing at 22', loose	SP	Coarse Alluvium								
20	804											
21	803				5		8	SB				
22	802					▽						
23	801											
24	800	SILTY SAND, brown, water bearing, loose	SP	Coarse Alluvium								
25	799	End of Boring 25.0 ft.			6		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	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

PL202300193
PL2023-193

WSB & Associates, Inc.

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 No.	SAMPLE TYPE	LABORATORY TESTS 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			1	HSA				
2	824											
3	823				8		2	SB				
4	822											
5	821											
6	820				4		3	SB				
7	819	LEAN CLAY, gray, wet, very soft	CL	Fine Alluvium								
8	818				2		4	SB	21	91		
9	817											
10	816				2		5	SB				
11	815											
12	814											
13	813				2		6	SB				
14	812	FAT CLAY, gray, wet, soft	CH	Fine Alluvium								
15	811											
16	810				6		7	SB				
17	809											
18	808					▽						
19	807	SILTY SAND WITH A LITTLE GRAVEL, gray, water bearing, loose, a few lenses of Clay	SP	Coarse Alluvium								
20	806											
21	805				5		8	SB				
22	804											
23	803											
24	802											
25	801				8		9	SB				
26	800	End of Boring 25.0 ft.										

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

PL202300193
PL2023-193

WSB & Associates, Inc.

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 No.	SAMPLE TYPE	LABORATORY TESTS 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			1	HSA				
2	823											
3	822				13		2	SB				
4	821											
5	820				4		3	SB				
6	819											
7	818	FAT CLAY, dark gray, wet, very soft	CH	Fine Alluvium								
8	817				3		4	SB	23	95		
9	816											
10	815	SAND WITH SILT, fine to medium grained, gray, water bearing, loose	SP-SM	Coarse Alluvium								
11	814				7	▽	5	SB				
12	813	FAT CLAY, dark gray, wet, firm	CH	Fine Alluvium								
13	812				10		6	SB				
14	811											
15	810	SAND WITH GRAVEL, fine to medium grained, gray, water bearing, loose	SP	Coarse Alluvium								
16	809				8		7	SB				
17	808											
18	807											
19	806											
20	805											
21	804				10		8	SB				
22	803											
23	802											
24	801	SAND WITH GRAVEL, fine grained, brown, water bearing, loose	SP	Coarse Alluvium								
25	800	End of Boring 25.0 ft.			7		9	SB				
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:
								J. Tatro	DAJ
11/18/2016	11:45 am	25	24.5		11.0	814.1	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

PL202300193
PL2023-193

WSB & Associates, Inc.

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 No.	SAMPLE TYPE	LAB: MC (%)	LAB: DD (pcf)	LAB: LL (%)	LAB: PL (%)
0	824	FILL, a mixture of Sand with Silt, Silty Sand, a little Gravel, a few pieces of Limestone		Fill								
1	823						1	HSA				
2	822											
3	821				16		2	SB				
4	820											
5	819	SAND WITH SILT AND A LITTLE GRAVEL, brown, wet, loose	SP-SM	Coarse Alluvium								
6	818				8		3	SB				
7	817											
8	816				8		4	SB				
9	815											
10	814	LEAN CLAY, dark gray, wet, soft	CL	Fine Alluvium								
11	813				6		5	SB				
12	812	FAT CLAY, dark gray, wet to saturated at 19', very soft	CH	Fine Alluvium								
13	811				2		6	SB				
14	810											
15	809						7	SB				
16	808											
17	807											
18	806											
19	805					▽						
20	804											
21	803				2		8	SB				
22	802											
23	801											
24	800											
25	799				2		9	SB				
		End of Boring 25.0 ft.										
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

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PL2023-193

WSB & Associates, Inc.

SYMBOLS AND TERMINOLOGOY ON TEST BORING LOG

SYMBOLS

Drilling and Sampling

Symbol	Description
HSA	3-1/4" I.D. Hollow stem auger
_FA	4", 6" or 10" diameter flight auger
_HA	2", 4", or 6" hand auger
_DC	2-1/2", 4", 5", or 6" steel drive casing
_RC	Size A, B or N rotary casing
PD	Pipe drill or cleanout tube
CS	Continuous split barrel sampling
DM	Drilling mud
JW	Jetting water
SB	2" O.D. split barrel sampling
_L	2-1/2" or 3-1/2" O.D. SB liner sampler
_T	2" or 3" thin walled tube sample
3TP	3" thin walled tube using pitcher sampler
_TO	2" or 3" thin walled tube using Osterberg sampler
W	Wash sample
B	Bag sample
P	Test pit sample
_Q	BQ, NQ, or PQ wire line system
_X	AX, BX, or NX double tube barrel
N	Standard penetration test, blows per foot
CR	Core recovery, percent
WL	Water level
▼	Water level
NMR	No measurement recorded, primarily due to presence of drilling or coring fluid.

Laboratory Testing

Symbol	Description
W	Water content, % (ASTM** D2216)
D	Dry density, pcf
LL	Liquid limit (ASTM D4318)
PL	Plastic limit (ASTM D4318)
	-Inserts in last column (Qu or RQD)-
Qu	Unconfined compressive strength, psf (ASTM D2166)
Pq	Penetrometer reading, tsf (ASTM D1558)
Ts	Torvane reading, tsf
G	Specific gravity (ASTM D854)
SL	Shrinkage limits (ASTM D427)
OC	Organic content-combustion method (ASTM D2974)
SP	Swell pressure, tsf (ASTM D4546)
PS	Percent swell under pressure (ASTM D4546)
FS	Free swell, % (ASTM D4546)
SS	Shrink swell, % (ASTM D4546)
pH	Hydrogen ion content-Meter Method (ASTM D4972)
SC	Sulfate content, parts/million or mg/l
CC	Chloride content, parts/million or mg/l
C*	One dimensional consolidation (ASTM D2435)
Qc*	Triaxial compression (ASSTM D2850 and D4767)
D.S.*	Direct Shear (ASTM D3080)
K*	Coefficient of permeability, cm/sec (ASTM D2434)
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*	Infiltrometer 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

Type	Size Range
Boulders	> 12"
Cobbles	3" – 12"
Coarse gravel	3/4" – 3"
Fine gravel	#4 sieve – 3/4"
Coarse sand	#4 - #10 sieve
Medium sand	#10-#40 sieve
Fine sand	#40-#200 sieve
Silt	100% passing #200 sieve and > 0.005mm
Clay	100% passing #200 sieve and < 0.005mm

Soil layering and Moisture

Term	Visual Observation
Lamination	Up to 1/4" thick stratum
Varved	Altering laminations of any combination of clay, silt, fine sand, or colors
Lenses	Small pockets of different soils in a soil mass
Stratified	Altering layers of varying materials or colors
Layer	1/4" to 12" thick stratum
Dry	Powdery, no noticeable water
Moist	Damp, below saturation
Waterbearing	Pervious soil below water
Wet	Saturated, above liquid limit

Gravel Content

Coarse-Grained Soils

% Gravel	Description
2-15	A little gravel
16-49	With gravel

Fine-Grained Soils

% Gravel	Description
< 5	Trace of gravel
5-15	A little gravel
16-30	With gravel
31-49	Gravelly

Standard Penetration Resistance

Cohesionless Soils

N-Value	Relative Density
0-4	Very loose
5-10	Loose
11-30	Medium dense
31-50	Dense
> 50	Very dense

Cohesive Soils

N-Value	Consistency
0-4	Very soft
5-8	Soft
9-15	Firm
16-30	Hard
> 30	Very hard

WSB & Associates, Inc.

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.

WSB & Associates, Inc.

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.)			
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravels (Less than 5% fines)	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
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sands (Less than 5% fines)	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