Westwood

Stormwater Management Plan for

Enclave Apartments, Maplewood

Intersection of County Road D East and Southlawn Drive

Prepared for:
Enclave Development
300 23rd Ave E, Suite 300
West Fargo, ND 58078

Prepared by:
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Project Number: 0037066.00

Date: 09/26/2022

Enclave Apartments, Maplewood

INTRODUCTION

This stormwater memorandum summarizes the analysis of the proposed Enclave Apartments development at the southeast intersection of County Road D East and Southlawn Drive in Maplewood, MN.

REGULATIONS

Ramsey Washington Metro Watershed District stormwater regulations are listed below:

1. Rate Control – 2, 10, and 100 year events not to exceed Existing Conditions.

2. Volume Reduction – reduction volume to equal to 1.1 inch of rainfall off new and reconstructed impervious surface. BMP's may retain a max of 2.5" of runoff over their tributary impervious surfaces.

3. Water Quality – BMP's to achieve 90% TSS removal from the disturbed area of the project. (Note: if volume reduction is met, the required TSS removal are general met.)

PROPOSED PROJECT DEVELOPMENT

The proposed 5.85 acre parcel currently contains one commercial building, a parking lot, and a stormwater pond. The proposed development is to construct a 4 story apartment with underground parking, a parking lot, landscaping, and plaza.

The area disturbed by the proposed development is 203,162 SF (4.67 acres) and was used for equitable comparison of the existing impervious and drainage conditions. The existing parking lot extends over the easterly property line. This area was included in the disturbed boundary area as the intent is to remove unusable paved parking area and replace it with vegetation. The overall site redevelopment project will increase the pervious area from 8% to 39%. The area within the project development boundary is shown in Table 1.

Table 1: Project Area Information

Project Site	**Existing SF**		**Proposed SF**	
Total Proposed Project Area	203,162		203,162	
Impervious Area	187,582	(92%)	124,331	(61%)
Pervious Area	15,580	(8%)	78,831	(39%)

PROPOSED STORMWATER MANAGEMENT SYSTEM

The proposed project will utilize an underground storm chamber system (StormTech or equivalent system) and a surface infiltration basin for volume reduction, rate control and water quality. Westwood utilized the HydroCAD computer model for the analysis of stormwater management system at this site and the result of the model are attached to this memorandum.

Stormwater runoff from the building, plaza and the parking lot will be directed to an underground storm chamber system (Basin A) via storm pipes. Basin A, will be located under the parking lot and will provide treatment, infiltration, and rate control for runoff from the parking lot, building roof, plaza, and adjacent landscaping areas.

Stormwater runoff from the entrance driveways will be directed in infiltration basin (Basin B). Basin B will be located at the southwest corner of the site and will provide treatment, filtration, and rate control for runoff from the driveways leading into the overall site, garage parking, and surface parking lot.

Stormwater runoff from the east and south portions of the site is primarily greenspace and will be directed into the existing stormwater pond to the south. The remaining site runoff will be directed off site, similar to existing conditions.

Refer to Exhibit 1 for Existing and Proposed Drainage Area Map and Exhibit 2 for Existing and Proposed Cover Conditions Map.

RATE CONTROL

The stormwater management system design was modeled to achieve no net increase in peak discharge rates for the proposed development from pre-development conditions for the 2-year, 10-year and 100-year storm events. The proposed runoff rates are less than the overall existing runoff rates. Refer to Attachments A and B for Existing and Proposed HydroCAD Models. The predevelopment and proposed peak discharge rates are shown in Table 2.

Table 2: Peak Discharge Rates

	Pre-development Conditions [cfs]			**Proposed Development [cfs]**		
	Discharge to Existing Pond	Discharge to Off-Site	Overall Discharge from project area	Discharge to Existing Pond	Discharge to Off-Site	Overall Discharge from project area
2-yr Event	14.95	0.81	15.76	1.64	0.90	2.57
10-yr Event	22.67	1.39	24.06	6.92	1.77	8.69
100-yr Event	40.45	2.80	43.25	23.73	4.00	27.73

VOLUME CONTROL

The required volume reduction of stormwater is 11,029 CF determined by taking the proposed impervious area multiplied by 1.1" of rainfall. Most of the impervious area will be directed to an underground infiltration system (Basin A). Runoff from the southeasterly drives will be directed to Basin B. Using an infiltration rate of 0.2 in/hour, this volume will draw down in 48 hours.

Remaining impervious runoff from the proposed stair and sidewalk connection from the public sidewalk along the north side of the building will be directed off site into the existing storm sewer system. The overall volume abstraction provided is greater than required.

Table 4: Volume Abstraction Requirement

	New or Reconstructed Impervious Area [ac.]	Restricted Site Required Volume (0.55") [CF]	Volume Abstraction Provided [CF]
To Basin A	113,400	10,395	10,645
To Basin B	6,918	634	870
To Offsite	1,322	121	
Total	123,009	11,150	11,515

WATER QUALITY

Sump manhole structures will provide initial pretreatment with addition sediment removal via the storm chamber system isolator row system. The volume reduction being met as noted above, therefore the TSS removals is met. In addition, the storm chamber system isolator row will provide additional TSS removal.

Water quality performance studies for the StormTech System Isolator Row identified TSS removal of 80%. The StormTech system is designed to contain sediment and floatable debris within the isolator row, which can then be removed as need.

ATTACHMENTS

Exhibit 1 Existing & Proposed Drainage Area Map

Exhibit 2 Existing & Proposed Cover Conditions Map

Attachment A – HydroCAD Model for Existing Conditions

Attachment B – HydroCAD Model for Proposed Conditions

Attachment C – Subwatershed Information

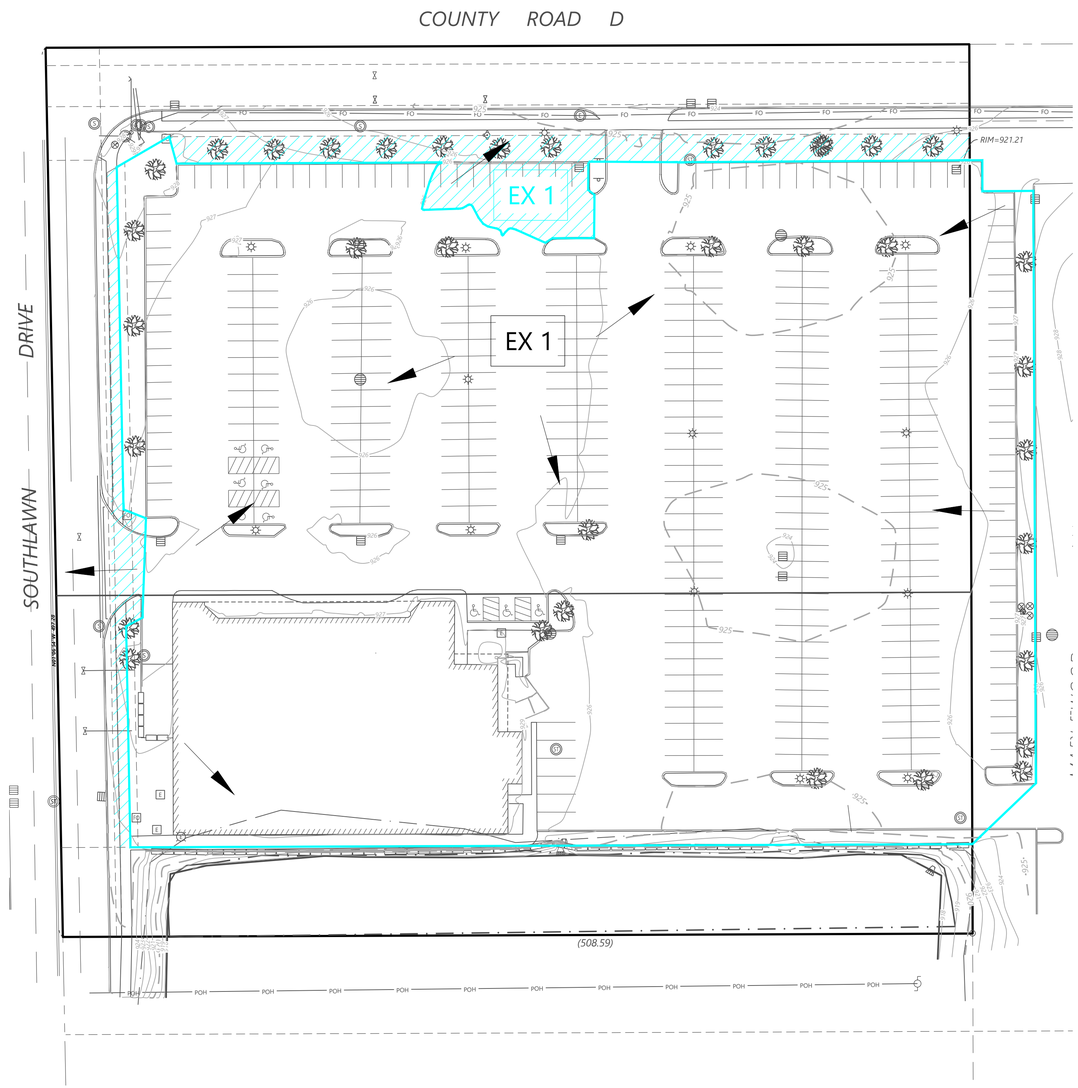
Attachment D – Civil Plans dated 09/23/2022

Attachment E – Geotechnical Report

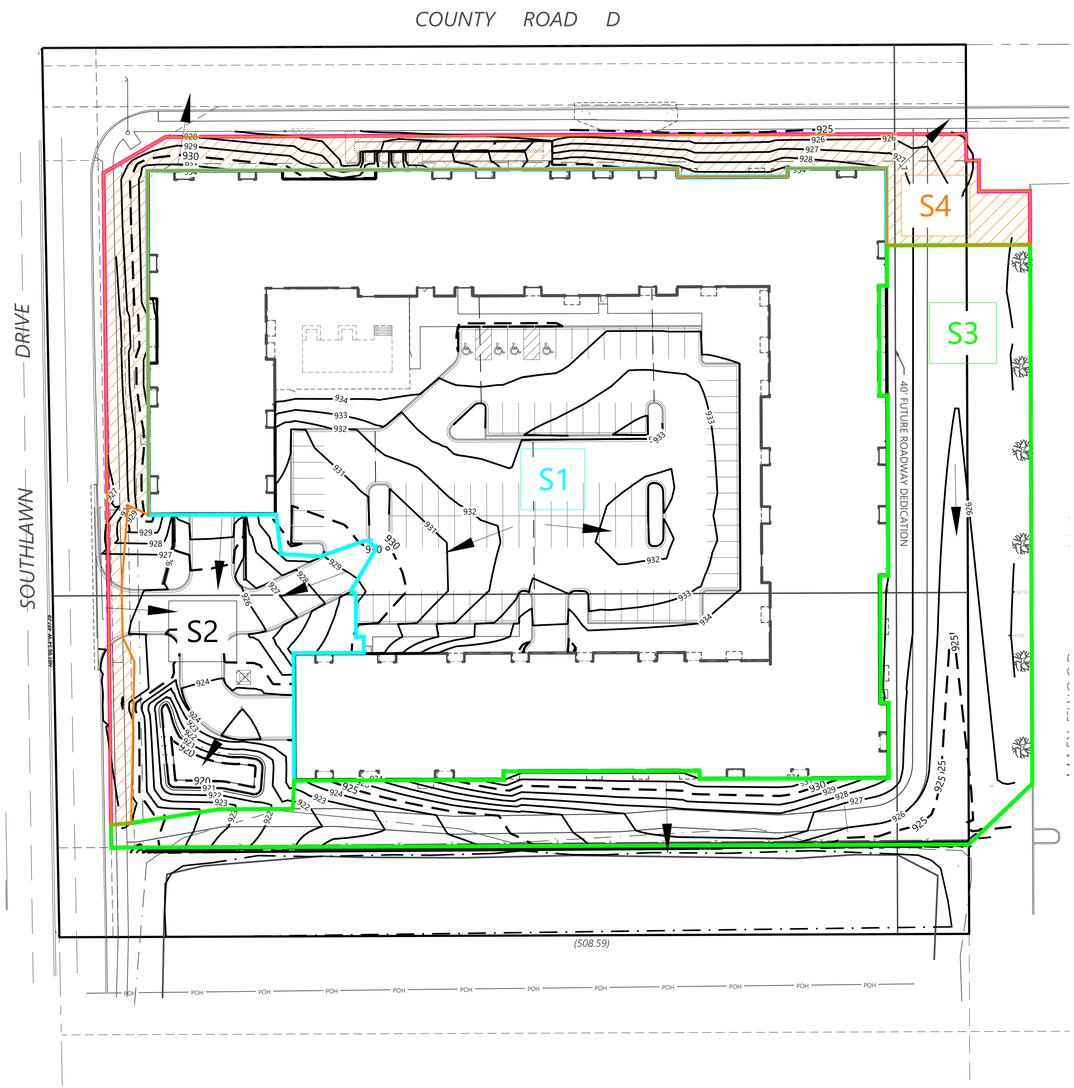
Exhibit 1 Existing & Proposed Drainage Area Map

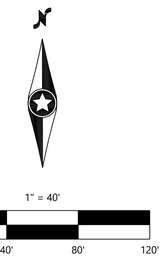
Call 48 Hours before digging:
811 or call811.com
Common Ground Alliance

EXISTING CONDITIONS



PROPOSED CONDITIONS





NOT FOR CONSTRUCTION

N:\0037066.00\DWG\CIVIL\EXISTING & PROPOSED DRAINAGE AREAS EXHIBIT.DWG

DESIGNED:
CHECKED:
DRAWN:
HORIZONTAL SCALE: 40'
VERTICAL SCALE: 8' or 4'

INITIAL ISSUE: 09/23/2022
REVISIONS:

PREPARED FOR:
ENCLAVE DEVELOPMENT
300 23RD AVE E, SUITE 300
WEST FARGO, ND 58078

I HEREBY CERTIFY THAT THIS PLAN 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

SHARI LYNN S. AHRENS
DATE 09/23/2022 LICENSE NO. ____

MAPLEWOOD ENCLAVE
MAPLEWOOD, MN

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12701 Whitewater Drive, Suite #200
Minnetonka, MN 55343
westwoodps.com
Westwood Professional Services, Inc.

EXISTING & PROPOSED DRAINAGE AREAS

SHEET NUMBER: 1 OF 1

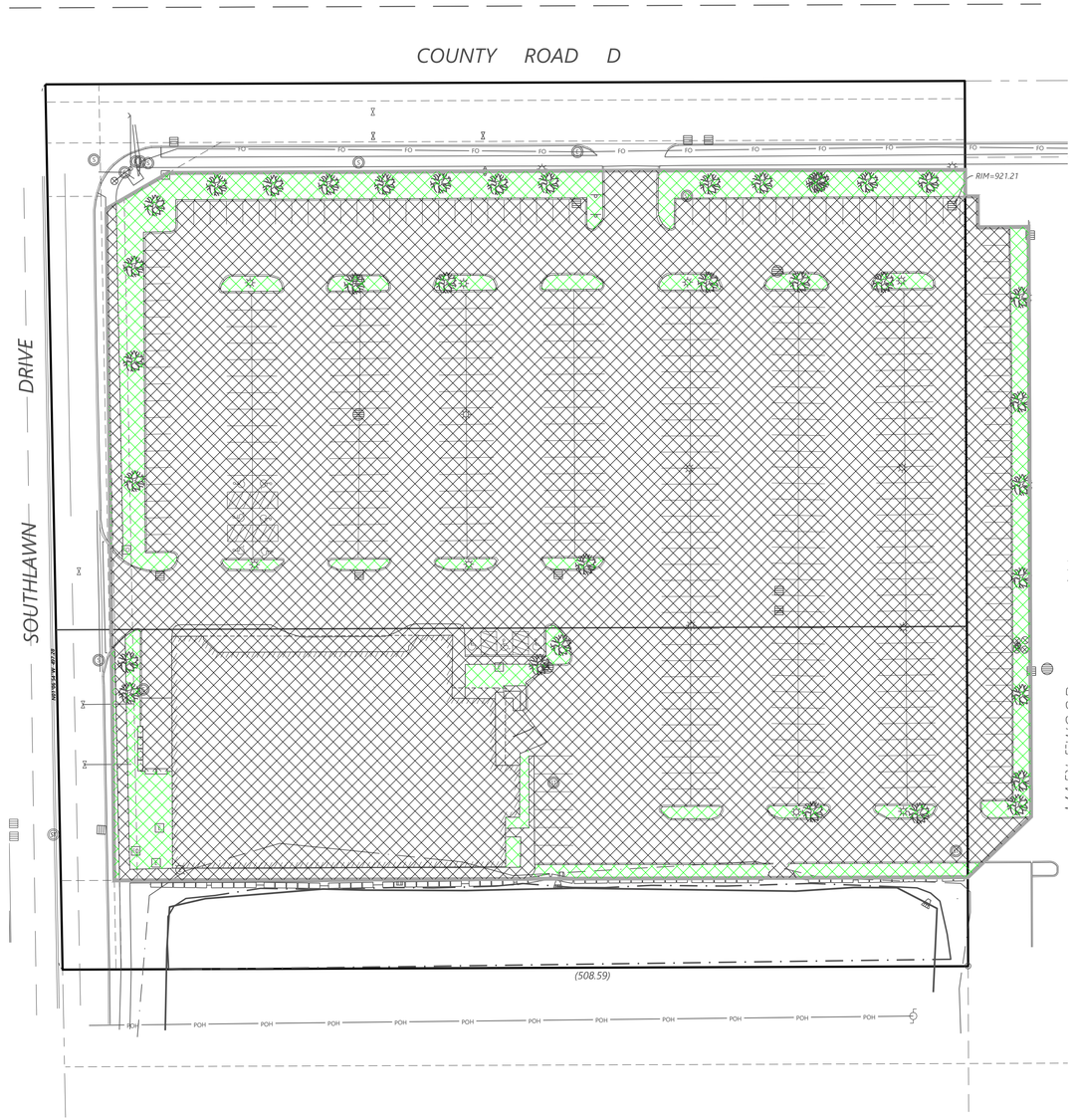
DATE: 09/26/2022

PROJECT NUMBER: 0037066.00

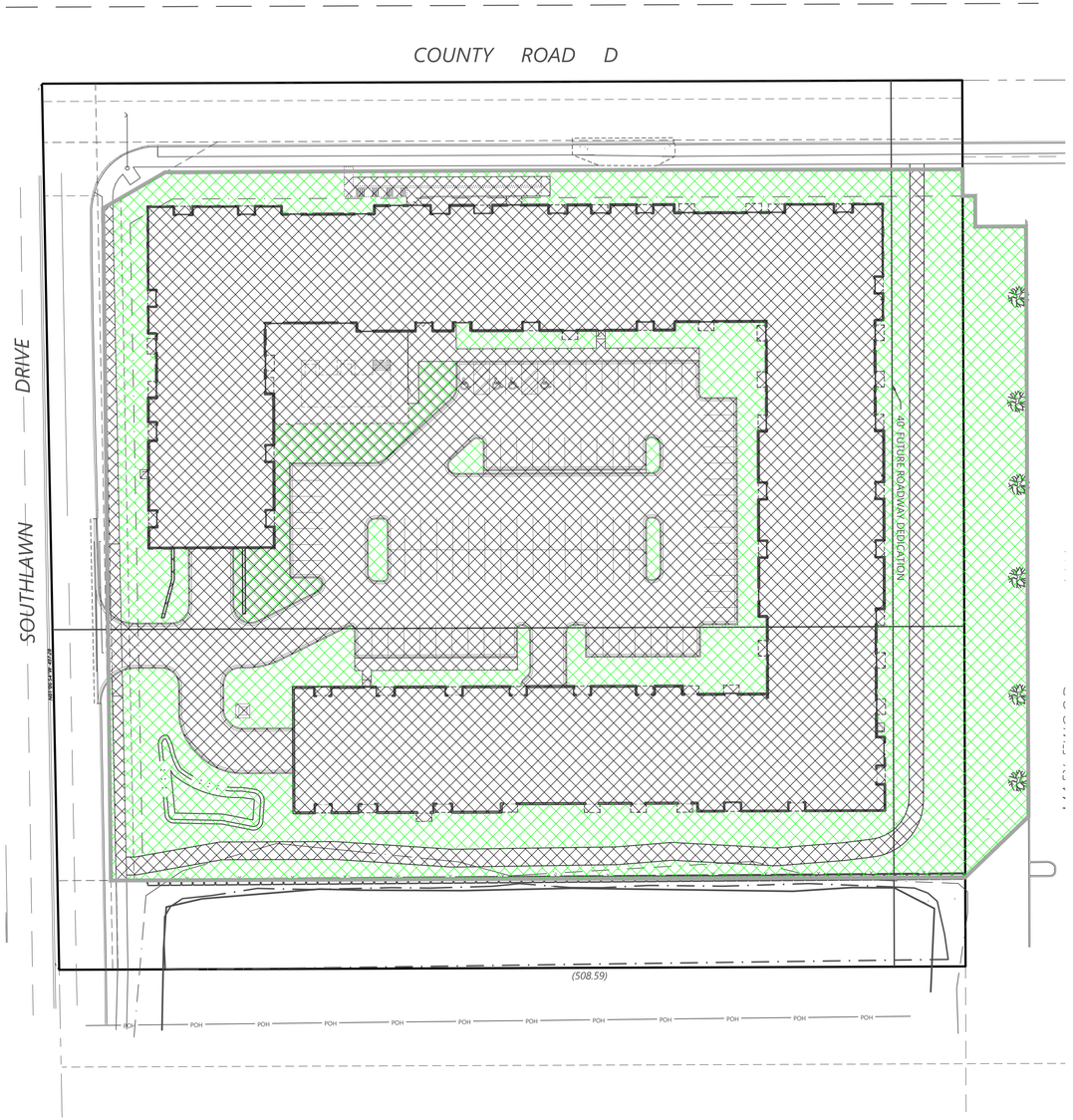
MAPLEWOOD ENCLAVE

Exhibit 2 Existing & Proposed Cover Conditions Map

EXISTING CONDITIONS



PROPOSED CONDITIONS



COVER CONDITION SUMMARY

IMPERVIOUS		
	EXISTING	92.3%
	PROPOSED	61.1%
PERVIOUS		
	EXISTING	7.7%
	PROPOSED	38.9%

COVER CONDITION LEGEND

IMPERVIOUS

PERVIOUS

1" = 40'

0' 40' 80' 120'

NOT FOR CONSTRUCTION

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Common Ground Alliance

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EXISTING & PROPOSED COVER CONDITIONS

SHEET NUMBER: 1 OF 1

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MAPLEWOOD ENCLAVE

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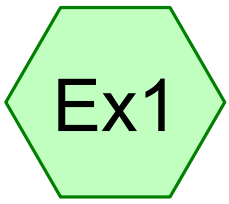
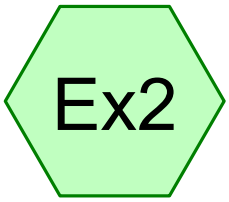
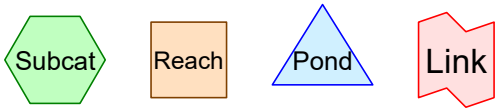
Attachment A – HydroCAD Model for Existing Conditions



Existing Conditions - Drainage to Existing Pond



Existing - discharge to off-site



Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.359	74	>75% Grass cover, Good, HSG C (Ex1, Ex2)
4.155	98	Paved parking, HSG C (Ex1)
0.151	98	pavement and sidewalk (Ex2)
4.665	**96**	**TOTAL AREA**

Time span=1.00-72.00 hrs, dt=0.01 hrs, 7101 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEx1: Existing Conditions - Runoff Area=189,840 sf 95.34% Impervious Runoff Depth=2.50"
Tc=10.0 min CN=74/98 Runoff=14.95 cfs 0.906 af

SubcatchmentEx2: Existing - discharge to Runoff Area=13,370 sf 49.35% Impervious Runoff Depth=1.67"
Tc=7.0 min CN=74/98 Runoff=0.81 cfs 0.043 af

Total Runoff Area = 4.665 ac Runoff Volume = 0.949 af Average Runoff Depth = 2.44"
7.69% Pervious = 0.359 ac 92.31% Impervious = 4.306 ac

Summary for Subcatchment Ex1: Existing Conditions - Drainage to Existing Pond

Runoff = 14.95 cfs @ 12.17 hrs, Volume= 0.906 af, Depth= 2.50"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.81"

Area (sf)	CN	Description
8,856	74	>75% Grass cover, Good, HSG C
180,984	98	Paved parking, HSG C
189,840	97	Weighted Average
8,856	74	4.66% Pervious Area
180,984	98	95.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Summary for Subcatchment Ex2: Existing - discharge to off-site

Runoff = 0.81 cfs @ 12.14 hrs, Volume= 0.043 af, Depth= 1.67"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.81"

	Area (sf)	CN	Description
*	6,598	98	pavement and sidewalk
	6,772	74	>75% Grass cover, Good, HSG C
	13,370	86	Weighted Average
	6,772	74	50.65% Pervious Area
	6,598	98	49.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0					**Direct Entry,**

Time span=1.00-72.00 hrs, dt=0.01 hrs, 7101 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEx1: Existing Conditions - Runoff Area=189,840 sf 95.34% Impervious Runoff Depth=3.85"
Tc=10.0 min CN=74/98 Runoff=22.67 cfs 1.399 af

SubcatchmentEx2: Existing - discharge to Runoff Area=13,370 sf 49.35% Impervious Runoff Depth=2.83"
Tc=7.0 min CN=74/98 Runoff=1.39 cfs 0.072 af

Total Runoff Area = 4.665 ac Runoff Volume = 1.471 af Average Runoff Depth = 3.78"
7.69% Pervious = 0.359 ac 92.31% Impervious = 4.306 ac

Summary for Subcatchment Ex1: Existing Conditions - Drainage to Existing Pond

Runoff = 22.67 cfs @ 12.17 hrs, Volume= 1.399 af, Depth= 3.85"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.19"

Area (sf)	CN	Description
8,856	74	>75% Grass cover, Good, HSG C
180,984	98	Paved parking, HSG C
189,840	97	Weighted Average
8,856	74	4.66% Pervious Area
180,984	98	95.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Summary for Subcatchment Ex2: Existing - discharge to off-site

Runoff = 1.39 cfs @ 12.14 hrs, Volume= 0.072 af, Depth= 2.83"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.19"

	Area (sf)	CN	Description
*	6,598	98	pavement and sidewalk
	6,772	74	>75% Grass cover, Good, HSG C
	13,370	86	Weighted Average
	6,772	74	50.65% Pervious Area
	6,598	98	49.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0					**Direct Entry,**

Time span=1.00-72.00 hrs, dt=0.01 hrs, 7101 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment Ex1: Existing Conditions - Runoff Area=189,840 sf 95.34% Impervious Runoff Depth=6.99"
Tc=10.0 min CN=74/98 Runoff=40.45 cfs 2.539 af

Subcatchment Ex2: Existing - discharge to Runoff Area=13,370 sf 49.35% Impervious Runoff Depth=5.72"
Tc=7.0 min CN=74/98 Runoff=2.80 cfs 0.146 af

Total Runoff Area = 4.665 ac Runoff Volume = 2.686 af Average Runoff Depth = 6.91"
7.69% Pervious = 0.359 ac 92.31% Impervious = 4.306 ac

Summary for Subcatchment Ex1: Existing Conditions - Drainage to Existing Pond

Runoff = 40.45 cfs @ 12.17 hrs, Volume= 2.539 af, Depth= 6.99"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=7.36"

Area (sf)	CN	Description
8,856	74	>75% Grass cover, Good, HSG C
180,984	98	Paved parking, HSG C
189,840	97	Weighted Average
8,856	74	4.66% Pervious Area
180,984	98	95.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Summary for Subcatchment Ex2: Existing - discharge to off-site

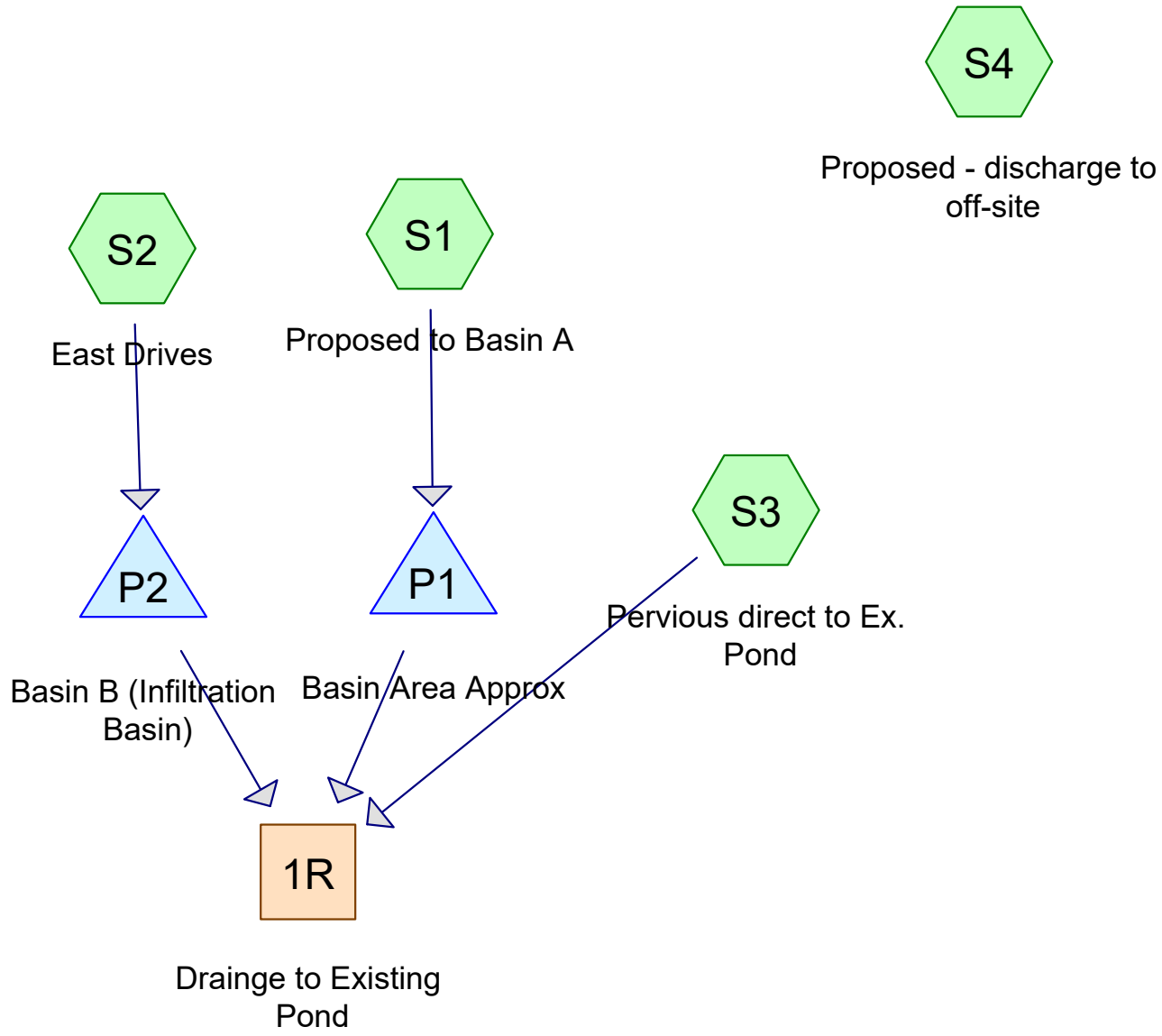
Runoff = 2.80 cfs @ 12.14 hrs, Volume= 0.146 af, Depth= 5.72"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=7.36"

	Area (sf)	CN	Description
*	6,598	98	pavement and sidewalk
	6,772	74	>75% Grass cover, Good, HSG C
	13,370	86	Weighted Average
	6,772	74	50.65% Pervious Area
	6,598	98	49.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0					**Direct Entry,**

Attachment B – HydroCAD Model for Proposed Conditions



Subcat Reach Pond Link

Routing Diagram for 09-23-2022 Enclave Maplewood
Prepared by Westwood MultiDisciplined Eng, Printed 9/26/2022

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.876	74	>75% Grass cover, Good, HSG C (S1, S2, S3, S4)
0.159	98	Paved parking, HSG A (S2)
0.822	98	Paved parking, HSG B (S1)
0.098	98	Pool Deck and Pool (S1)
1.683	98	Roofs, HSG C (S1)
0.092	98	east sidewalk, stairs and ramp from bldg (S4)
4.730	**88**	**TOTAL AREA**

Time span=1.00-72.00 hrs, dt=0.01 hrs, 7101 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentS1: Proposed to Basin A Runoff Area=125,720 sf 90.20% Impervious Runoff Depth=2.40"
Tc=10.0 min CN=74/98 Runoff=9.54 cfs 0.578 af

SubcatchmentS2: East Drives Runoff Area=17,586 sf 39.34% Impervious Runoff Depth=1.49"
Tc=7.0 min CN=74/98 Runoff=0.96 cfs 0.050 af

SubcatchmentS3: Pervious direct to Ex. Runoff Area=41,560 sf 0.00% Impervious Runoff Depth=0.79"
Flow Length=300' Slope=0.0800 '/' Tc=14.5 min CN=74/0 Runoff=0.93 cfs 0.063 af

SubcatchmentS4: Proposed - discharge Runoff Area=21,192 sf 18.94% Impervious Runoff Depth=1.13"
Tc=7.0 min CN=74/98 Runoff=0.90 cfs 0.046 af

Reach 1R: Drainge to Existing Pond Inflow=1.64 cfs 0.314 af
Outflow=1.64 cfs 0.314 af

Pond P1: Basin Area Approx Peak Elev=922.14' Storage=15,360 cf Inflow=9.54 cfs 0.578 af
Discarded=0.07 cfs 0.357 af Primary=1.06 cfs 0.221 af Outflow=1.13 cfs 0.578 af

Pond P2: Basin B (Infiltration Basin) Peak Elev=920.96' Storage=998 cf Inflow=0.96 cfs 0.050 af
Outflow=0.54 cfs 0.030 af

Total Runoff Area = 4.730 ac Runoff Volume = 0.737 af Average Runoff Depth = 1.87"
39.66% Pervious = 1.876 ac 60.34% Impervious = 2.854 ac

Summary for Subcatchment S1: Proposed to Basin A

Runoff = 9.54 cfs @ 12.17 hrs, Volume= 0.578 af, Depth= 2.40"
Routed to Pond P1 : Basin Area Approx

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.81"

	Area (sf)	CN	Description
	73,292	98	Roofs, HSG C
	35,818	98	Paved parking, HSG B
*	4,290	98	Pool Deck and Pool
	12,320	74	>75% Grass cover, Good, HSG C
	125,720	96	Weighted Average
	12,320	74	9.80% Pervious Area
	113,400	98	90.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Direct to Storm CB's**

Summary for Subcatchment S2: East Drives

Runoff = 0.96 cfs @ 12.14 hrs, Volume= 0.050 af, Depth= 1.49"
Routed to Pond P2 : Basin B (Infiltration Basin)

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.81"

Area (sf)	CN	Description
6,918	98	Paved parking, HSG A
10,668	74	>75% Grass cover, Good, HSG C
17,586	83	Weighted Average
10,668	74	60.66% Pervious Area
6,918	98	39.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0					**Direct Entry, direct**

Summary for Subcatchment S3: Pervious direct to Ex. Pond

Runoff = 0.93 cfs @ 12.25 hrs, Volume= 0.063 af, Depth= 0.79"
Routed to Reach 1R : Drainge to Existing Pond

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.81"

Area (sf)	CN	Description
41,560	74	>75% Grass cover, Good, HSG C
41,560	74	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	300	0.0800	0.35		**Sheet Flow, swale to pond** Grass: Short n= 0.150 P2= 2.80"

Summary for Subcatchment S4: Proposed - discharge to off-site

Runoff = 0.90 cfs @ 12.15 hrs, Volume= 0.046 af, Depth= 1.13"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.81"

	Area (sf)	CN	Description
	17,179	74	>75% Grass cover, Good, HSG C
*	4,013	98	east sidewalk, stairs and ramp from bldg
	21,192	79	Weighted Average
	17,179	74	81.06% Pervious Area
	4,013	98	18.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0					**Direct Entry, direct**

Summary for Reach 1R: Drainge to Existing Pond

Inflow Area = 4.244 ac, 65.08% Impervious, Inflow Depth = 0.89" for 2-Year event
Inflow = 1.64 cfs @ 12.30 hrs, Volume= 0.314 af
Outflow = 1.64 cfs @ 12.30 hrs, Volume= 0.314 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond P1: Basin Area Approx

Inflow Area = 2.886 ac, 90.20% Impervious, Inflow Depth = 2.40" for 2-Year event
Inflow = 9.54 cfs @ 12.17 hrs, Volume= 0.578 af
Outflow = 1.13 cfs @ 12.68 hrs, Volume= 0.578 af, Atten= 88%, Lag= 30.7 min
Discarded = 0.07 cfs @ 7.49 hrs, Volume= 0.357 af
Primary = 1.06 cfs @ 12.68 hrs, Volume= 0.221 af
Routed to Reach 1R : Drainge to Existing Pond

Routing by Stor-Ind method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 922.14' @ 12.68 hrs Surf.Area= 14,723 sf Storage= 15,360 cf

Plug-Flow detention time= 962.2 min calculated for 0.578 af (100% of inflow)
Center-of-Mass det. time= 962.1 min (1,722.4 - 760.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	920.50'	14,353 cf	**106.00'W x 138.90'L x 3.75'H Field A** 55,211 cf Overall - 19,328 cf Embedded = 35,883 cf x 40.0% Voids
#2A	921.25'	19,328 cf	**ADS_StormTech DC-780 +Cap** x 418 Inside #1 Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 418 Chambers in 22 Rows
		33,681 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	921.75'	**30.0" Round Culvert** L= 78.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 921.75' / 920.23' S= 0.0195 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 4.91 sf
#2	Discarded	920.50'	**0.200 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.07 cfs @ 7.49 hrs HW=920.54' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=1.06 cfs @ 12.68 hrs HW=922.14' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 1.06 cfs @ 2.14 fps)

Summary for Pond P2: Basin B (Infiltration Basin)

Inflow Area = 0.404 ac, 39.34% Impervious, Inflow Depth = 1.49" for 2-Year event
Inflow = 0.96 cfs @ 12.14 hrs, Volume= 0.050 af
Outflow = 0.54 cfs @ 12.23 hrs, Volume= 0.030 af, Atten= 44%, Lag= 5.3 min
Primary = 0.54 cfs @ 12.23 hrs, Volume= 0.030 af
Routed to Reach 1R : Drainge to Existing Pond

Routing by Stor-Ind method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 920.96' @ 12.23 hrs Surf.Area= 1,236 sf Storage= 998 cf

Plug-Flow detention time= 163.1 min calculated for 0.030 af (60% of inflow)
Center-of-Mass det. time= 77.2 min (858.1 - 780.9)

Volume	Invert	Avail.Storage	Storage Description
#1	919.85'	1,950 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
919.85	582	0	0
920.85	1,158	870	870
921.00	1,267	182	1,052
921.60	1,728	899	1,950

Device	Routing	Invert	Outlet Devices
#1	Primary	918.05'	**12.0" Round Culvert** L= 10.0' RCP, square edge headwall, Ke= 0.500

			Inlet / Outlet Invert= 918.05' / 918.00' S= 0.0050 '/' Cc= 0.900
			n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#2	Device 1	920.85'	**18.0" Horiz. Orifice/Grate** C= 0.600
			Limited to weir flow at low heads

Primary OutFlow Max=0.54 cfs @ 12.23 hrs HW=920.96' (Free Discharge)
↑—**1=Culvert** (Passes 0.54 cfs of 5.87 cfs potential flow)
↑—**2=Orifice/Grate** (Weir Controls 0.54 cfs @ 1.07 fps)

Time span=1.00-72.00 hrs, dt=0.01 hrs, 7101 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment S1: Proposed to Basin A Runoff Area=125,720 sf 90.20% Impervious Runoff Depth=3.74"
Tc=10.0 min CN=74/98 Runoff=14.62 cfs 0.899 af

Subcatchment S2: East Drives Runoff Area=17,586 sf 39.34% Impervious Runoff Depth=2.61"
Tc=7.0 min CN=74/98 Runoff=1.71 cfs 0.088 af

Subcatchment S3: Pervious direct to Ex. Runoff Area=41,560 sf 0.00% Impervious Runoff Depth=1.74"
Flow Length=300' Slope=0.0800 '/' Tc=14.5 min CN=74/0 Runoff=2.16 cfs 0.138 af

Subcatchment S4: Proposed - discharge Runoff Area=21,192 sf 18.94% Impervious Runoff Depth=2.16"
Tc=7.0 min CN=74/98 Runoff=1.77 cfs 0.087 af

Reach 1R: Drainge to Existing Pond Inflow=6.92 cfs 0.734 af
Outflow=6.92 cfs 0.734 af

Pond P1: Basin Area Approx Peak Elev=922.60' Storage=20,565 cf Inflow=14.62 cfs 0.899 af
Discarded=0.07 cfs 0.370 af Primary=4.65 cfs 0.528 af Outflow=4.72 cfs 0.899 af

Pond P2: Basin B (Infiltration Basin) Peak Elev=921.07' Storage=1,139 cf Inflow=1.71 cfs 0.088 af
Outflow=1.57 cfs 0.068 af

Total Runoff Area = 4.730 ac Runoff Volume = 1.212 af Average Runoff Depth = 3.08"
39.66% Pervious = 1.876 ac 60.34% Impervious = 2.854 ac

Summary for Subcatchment S1: Proposed to Basin A

Runoff = 14.62 cfs @ 12.17 hrs, Volume= 0.899 af, Depth= 3.74"
Routed to Pond P1 : Basin Area Approx

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.19"

	Area (sf)	CN	Description
	73,292	98	Roofs, HSG C
	35,818	98	Paved parking, HSG B
*	4,290	98	Pool Deck and Pool
	12,320	74	>75% Grass cover, Good, HSG C
	125,720	96	Weighted Average
	12,320	74	9.80% Pervious Area
	113,400	98	90.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Direct to Storm CB's**

Summary for Subcatchment S2: East Drives

Runoff = 1.71 cfs @ 12.14 hrs, Volume= 0.088 af, Depth= 2.61"
Routed to Pond P2 : Basin B (Infiltration Basin)

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.19"

Area (sf)	CN	Description
6,918	98	Paved parking, HSG A
10,668	74	>75% Grass cover, Good, HSG C
17,586	83	Weighted Average
10,668	74	60.66% Pervious Area
6,918	98	39.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0					**Direct Entry, direct**

Summary for Subcatchment S3: Pervious direct to Ex. Pond

Runoff = 2.16 cfs @ 12.23 hrs, Volume= 0.138 af, Depth= 1.74"
Routed to Reach 1R : Drainge to Existing Pond

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.19"

Area (sf)	CN	Description
41,560	74	>75% Grass cover, Good, HSG C
41,560	74	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	300	0.0800	0.35		**Sheet Flow, swale to pond** Grass: Short n= 0.150 P2= 2.80"

Summary for Subcatchment S4: Proposed - discharge to off-site

Runoff = 1.77 cfs @ 12.14 hrs, Volume= 0.087 af, Depth= 2.16"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.19"

	Area (sf)	CN	Description
	17,179	74	>75% Grass cover, Good, HSG C
*	4,013	98	east sidewalk, stairs and ramp from bldg
	21,192	79	Weighted Average
	17,179	74	81.06% Pervious Area
	4,013	98	18.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0					**Direct Entry, direct**

Summary for Reach 1R: Drainge to Existing Pond

Inflow Area = 4.244 ac, 65.08% Impervious, Inflow Depth = 2.08" for 10-Year event
Inflow = 6.92 cfs @ 12.30 hrs, Volume= 0.734 af
Outflow = 6.92 cfs @ 12.30 hrs, Volume= 0.734 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond P1: Basin Area Approx

Inflow Area = 2.886 ac, 90.20% Impervious, Inflow Depth = 3.74" for 10-Year event
Inflow = 14.62 cfs @ 12.17 hrs, Volume= 0.899 af
Outflow = 4.72 cfs @ 12.39 hrs, Volume= 0.899 af, Atten= 68%, Lag= 13.4 min
Discarded = 0.07 cfs @ 5.60 hrs, Volume= 0.370 af
Primary = 4.65 cfs @ 12.39 hrs, Volume= 0.528 af
Routed to Reach 1R : Drainge to Existing Pond

Routing by Stor-Ind method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 922.60' @ 12.39 hrs Surf.Area= 14,723 sf Storage= 20,565 cf

Plug-Flow detention time= 662.0 min calculated for 0.899 af (100% of inflow)
Center-of-Mass det. time= 661.8 min (1,416.3 - 754.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	920.50'	14,353 cf	**106.00'W x 138.90'L x 3.75'H Field A** 55,211 cf Overall - 19,328 cf Embedded = 35,883 cf x 40.0% Voids
#2A	921.25'	19,328 cf	**ADS_StormTech DC-780 +Cap** x 418 Inside #1 Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 418 Chambers in 22 Rows
		33,681 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	921.75'	**30.0" Round Culvert** L= 78.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 921.75' / 920.23' S= 0.0195 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 4.91 sf
#2	Discarded	920.50'	**0.200 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.07 cfs @ 5.60 hrs HW=920.54' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=4.65 cfs @ 12.39 hrs HW=922.60' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 4.65 cfs @ 3.14 fps)

Summary for Pond P2: Basin B (Infiltration Basin)

Inflow Area = 0.404 ac, 39.34% Impervious, Inflow Depth = 2.61" for 10-Year event
Inflow = 1.71 cfs @ 12.14 hrs, Volume= 0.088 af
Outflow = 1.57 cfs @ 12.17 hrs, Volume= 0.068 af, Atten= 8%, Lag= 1.7 min
Primary = 1.57 cfs @ 12.17 hrs, Volume= 0.068 af
Routed to Reach 1R : Drainge to Existing Pond

Routing by Stor-Ind method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 921.07' @ 12.17 hrs Surf.Area= 1,319 sf Storage= 1,139 cf

Plug-Flow detention time= 115.6 min calculated for 0.068 af (77% of inflow)
Center-of-Mass det. time= 47.9 min (824.5 - 776.6)

Volume	Invert	Avail.Storage	Storage Description
#1	919.85'	1,950 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
919.85	582	0	0
920.85	1,158	870	870
921.00	1,267	182	1,052
921.60	1,728	899	1,950

Device	Routing	Invert	Outlet Devices
#1	Primary	918.05'	**12.0" Round Culvert** L= 10.0' RCP, square edge headwall, Ke= 0.500

			Inlet / Outlet Invert= 918.05' / 918.00' S= 0.0050 '/' Cc= 0.900
			n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#2	Device 1	920.85'	**18.0" Horiz. Orifice/Grate** C= 0.600
			Limited to weir flow at low heads

Primary OutFlow Max=1.57 cfs @ 12.17 hrs HW=921.07' (Free Discharge)
↑—**1=Culvert** (Passes 1.57 cfs of 6.00 cfs potential flow)
↑—**2=Orifice/Grate** (Weir Controls 1.57 cfs @ 1.53 fps)

Time span=1.00-72.00 hrs, dt=0.01 hrs, 7101 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentS1: Proposed to Basin A Runoff Area=125,720 sf 90.20% Impervious Runoff Depth=6.85"
Tc=10.0 min CN=74/98 Runoff=26.39 cfs 1.647 af

SubcatchmentS2: East Drives Runoff Area=17,586 sf 39.34% Impervious Runoff Depth=5.44"
Tc=7.0 min CN=74/98 Runoff=3.56 cfs 0.183 af

SubcatchmentS3: Pervious direct to Ex. Runoff Area=41,560 sf 0.00% Impervious Runoff Depth=4.36"
Flow Length=300' Slope=0.0800 '/' Tc=14.5 min CN=74/0 Runoff=5.45 cfs 0.346 af

SubcatchmentS4: Proposed - discharge Runoff Area=21,192 sf 18.94% Impervious Runoff Depth=4.88"
Tc=7.0 min CN=74/98 Runoff=4.00 cfs 0.198 af

Reach 1R: Drainge to Existing Pond Inflow=23.73 cfs 1.772 af
Outflow=23.73 cfs 1.772 af

Pond P1: Basin Area Approx Peak Elev=923.49' Storage=29,070 cf Inflow=26.39 cfs 1.647 af
Discarded=0.07 cfs 0.384 af Primary=16.42 cfs 1.263 af Outflow=16.49 cfs 1.647 af

Pond P2: Basin B (Infiltration Basin) Peak Elev=921.21' Storage=1,337 cf Inflow=3.56 cfs 0.183 af
Outflow=3.35 cfs 0.163 af

Total Runoff Area = 4.730 ac Runoff Volume = 2.375 af Average Runoff Depth = 6.02"
39.66% Pervious = 1.876 ac 60.34% Impervious = 2.854 ac

Summary for Subcatchment S1: Proposed to Basin A

Runoff = 26.39 cfs @ 12.17 hrs, Volume= 1.647 af, Depth= 6.85"
Routed to Pond P1 : Basin Area Approx

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=7.36"

	Area (sf)	CN	Description
	73,292	98	Roofs, HSG C
	35,818	98	Paved parking, HSG B
*	4,290	98	Pool Deck and Pool
	12,320	74	>75% Grass cover, Good, HSG C
	125,720	96	Weighted Average
	12,320	74	9.80% Pervious Area
	113,400	98	90.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Direct to Storm CB's**

Summary for Subcatchment S2: East Drives

Runoff = 3.56 cfs @ 12.14 hrs, Volume= 0.183 af, Depth= 5.44"
Routed to Pond P2 : Basin B (Infiltration Basin)

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=7.36"

Area (sf)	CN	Description
6,918	98	Paved parking, HSG A
10,668	74	>75% Grass cover, Good, HSG C
17,586	83	Weighted Average
10,668	74	60.66% Pervious Area
6,918	98	39.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0					**Direct Entry, direct**

Summary for Subcatchment S3: Pervious direct to Ex. Pond

Runoff = 5.45 cfs @ 12.23 hrs, Volume= 0.346 af, Depth= 4.36"
Routed to Reach 1R : Drainge to Existing Pond

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=7.36"

Area (sf)	CN	Description
41,560	74	>75% Grass cover, Good, HSG C
41,560	74	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	300	0.0800	0.35		**Sheet Flow, swale to pond** Grass: Short n= 0.150 P2= 2.80"

Summary for Subcatchment S4: Proposed - discharge to off-site

Runoff = 4.00 cfs @ 12.14 hrs, Volume= 0.198 af, Depth= 4.88"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=7.36"

	Area (sf)	CN	Description
	17,179	74	>75% Grass cover, Good, HSG C
*	4,013	98	east sidewalk, stairs and ramp from bldg
	21,192	79	Weighted Average
	17,179	74	81.06% Pervious Area
	4,013	98	18.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0					**Direct Entry, direct**

Summary for Reach 1R: Drainge to Existing Pond

Inflow Area = 4.244 ac, 65.08% Impervious, Inflow Depth = 5.01" for 100-Year event
Inflow = 23.73 cfs @ 12.25 hrs, Volume= 1.772 af
Outflow = 23.73 cfs @ 12.25 hrs, Volume= 1.772 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond P1: Basin Area Approx

Inflow Area = 2.886 ac, 90.20% Impervious, Inflow Depth = 6.85" for 100-Year event
Inflow = 26.39 cfs @ 12.17 hrs, Volume= 1.647 af
Outflow = 16.49 cfs @ 12.27 hrs, Volume= 1.647 af, Atten= 38%, Lag= 6.1 min
Discarded = 0.07 cfs @ 3.74 hrs, Volume= 0.384 af
Primary = 16.42 cfs @ 12.27 hrs, Volume= 1.263 af
Routed to Reach 1R : Drainge to Existing Pond

Routing by Stor-Ind method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 923.49' @ 12.27 hrs Surf.Area= 14,723 sf Storage= 29,070 cf

Plug-Flow detention time= 398.8 min calculated for 1.646 af (100% of inflow)
Center-of-Mass det. time= 398.9 min (1,146.7 - 747.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	920.50'	14,353 cf	**106.00'W x 138.90'L x 3.75'H Field A** 55,211 cf Overall - 19,328 cf Embedded = 35,883 cf x 40.0% Voids
#2A	921.25'	19,328 cf	**ADS_StormTech DC-780 +Cap** x 418 Inside #1 Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 418 Chambers in 22 Rows
		33,681 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	921.75'	**30.0" Round Culvert** L= 78.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 921.75' / 920.23' S= 0.0195 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 4.91 sf
#2	Discarded	920.50'	**0.200 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.07 cfs @ 3.74 hrs HW=920.54' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=16.41 cfs @ 12.27 hrs HW=923.49' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 16.41 cfs @ 4.49 fps)

Summary for Pond P2: Basin B (Infiltration Basin)

Inflow Area = 0.404 ac, 39.34% Impervious, Inflow Depth = 5.44" for 100-Year event
Inflow = 3.56 cfs @ 12.14 hrs, Volume= 0.183 af
Outflow = 3.35 cfs @ 12.16 hrs, Volume= 0.163 af, Atten= 6%, Lag= 1.4 min
Primary = 3.35 cfs @ 12.16 hrs, Volume= 0.163 af
Routed to Reach 1R : Drainge to Existing Pond

Routing by Stor-Ind method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 921.21' @ 12.16 hrs Surf.Area= 1,430 sf Storage= 1,337 cf

Plug-Flow detention time= 77.6 min calculated for 0.163 af (89% of inflow)
Center-of-Mass det. time= 32.5 min (801.9 - 769.4)

Volume	Invert	Avail.Storage	Storage Description
#1	919.85'	1,950 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
919.85	582	0	0
920.85	1,158	870	870
921.00	1,267	182	1,052
921.60	1,728	899	1,950

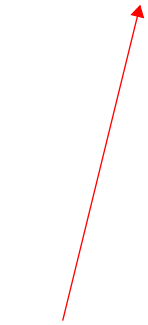
Device	Routing	Invert	Outlet Devices
#1	Primary	918.05'	**12.0" Round Culvert** L= 10.0' RCP, square edge headwall, Ke= 0.500

			Inlet / Outlet Invert= 918.05' / 918.00' S= 0.0050 '/' Cc= 0.900
			n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#2	Device 1	920.85'	**18.0" Horiz. Orifice/Grate** C= 0.600
			Limited to weir flow at low heads

Primary OutFlow Max=3.34 cfs @ 12.16 hrs HW=921.21' (Free Discharge)
↑—**1=Culvert** (Passes 3.34 cfs of 6.17 cfs potential flow)
↑—**2=Orifice/Grate** (Weir Controls 3.34 cfs @ 1.97 fps)

Stage-Area-Storage for Pond P1: Basin Area Approx

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
920.50	**14,723**	0	922.30	14,723	17,173	924.10	14,723	32,798
920.55	14,723	294	922.35	14,723	17,745	924.15	14,723	33,092
920.60	14,723	589	922.40	14,723	18,312	924.20	14,723	33,387
920.65	14,723	883	922.45	14,723	18,875	924.25	14,723	**33,681**
920.70	14,723	1,178	922.50	14,723	19,434			
920.75	14,723	1,472	922.55	14,723	19,987			
920.80	14,723	1,767	922.60	14,723	20,535			
920.85	14,723	2,061	922.65	14,723	21,078			
920.90	14,723	2,356	922.70	14,723	21,615			
920.95	14,723	2,650	922.75	14,723	22,147			
921.00	14,723	2,945	922.80	14,723	22,672			
921.05	14,723	3,239	922.85	14,723	23,191			
921.10	14,723	3,534	922.90	14,723	23,704			
921.15	14,723	3,828	922.95	14,723	24,209			
921.20	14,723	4,122	923.00	14,723	24,706			
921.25	14,723	4,417	923.05	14,723	25,196			
921.30	14,723	5,048	923.10	14,723	25,677			
921.35	14,723	5,679	923.15	14,723	26,149			
921.40	14,723	6,308	923.20	14,723	26,613			
921.45	14,723	6,934	923.25	14,723	27,066			
921.50	14,723	7,559	923.30	14,723	27,508			
921.55	14,723	8,181	923.35	14,723	27,938			
921.60	14,723	8,800	923.40	14,723	28,353			
921.65	14,723	9,418	923.45	14,723	28,750			
921.70	14,723	10,033	923.50	14,723	29,124			
921.75	14,723	10,645	923.55	14,723	29,476			
921.80	14,723	11,255	923.60	14,723	29,808			
921.85	14,723	11,861	923.65	14,723	30,127			
921.90	14,723	12,465	923.70	14,723	30,437			
921.95	14,723	13,066	923.75	14,723	30,737			
922.00	14,723	13,664	923.80	14,723	31,031			
922.05	14,723	14,258	923.85	14,723	31,326			
922.10	14,723	14,849	923.90	14,723	31,620			
922.15	14,723	15,436	923.95	14,723	31,915			
922.20	14,723	16,019	924.00	14,723	32,209			
922.25	14,723	16,598	924.05	14,723	32,503			



Outlet IE = 921.75
Volume provided below outlet = 10,645

Stage-Area-Storage for Pond P2: Basin B (Infiltration Basin)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
919.85	582	0
919.87	594	12
919.89	605	24
919.91	617	36
919.93	628	48
919.95	640	61
919.97	651	74
919.99	663	87
920.01	674	100
920.03	686	114
920.05	697	128
920.07	709	142
920.09	720	156
920.11	732	171
920.13	743	186
920.15	755	201
920.17	766	216
920.19	778	231
920.21	789	247
920.23	801	263
920.25	812	279
920.27	824	295
920.29	835	312
920.31	847	329
920.33	858	346
920.35	870	363
920.37	882	381
920.39	893	398
920.41	905	416
920.43	916	434
920.45	928	453
920.47	939	472
920.49	951	490
920.51	962	510
920.53	974	529
920.55	985	549
920.57	997	568
920.59	1,008	588
920.61	1,020	609
920.63	1,031	629
920.65	1,043	650
920.67	1,054	671
920.69	1,066	692
920.71	1,077	714
920.73	1,089	735
920.75	1,100	757
920.77	1,112	779
920.79	1,123	802
920.81	1,135	824
920.83	1,146	847
920.85	1,158	870
920.87	1,173	893
920.89	1,187	917
920.91	1,202	941
920.93	1,216	965
920.95	1,231	989
920.97	1,245	1,014
920.99	1,260	1,039
921.01	1,275	1,065
921.03	1,290	1,090
921.05	1,305	1,116
921.07	1,321	1,142
921.09	1,336	1,169
921.11	1,352	1,196
921.13	1,367	1,223
921.15	1,382	1,251
921.17	1,398	1,278
921.19	1,413	1,306
921.21	1,428	1,335
921.23	1,444	1,364
921.25	1,459	1,393
921.27	1,474	1,422
921.29	1,490	1,452
921.31	1,505	1,482
921.33	1,521	1,512
921.35	1,536	1,542
921.37	1,551	1,573
921.39	1,567	1,604
921.41	1,582	1,636
921.43	1,597	1,668
921.45	1,613	1,700
921.47	1,628	1,732
921.49	1,643	1,765
921.51	1,659	1,798
921.53	1,674	1,831
921.55	1,690	1,865
921.57	1,705	1,899
921.59	**1,720**	**1,933**

Outlet IE = 920.85
Volume provided below outlet = 870 CF

Attachment C – Subwatershed Information

Myth Nightclub Drainage, Maplewood

Ramsey-Washington Metro Watershed District

0 0.05 0.1 0.2 Miles

N

Key

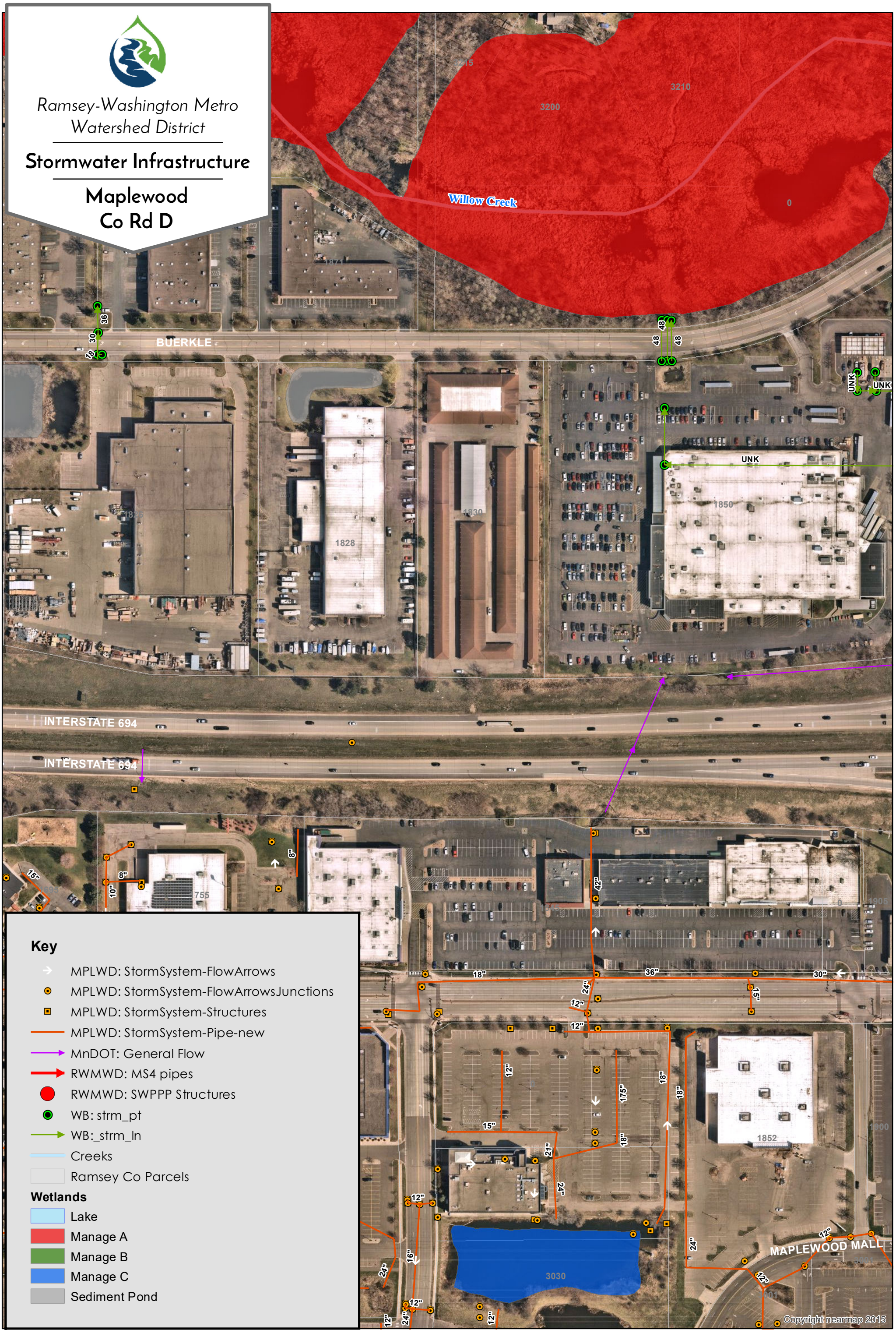
Roads

Major Subwatersheds

Ramsey-Washington Metro Watershed District

Stormwater Infrastructure

Maplewood
Co Rd D



Key

- MPLWD: StormSystem-FlowArrows
- MPLWD: StormSystem-FlowArrowsJunctions
- MPLWD: StormSystem-Structures
- MPLWD: StormSystem-Pipe-new
- MnDOT: General Flow
- RWMWD: MS4 pipes
- RWMWD: SWPPP Structures
- WB: strm_pt
- WB:_strm_ln
- Creeks
- Ramsey Co Parcels

Wetlands

- Lake
- Manage A
- Manage B
- Manage C
- Sediment Pond

0 200 400 Feet

Note: Directionality assumed to be part of linework from other municipalities. Consider this when reviewing linework. Use as reference only.

Attachment D – Civil Plans dated 09/23/2022

PRELIMINARY PLANS

FOR

ENCLAVE MAPLEWOOD

MAPLEWOOD, MN

Vicinity Map
(NOT TO SCALE)

PREPARED FOR:
ENCLAVE DEVELOPMENT
300 23RD AVE E, SUITE 300
WEST FARGO, ND 58078
CONTACT: BRIAN BOCHMAN
PHONE: 701-212-8110
EMAIL: BRIAN@ENCLAVECOMPANIES.COM

PREPARED BY:
Westwood

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

Westwood Professional Services, Inc.

PROJECT NUMBER: 0037066.00
CONTACT: SHARI LYNN S. AHRENS

SHEET INDEX

Sheet List Table

NO.	DATE	REVISION	SHEETS
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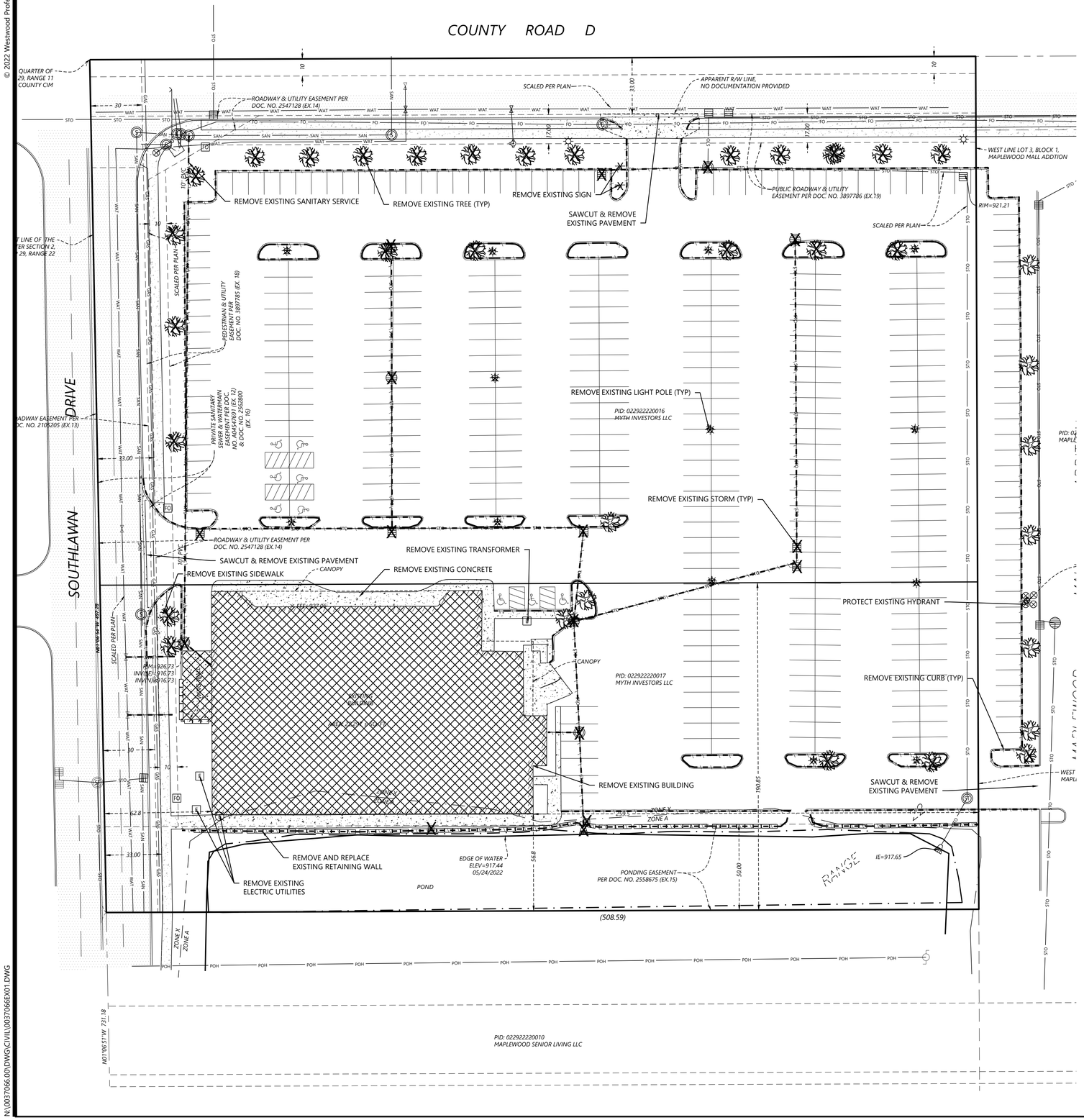
PRELIMINARY PLANS

FOR

ENCLAVE MAPLEWOOD
MAPLEWOOD, MN

INITIAL SUBMITTAL DATE: 09/23/2022 SHEET: C001



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

REMOVAL LEGEND

- PROPERTY LINE
- SAW CUT PAVEMENT
- CURB & GUTTER
- SANITARY SEWER
- WATER MAIN
- HYDRANT
- STORM SEWER
- GAS
- UNDERGROUND ELECTRIC
- OVERHEAD ELECTRIC
- UNDERGROUND TELEPHONE
- OVERHEAD TELEPHONE
- TELEPHONE FIBER OPTIC
- CABLE TELEVISION
- RETAINING WALL
- FENCE
- CONCRETE
- BITUMINOUS
- BUILDING
- TREE
- LIGHT POLE
- TRAFFIC SIGN
- CONSTRUCTION BARRICADE
- SB-19 SOIL BORING LOCATION
- TREE LINE

REMOVAL NOTES

1. LOCATIONS AND ELEVATIONS OF EXISTING TOPOGRAPHY AND UTILITIES AS SHOWN ON THIS PLAN ARE APPROXIMATE. CONTRACTOR SHALL FIELD VERIFY SITE CONDITIONS AND UTILITY LOCATIONS PRIOR TO EXCAVATION/CONSTRUCTION. THE ENGINEER SHALL BE NOTIFIED IMMEDIATELY IF ANY DISCREPANCIES ARE FOUND.
2. CONTRACTOR SHALL COORDINATE LIMITS OF REMOVALS WITH PROPOSED IMPROVEMENTS AND FIELD VERIFY CONDITION OF EXISTING APPURTENANCES TO REMAIN. CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING OR REPLACING MISCELLANEOUS ITEMS (SUCH AS FENCES, SIGNS, IRRIGATION HEADS, ETC.) THAT MAY BE DAMAGED BY CONSTRUCTION.
3. CONTRACTOR SHALL PLACE ALL NECESSARY EROSION CONTROL MEASURES REQUIRED TO MAINTAIN SITE STABILITY PRIOR TO EXECUTING ANY SITE REMOVALS.
4. CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATION WITH UTILITY PROVIDERS FOR REMOVAL AND/OR RELOCATION OF EXISTING UTILITIES AFFECTED BY SITE DEVELOPMENT. ALL PERMITS, APPLICATIONS AND FEES ARE THE RESPONSIBILITY OF THE CONTRACTOR.

1" = 30'
0' 30' 60' 90'

NOT FOR CONSTRUCTION

DESIGNED:
CHECKED:
DRAWN:
HORIZONTAL SCALE: 30'
VERTICAL SCALE: 6' or 3'

INITIAL ISSUE: 09/23/2022
REVISIONS:

PREPARED FOR:
ENCLAVE DEVELOPMENT
300 23RD AVE E, SUITE 300
WEST FARGO, ND 58078

I HEREBY CERTIFY THAT THIS PLAN 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
SHARI LYNN S. AHRENS
DATE 09/23/2022 LICENSE NO. ____

MAPLEWOOD ENCLAVE
MAPLEWOOD, MN

Westwood
Phone (952) 937-5150
Fax (952) 937-5822
Toll Free (888) 937-5150
12701 Whitewater Drive, Suite #200
Minnetonka, MN 55343
westwoodps.com
Westwood Professional Services, Inc.

EXISTING CONDITIONS & REMOVALS PLAN

SHEET NUMBER:
C100
DATE: 09/23/2022

MAPLEWOOD ENCLAVE
PROJECT NUMBER: 0037066.00

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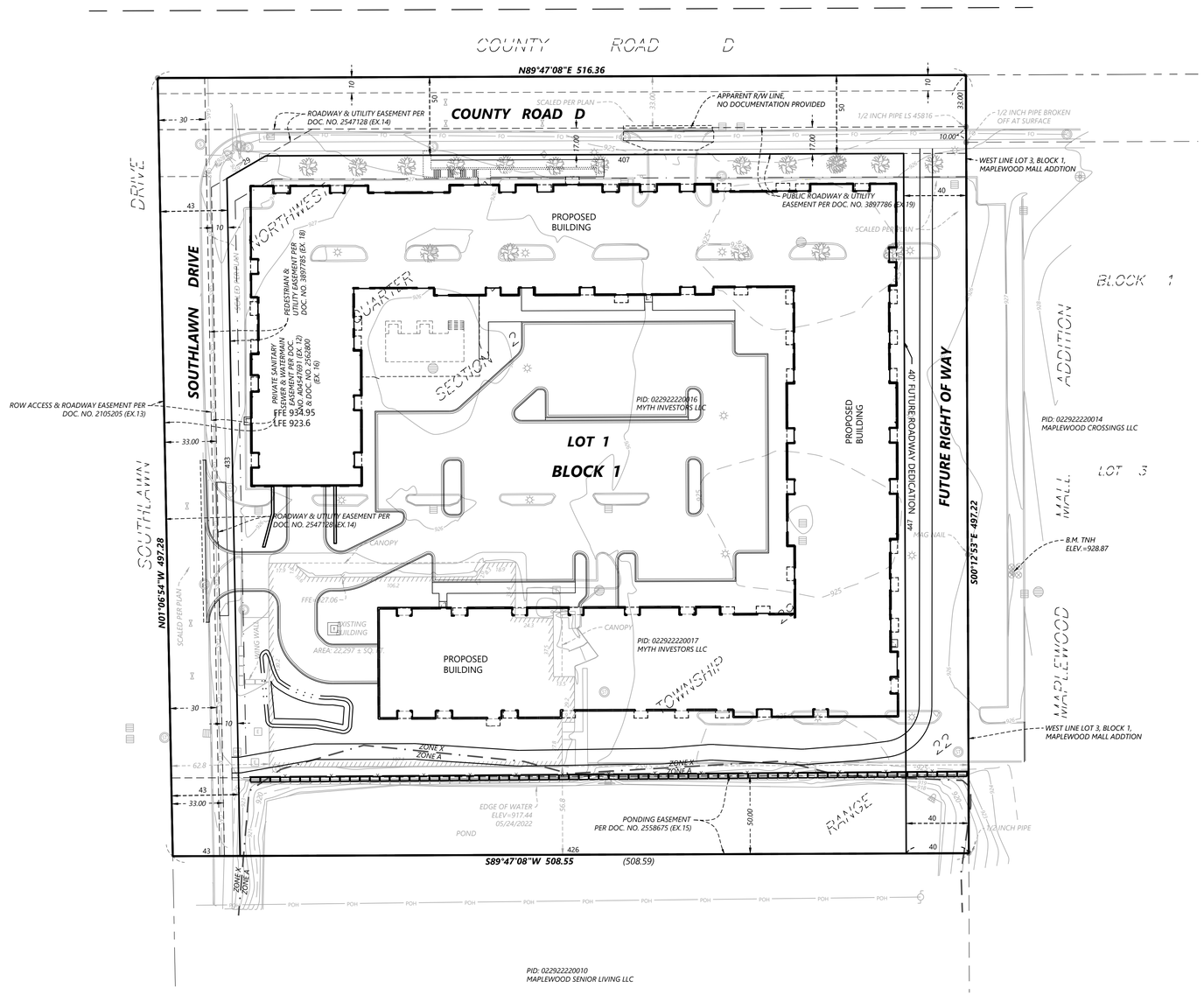
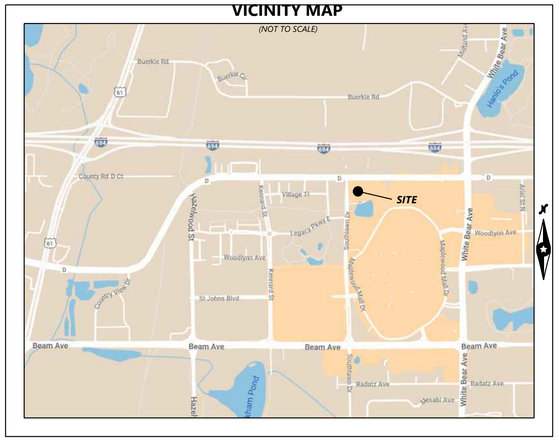


VICINITY MAP

(NOT TO SCALE)



PROPERTY DESCRIPTION

That part of the Northwest Quarter of Section 2, Township 29, Range 22, Ramsey County, Minnesota, lying West of Lot 3,Block 1, Maplewood Mall Addition, and lying Northerly of the following described line:

Commencing at the Northwest corner of Lot 6, said Block 1; thence North 46 degrees 08 minutes 30 seconds East, assumed bearing, along the Northwesterly line of said Lot 6 a distance of 47.32 feet; thence Northeasterly 130.22 feet along said Northwesterly line on a tangential curve concave to the Southeast having a central angle of 5 degrees 10 minutes 06 seconds East and a radius of 1,443.54 feet; thence South 89 degrees 33 minutes 44 seconds West 132.86 feet to the West line of said Northwest Quarter; thence North 0 degrees 26 minutes 16 seconds West along said West line 731.18 feet to the point of beginning of the line to be herein described; thence South 89 degrees 32 minutes 06 seconds East parallel with the North line of said Northwest Quarter 508.59 feet to the West line of said Lot 3 and there terminating.

Ramsey County, Minnesota
Abstract Property

ENGINEER AND SURVEYOR

Westwood Professional Services, Inc.
12701 Whitewater Drive, Suite 300,
Minnetonka, Minnesota 55343
Phone 952-937-5150

SITE LEGEND

- PROPERTY LINE
- EASEMENT LINE
- PROPOSED RIGHT OF WAY LINE

SITE DATA CHART

LEGAL DESCRIPTION	LOT AREA (ACRE)
LOT 1, BLOCK 1	4.401 AC.
FUTURE R/W	1.448 AC.
TOTAL	5.849 AC.

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

DESIGNED:
CHECKED:
DRAWN:
HORIZONTAL SCALE: 40'
VERTICAL SCALE: 8' or 4'

INITIAL ISSUE: 09/23/2022
REVISIONS:

PREPARED FOR:
ENCLAVE DEVELOPMENT
300 23RD AVE E, SUITE 300
WEST FARGO, ND 58078

I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED LAND SURVEYOR UNDER THE LAWS OF THE STATE OF MINNESOTA
DATE: 09/23/2022 LICENSE NO. .

MAPLEWOOD ENCLAVE
MAPLEWOOD, 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.

PRELIMINARY PLAT

SHEET NUMBER:
C101
DATE: 09/23/2022

MAPLEWOOD ENCLAVE
PROJECT NUMBER: 0037066.00

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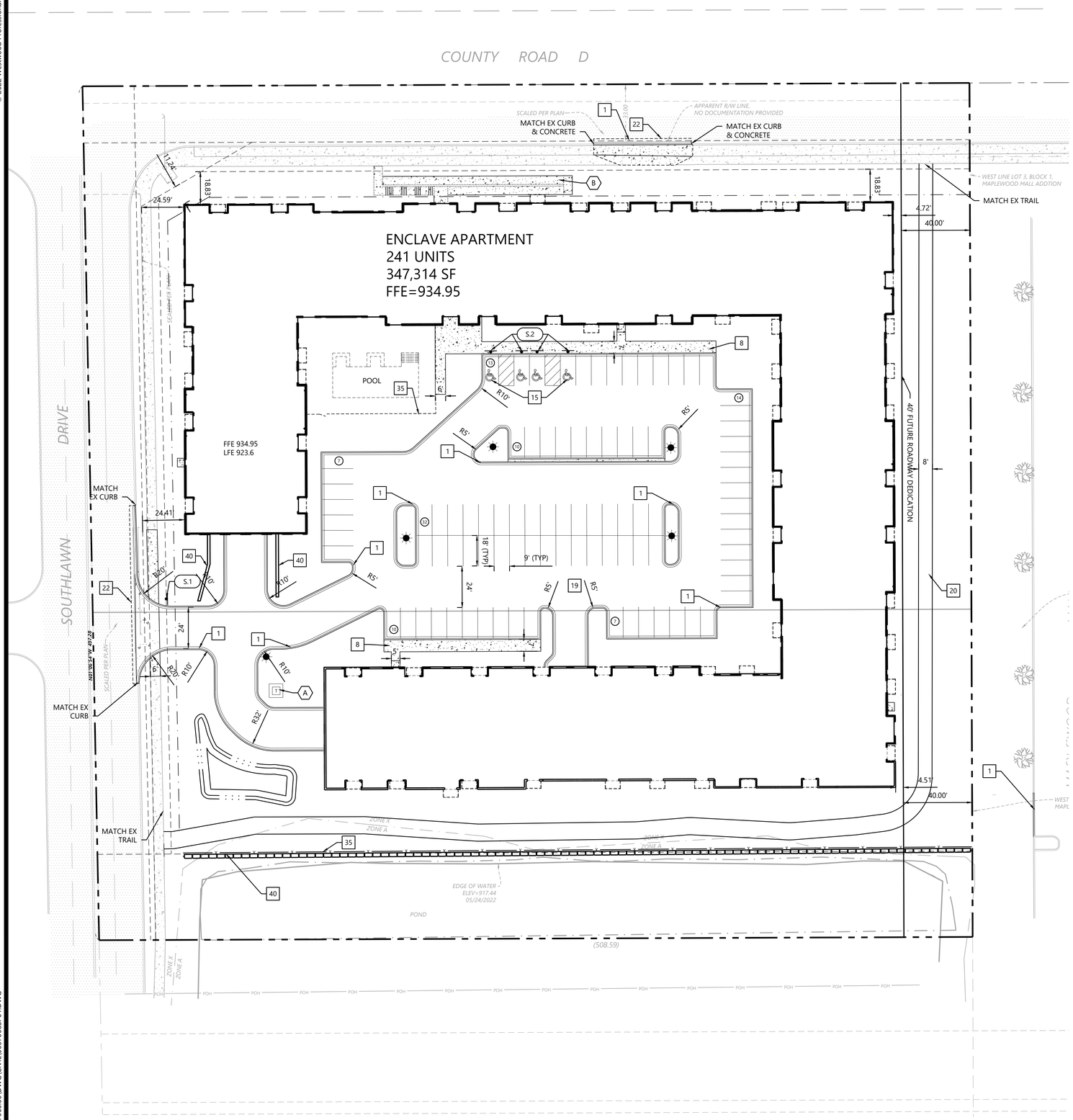

SITE DETAILS (SI-0XX)

1	B612 CURB AND GUTTER
8	PRIVATE CONCRETE SIDEWALK
13	TRAFFIC ARROW
15	HANDICAP ACCESSIBLE SIGNAGE AND STRIPING
18	BOLLARD
19	PAVEMENT SECTIONS
20	BITUMINOUS TRAIL
22	SAW CUT CONTROL JOINT
35	ORNAMENTAL FENCE
40	MODULAR BLOCK RETAINING WALL

SITE KEY NOTES

A	TRANSFORMER PAD
B	SIDEWALK RAMP AND STAIR

SITE LEGEND

EXISTING	PROPOSED	
		PROPERTY LINE
		LOT LINE
		SETBACK LINE
		EASEMENT LINE
		CURB AND GUTTER
		TIP-OUT CURB AND GUTTER
		POND NORMAL WATER LEVEL
		RETAINING WALL
x	x	FENCE
		CONCRETE PAVEMENT
		CONCRETE SIDEWALK
		HEAVY DUTY BITUMINOUS PAVEMENT
		NORMAL DUTY BITUMINOUS PAVEMENT
	S	NUMBER OF PARKING STALLS
	T	TRANSFORMER
		SITE LIGHTING
		TRAFFIC SIGN
		POWER POLE
		BOLLARD / POST

GENERAL SITE NOTES

1. BACKGROUND INFORMATION FOR THIS PROJECT PROVIDED BY WESTWOOD PROFESSIONAL SERVICES, MINNETONKA, MN, 05/26/2022.
2. LOCATIONS AND ELEVATIONS OF EXISTING TOPOGRAPHY AND UTILITIES AS SHOWN ON THIS PLAN ARE APPROXIMATE. CONTRACTOR SHALL FIELD VERIFY SITE CONDITIONS AND UTILITY LOCATIONS PRIOR TO EXCAVATION/CONSTRUCTION. IF ANY DISCREPANCIES ARE FOUND, THE ENGINEER SHOULD BE NOTIFIED IMMEDIATELY.
3. REFER TO BOUNDARY SURVEY FOR LOT BEARINGS, DIMENSIONS AND AREAS.
4. ALL DIMENSIONS ARE TO FACE OF CURB OR EXTERIOR FACE OF BUILDING UNLESS OTHERWISE NOTED.
5. REFER TO ARCHITECTURAL PLANS FOR EXACT BUILDING DIMENSIONS AND LOCATIONS OF EXITS, RAMPS, AND TRUCK DOCKS.
6. ALL CURB RADII ARE SHALL BE 3.0 FEET (TO FACE OF CURB) UNLESS OTHERWISE NOTED.
7. ALL CURB AND GUTTER SHALL BE B612 UNLESS OTHERWISE NOTED.
8. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING AND MAINTAINING TRAFFIC CONTROL DEVICES SUCH AS BARRICADES, WARNING SIGNS, DIRECTIONAL SIGNS, FLAGGERS AND LIGHTS TO CONTROL THE MOVEMENT OF TRAFFIC WHERE NECESSARY. PLACEMENT OF THESE DEVICES SHALL BE APPROVED BY THE CITY AND ENGINEER PRIOR TO PLACEMENT. TRAFFIC CONTROL DEVICES SHALL CONFORM TO APPROPRIATE MNDOT STANDARDS.
9. BITUMINOUS PAVEMENT AND CONCRETE SECTIONS TO BE IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE GEOTECHNICAL ENGINEER.
10. CONTRACTOR SHALL MAINTAIN FULL ACCESS TO ADJACENT PROPERTIES DURING CONSTRUCTION AND TAKE ALL PRECAUTIONS NECESSARY TO AVOID PROPERTY DAMAGE TO ADJACENT PROPERTIES.
11. SITE LIGHTING SHOWN ON PLAN IS FOR REFERENCE ONLY. REFER TO LIGHTING PLAN PREPARED BY OTHERS FOR SITE LIGHTING DETAILS AND PHOTOMETRICS.

SITE DEVELOPMENT SUMMARY

• EXISTING ZONING:	BC, BUSINESS COMMERCIAL
• PROPOSED ZONING:	R3-B, RESIDENCE DISTRICT
• PARCEL DESCRIPTION:	LOT 1, BLOCK 1, ENCLAVE ADDITION
• PROPERTY AREA:	254,803 SF (5.85 AC)
• BUILDING GROSS SIZE:	347,314 SF
• BUILDING SETBACK PER CODE:	15'-30'=MAJOR COLLECTOR 10'-25'=LOCAL CONNECTOR 5'-10'=REAR (NEIGHBORHOOD MAIN STREET)
• PARKING SETBACK:	15'=FRONT AND ROW 5'=SIDE AND REAR
• PARKING SPACE/DRIVE AISLE:	9.5' WIDE X 18' LONG, 24' AISLE
• PARKING REQUIRED (CITY OF MAPLEWOOD):	MIN 1 STALL PER UNIT/MAX 2.5 STALL PER UNIT
• PARKING PROVIDED:	260 ENCLOSED 93 SURFACE 353 TOTAL

SIGN LEGEND

REFERENCE		SIZE	MnDOT DESIGNATION
S.1	STOP SIGN	30" X 30"	R1-1
S.2	HANDICAP ACCESSIBLE	12" X 18"	R7-8M

1" = 30'

0' 30' 60' 90'

NOT FOR CONSTRUCTION

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

DESIGNED:
CHECKED:
DRAWN:
HORIZONTAL SCALE: 30"
VERTICAL SCALE: 6" or 3"

INITIAL ISSUE: 09/23/2022
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300 23RD AVE E, SUITE 300
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SHARI LYNN S. AHRENS
DATE 09/23/2022 LICENSE NO. ____

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MAPLEWOOD, MN

Westwood
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Fax (952) 937-5822
Toll Free (888) 937-5150
12701 Whitewater Drive, Suite #200
Minnetonka, MN 55343
westwoodps.com
Westwood Professional Services, Inc.

SITE PLAN

SHEET NUMBER:
C200

DATE: 09/23/2022

PROJECT NUMBER: 0037066.00

MAPLEWOOD ENCLAVE

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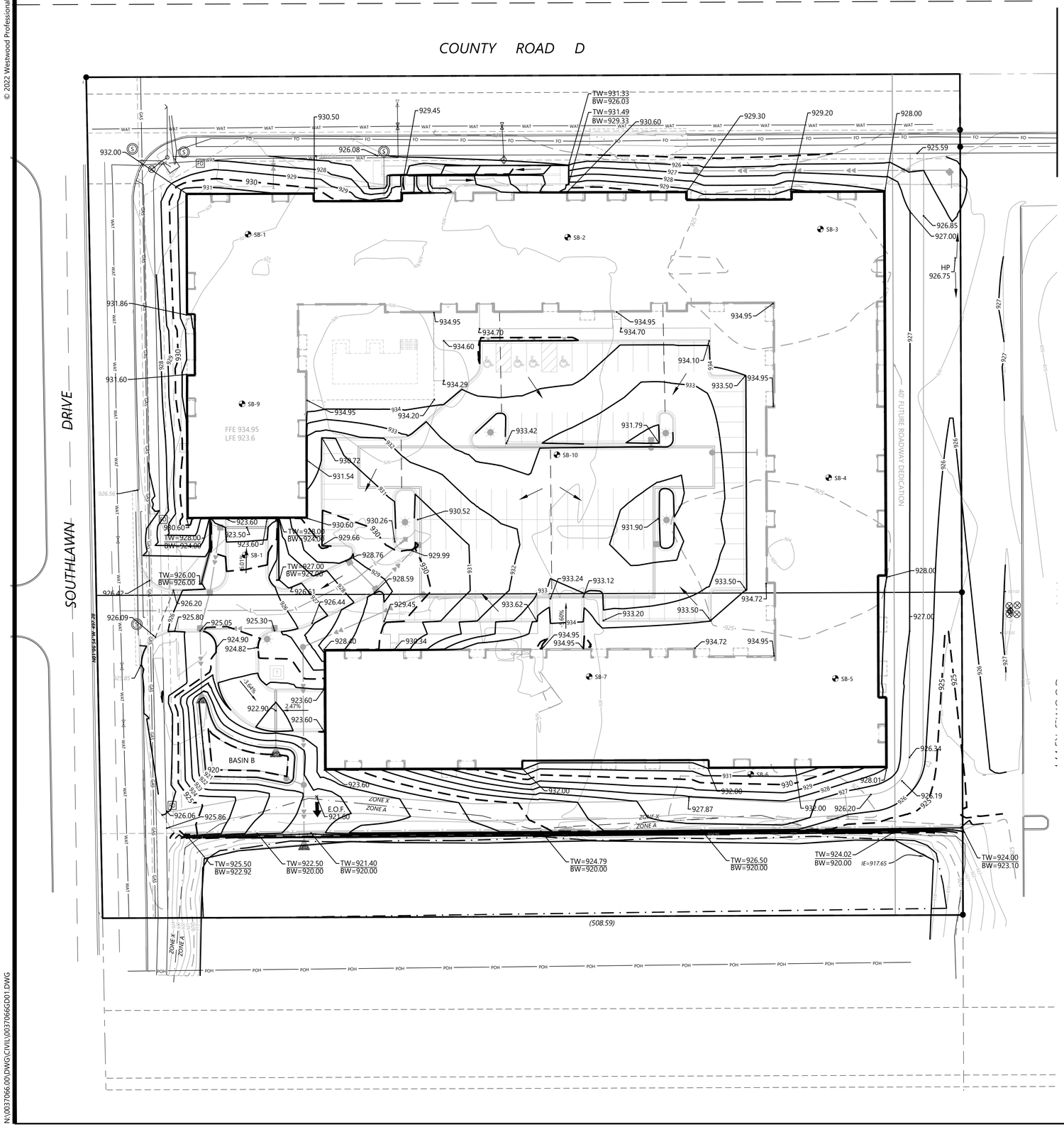
811 or call811.com
Common Ground Alliance



GRADING LEGEND

EXISTING	PROPOSED	
		PROPERTY LINE
980	980	INDEX CONTOUR
982	982	INTERVAL CONTOUR
		CURB AND GUTTER
		POND NORMAL WATER LEVEL
STO		STORM SEWER
		FLARED END SECTION (WITH RIPRAP)
WAT		WATER MAIN
SAN		SANITARY SEWER
		RETAINING WALL
		DRAIN TILE
		RIDGE LINE
	GL	GRADING LIMITS
+ 900.00	× 900.00	SPOT ELEVATION
	0.00%	FLOW DIRECTION
	TW=XXX.XX BW=XXX.XX	TOP AND BOTTOM OF RETAINING WALL
	E.O.F.—×	EMERGENCY OVERFLOW
SB-19	SB-19	SOIL BORING LOCATION

GRADING NOTES

1. LOCATIONS AND ELEVATIONS OF EXISTING TOPOGRAPHY AND UTILITIES AS SHOWN ON THIS PLAN ARE APPROXIMATE. CONTRACTOR SHALL FIELD VERIFY SITE CONDITIONS AND UTILITY LOCATIONS PRIOR TO EXCAVATION/CONSTRUCTION. THE ENGINEER SHALL BE NOTIFIED IMMEDIATELY IF ANY DISCREPANCIES ARE FOUND.
2. CONTRACTORS SHALL REFER TO ARCHITECTURAL PLANS FOR EXACT LOCATIONS AND DIMENSIONS OF VESTIBULE, SLOPED PAVEMENT, EXIT PORCHES, RAMPS, TRUCK DOCKS, PRECISE BUILDING DIMENSIONS, EXACT BUILDING UTILITY ENTRANCE LOCATIONS, AND EXACT LOCATIONS AND NUMBER OF DOWNSPOUTS.
3. ALL EXCAVATION SHALL BE IN ACCORDANCE WITH THE CURRENT EDITION OF "STANDARD SPECIFICATIONS FOR TRENCH EXCAVATION AND BACKFILL/SURFACE RESTORATION" AS PREPARED BY THE CITY ENGINEERS ASSOCIATION OF MINNESOTA.
4. ALL DISTURBED UNPAVED AREAS ARE TO RECEIVE SIX INCHES OF TOPSOIL AND SOD OR SEED. THESE AREAS SHALL BE WATERED UNTIL A HEALTHY STAND OF GRASS IS OBTAINED. SEE LANDSCAPE PLAN FOR PLANTING AND TURF ESTABLISHMENT.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING AND MAINTAINING TRAFFIC CONTROL DEVICES SUCH AS BARRICADES, WARNING SIGNS, DIRECTIONAL SIGNS, FLAGMEN AND LIGHTS TO CONTROL THE MOVEMENT OF TRAFFIC WHERE NECESSARY. PLACEMENT OF THESE DEVICES SHALL BE APPROVED BY THE ENGINEER PRIOR TO PLACEMENT. TRAFFIC CONTROL DEVICES SHALL CONFORM TO APPROPRIATE MNDOT STANDARDS.
6. ALL SLOPES SHALL BE GRADED TO 3:1 OR FLATTER, UNLESS OTHERWISE INDICATED ON THIS SHEET.
7. CONTRACTOR SHALL UNIFORMLY GRADE AREAS WITHIN LIMITS OF GRADING AND PROVIDE A SMOOTH FINISHED SURFACE WITH UNIFORM SLOPES BETWEEN POINTS WHERE ELEVATIONS ARE SHOWN OR BETWEEN SUCH POINTS AND EXISTING GRADES.
8. **SPOT ELEVATIONS SHOWN INDICATE FINISHED PAVEMENT ELEVATIONS & GUTTER FLOW LINE UNLESS OTHERWISE NOTED. PROPOSED CONTOURS ARE TO FINISHED SURFACE GRADE.**
9. SEE SOILS REPORT FOR PAVEMENT THICKNESSES AND HOLD DOWNS.
10. CONTRACTOR SHALL DISPOSE OF ANY EXCESS SOIL MATERIAL THAT EXISTS AFTER THE SITE GRADING AND UTILITY CONSTRUCTION IS COMPLETED. THE CONTRACTOR SHALL DISPOSE OF ALL EXCESS SOIL MATERIAL IN A MANNER ACCEPTABLE TO THE OWNER AND THE REGULATING AGENCIES.
11. CONTRACTOR SHALL PROVIDE A STRUCTURAL RETAINING WALL DESIGN CERTIFIED BY A LICENSED PROFESSIONAL ENGINEER.
12. ALL CONSTRUCTION SHALL CONFORM TO LOCAL, STATE AND FEDERAL RULES INCLUDING THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT REQUIREMENTS.
13. PRIOR TO PLACEMENT OF ANY STRUCTURE OR PAVEMENT, A PROOF ROLL, AT MINIMUM, WILL BE REQUIRED ON THE SUBGRADE. PROOF ROLLING SHALL BE ACCOMPLISHED BY MAKING MINIMUM OF 2 COMPLETE PASSES WITH FULLY-LOADED TANDEM-AXLE DUMP TRUCK, OR APPROVED EQUAL, IN EACH OF 2 PERPENDICULAR DIRECTIONS WHILE UNDER SUPERVISION AND DIRECTION OF THE INDEPENDENT TESTING LABORATORY. AREAS OF FAILURE SHALL BE EXCAVATED AND RE-COMPACTED AS SPECIFIED HEREIN.
14. EMBANKMENT MATERIAL PLACED BENEATH BUILDINGS AND STREET OR PARKING AREAS SHALL BE COMPACTED IN ACCORDANCE WITH THE SPECIFIED DENSITY METHOD AS OUTLINED IN MNDOT 2105.3F1 AND THE REQUIREMENTS OF THE GEOTECHNICAL ENGINEER.
15. EMBANKMENT MATERIAL NOT PLACED IN THE BUILDING PAD, STREETS OR PARKING AREA, SHALL BE COMPACTED IN ACCORDANCE WITH REQUIREMENTS OF THE ORDINARY COMPACTION METHOD AS OUTLINED IN MNDOT 2105.3F2.
16. ALL SOILS AND MATERIALS TESTING SHALL BE COMPLETED BY AN INDEPENDENT GEOTECHNICAL ENGINEER. EXCAVATION FOR THE PURPOSE OF REMOVING UNSTABLE OR UNSUITABLE SOILS SHALL BE COMPLETED AS REQUIRED BY THE GEOTECHNICAL ENGINEER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING ALL REQUIRED SOILS TESTS AND INSPECTIONS WITH THE GEOTECHNICAL ENGINEER.

1" = 30'
0' 30' 60' 90'

NOT FOR CONSTRUCTION

DESIGNED:
CHECKED:
DRAWN:
HORIZONTAL SCALE: 30'
VERTICAL SCALE: 6' or 3'

INITIAL ISSUE: 09/23/2022
REVISIONS:

PREPARED FOR:
ENCLAVE DEVELOPMENT
300 23RD AVE E, SUITE 300
WEST FARGO, ND 58078

I HEREBY CERTIFY THAT THIS PLAN 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

SHARI LYNN S. AHRENS
DATE 09/23/2022 LICENSE NO. ———

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MAPLEWOOD, MN

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12701 Whitewater Drive, Suite #200
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Westwood Professional Services, Inc.

GRADING PLAN

SHEET NUMBER:
C300

DATE: 09/23/2022

MAPLEWOOD ENCLAVE

PROJECT NUMBER: 0037066.00

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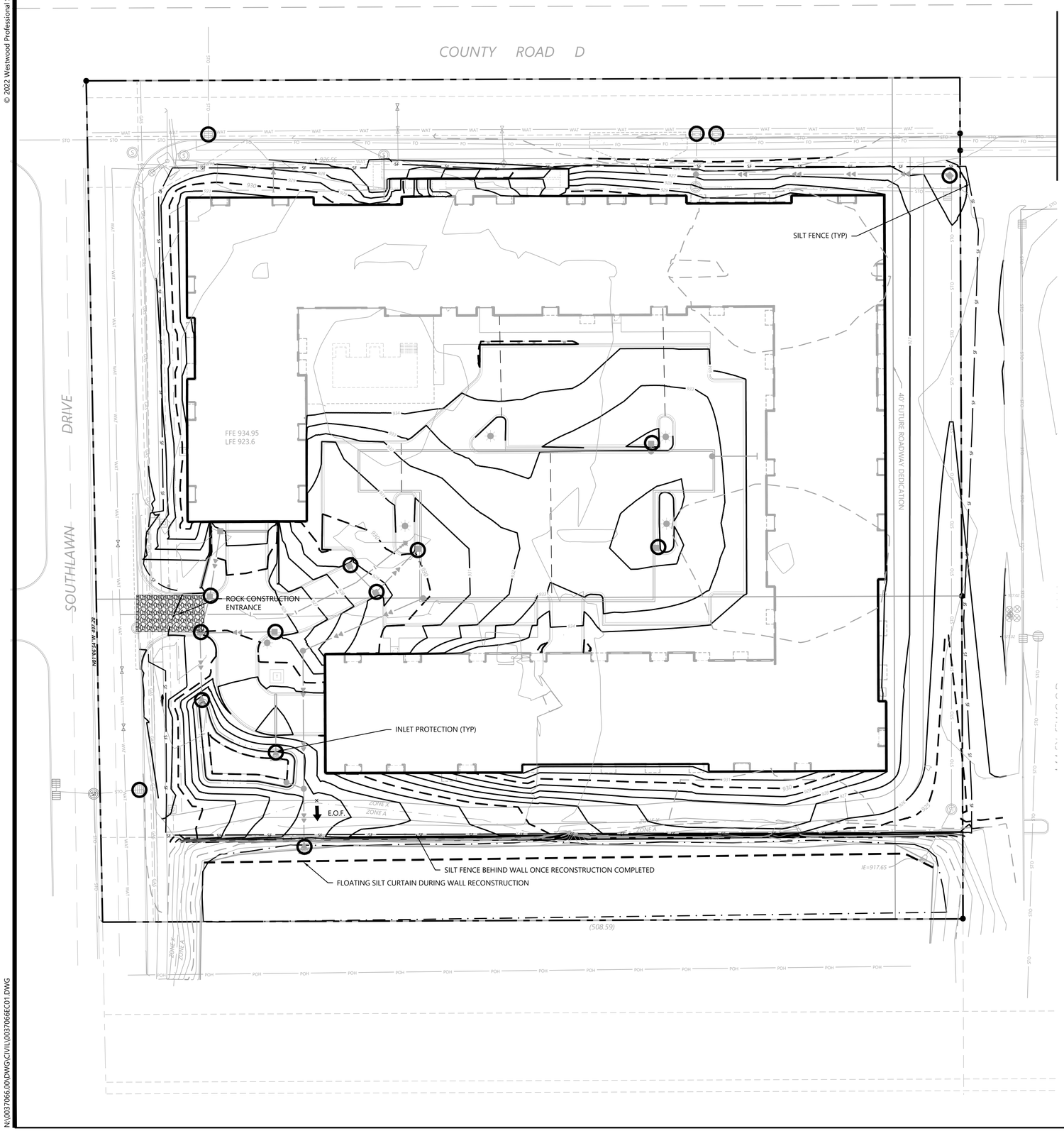

EROSION CONTROL LEGEND

EXISTING	PROPOSED	
		PROPERTY LINE
980	980	INDEX CONTOUR
982	982	INTERVAL CONTOUR
		CURB AND GUTTER
		POND NORMAL WATER LEVEL
	SF	SILT FENCE
	HDSF	HEAVY DUTY SILT FENCE
		FLOATING SILT CURTAIN
STO		STORM SEWER
		FLARED END SECTION (WITH RIPRAP)
WAT		WATER MAIN
SAN		SANITARY SEWER
		RETAINING WALL
		DRAIN TILE
	GL	GRADING LIMITS
		ROCK CONSTRUCTION ENTRANCE
		EROSION CONTROL BLANKET
		TURF REINFORCEMENT MAT
	E.O.F.	EMERGENCY OVERFLOW
SB-19	SB-19	SOIL BORING LOCATION
		INLET PROTECTION

GENERAL EROSION CONTROL NOTES

1. THE CONTRACTOR IS SPECIFICALLY CAUTIONED THAT THE LOCATION AND/OR ELEVATION OF EXISTING UTILITIES AS SHOWN ON THESE PLANS ARE BASED ON RECORDS OF THE VARIOUS UTILITY COMPANIES AND LIMITED MEASUREMENTS TAKEN IN THE FIELD. THE INFORMATION SHALL NOT BE RELIED ON AS BEING EXACT OR COMPLETE. THE CONTRACTOR SHALL VERIFY EXISTING CONDITIONS PRIOR TO CONSTRUCTION AND NOTIFY THE OWNER OR ENGINEER OF DISCREPANCIES.

2. ALL SILT FENCE AND OTHER EROSION CONTROL FEATURES SHALL BE IN-PLACE PRIOR TO ANY EXCAVATION/CONSTRUCTION AND SHALL BE MAINTAINED UNTIL VIABLE TURF OR GROUND COVER HAS BEEN ESTABLISHED. EXISTING SILT FENCE ON-SITE SHALL BE MAINTAINED AND OR REMOVED AND SHALL BE CONSIDERED INCIDENTAL TO THE GRADING CONTRACT. IT IS OF EXTREME IMPORTANCE TO BE AWARE OF CURRENT FIELD CONDITIONS WITH RESPECT TO EROSION CONTROL. TEMPORARY PONDING, DIKES, HAYBALES, ETC., REQUIRED BY THE CITY SHALL BE INCIDENTAL TO THE GRADING CONTRACT.

3. EROSION AND SILTATION CONTROL (ESC): THE CONTRACTOR SHALL ASSUME COMPLETE RESPONSIBILITY FOR CONTROLLING ALL SILTATION AND EROSION OF THE PROJECT AREA. THE CONTRACTOR SHALL USE WHATEVER MEANS NECESSARY TO CONTROL THE EROSION AND SILTATION INCLUDING BUT NOT LIMITED TO: CATCH BASIN INSERTS, CONSTRUCTION ENTRANCES, EROSION CONTROL BLANKET, AND SILT FENCE. ESC SHALL COMMENCE WITH GRADING AND CONTINUE THROUGHOUT THE PROJECT UNTIL ACCEPTANCE OF THE WORK BY THE OWNER. THE CONTRACTOR'S RESPONSIBILITY INCLUDES ALL IMPLEMENTATION AS REQUIRED TO PREVENT EROSION AND THE DEPOSITING OF SILT. THE OWNER MAY DIRECT THE CONTRACTOR'S METHODS AS DEEMED FIT TO PROTECT PROPERTY AND IMPROVEMENTS. ANY DEPOSITION OF SILT OR MUD ON NEW OR EXISTING PAVEMENT OR IN EXISTING STORM SEWERS OR SWALES SHALL BE REMOVED AFTER EACH RAIN EVENT. AFFECTED AREAS SHALL BE CLEANED TO THE SATISFACTION OF THE OWNER, ALL AT THE EXPENSE OF THE CONTRACTOR. ALL TEMPORARY EROSION CONTROL SHALL BE REMOVED BY THE CONTRACTOR AFTER THE TURF IS ESTABLISHED.

4. ALL STREETS DISTURBED DURING WORKING HOURS MUST BE CLEANED AT THE END OF EACH WORKING DAY. A CONSTRUCTION ENTRANCE TO THE SITE MUST BE PROVIDED ACCORDING TO DETAILS TO REDUCE TRACKING OF DIRT ONTO PUBLIC STREETS.

5. PROPOSED PONDS SHALL BE EXCAVATED FIRST AND USED AS TEMPORARY PONDING DURING CONSTRUCTION.

6. WHEN INSTALLING END-OF-LINE FLARED END SECTIONS, BRING THE SILT FENCE UP & OVER THE FLARED END SECTIONS & COVER DISTURBED AREAS WITH RIP RAP. THE UPSTREAM FLARED END SECTIONS SHALL HAVE WOOD FIBER BLANKET INSTALLED ON THE DISTURBED SOILS.

7. ALL UNPAVED AREAS ALTERED DUE TO CONSTRUCTION ACTIVITIES MUST BE RESTORED WITH SEED AND MULCH, SOD, EROSION CONTROL BLANKET OR BE HARD SURFACE WITHIN 2 WEEKS OF COMPLETION OF CONSTRUCTION.

8. THE SITE MUST BE STABILIZED PER THE REQUIREMENTS OF THE MPCA, NPDES, MNDOT, AND CITY.

   A. TEMPORARY (GREATER THAN 1-YEAR) SEED SHALL BE MNDOT SEED MIX 22-111 AT 30.5-POUNDS PER ACRE.

   B. TEMPORARY (LESS THAN 1-YEAR) SEED SHALL BE MNDOT SEED MIX 21-112 (FALL) OR 21-111 (SPRING/SUMMER) AT 100-POUNDS PER ACRE

   C. INFILTRATION/FILTRATION BASIN SHALL BE MNDOT SEED MIX 34-262 AT 14.5-POUNDS PER ACRE.

   D. POND SLOPES SHALL BE MNDOT SEED MIX 33-261 AT 35-POUNDS PER ACRE.

   E. GENERAL SEEDING SHALL BE MNDOT SEED MIX 25-151 AT 70-POUNDS PER ACRE.

   F. MULCH SHALL BE MNDOT TYPE 1 APPLIED AT 2-TONS PER ACRE.

9. FOR AREAS WITH SLOPE OF 3:1 OR GREATER, RESTORATION WITH SOD OR EROSION CONTROL BLANKET IS REQUIRED.

10. ALL TEMPORARY STOCKPILES MUST HAVE SILT FENCE INSTALLED AROUND THEM TO TRAP SEDIMENT.

11. ALL PERMANENT PONDS USED AS TEMPORARY SEDIMENT BASINS DURING CONSTRUCTION SHALL BE DREDGED AFTER THE SITE HAS BEEN STABILIZED TO RESTORE THE POND TO THE PROPOSED BOTTOM ELEVATION.

12. ALL CONSTRUCTION SHALL CONFORM TO LOCAL AND STATE RULES INCLUDING THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT REQUIREMENTS.

13. THE SITE MUST BE KEPT IN A WELL-DRAINED CONDITION AT ALL TIMES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR TEMPORARY DITCHES, PIPING OR OTHER MEANS REQUIRED TO INSURE PROPER DRAINAGE DURING CONSTRUCTION. LOW POINTS IN ROADWAYS OR BUILDING PADS MUST BE PROVIDED WITH A POSITIVE OUTFLOW.

14. PUBLIC STREETS USED FOR HAULING SHALL BE KEPT FREE OF SOIL AND DEBRIS. STREET SWEEPING SHALL BE CONCURRENT WITH SITE WORK.

1" = 30'

0' 30' 60' 90'

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EROSION CONTROL PLAN

SHEET NUMBER:
C400

DATE: 09/23/2022

MAPLEWOOD ENCLAVE

PROJECT NUMBER: 0037066.00

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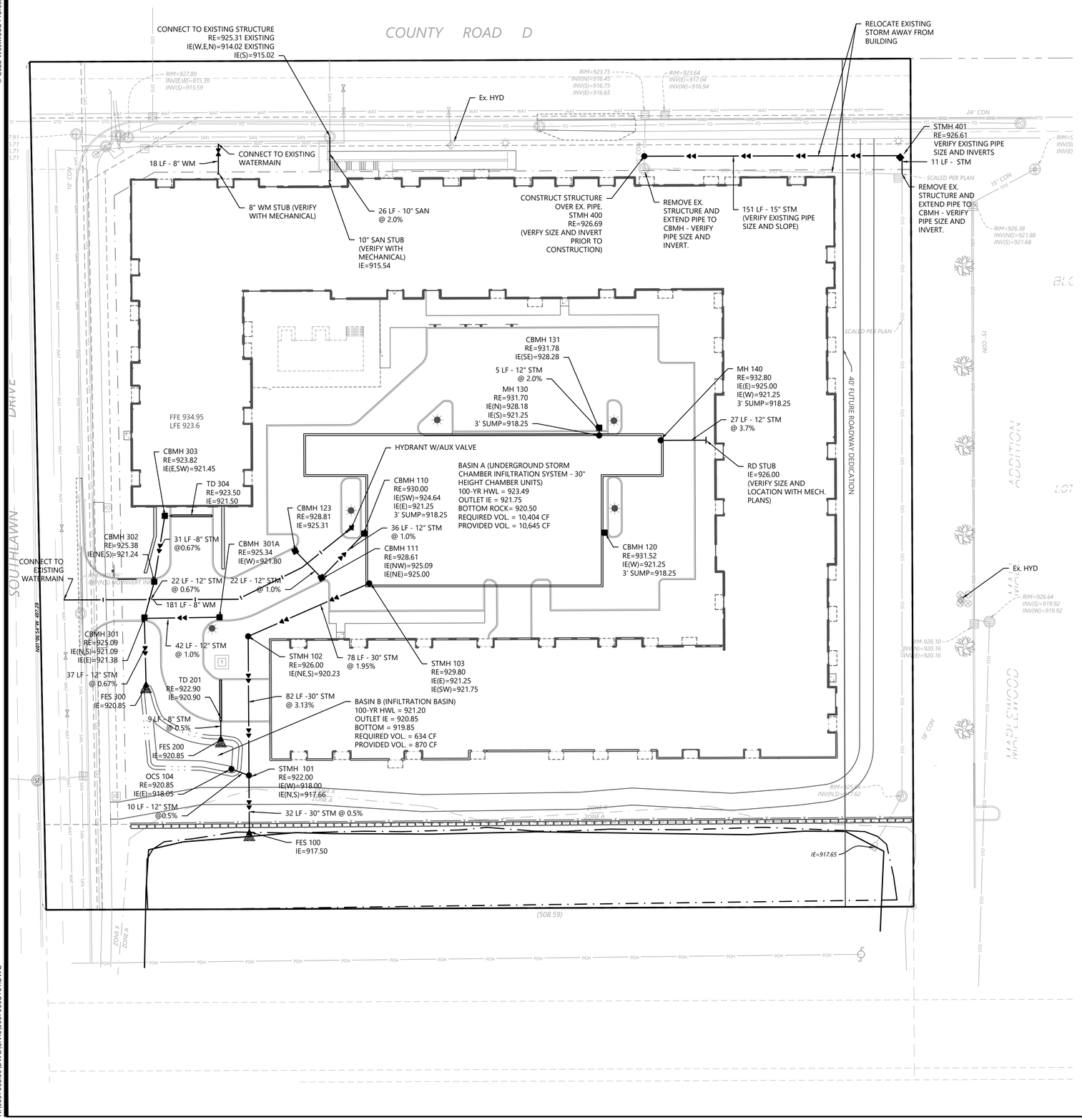

Call 48 Hours before digging:
811 or call811.com
Common Ground Alliance

UTILITY LEGEND

EXISTING	PROPOSED	
		PROPERTY LINE
		EASEMENT LINE
		CURB AND GUTTER
SAN		SANITARY SEWER
FM	FM	SANITARY SEWER FORCE MAIN
STO		STORM SEWER
WAT		WATER MAIN
WAT		HYDRANT
GAS	GAS	GAS
PUG	PUG	UNDERGROUND ELECTRIC
POH	POH	OVERHEAD ELECTRIC
TUG	TOH	UNDERGROUND TELEPHONE
TOH	TOH	OVERHEAD TELEPHONE
FO	FO	TELEPHONE FIBER OPTIC
CTV	CTV	CABLE TELEVISION
DT		DRAIN TILE
		GATE VALVE
		FLARED END SECTION (WITH RIPRAP)
		LIGHT POLE

GENERAL UTILITY NOTES

1. THE CONTRACTOR IS SPECIFICALLY CAUTIONED THAT THE LOCATION AND/OR ELEVATION OF EXISTING UTILITIES AS SHOWN ON THESE PLANS ARE BASED ON RECORDS OF THE VARIOUS UTILITY COMPANIES AND LIMITED MEASUREMENTS TAKEN IN THE FIELD. THE INFORMATION SHALL NOT BE RELIED ON AS BEING EXACT OR COMPLETE. THE CONTRACTOR SHALL VERIFY EXISTING CONDITIONS PRIOR TO CONSTRUCTION AND NOTIFY THE OWNER OR ENGINEER OF DISCREPANCIES.
2. ALL SANITARY SEWER, STORM SEWER AND WATER MAIN MATERIAL AND INSTALLATIONS SHALL BE PER CITY REQUIREMENTS, MINNESOTA PLUMBING CODE, AND IN ACCORDANCE WITH THE CURRENT EDITION OF "STANDARD SPECIFICATIONS FOR WATER MAIN AND SERVICE LINE INSTALLATION AND SANITARY SEWER AND STORM SEWER INSTALLATION" AS PREPARED BY THE CITY ENGINEERS ASSOCIATION OF MINNESOTA.
3. PRIOR TO CONSTRUCTION, THE CONTRACTOR SHALL OBTAIN THE NECESSARY FEDERAL, STATE AND LOCAL PERMITS FOR THE PROPOSED WORK OR VERIFY WITH THE OWNER OR ENGINEER THAT PERMITS HAVE BEEN OBTAINED. PERMIT FEES SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR UNLESS OTHERWISE ARRANGED WITH THE OWNER.
4. CONTRACTOR SHALL REFER TO ARCHITECTURAL PLANS FOR EXACT LOCATION AND DIMENSIONS OF DOORWAYS, RAMPS, TRUCK DOCKS, PRECISE BUILDING DIMENSIONS AND EXACT BUILDING UTILITY CONNECTION LOCATIONS.
5. ALL PRIVATE UTILITIES SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE SPECIFICATIONS OF THE APPROPRIATE UTILITY COMPANY. THE CONTRACTOR SHALL COORDINATE THE SERVICE LINE CONSTRUCTION WITH THE UTILITY COMPANIES.
6. CONTRACTOR SHALL OBTAIN ALL NECESSARY CITY PERMITS FOR UTILITY CONNECTIONS, AND UTILITIES SHALL BE INSPECTED AND APPROVED BY THE CITY. THE CITY SHALL BE NOTIFIED 48-HOURS PRIOR TO COMMENCING WITH THE UTILITY CONSTRUCTION OR ANY REQUIRED TESTING. CONTRACTOR SHALL NOT OPERATE, INTERFERE WITH, CONNECT ANY PIPE OR HOSE TO, OR TAP ANY WATER MAIN BELONGING TO THE CITY UNLESS DULY AUTHORIZED TO DO SO BY THE CITY. ANY ADVERSE CONSEQUENCES OF SCHEDULED OR UNSCHEDULED DISRUPTIONS OF SERVICE TO THE PUBLIC ARE TO BE THE RESPONSIBILITY OF THE CONTRACTOR.
7. WATER MAIN LENGTHS AS SHOWN ARE APPROXIMATE HORIZONTAL LENGTHS. ALLOW FOR ADDITIONAL PIPE WHEN INSTALLING ON SLOPES OR WHEN DEFLECTIONS ARE REQUIRED. THE JOINT DEFLECTIONS SHALL NOT EXCEED THE MAXIMUM RECOMMENDED BY THE PIPE MANUFACTURER OR BY LOCAL GOVERNING SPECIFICATIONS. FITTINGS REQUIRED TO CONSTRUCT WATER MAIN SHALL BE INCLUDED IN WATER MAIN CONSTRUCTION.
8. PROVIDE WATER MAIN THRUST RESTRAINTS PER CITY STANDARD REQUIREMENTS.
9. A MINIMUM VERTICAL SEPARATION OF 18 INCHES IS REQUIRED AT ALL WATER LINE CROSSINGS WITH SANITARY SEWER OR STORM SEWER. THE WATER LINE SHALL NOT HAVE JOINTS OR CONNECTION WITHIN 10-FEET OF THE CROSSING. INSULATE CROSSINGS WITH STORM SEWER.
10. UTILITY SERVICES TYPICALLY TERMINATE 5' OUTSIDE BUILDING WALL UNLESS OTHERWISE SHOWN OR NOTED.
11. DUCTILE IRON WATER LINES SHALL BE CLASS 52, PER AWWA C115 OR C151. COPPER WATER LINES SHALL BE TYPE K PER ASTM B88. PVC WATER LINES SHALL BE PER AWWA C900 AND INSTALLED PER AWWA C605 IF ALLOWED BY CITY.
12. ALL WATER LINES SHALL HAVE 7.5' MINIMUM COVER. INSULATE WATER MAIN IF LESS THAN 8' OF COVER. INSULATION SHALL BE DOW STYROFOAM HI BRAND 35 OR EQUIVALENT, WITH 4 INCHES OF THICKNESS.
13. SANITARY SEWER PIPE OUTSIDE THE BUILDING ENVELOPE SHALL BE POLYVINYL CHLORIDE (PVC) SDR 35 OR 26. SDR 26 IS REQUIRED FOR DEPTHS GREATER THAN 15 FEET. SANITARY SEWER PIPE WITHIN 5 FEET OF THE BUILDING AND UNDER FOOTINGS SHALL BE SCHEDULE 40 PER ASTM D2665. ALL PLASTIC SANITARY SEWER SHALL BE INSTALLED PER D2321. SOLVENT WELD JOINTS MUST INCLUDE USE OF A PRIMER WHICH IS OF A CONTRASTING COLOR TO THE PIPE AND CEMENT. ALL SANITARY SEWER SHALL BE TESTED ACCORDING TO MINNESOTA PLUMBING CODE, PART 712.0.
14. STORM SEWER PIPE:
    - A. RCP AND HDPE PIPE MAY BE INSTALLED WITH APPROVAL OF LOCAL GOVERNING AGENCY.
    - B. REINFORCED CONCRETE PIPE SHALL BE CLASS 5 FOR PIPE DIAMETERS 18" AND SMALLER, CLASS 3 FOR PIPE DIAMETERS 21" AND LARGER UNLESS OTHERWISE NOTED, PER ASTM C76, WITH GASKETS PER ASTM C443.
    - C. HDPE STORM PIPE 4- TO 10-INCHES IN DIAMETER SHALL MEET REQUIREMENTS OF AASHTO M252. HDPE STORM PIPE 12- TO 60-INCHES IN DIAMETER SHALL MEET REQUIREMENTS OF ASTM F2306. FITTINGS SHALL BE PER ASTM D3212 AND INSTALLED PER ASTM D2321.
    - D. PVC STORM SEWER PIPE AND FITTINGS SHALL BE SCHEDULE 40 PIPE PER ASTM D2665 AND INSTALLED PER ASTM D2321.
    - E. CORRUGATED METAL PIPE (CMP) FOR SIZES 18- TO 120-INCH AND MUST MEET ASTM A760 OR ASTM A796 AND BE INSTALLED PER ASTM A798. CMP MAY NOT BE INSTALLED WITHIN 10-FEET OF A WATERMAIN, WATER SERVICE, OR A BUILDING.
    - F. ALL STORM SEWER JOINTS AND STRUCTURE CONNECTIONS SHALL BE GASTIGHT OR WATERTIGHT AS REQUIRED BY MINNESOTA PLUMBING CODE, PART 707.3. STORM SEWER LOCATED WITHIN 10-FEET OF A BUILDING AND/OR WATER LINE SHALL BE TESTED PER MINNESOTA PLUMBING CODE, PART 712.
15. ALL NONCONDUCTIVE PIPE SHALL BE INSTALLED WITH A LOCATE (TRACER) WIRE PER MINNESOTA RULES, PART 7560.0150.
16. AFTER CONSTRUCTION IS COMPLETED, THE CONTRACTOR SHALL PROVIDE THE OWNER WITH AN AS-BUILT RECORD OF UTILITY CONSTRUCTION. THE AS-BUILT SHALL INCLUDE LOCATION AND LENGTH DEVIATIONS OR CHANGES TO THE PLAN. CONTRACTOR TO VERIFY WITH OWNER OR ENGINEER WHETHER A PLAN WITH POST-CONSTRUCTION ELEVATIONS IS REQUIRED.
17. ALL MANHOLE CASTINGS IN PAVED AREAS SHALL BE SUMPED 0.05 FEET. RIM ELEVATIONS ON PLAN REFLECT THE SUMPED ELEVATIONS.
18. ALL CATCH BASIN CASTINGS IN CURB SHALL BE SUMPED 0.15 FEET AND MANHOLE CASTINGS IN PAVED AREAS SHALL BE SUMPED 0.05 FEET. RIM ELEVATIONS ON PLAN REFLECT THE SUMPED ELEVATIONS.

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0' 30' 60' 90'

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1 -
2 -
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4 -
5 -

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DATE 09/23/2022 LICENSE NO. -

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Westwood Professional Services, Inc.

UTILITY PLAN

SHEET NUMBER: C500
DATE: 09/23/2022
MAPLEWOOD ENCLAVE

PROJECT NUMBER: 0037066.00

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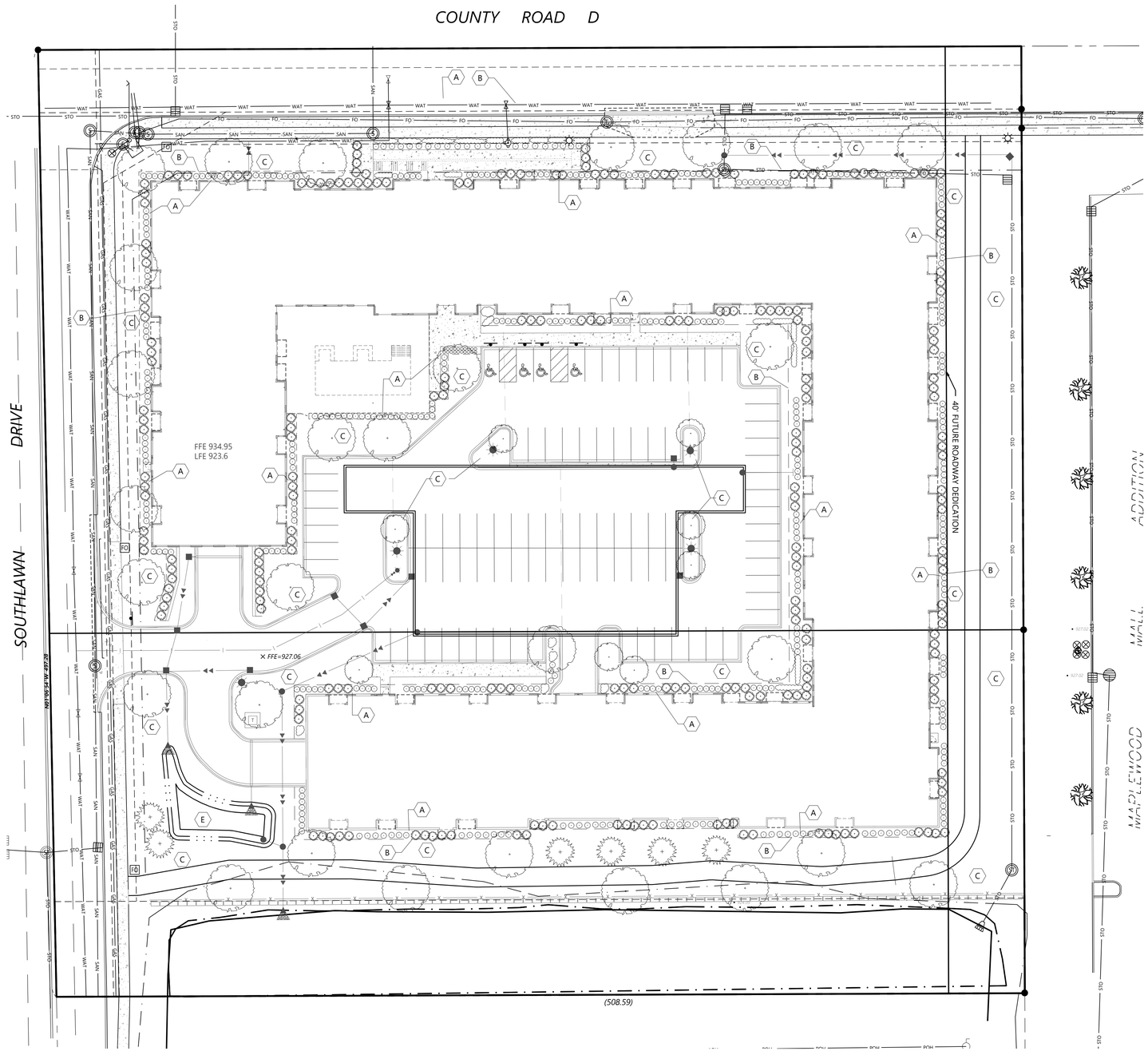


PLANT SCHEDULE

CODE	QTY	COMMON	BOTANICAL NAME	SIZE	ROOT	SPACING	REMARKS
OVERSTORY TREE	**28**						
SGM	--	SIENNA GLEN MAPLE	ACER X FREEMANII 'SIENNA'	3.5" CAL.	B&B	AS SHOWN	SINGLE
NWM	--	NORTHWOOD MAPLE	ACER RUBRUM 'NORTHWOOD'	2.5" CAL.	B&B	AS SHOWN	SINGLE
WSB	--	WHITESPIRE BIRCH	BETULA POPULIFOLIA 'WHITESPIRE'	3.5" CAL.	B&B	AS SHOWN	SINGLE
IMH	--	IMPERIAL HONEYLOCUST	GLEDITSIA TRIACANTHOS VAR. INERMIS 'IMPCOLE'	3.5" CAL.	B&B	AS SHOWN	SINGLE
NPO	--	NORTHERN PIN OAK	QUERCUS ELLIPSOIDALIS	2.5" CAL.	B&B	AS SHOWN	SINGLE
SWO	--	SWAMP WHITE OAK	QUERCUS BICOLOR	2.5" CAL.	B&B	AS SHOWN	SINGLE
CHB	--	HACKBERRY	CELTIS OCCIDENTALIS	2.5" CAL.	B&B	AS SHOWN	SINGLE
BOL	--	BOULEVARD LINDEN	TILIA AMERICANA 'BOULEVARD'	2.5" CAL.	B&B	AS SHOWN	SINGLE
ORNAMENTAL TREE	**8**						
TCH	--	THORNLESS COCKSPUR HAWTHORN	CRATAEGUS CRUSGALLI 'INERMIS'	1.5" CAL.	B&B	AS SHOWN	SINGLE
JTL	--	JAPANESE TREE LILAC	SYRINGA RETICULATA	1.5" CAL.	B&B	AS SHOWN	CLUMP
SSC	--	SPRING SNOW CRAB	MALUS 'SPRING SNOW'	1.5" CAL.	B&B	AS SHOWN	SINGLE
CONIFEROUS TREE	**6**						
BHS	--	BLACK HILLS SPRUCE	PICEA GLAUCA DENSATA	6' HT.	B&B	AS SHOWN	FULL
WHP	--	WHITE PINE	PINUS STROBUS	6' HT.	B&B	AS SHOWN	FULL
CONIFEROUS SHRUB	**234**						
BNS	--	BIRD'S NEST SPRUCE	PICEA ABIES 'NIDIFORMIS'	5'-0" O.C.	#5 CONT.	X'-X" O.C.	--
HZA	--	HETZ MIDGET ARBORVITAE	THUJA OCCIDENTALIS 'HETZ MIDGET'	3'-0" O.C.	#5 CONT.	X'-X" O.C.	--
HMA	--	HOLMSTRUP ARBORVITAE	THUJA OCCIDENTALIS 'HOLMSTRUP'	3'-0" O.C.	#5 CONT.	X'-X" O.C.	--
MJJ	--	MINT JULEP JUNIPER	JUNIPERUS CHINENSIS 'MONLEP'	4'-0" O.C.	#5 CONT.	X'-X" O.C.	--
MUP	--	MUGO PINE	PINUS MUGO PUMILIO	4'-0" O.C.	#5 CONT.	X'-X" O.C.	--
TAY	--	TAUNTON YEW	TAXUS MEDII 'TAUNTON'	4'-0" O.C.	#5 CONT.	X'-X" O.C.	--
DECIDUOUS SHRUB	**343**						
NFS	--	NEON FLASH SPIREA	SPIRAEA JAPONICA 'NEON FLASH'	3'-0" O.C.	#5 CONT.	X'-X" O.C.	--
HEC	--	HEDGE COTONEASTER	COTONEASTER LUCIDUS	3'-0" O.C.	#5 CONT.	X'-X" O.C.	--
DBH	--	DWARF BUSH HONEYSUCKLE	DIERVILLA LONICERA	3'-0" O.C.	#5 CONT.	X'-X" O.C.	--
SMS	--	SNOWMOUND SPIREA	SPIRAEA NIPPONICA 'SNOWMOUND'	3'-0" O.C.	#5 CONT.	X'-X" O.C.	--
MWG	--	MINUET WEIGELA	WEIGELA FLORIDA 'MINUET'	3'-0" O.C.	#5 CONT.	X'-X" O.C.	--
ANH	--	ANNABELLE HYDRANGEA	HYDRANGEA ARBORESCENS 'ANNABELLE'	4'-0" O.C.	#5 CONT.	X'-X" O.C.	--
AJN	--	AMBER JUBILEE NINEBARK	PHYSOCARPUS OPULIFOLIUS 'JEFAM'	4'-0" O.C.	#5 CONT.	X'-X" O.C.	--
DGN	--	DART'S GOLD NINEBARK	PHYSOCARPUS OPULIFOLIUS 'DART'S GOLD'	4'-0" O.C.	#5 CONT.	X'-X" O.C.	--
RGD	--	RED GNOME DOGWOOD	CORNUS ALBA SIBIRICA	4'-0" O.C.	#5 CONT.	X'-X" O.C.	--
BLC	--	BLACK CHOKEBERRY	ARONIA MELANOCARPA	4'-0" O.C.	#5 CONT.	X'-X" O.C.	--
PERENNIALS	**300**						
ASD	--	APRICOT SPARKLES DAYLILY	HEMEROCALLIS 'APRICOT SPARKLES'	12" O.C.	#1 CONT.	X" O.C.	--
BJD	--	BAJA DAYLILY	HEMEROCALLIS 'BAJA'	18" O.C.	#1 CONT.	X" O.C.	--
ICD	--	ICE CARNIVAL DAYLILY	HEMEROCALLIS 'ICE CARNIVAL'	18" O.C.	#1 CONT.	X" O.C.	--
BES	--	BLACK EYED SUSAN	RUDBECKIA FULGIDA 'GOLDSTURM'	16" O.C.	#1 CONT.	X" O.C.	--
WBA	--	WOODS BLUE ASTER	ASTER 'WOODS BLUE'	12" O.C.	#1 CONT.	X" O.C.	--
AAA	--	ALERT ASTER	ASTER NOVI-BELGII 'ALERT'	12" O.C.	#1 CONT.	X" O.C.	--
VRA	--	VISIONS IN RED ASTILBE	ASTILBE CHINENSIS 'VISIONS'	12" O.C.	#1 CONT.	X" O.C.	--
STL		STARGAZER LILY	LILIUM 'STARGAZER'	12" O.C.	#1 CONT.	X" O.C.	
PUC	--	PURPLE CONEFLOWER	ECHINACEA PURPUREA 'MAGNA'	18" O.C.	#1 CONT.	X" O.C.	--
PWW	--	POW WOW WILDBERRY ECHINACEA	ECHINACEA PURPUREA 'POW WOW WILDBERRY'	18" O.C.	#1 CONT.	X" O.C.	--
SWE	--	WHITE SWAN ECHINACEA	ECHINACEA PURPUREA 'WHITE SWAN'	18" O.C.	#1 CONT.	X" O.C.	--
RUS	--	RUSSIAN SAGE	PEROVSKIA ATRIPLICFOLIA	18" O.C.	#1 CONT.	X" O.C.	--
AJS	--	AUTUMN JOY SEDUM	SEDUM X 'AUTUMN JOY'	18" O.C.	#1 CONT.	X" O.C.	--
AFS	--	AUTUMN FIRE SEDUM	SEDUM X 'AUTUMN FIRE'	18" O.C.	#1 CONT.	X" O.C.	--
BLB	--	BLAZE LITTLE BLUESTEM GRASS	SCHIZACHYRIUM SCOPARIUM 'BLAZE'	18" O.C.	#1 CONT.	X" O.C.	--
KFG	--	KARL FOERSTER FEATHER REED GRASS	CALAMAGROSTIS X ACUTIFLORA 'KARL FOERSTER'	24" O.C.	#1 CONT.	X" O.C.	--
RSG	--	RED SWITCH GRASS	PANICUM VIRGATUM 'SHENANDOAH'	24" O.C.	#1 CONT.	X" O.C.	--
MFG	--	MISCANTHUS FLAME GRASS	MISCANTHUS SINENSIS 'PURPURASCENS'	18" O.C.	#1 CONT.	X" O.C.	--
PDS	--	PRAIRIE DROPSEED GRASS	SPOROBOLUS HETEROLEPIS	18" O.C.	#1 CONT.	X" O.C.	--

ABBREVIATIONS: B&B = BALLED AND BURLAPPED CAL. = CALIPER HT. = HEIGHT MIN. =MINIMUM O.C. = ON CENTER SP. = SPREAD QTY .= QUANTITY CONT. = CONTAINER
NOTE: QUANTITIES ON PLAN SUPERSEDE LIST QUANTITIES IN THE EVENT OF A DISCREPANCY.

LANDSCAPE LEGEND

OVERSTORY DECIDUOUS TREE
ORNAMENTAL TREE
SHRUBS
PERENNIALS
EDGER

LANDSCAPE KEYNOTES (A)

A SHREDDED HARDWOOD MULCH (TYP.)
B EDGER (TYP.)
C SOD (TYP.)
D ROCK MULCH
E RAIN GARDEN SEED MIX

1" = 30'
0' 30' 60' 90'

NOT FOR CONSTRUCTION

DESIGNED:
CHECKED:
DRAWN:
HORIZONTAL SCALE: 30'
VERTICAL SCALE: 6' or 3'

INITIAL ISSUE: 09/23/2022
REVISIONS:

PREPARED FOR:
ENCLAVE DEVELOPMENT
300 23RD AVE E, SUITE 300
WEST FARGO, ND 58078

I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED LANDSCAPE ARCHITECT UNDER THE LAWS OF THE STATE OF MINNESOTA
SHARI LYNN S. AHRENS
DATE 09/23/2022 LICENSE NO. .

MAPLEWOOD ENCLAVE
MAPLEWOOD, MN

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

LANDSCAPE PLAN

SHEET NUMBER:
L100
DATE: 09/23/2022

MAPLEWOOD ENCLAVE

PROJECT NUMBER: 0037066.00

N:\0037066.00\DWG\CIVIL\0037066PL01.DWG

Attachment E – Geotechnical Report

PRELIIMINARY REPORT OF GEOTECHNICAL EXPLORATION

Proposed Maplewood Apartment Building
Maplewood, Minnesota

AET Project No. AET No. P-0013939

Date: August 1, 2022

Prepared for:

Enclave Development
300 23rd Avenue East
Suite 300
West Fargo, North Dakota 58078

Geotechnical • Materials
Forensic • Environmental
Building Technology
Petrography/Chemistry

American Engineering Testing
550 Cleveland Avenue North
St. Paul, MN 55114-1804
TeamAET.com * 800.972.6364

August 1, 2022

Enclave Development
300 23rd Avenue East, Suite 300
West Fargo, North Dakota 58078

Attn: Mr. Patrick Brama
Patrick.brama@enclavecompanies.com

RE: Preliminary Report of Geotechnical Exploration
Proposed Maplewood Apartment Building
3090 Southlawn Drive
Maplewood, Minnesota
AET Project No. P-0013939

Dear Mr. Brama:

American Engineering Testing, Inc. (AET) is pleased to present the results of our subsurface exploration program and geotechnical engineering review for the Proposed Maplewood Apartment Building project in Maplewood, Minnesota. These services were performed according to our proposal dated June 3, 2022.

We are submitting an electronic pdf copy of this report to you. We can also provide you with hard copies of the report if needed.

Please contact me if you have any questions about the report. I can also be contacted for arranging construction observation and testing services during the construction phase.

Sincerely,
American Engineering Testing, Inc.

Andrew T. Schmid, PE (MN, WI, ND, FL, GA)
Senior Engineer
aschmid@amengtest.com
651-523-1274

SIGNATURE PAGE

Prepared for:

Enclave Development
300 23rd Avenue East, Suite 200
West Fargo, North Dakota 58078

Attn: Mr. Patrick Brama

Prepared by:

American Engineering Testing, Inc.
550 Cleveland Avenue North
St. Paul, Minnesota 55114
(651) 659-9001/www.amengtest.com

Authored by:

Andrew T. Schmid, PE (MN, WI, ND, FL, GA)
Senior Engineer

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 Minnesota Statute Section 326.02 to 326.15

Name: Andrew T. Schmid, PE

Date: 8/1/22 License #: 48982

Reviewed by:

Mitchell G. Nelson, PE (MN)
Staff Geotechnical Engineer

TABLE OF CONTENTS

1.0 INTRODUCTION

It is our understanding that Enclave Development is planning to construct a new apartment building in Maplewood, Minnesota. To assist planning and design, you have authorized American Engineering Testing, Inc. (AET) to conduct a subsurface exploration program at the site, conduct soil laboratory testing, and perform a geotechnical engineering review for the project. This report presents the results of the above services and provides our preliminary engineering recommendations based on this data. Once final plans are better established, we can review our data, but additional exploration might be required based on the site layout and design requirements for is to issue a final geotechnical report of our recommendations. A final geotechnical report should be prepared once final design information and building loads are known.

2.0 SCOPE OF SERVICES

AET's services were performed according to our proposal dated June 3, 2022, which was authorized on June 10, 2022. The authorized scope consists of the following:

- Drill ten (10) standard penetration test (SPT) borings to depths of about 10 to 35 feet below grade.
- Perform soil laboratory testing.
- Conduct a geotechnical engineering review based on the data and prepare this report.

These services are intended for geotechnical purposes. The scope to explore for the presence of environmental contamination was limited only to our field crew noting visual or olfactory evidence in the soil samples. A Phase 1 Environmental Site Assessment (ESA) report was also authorized via the project proposal; our environmental services team will deliver these services in a separate report.

3.0 PROJECT INFORMATION

3.1 Project Description

The Site is listed as the Myth night club and encompasses two occupied adjoining parcels located at the southeast corner of County Road D East and Southlawn Drive North in Maplewood, Ramsey County, Minnesota. We understand that you are planning the construction of a 4-story wood-framed apartment building with a possible below-grade parking level and paved surface parking lots. The two adjoining parcels are about 2.8-acres of paved parking, Parcel Identification Number (PID) 022922220016 (North Lot), and 2.1-acres of building and paved parking, PID 022922220017. We understand that the development is conceptual at this time and the exact location of the building and pavement areas are not known.

For preliminary purposes, we have assumed that the apartment building may have masonry or sat in-place concrete foundations walls. There will likely be wood-frame construction above street level. Based on past similar projects, we have estimated maximum wall loads of approximately 15 to 20 kips per linear foot and maximum column loads of about 250 kips per column. Floor slab loads are estimated to be less than about 150 pounds per square foot (psf). These loads will need to be confirmed for the final report.

The above stated information represents our understanding of the proposed construction. This information is an integral part of our engineering review. It is important that you contact us if there are changes from that described so that we can evaluate whether modifications to our recommendations are appropriate.

4.0 SUBSURFACE EXPLORATION AND TESTING

4.1 Field Exploration Program

The subsurface exploration program conducted for the project consisted of drilling 10 standard penetration testing (SPT) borings. Enclave Development and the design team determined the number and locations of the borings, and AET proposed the depths. The logs of the borings/soundings and details of the methods used appear in Appendix A.

The boring logs contain information concerning soil layering, soil classification, geologic description, and moisture condition. Relative density or consistency is also noted for the natural soils, which is based on the standard penetration resistance (N-value).

The approximate boring/sounding locations are shown on Figure 1 in Appendix A. The borings were located in the field by AET personnel by taping from nearby site features. AET field personnel recorded final boring locations using a field GPS unit with submeter accuracy. Ground surface elevations were recorded with a surveyor's elevation rod and level sight and correlated to existing elevations; the elevations are presented on the logs in Appendix A.

4.2 Laboratory Testing

Samples collected in the field were analyzed at the AET lab to provide a more detailed characterization of sample properties. The laboratory test program included testing for moisture content test on fine-grained soil samples. Laboratory review and characterization of soils samples also provided the Unified Soil Classification System (USCS) classification of materials encountered during site exploration. Additionally, organic content testing and grain-size analysis was performed to further characterize soil samples. The test results appear in Appendix A on the individual boring logs adjacent to the samples upon which they were performed.

5.0 SITE CONDITIONS

5.1 Surface Observations

The site is located at the southeast corner of County Road D East and Southlawn Drive in Maplewood, Minnesota. Most of the site of the planned building is currently used as an asphalt paved parking lot. An existing building occupied the southwest corner of the site. Ground surface elevations at the boring locations range from 924.7 feet at Boring B-3 to 927.5 feet at Boring B-1.

5.2 Subsurface Soils/Geology

The site geology consists primarily of variable thickness of fill underlain in many areas by swamp deposits which are in turn underlain by fine or coarse alluvium and glacial till. The composition of the fill varies considerably, but consists primarily of silty sand, clayey sand, sand with silt and sand with varying amount of gravel and ranging in color from black to

brown. At some locations, organic fines, peat, cinders, brick, and wood were present within the fill. The swamp deposits consist of peat and organic clay. The fine alluvium consists of lean and fat clay, silt, and silty clay. The coarse alluvium consists of sand with silt, sand with gravel, silty sand, and sand. The till consists of clayey sand and sandy lean clay.

5.3 Groundwater

Groundwater measurements made in the borings at the time of drilling are presented on the attached boring logs and are summarized in Table A-1 in the report Appendix A.

Groundwater was measured at the borings at depths ranging from 7.6 to 13 feet at the time of drilling, corresponding to elevations between 917.1 to 912.9 feet. Where the primary soils encountered are slow draining materials, it takes an extended observation period to reliably establish the ground water level in the slower draining soils. Such an extended observation period is beyond the scope of this work. Where the predominate soils consisted of the relatively free draining coarse alluvial sands, the measured water levels should be representative of the water level at the time and location of drilling. At some locations, observations of samples retrieved indicate water may be present. Notations indicating the estimated depth of water based on sample observation are included on the boring logs. In soils such as those present at this site, it is likely perched water may at times be present within the interlayered soils or where sand lenses or laminations are present within the slower draining soils at variable depths.

Ground water levels fluctuate due to varying seasonal and annual rainfall and snow melt amounts, as well as other factors. The Twin Cities area has been in a low precipitation pattern for the last 2 years and the presently observed (or not observed) groundwater levels may be lower than normal

5.4 Review of Soil Properties

Based on the sample appearance and N-values, it appears most of the fill was not placed and compacted in a controlled manner. The fill is underlain by highly compressible swamp deposits at four of the ten boring locations. It is our judgment there is a significant risk of detrimental building settlement if the new construction is supported on the fill and/or swamp deposits. The fill in the area of the existing building may have been placed and compacted in a controlled manner. We understand that the existing structure has

performed satisfactorily but is experiencing some settlement.

The swamp deposits are judged to be highly compressible materials. Significant total and differential settlement will likely occur where these materials are subjected to increased stresses due to building foundations, new fill placement, or underground utility construction. We estimate that most of the settlement will occur within about the first 3 months following the introduction of the increased stress (i.e., placement of fill). Based on soil conditions encountered at the borings, we estimate the settlement due to the weight of new fill required to establish planned finish grades could be up to several inches at the building and pavement areas, depending on actual building and traffic loads and anticipated fill volumes.

5.5 Frost Susceptibility

The primary near surface soils present at the site are moderately slow draining and are at least moderately frost susceptible. The coarse alluvial soils and the deeper portions of the in-place fills consisting of sand with gravel are relatively free draining and generally are not frost susceptible materials.

5.6 Permeability

Much of the on-site soils have low permeability. The silty and clayey sands have moderate to low permeability. The coarse alluvium soils, consisting of sand with varying amount of gravel have, higher permeability.

6.0 RECOMMENDATIONS

6.1 Discussion

No preliminary grading plans were available at the time of our analysis for this project. We anticipate the planned project grades will approximately follow existing site grades. Based on a review of the collected ground surface elevations, we estimate the finished project grade will be near an elevation of about 926 feet. We used this elevation as the basis for our recommendations. This will need to be confirmed for the final report.

The existing fill that is underlain by organic soils will continue to settle slowly over time due to secondary compression even if the site grades do not change. Increasing site grade elevations higher than current grades in areas where organic soils and soft soils exist will also cause settlement due to both primary compression and secondary

compression.

The existing fill soils, buried organic soils, and soft soils are not suitable for foundation support. A conventional remove-and-replace soil correction would require dewatering and excavation depths as deep as 20 feet. The excavation would need to be completely de-watered to make sure that all organic and soft soils are removed and that the new fill is properly placed and compacted. In our opinion, the excavation depths required, the presence of shallow groundwater, and the proximity of the adjacent roadways would not make excavation and replacement a feasible option for this site. We assume that anticipated post construction settlements of the magnitudes discussed earlier are not acceptable for the planned construction. Therefore, special site preparation, construction techniques and foundation systems will be required.

For structural support of the planned apartment building, several soil correction and foundation system options have been considered by the project team. In summary, these consist of: (1) complete excavation of the existing fill and swamp deposits, followed by placement and compaction of new fill; (2) use of a deep foundation system such as driven piles for support of the floor and foundations; and (3) use of rammed aggregate/impact piers or rigid inclusion piles to support the foundations and the floor. Based on past site experience, the use of rammed aggregate/impact piers or rigid inclusion piles have been selected options. Based on prior discussion with the deign team, it is our understanding that both rammed aggregate/impact piers or rigid inclusion piles are being considered. Should it be decided to consider another option please let us know and we can provide supplemental recommendations.

External structures, such as light poles and utilities, could be supported on helical piles or on rammed aggregate piers/impact piers or rigid inclusion piles. Because there are many different types of proprietary helical piles, with varying shaft diameters and helical configurations, we recommend that you contact the various helical pile contractors directly to determine estimated installation depths and helical configurations for their particular helical pile brand to support the design loads.

We are presenting recommendations for ground improvements of the existing fill and swamp deposits in the building area and leaving the existing fill (if not organic) in-place in pavement areas.

6.2 Building Grading

6.2.1 Excavation

The apartment building can be supported on spread footings, with an on-grade supported floor slab, after installing the rammed aggregate/impact piers or rigid inclusion piles. A local representative for rammed aggregate/impact piers or rigid inclusion piles should be contacted for design.

In order to install the rammed aggregate/impact piers or rigid inclusions, some site excavation and filling will be required. Depending on the time of year of construction, throughout the majority of the apartment building area, excavation could consist of removal of frozen soils. The existing subgrade soils are fine-grained and susceptible to freeze-thaw movements. We recommend replacing the upper 3 to 4 feet of the subgrade with non-frost susceptible sands to reduce the potential for floor slab distress.

Along the planned apartment building lines, existing pavement should be removed to promote easier installations or either system. The soil borings (Borings B-2, B-3, B-4, and B-7) indicate that swamp deposits are present beneath the fill. In areas where significant depths of fill will be required to establish planned finish elevations. Where the swamp deposits are present beneath the existing fill and grades are planned to be raised, excess consolidation of the swamp deposits may occur. The engineers at the local representative should design the ground improvement system to support the mass of the new fill system as well as the new apartment building construction.

The excavation recommendations are based on the soil condition at the specific boring locations. Since conditions will vary away from the boring location, it is recommended that AET geotechnical personnel observe and confirm the competency of the soils in the entire excavation bottom prior to new fill or footing placement.

6.2.2 Fill Placement and Compaction

Fill placed to attain grade for foundation support should be compacted in thin lifts, such that the entire lift achieves a minimum compaction level of 98% of the standard maximum dry unit weight per ASTM: D698 (Standard Proctor test). Fill placed in floor slab areas can be compacted to a minimum compaction level of 95%. We recommend that fill be placed in lift thicknesses appropriate for the type of equipment used and the conditions at the time of the actual earthwork. The thickness should be such that the entire lift attains the minimum specified compaction level.

The fill should consist of a suitable inorganic granular soil consisting of sand (SP) or sand with silt (SP-SM). Most of the presently in-place fill at the borings in the building addition area will likely not be reusable within the compacted fill system due to the presence of organic fines and peat within the fill. We recommend the fill placed in foundation areas consist of sand (SP) and sand with silt (SP-SM).

If any excavation extends below the water level or if perched water which enters the excavation is encountered, the excavation should be dewatered during excavation and fill placement. If standing water or wet conditions exist in the bottoms of the excavations, we recommend the initial lifts of fill consist of free draining sands. These sands should have no more than 5% of the particles (by weight) finer than the #200 sieve and no more than 40% of the particles (by weight) finer than the #40 sieve.

If encountered, frozen soils should not be used within the compacted fill system and no fill should be placed upon frozen soils.

6.3 Rammed Aggregate/impact Pier Foundation Alternative

The structure can be supported on conventional spread foundations placed upon the compacted fill above the rammed aggregate/impact piers or upon in-place soils improved by the rammed aggregate/impact pier installation. We recommend perimeter foundations for heated building space be placed such that the bottom is a minimum of 42 inches below exterior grade. We recommend foundations for unheated building space (such as canopy foundations) be extended to a minimum of 60 inches below exterior grade.

The specialty contractor will determine the allowable soil bearing pressure and settlement estimates depending on the system utilized, but we anticipate that the total settlements under loading should not exceed 1 inch. We also anticipate that differential settlements of conditions depicted by the borings should not exceed ½ inch. Based on the conditions encountered, our experience with rammed aggregate/impact piers, and the recommended fill compaction levels, we anticipate the building foundations will be designed based on a net maximum allowable soil bearing pressure of about 4,000 psf.

Rammed aggregate/impact piers (for example, “Geopiers”) may be a deep foundation (ground improvement) alternative, but because these are proprietary, we recommend that you contact the various design-build contractors directly that design and install them as to their viability at this site. There are three such design-build contractors in the Twin Cities area that design and install these types of foundations: Subsurface Constructors, Ground Improvement Engineering/Geopier, and Menard.

6.4 Rigid Inclusion Foundation Alternative

The rigid inclusion piles should be designed to transfer loads through the soft soils into underlying stiff or dense strata using high modulus concrete or grout columns. These are designed and installed by specialty geotechnical contractors, each with their own proprietary system. Rigid inclusion piles are vertical ground improvements constructed of drilled shafts of cement-sand grout using a soil displacement tool while drilling. Since rigid inclusion piles are installed using a displacement tool, they produce little or no spoils, because the cuttings are pushed back into the surrounding soils. They typically are designed to support a load transfer platform at the ground surface made of either compacted granular fill and geotextile fabric or a crushed aggregate base material, and the building or embankment is then supported on the load transfer platform.

This method also allows the structure to be supported on conventional spread foundations placed upon the compacted fill above the rigid inclusion piles or upon in-place soils improved by the rigid inclusion pile installation. Similar to other ground improvement methods, we recommend perimeter foundations for heated building space be placed such that the bottom is a minimum of 42 inches below exterior grade. We recommend foundations for unheated building space (such as canopy foundations) be extended to a minimum of 60 inches below exterior grade.

The specialty rigid inclusion design contractor will determine the allowable soil bearing pressure and settlement estimates depending on the system utilized, but we anticipate that the total settlements under loading should not exceed 1 inch. We also anticipate that differential settlements of conditions depicted by the borings should not exceed ½ inch. Based on the conditions encountered, our experience with rigid inclusion, and the recommended fill compaction levels, we anticipate the building foundations will be designed based on a net maximum allowable soil bearing pressure of about 4,000 psf.

Because ridged inclusion pile systems are proprietary, we recommend that you contact the design-build contractors directly to discuss their viability at this site. Many specialty design-build firms that install ground improvement systems will also design and install rigid inclusion pile systems.

6.5 Floor Slab Design

The floor slab can be supported on rammed aggregate/impact piers or rigid inclusion piles if either option is selected. A slab supported over the existing fill and buried organic soils without ground improvement or foundation support is an option if the owner can accept an increased risk of settlement.

The existing fill soils would remain in place for both the rammed aggregate/impact piers or rigid inclusion piles. These soils are frost susceptible and would experience heave in the winter and loss of strength upon thawing. This could cause distress to the floor slab. We recommend that the surficial organic soil and existing fill be removed to a depth of 4 feet below the floor slab aggregate base and be replaced with non-frost susceptible (NFS) sand, classified as (SP) as a sand subbase. The sand should contain no more than 5% (by weight) passing the No. 200 sieve and no more than 40% (by weight) passing the No. 40 sieve. The sand should be drained to a stormwater system with draintile. The fill should be placed and compacted in thin lifts (12" thick or less) to at least 95% of the standard Proctor maximum dry density (ASTM: D698).

We recommend that a floor slab aggregate base of at least 5 inches in thickness be placed. This should consist of “trimmable” granular soils such as crushed limestone or crushed recycled concrete material meeting a MnDOT Class 5 gradation. Sand with a low percentage of fines should not be used as the aggregate base as this type of sand ruts easily under construction traffic. A rutted aggregate base can contribute to additional floor

cracking as the floor slab cannot move uniformly when it shrinks. A vapor retarder should be placed directly under the floor slab where there are moisture sensitive floor coverings/coatings.

6.6 Exterior Entry Slabs and Appurtenant Structures

We anticipate that exterior entry slabs and sidewalks will be affected by both settlement of the underlying organic soils and could also be affected by frost heave. If these types of items are to abut the building and settlement would be a concern or problem, we recommend that the slabs and sidewalks be constructed as structural slabs, supported on rammed aggregate/impact piers, rigid inclusion piles, or helical piles. There should be a minimum air gap of 4 inches between the top of the subgrade and the bottom of the slabs.

As an alternative, provided some movement can be tolerated where slabs and sidewalks abut the building, to mitigate frost effects we recommend constructing a subgrade of non-frost susceptible (NFS) sand. The purpose of this is to reduce the potential for the characteristic heave that occurs when clayey or silty soils freeze in the winter. This heave can raise the slabs, causing jamming of doorways and possible damage to the building. The NFS sand should be a select granular soil with less than 5% passing the No. 200 sieve and less than 50% passing the No. 40 sieve. It should be placed at least 4 feet thick under the slab and at least 2 feet beyond the outside edges of the slab to minimize abrupt differential movement. This fill should be compacted to at least 95% of the maximum Standard Proctor dry density. Dependent on the soil encountered in these areas, drainpipes could be required at the base of the NFS sand, connected to the storm sewer, to remove infiltrating water.

For the slabs and sidewalks supported on grade, the design should also incorporate the potential for settlement of the soils surrounding the building. This can be performed by various details, including hinged slabs at entry points that connect to the building and are allowed to rotate with the “free-end” abutting the adjacent sidewalks or pavement areas. In this manner abrupt differential settlements can be reduced.

6.7 Exterior Underground Utilities

In our opinion, the non-settlement sensitive utilities can be supported (floated) in the existing surface fill soils. The connections of utilities to the building, which would be supported on either rammed aggregate/impact piers or rigid inclusion piles supported foundations, should be flexible to allow for some movement. Any new fill from site grading and also the existing fill will cause the underlying buried organic soils to continue to settle, which could damage utilities. This could also affect the flow of the sanitary sewer system. There should be enough elevation change in the sanitary sewer to account for some differential settlements, if the utilities will not have either rammed aggregate/impact pier or rigid inclusion pile foundations or helical pile support.

Consideration can be given to supporting utilities on rammed aggregate/impact pier or rigid inclusion pile foundations, or alternatively helical piles, if movement of utilities is not desired. However, in our experience, supporting utilities on pile foundations can create “hard spots” within pavement areas. The pavement will be supported over the organic and soft soils, with continued settlement anticipated while the pile-supported utilities are not expected to settle causing elevation differences in these areas. If possible, pile-supported utilities should be routed through a landscape area where future grading and leveling can be performed. We recommend that AET be contacted once the design is finalized for review of the utilities.

6.8 Pavements

Based on our understanding of the project, the proposed finish surface of the expanded pavement areas should be at or near existing grade. At the boring locations, the generalized soil profile consists of fill overlying compressible swamp deposits. Based on the conditions encountered, we estimate that total settlements due to the weight of compacted fill soils, aggregate base and bituminous could be up to several inches, again assuming that minimal additional fill is required to attain finished grade. We understand

that some underground utilities would be present within the area of the expanded pavements. No information regarding the types of utilities or proposed depths are available. If these utilities were installed within or above the compressible swamp deposits, settlement of the existing utilities may also occur.

Our preferred recommendation for the pavement construction is to remove the existing fill and compressible swamp deposits and place new compacted fill to establish finish grades. The excavation and fill placement should be performed following the recommendations in Section 6.2 of this report.. Dewatering of the excavation during the earthwork would be required. Use of imported clean sand fill for at least lower portions of the fill placement would be required. Completion of the excavation and filling will require extensive earthwork and may not be feasible.

If the project owner is willing to accept a reduced level of pavement performance, alternative pavement construction procedures are feasible. If some settlement of the pavement is acceptable, the pavement could be constructed over the existing fill. If this alternative is selected, we recommend the surface vegetation be removed from the planned pavement areas. In addition, about 2 feet of the presently in-place fill should be removed. The excavation should extend 2 feet beyond the edge of pavements. A layer of geotextile fabric should then be placed over the bottom of the subcut excavation, suitable fill soils should then be placed upon the fabric to the base of the aggregate base (Class 5). To help further reduce possible settlements, a second layer of geotextile fabric could then be placed over the suitable fill followed by the base and bituminous sections.

The excavation, fill placement, and roadway thickness design should be performed according to the recommendations presented in Section 6.2. However, due to the magnitudes of anticipated settlements we do recommend that if this procedure is used, placement of the storm sewer, concrete curb and gutter, and bituminous should be delayed as long as possible (for about 6 months to 1 year if possible) following placement of the fill. Even with this delay, post construction settlement of up to a few inches should be expected. In addition, since the settlement will likely be differential, the settlement may result in poor surface drainage of the bituminous surface.
We recommend the upper portion of the pavement construction consist of a minimum of 5 inches of bituminous surfacing placed over at least 10 inches of 100% crushed limestone Class 5 aggregate base. For at least 10 inches between the Class 5 base and

the surface of the suitable fill soils, we recommend a layer of Select Granular Borrow.

Depending on the option chosen, the bituminous pavement sections given above could have an estimated life of 20 years. However, the owner should not expect that the pavements would last 20 years without maintenance. Within one to three years after construction, cracks can appear in the bituminous mat due to thermal expansion and contraction, and due to the loss of volatiles from the bituminous cement. These cracks cannot be avoided; they should be cleaned annually and filled with a hot bituminous sealant. Within three to five years after construction, cracks and depressions may appear in heavily traveled areas. Such areas should be cut out and repaired expeditiously to extend the pavement life. Periodically during the pavement life, it may be necessary to apply a seal coat of hot bituminous and rock chips.

We anticipate that the pavements on this site will settle differentially with time, which will affect the surface drainage and runoff. Further, ridges or humps may develop in the pavements over the rammed aggregate/impaction piers, rigid inclusion piles, or helical pile-supported utility lines. Significant differential settlement may also occur where pavements abut pile-supported sidewalks and the buildings; these areas will likely require periodic filling or overlays.

6.9 Stormwater Management

The primary soil type at the location of the proposed stormwater feature, Boring B-10, is clayey sand with varying amount of gravel. Based on the Minnesota Storm Water Manual (MSWM) produced by the Minnesota Pollution Control Agency (MPCA), the infiltration rates for clayey sands are estimated to be 0.06 inches per hour.

More site-specific representative rates may be determined by performing in-situ testing via the Double-Ring Infiltrometer (DRI) method or Modified Phillip-Dunne (MPD) Infiltrometer method, if desired. This testing, if performed, should be conducted at or just below the bottom elevations of the proposed infiltration structures/devices. This testing should be used to document that the infiltration rates used by the design engineer are comparable with the in-place soils.

7.0 CONSTRUCTION CONSIDERATIONS

7.1 Potential Difficulties

7.1.1 Water in Excavations

Excavations at this site, for example for utility construction, could likely encounter groundwater. Water can also be expected to collect in excavation bottoms during times of inclement weather or snow melt. To facilitate construction operations, we recommend water be removed from within the excavation during construction. The selection and installation of the dewatering system, however, is solely the responsibility of the contractor. The type of system to use will be dependent in part on the prevailing groundwater conditions at the time of construction.

7.1.2 Disturbance of Soils

The on-site soils can become disturbed under construction traffic, especially if the soils are wet. If soils become disturbed, they should be subcut to the underlying undisturbed soils. The subcut soils can then be dried and recompacted back into place, or they should be removed and replaced with drier imported fill.

7.1.3 Cobbles, Boulders, and Debris Fill

The soils at this site can include cobbles and boulders and possible debris in the existing fills. This may make excavating procedures somewhat more difficult than normal if they are encountered.

7.1.4 Winter Construction

If construction occurs during the winter, it is necessary for the contractor to protect the base soils from freezing each day and each night before new fill is placed. Fill should not be placed over frozen soils, snow, or ice, nor should the use of frozen fill soils be permitted. The contractor must protect base soils from freezing before and after fill placement, and before, during, and after concrete placement.

7.2 Excavation Backsloping

If excavation faces are not retained, the excavations should maintain maximum allowable slopes in accordance with *OSHA Regulations (Standards 29 CFR), Part 1926, Subpart P, "Excavations"* (can be found on www.osha.gov). Even with the required OSHA sloping, water seepage or surface runoff can potentially induce sideslope erosion or running which could require slope maintenance.

7.3 Observation and Testing

The recommendations in this report are based on the subsurface conditions found at our test boring locations. Because the soil conditions can be expected to vary away from the soil boring locations, we recommend on-site observation by AET geotechnical personnel during construction to evaluate the effect of these potential changes.

We recommend the soils in excavation bottoms be observed by an AET geotechnical engineer immediately prior to placing fill or forming for footings. Soil density testing should also be performed on fill placed at the site to document that our recommendations and the specifications for compaction and moisture have been satisfied. Where fill material type is important, laboratory sieve analyses should be performed to document that the actual fill meets the recommended gradation criteria. The building materials should also be tested in accordance with the project specifications and the building codes.

The rammed aggregate/impact pier or rigid inclusion pile installation operations should be conducted under the observation of a geotechnical engineer or technician. This observation is conducted to reduce the potential for short pile element installations and excessive aggregate lift thicknesses. Full-time observations may reduce risk and help confirm that the rammed aggregate or /impact pier or rigid inclusion pile elements are installed in general accordance with their intended design.

8.0 ASTM STANDARDS

When we refer to an ASTM Standard in this report, we mean that our services were performed in general accordance with that standard. Compliance with any other standards referenced within the specified standard is neither inferred nor implied.

9.0 LIMITATIONS

Within the limitations of scope, budget, and schedule, we have endeavored to provide our services according to generally accepted geotechnical engineering practices at this time and location. Other than this, no warranty, either express or implied, is intended.

Important information regarding risk management and proper use of this report is given in Appendix B entitled “Geotechnical Report Limitations and Guidelines for Use”.

Standard Sheets

Floor Slab Moisture/Vapor Protection
Basement/Retaining Wall Backfill and Water Control
Freezing Weather Effects on Building Construction

FLOOR SLAB MOISTURE/VAPOR PROTECTION

Floor slab design relative to moisture/vapor protection should consider the type and location of two elements, a granular layer and a vapor membrane (vapor retarder, water resistant barrier or vapor barrier). In the following sections, the pros and cons of the possible options regarding these elements will be presented, such that you and your specifier can make an engineering decision based on the benefits and costs of the choices.

GRANULAR LAYER

In American Concrete Institute (ACI) 302.1R-04, a "base material" is recommended over the vapor membrane, rather than the conventional clean "sand cushion" material. The base layer should be a minimum of 4 inches (100 mm) thick, trimmable, compactable, granular fill (not sand), a so-called crusher-run material. Usually graded from 1½ inches to 2 inches (38 to 50 mm) down to rock dust is suitable. Following compaction, the surface can be choked off with a fine-grade material. We refer you to ACI 302.1R-04 for additional details regarding the requirements for the base material.

In cases where potential static water levels or significant perched water sources appear near or above the floor slab, an under floor drainage system may be needed wherein a draintile system is placed within a thicker clean sand or gravel layer. Such a system should be properly engineered depending on subgrade soil types and rate/head of water inflow.

VAPOR MEMBRANE

The need for a vapor membrane depends on whether the floor slab will have a vapor sensitive covering, will have vapor sensitive items stored on the slab, or if the space above the slab will be a humidity controlled area. If the project does not have this vapor sensitivity or moisture control need, placement of a vapor membrane may not be necessary. Your decision will then relate to whether to use the ACI base material or a conventional sand cushion layer. However, if any of the above sensitivity issues apply, placement of a vapor membrane is recommended. Some floor covering systems (adhesives and flooring materials) require installation of a vapor membrane to limit the slab moisture content as a condition of their warranty.

VAPOR MEMBRANE/GRANULAR LAYER PLACEMENT

A number of issues should be considered when deciding whether to place the vapor membrane above or below the granular layer. The benefits of placing the slab on a granular layer, with the vapor membrane placed **below** the granular layer, include **reduction** of the following:

- Slab curling during the curing and drying process.
- Time of bleeding, which allows for quicker finishing.
- Vapor membrane puncturing.
- Surface blistering or delamination caused by an extended bleeding period.
- Cracking caused by plastic or drying shrinkage.

The benefits of placing the vapor membrane over the granular layer include the following:

- A lower moisture emission rate is achieved faster.
- Eliminates a potential water reservoir within the granular layer above the membrane.
- Provides a "slip surface", thereby reducing slab restraint and the associated random cracking.

If a membrane is to be used in conjunction with a granular layer, the approach recommended depends on slab usage and the construction schedule. The vapor membrane should be placed above the granular layer when:

- Vapor sensitive floor covering systems are used or vapor sensitive items will be directly placed on the slab.
- The area will be humidity controlled, but the slab will be placed before the building is enclosed and sealed from rain.
- Required by a floor covering manufacturer's system warranty.

The vapor membrane should be placed below the granular layer when:

- Used in humidity controlled areas (without vapor sensitive coverings/stored items), with the roof membrane in place, and the building enclosed to the point where precipitation will not intrude into the slab area. Consideration should be given to slight sloping of the membrane to edges where draintile or other disposal methods can alleviate potential water sources, such as pipe or roof leaks, foundation wall damp proofing failure, fire sprinkler system activation, etc.

There may be cases where membrane placement may have a detrimental effect on the subgrade support system (e.g., expansive soils). In these cases, your decision will need to weigh the cost of subgrade options and the performance risks.

BASEMENT/RETAINING WALL BACKFILL AND WATER CONTROL

DRAINAGE

Below grade basements should include a perimeter backfill drainage system on the exterior side of the wall. The exception may be where basements lie within free draining sands where water will not perch in the backfill. Drainage systems should consist of perforated or slotted PVC drainage pipes located at the bottom of the backfill trench, lower than the interior floor grade. The drain pipe should be surrounded by properly graded filter rock. A geosynthetic "filter fabric" should then envelope the filter rock. The drain pipe should be connected to a suitable means of disposal, such as a sump basket or a gravity outfall. A storm sewer gravity outfall would be preferred over exterior daylighting, as the latter may freeze during winter. For non-building, exterior retaining walls, weep holes at the base of the wall can be substituted for a drain pipe.

BACKFILLING

Prior to backfilling, damp/water proofing should be applied on perimeter basement walls. The backfill materials placed against basement walls will exert lateral loadings. To reduce this loading by allowing for drainage, we recommend using free-draining sands for backfill. The zone of sand backfill should extend outward from the wall at least 2 feet, and then upward and outward from the wall at a 30° or greater angle from vertical. The free-draining sand backfill should contain no more than 40% by weight passing the #40 sieve and no greater than 5% by weight passing the #200 sieve. The sand backfill should be placed in lifts and compacted with portable compaction equipment. This compaction should be to the specified levels if slabs or pavements are placed above. Where slab/pavements are not above, we recommend capping the sand backfill with a layer of clayey soil to minimize surface water infiltration. Positive surface drainage away from the building should also be maintained. If surface capping or positive surface drainage cannot be maintained, then the trench should be filled with more permeable soils, such as the Fine Filter or Coarse Filter Aggregates defined in MnDOT Specification 3149. You should recognize that if the backfill soils are not properly compacted, settlements may occur which may affect surface drainage away from the building.

Backfilling with silty or clayey soil is possible but not preferred. These soils can build-up water which increases lateral pressures and results in wet wall conditions and possible water infiltration into the basement. If you elect to place silty or clayey soils as backfill, we recommend you place a prefabricated drainage composite against the wall which is hydraulically connected to a drainage pipe at the base of the backfill trench. High plasticity clays should be avoided as backfill due to their swelling potential.

LATERAL PRESSURES

Lateral earth pressures on below grade walls vary, depending on backfill soil classification, backfill compaction and slope of the backfill surface. Static or dynamic surcharge loads near the wall will also increase lateral wall pressure. For design, we recommend the following ultimate lateral earth pressure values (given in equivalent fluid pressure values) for a drained soil compacted to 95% of the Standard Proctor density and a level ground surface.

	Equivalent Fluid Density	
Soil Type	**Active (pcf)**	**At-Rest (pcf)**
Sands (SP or SP-SM)	35	60
Silty Sands (SM)	45	65
Fine Grained Soils (SC, CL or ML)	70	90

Basement walls are normally restrained at the top which restricts movement. In this case, the design lateral pressures should be the "at-rest" pressure situation. Retaining walls which are free to rotate or deflect should be designed using the active case. Lateral earth pressures will be significantly higher than that shown if the backfill soils are not drained and become saturated.

FREEZING WEATHER EFFECTS ON BUILDING CONSTRUCTION

GENERAL

Because water expands upon freezing and soils contain water, soils which are allowed to freeze will heave and lose density. Upon thawing, these soils will not regain their original strength and density. The extent of heave and density/strength loss depends on the soil type and moisture condition. Heave is greater in soils with higher percentages of fines (silts/clays). High silt content soils are most susceptible, due to their high capillary rise potential which can create ice lenses. Fine grained soils generally heave about 1/4" to 3/8" for each foot of frost penetration. This can translate to 1" to 2" of total frost heave. This total amount can be significantly greater if ice lensing occurs.

DESIGN CONSIDERATIONS

Clayey and silty soils can be used as perimeter backfill, although the effect of their poor drainage and frost properties should be considered. Basement areas will have special drainage and lateral load requirements which are not discussed here. Frost heave may be critical in doorway areas. Stoops or sidewalks adjacent to doorways could be designed as structural slabs supported on frost footings with void spaces below. With this design, movements may then occur between the structural slab and the adjacent on-grade slabs. Non-frost susceptible sands (with less than 40% by weight passing a #40 sieve and no more than 5% by weight passing a #200 sieve) can be used below such areas. Depending on the function of surrounding areas, the sand layer may need a thickness transition away from the area where movement is critical. With sand placement over slower draining soils, subsurface drainage would be needed for the sand layer. High density extruded polystyrene insulation could be used within the sand to reduce frost penetration, thereby reducing the sand thickness needed. We caution that insulation placed near the surface can increase the potential for ice glazing of the surface.

The possible effects of adfreezing should be considered if clayey or silty soils are used as backfill. Adfreezing occurs when backfill adheres to rough surfaced foundation walls and lifts the wall as it freezes and heaves. This occurrence is most common with masonry block walls, unheated or poorly heated building situations and clay backfill. The potential is also increased where backfill soils are poorly compacted and become saturated. The risk of adfreezing can be decreased by placing a low friction separating layer between the wall and backfill.

Adfreezing can occur on exterior piers (such as deck, fence, or other similar pier footings), even if a smooth surface is provided. This is more likely in poor drainage situations where soils become saturated. Additional footing embedment and/or widened footings below the frost zones (which include tensile reinforcement) can be used to resist uplift forces. Specific designs would require individual analysis.

CONSTRUCTION CONSIDERATIONS

Foundations, slabs and other improvements which may be affected by frost movements should be insulated from frost penetration during freezing weather. If filling takes place during freezing weather, all frozen soils, snow and ice should be stripped from areas to be filled prior to new fill placement. The new fill should not be allowed to freeze during transit, placement or compaction. This should be considered in the project scheduling, budgeting and quantity estimating. It is usually beneficial to perform cold weather earthwork operations in small areas where grade can be attained quickly rather than working larger areas where a greater amount of frost stripping may be needed. If slab subgrade areas freeze, we recommend the subgrade be thawed prior to floor slab placement. The frost action may also require reworking and recompaction of the thawed subgrade.

Appendix A

Geotechnical Field Exploration and Testing
Boring Log Notes
Unified Soil Classification System
Figure 1 – Approximate Boring Locations Diagram
Subsurface Boring Logs
Gradation Curves

Appendix A
Geotechnical Field Exploration and Testing
Report No. P-0013939

A.1 FIELD EXPLORATION

The subsurface conditions at the site were explored by drilling and sampling 10 standard penetration test (SPT) borings throughout the site. The approximate locations of the borings and soundings appear on appended Figure 1.

A.2 SAMPLING METHODS

A.2.1 Split-Spoon Samples (SS) - Calibrated to N_{60} Values

Standard penetration (split-spoon) samples were collected in general accordance with ASTM: D1586 with one primary modification. The ASTM test method consists of driving a 2-inch O.D. split-barrel sampler into the in-situ soil with a 140-pound hammer dropped from a height of 30 inches. The sampler is driven a total of 18 inches into the soil. After an initial set of 6 inches, the number of hammer blows to drive the sampler the final 12 inches is known as the standard penetration resistance or N-value. Our method uses a modified hammer weight, which is determined by measuring the system energy using a Pile Driving Analyzer (PDA) and an instrumented rod.

In the past, standard penetration N-value tests were performed using a rope and cathead for the lift and drop system. The energy transferred to the split-spoon sampler was typically limited to about 60% of its potential energy due to the friction inherent in this system. This converted energy then provides what is known as an N_{60} blow count.

The most recent drill rigs incorporate an automatic hammer lift and drop system, which has higher energy efficiency and subsequently results in lower N-values than the traditional N_{60} values. By using the PDA energy measurement equipment, we are able to determine actual energy generated by the drop hammer. With the various hammer systems available, we have found highly variable energies ranging from 55% to over 100%. Therefore, the intent of AET's hammer calibrations is to vary the hammer weight such that hammer energies lie within about 60% to 65% of the theoretical energy of a 140-pound weight falling 30 inches. The current ASTM procedure acknowledges the wide variation in N-values, stating that N-values of 100% or more have been observed. Although we have not yet determined the statistical measurement uncertainty of our calibrated method to date, we can state that the accuracy deviation of the N-values using this method is significantly better than the standard ASTM Method.

A.2.2 Disturbed Samples (DS)/Spin-up Samples (SU)

Sample types described as "DS" or "SU" on the boring logs are disturbed samples, which are taken from the flights of the auger. Because the auger disturbs the samples, possible soil layering and contact depths should be considered approximate.

A.2.3 Sampling Limitations

Unless actually observed in a sample, contacts between soil layers are estimated based on the spacing of samples and the action of drilling tools. Cobbles, boulders, and other large objects generally cannot be recovered from test borings, and they may be present in the ground even if they are not noted on the boring logs.

Determining the thickness of "topsoil" layers is usually limited, due to variations in topsoil definition, sample recovery, and other factors. Visual-manual description often relies on color for determination, and transitioning changes can account for significant variation in thickness judgment. Accordingly, the topsoil thickness presented on the logs should not be the sole basis for calculating topsoil stripping depths and volumes. If more accurate information is needed relating to thickness and topsoil quality definition, alternate methods of sample retrieval and testing should be employed.

A.3 CLASSIFICATION METHODS

Soil descriptions shown on the boring logs are based on the Unified Soil Classification (USC) system. The USC system is described in ASTM: D2487 and D2488. Where laboratory classification tests (sieve analysis or Atterberg Limits) have been performed, accurate classifications per ASTM: D2487 are possible. Otherwise, soil descriptions shown on the boring logs are visual-manual judgments. Charts are attached which provide information on the USC system, the descriptive terminology, and the symbols used on the boring logs.

The boring logs include descriptions of apparent geology. The geologic depositional origin of each soil layer is interpreted primarily by observation of the soil samples, which can be limited. Observations of the surrounding topography, vegetation, and development can sometimes aid this judgment.

A.4 WATER LEVEL MEASUREMENTS

The ground water level measurements are shown at the bottom of the boring logs. The following information appears under "Water Level Measurements" on the logs:

- Date and Time of measurement
- Sampled Depth: lowest depth of soil sampling at the time of measurement
- Casing Depth: depth to bottom of casing or hollow-stem auger at time of measurement
- Cave-in Depth: depth at which measuring tape stops in the borehole
- Water Level: depth in the borehole where free water is encountered
- Drilling Fluid Level: same as Water Level, except that the liquid in the borehole is drilling fluid

The true location of the water table at the boring locations may be different than the water levels measured in the boreholes. This is possible because there are several factors that can affect the water level measurements in the borehole. Some of these factors include: permeability of each soil layer in profile, presence of perched water, amount of time between water level readings, presence of drilling fluid, weather conditions, and use of borehole casing.

A.5 LABORATORY TEST METHODS

A.5.1 Water Content Tests

Conducted per AET Procedure 01-LAB-010, which is performed in general accordance with ASTM: D2216 and AASHTO: T265.

A.5.2 Sieve Analysis of Soils (thru #200 Sieve)

Conducted per AET Procedure 01-LAB-040, which is performed in general conformance with ASTM: D6913, Method A.

A.5.3 Particle Size Analysis of Soils (with hydrometer)

Conducted per AET Procedure 01-LAB-050, which is performed in general accordance with ASTM: D422 and AASHTO: T88.

A.6 TEST STANDARD LIMITATIONS

Field and laboratory testing is done in general conformance with the described procedures. Compliance with any other standards referenced within the specified standard is neither inferred nor implied.

A.7 SAMPLE STORAGE

Unless notified to do otherwise, we routinely retain representative samples of the soils recovered from the borings for a period of 30 days.

BORING LOG NOTES

DRILLING AND SAMPLING SYMBOLS

Symbol	Definition
B,H,N:	Size of flush-joint casing
CA:	Crew Assistant (initials)
CAS:	Pipe casing, number indicates nominal diameter in inches
CC:	Crew Chief (initials)
COT:	Clean-out tube
DC:	Drive casing; number indicates diameter in inches
DM:	Drilling mud or bentonite slurry
DR:	Driller (initials)
DS:	Disturbed sample from auger flights
FA:	Flight auger; number indicates outside diameter in inches
HA:	Hand auger; number indicates outside diameter
HSA:	Hollow stem auger; number indicates inside diameter in inches
LG:	Field logger (initials)
MC:	Column used to describe moisture condition of samples and for the ground water level symbols
N (BPF):	Standard penetration resistance (N-value) in foot (see notes)
NQ:	NQ wireline core barrel
PQ:	PQ wireline core barrel
RD:	Rotary drilling with fluid and roller or drag bit
REC:	In split-spoon (see notes) and thin-walled tube sampling, the recovered length (in inches) of sample. In rock coring, the length of core recovered (expressed as percent of the total core run). Zero indicates no sample recovered.
REV:	Revert drilling fluid
SS:	Standard split-spoon sampler (steel; 1-3/8" is inside diameter; 2" outside diameter); unless indicated otherwise
SU	Spin-up sample from hollow stem auger
TW:	Thin-walled tube; number indicates inside diameter in inches
WASH:	Sample of material obtained by screening returning rotary drilling fluid or by which has collected inside the borehole after "falling" through drilling fluid
WH:	Sampler advanced by static weight of drill rod and 140-pound hammer
WR:	Sampler advanced by static weight of drill rod
94mm:	94 millimeter wireline core barrel
▼:	Water level directly measured in boring
∇:	Estimated water level based solely on sample appearance

TEST SYMBOLS

Symbol	Definition
CONS:	One-dimensional consolidation test
DEN:	Dry density, pcf
DST:	Direct shear test
E:	Pressuremeter Modulus, tsf
HYD:	Hydrometer analysis
LL:	Liquid Limit, %
LP:	Pressuremeter Limit Pressure, tsf
OC:	Organic Content, %
PERM:	Coefficient of permeability (K) test; F - Field; L - Laboratory
PL:	Plastic Limit, %
q_p:	Pocket Penetrometer strength, tsf (approximate)
q_c:	Static cone bearing pressure, tsf
q_u:	Unconfined compressive strength, psf
R:	Electrical Resistivity, ohm-cms
RQD:	Rock Quality Designation of Rock Core, in percent (aggregate length of core pieces 4" or more in length as a percent of total core run)
SA	Sieve analysis
TRX:	Triaxial compression test
VSR:	Vane shear strength, remoulded (field), psf
VSU:	Vane shear strength, undisturbed (field), psf
WC:	Water content, as percent of dry weight
%-200:	Percent of material finer than #200 sieve

STANDARD PENETRATION TEST NOTES

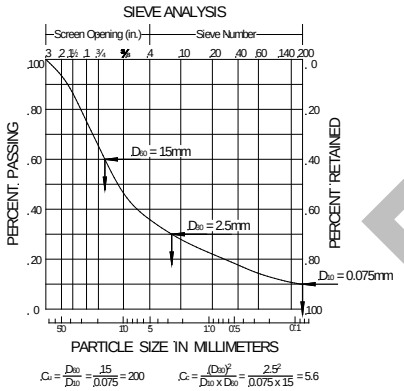
The standard penetration test consists of driving the sampler with a 140 pound hammer and counting the number of blows applied in each of three 6" increments of penetration. If the sampler is driven less than 18" (usually in highly resistant material), permitted in ASTM:D1586, the blows for each complete 6" increment and for each partial increment is on the boring log. For partial increments, the number of blows is shown to the nearest 0.1' below the slash.

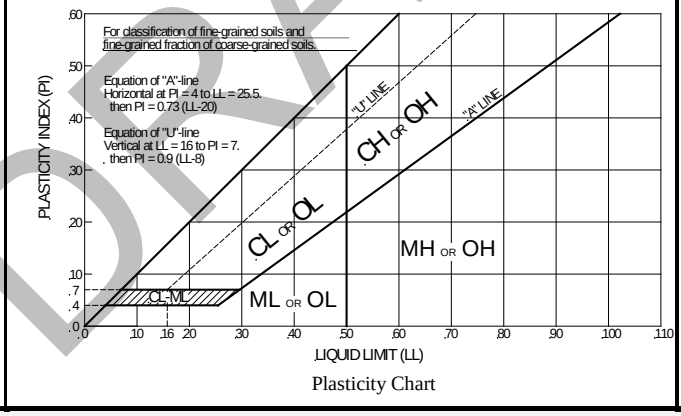
The length of sample recovered, as shown on the "REC" column, may be greater than the distance indicated in the N column. The disparity is because the N-value is recorded below the initial 6" set (unless partial penetration defined in ASTM:D1586 is encountered) whereas the length of sample recovered is for the entire sampler drive (which may even extend more than 18").

UNIFIED SOIL CLASSIFICATION SYSTEM
ASTM Designations: D 2487, D2488

AMERICAN ENGINEERING TESTING, INC.

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Soil Classification: Group Symbol	Soil Classification: Group Name[B]
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	Cu≥4 and 1≤Cc≤3[E]	GW	Well graded gravel[F]
			Cu<4 and/or 1>Cc>3[E]	GP	Poorly graded gravel[F]
		Gravels with Fines more than 12% fines[C]	Fines classify as ML or MH	GM	Silty gravel[F,G,H]
			Fines classify as CL or CH	GC	Clayey gravel[F,G,H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[D]	Cu≥6 and 1≤Cc≤3[E]	SW	Well-graded sand[I]
			Cu<6 and/or 1>Cc>3[E]	SP	Poorly-graded sand[I]
		Sands with Fines more than 12% fines[D]	Fines classify as ML or MH	SM	Silty sand[G,H,I]
			Fines classify as CL or CH	SC	Clayey sand[G,H,I]
Fine-Grained Soils 50% or more passes the No. 200 sieve (see Plasticity Chart below)	Silts and Clays Liquid limit less than 50	inorganic	PI>7 and plots on or above "A" line[J]	CL	Lean clay[K,L,M]
			PI<4 or plots below "A" line[J]	ML	Silt[K,L,M]
		organic	Liquid limit–oven dried / Liquid limit – not dried <0.75	OL	Organic clay[K,L,M,N] / Organic silt[K,L,M,O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay[K,L,M]
			PI plots below "A" line	MH	Elastic silt[K,L,M]
		organic	Liquid limit–oven dried / Liquid limit – not dried <0.75	OH	Organic clay[K,L,M,P] / Organic silt[K,L,M,Q]
Highly organic soil			Primarily organic matter, dark in color, and organic in odor	PT	Peat[R]





Plasticity Chart

Notes

[A]Based on the material passing the 3-in (75-mm) sieve.
[B]If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C]Gravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay
[D]Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay

[E]$Cu = D_{60} / D_{10}$, $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F]If soil contains ≥15% sand, add "with sand" to group name.
[G]If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[H]If fines are organic, add "with organic fines" to group name.
[I]If soil contains ≥15% gravel, add "with gravel" to group name.
[J]If Atterberg limits plot is hatched area, soil is a CL-ML silty clay.
[K]If soil contains 15 to 29% plus No. 200 add "with sand" or "with gravel", whichever is predominant.
[L]If soil contains ≥30% plus No. 200, predominantly sand, add "sandy" to group name.
[M]If soil contains ≥30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N]PI≥4 and plots on or above "A" line.
[O]PI<4 or plots below "A" line.
[P]PI plots on or above "A" line.
[Q]PI plots below "A" line.
[R]Fiber Content description shown below.

ADDITIONAL TERMINOLOGY NOTES USED BY AET FOR SOIL IDENTIFICATION AND DESCRIPTION

Grain Size

Term	Particle Size
Boulders	Over 12"
Cobbles	3" to 12"
Gravel	#4 sieve to 3"
Sand	#200 to #4 sieve
Fines (silt & clay)	Pass #200 sieve

Gravel Percentages

Term	Percent
A Little Gravel	3% - 14%
With Gravel	15% - 29%
Gravelly	30% - 50%

Consistency of Plastic Soils

Term	N-Value, BPF
Very Soft	less than 2
Soft	2 - 4
Firm	5 - 8
Stiff	9 - 15
Very Stiff	16 - 30
Hard	Greater than 30

Relative Density of Non-Plastic Soils

Term	N-Value, BPF
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	Greater than 50

Moisture/Frost Condition

(MC Column)

D (Dry): Absence of moisture, dusty, dry to touch.
M (Moist): Damp, although free water not visible. Soil may still have a high water content (over "optimum").
W (Wet/ Waterbearing): Free water visible, intended to describe non-plastic soils. Waterbearing usually relates to sands and sand with silt.
F (Frozen): Soil frozen

Layering Notes

Laminations: Layers less than ½" thick of differing material or color.
Lenses: Pockets or layers greater than ½" thick of differing material or color.

Peat Description

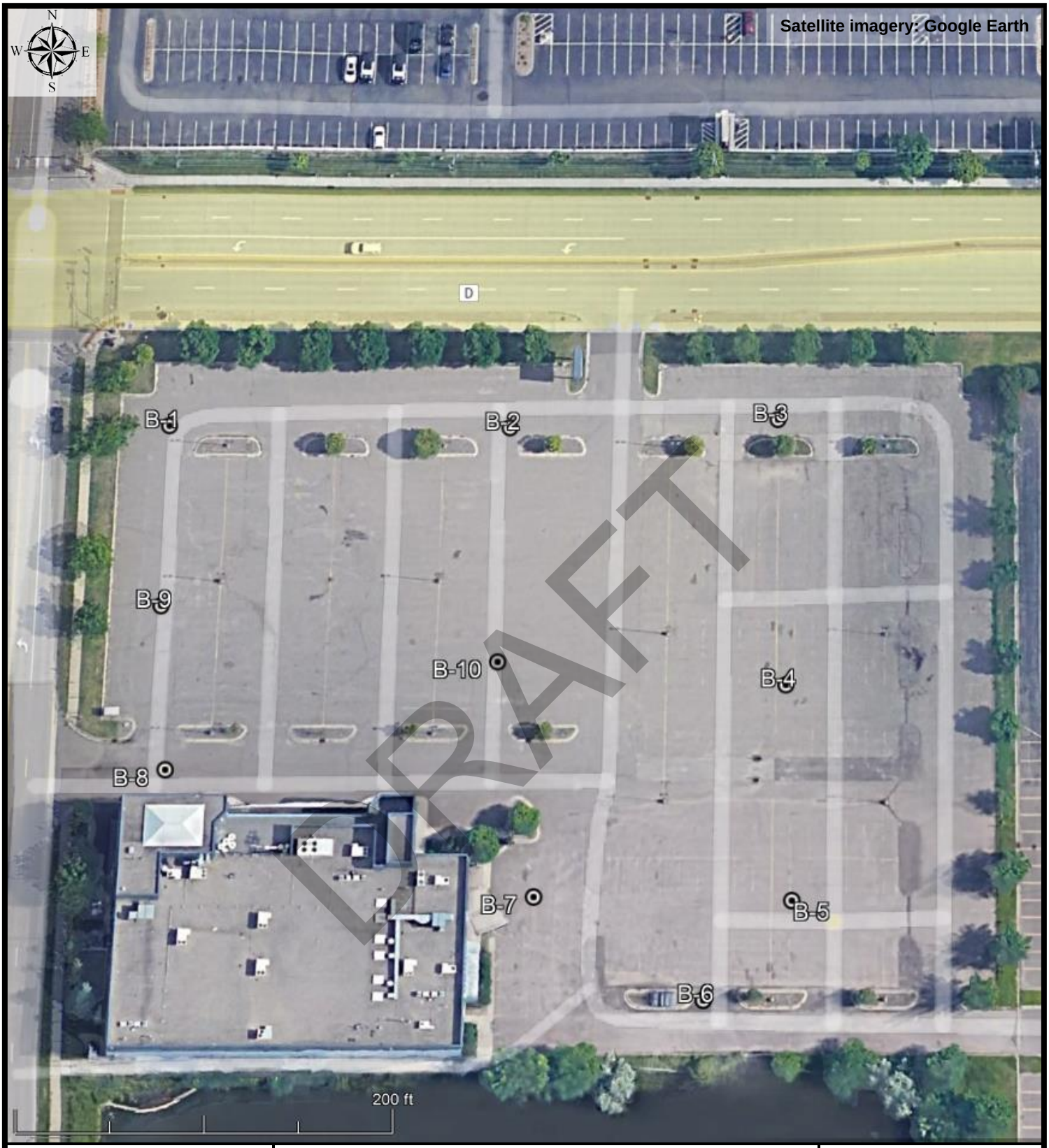
Term	Fiber Content (Visual Estimate)
Fibric Peat:	Greater than 67%
Hemic Peat:	33 – 67%
Sapric Peat:	Less than 33%

Organic Description (if no lab tests)

Soils are described as *organic*, if soil is not peat and is judged to have sufficient organic fines content to influence the Liquid Limit properties. *Slightly organic* used for borderline cases.

Root Inclusions

With roots: Judged to have sufficient quantity of roots to influence the soil properties.
Trace roots: Small roots present, but not judged to be in sufficient quantity to significantly affect soil properties.



AMERICAN ENGINEERING TESTING	**PROJECT:** Proposed Apartment Building 3090 Southlawn Drive; Maplewood, Minnesota	**AET NO.:** P-0013939
	SUBJECT: Final SPT Soil Boring Locations	**DATE:** July 18, 2022
	SCALE: As Shown **PREPARED BY** MN	**FIGURE 1**

SUBSURFACE BORING LOG

AET No: **P-0013939** Log of Boring No. **B-1 (p. 1 of 1)**

Project: **Proposed Maplewood Apartment Building; 3090 Southlawn Drive; Maplewood, MN**

Surface Elevation **927.5**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
	4.5" Bituminous pavement	FILL			SU						
1	FILL, mostly clayey sand and silty sand, some gravel, trace roots, dark brown		22	M	SS	17	10				
2											
3			13	M	SS	10	10				
4											
5	FILL, mixture of silty sand and clayey sand with organic fines, a little gravel, trace wood, dark brown to black										
6			5	M	SS	7	17				
7											
8	SAND, a little gravel, fine grained, brown, moist, medium dense (SP)	COARSE ALLUVIUM	16	M	SS	8					6
9											
10											
11			16	M	SS	11					
12											
13	SILTY SAND, a little gravel, fine to medium grained, wet, medium dense (SM)		20	W	SS	3					
14											
15	SAND, a little gravel, fine to medium grained, brown, waterbearing, medium dense (SP)		15	W/M	SS	16	14				
16	CLAYEY SAND, a little gravel, brown, stiff to very stiff (SC)	TILL									
17											
18											
19											
20			18	M	SS	18	13				
21											
22											
23											
24											
25			28	M	SS	4	13				
26	**END OF BORING**										

DEPTH:	DRILLING METHOD
0-24½'	**3.25" HSA**

BORING COMPLETED: **7/8/22**

DR: **DS** LG: **SB** Rig: **1C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/8/22	**12:30**	**16.5**	**14.5**	**15.3**		**14.0**
7/8/22	**12:50**	**16.5**	**14.5**	**14.0**		**12.8**
7/8/22	**1:15**	**26.5**	**24.5**	**25.1**		**24.0**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP P-0013939.GPJ AET+CPT+WELL.GDT 7/26/22

SUBSURFACE BORING LOG

AET No: **P-0013939** Log of Boring No. **B-2 (p. 1 of 2)**

Project: **Proposed Maplewood Apartment Building; 3090 Southlawn Drive; Maplewood, MN**

Surface Elevation **926.3**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
	3.5" Bituminous pavement	FILL			SU						
1	FILL, mostly silty sand with gravel, and crushed limestone, dark brown		24	M	SS	15	11				
2	FILL, mixture of silty sand and clayey sand with organic fines with gravel, a little concrete and brick, trace cinders, dark brown to black										
3			16	M	SS	19	13				
4	FILL, mostly clayey sand, a little gravel, dark brown to reddish brown, concrete at 2' to 4'										
5											
6			17	M	SS	22	15				
7	SILTY SAND, a little gravel, fine grained, gray, moist, medium dense, lamination of clayey sand with organic fines (SM) (possible fill)	COARSE ALLUVIUM OR FILL									
8			18	M	SS	19					
9											
10	SAPRIC PEAT WITH SAND, black (PT)	SWAMP DEPOSIT									
11			3	M	SS	17	32				
12											
13	SAND WITH SILT, a little gravel, fine grained, gray, wet, loose (SP-SM)	COARSE ALLUVIUM	8	W/M	SS	18	15				
14	CLAYEY SAND, a little gravel, gray to reddish brown, firm to stiff (SC)	TILL									
15											
16			10	W/M	SS	22	13				
17											
18											
19											
20	CLAYEY SAND, a little gravel, brown, hard (SC/SM) (A-2-6)										
21			50	W/M	SS	17	10				
22											
23											
24	SAND, a little gravel, medium to fine grained, brown, waterbearing, medium dense (SP) (A-1-b)	COARSE ALLUVIUM									
25											
26			16	W	SS	23					
27											

DEPTH: DRILLING METHOD

0-34½' 3.25" HSA

BORING COMPLETED: **7/8/22**

DR: **DS** LG: **SB** Rig: **1C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/8/22	**2:30**	**16.5**	**14.5**	**16.0**		**15.9**
7/11/22	**7:59**	**16.5**	**14.5**	**14.3**		**11.3**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

SUBSURFACE BORING LOG

AET No: **P-0013939** Log of Boring No. **B-2 (p. 2 of 2)**

Project: **Proposed Maplewood Apartment Building; 3090 Southlawn Drive; Maplewood, MN**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
29	SAND, a little gravel, medium to fine grained, brown, waterbearing, medium dense (SP) (A-1-b) *(continued)*	COARSE ALLUVIUM *(continued)*									
30											
31			16	W/M	SS	17					
32											
33											
34	SILTY SAND, a little gravel, brownish gray, medium dense (SM) (A-2-4)	TILL									
35											
36			17	M/W	SS	22					
	END OF BORING										

SUBSURFACE BORING LOG

AET No: **P-0013939** Log of Boring No. **B-3 (p. 1 of 1)**

Project: **Proposed Maplewood Apartment Building; 3090 Southlawn Drive; Maplewood, MN**

Surface Elevation **924.7**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
0	4" Bituminous pavement	FILL			SU						
1	FILL, mostly silty sand with crushed limestone, light to dark brown		9	M	SS	4					
2					SU		17				
3	FILL, mostly clayey sand with organic fines, a little gravel, black to dark brown, cinders at 2' to 4'		10	M	SS	14	10				
4											
5											
6			8	M	SS	15	14				
7											
8	FILL, mostly silty sand, a little gravel, trace roots, dark brown		57	M	SS	4					
9											
10	SILTY SAND, a little gravel, fine grained, gray, wet, medium dense (SM)	COARSE ALLUVIUM	29	M	SS	20					
11											
12	SAPRIC PEAT, black (PT)	SWAMP DEPOSIT									
13			4	M	SS	20	218				
14	ORGANIC SANDY LEAN CLAY, black, soft, laminations of sand (OL)						18				
15	CLAYEY SAND WITH ORGANIC FINES, a little gravel, black, very soft (SC)		2	W/M	SS	24	16				
16	SILTY CLAY, trace roots, gray, soft, laminations of silt (CLM)	FINE ALLUVIUM					29				
17	SAND, a little gravel, fine to medium grained, gray, waterbearing, loose, laminations of silty sand (SP)	COARSE ALLUVIUM	11	W	SS	17					
18											
19											
20			9	W	SS	6					
21											
22											
23											
24											
25	SAND, fine to medium grained, gray, waterbearing, medium dense, laminations of silt (SP)		23	W	SS	19					
26	**END OF BORING**										

DRILLING METHOD: **0-24½' 3.25" HSA**

BORING COMPLETED: **7/8/22**

DR: **DS** LG: **SB** Rig: **1C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/8/22	**10:00**	**16.5**	**14.5**	**16.0**		**12.5**
7/8/22	**10:30**	**16.5**	**14.5**	**14.4**		**10.1**
7/8/22	**11:00**	**26.0**	**24.5**	**20.5**		**7.6**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

SUBSURFACE BORING LOG

AET No: **P-0013939** Log of Boring No. **B-4 (p. 1 of 1)**

Project: **Proposed Maplewood Apartment Building; 3090 Southlawn Drive; Maplewood, MN**

DEPTH IN FEET	MATERIAL DESCRIPTION (Surface Elevation 925.4)	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
	4" Bituminous pavement	FILL			SU						
1	FILL, mostly sand with gravel, and crushed limestone, light brown		35	M	SS	9					
2	FILL, mostly clayey sand with organic fines, a little gravel, dark brown to black										
3			19	M	SS	20	12				
4											
5											
6			11	M	SS	10	11				
7											
8			16	M	SS	6	10				
9											
10	SILTY SAND, a little gravel, trace roots, fine grained, gray, moist, dense (SM)	COARSE ALLUVIUM	35	M	SS	15					15
11				▼							
12	SAPRIC PEAT, black (PT)	SWAMP DEPOSIT									
13			9	M	SS	16	49				
14	SILTY SAND WITH ORGANIC FINES, a little gravel, fine grained, dark brown, wet, loose, lamination of lean clay (SM)										
15	SILT, a little gravel, gray, very loose, lamination of lean clay (ML)	FINE ALLUVIUM	54	W/M	SS	14	31				
16	SILTY SAND, a little gravel, fine grained, wet, very loose (SM)	COARSE ALLUVIUM									
17											
18											
19											
20	CLAYEY SAND, a little gravel, dark brown, very stiff (SC)		19	M	SS	18					
21											
22											
23											
24											
25	SAND WITH SILT, a little gravel, coarse to medium grained, wet, loose, lamination of clayey sand (SP-SM)		7	W	SS	20					
26	**END OF BORING**										

DEPTH: DRILLING METHOD

0-24½' 3.25" HSA

BORING COMPLETED: **7/8/22**

DR: **DS** LG: **SB** Rig: **1C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/7/22	**1:40**	**16.5**	**14.5**	**14.3**		**13.3**
7/7/22	**2:15**	**26.5**	**24.5**	**20.5**		**14.4**
7/8/22	**8:00**	**26.5**	**24.5**	**19.4**		**11.6**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP P-0013939.GPJ AET+CPT+WELL.GDT 7/26/22

SUBSURFACE BORING LOG

AET No: **P-0013939** Log of Boring No. **B-5 (p. 1 of 2)**

Project: **Proposed Maplewood Apartment Building; 3090 Southlawn Drive; Maplewood, MN**

Surface Elevation **925.9**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
0	3" Bituminous pavement	FILL									
1	FILL, mostly silty sand with crushed limestone, dark to light brown, a little brick		30	M	SS	15					
2											
3	FILL, mostly clayey sand, a little gravel, dark brown, 8.5' bituminous		18	M	SS	19	12				
4											
5											
6			19	M	SS	24	9				
7											
8			22	M	SS	17	11				
9											
10	FILL, mostly sandy lean clay, a little organic lean clay, a little concrete and cinders, dark brown to black										
11			39	M	SS	12	16				
12											
13	CLAYEY SAND, a little gravel, trace roots, brown, soft to firm, lamination of silty sand from 14.5' to 15' (SC)	TILL	3	M	SS	24	17				
14											
15							11				
16			6	M/W	SS	22	20				
17											
18	CLAYEY SAND, a little gravel, brown, stiff, lens of silt, lamination of lean clay (SC)		13	M/W	SS	23	12				
19	SILTY SAND, a little gravel, fine to medium grained, brown, wet, medium dense, lens of clayey sand (SM)	COARSE ALLUVIUM									
20		TILL									
21	CLAYEY SAND, a little gravel, brown, stiff, lamination of sand (SC)		14	M/W	SS	20	11				
22											
23											
24	SAND, a little gravel, medium to fine grained, brown, wet, medium dense, lenses of clayey sand (SP)	COARSE ALLUVIUM									
25											
26			18	W	SS	24					
27											

DEPTH: DRILLING METHOD

0-24½'	**3.25" HSA**
24½'-34½'	**RD w/DM**

BORING COMPLETED: **7/12/22**

DR: **SD** LG: **AG** Rig: **91C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/12/22	**9:14**	**14.0**	**12.0**	**13.7**		**None**
7/12/22	**9:23**	**14.0**	**12.0**	**13.3**		**13.0**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

SUBSURFACE BORING LOG

AET No: **P-0013939** Log of Boring No. **B-5 (p. 2 of 2)**

Project: **Proposed Maplewood Apartment Building; 3090 Southlawn Drive; Maplewood, MN**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
29	SANDY LEAN CLAY, a little gravel, brown, hard (CL)	TILL									
30											
31			42	M/W	SS	24	13				
32											
33											
34	CLAYEY SAND, a little gravel, brown, hard (SC)										
35											
36			32	M/W	SS	24	14				
	END OF BORING										

SUBSURFACE BORING LOG

AET No: **P-0013939** Log of Boring No. **B-6 (p. 1 of 1)**

Project: **Proposed Maplewood Apartment Building; 3090 Southlawn Drive; Maplewood, MN**

Surface Elevation **925.4**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
	3.5" Bituminous pavement	FILL									
1	FILL, mixture of clayey sand with organic fines and silty sand with crushed limestone, dark brown to light brown		16	M	SS	9	11				
2											
3	FILL, mostly clayey sand, a little gravel, dark brown		19	M	SS	19	10				
4											
5											
6			15	M	SS	17	17				
7											
8	FILL, mostly clayey sand with organic fines and gravel, dark brown to black, 9.5' to 11.5' trace wood and cinders		24	M	SS	11	13				
9											
10											
11			4	▼	SS	10	15				
12											
13	CLAYEY SAND, some gravel, dark brown to brown (SC) (possible fill)	TILL OR FILL	6	W/M	SS	13	22				
14											
15	CLAYEY SAND, a little gravel, brown, firm, lenses of silt (SC)	TILL	8	M	SS	19	15				
16											
	END OF BORING										

DEPTH:	DRILLING METHOD
0-14½'	**3.25" HSA**
BORING COMPLETED:	**7/12/22**
DR: **DS**	LG: **SG** Rig: **1C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/12/22	**2:14**	**14.0**	**12.0**	**14.0**		**12.5**
7/12/22	**2:27**	**14.0**	**12.0**	**13.6**		**10.8**
7/12/22	**2:45**	**16.5**	**14.5**	**16.0**		**13.0**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP P-0013939.GPJ AET+CPT+WELL.GDT 7/26/22

SUBSURFACE BORING LOG

AET No: **P-0013939** Log of Boring No. **B-7 (p. 1 of 1)**

Project: **Proposed Maplewood Apartment Building; 3090 Southlawn Drive; Maplewood, MN**

Surface Elevation **926.4**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
1	4" Bituminous pavement	FILL									
2	FILL, mostly silty sand with crushed limestone, light brown										
3	FILL, mixture of clayey sand and silty sand, a little gravel, dark brown		32	M	SS	20	12				
4											
5	FILL, mostly clayey sand, a little gravel, brown, organics at 5' - 6'		13	M	SS	24	12				
6											
7											
8			25	M	SS	24	11				
9											
10	FILL, mostly clayey sand, a little gravel, trace cinders and roots, grayish brown		14	M	SS	24	14				
11				▼							
12											
13	SANDY LEAN CLAY, a little gravel, some organics, grayish brown, soft (CL) (possible fill)	FINE ALLUVIUM OR FILL	4	M/W	SS	20	3				
14											
15	SAPRIC PEAT, black, laminations of silty sand with organic fines (PT)	SWAMP DEPOSIT	5	M/W	SS	24	26				
16											
17											
18	FAT CLAY, gray, very soft, laminations of silt (CH)	FINE ALLUVIUM	WH	M/W	SS	19	49				
19											
20	SAND, a little gravel, fine to medium grained, dark gray,waterbearing, loose (SP)	COARSE ALLUVIUM	8	W	SS	7					
21											
22											
23											
24	SAND WITH SILT, fine to medium grained, dark gray, waterbearing, dense, lenses of clayey sand (SP-SM)										
25			38	M/W	SS	17					
26											
	SAND, a little gravel, fine to medium grained, dark gray, waterbearing, dense (SP)										
	END OF BORING										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS						
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-24½' 3.25" HSA	**7/12/22**	**12:56**	**14.0**	**12.0**	**12.0**		**11.8**
	7/12/22	**1:09**	**14.0**	**12.0**	**12.0**		**11.7**
BORING COMPLETED: **7/12/22**							
DR: **SD** LG: **AG** Rig: **91C**							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP P-0013939.GPJ AET+CPT+WELL.GDT 7/26/22

SUBSURFACE BORING LOG

AET No: **P-0013939** Log of Boring No. **B-8 (p. 1 of 2)**

Project: **Proposed Maplewood Apartment Building; 3090 Southlawn Drive; Maplewood, MN**

Surface Elevation **926.4**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
0	4" Bituminous pavement	FILL									
1	FILL, mostly silty sand, a little gravel, brown (possible void from 6" to 8")		24	M	SS	10	8				
2	FILL, a mixture of clayey sand and silty sand with gravel, brown										
3			16	M	SS	17	11				
4	FILL, mostly sand, a little gravel, pieces of bituminous, brown and gray										
5											
6			17	M	SS	19	9				
7	SILTY SAND, a little gravel, fine to medium grained, brown to gray, moist to wet, loose to dense (SM)										
8			8	M	SS	15					13
9											
10											
11			11	▼	SS	15					
12											
13			25	W	SS	9					
14											
15											
16			13	W	SS	1					
17	CLAYEY SAND, a little gravel, brown, stiff to very stiff, 24.5' to 26.5' lamination of silty sand (SC)	TILL									
18											
19											
20											
21			13	M/W	SS	24	13				
22											
23											
24											
25											
26			17	M/W	SS	24	12				
27		COARSE ALLUVIUM									

DEPTH: **0-34½'** DRILLING METHOD: **3.25" HSA**

BORING COMPLETED: **7/12/22**

DR: **DS** LG: **SG** Rig: **1C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/11/22	**1:20**	**14.0**	**12.0**	**13.4**		**11.8**
7/11/22	**1:50**	**14.0**	**12.0**	**12.3**		**11.0**
7/12/22	**7:59**	**31.5**	**34.5**	**23.0**		**12.4**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

SUBSURFACE BORING LOG

AET No: **P-0013939** Log of Boring No. **B-8 (p. 2 of 2)**

Project: **Proposed Maplewood Apartment Building; 3090 Southlawn Drive; Maplewood, MN**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
29	SAND WITH SILT, medium to fine grained, grayish brown, very loose, laminations of silt with sand (SP-SM) *(continued)*	COARSE ALLUVIUM *(continued)*									
30											
31			4	W	SS	24					
32											
33											
34	SILT WITH SAND, grayish brown, wet, medium dense (ML)	FINE ALLUVIUM									
35			18	W	SS	17	21				
36											
	END OF BORING										

SUBSURFACE BORING LOG

AET No: **P-0013939** Log of Boring No. **B-9 (p. 1 of 1)**

Project: **Proposed Maplewood Apartment Building; 3090 Southlawn Drive; Maplewood, MN**

Surface Elevation **926.8**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
0	3.5" Bituminous pavement	FILL									
1	FILL, mixture of silty sand and clayey sand with gravel, brown to dark brown		13	M	SS	15	12				
2											
3			16	M	SS	17	10				
4											
5	FILL, mixture of clayey sand and silty sand, a little gravel, dark brown		11	M	SS	16	11				
6											
7	SAND WITH SILT, a little gravel, fine to medium grained, brown, moist to waterbearing, loose to medium dense (SP-SM)	COARSE ALLUVIUM									
8			10	M	SS	11					
9											
10											
11			15	M ▼	SS	16					4
12											
13			11	W	SS	17					
14											
15	SAND, a little gravel, fine to medium grained, grayish brown, waterbearing, medium dense (SP)										
16			22	W	SS	8					
17											
18											
19	CLAYEY SAND, a little gravel, brown, hard (SC)	TILL									
20			14	M	SS	18	13				
21											
22											
23											
24											
25			34	M	SS	0					
26	**END OF BORING**										

DEPTH:	DRILLING METHOD
0-24½'	**3.25" HSA**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
7/11/22	**10:39**	**14.0**	**12.0**	**12.4**		**11.7**
7/11/22	**11:15**	**14.0**	**12.0**	**12.1**		**11.4**
7/11/22	**11:43**	**26.0**	**24.5**	**24.2**		**20.2**

BORING COMPLETED: **7/11/22**

DR: **DS** LG: **SG** Rig: **1C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP P-0013939.GPJ AET+CPT+WELL.GDT 7/26/22

SUBSURFACE BORING LOG

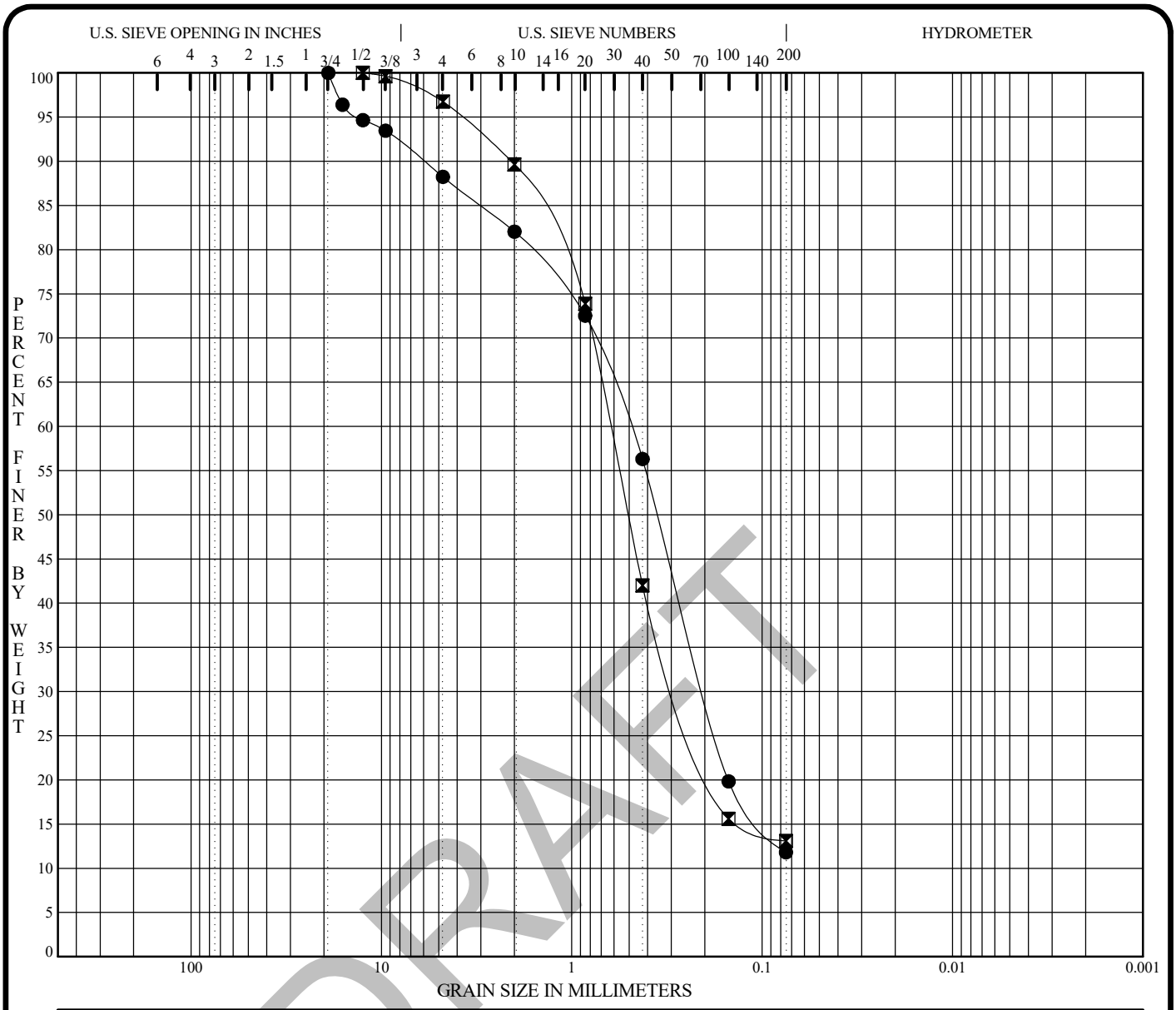
AET No: **P-0013939** Log of Boring No. **B-10 (p. 1 of 1)**

Project: **Proposed Maplewood Apartment Building; 3090 Southlawn Drive; Maplewood, MN**

DEPTH IN FEET	Surface Elevation **926.5** MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
1	3.5" Bituminous pavement	FILL									
	FILL, mostly clayey sand, a little gravel and cinders, gray to brown		15	M	SS	10	9				
2											
3			14	M	SS	21	9				
4											
5											
6	CLAYEY SAND, a little gravel, grayish brown, very stiff, lamination of silt (SC)	TILL	16	M	SS	21	11 9				
7											
8	SAND WITH SILT, fine grained, gray, moist, medium dense to dense, lamination of clayey sand (SW/SM)		49	M	SS	23					12
9											
10											
11			17	W/M	SS	19					
	END OF BORING										

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-9½' 3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
	7/12/22	**1:13**	**11.5**	**9.5**	**11.0**		**None**	
	7/12/22	**1:27**	**11.5**	**9.5**	**11.0**		**None**	
BORING COMPLETED: **7/12/22**								
DR: **DS** LG: **SG** Rig: **1C**								

AET_CORP P-0013939.GPJ AET+CPT+WELL.GDT 7/26/22



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	**B-10**	**7.0'**	**WELL-GRADED SAND with SILT (SW/SM)**					**1.26**	**7.8**
⧓	**B-8**	**7.0'**	**SILTY SAND (SM)**						

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-10**	**7.0'**	**19.00**	**0.50**	**0.201**		**11.8**	**76.4**	**11.8**	
⧓	**B-8**	**7.0'**	**12.50**	**0.63**	**0.265**		**3.3**	**83.7**	**13.1**	

PROJECT **Proposed Maplewood Apartment Building; 3090 Southlawn Drive; Maplewood, MN**

AET JOB NO. **P-0013939**

DATE **7/12/22**

AMERICAN ENGINEERING TESTING
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GRADATION CURVES

Appendix B

Geotechnical Report Limitations and Guidelines for Use

Appendix B
Geotechnical Report Limitations and Guidelines for Use
Report No. P-0013939

B.1 REFERENCE

This appendix provides information to help you manage your risks relating to subsurface problems which are caused by construction delays, cost overruns, claims, and disputes. This information was developed and provided by GBA[1], of which, we are a member firm.

B.2 RISK MANAGEMENT INFORMATION

B.2.1 Understand the Geotechnical Engineering Services Provided for this Report

Geotechnical engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical engineering services is typically a geotechnical engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

B.2.2 Geotechnical Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared solely for the client.

Likewise, geotechnical engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. If you are the least bit uncertain about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

[1] Geoprofessional Business Association, 1300 Piccard Drive, LL14, Rockville, MD 20850
Telephone: 301/565-2733; www.geoprofessional.org

B.2.3 Read the Full Report
Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. Read and refer to the report in full.

B.2.4 You Need to Inform Your Geotechnical Engineer About Change
Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, always inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

B.2.5 Most of the "Findings" Related in This Report Are Professional Opinions
Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed. The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

B.2.6 This Report's Recommendations Are Confirmation-Dependent
The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations only after observing actual subsurface conditions exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.

B.2.7 This Report Could Be Misinterpreted
Other design professionals' misinterpretation of geotechnical engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

B.2.8 Give Constructors a Complete Report and Guidance
Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical engineering report, along with any attachments or appendices, with your contract documents, but be certain to note conspicuously that you've included the material

for information purposes only. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, only from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to and be sure to allow enough time to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

B.2.9 Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. Read these provisions closely. Ask questions. Your geotechnical engineer should respond fully and frankly.

B.2.10 Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical engineering study. For that reason, a geotechnical engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Unanticipated subsurface environmental problems have led to project failures. If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

B.2.11 Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. Geotechnical engineers are not building-envelope or mold specialists.