

**SUPPLEMENTAL INFORMATION
FOR THE
TECHNICAL REPORT
501 & 600 GRIFFIN BROOK DRIVE
METHUEN, MASSACHUSETTS
MAY 20, 2022**

**SUBMITTED TO:
CITY OF METHUEN
PLANNING BOARD
CITY HALL
SEARLES BUILDING
41 PLEASANT STREET
METHUEN, MA 01844**

**APPLICANT:
GRIFFIN BROOK DRIVE OWNER LLC
55 CAMBRIDGE STREET
BURLINGTON, MA 01803**



Table of Contents

REVISED SECTIONS

FIGURES

- Fire Truck Swept Path Analysis Sketch
- Rational Method Calculation
- Lot Coverage Figure

APPENDICIES

APPENDIX C: Proposed Conditions Hydrologic Analysis

- 2-yr, 10-yr & 100-yr Summaries

- P1 Summary

- P2 Summary

APPENDIX D: Stormwater Management Calculations

- Groundwater Recharge Calculation

- Pond Storage Tables

- Pipe Sizing Calculation Spreadsheet

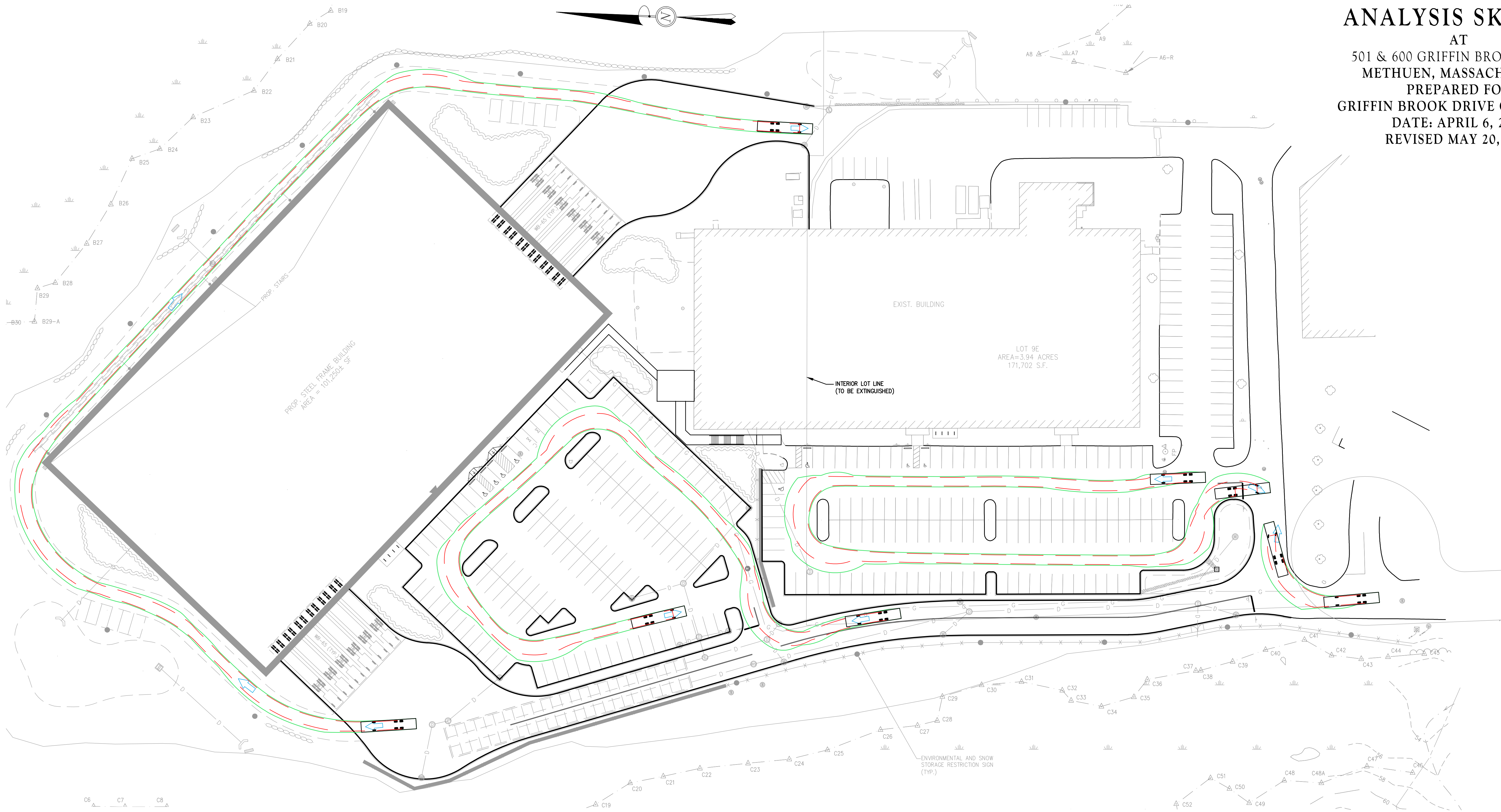
- Rip Rap Sizing Calculation Spreadsheet

APPENDIX E: Construction Phase Best Management Practices

FIGURES

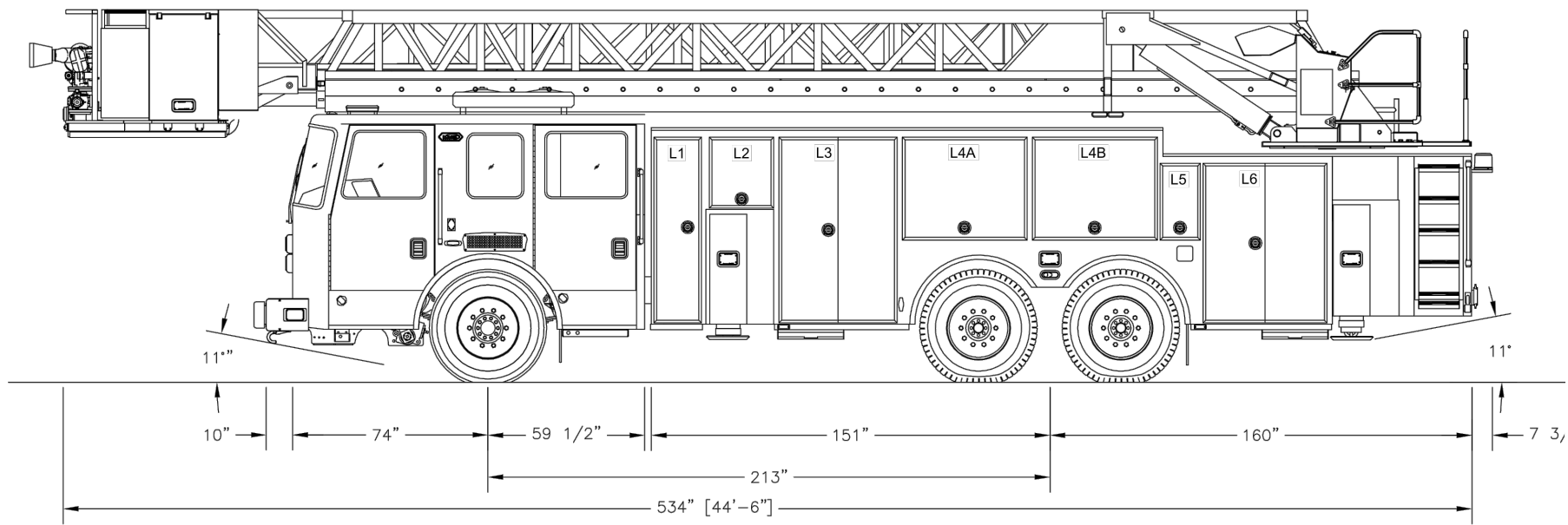
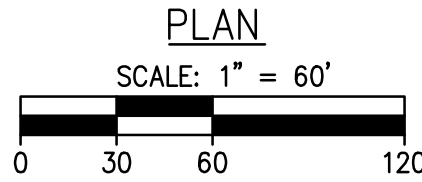
FIRE TRUCK SWEEP PATH
ANALYSIS SKETCH

AT
501 & 600 GRIFFIN BROOK DRIVE
METHUEN, MASSACHUSETTS
PREPARED FOR
GRIFFIN BROOK DRIVE OWNER LLC
DATE: APRIL 6, 2022
REVISED MAY 20, 2022



DESIGN SPEED: 5 MPH

LEGEND:
→ PATH DIRECTION
— TRUCK OVERHANG PATH
- - - TRUCK OUTSIDE WHEEL PATH



METHUEN FIRE TRUCK



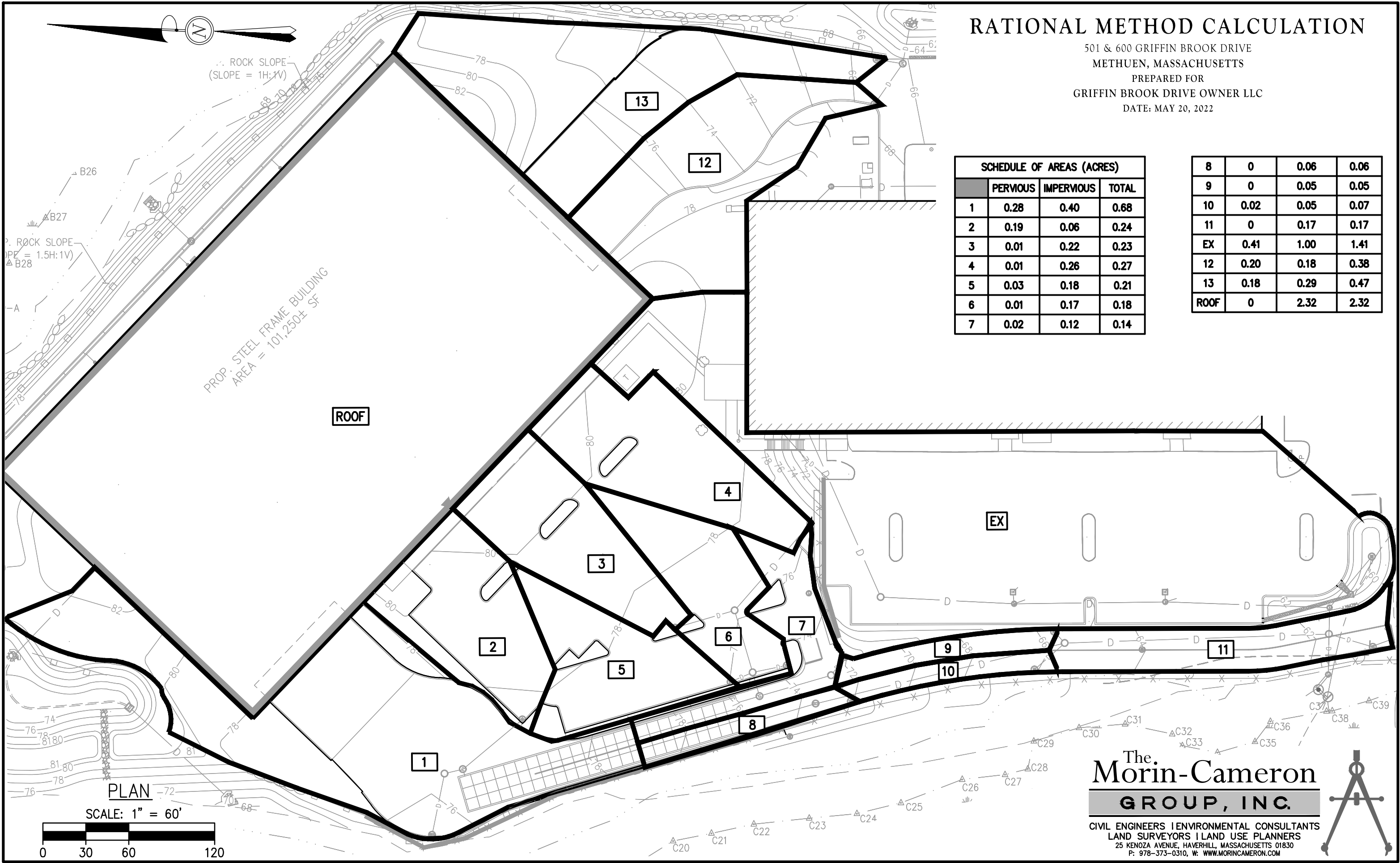
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LAND SURVEYORS | LAND USE PLANNERS
25 KENZO AVENUE, HAVERHILL, MASSACHUSETTS 01830
P: 978-373-0310, W: WWW.MORINCAMERON.COM

RATIONAL METHOD CALCULATION

501 & 600 GRIFFIN BROOK DRIVE
METHUEN, MASSACHUSETTS
PREPARED FOR
GRIFFIN BROOK DRIVE OWNER LLC
DATE: MAY 20, 2022

SCHEDULE OF AREAS (ACRES)			
	PERVIOUS	IMPERVIOUS	TOTAL
1	0.28	0.40	0.68
2	0.19	0.06	0.24
3	0.01	0.22	0.23
4	0.01	0.26	0.27
5	0.03	0.18	0.21
6	0.01	0.17	0.18
7	0.02	0.12	0.14

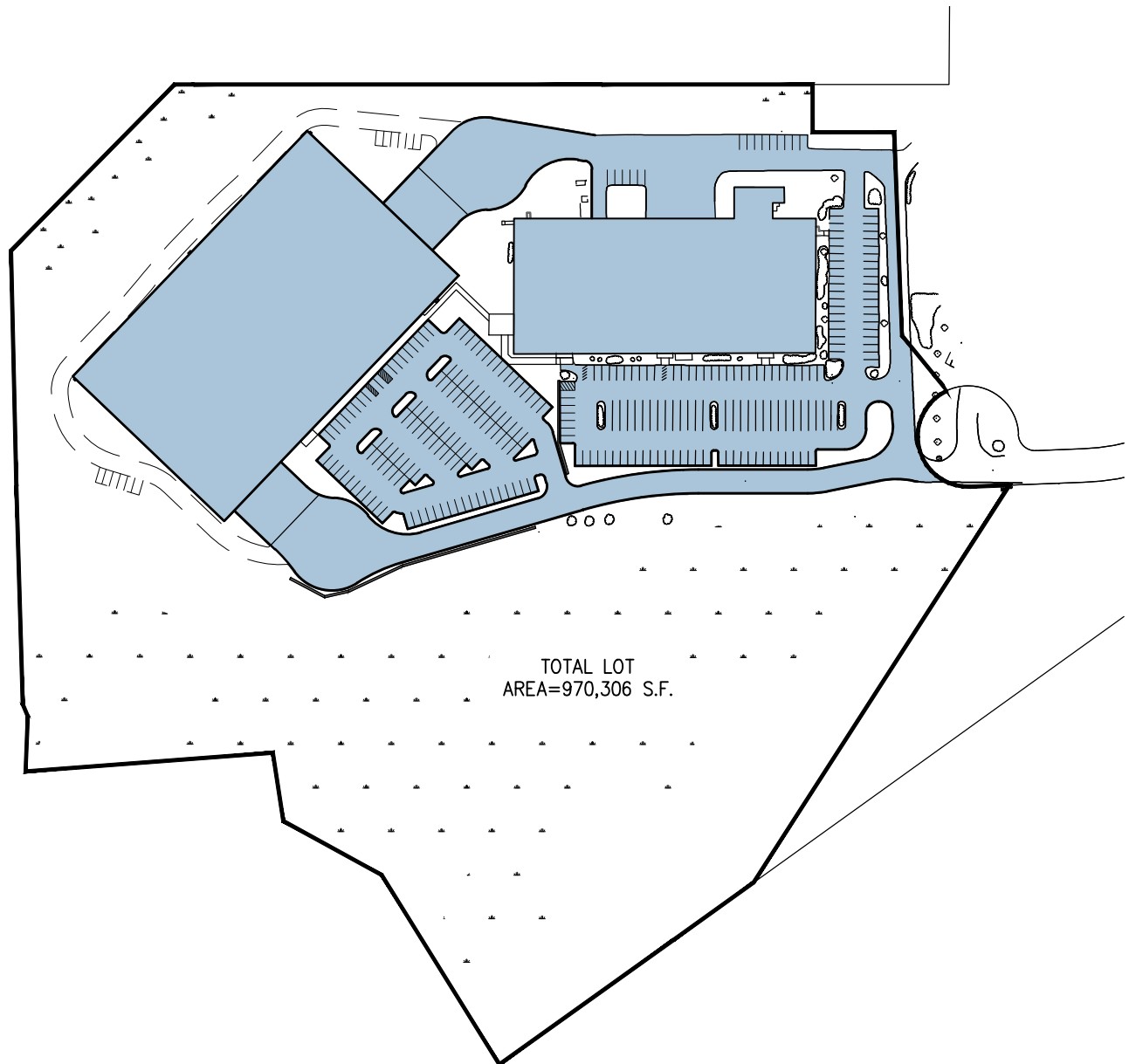
8	0	0.06	0.06
9	0	0.05	0.05
10	0.02	0.05	0.07
11	0	0.17	0.17
EX	0.41	1.00	1.41
12	0.20	0.18	0.38
13	0.18	0.29	0.47
ROOF	0	2.32	2.32



LEGEND:



LOT COVERAGE AREA = 339,600 S.F.
(INCLUDES BUILDINGS, STRUCTURES, PARKING, LOADING,
ROADWAY OR DRIVEWAY AREAS PER METHUEN ZONING ORDINANCE)



LOT COVERAGE FIGURE

AT

501 & 600 GRIFFIN BROOK DRIVE
METHUEN, MASSACHUSETTS

The
Morin-Cameron
GROUP, INC.

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DATE: MAY 20, 2022

SCALE: 1"=200'

APPENDICIES

APPENDIX C:
PROPOSED CONDITIONS
HYDROLOGIC ANALYSIS

4046 Proposed

Prepared by The Morin-Cameron Group, Inc.

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NRCC 24-hr D 2-yr Rainfall=3.12"

Printed 5/23/2022

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P5a:	Runoff Area=19,372 sf 76.35% Impervious Runoff Depth=1.69" Flow Length=280' Tc=19.8 min CN=85 Runoff=0.53 cfs 2,727 cf
Subcatchment PS1:	Runoff Area=71,570 sf 0.00% Impervious Runoff Depth=0.00" Flow Length=384' Tc=18.4 min CN=31 Runoff=0.00 cfs 0 cf
Subcatchment PS1a: Access Drive	Runoff Area=15,854 sf 0.00% Impervious Runoff Depth=0.52" Flow Length=384' Tc=18.4 min CN=64 Runoff=0.10 cfs 690 cf
Subcatchment PS2:	Runoff Area=66,442 sf 68.70% Impervious Runoff Depth=1.47" Flow Length=304' Tc=20.5 min CN=82 Runoff=1.56 cfs 8,162 cf
Subcatchment PS3: Same as ES3	Runoff Area=15,025 sf 74.58% Impervious Runoff Depth=1.54" Flow Length=262' Tc=7.5 min CN=83 Runoff=0.56 cfs 1,933 cf
Subcatchment PS4:	Runoff Area=71,594 sf 0.00% Impervious Runoff Depth=0.02" Flow Length=1,297' Tc=39.5 min CN=43 Runoff=0.00 cfs 96 cf
Subcatchment PS5:	Runoff Area=88,896 sf 75.17% Impervious Runoff Depth=1.62" Flow Length=705' Tc=15.5 min CN=84 Runoff=2.61 cfs 11,968 cf
Subcatchment PS6:	Runoff Area=13,676 sf 81.79% Impervious Runoff Depth=1.84" Flow Length=226' Tc=7.4 min CN=87 Runoff=0.61 cfs 2,102 cf
Subcatchment PS7: West Parking Lot	Runoff Area=86,432 sf 80.90% Impervious Runoff Depth=2.01" Flow Length=274' Tc=6.0 min CN=89 Runoff=4.38 cfs 14,468 cf
Subcatchment PS8: Prop. Roof	Runoff Area=112,169 sf 90.27% Impervious Runoff Depth=2.27" Flow Length=697' Slope=0.0200 '/' Tc=5.1 min CN=92 Runoff=6.49 cfs 21,262 cf
Subcatchment PS9:	Runoff Area=52,942 sf 43.21% Impervious Runoff Depth=0.65" Flow Length=304' Tc=15.1 min CN=67 Runoff=0.52 cfs 2,848 cf
Reach DP1: Wetland Northeast	Inflow=0.00 cfs 0 cf Outflow=0.00 cfs 0 cf
Reach DP2: Wetland Southeast	Inflow=1.81 cfs 10,095 cf Outflow=1.81 cfs 10,095 cf
Reach DP3: Catch Basin	Inflow=0.61 cfs 2,102 cf Outflow=0.61 cfs 2,102 cf
Reach DP4: Wetland West	Inflow=2.61 cfs 12,064 cf Outflow=2.61 cfs 12,064 cf
Reach R1: Stream Channel	Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0 cf n=0.040 L=1,058.0' S=0.0104 '/' Capacity=24.40 cfs Outflow=0.00 cfs 0 cf

4046 Proposed

NRCC 24-hr D 2-yr Rainfall=3.12"

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Printed 5/23/2022

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Reach R2: Stream ChannelAvg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0 cf
n=0.030 L=629.3' S=0.0175 '/ Outflow=0.00 cfs 0 cf**Pond P1: North West Pond**Peak Elev=77.29' Storage=11,107 cf Inflow=6.49 cfs 21,262 cf
Discarded=0.26 cfs 20,855 cf Primary=0.00 cfs 0 cf Secondary=0.00 cfs 0 cf Outflow=0.26 cfs 20,855 cf**Pond P2: East Pond**Peak Elev=58.67' Storage=816 cf Inflow=0.52 cfs 2,848 cf
Discarded=0.08 cfs 2,848 cf Primary=0.00 cfs 0 cf Secondary=0.00 cfs 0 cf Outflow=0.08 cfs 2,848 cf**Pond P3: Subsurface Chambers**Peak Elev=65.50' Storage=5,403 cf Inflow=4.38 cfs 14,468 cf
Discarded=0.31 cfs 14,468 cf Primary=0.00 cfs 0 cf Outflow=0.31 cfs 14,468 cf**Pond P4: Gravel Access French Drain**Peak Elev=72.05' Storage=27 cf Inflow=0.10 cfs 690 cf
Discarded=0.08 cfs 690 cf Primary=0.00 cfs 0 cf Outflow=0.08 cfs 690 cf**Pond P5: Retention Area**Peak Elev=61.13' Storage=1,021 cf Inflow=0.53 cfs 2,727 cf
Discarded=0.07 cfs 2,727 cf Primary=0.00 cfs 0 cf Outflow=0.07 cfs 2,727 cf**Total Runoff Area = 613,972 sf Runoff Volume = 66,256 cf Average Runoff Depth = 1.29"**
44.02% Pervious = 270,264 sf 55.98% Impervious = 343,708 sf

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NRCC 24-hr D 10-yr Rainfall=4.91"

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Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P5a:	Runoff Area=19,372 sf 76.35% Impervious Runoff Depth=3.28" Flow Length=280' Tc=19.8 min CN=85 Runoff=1.03 cfs 5,303 cf
Subcatchment PS1:	Runoff Area=71,570 sf 0.00% Impervious Runoff Depth=0.01" Flow Length=384' Tc=18.4 min CN=31 Runoff=0.00 cfs 55 cf
Subcatchment PS1a: Access Drive	Runoff Area=15,854 sf 0.00% Impervious Runoff Depth=1.52" Flow Length=384' Tc=18.4 min CN=64 Runoff=0.38 cfs 2,011 cf
Subcatchment PS2:	Runoff Area=66,442 sf 68.70% Impervious Runoff Depth=3.00" Flow Length=304' Tc=20.5 min CN=82 Runoff=3.18 cfs 16,603 cf
Subcatchment PS3: Same as ES3	Runoff Area=15,025 sf 74.58% Impervious Runoff Depth=3.09" Flow Length=262' Tc=7.5 min CN=83 Runoff=1.11 cfs 3,872 cf
Subcatchment PS4:	Runoff Area=71,594 sf 0.00% Impervious Runoff Depth=0.33" Flow Length=1,297' Tc=39.5 min CN=43 Runoff=0.08 cfs 1,962 cf
Subcatchment PS5:	Runoff Area=88,896 sf 75.17% Impervious Runoff Depth=3.19" Flow Length=705' Tc=15.5 min CN=84 Runoff=5.12 cfs 23,618 cf
Subcatchment PS6:	Runoff Area=13,676 sf 81.79% Impervious Runoff Depth=3.48" Flow Length=226' Tc=7.4 min CN=87 Runoff=1.12 cfs 3,969 cf
Subcatchment PS7: West Parking Lot	Runoff Area=86,432 sf 80.90% Impervious Runoff Depth=3.69" Flow Length=274' Tc=6.0 min CN=89 Runoff=7.79 cfs 26,548 cf
Subcatchment PS8: Prop. Roof	Runoff Area=112,169 sf 90.27% Impervious Runoff Depth=4.00" Flow Length=697' Slope=0.0200 '/' Tc=5.1 min CN=92 Runoff=11.03 cfs 37,403 cf
Subcatchment PS9:	Runoff Area=52,942 sf 43.21% Impervious Runoff Depth=1.74" Flow Length=304' Tc=15.1 min CN=67 Runoff=1.64 cfs 7,679 cf
Reach DP1: Wetland Northeast	Inflow=0.00 cfs 55 cf Outflow=0.00 cfs 55 cf
Reach DP2: Wetland Southeast	Inflow=3.67 cfs 20,476 cf Outflow=3.67 cfs 20,476 cf
Reach DP3: Catch Basin	Inflow=1.12 cfs 3,969 cf Outflow=1.12 cfs 3,969 cf
Reach DP4: Wetland West	Inflow=5.12 cfs 25,803 cf Outflow=5.12 cfs 25,803 cf
Reach R1: Stream Channel	Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0 cf n=0.040 L=1,058.0' S=0.0104 '/' Capacity=24.40 cfs Outflow=0.00 cfs 0 cf

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NRCC 24-hr D 10-yr Rainfall=4.91"

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Reach R2: Stream Channel

Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0 cf
n=0.030 L=629.3' S=0.0175 '/ Capacity=42.18 cfs Outflow=0.00 cfs 0 cf

Pond P1: North West Pond

Peak Elev=79.26' Storage=21,876 cf Inflow=11.03 cfs 37,403 cf
Discarded=0.35 cfs 30,279 cf Primary=0.00 cfs 0 cf Secondary=0.00 cfs 0 cf Outflow=0.35 cfs 30,279 cf

Pond P2: East Pond

Peak Elev=60.12' Storage=3,459 cf Inflow=1.64 cfs 7,679 cf
Discarded=0.12 cfs 7,679 cf Primary=0.00 cfs 0 cf Secondary=0.00 cfs 0 cf Outflow=0.12 cfs 7,679 cf

Pond P3: Subsurface Chambers

Peak Elev=66.99' Storage=12,360 cf Inflow=7.79 cfs 26,548 cf
Discarded=0.34 cfs 26,548 cf Primary=0.00 cfs 0 cf Outflow=0.34 cfs 26,548 cf

Pond P4: Gravel Access French Drain

Peak Elev=72.87' Storage=493 cf Inflow=0.38 cfs 2,011 cf
Discarded=0.08 cfs 2,011 cf Primary=0.00 cfs 0 cf Outflow=0.08 cfs 2,011 cf

Pond P5: Retention Area

Peak Elev=61.87' Storage=2,170 cf Inflow=1.03 cfs 5,303 cf
Discarded=0.10 cfs 5,081 cf Primary=0.10 cfs 222 cf Outflow=0.20 cfs 5,303 cf

Total Runoff Area = 613,972 sf Runoff Volume = 129,025 cf Average Runoff Depth = 2.52"
44.02% Pervious = 270,264 sf 55.98% Impervious = 343,708 sf

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NRCC 24-hr D 100-yr Rainfall=7.74"

Printed 5/23/2022

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPS5a:	Runoff Area=19,372 sf 76.35% Impervious Runoff Depth=5.96" Flow Length=280' Tc=19.8 min CN=85 Runoff=1.82 cfs 9,626 cf
SubcatchmentPS1:	Runoff Area=71,570 sf 0.00% Impervious Runoff Depth=0.42" Flow Length=384' Tc=18.4 min CN=31 Runoff=0.10 cfs 2,525 cf
SubcatchmentPS1a: Access Drive	Runoff Area=15,854 sf 0.00% Impervious Runoff Depth=3.58" Flow Length=384' Tc=18.4 min CN=64 Runoff=0.95 cfs 4,723 cf
SubcatchmentPS2:	Runoff Area=66,442 sf 68.70% Impervious Runoff Depth=5.61" Flow Length=304' Tc=20.5 min CN=82 Runoff=5.83 cfs 31,080 cf
SubcatchmentPS3: Same as ES3	Runoff Area=15,025 sf 74.58% Impervious Runoff Depth=5.73" Flow Length=262' Tc=7.5 min CN=83 Runoff=2.01 cfs 7,174 cf
SubcatchmentPS4:	Runoff Area=71,594 sf 0.00% Impervious Runoff Depth=1.41" Flow Length=1,297' Tc=39.5 min CN=43 Runoff=0.87 cfs 8,422 cf
SubcatchmentPS5:	Runoff Area=88,896 sf 75.17% Impervious Runoff Depth=5.85" Flow Length=705' Tc=15.5 min CN=84 Runoff=9.15 cfs 43,307 cf
SubcatchmentPS6:	Runoff Area=13,676 sf 81.79% Impervious Runoff Depth=6.20" Flow Length=226' Tc=7.4 min CN=87 Runoff=1.93 cfs 7,062 cf
SubcatchmentPS7: West Parking Lot	Runoff Area=86,432 sf 80.90% Impervious Runoff Depth=6.43" Flow Length=274' Tc=6.0 min CN=89 Runoff=13.14 cfs 46,327 cf
SubcatchmentPS8: Prop. Roof	Runoff Area=112,169 sf 90.27% Impervious Runoff Depth=6.79" Flow Length=697' Slope=0.0200 '/' Tc=5.1 min CN=92 Runoff=18.09 cfs 63,433 cf
SubcatchmentPS9:	Runoff Area=52,942 sf 43.21% Impervious Runoff Depth=3.91" Flow Length=304' Tc=15.1 min CN=67 Runoff=3.81 cfs 17,235 cf
Reach DP1: Wetland Northeast	Inflow=0.21 cfs 2,820 cf Outflow=0.21 cfs 2,820 cf
Reach DP2: Wetland Southeast	Inflow=7.36 cfs 44,110 cf Outflow=7.36 cfs 44,110 cf
Reach DP3: Catch Basin	Inflow=1.93 cfs 7,062 cf Outflow=1.93 cfs 7,062 cf
Reach DP4: Wetland West	Inflow=10.27 cfs 74,674 cf Outflow=10.27 cfs 74,674 cf
Reach R1: Stream Channel	Avg. Flow Depth=0.49' Max Vel=2.01 fps Inflow=4.05 cfs 16,775 cf n=0.040 L=1,058.0' S=0.0104 '/' Capacity=24.40 cfs Outflow=3.41 cfs 16,775 cf

4046 Proposed

NRCC 24-hr D 100-yr Rainfall=7.74"

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Reach R2: Stream Channel

Avg. Flow Depth=0.11' Max Vel=1.46 fps Inflow=0.52 cfs 3,080 cf
n=0.030 L=629.3' S=0.0175 '/' Capacity=42.18 cfs Outflow=0.51 cfs 3,080 cf

Pond P1: North West Pond

Peak Elev=80.26' Storage=28,677 cf Inflow=18.09 cfs 63,433 cf
Discarded=0.43 cfs 35,563 cf Primary=4.05 cfs 16,775 cf Secondary=0.00 cfs 0 cf Outflow=4.48 cfs 52,338 cf

Pond P2: East Pond

Peak Elev=60.87' Storage=5,305 cf Inflow=3.81 cfs 17,235 cf
Discarded=0.15 cfs 11,218 cf Primary=1.83 cfs 5,857 cf Secondary=0.00 cfs 0 cf Outflow=1.98 cfs 17,075 cf

Pond P3: Subsurface Chambers

Peak Elev=69.12' Storage=23,013 cf Inflow=13.14 cfs 46,327 cf
Discarded=0.40 cfs 38,487 cf Primary=0.52 cfs 3,080 cf Outflow=0.92 cfs 41,567 cf

Pond P4: Gravel Access French Drain

Peak Elev=74.54' Storage=1,711 cf Inflow=0.95 cfs 4,723 cf
Discarded=0.08 cfs 4,428 cf Primary=0.11 cfs 296 cf Outflow=0.18 cfs 4,723 cf

Pond P5: Retention Area

Peak Elev=62.00' Storage=2,417 cf Inflow=1.82 cfs 9,626 cf
Discarded=0.11 cfs 6,536 cf Primary=1.59 cfs 3,089 cf Outflow=1.70 cfs 9,626 cf

Total Runoff Area = 613,972 sf Runoff Volume = 240,912 cf Average Runoff Depth = 4.71"
44.02% Pervious = 270,264 sf 55.98% Impervious = 343,708 sf

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Page 2

Summary for Pond P1: North West Pond

Inflow Area = 112,169 sf, 90.27% Impervious, Inflow Depth = 6.79" for 100-yr event
 Inflow = 18.09 cfs @ 12.12 hrs, Volume= 63,433 cf
 Outflow = 4.48 cfs @ 12.34 hrs, Volume= 52,338 cf, Atten= 75%, Lag= 13.1 min
 Discarded = 0.43 cfs @ 12.34 hrs, Volume= 35,563 cf
 Primary = 4.05 cfs @ 12.34 hrs, Volume= 16,775 cf
 Routed to Reach R1 : Stream Channel
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Routed to Reach R1 : Stream Channel

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 80.26' @ 12.34 hrs Surf.Area= 7,683 sf Storage= 28,677 cf

Plug-Flow detention time= 419.9 min calculated for 52,323 cf (82% of inflow)
 Center-of-Mass det. time= 335.6 min (1,111.8 - 776.2)

Volume	Invert	Avail.Storage	Storage Description
#1	74.00'	35,103 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
74.00	1,804	0	0
75.00	2,970	2,387	2,387
76.00	3,684	3,327	5,714
77.00	4,437	4,061	9,775
78.00	5,229	4,833	14,608
79.00	6,060	5,645	20,252
80.00	6,931	6,496	26,748
81.00	9,779	8,355	35,103

Device	Routing	Invert	Outlet Devices
#1	Primary	74.00'	18.0" Round Culvert L= 87.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 74.00' / 70.00' S= 0.0460 '/ S= 0.0460 ' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf
#2	Device 1	79.80'	4.0' long Outlet Structure Weir 2 End Contraction(s)
#3	Secondary	80.50'	15.0' long x 5.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#4	Discarded	74.00'	2.410 in/hr Exfiltration over Surface area Phase-In= 0.01'

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Page 3

Discarded OutFlow Max=0.43 cfs @ 12.34 hrs HW=80.26' (Free Discharge)↑**4=Exfiltration** (Exfiltration Controls 0.43 cfs)**Primary OutFlow** Max=4.04 cfs @ 12.34 hrs HW=80.26' (Free Discharge)↑**1=Culvert** (Passes 4.04 cfs of 19.98 cfs potential flow)↑**2=Outlet Structure Weir** (Weir Controls 4.04 cfs @ 2.23 fps)**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=74.00' (Free Discharge)↑**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)**Summary for Pond P2: East Pond**

Inflow Area = 52,942 sf, 43.21% Impervious, Inflow Depth = 3.91" for 100-yr event

Inflow = 3.81 cfs @ 12.23 hrs, Volume= 17,235 cf

Outflow = 1.98 cfs @ 12.44 hrs, Volume= 17,075 cf, Atten= 48%, Lag= 12.6 min

Discarded = 0.15 cfs @ 12.44 hrs, Volume= 11,218 cf

Primary = 1.83 cfs @ 12.44 hrs, Volume= 5,857 cf

Routed to Reach DP2 : Wetland Southeast

Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routed to Reach DP2 : Wetland Southeast

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Peak Elev= 60.87' @ 12.44 hrs Surf.Area= 2,695 sf Storage= 5,305 cf

Plug-Flow detention time= 277.8 min calculated for 17,070 cf (99% of inflow)

Center-of-Mass det. time= 272.5 min (1,138.6 - 866.0)

Volume	Invert	Avail.Storage	Storage Description
#1	58.00'	8,754 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
58.00	1,050	0	0
59.00	1,583	1,317	1,317
60.00	2,160	1,872	3,188
61.00	2,773	2,467	5,655
62.00	3,426	3,100	8,754

Device	Routing	Invert	Outlet Devices
#1	Primary	58.00'	18.0" Round Culvert L= 70.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 58.00' / 57.00' S= 0.0143 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf
#2	Device 1	60.60'	4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#3	Secondary	61.00'	10.0' long x 10.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#4	Discarded	58.00'	2.410 in/hr Exfiltration over Surface area

4046 Proposed

NRCC 24-hr D 100-yr Rainfall=7.74"

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Page 4

Discarded OutFlow Max=0.15 cfs @ 12.44 hrs HW=60.87' (Free Discharge)

↑**4=Exfiltration** (Exfiltration Controls 0.15 cfs)

Primary OutFlow Max=1.83 cfs @ 12.44 hrs HW=60.87' (Free Discharge)

↑**1=Culvert** (Passes 1.83 cfs of 9.79 cfs potential flow)

↑**2=Sharp-Crested Rectangular Weir** (Weir Controls 1.83 cfs @ 1.71 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=58.00' (Free Discharge)

↑**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

APPENDIX D:
STORMWATER MANAGEMENT
CALCULATIONS

4. Calculate Provided Recharge

Proposed recharge provided in infiltration basins

HCAD System ID	Bottom of Infiltration	Lowest System Outlet	Total Recharge Volume Provided (cf)	10-YR STORM EVENT PEAK ELEVATION*
P1	74.0	79.80	25,379	80.39
P2	58.0	60.60	4,594	60.87
P3	64.0	69.00	22,404	69.12
P5	60.0	61.85	2,127	62.00
TOTAL			55,873	

Required Recharge Volume Summary

Total Volume Provided Below Outlets = 55,873 cf

Total Volume Required = 9,141 CF

55,873 cf provided > 9,141 cf required

Verify Drawdown, Maximum 72-Hours: Static Method

HCAD System ID	Recharge Volume (CF)	Bottom Surface Area (SF)	Infiltration Rate Inches/Hour	Drawdown Time Rv / (K x A) (Hours)	Description
P1	25,379	1,804	2.41	70.04	Retention Basin
P2	2,523	1,050	2.41	11.96	Retention Basin
P3	22,404	4,800	2.41	22.34	Concrete Galleys
P5	1,089	547	2.41	9.91	Retention Basin

*****Design Complies with Recharge Volume Standard*******STANDARD 4: Water Quality Volume**

See proprietary hydrodynamic separator and TSS calculations sheets.

4046 Proposed

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NRCC 24-hr D 10-yr Rainfall=4.91"

Printed 5/20/2022

Stage-Area-Storage for Pond P1: North West Pond

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
74.00	1,804	0	79.30	6,321	22,109
74.10	1,921	186	79.40	6,408	22,746
74.20	2,037	384	79.50	6,496	23,391
74.30	2,154	594	79.60	6,583	24,045
74.40	2,270	815	79.70	6,670	24,707
74.50	2,387	1,048	79.80	6,757	25,379
74.60	2,504	1,292	79.90	6,844	26,059
74.70	2,620	1,548	80.00	6,931	26,748
74.80	2,737	1,816	80.10	7,216	27,455
74.90	2,853	2,096	80.20	7,501	28,191
75.00	2,970	2,387	80.30	7,785	28,955
75.10	3,041	2,688	80.40	8,070	29,748
75.20	3,113	2,995	80.50	8,355	30,569
75.30	3,184	3,310	80.60	8,640	31,419
75.40	3,256	3,632	80.70	8,925	32,297
75.50	3,327	3,961	80.80	9,209	33,204
75.60	3,398	4,298	80.90	9,494	34,139
75.70	3,470	4,641	81.00	9,779	35,103
75.80	3,541	4,991			
75.90	3,613	5,349			
76.00	3,684	5,714			
76.10	3,759	6,086			
76.20	3,835	6,466			
76.30	3,910	6,853			
76.40	3,985	7,248			
76.50	4,061	7,650			
76.60	4,136	8,060			
76.70	4,211	8,477			
76.80	4,286	8,902			
76.90	4,362	9,335			
77.00	4,437	9,775			
77.10	4,516	10,222			
77.20	4,595	10,678			
77.30	4,675	11,141			
77.40	4,754	11,613			
77.50	4,833	12,092			
77.60	4,912	12,579			
77.70	4,991	13,074			
77.80	5,071	13,578			
77.90	5,150	14,089			
78.00	5,229	14,608			
78.10	5,312	15,135			
78.20	5,395	15,670			
78.30	5,478	16,214			
78.40	5,561	16,766			
78.50	5,645	17,326			
78.60	5,728	17,894			
78.70	5,811	18,471			
78.80	5,894	19,057			
78.90	5,977	19,650			
79.00	6,060	20,252			
79.10	6,147	20,862			
79.20	6,234	21,481			

VERIFY PIPE CAPACITY-10 YEAR STORM

Pipe Sizing Calculation Spreadsheet:

THE MORIN-CAMERON GROUP, INC.

25 Kenoza Avenue
Haverhill, MA 01830
P: (978) 373-0310

W: www.morincameron.com

Proj. No.: 4046
Location: 501 & 600 Griffin Brook Dr
Methuen. MA
Owner: Griffin Brook Drive Owner LLC

Date: 5/20/2022
Revised:
Computed by: Cora McLean
Checked by: Scott P, Cameron, P.E.

Design Parameters:

IDF Curve
10 Year Storm
Boston
k_s= 0.2

DESCRIPTION	LOCATION		AREA (AC.)	C	C x A	SUM C x A	FLOW TIME (MIN)		i*	DESIGN					CAPACITY		PIPE PROFILE				
	FROM	TO					PIPE	CONC. TIME		Q cfs	V fps	n	PIPE SIZE	SLOPE	Q full ft^3/s	V full ft/s	LENGTH ft	FALL ft	RIM	INV UPPER	INV LOWER
1	CB-1	DMH-1	0.68	0.68	0.46	0.46	0.16	6.0	5.0	2.3	3.9	0.01	12	0.005	3.3	4.2	38	0.19	75.80	69.00	68.81
	DMH-1	ST-1				0.46	0.04	6.2	5.0	2.3	3.9	0.01	12	0.005	3.3	4.2	10	0.05	76.30	67.81	67.76
2	CB-2	ST-1	0.24	0.48	0.12	0.12	0.33	6.0	5.0	0.6	2.5	0.01	12	0.005	3.3	4.2	50	0.25	77.60	69.06	68.81
	ST-1	P3				0.58	0.01	6.3	5.0	2.9	6.7	0.01	15	0.020	11.9	9.7	3	0.06	76.40	67.66	67.60
3	CB-3	DMH-2	0.23	0.88	0.20	0.20	0.20	6.0	5.0	1.0	3.1	0.01	12	0.005	3.3	4.2	38	0.19	77.00	68.57	68.38
4	CB-4	DMH-2	0.27	0.89	0.24	0.24	0.40	6.0	5.0	1.2	3.2	0.01	12	0.005	3.3	4.2	77	0.39	76.30	68.76	68.38
	DMH-2	DMH-3				0.24	0.21	6.4	4.9	1.2	3.2	0.01	12	0.005	3.3	4.2	41	0.21	76.30	68.28	68.07
5	CB-5	DMH-3	0.21	0.82	0.17	0.17	0.07	6.0	5.0	0.9	3.0	0.01	12	0.005	3.3	4.2	13	0.07	76.00	68.14	68.07
6	CB-6	DMH-3	0.18	0.88	0.16	0.16	0.12	6.0	5.0	0.8	2.9	0.01	12	0.005	3.3	4.2	21	0.11	76.70	68.18	68.07
	DMH-3	ST-2				0.16	0.06	6.1	5.0	0.8	3.6	0.01	12	0.010	4.6	5.9	13	0.13	75.50	67.97	67.84
7	CB-7	DMH-4	0.14	0.81	0.12	0.12	0.08	6.0	5.0	0.6	2.5	0.01	12	0.005	3.3	4.2	12	0.06	72.00	68.48	68.42
8	CB-8	DMH-4	0.06	0.90	0.05	0.05	0.17	6.0	5.0	0.3	1.8	0.01	12	0.005	3.3	4.2	19	0.10	72.10	68.52	68.42
	DMH-4	ST-2				0.05	0.34	6.2	5.0	0.3	2.4	0.01	12	0.010	4.6	5.9	48	0.48	72.50	68.32	67.84
	ST-2	P3				0.05	0.12	6.5	4.9	0.2	2.0	0.01	15	0.010	8.4	6.8	14	0.14	75.50	67.74	67.60
9	CB-9	DMH-5	0.05	0.90	0.05	0.05	0.06	6.0	5.0	0.2	1.8	0.01	12	0.005	3.3	4.2	7	0.04	66.00	62.10	62.07
10	CB-10	DMH-5	0.07	0.73	0.05	0.05	0.22	6.0	5.0	0.3	1.8	0.01	12	0.005	3.3	4.2	24	0.12	66.00	62.19	62.07
	DMH-5	DMH-6				0.05	1.09	6.2	5.0	0.3	2.8	0.01	12	0.020	6.6	8.3	180	3.60	66.50	61.97	58.37
11	CB-11	DMH-6	0.17	0.90	0.15	0.15	0.16	6.0	5.0	0.8	2.8	0.01	12	0.005	3.3	4.2	28	0.14	61.70	58.51	58.37
EX	EX	DMH-6	1.41	0.74	1.04	1.04	6.60	6.0	5.0	5.3	4.9	0.01	15	0.005	5.9	4.8	29	0.15	61.70	58.51	58.37
12	CB-12	ST-3	0.38	0.62	0.24	0.24	0.16	6.0	5.0	1.2	3.2	0.01	12	0.005	3.3	4.2	30	0.15	68.00	60.65	60.50
13	CB-13	ST-3	0.47	0.69	0.33	0.33	0.07	6.0	5.0	1.6	3.5	0.01	12	0.005	3.3	4.2	14	0.07	68.00	60.57	60.50
	ST-3	P2				0.33	0.19	6.1	5.0	1.6	1.9	0.01	12	0.001	1.5	1.9	22	0.02	65.80	60.40	60.20
ROOF	ROOF	P1	2.32	0.90	2.09	2.09	1.09	6.0	5.0	10.5	9.9	0.01	15	0.020	11.9	9.7	647	12.94		88.74	75.80

Rip Rap Sizing Calculation Spreadsheet

THE MORIN-CAMERON GROUP, INC.

25 Kenoza Avenue
Haverhill, MA 01830
P: (978) 373-0310

Proj. No.: 4046

Location: 501 & 600 Griffin Brook Drive
Methuen. MA

Owner: Griffin Brook Drive Owner LLC

Date: 5/20/2022

Computed by: Cora McLean

Checked by: Scott P, Cameron, P.E.

Reference: Federal Highway Administration, Hydraulic Engineering Circular No. 14, Third Edition (HEC-14), Hydraulic Design for Culverts and Channels, Publication No. FHWA-NHI-06-086, July 2006

Outlet	Pipe Diameter (D, inch)	Pipe Diameter (D, ft)	Design discharge (Q, cfs)	Tailwater depth (TW)(=0.4D)	Aceeleration due to gravity (g, ft/s^2)	Yn	D'	D ₅₀ (MIN) (ft)	D ₅₀ (MIN) (in)	D ₅₀ (SELECTED) (in)	Class	Apron Length (ft)	Apron Depth (ft)	Apron Width (ft)
HW-1	12	1	18.09	0.4	32.2	1.786	1.393	1.51	19	10	3	5.0	3.8	6.7
HW-2	18	1.5	4.5	0.6	32.2	0.805	1.153	0.20	3	14	4	9.0	0.6	12
HW-3	12	1	3.81	0.4	32.2	0.820	0.910	0.33	5	6	1	4.0	1.0	5.4
HW-4	18	1.5	1.98	0.6	32.2	0.534	1.017	0.08	1	10	3	7.5	0.2	10
HW-5	12	1	0.18	0.4	33.2	0.178	0.589	0.01	1	10	3	5.0	0.2	6.7

CLASS		D ₅₀ (in)	Apron Length	Apron Depth
1		5	4D	3.5D50
2		6	4D	3.3D50
3		10	5D	2.4D50
4		14	6D	2.2D50

Equations:

$$D_{50} = 0.2D \left(\frac{Q}{D^{2.5}\sqrt{g}} \right)^{\frac{4}{3}} (D/TW)$$

$$\text{Supercritical Flow } D' = (D + y_n)/2$$

$$y_n = 0.42 [(Q^{1/2})/(D^{1/4})]$$

**APPENDIX E:
CONSTRUCTION PHASE
BEST MANAGEMENT
PRACTICES**

operations directly to the nearest drainage system, stream, or waterway after filtering by an approved method.

- The pumped water shall be filtered through either: bailed straw, a vegetative filter strip, a vegetative channel, dewatering bag or a mechanical tank system to trap sediment occurring as a result of the construction operations. Vegetated channels, if utilized shall be constructed such that the discharge flow rate shall not exceed a velocity of more than 1 foot per second. Accumulated sediment shall be cleared from the channel periodically.

Sediment material removed shall be disposed of in accordance with all applicable local, state, and federal regulations.

The developer and site general contractor will comply with the E.P.A.'s Final General Permit for Construction De-watering Discharges, (N.P.D.E.S., Section 402 and 40 C.F.R. 122.26(b) (14) (x).

Inspection/Maintenance:

Operator personnel must inspect the construction site at least once every 14 calendar days and within 24 hours of a storm event of ½-inch or greater. The applicant shall be responsible to secure the services of a design professional or similar professional (inspector) on an on-going basis throughout all phases of the project. Refer to the Inspection/Maintenance Requirements presented earlier in the "Structural and Stabilization Practices." The inspector should review the erosion and sediment controls with respect to the following:

- Whether or not the measure was installed/performed correctly.
- Whether or not there has been damage to the measure since it was installed or performed.
- What should be done to correct any problems with the measure.

The inspector should document the findings and should request the required maintenance or repair for the pollution prevention measures when the inspector finds that it is necessary for the measure to be effective. The inspector should notify the appropriate person to make the required changes.

It is essential that the inspector document the inspection of the pollution prevention measures. These records will be used to request maintenance and repair and to prove that the inspection and maintenance were performed. The forms list each of the measures to be inspected on the site, the inspector's name, the date of the inspection, the condition of the measure/area inspected, maintenance or repair performed and any changes which should be made to the Operation and Maintenance Plan to control or eliminate unforeseen pollution of storm water.

Spill Prevention and Response:

The site supervisor or their representative shall be present on the job site at all times during the course of work and shall be present during the delivery, removal of any liquid/chemical materials to or from the job site. They will also be present during any refueling practices. All subcontractors will be notified of their responsibilities in writing.

In the event a spill occurs, the site supervisor shall be notified immediately. The site supervisor shall have in place a spill prevention plan and resources to contain and clean up any potential spills in a timely manner.

Fueling and Maintenance of Equipment or Vehicles:

The site supervisor shall produce a written document received by all subcontractors and employees that delineates their responsibilities on site. This document shall include language that shall specify the maintenance of vehicles on the job site. The site supervisor shall document receipt of these instructions by obtaining the signatures of subcontractors and individuals that may enter the site and the date in which they were notified of their responsibilities. Refueling for vehicles or equipment shall occur either within the designated washout area or shall utilize temporary drip protection measures at the location of fueling. The site supervisor or their representative shall be present at the time of any fueling procedure. The site supervisor shall have a fuel spill plan and measures on site to initiate containment and clean-up in the event a fuel spill occurs.

- Installation Schedule: Prior to start of Work
- Maintenance and Inspection: The site supervisor shall maintain a log of individuals receiving these instructions.
- Responsible Staff: Site Supervisor

Storage, Handling, and Disposal of Construction Products, Materials, and Wastes:

The site supervisor shall produce a written document received by all subcontractors and employees that delineates their responsibilities on site. The site supervisor shall document receipt of these instructions by obtaining the signatures of subcontractors and individuals that may enter the site and the date in which they were notified of their responsibilities. This document shall instruct all waste to be properly distributed to a designated area. The general contractor and site supervisor shall assemble a recycling and waste management area on the site, in the location indicated on the plans, after excavation and preliminary site grading have been completed. This area shall include dumpsters and storage areas for materials recycling and construction waste. Waste and recycling shall be removed from the site on a weekly basis as appropriate to the stage of construction.

- Installation Schedule: Prior to start of Work
- Maintenance and Inspection: The site supervisor shall inspect the waste and recycling area on a daily basis to ensure the proper sorting and disposal of materials. This shall also include evaluation that waste/recycling are confined to the designated area. The site supervisor shall maintain a log of individuals receiving these instructions.
- Responsible Staff: Site Supervisor

The site supervisor shall designate a materials staging area on site. This area shall be covered with 2" of gravel (this gravel shall be subsequently stripped and can be reused as a base for paving or other construction activities)

- Installation Schedule: Prior to start of Work
- Maintenance and Inspection: The site supervisor shall inspect this area once week to ensure orderly materials storage is confined to the designated area. The site supervisor shall coordinate all materials delivery to ensure proper placement of materials.

- Responsible Staff: Site Supervisor
- a) Building Products
 - All building products will be stored in contained areas within the construction site away from the elements. Storage containers will shall be used to protect stored materials. Material storage and stockpiling areas will be surrounded by haybales and silt fencing to prevent erosion.
- b) Pesticides, Herbicides, Insecticides, Fertilizers, and Landscape Materials
 - Pesticides and herbicides shall be used sparingly. Fertilizers should be restricted to the use of organic fertilizers only.
- c) Diesel Fuel, Oil, Hydraulic Fluids, Other Petroleum Products, and Other Chemicals
 - Vehicle fueling and maintenance shall occur off-site for the duration of the project.
- d) Hazardous or Toxic Waste
 - All import of hazardous or toxic materials onto the site shall be limited to those necessary for immediate work. No stockpiling of hazardous or toxic materials shall occur.
 - All hazardous materials must be clearly labeled and stored in a locked area.
 - A spill prevention and response plan shall be created by the site contractor to ensure that pollutants are not distributed into stormwater runoff.
 - All hazardous materials shall be disposed of off-site according to MA DEP and Federal EPA regulations.
- e) Construction and Domestic Waste

The site supervisor shall produce a written document received by all subcontractors and employees that delineates their responsibilities on site. The site supervisor shall document receipt of these instructions by obtaining the signatures of subcontractors and individuals that may enter the site and the date in which they were notified of their responsibilities. This document shall instruct all waste to be properly distributed to a designated area. The general contractor and site supervisor shall assemble a recycling and waste management area on the site, in the location indicated on the plans, after excavation and preliminary site grading have been completed. This area shall include dumpsters and storage areas for materials recycling and construction waste. Waste and recycling shall be removed from the site on a weekly basis as appropriate to the stage of construction.

 - Installation Schedule: Prior to start of Work
 - Maintenance and Inspection: The site supervisor shall inspect the waste and recycling area on a daily basis to ensure the proper sorting and disposal of materials. This shall also include evaluation that waste/recycling are confined to the designated area. The site supervisor shall maintain a log of individuals receiving these instructions.
 - Responsible Staff: Site Supervisor
- f) Sanitary Waste
 - Portable sanitary waste facilities shall be kept on site for the duration of the project for use by personnel on site.
 - Waste facilities shall be cleaned weekly and emptied as necessary by licensed personnel.