

BP 140 KENDRICK STREET LLC
C/O BOSTON PROPERTIES, INC.
800 Boylston Street
Boston, MA 02199

FREDERICK J. DEANGELIS, ESQUIRE
Senior Vice President & Senior Counsel

October 15, 2020

Needham Planning Board
500 Dedham Avenue
Needham, Massachusetts 02492
Attn: Lee Newman
Planning Director

Re: 140 Kendrick Street, Needham MA
Application of BP 140 Kendrick Street LLC for Malfunction of Site Plan
Special Permit

Dear Board Members:

By Decision of the Needham Planning Board filed with the Needham Town Clerk on or about June 17, 1999 (Application 99-2), a Site Plan Special Permit for the 140 Kendrick Street Project was granted to the predecessor in title to the current owner, BP 140 Kendrick Street LLC (an affiliate of Boston Properties and herein called the "Applicant"). The Applicant plans to convert the 140 Kendrick Street Project from a single tenant to a multi-tenant project. Exterior improvements are limited to adding entrance locations to the buildings, patio improvements, and accessible parking and landscape improvements at the new entrance locations (the "Improvements").

The Applicant has filed a Notice of Intent with the Needham Conservation Commission and an Application with the Needham Design Review Board.

A hearing before the Conservation Commission was held on October 8, 2020 at which all matters were addressed and satisfactorily answered. The hearing was continued in order to obtain a Massachusetts DEP File Number.

The Design Review Board hearing is scheduled for October 19, 2020.

Page 2
October 15, 2020

The Applicant is submitting herewith an Application seeking a modification of the 1999 Site Plan Special Permit to allow the construction of the Improvements, all as shown on the plans submitted with the Application.

Should you have any questions or need additional information, please do not hesitate to call me (cell: 617-512-0319 or email: rdeangelis@bxp.com), or our Civil Engineer, Nick Skoly of VHB (cell: 401-595-6442 or email: nskoly@vhb.com).

Very truly yours,



Frederick J. DeAngelis

cc: David C. Provost
Madeleine C. Timin, Esq.

TOWN OF NEEDHAM
MASSACHUSETTS



500 Dedham Avenue
Needham, MA 02492
781-455-7550

PLANNING BOARD

APPLICATION FOR SITE PLAN REVIEW

Project Determination: (circle one) Major Project Minor Project

This application must be completed, signed, and submitted with the filing fee by the applicant or his representative in accordance with the Planning Board's Rules as adopted under its jurisdiction as a Special Permit Granting Authority. Section 7.4 of the By-Laws.

Location of Property 140 Kendrick Street
Name of Applicant BP 140 Kendrick Street LLC c/o Boston Properties Limited Partnership
Applicant's Address 800 Boylston Street, Suite 1900 - Boston MA 02199
Phone Number 617-236-3392

Applicant is: Owner X Tenant _____
Agent/Attorney _____ Purchaser _____

Property Owner's Name BP 140 Kendrick Street LLC c/o Boston Properties Limited Partnership
Property Owner's Address 800 Boylston Street, Suite 1900 - Boston MA 02199
Telephone Number 617-236-3392

Characteristics of Property: Lot Area 621,402 sf Present Use Office
Map # 30 Parcel # 1,3 Zoning District New England
Business Center

Description of Project for Site Plan Review under Section 7.4 of the Zoning By-Law:

The 140 Kendrick Street Project was originally approved and constructed pursuant to Special permit/Site Plan Review issued by the Planning Board on June 15th, 1999. The current project consists of renovating the existing single tenant office space to allow multiple tenants to lease the buildings. Exterior improvements are limited to adding entrance locations to the buildings, patio improvements, and accessible parking & landscape improvements at the new entrance locations.

Signature of Applicant (or representative)

Address if not applicant

Telephone # (617) 617-512-0319 (0) 617-236-3333

Owner's permission if other than applicant

BP 140 KENDRICK STREET LLC

By Frederick J. DeAngelis

FREDERICK J. DEANGELIS SR VP + COUNSEL

SUMMARY OF PLANNING BOARD ACTION

Received by Planning Board _____ Date _____

Hearing Date _____ Parties of Interest Notified of Public Hearing _____

Decision Required by _____ Decision/Notices of Decision sent _____

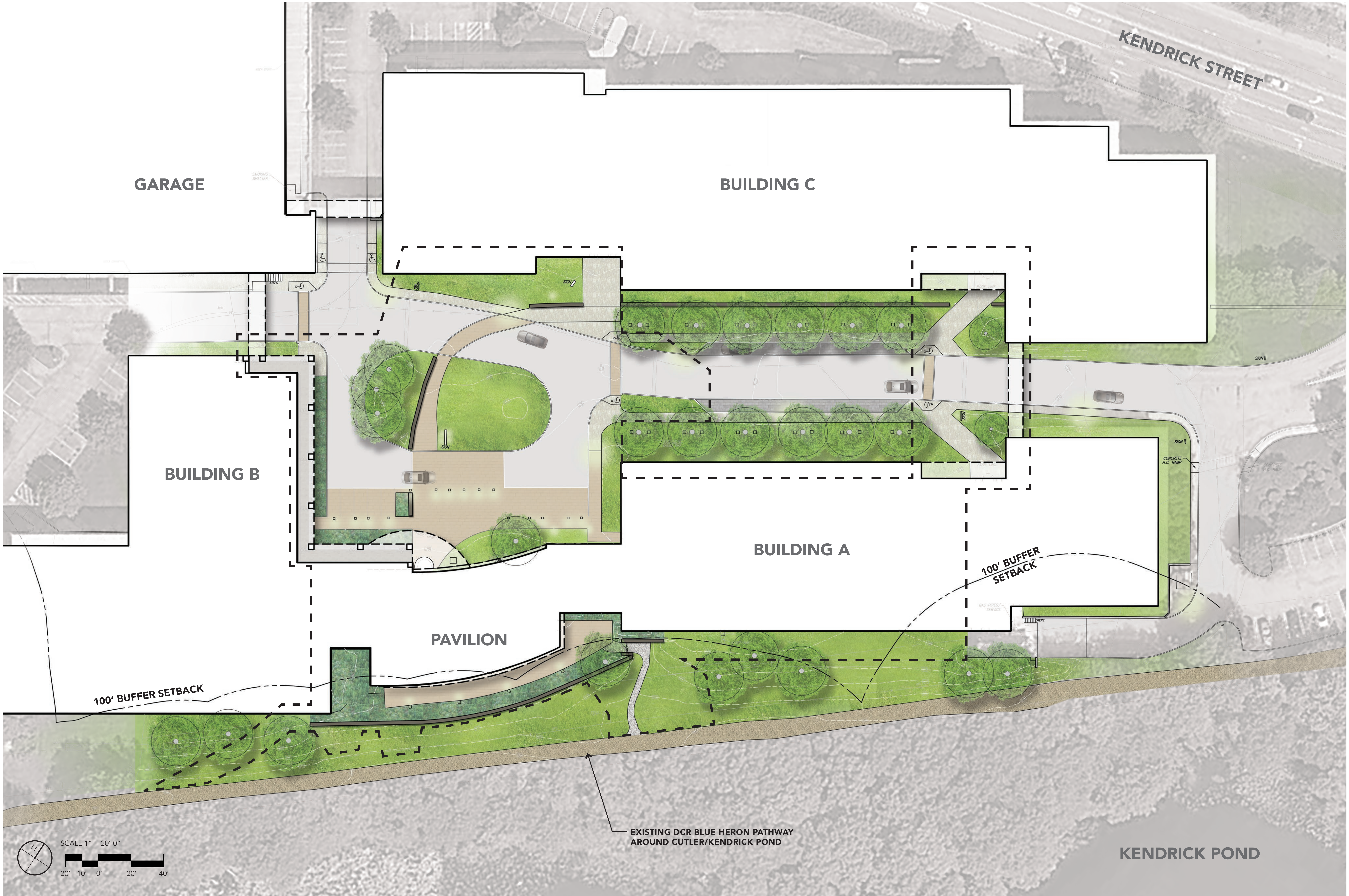
Granted _____

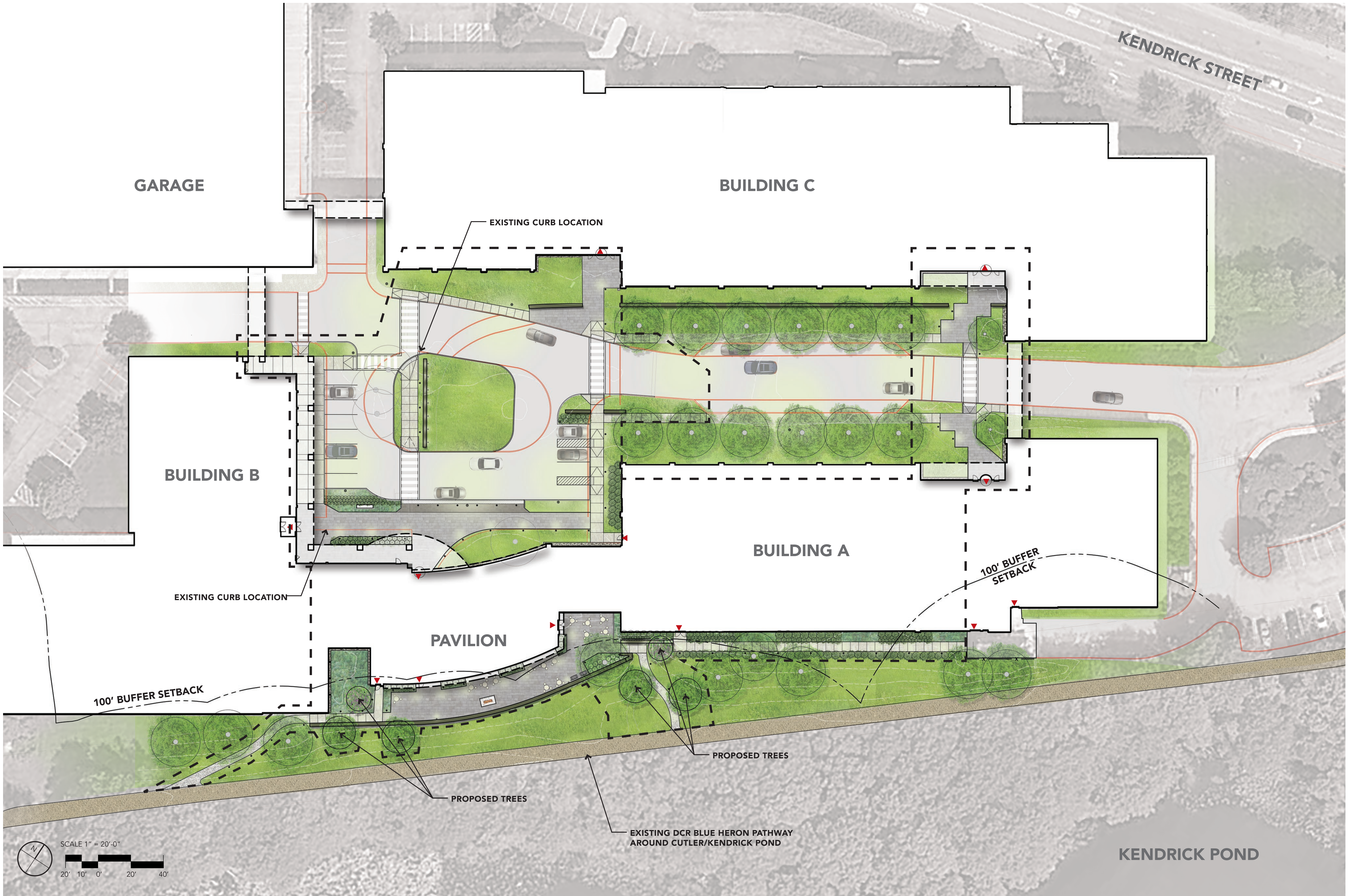
Denied _____

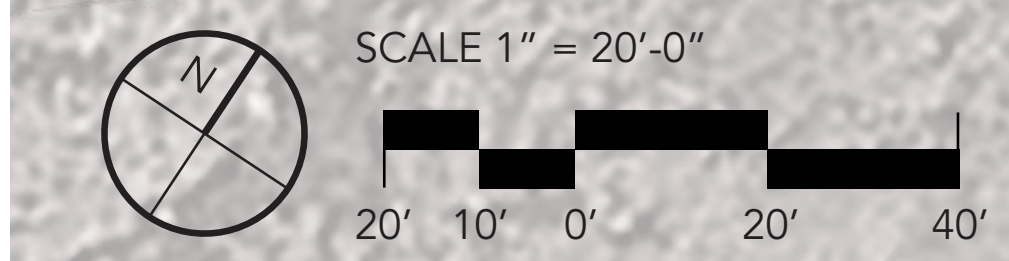
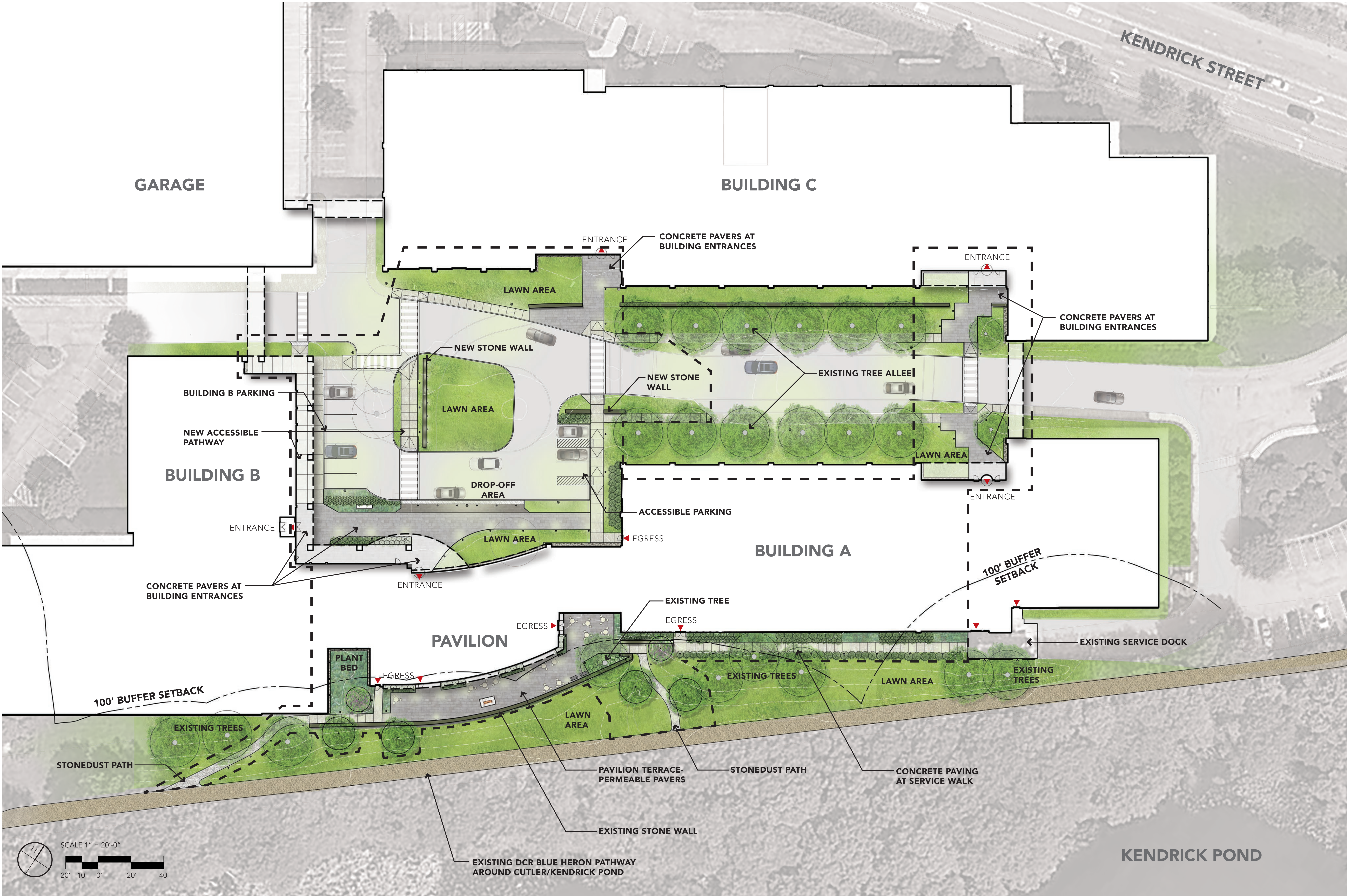
Fee Paid _____ Fee Waived _____

Withdrawn _____

NOTE: Reports on Minor Projects must be issued within 35 days of filing date.







Copley Wolff Design Group
Landscape Architects & Planners

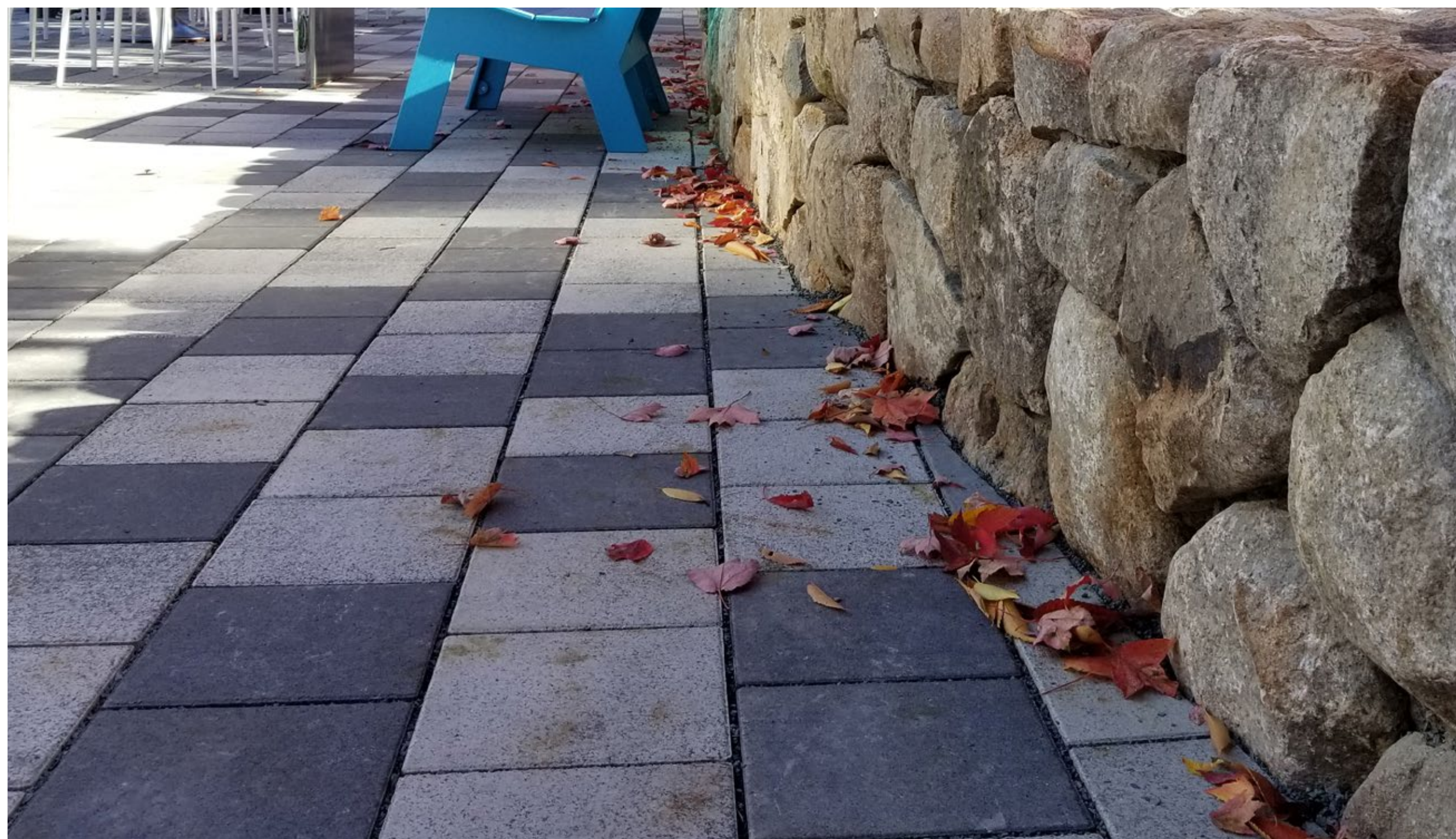
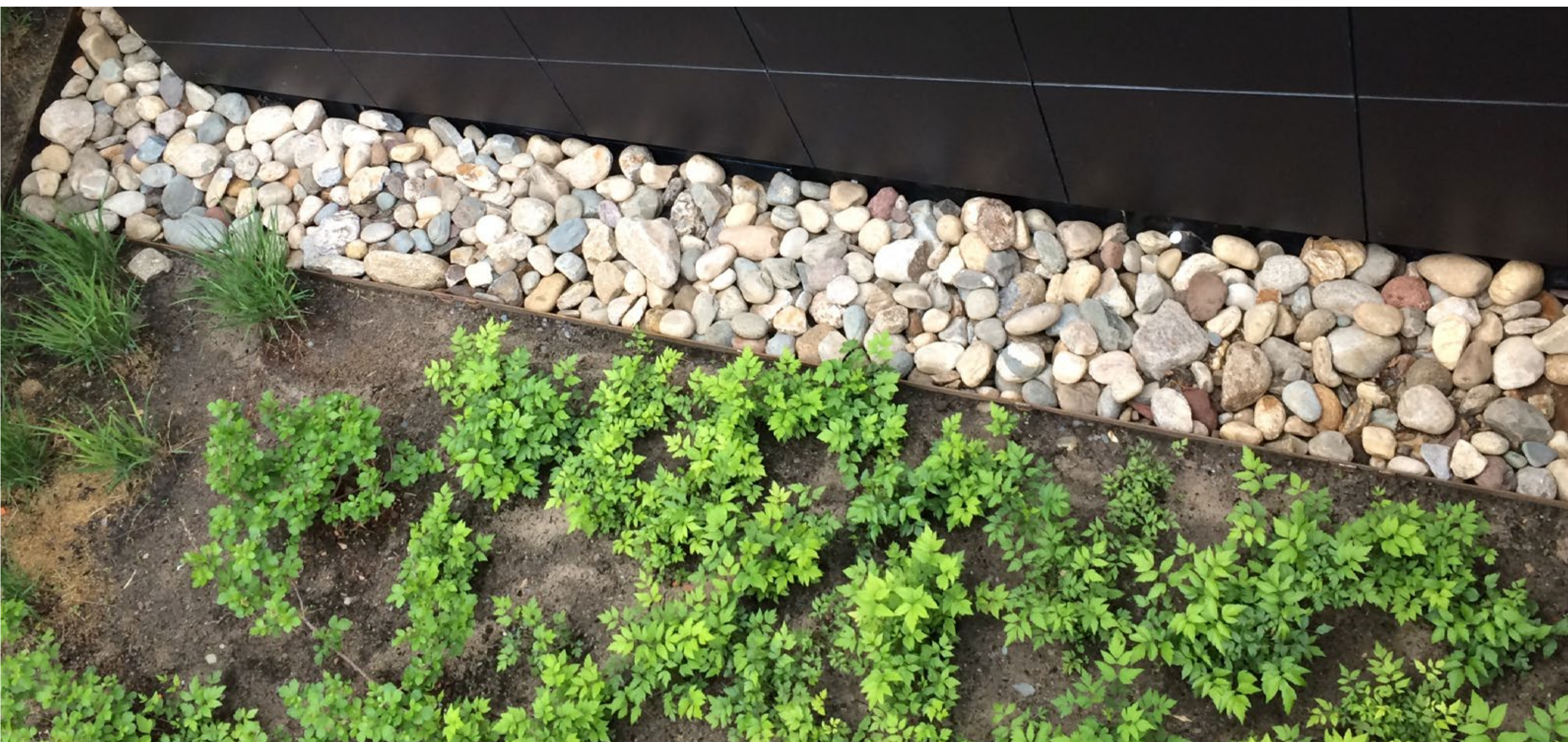
140 KENDRICK STREET

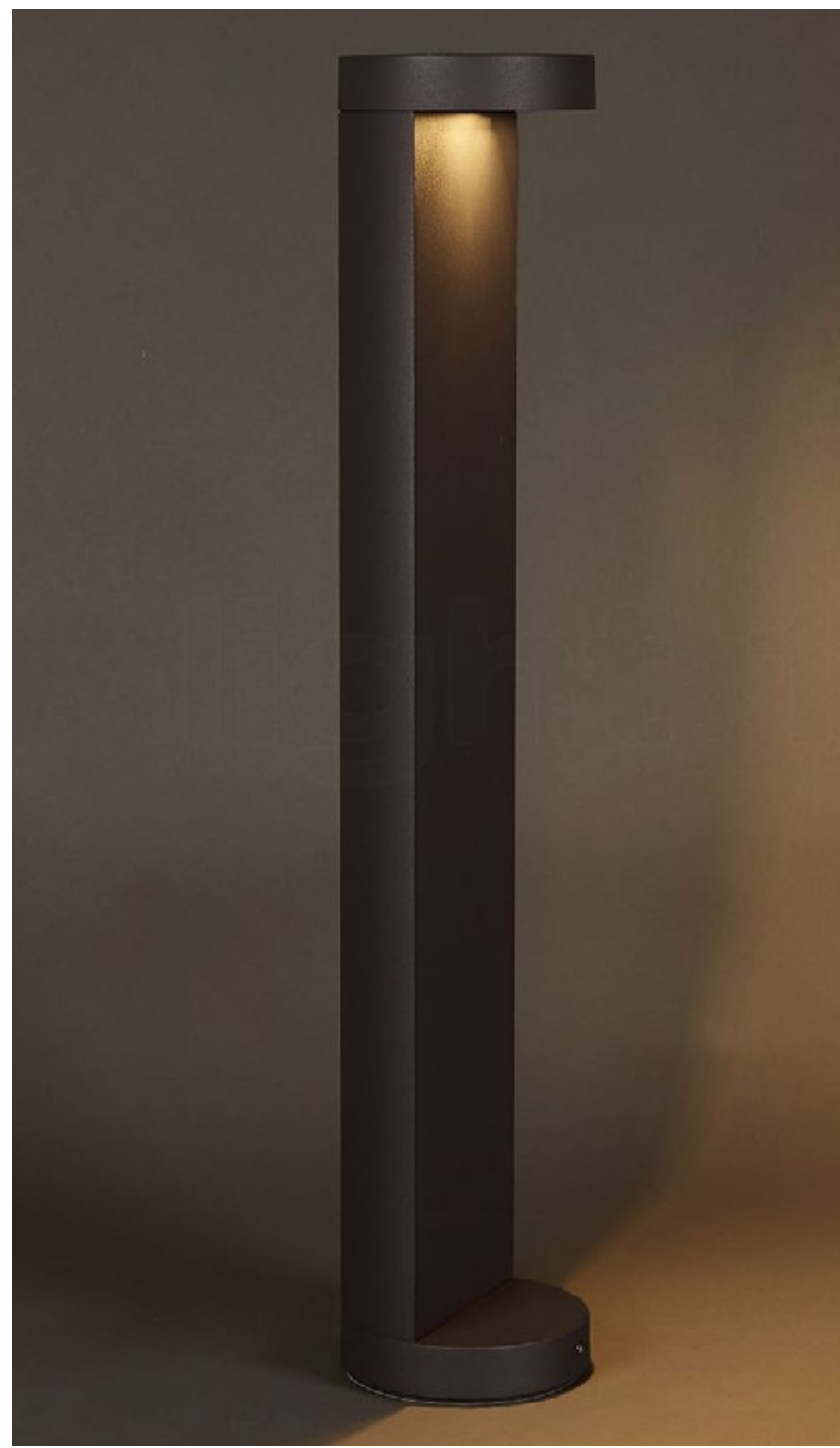
Boston Properties
Needham, MA

PROPOSED PLAN RENDERING

OCTOBER 19, 2020







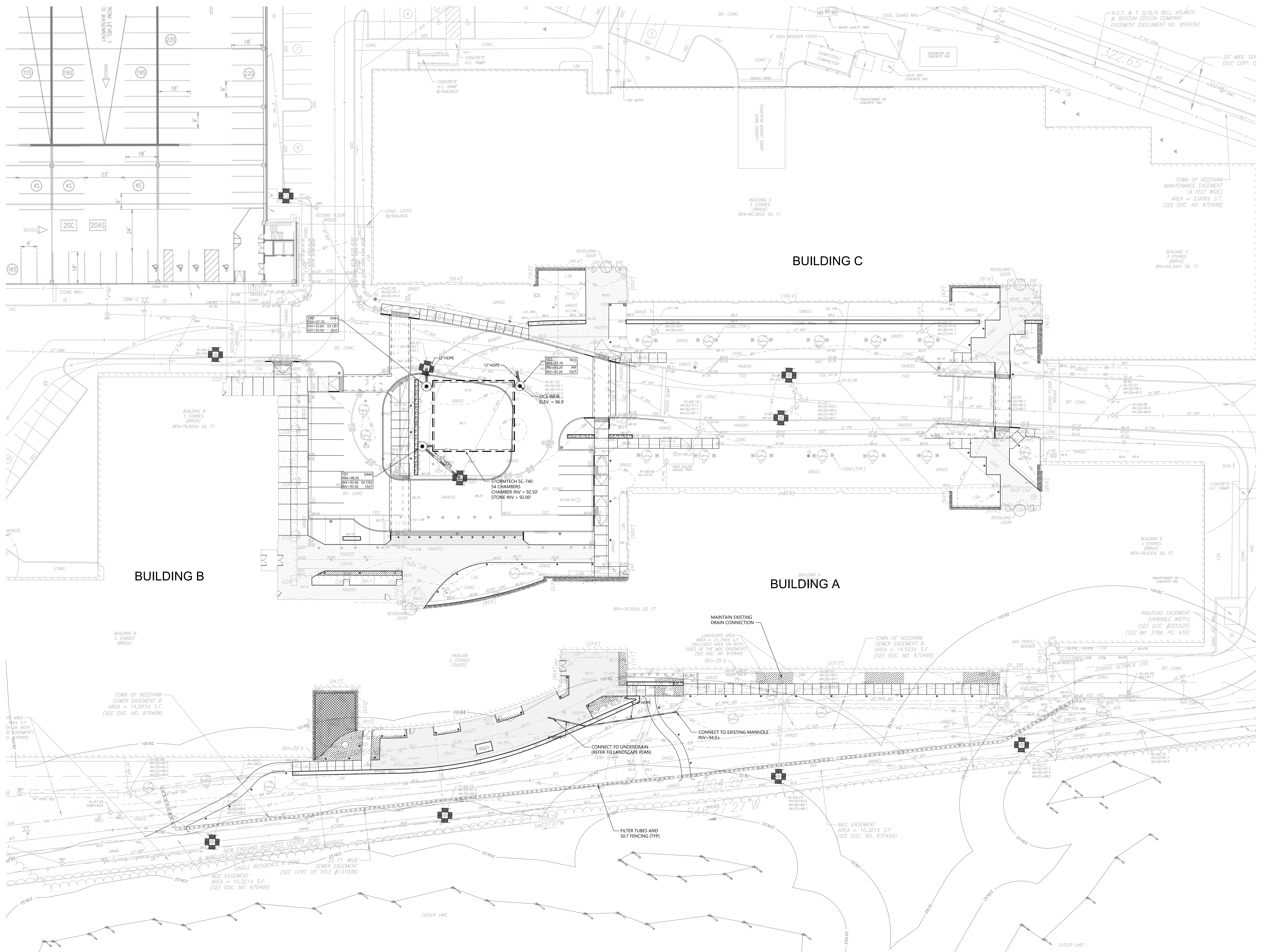
Copley Wolff Design Group
Landscape Architects & Planners

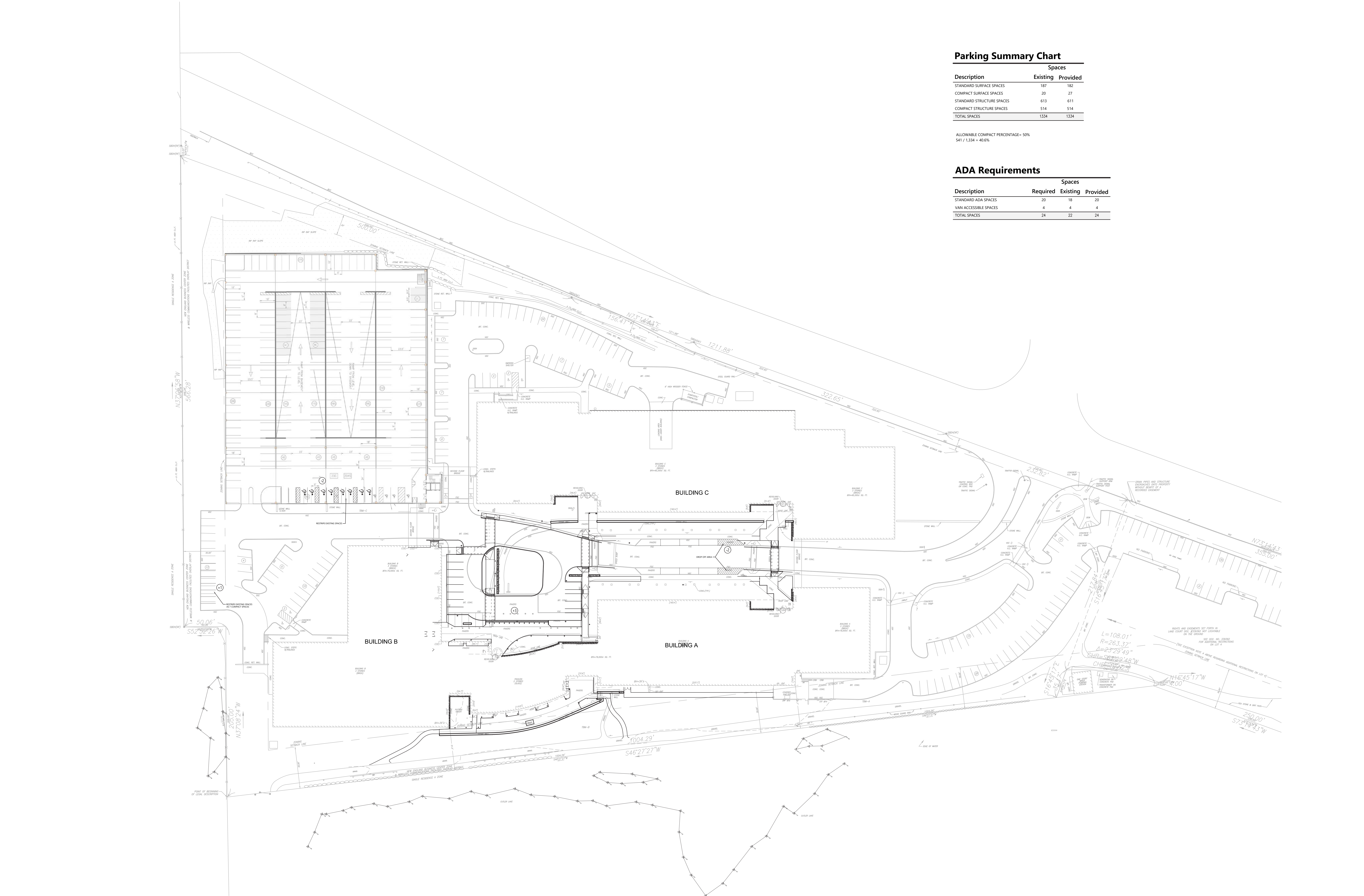
140 KENDRICK STREET

Boston Properties
Needham, MA

AMENITY PRECEDENT PHOTOS - TERRACE, TECHNOLOGY, PATHWAY LIGHTING, PERMEABLE PAVERS, FIRE TABLE

OCTOBER 19, 2020





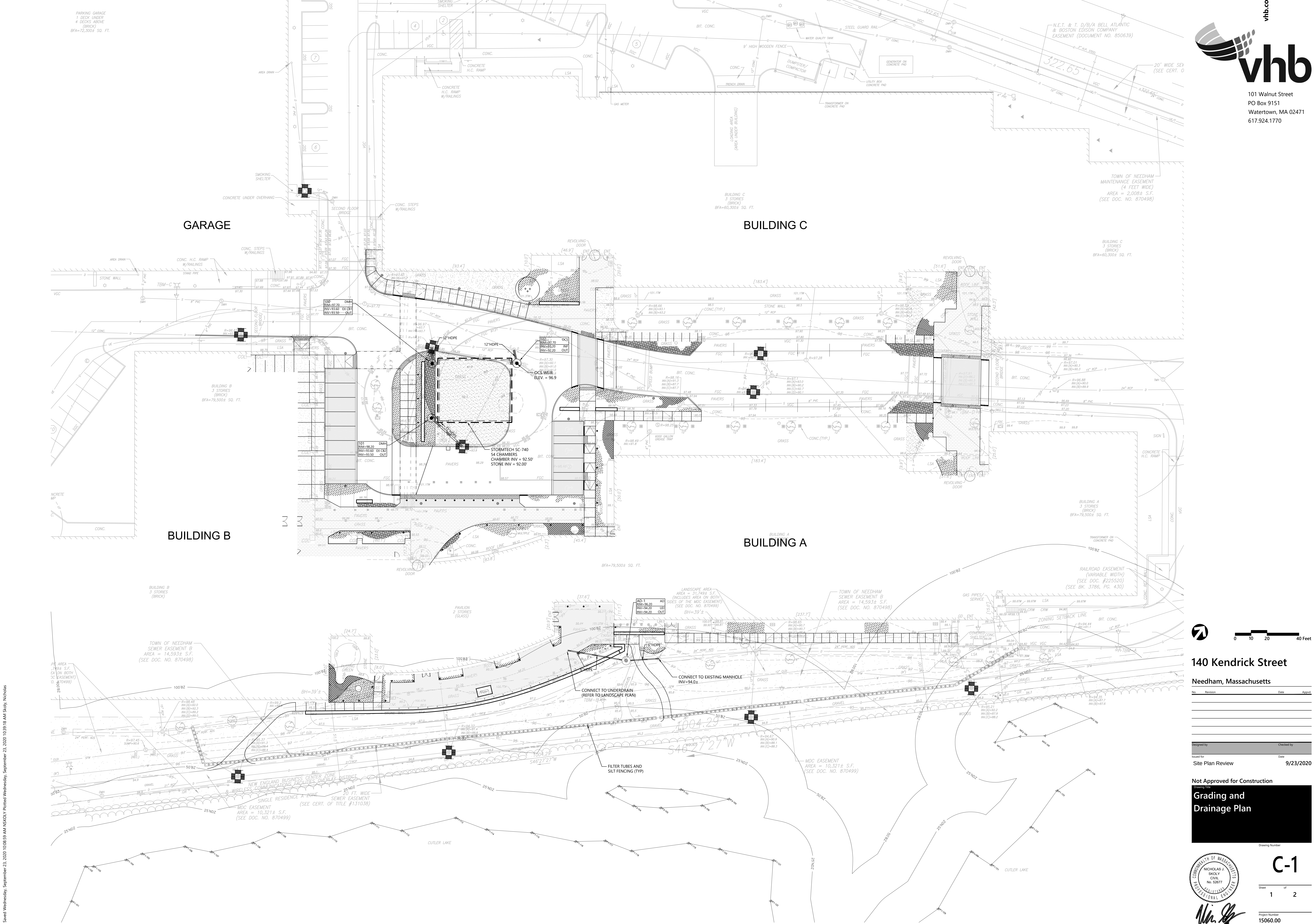
Parking Summary Chart

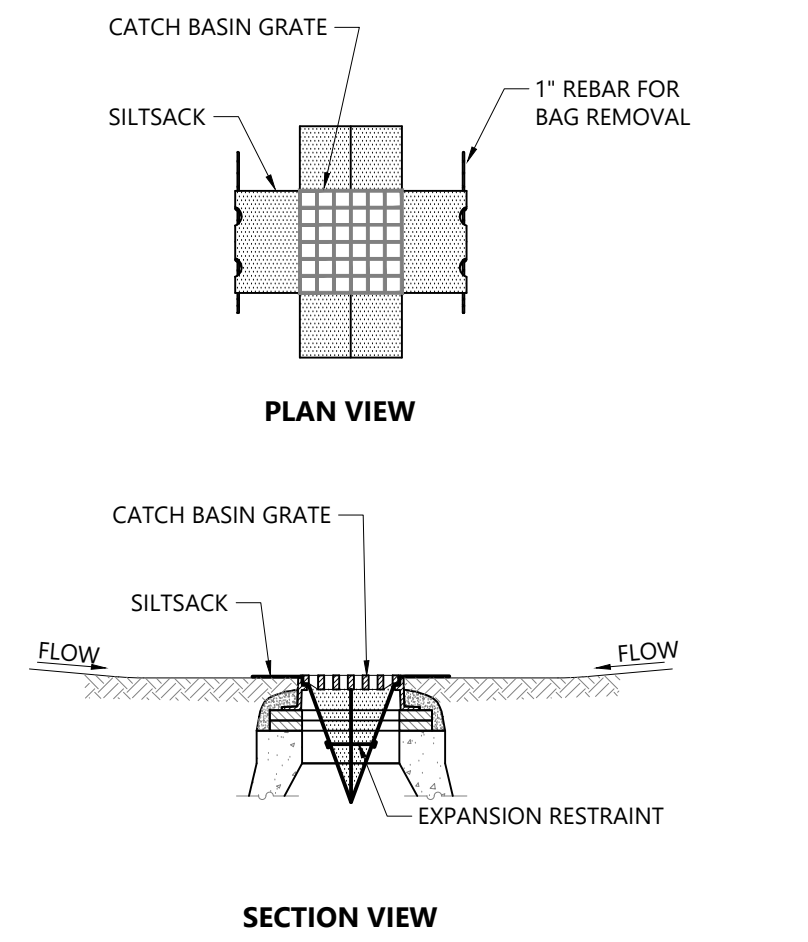
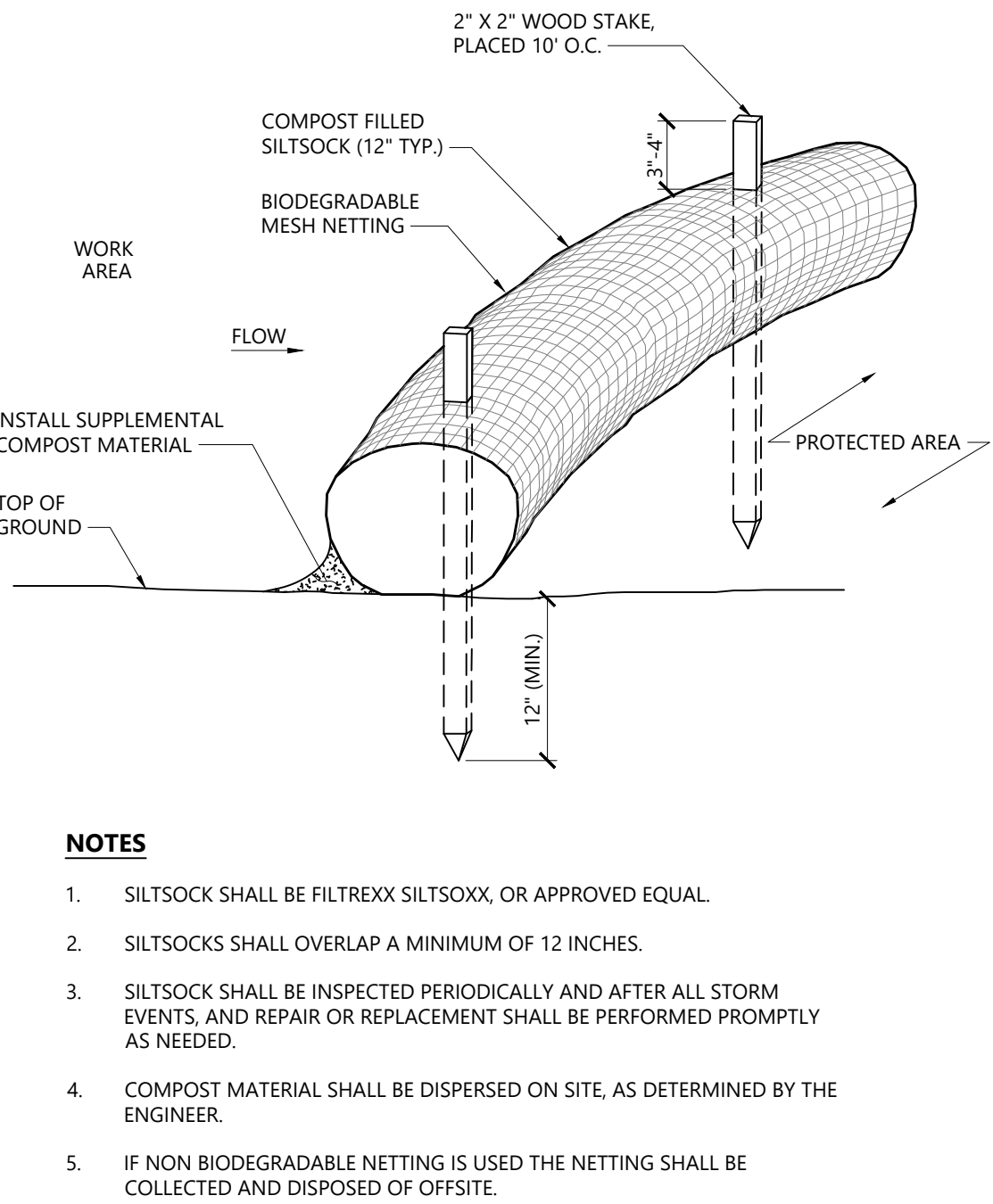
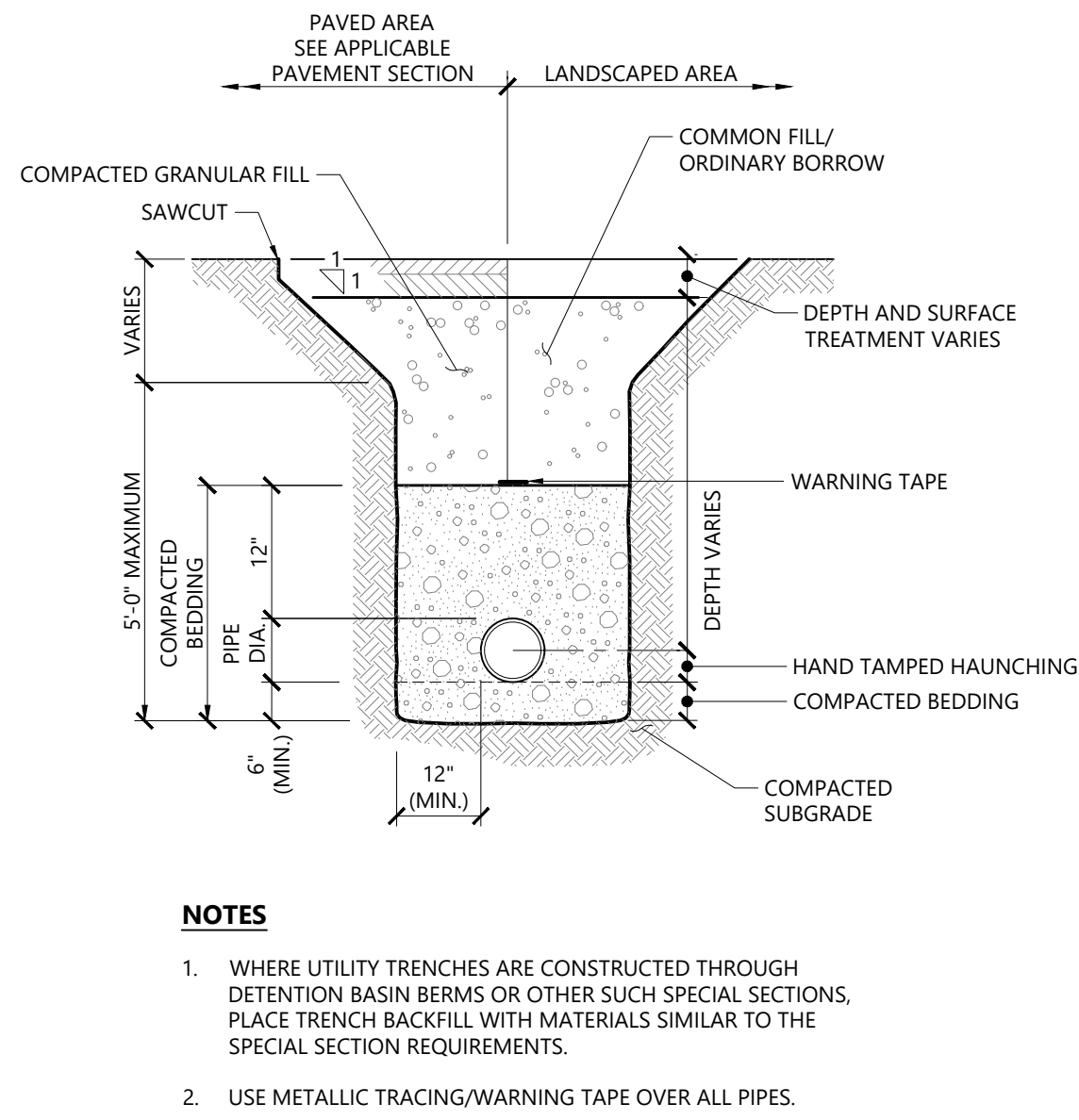
Description	Spaces	
	Existing	Provided
STANDARD SURFACE SPACES	187	182
COMPACT SURFACE SPACES	20	27
STANDARD STRUCTURE SPACES	613	611
COMPACT STRUCTURE SPACES	514	514
TOTAL SPACES	1334	1334

ALLOWABLE COMPACT PERCENTAGE= 50%
541 / 1,334 = 40.6%

ADA Requirements

Description	Spaces		
	Required	Existing	Provided
STANDARD ADA SPACES	20	18	20
VAN ACCESSIBLE SPACES	4	4	4
TOTAL SPACES	24	22	24

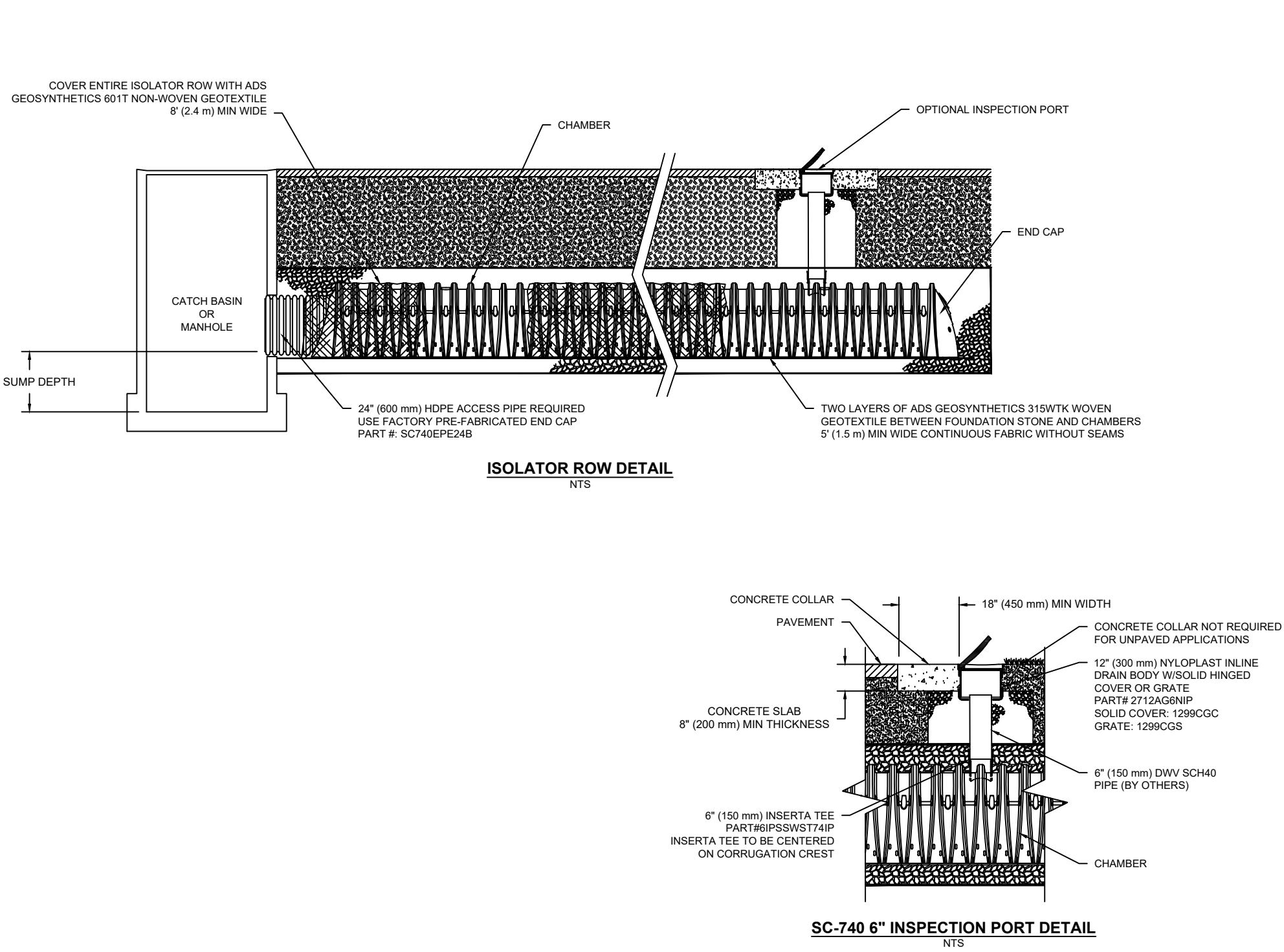




Utility Trench 1/1/1
 N.T.S. Source: VHB LD_301

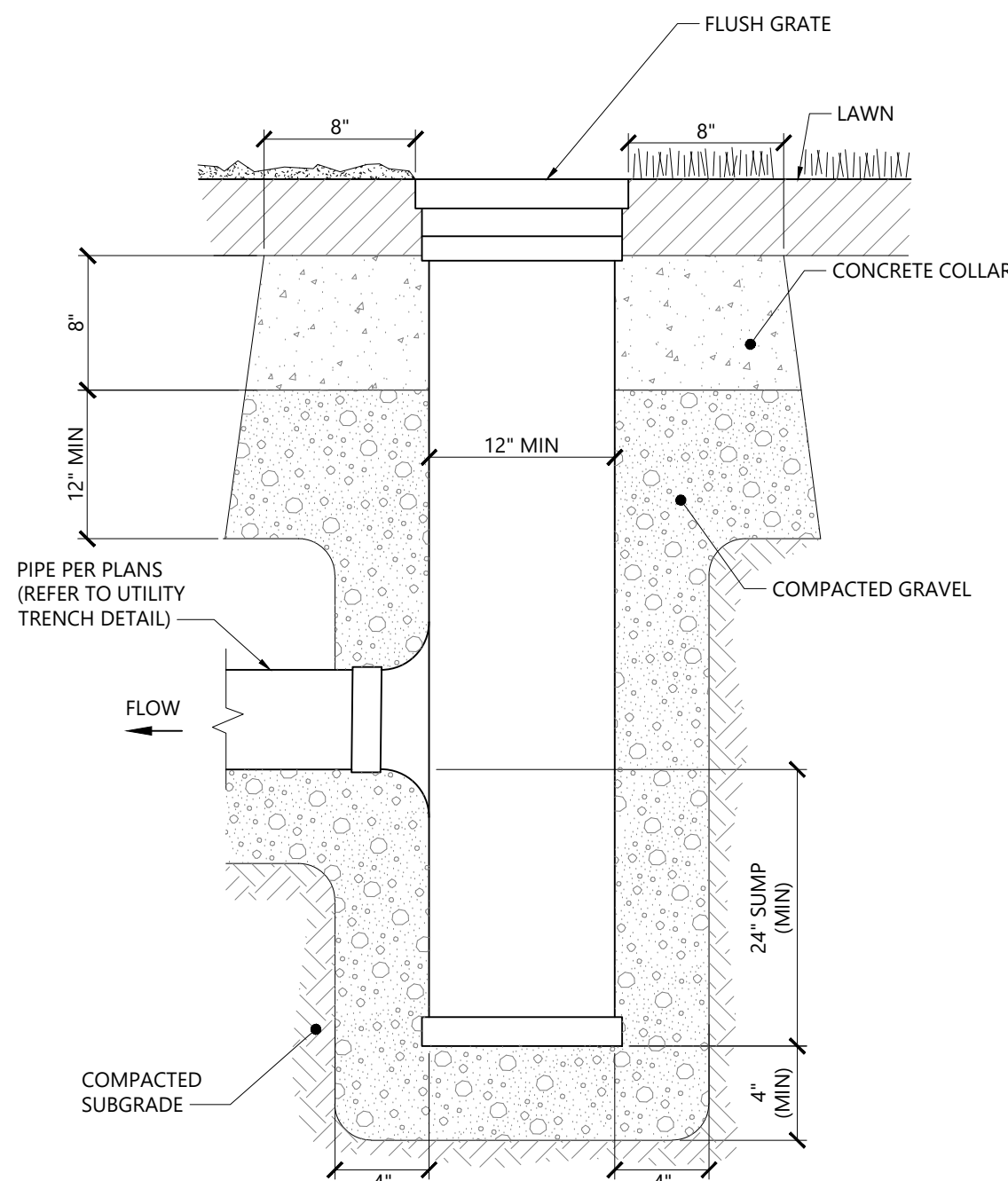
Siltsock - Erosion Control Barrier		1/16
N.T.S.	Source: VHB	LD_658

Siltsack Sediment Trap		1/16
N.T.S.	Source: VHB	LD_674



Isolator Row Profile

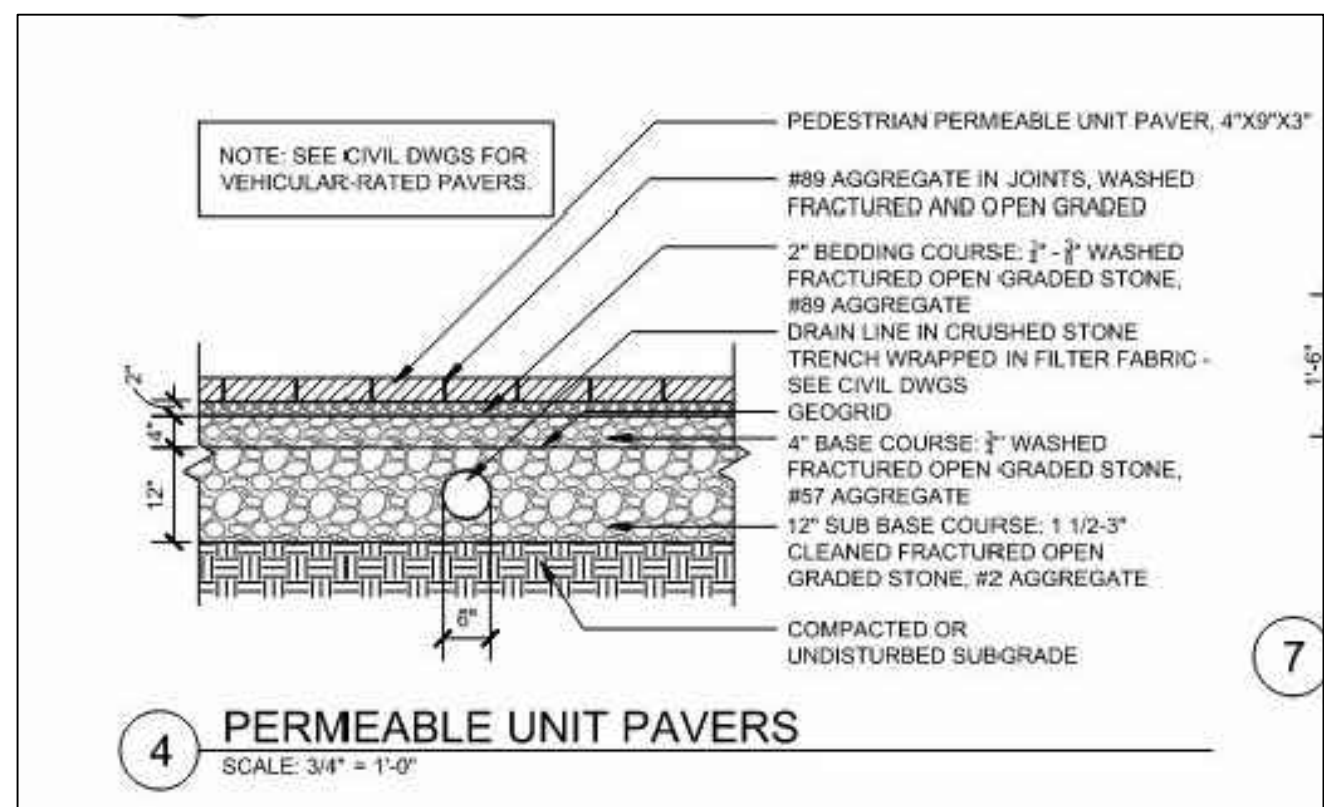
N.T.S. Source: StormTech



NOTES:

1. LANDSCAPE DRAINS SHALL BE NYLOPLAST 12" DRAIN BASIN, OR APPROVED EQUAL.
2. GRATES SHALL BE NYLOPLAST, 12" FLUSH GRATE OR APPROVED EQUAL AS SHOWN ON PLANS.

Area Drain (AD)		9/17
N.T.S.	Source: VHB	LD_197



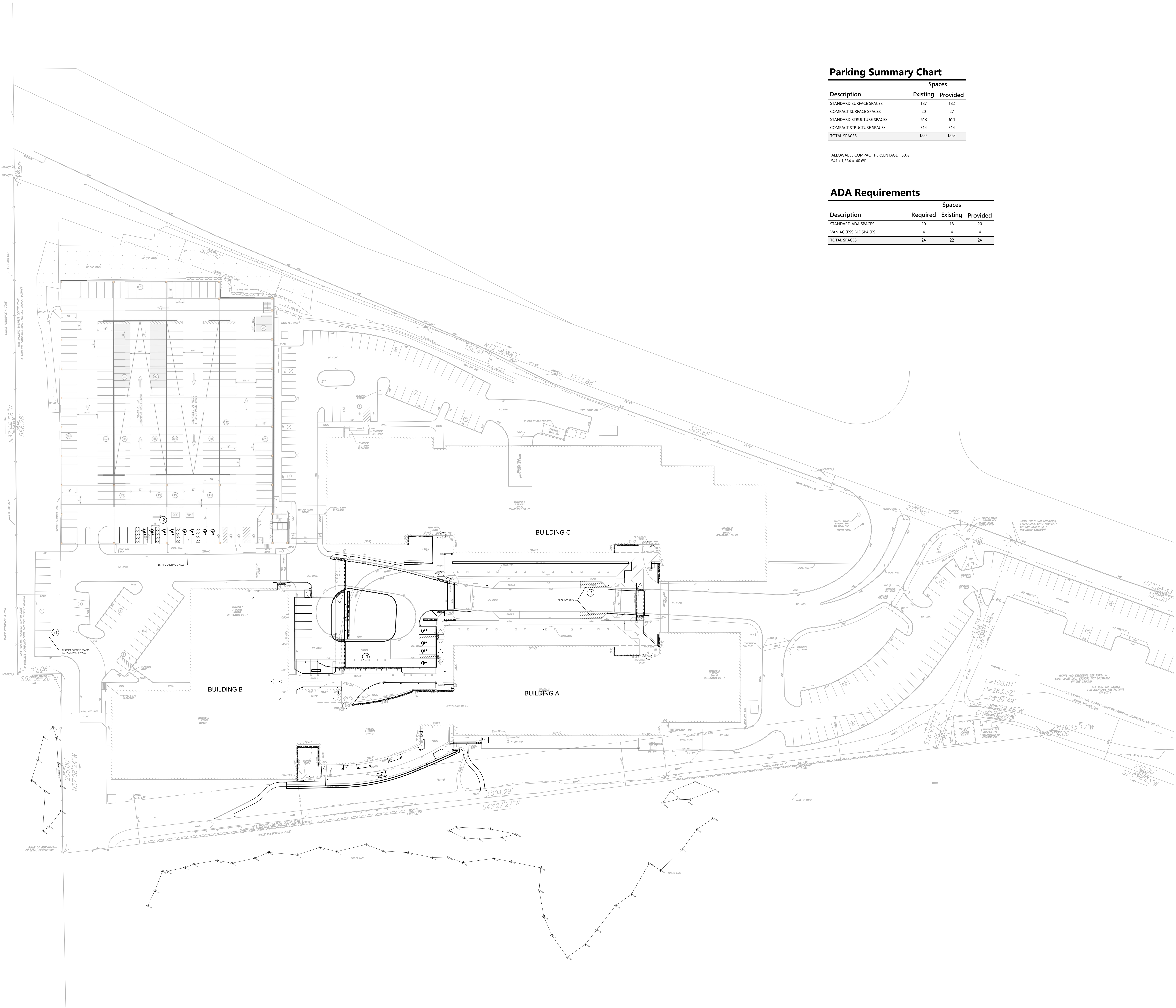
Parking Summary Chart

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STANDARD SURFACE SPACES	187	182
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140 Kendrick Street

Needham, Massachusetts

No.	Revision	Date	App'd.
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Designed by _____ Checked by _____

Issued for _____ Date _____

Site Plan Review 9/23/2020

Not Approved for Construction

Drawing Title

Parking Plan

Drawing Number

C-3

Sheet 3 of 2

Project Number 15060.00

LANDSCAPE MATERIAL NOTES

1. THE CONTRACTOR SHALL REVIEW ALL DRAWINGS AND NOTES TO DETERMINE THE TOTAL SCOPE OF WORK AND ALL REQUIRED COORDINATION.
2. THE CONTRACTOR IS RESPONSIBLE FOR A THOROUGH SITE EXAMINATION TO SATISFY HIM OR HERSELF AS TO THE ACTUAL SITE CONDITIONS BEFORE SUBMISSION OF BIDS.
3. CONTRACTOR SHALL VERIFY ALL EXISTING UTILITY LOCATIONS PRIOR TO EXCAVATION.
4. CONTRACTOR SHALL ARRANGE PRE-INSTALLATION CONFERENCES AT PROJECT SITE FOR STONE WALLS AND PAVEMENT WORK. ATTENDEES SHALL INCLUDE OWNER'S REPRESENTATIVE, LANDSCAPE ARCHITECT, GENERAL CONTRACTOR AND ALL SUB-CONTRACTORS DIRECTLY CONCERNED WITH THE WORK.
5. CONTRACTOR SHALL PREPARE SUBMITTALS TO THE LANDSCAPE ARCHITECT FOR ALL COMPONENTS OF THE FINISHED WORK, INCLUDING SHOP DRAWINGS, PRODUCT DATA, MATERIAL CERTIFICATIONS, MIX DESIGNS AND SAMPLES.
6. CONTRACTOR SHALL FURNISH AND INSTALL CONSTRUCTED SAMPLES (MOCK-UPS) DEMONSTRATING ALL COMPONENTS OF THE DESIGN, INCLUDING FINISHED EXPOSED EDGES AND SURFACES, COLORS AND JOINTING FOR REVIEW AND APPROVAL BY THE LANDSCAPE ARCHITECT PRIOR TO CONSTRUCTING FINAL WORK. MOCK-UPS MAY BE PART OF THE FINAL CONSTRUCTION. MOCK-UPS SHALL BE MAINTAINED AND PROTECTED THROUGHOUT THE DURATION OF THE PROJECT AND WILL SERVE AS PROJECT STANDARD. CONTRACTOR SHALL DEMOLISH AND RECONSTRUCT MOCK-UP UNTIL APPROVAL FROM LANDSCAPE ARCHITECT. MOCK-UPS SHALL INCLUDE: ONE FULL HEIGHT AND WIDTH BY 6' LONG STONE WALL SECTION AND ONE 6' X 6' PANEL OF CONCRETE PAVEMENT.
7. THE DIMENSIONS OF PAVEMENT JOINTS AS SHOWN ON THE DRAWINGS ARE TO THE CENTER LINE OF EACH TYPE OF JOINT EXCEPT WHERE PAVEMENT MEETS A VERTICAL FACE; AT THIS LOCATION DIMENSIONS ARE TO THE VERTICAL FACE. THE DIMENSIONS SHOWN ON DRAWINGS SHOW DESIGN INTENT AND MUST BE FIELD VERIFIED PRIOR TO PREPARATION OF SHOP DRAWINGS. ALL ALIGNMENTS SHALL BE INSTALLED AS SHOWN.
8. THE CONTRACTOR SHALL BE RESPONSIBLE FOR DOCUMENTING THE LOCATIONS OF ALL EXISTING SITE ELEMENTS TO BE RESET IN THEIR SAME HORIZONTAL LOCATION.
9. THE CONTRACTOR IS RESPONSIBLE FOR ALL DAMAGE INSIDE OR OUTSIDE OF LIMIT OF WORK LINE DUE TO HIS/HER CONSTRUCTION OPERATIONS.
10. STORAGE AREAS FOR THE GENERAL CONTRACTOR'S EQUIPMENT AND MATERIALS SHALL BE LOCATED WITHIN THE LIMITS OF WORK AS APPROVED BY THE LANDSCAPE ARCHITECT.
11. WHERE NEW PAVING MEETS EXISTING PAVING, MEET LINE AND GRADE OF EXISTING WITH NEW CONSTRUCTION.
12. AT ALL LOCATIONS WHERE EXISTING BITUMINOUS CONCRETE PAVEMENT ABUTS NEW CONSTRUCTION, THE EDGE OF THE EXISTING PAVEMENT SHALL BE SAW CUT TO A CLEAN SMOOTH EDGE.
13. ALL EXISTING LIGHT POLES AND LIGHT BOLLARDS SHALL BE SAVED FOR OWNER FOR RELOCATION
14. EXISTING LIGHTS AND FLAG POLES SHALL BE SAVED FOR OWNER

MATERIALS LEGEND

CONCRETE PAVING

UNIT PAVERS TYPE 1

PERMEABLE UNIT PAVERS TYPE 2

UNIT PAVERS TYPE 3

STONE DUST PATH

STONE WALL, EXISTING TO REMAIN

STONE WALL, PROPOSED

FIRE PIT IN TABLE

EX-1 WALL WASH LIGHT - MP LIGHTING L01

EX-3 TREE UPLIGHT - BK LIGHTING DELTA STAR

EX-4 BOLLARD LIGHT - BEGA 99058

EX-6 TAPE LIGHT BELOW FIRE PIT - OPTIC ARTS FLEX AC 4

EX-6 POLE LIGHT, MATCH EXISTING. SEE CIVIL DRAWINGS

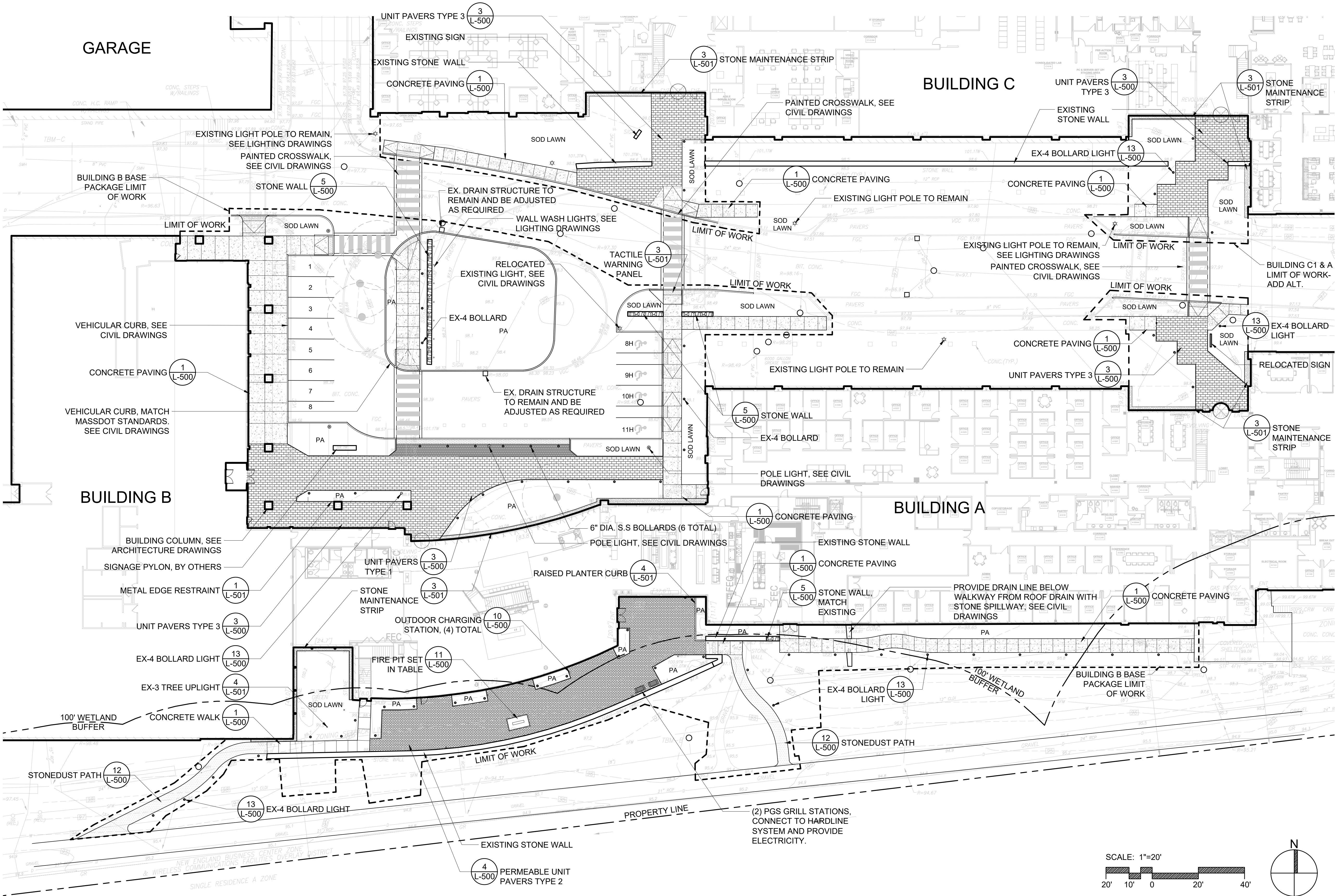
EXISTING POLE FIXTURE

PA PLANTING

PAVER SCHEDULE - HANOVER

TYPE	PRODUCT	PERMEABILITY	SIZE (LXWXD)	COLOR	TOTAL SF
1	PREST PAVERS	NON-PERMEABLE	3.25" X 18" X 4"	STANDARD/TUDOR FINISH	395
2	PERMEABLE 12" X 18"	PERMEABLE	12" X 18" X 4"	STANDARD/TUDOR FINISH	3,350
3	PREST PAVERS	NON-PERMEABLE	12" X 36" X 4"	STANDARD/TUDOR FINISH	7,035

1. ALL CONCRETE PAVERS WILL BE SELECTED FROM THE RANGE OF STANDARD MANUFACTURER COLORS
2. ALL PAVERS SHALL BE GAUGED



Consultant

Notes

DESIGN PACKAGE	2/20/2012
SCHEMATIC DESIGN	2/20/2012
Issued/Revision	XXXXMMDD

Permit/Seal

PRELIMINARY
NOT FOR
CONSTRUCTION

Scale 1"=20'-0"
Project No. 2012

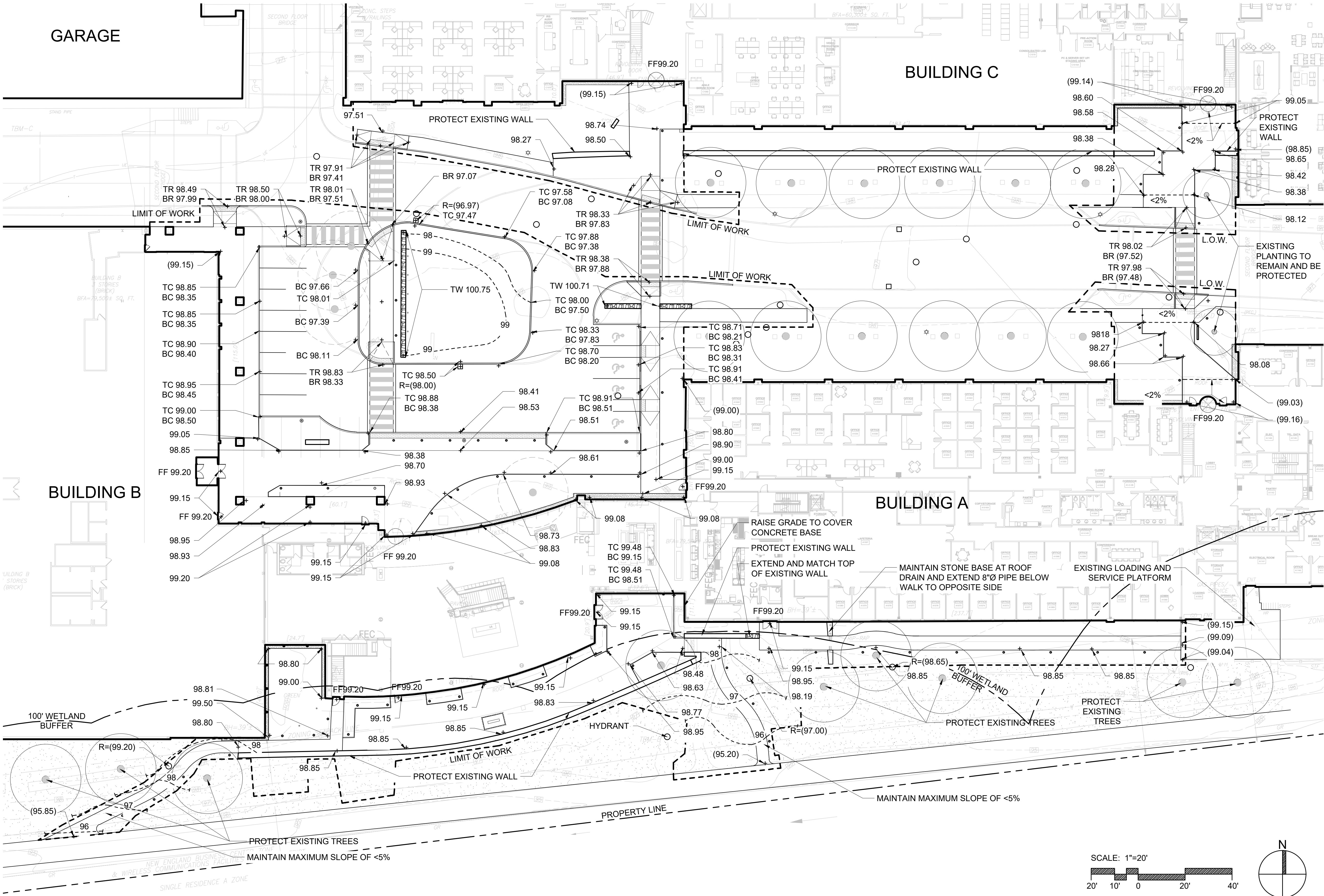
LANDSCAPE
MATERIALS PLAN

L-100

1. SEE CIVIL ENGINEERING PLANS FOR FINAL GRADING.
2. PITCH EVENLY BETWEEN SPOT GRADES. ALL PAVING AREAS MUST PITCH TO DRAIN AT MIN. PITCH OF $\frac{1}{8}$ " PER FOOT UNLESS OTHERWISE SHOWN. REPORT ANY DISCREPANCIES BETWEEN EXISTING AND PROPOSED SPOT GRADES THAT DO NOT PITCH ACCORDINGLY TO THE LANDSCAPE ARCHITECT BEFORE COMMENCING WORK.
3. WHERE NEW PAVING MEETS EXISTING PAVING, MEET LINE AND GRADE OF EXISTING SMOOTHLY WITH NEW CONSTRUCTION.
4. EXCAVATION ADJACENT TO EXISTING AND PROPOSED UTILITY LINES AND EXISTING TREES SHALL BE DONE BY HAND. CONTRACTOR SHALL PROTECT ALL EXPOSED UTILITIES.
5. THE CONTRACTOR SHALL PROTECT EXISTING UTILITIES, EXISTING STRUCTURES, IMPROVEMENTS, APPURTENANCES AND VEGETATION TO REMAIN. THE CONTRACTOR SHALL REPAIR ANY DAMAGE INCURRED AT NO COST TO OWNER.

6. THE CONTRACTOR SHALL COMPLY WITH ALL REQUIREMENTS OF PERMITS AND LICENSES ISSUED BY THE FEDERAL, STATE AND LOCAL AGENCIES (SEE SPECS).
7. THE CONTRACTOR SHALL COORDINATE ALL SITE UTILITY IMPROVEMENTS WITH THE PROPER AUTHORITIES.
8. MAINTAIN A MAXIMUM OF 1.8% CROSS SLOPE ON ALL PAVED SURFACES, UNLESS OTHERWISE NOTED.
9. ALL MANHOLES, DRAINAGE STRUCTURES, STEAM MANHOLES, ELECTRIC MANHOLE FRAMES AND COVERS WITHIN THE PROJECT WORK AREA SHALL BE ADJUSTED TO FINISH GRADES UNLESS OTHERWISE NOTED.
10. SEE CIVIL ENGINEER'S DRAWINGS FOR GRADING IN VEHICULAR AREAS, SIDEWALKS, AND ACCESSIBLE CURB RAMPS.

+ (XX.XX)	EXISTING SPOT GRADE (SEE CIVIL/SURVEY DRAWINGS)
+ 15.92	PROPOSED SPOT GRADE
FFE	FINISH FLOOR ELEVATION
TC / BC	TOP/BOTTOM OF CURB
FC	FLUSH CURB
TW / BW	TOP/BOTTOM OF WALL
+ HP	HIGH POINT
+ LP	LOW POINT



Issued/Revision		YYYY.MM.DD
2	DESIGN PACKAGE	2020.09.01
1	SCHEMATIC DESIGN	2020.08.20

Permit/Seal

**PRELIMINARY
NOT FOR
CONSTRUCTION**

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Project No.	20

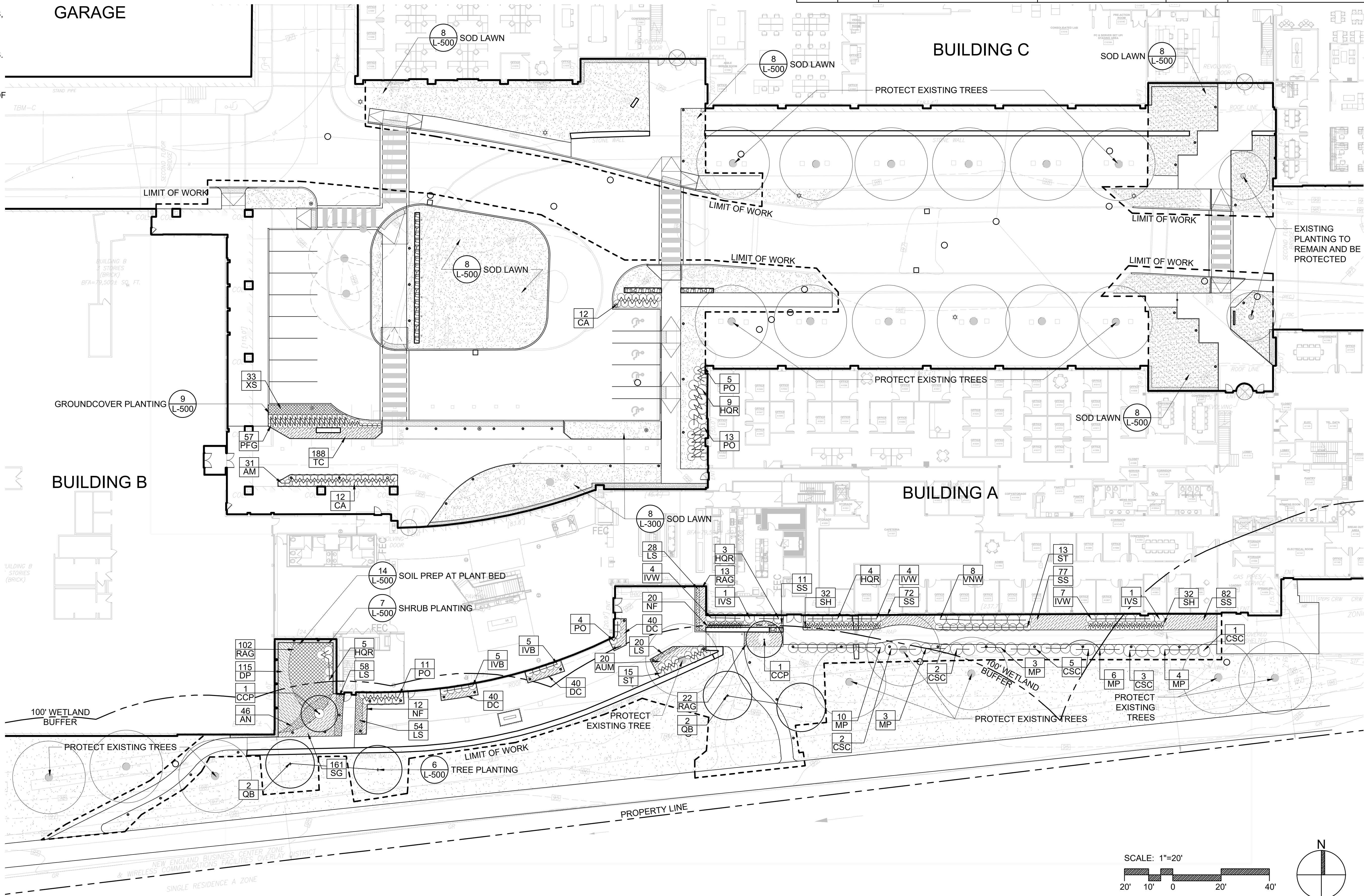
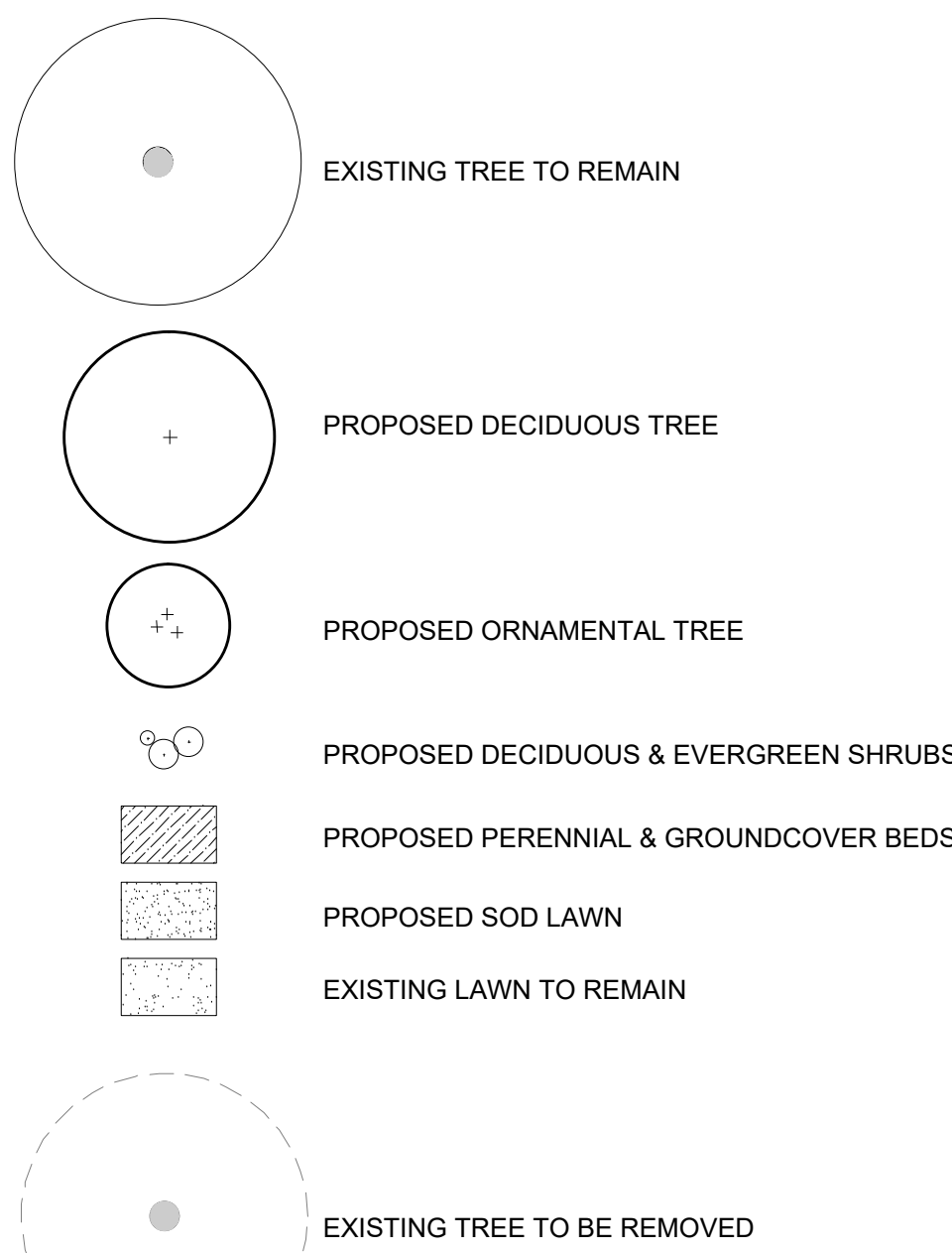
LANDSCAPE
GRADING PLAN

L-300

PLANTING AND SOIL NOTES

- IF DISCREPANCIES EXIST BETWEEN THE NUMBER OF PLANTS DRAWN ON THE PLANTING PLAN AND THE NUMBER OF PLANTS IN THE PLANT LIST, THE PLANTING PLAN SHALL GOVERN.
- ALL NEW PLANT MATERIAL SHALL CONFORM TO THE MINIMUM GUIDELINES ESTABLISHED FOR NURSERY STOCK PUBLISHED BY THE AMERICAN ASSOCIATION OF NURSERYMEN, INC. IN ADDITION, ALL NEW PLANT MATERIAL FOR THE PROJECT SHALL BE OF SPECIMEN QUALITY.
- THE LANDSCAPE ARCHITECT SHALL ONLY REVIEW TREES THAT ARE IN THE GROUND AT THE NURSERY. NO PRE-DUG TREES WILL BE ACCEPTED. THEREFORE TIMING OF IN-GROUND REVIEWS MUST BE COORDINATED WITH EXPECTED INSTALLATION DATES.
- ALL NEW PLANTS TO BE BALLED & BURLAPPED OR CONTAINER GROWN, UNLESS OTHERWISE NOTED ON THE PLANT LIST.
- THE CONTRACTOR SHALL SUPPLY ALL NEW PLANT MATERIAL IN QUANTITIES SUFFICIENT TO COMPLETE THE PLANTING SHOWN ON THE DRAWINGS.
- ANY PROPOSED SUBSTITUTIONS OF PLANT SPECIES SHALL BE MADE WITH PLANTS OF EQUIVALENT OVERALL FORM, HEIGHT, BRANCHING HABIT, FLOWER, LEAF, COLOR, FRUIT AND CULTURE, AND ONLY AFTER WRITTEN APPROVAL OF THE LANDSCAPE ARCHITECT.
- ALL NEW PLANTS SHALL BE TAGGED AND APPROVED BY THE LANDSCAPE ARCHITECT AT THE NURSERY PRIOR TO DIGGING OR DELIVERY TO THE SITE.
- CONTRACTOR SHALL LOCATE AND VERIFY ALL EXISTING UTILITY LINES PRIOR TO PLANTING AND SHALL REPORT ANY CONFLICTS TO THE LANDSCAPE ARCHITECT.
- STAKE LOCATION OF ALL PROPOSED PLANTING FOR APPROVAL BY LANDSCAPE ARCHITECT PRIOR TO THE COMMENCEMENT OF PLANTING.
- NEW SHRUBS AND GROUND COVER SHALL BEAR THE SAME RELATIONSHIP TO GRADE AS IT BORE TO PREVIOUS GRADE. TREES SHALL BE SET 3" HIGHER THAN PREVIOUS GRADE. NO TREES SHALL BE PLANTED BEFORE ACCEPTANCE OF ROUGH GRADING.
- ALL PLANT BEDS TO RECEIVE UN-DYED, AGED AND SHREDDED BARK MULCH AS PER SPECIFICATIONS.
- ALL EXISTING TREES TO REMAIN SHALL BE PROPERLY PROTECTED DURING CONSTRUCTION. PROTECTION TECHNIQUES SHALL BE REVIEWED AND APPROVED BY THE LANDSCAPE ARCHITECT.
- PRUNE TREES IN ACCORDANCE WITH THE SPECIFICATIONS.
- ALL PLANT MATERIAL SHALL BE MAINTAINED BY CONTRACTOR FOR ONE-FULL CALENDAR YEAR AND GUARANTEED FOR ONE-FULL CALENDAR YEAR.
- CONFIRM ALL QUANTITIES AGAINST PLANTING PLANS, GRADING PLANS, AND SPECIFICATIONS, INCLUDING SITE DISTURBANCE OUTSIDE OF THE LIMIT OF GRADING NECESSITATED TO FACILITATE CONSTRUCTION.
- WHERE SAND AND GRAVEL ARE SPECIFIED FOR A DRAINAGE LAYER, EXTEND DRAINAGE LAYER TO ASSOCIATED DRAIN LINES, DRAINAGE AREAS, OR DAYLIGHT.
- WHERE ONE SOIL TYPE MEETS ANOTHER SOIL TYPE, FORM A 1:1 SLOPED BOUNDARY TRANSITION.
- WHERE A SOIL PROFILE ENCROACHES WITHIN THE DRIP LINE OF EXISTING TREES, CONSULT WITH LANDSCAPE ARCHITECT PRIOR TO COMMENCING EXCAVATION.
- ALL EXCAVATION AND PLACEMENT OF SOILS WITHIN THE DRIP LINE OF EXISTING TREES TO BE PERFORMED BY HAND.
- SCARIFY SUBGRADE AS SPECIFIED BEFORE PLACEMENT OF ANY PLANTING SOILS.
- DO NOT PLACE OR HANDLE SOILS THAT ARE WET.
- PROTECT ALL EXISTING SOILS AGAINST COMPACTION, CONTAMINATION WITH CONSTRUCTION MATERIALS, AND ALL DISTURBANCE.
- CONTRACTOR IS RESPONSIBLE FOR ACTUAL SITE CONDITIONS, COORDINATION OF SOILS PLACEMENT, AND PLANTING SUBDRAINAGE.
- DO NOT PLACE ANY PLANTING SOIL PRIOR TO INSPECTION BY LANDSCAPE ARCHITECT.
- SAND BASED STRUCTURAL SOIL (SBSS) WHERE IDENTIFIED SHALL CONSIST OF A MINIMUM OF 1,000 C.F. OF SBSS FOR EACH TREE.
- ALL EXISTING TREES ON SITE SHALL BE PRESERVED AND PROTECTED UNLESS OTHERWISE NOTED.

PLANTING LEGEND



Stantec Architecture and Engineering P.C.
311 Summer Street
Boston, 02210-1723
Tel: (617) 234-3100
www.stantec.com

Consultant



Copley Wolff Landscape Architects
10 Post Office Square
Boston, 02109
Tel: (617) 454-9000
www.copley-wolff.com



Notes

DESIGN PACKAGE	2/20/2012
SCHEMATIC DESIGN	2/20/2012
Issued/Revision	XXXXXX.XX

Permit/Seal

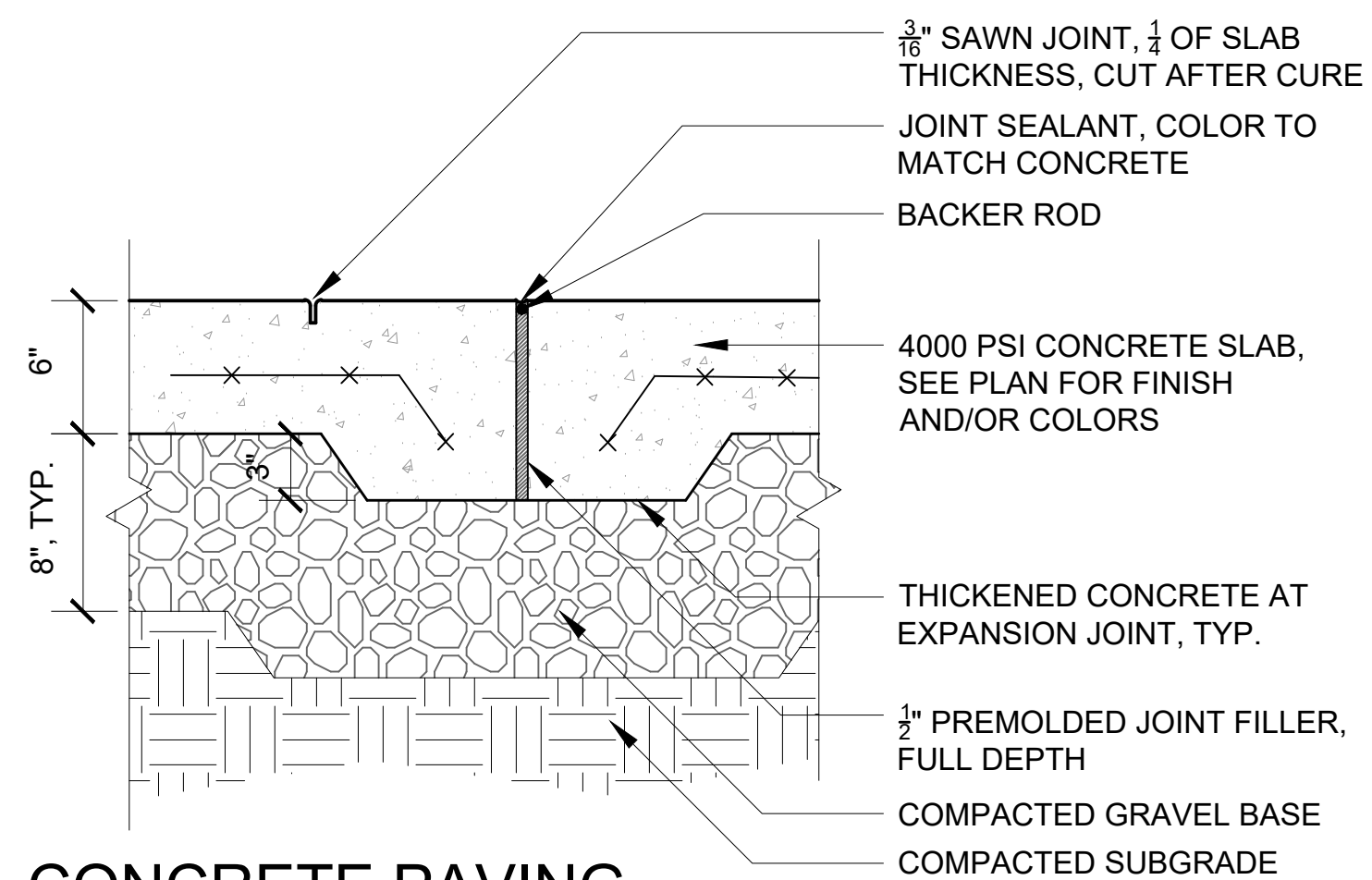
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Scale 1"=20'-0"
Project No. 2012

LANDSCAPE
PLANTING PLAN

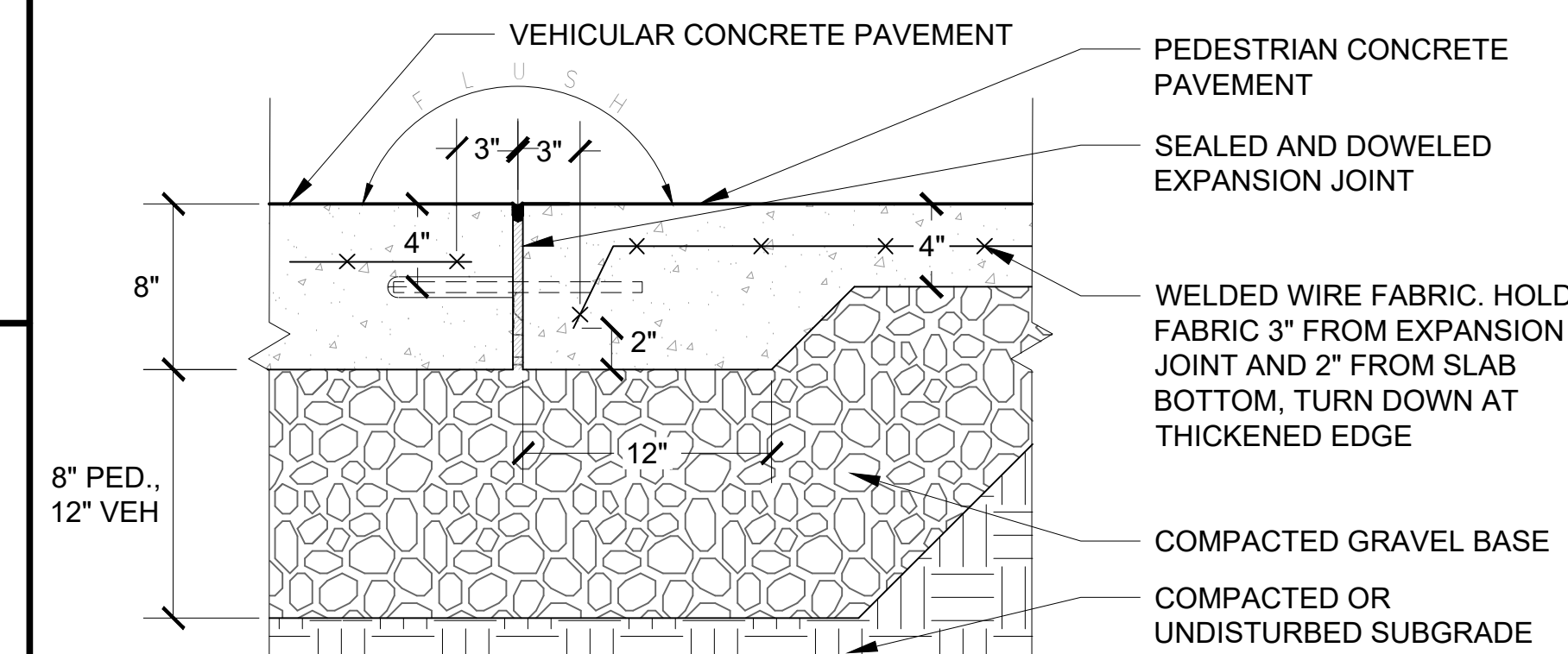
L-400

NOTE:
1. CONTROL JOINTS EVERY 5' UNLESS OTHERWISE SHOWN ON PLAN.
2. EXPANSION JOINTS EVERY 20' UNLESS OTHERWISE SHOWN ON PLAN.
3. PROVIDE 10" DEEP THICKENED EDGE AT PLANTING BEDS, 6" WIDTH.



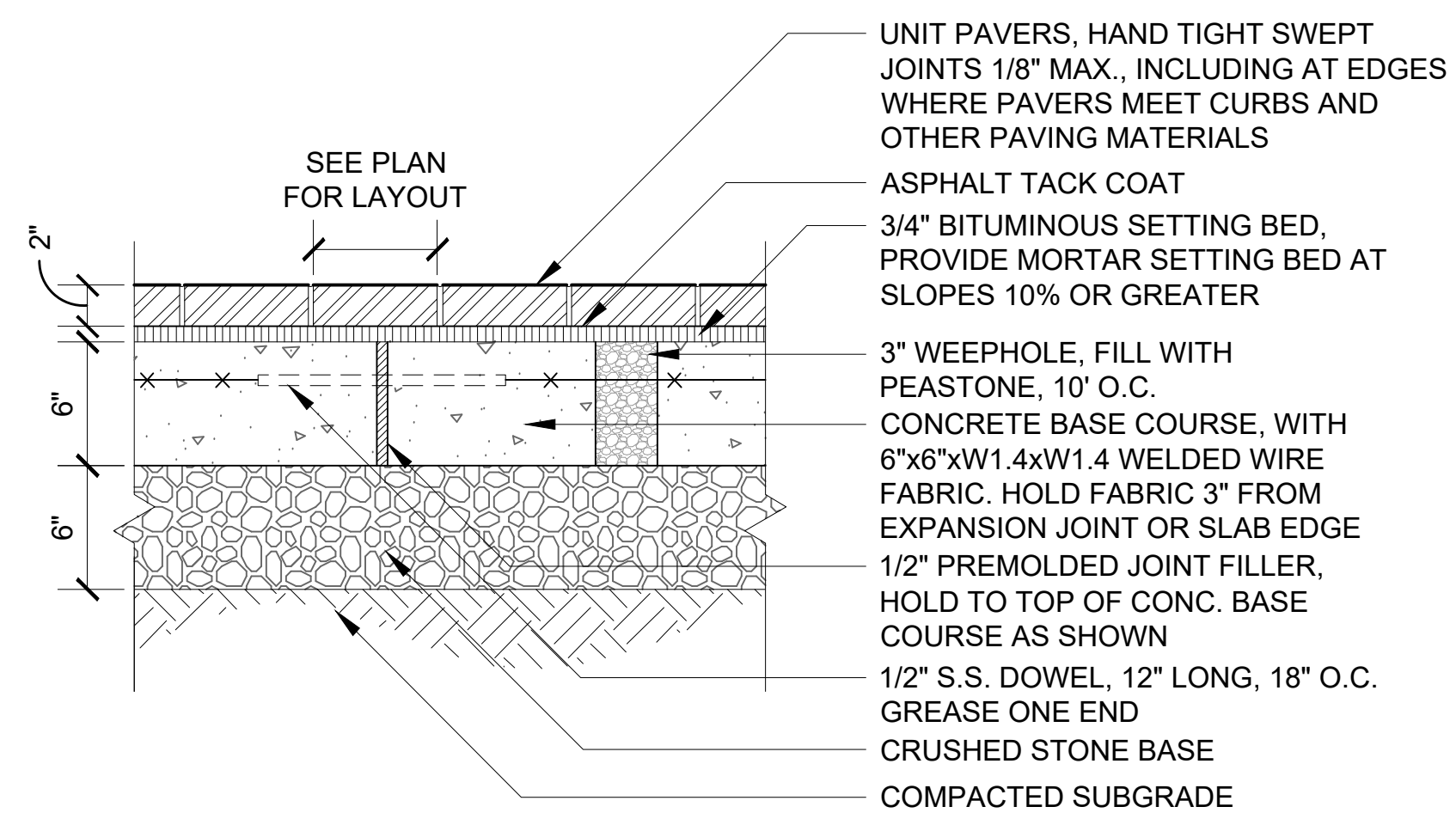
1 CONCRETE PAVING
SCALE: 1-1/2" = 1'-0"

NOTE:
1. PROVIDE EXPANSION JOINTS EVERY 20'-0" UNLESS OTHERWISE NOTED ON THE PLANS.
2. SEE CIVIL DWGS AND SPECS FOR VEHICULAR-RATED CONCRETE PAVEMENT.



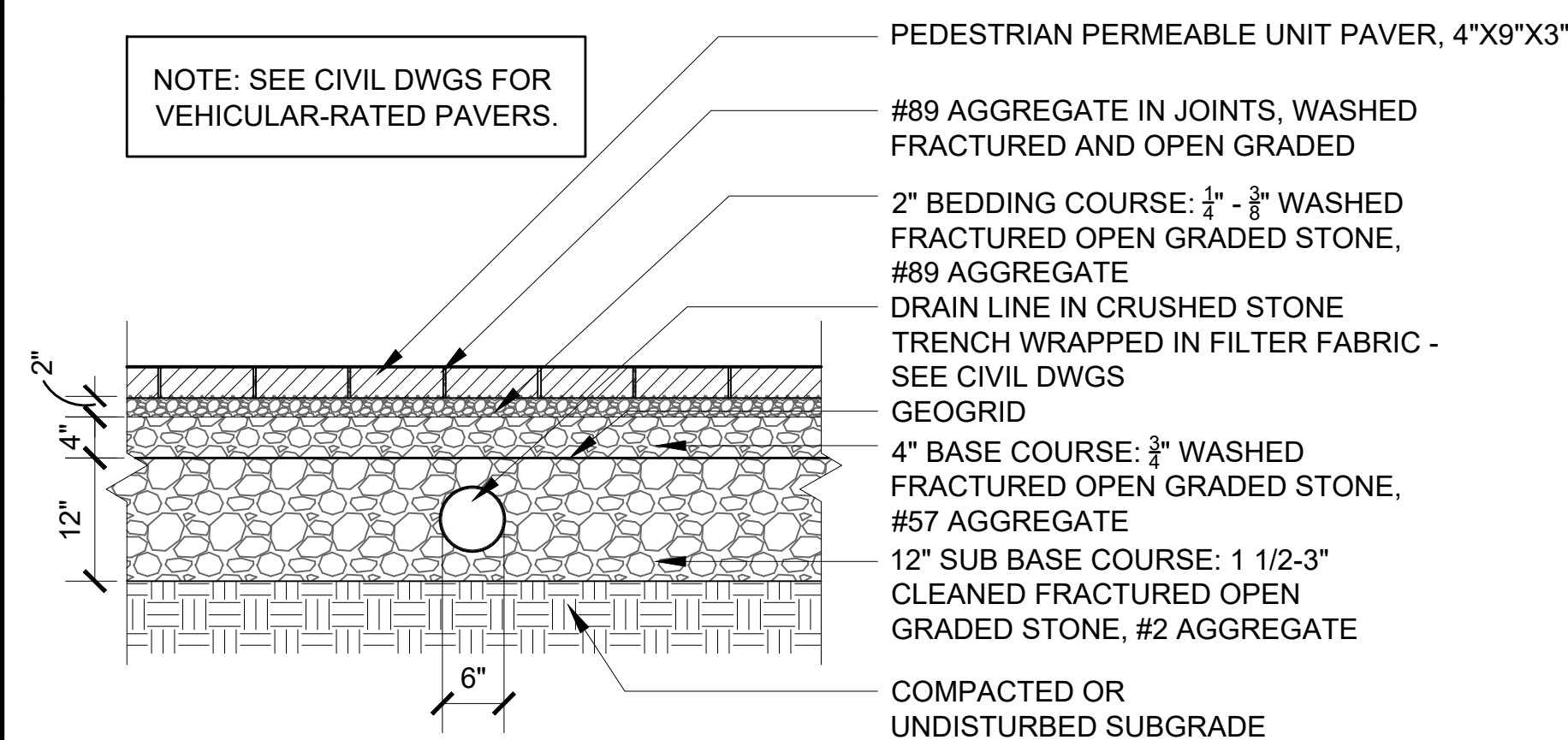
2 JOINT AT CONCRETE PAVEMENT
SCALE: 1-1/2" = 1'-0"

NOTE:
FOR UNIT PAVERS IN VEHICULAR AREAS, COORDINATE BASE COURSE DEPTH WITH PAVEMENT SECTIONS BY CIVIL ENGINEER

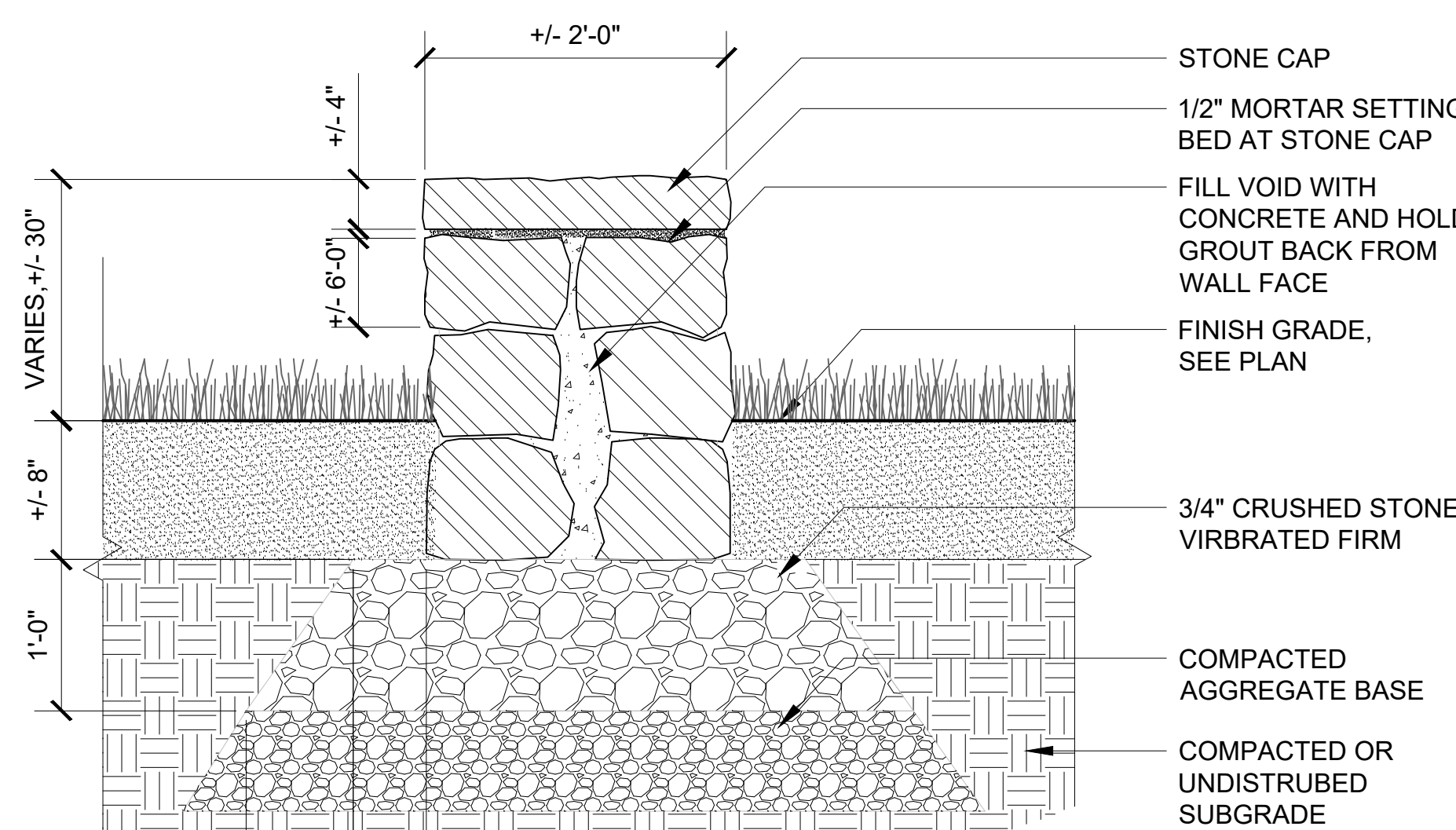


3 UNIT PAVERS
SCALE: 1-1/2" = 1'-0"

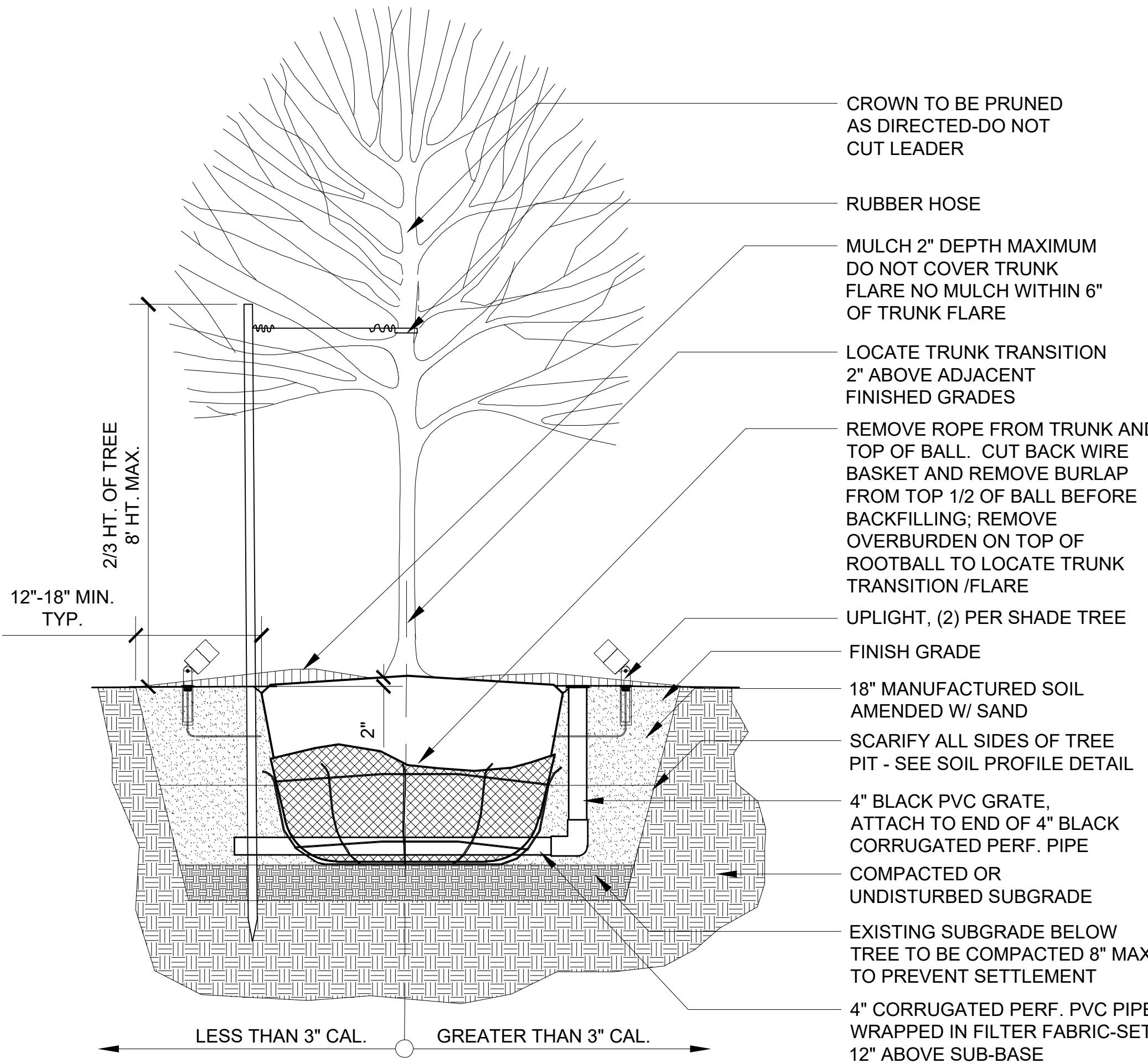
NOTE: SEE CIVIL DWGS FOR VEHICULAR-RATED PAVERS.



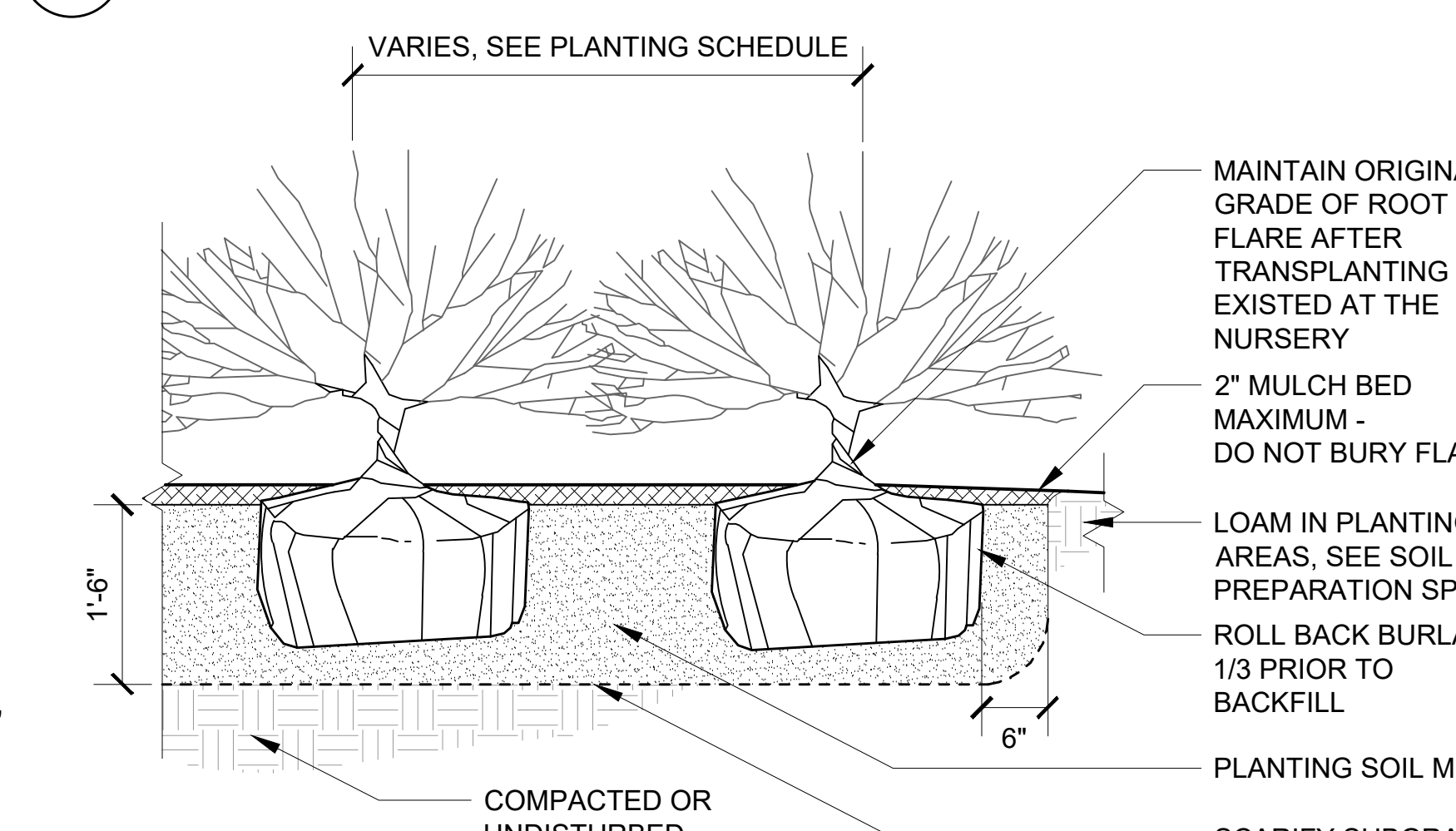
4 PERMEABLE UNIT PAVERS
SCALE: 3/4" = 1'-0"



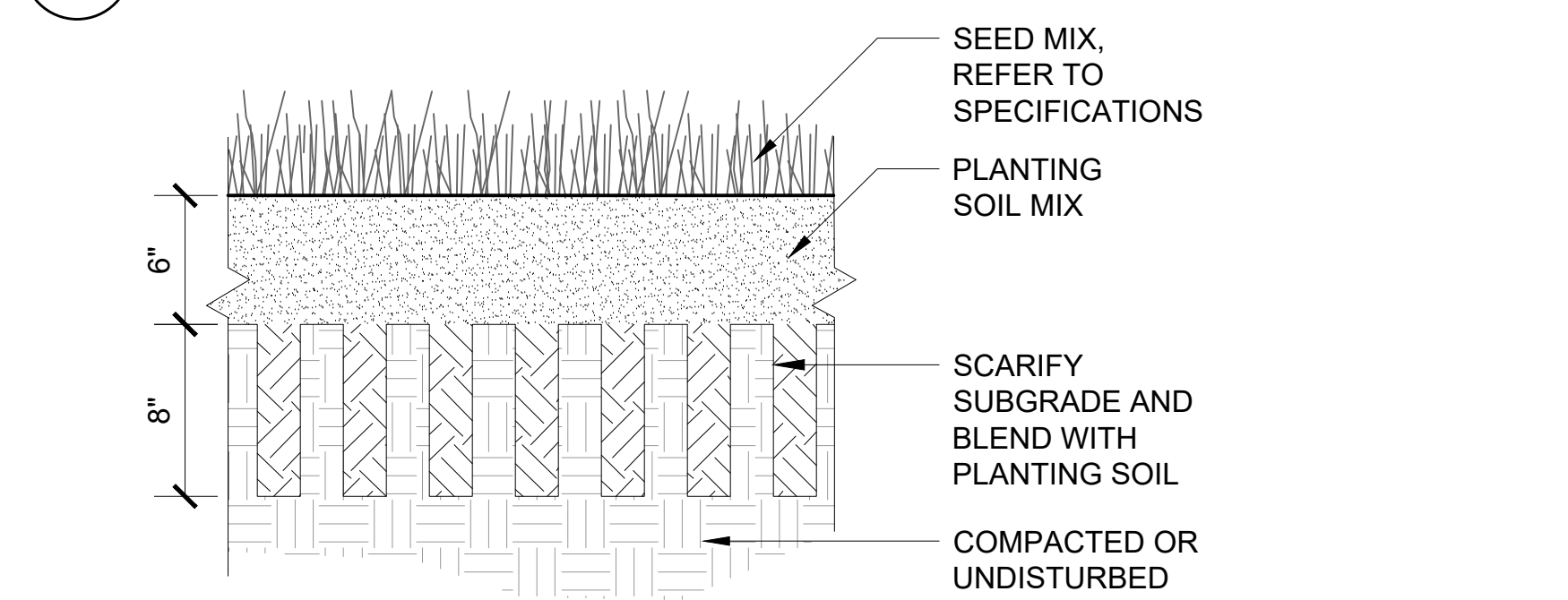
5 STONE WALL
SCALE: 1" = 1'-0"



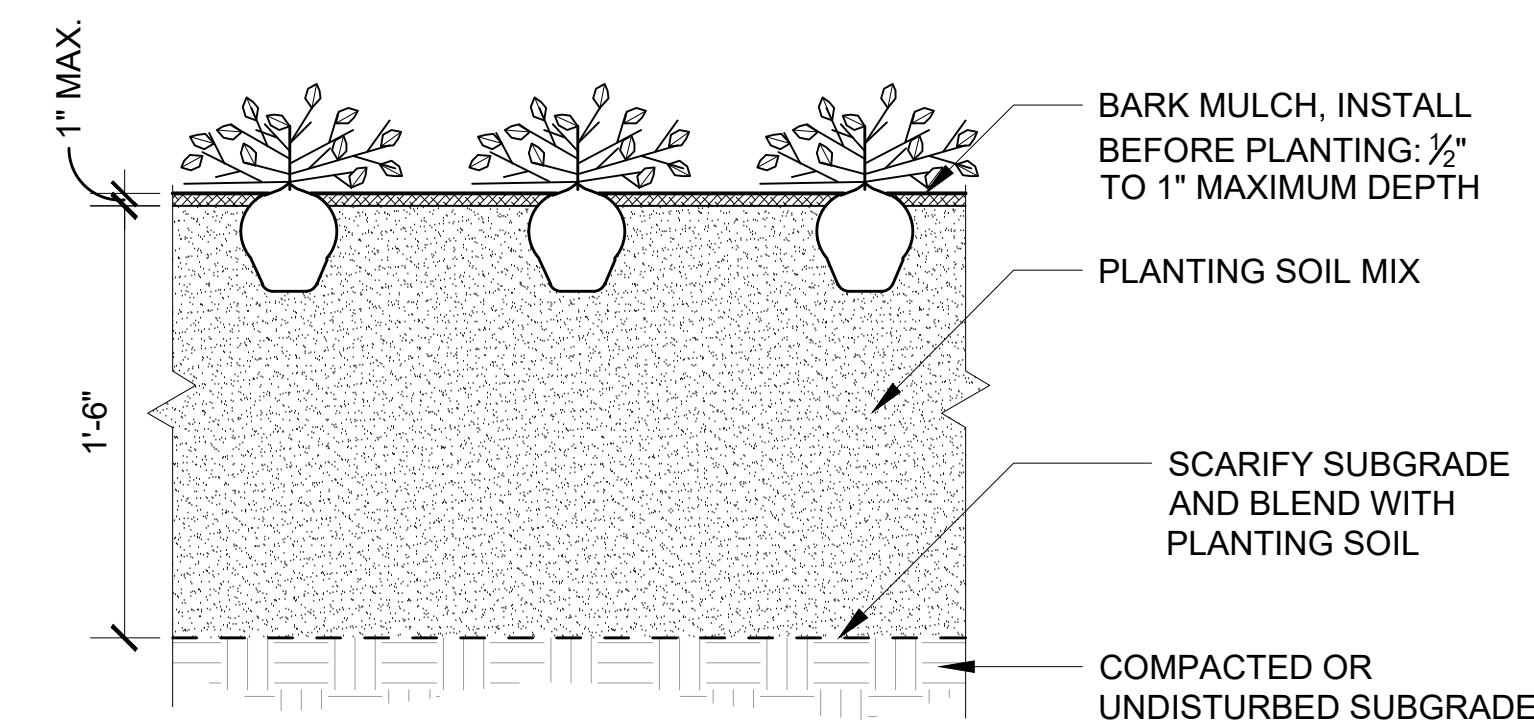
6 TREE PLANTING
SCALE: 1/2" = 1'-0"



7 SHRUB PLANTING
SCALE: 3/4" = 1'-0"

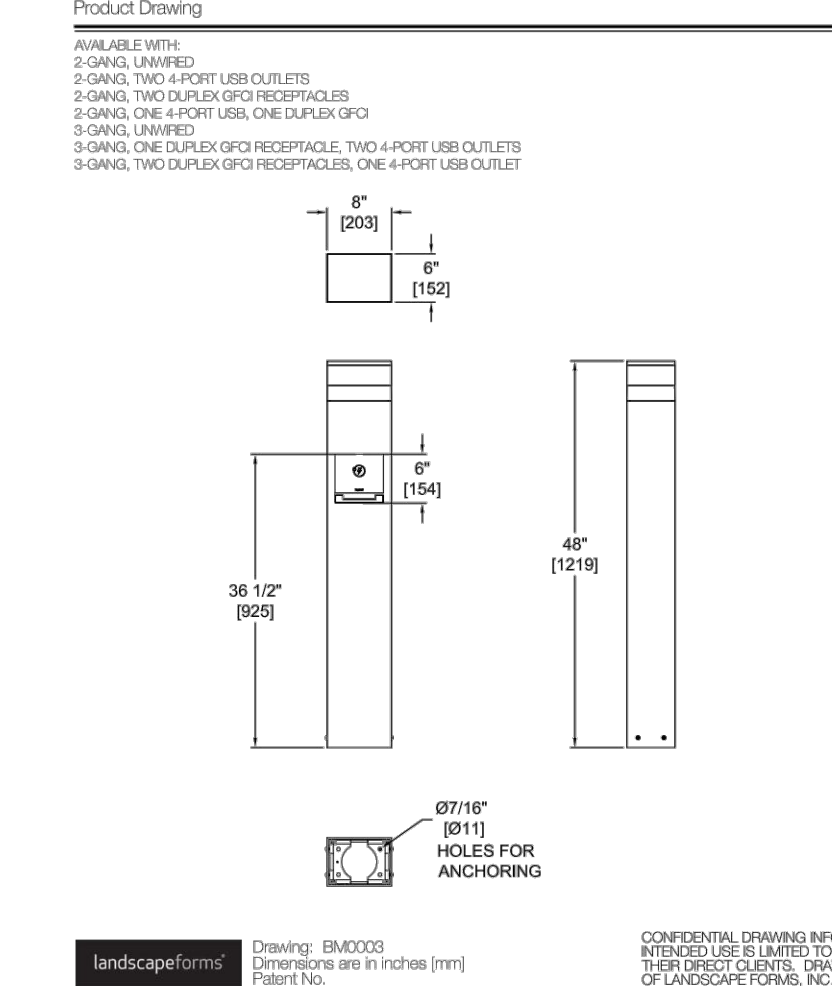


8 SOD LAWN
SCALE: 1-1/2" = 1'-0"

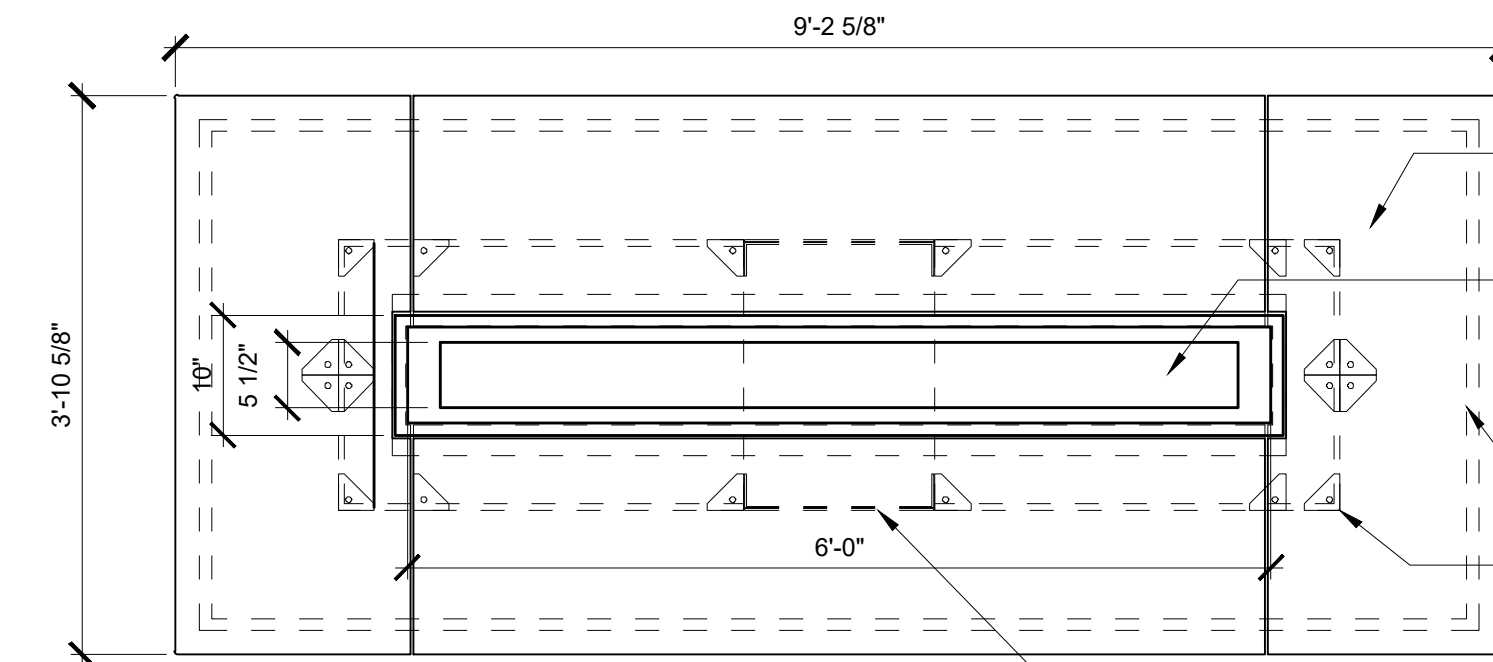


9 PERENNIAL / GROUND COVER PLANTING
SCALE: 1-1/2" = 1'-0"

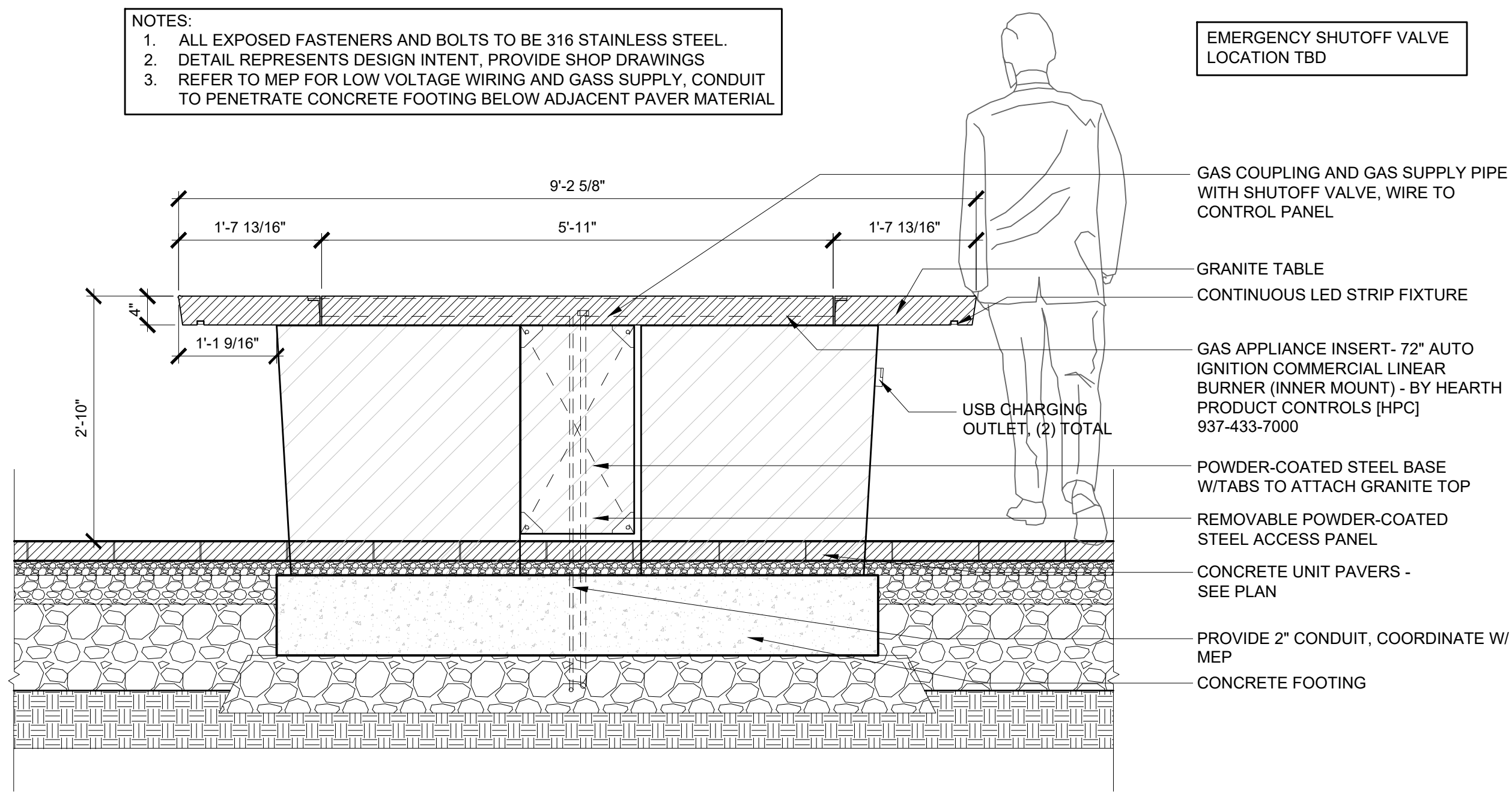
Outdoor charging station with area light



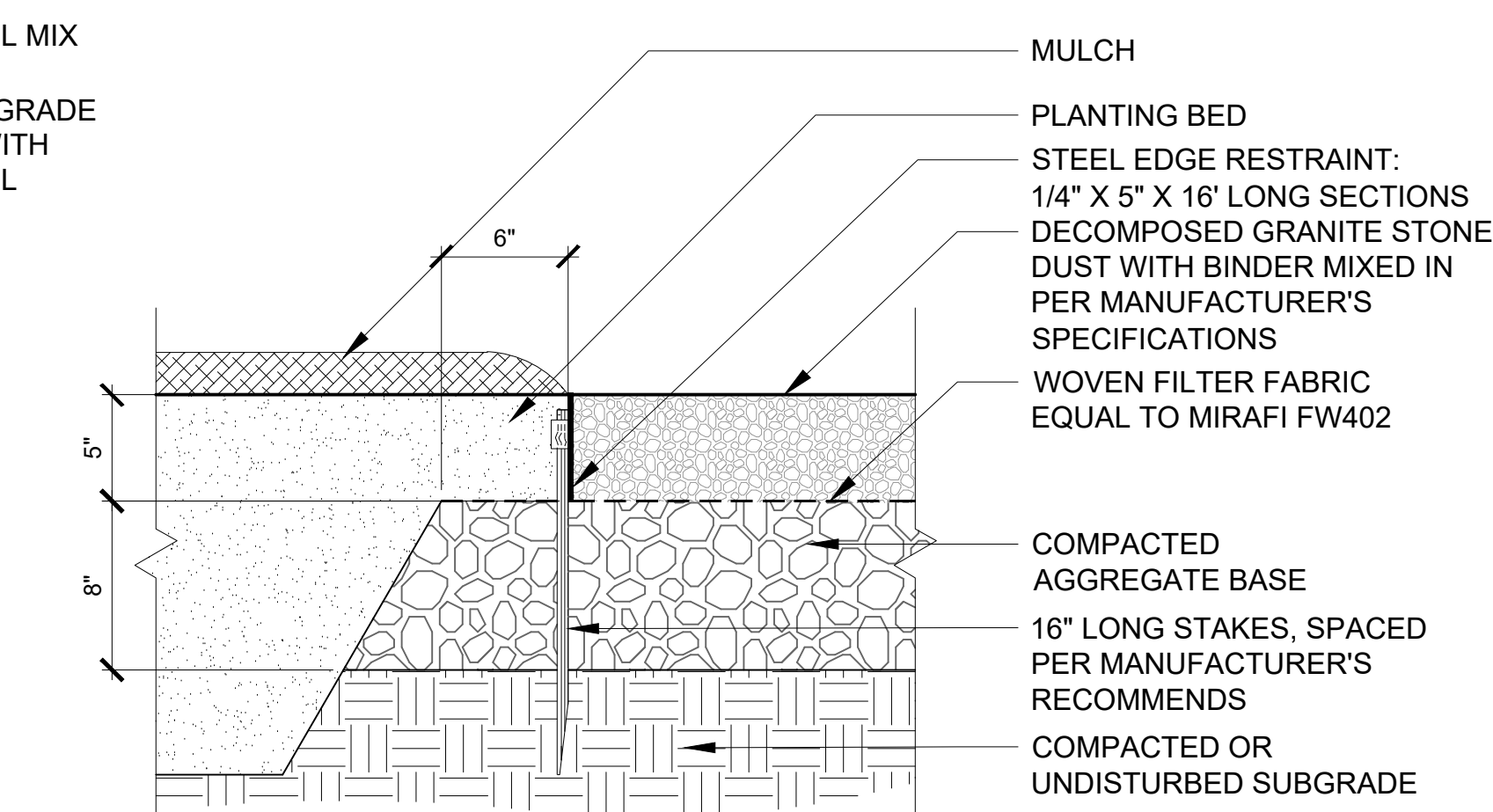
10 OUTDOOR CHARGING STATION
SCALE: NTS



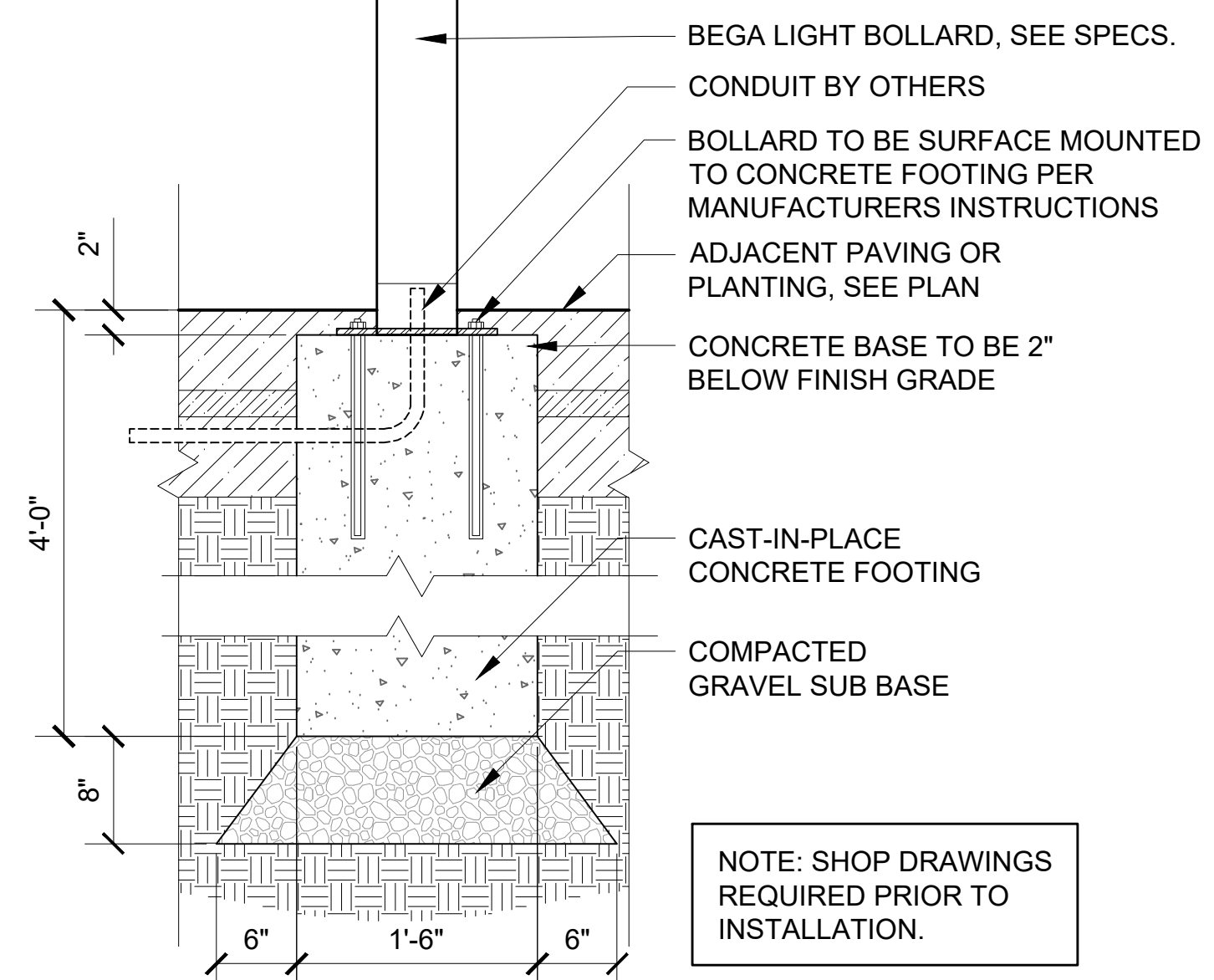
NOTES:
1. ALL EXPOSED FASTENERS AND BOLTS TO BE 316 STAINLESS STEEL.
2. DETAIL REPRESENTS DESIGN INTENT. PROVIDE SHOP DRAWINGS.
3. REFER TO MEP FOR LOW VOLTAGE WIRING AND GASS SUPPLY. CONDUIT TO PENETRATE CONCRETE FOOTING BELOW ADJACENT PAVER MATERIAL.



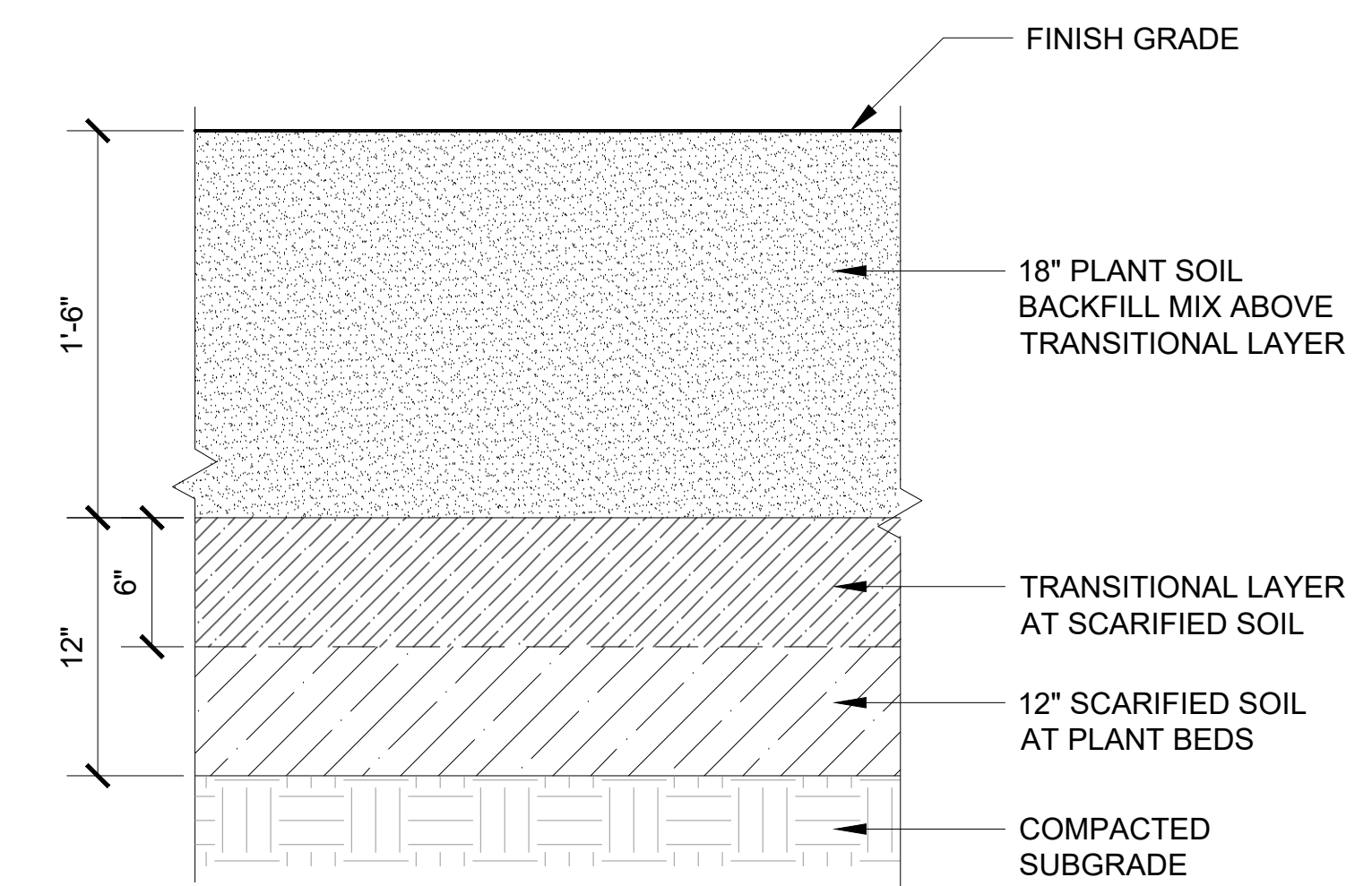
11 FIRE PIT SET IN GRANITE TABLE ON STEEL BASE
SCALE: 3/4" = 1'-0"



12 STONE DUST PATH
SCALE: 1-1/2" = 1'-0"



13 BEGA LIGHT BOLLARD
SCALE: 1" = 1'-0"



14 SOIL PREPARATION AT WOODY PLANTS
SCALE: 1-1/2" = 1'-0"

**PRELIMINARY
NOT FOR
CONSTRUCTION**

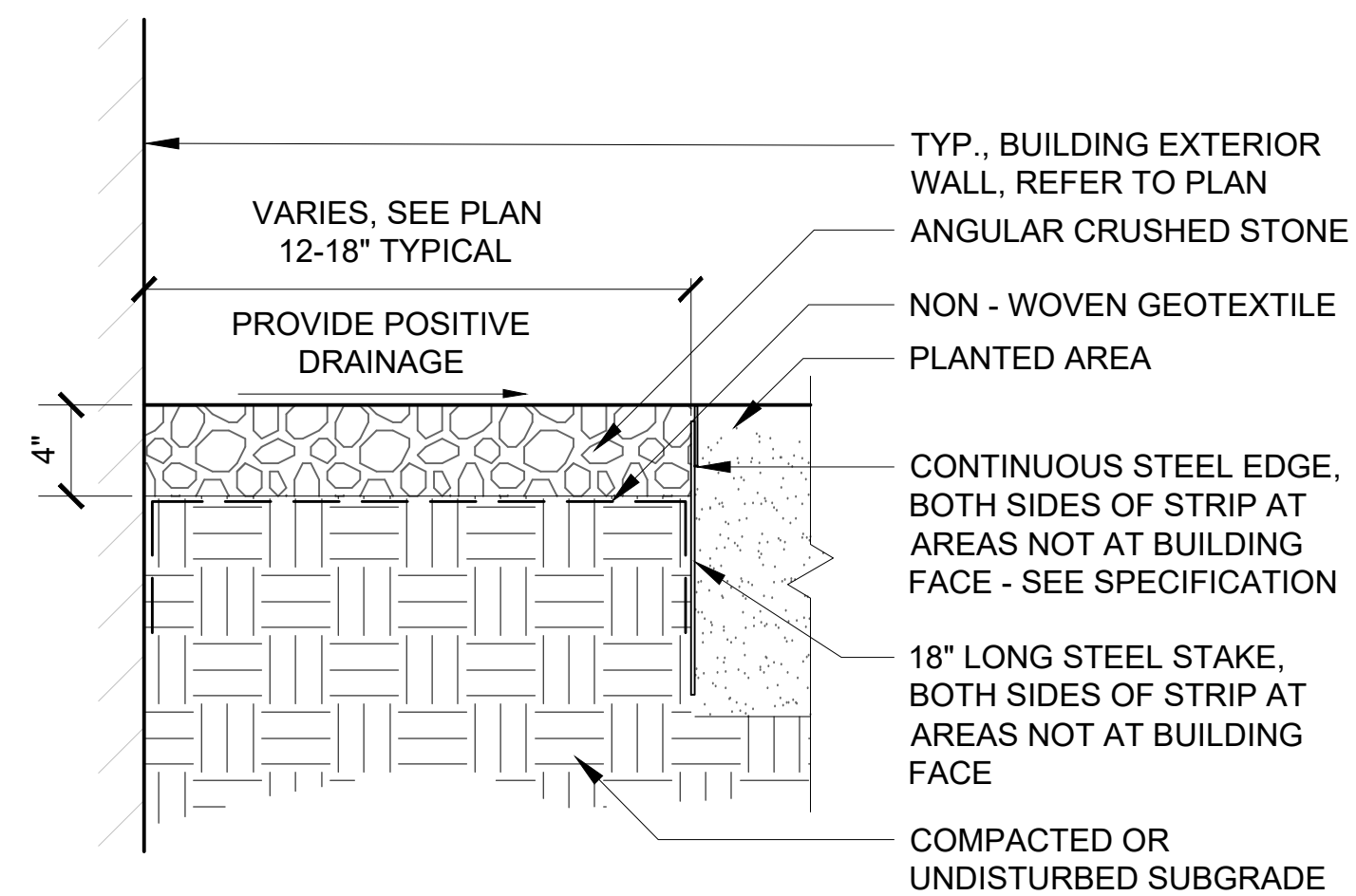
Scale AS NOTED
Project No. 2012

LANDSCAPE
DETAILS

L-500

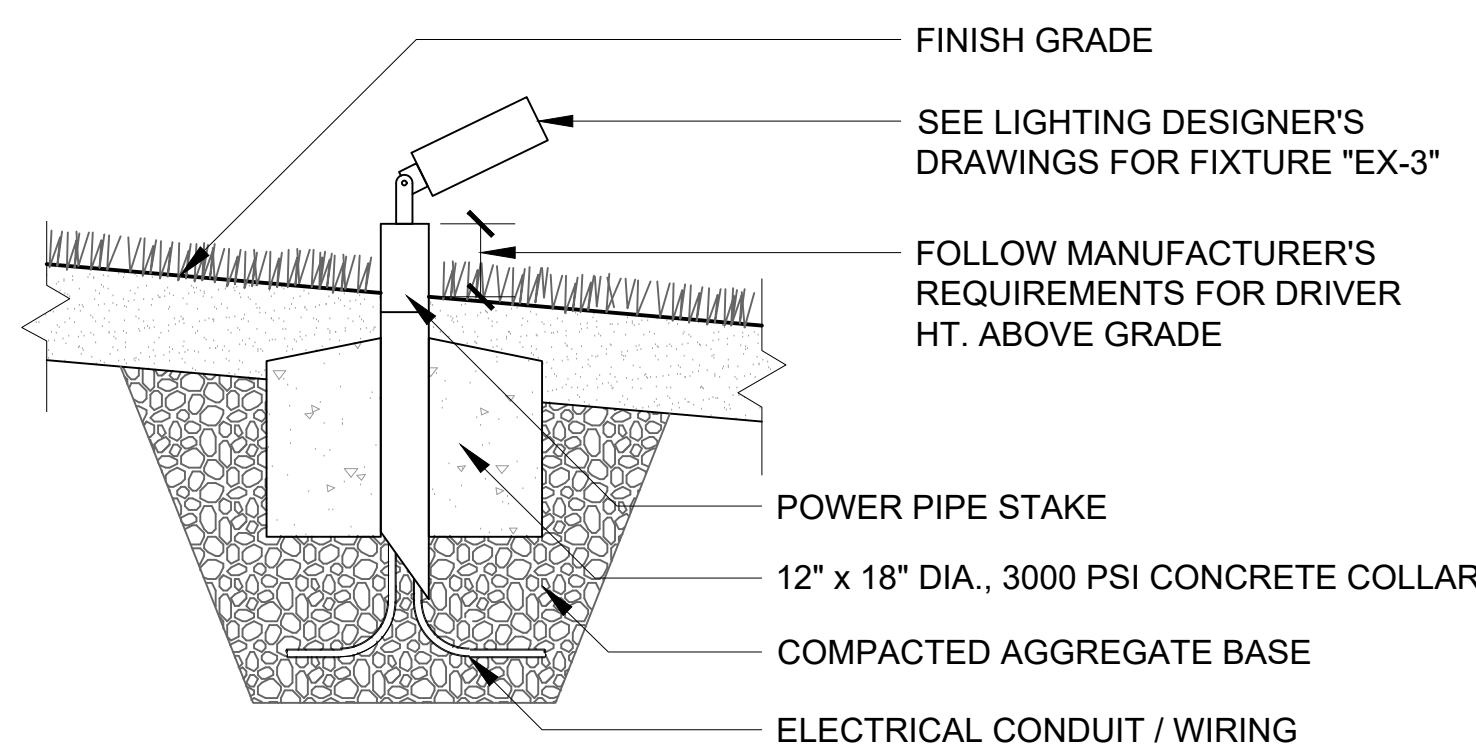
[illegible]

NOTE: SHOP DRAWINGS REQUIRED PRIOR TO INSTALLATION.



NOTE:

1. SUBMIT SHOP DRAWINGS FOR ALL FOOTING CONDITIONS AND WIRING PLANS.
2. CONFIRM TOP OF FOOTING ELEVATIONS WITH LANDSCAPE ARCHITECT PRIOR TO PROCEEDING.
3. INSTALL ACCORDING TO MANUFACTURER'S SPECIFICATIONS.



ORIGINAL SHEET - ARCH E1

[illegible]

Permit/Seal

**PRELIMINARY
NOT FOR
CONSTRUCTION**

Scale	AS NOTED
Project No.	2012

LANDSCAPE DETAILS

L-501



Memorandum

To: Anthony L. Del Gaizo
Town Engineer
Public Services Administration
Building
500 Dedham Avenue
Needham, MA 02492

Date: September 23, 2020

Project #: 15060.00

From: Nicholas Skoly, PE

Re: 140 Kendrick Stormwater Analysis

On behalf of Boston Properties, Vanasse Hangen Brustlin, Inc. (VHB) is pleased to submit the following memorandum to document the adherence to the Town of Needham Stormwater Regulations (Project). The proposed stormwater management infrastructure includes best management practices (BMP's) for maintaining stormwater runoff rates has been developed in compliance with the Massachusetts Stormwater Management Standards and the Town of Needham Requirements for On-Site Drainage (Stormwater management), as applicable.

A HydroCAD model, using TR-20 methodology, was developed to evaluate the site's existing and proposed stormwater runoff response for the 2-, 10-, 25-, and 100-year storm events. As summarized in the following sections, the analysis for these storm events indicates that there will be no increase in peak discharge rates or runoff volumes resulting from the additional impervious area.

Project Description

Boston Properties is proposing to renovate a portion of their existing building at 140 Kendrick Street. As part of that renovation, they are proposing to improve the hardscape and landscape areas surrounding the building. The exterior improvements will be limited to reworking parking spaces near the main entry, improving the vehicular drop off area and pedestrian circulation, and improving an outdoor patio.

Stormwater Approach

The exterior improvements are limited to the front entrance portion of the site located on the North side of the existing building and the back patio on the South side of the building. The improved drop-off area at the front entrance will generally maintain the same drainage patterns but will be improved with a subsurface detention system. Within the subcatchment, (approximately 60,675 sf) there is an increase in impervious area of approximately 1,620 sf. The improved patio area will generally maintain the same drainage patterns but will be improved with permeable pavers. Within the subcatchment (approximately 26,050 sf) there is a decrease in impervious area of approximately 960 sf.

The stormwater runoff in the proposed condition will be collected via the existing deep sump and hooded catch basins and routed to a subsurface detention basin installed adjacent to the catch basins via a pipe installed below the existing outlet of the catch basin. Once the detention basin reaches its capacity the stormwater will drain through the existing closed piping system and maintain the existing drainage patterns. The subsurface detention basin and permeable pavers provide the required volume for 1" over the impervious area. Under this requirement the design is required to store 3,575cf of runoff and the design provides stores 3,977cf. This storage assumes an infiltration rate of 1.02 which is consistent with the original stormwater design for the site. The Hydrologic model analyzes the subcatchment to the existing catch basin which encompasses all of the exterior work proposed.

Hydrologic Analysis

The rainfall runoff response of the Site under existing and proposed conditions was evaluated for storm events with recurrence intervals of 2-, 5-, 10-, 25-, and 100-years (as shown in the Site Construction permit Regulations.). Runoff coefficients for the pre- and post-development conditions, were determined using NRCS Technical Release 55 (TR-55) methodology as provided in HydroCAD. The HydroCAD model is based on NRCS Technical Release 20 (TR-20) Model for Project Formulation Hydrology. Printouts of the HydroCAD analyses are attached. Tables 1 below presents a summary of the existing and proposed conditions peak flow rates.

Table 1
Peak Discharge Rates (cubic feet per second)

<u>Design Point</u>	<u>2-year</u>	<u>10-year</u>	<u>25-year</u>	<u>100-year</u>
Design Point 1:				
Closed Drainage System				
Existing	2.26	5.06	6.90	9.85
Proposed	0.73	1.84	4.88	9.63
Design Point 2				
Closed Drainage System				
Existing	0.02	0.5	1.0	1.90
Proposed	0.02	0.44	0.9	1.66

Table 2
Runoff Volumes (cubic feet)

<u>Design Point</u>	<u>2-year</u>	<u>10-year</u>	<u>25-year</u>	<u>100-year</u>
Design Point 1:				
Closed Drainage System				
Existing	5,981	13,292	18,288	26,452
Proposed	1,987	8,158	13,001	20,981
Design Point 2:				
Closed Drainage System				
Existing	339	1,703	2,907	5,164
Proposed	293	1,474	2,545	4,681

**Massachusetts Department of Environmental Protection (DEP)
Stormwater Management Standards**

Standard 1: No New Untreated Discharges or Erosion to Wetlands

The Project has been designed to comply with Standard 1.

The Best Management Practices (BMPs) included in the proposed stormwater management system have been designed in accordance with the Massachusetts Stormwater Handbook. Supporting information and computations demonstrating that no new untreated discharges will result from the Project are presented through compliance with Standards 4 through 6.

There are no new untreated discharges that will result from the project. The project is using existing infrastructure and supplementing it with additional stormwater BMPs.

Standard 2: Peak Rate Attenuation

The Project has been designed to fully comply with Standard 2.

This project has been designed to reduce the peak attenuation rate for the 2-yr, 10-yr, 25-yr and 100-yr storm, as shown in the tables above.

Standard 3: Stormwater Recharge

The Project has been designed to comply with Standard 3. All runoff from impervious areas from the site is discharging into an infiltration BMP. Recharge BMPs have been sized to infiltrate the required recharge volume and sized to drain within 72-hours. These calculations have been provided.

Standard 4: Water Quality

This project has been designed to comply with Standard 4. A water quality calculation has been provided to show that greater than 1" of volume will be treated on site.

Standard 5: Land Uses with Higher Potential Pollutant Loads (LUHPPLs)

This project is not considered a LUHPPL.

Standard 6: Critical Area

This project will not discharge stormwater near or to a critical area.

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the Maximum Extent Practicable

This project is a redevelopment project and has been designed to comply with all the Stormwater Management Standards.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Controls

The Project will disturb approximately 2 acres of land and is therefore required to obtain coverage under the Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) Construction General Permit. As required under this permit, a Stormwater Pollution Prevention Plan (SWPPP) will be developed and submitted before land disturbance begins. Recommended construction period pollution prevention and erosion and sedimentation controls to be finalized in the SWPPP are included attached.

Standard 9: Operation and Maintenance Plan

In compliance with Standard 9, a Post Construction Stormwater Operation and Maintenance (O&M) Plan has been developed for the Project. The O&M Plan is included in Appendix D as part of the Long Term Pollution Prevention Plan.

Standard 10: Prohibition of Illicit Discharges

Sanitary sewer and storm drainage structures which were part of the previous development on this site are to be completely removed during the site redevelopment. The design plans submitted with this report have been designed in full compliance with current standards. The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges.

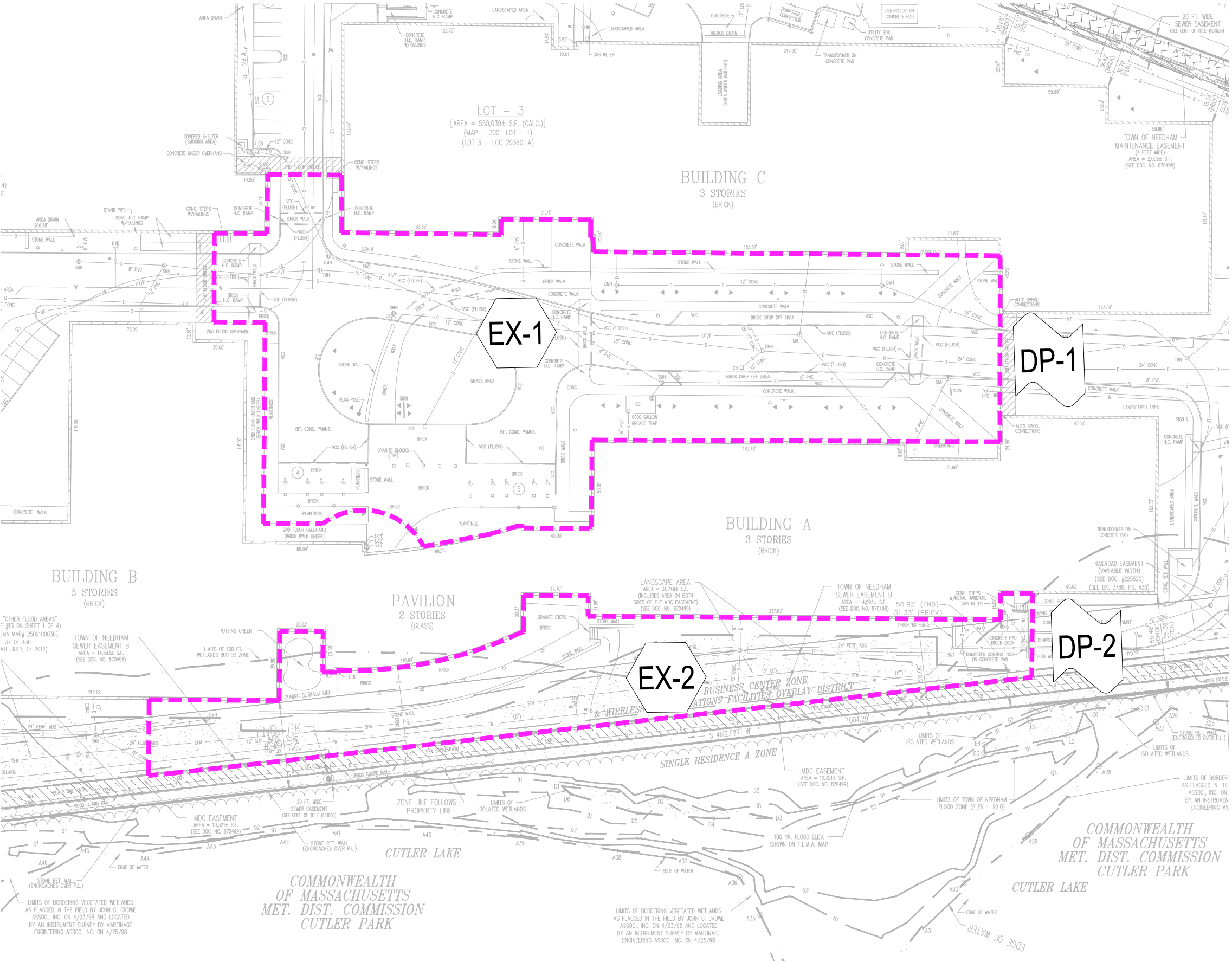
Stormwater Management Summary

The stormwater management design includes BMPs for maintaining stormwater runoff rates and has been developed with guidance provided by the DEP and in accordance with the applicable Town and State requirements listed in previous sections of the memo. A hydrologic model was developed to evaluate the Site's existing and proposed stormwater runoff response and the results of the analysis indicate that the site has been designed such that there will be no increase in peak discharge rates or volumes between the pre- and post-development conditions for the storm events studied. In addition, the subsurface infiltration system and permeable pavers provide a significant improvement to water quality as compared to the existing condition.

ATTACHMENTS:

Supporting Calculations:

Figure 1 – Existing Drainage Conditions
Figure 2 – Proposed Drainage Conditions
Figure 3 – Impervious Buffer Area Comparison
Water Quality Volume Calculations
Hydrologic Analysis
Long Term Pollution Prevention Plan
Operations and Maintenance Plan
FIRM



Legend

SYMBOLS

X

DESIGN POINT

X

DRAINAGE AREA DESIGNATION

X

POND

LINETYPES

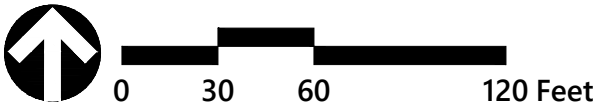
DRAINAGE AREA BOUNDARY

100' BUFFER ZONE

WETLAND BOUNDARY

4-220

4-219

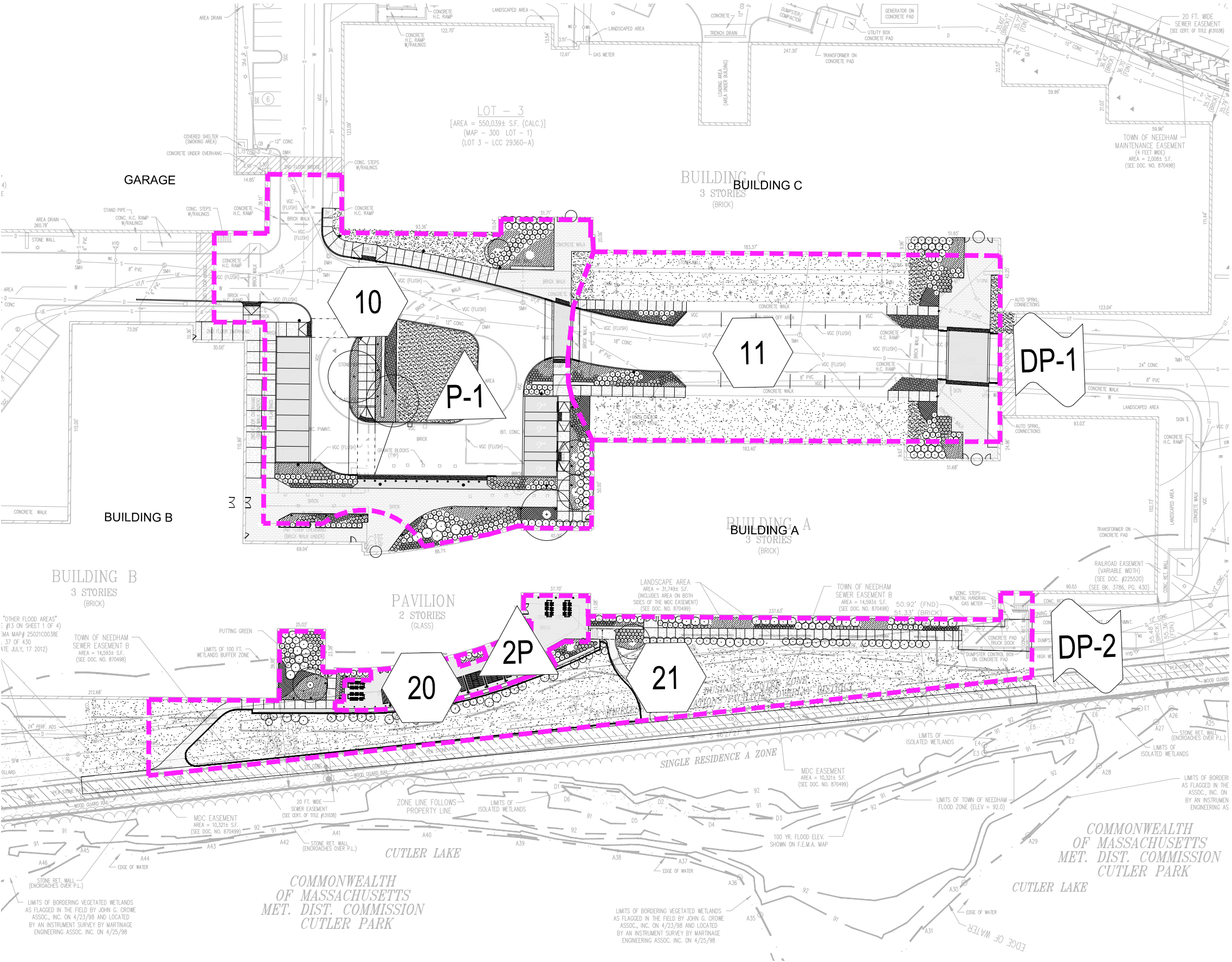


Existing Drainage Conditions

140 Kendrick Street
Needham, MA

Figure 1

9/10/2020



Legend

SYMBOLS

X

DESIGN POINT

X

DRAINAGE AREA DESIGNATION

X

POND

LINETYPES

DRAINAGE AREA BOUNDARY

100' BUFFER ZONE

WETLAND BOUNDARY



Proposed Drainage Conditions

Figure 2

140 Kendrick Street
Needham, MA

9/10/2020

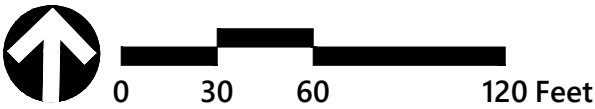
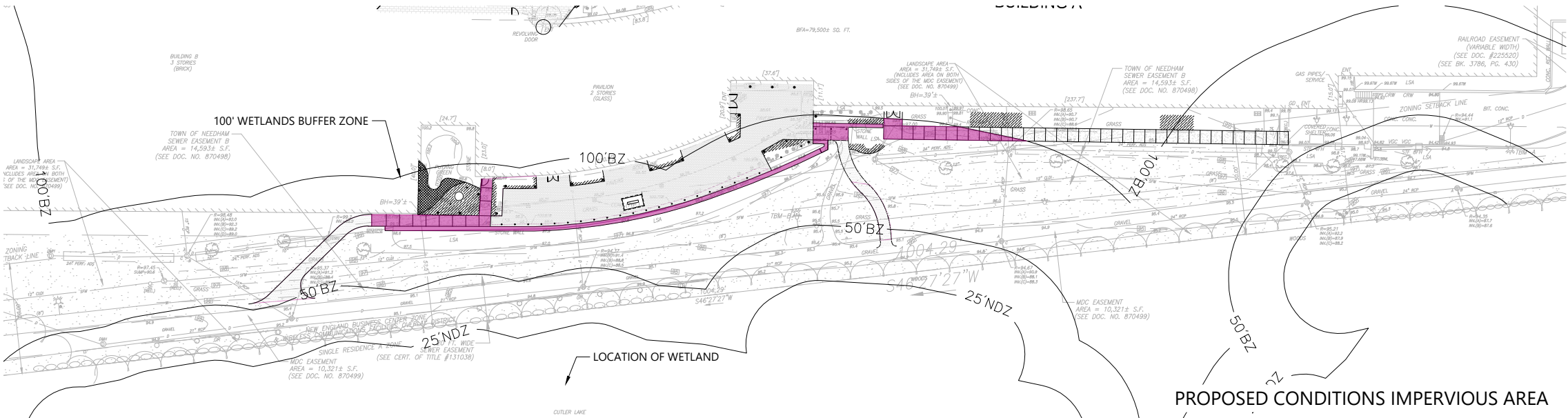
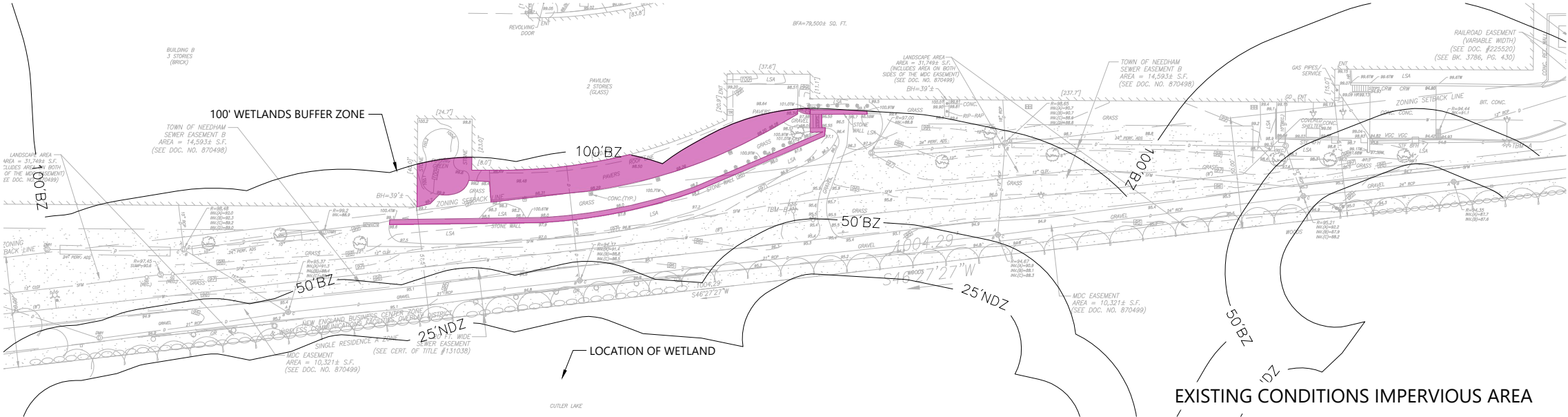
Wetland Buffer Areas

Designation	Existing	Proposed	Delta
APPROXIMATE IMPERVIOUS AREA WITHIN 100' BUFFER	2,480 SF	1,264 SF	-1,216 SF

Legend



IMPERVIOUS AREA WITHIN 100' BUFFER ZONE



Impervious Area

140 Kendrick Street
Needham, MA

Figure 3

9/23/20



Water Quality Volume Calculations

Project Name: 140 Kendrick Street
Project Location: Needham, MA

Proj. No.: -
Date: September 2020

Calculated by: NJS

Checked by:

Limit of Development Area

Total Impervious Area = 42,898 sf

Water Quality Requirement:

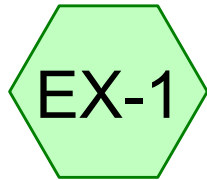
	Runoff Depth to be Treated (in.)	Required Volume (c.f.)
Water Quality Volume	1.0	3,575

Provided:

	Provided Volume (c.f.)	
Permeable Pavers (Rear of Building)	718	*For the 1-year design storm
Proposed Subsurface Infiltration System (Front Drop Off)	3,259	*For the 1-year design storm

Total Provided:

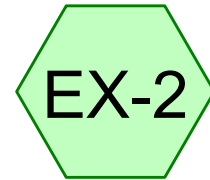
3,977



Front Entry



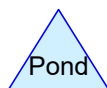
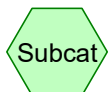
Front Entry



Back Patio



Back Patio



Routing Diagram for 1462800_EX

Prepared by VHB, Printed 9/17/2020

HydroCAD® 10.00-25 s/n 01038 © 2019 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
44,485	39	>75% Grass cover, Good, HSG A (EX-1, EX-2)
42,240	98	Paved parking, HSG A (EX-1, EX-2)
86,725	68	TOTAL AREA

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

SubcatchmentEX-1: Front Entry

Runoff Area=60,675 sf 61.34% Impervious Runoff Depth=1.18"
Tc=5.0 min CN=75 Runoff=2.26 cfs 5,981 cf

SubcatchmentEX-2: Back Patio

Runoff Area=26,050 sf 19.27% Impervious Runoff Depth=0.16"
Tc=5.0 min CN=50 Runoff=0.02 cfs 339 cf

Link DP1: Front Entry

Inflow=2.26 cfs 5,981 cf
Primary=2.26 cfs 5,981 cf

Link DP2: Back Patio

Inflow=0.02 cfs 339 cf
Primary=0.02 cfs 339 cf

Total Runoff Area = 86,725 sf Runoff Volume = 6,320 cf Average Runoff Depth = 0.87"
51.29% Pervious = 44,485 sf 48.71% Impervious = 42,240 sf

Summary for Subcatchment EX-1: Front Entry

Runoff = 2.26 cfs @ 12.13 hrs, Volume= 5,981 cf, Depth= 1.18"

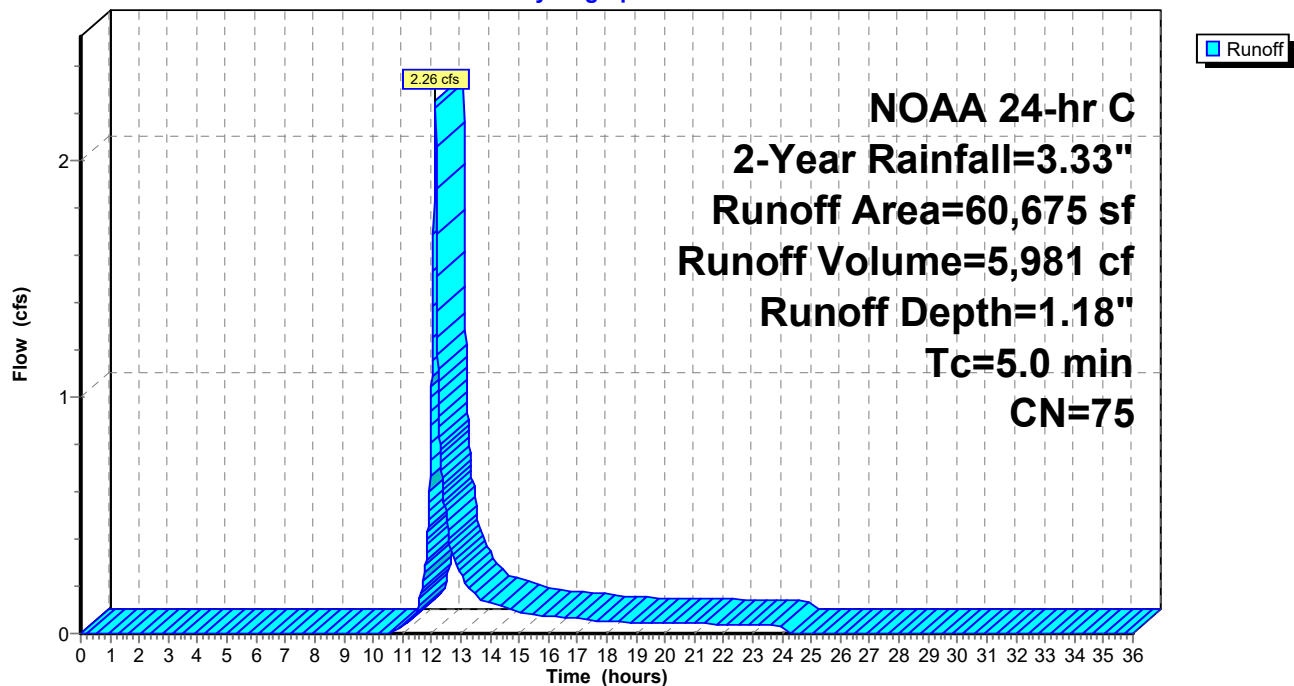
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 2-Year Rainfall=3.33"

Area (sf)	CN	Description
37,220	98	Paved parking, HSG A
23,455	39	>75% Grass cover, Good, HSG A
60,675	75	Weighted Average
23,455		38.66% Pervious Area
37,220		61.34% Impervious Area

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

Subcatchment EX-1: Front Entry

Hydrograph



Summary for Subcatchment EX-2: Back Patio

Runoff = 0.02 cfs @ 12.53 hrs, Volume= 339 cf, Depth= 0.16"

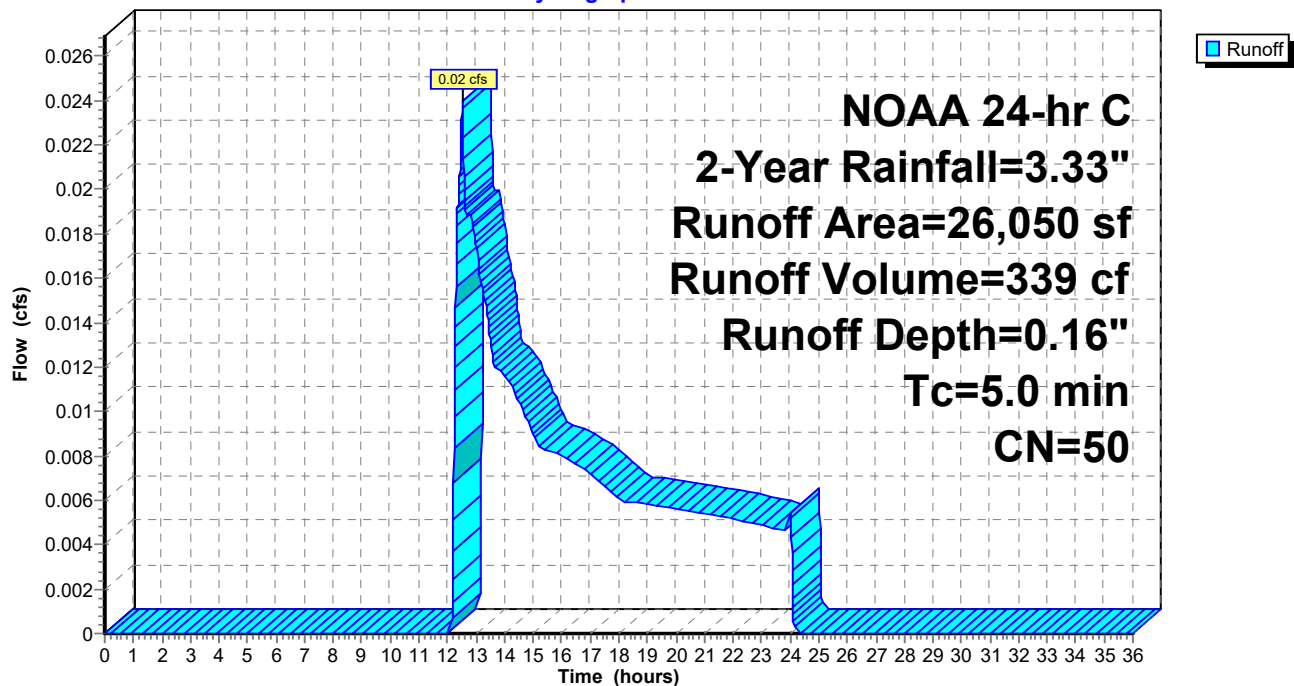
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 NOAA 24-hr C 2-Year Rainfall=3.33"

Area (sf)	CN	Description
5,020	98	Paved parking, HSG A
21,030	39	>75% Grass cover, Good, HSG A
26,050	50	Weighted Average
21,030		80.73% Pervious Area
5,020		19.27% Impervious Area

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

Subcatchment EX-2: Back Patio

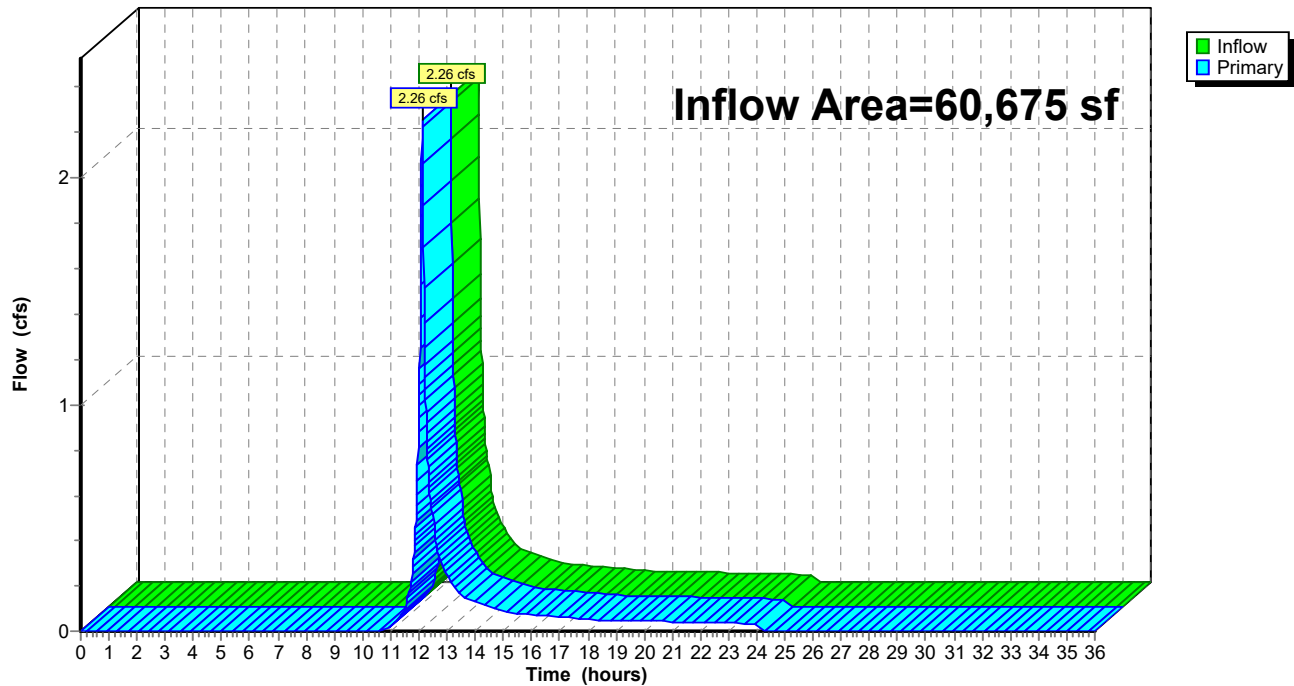
Hydrograph



Summary for Link DP1: Front Entry

Inflow Area = 60,675 sf, 61.34% Impervious, Inflow Depth = 1.18" for 2-Year event
Inflow = 2.26 cfs @ 12.13 hrs, Volume= 5,981 cf
Primary = 2.26 cfs @ 12.13 hrs, Volume= 5,981 cf, Atten= 0%, Lag= 0.0 min

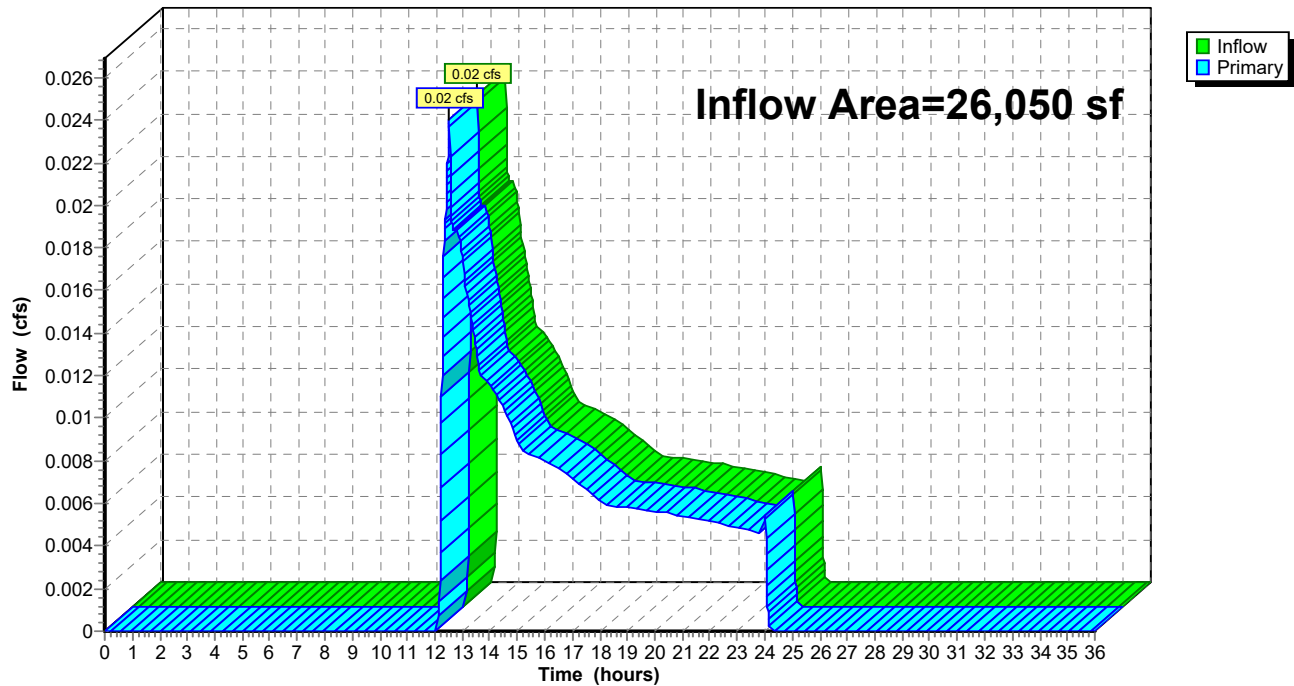
Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link DP1: Front Entry**Hydrograph**

Summary for Link DP2: Back Patio

Inflow Area = 26,050 sf, 19.27% Impervious, Inflow Depth = 0.16" for 2-Year event
Inflow = 0.02 cfs @ 12.53 hrs, Volume= 339 cf
Primary = 0.02 cfs @ 12.53 hrs, Volume= 339 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link DP2: Back Patio**Hydrograph**

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

SubcatchmentEX-1: Front Entry

Runoff Area=60,675 sf 61.34% Impervious Runoff Depth=2.63"
Tc=5.0 min CN=75 Runoff=5.06 cfs 13,292 cf

SubcatchmentEX-2: Back Patio

Runoff Area=26,050 sf 19.27% Impervious Runoff Depth=0.78"
Tc=5.0 min CN=50 Runoff=0.50 cfs 1,703 cf

Link DP1: Front Entry

Inflow=5.06 cfs 13,292 cf
Primary=5.06 cfs 13,292 cf

Link DP2: Back Patio

Inflow=0.50 cfs 1,703 cf
Primary=0.50 cfs 1,703 cf

Total Runoff Area = 86,725 sf Runoff Volume = 14,995 cf Average Runoff Depth = 2.07"
51.29% Pervious = 44,485 sf 48.71% Impervious = 42,240 sf

Summary for Subcatchment EX-1: Front Entry

Runoff = 5.06 cfs @ 12.13 hrs, Volume= 13,292 cf, Depth= 2.63"

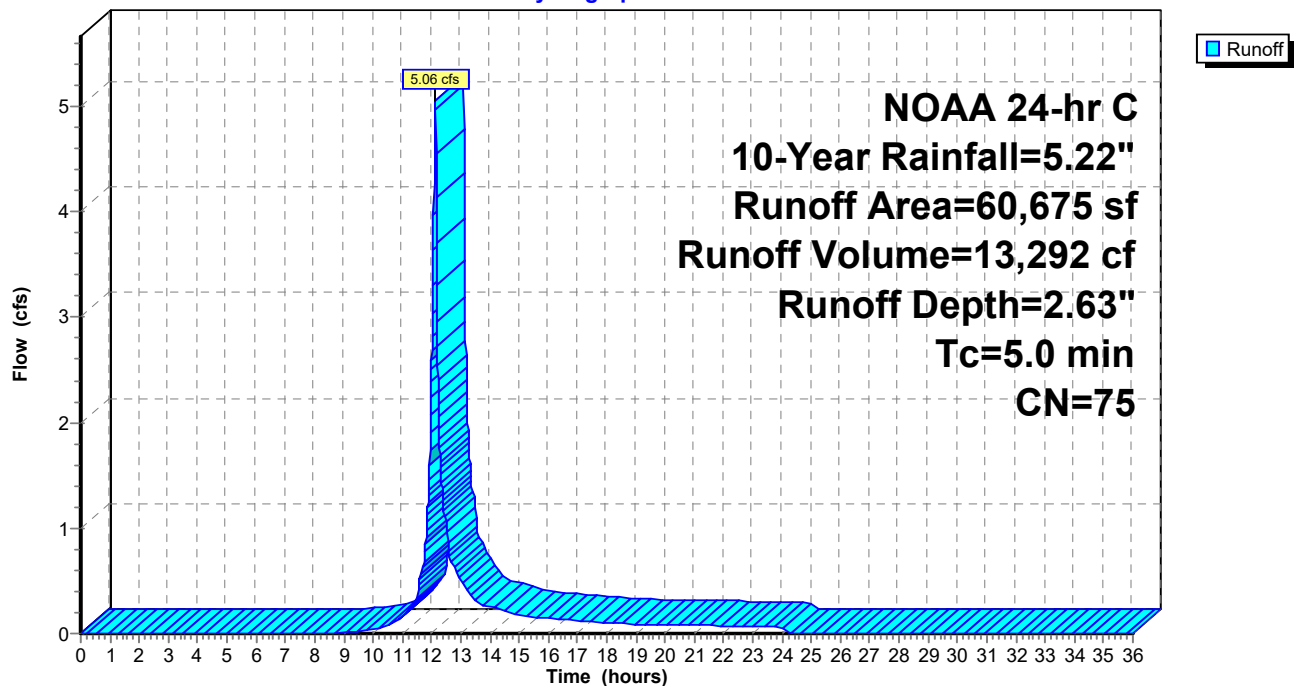
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 10-Year Rainfall=5.22"

Area (sf)	CN	Description
37,220	98	Paved parking, HSG A
23,455	39	>75% Grass cover, Good, HSG A
60,675	75	Weighted Average
23,455		38.66% Pervious Area
37,220		61.34% Impervious Area

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

Subcatchment EX-1: Front Entry

Hydrograph



Summary for Subcatchment EX-2: Back Patio

Runoff = 0.50 cfs @ 12.14 hrs, Volume= 1,703 cf, Depth= 0.78"

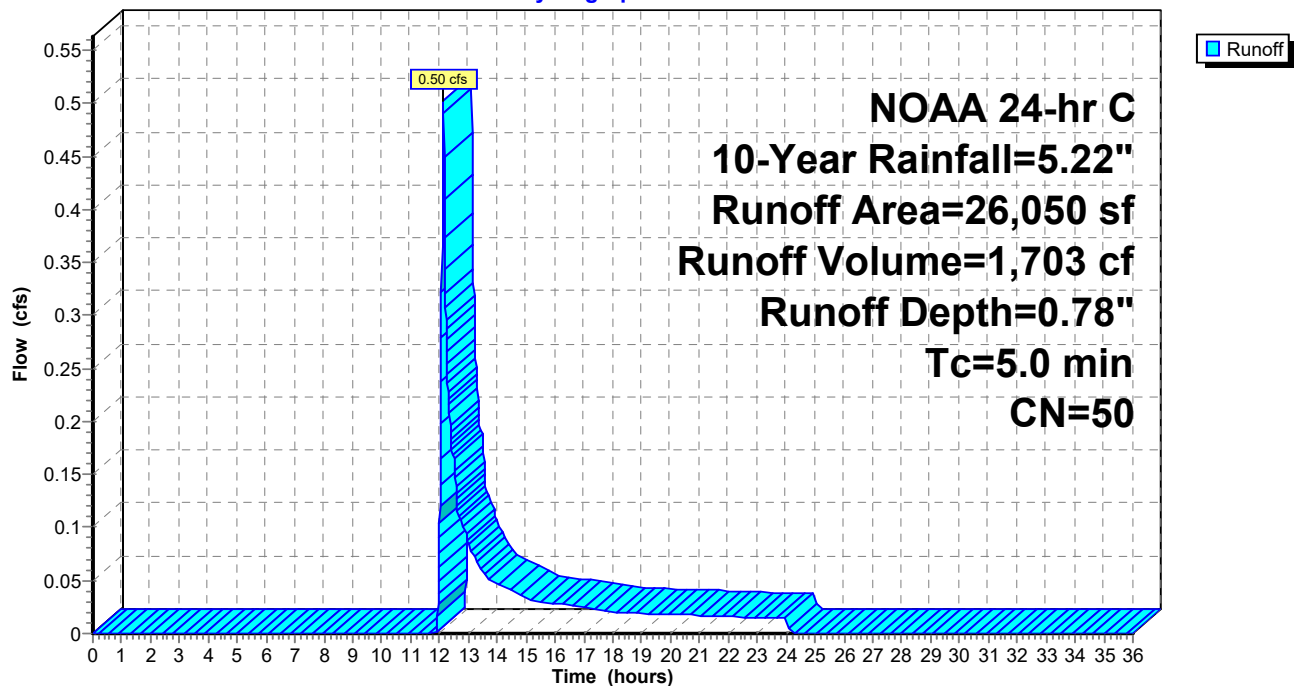
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 10-Year Rainfall=5.22"

Area (sf)	CN	Description
5,020	98	Paved parking, HSG A
21,030	39	>75% Grass cover, Good, HSG A
26,050	50	Weighted Average
21,030		80.73% Pervious Area
5,020		19.27% Impervious Area

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

Subcatchment EX-2: Back Patio

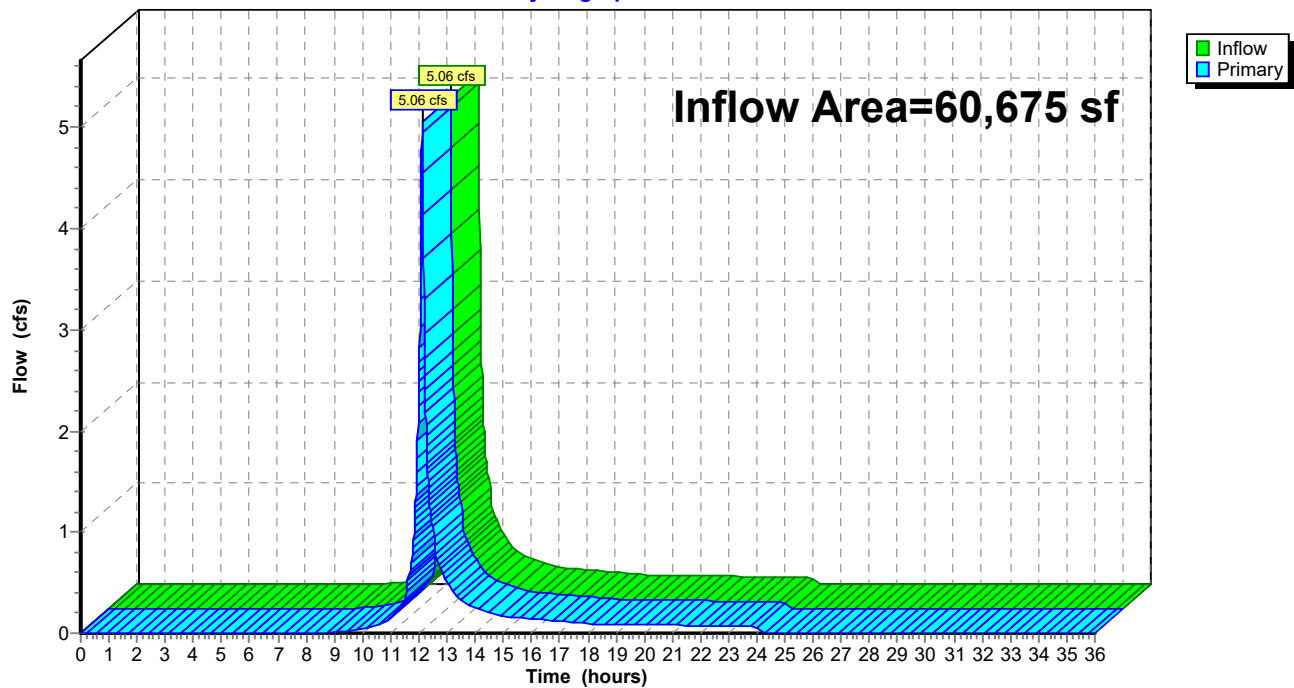
Hydrograph



Summary for Link DP1: Front Entry

Inflow Area = 60,675 sf, 61.34% Impervious, Inflow Depth = 2.63" for 10-Year event
Inflow = 5.06 cfs @ 12.13 hrs, Volume= 13,292 cf
Primary = 5.06 cfs @ 12.13 hrs, Volume= 13,292 cf, Atten= 0%, Lag= 0.0 min

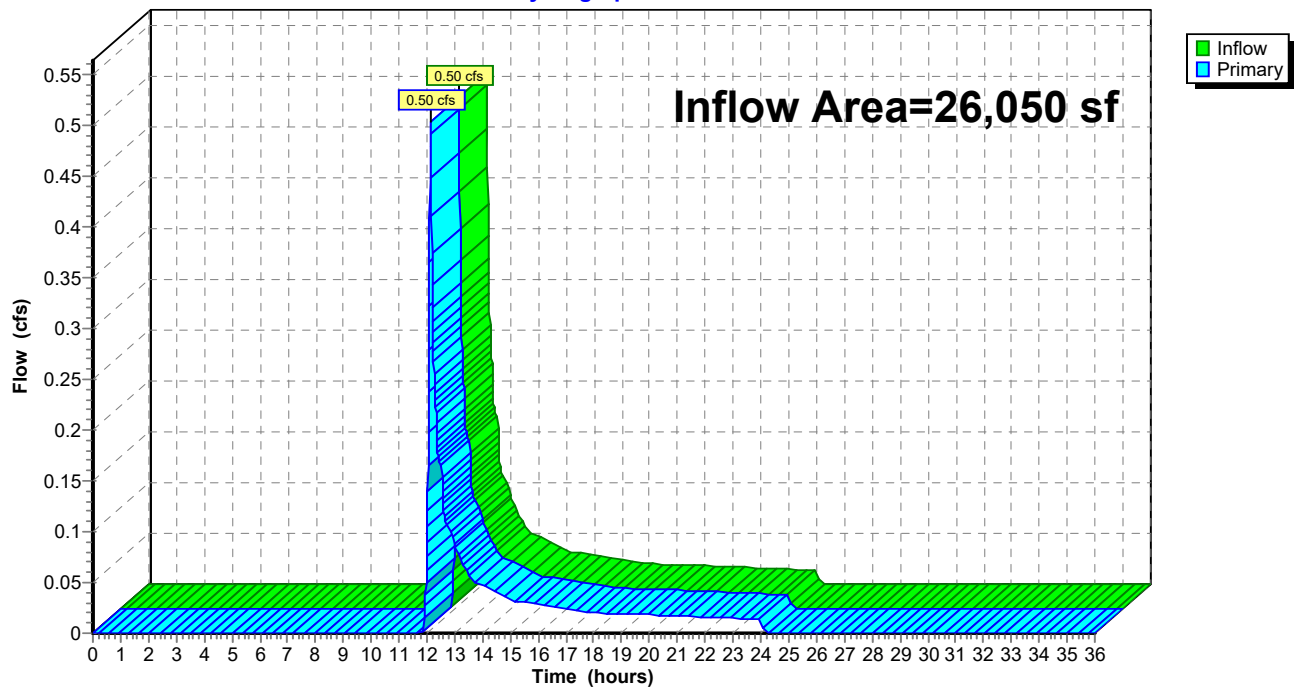
Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link DP1: Front Entry**Hydrograph**

Summary for Link DP2: Back Patio

Inflow Area = 26,050 sf, 19.27% Impervious, Inflow Depth = 0.78" for 10-Year event
Inflow = 0.50 cfs @ 12.14 hrs, Volume= 1,703 cf
Primary = 0.50 cfs @ 12.14 hrs, Volume= 1,703 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link DP2: Back Patio**Hydrograph**

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

SubcatchmentEX-1: Front Entry

Runoff Area=60,675 sf 61.34% Impervious Runoff Depth=3.62"
Tc=5.0 min CN=75 Runoff=6.90 cfs 18,288 cf

SubcatchmentEX-2: Back Patio

Runoff Area=26,050 sf 19.27% Impervious Runoff Depth=1.34"
Tc=5.0 min CN=50 Runoff=1.00 cfs 2,907 cf

Link DP1: Front Entry

Inflow=6.90 cfs 18,288 cf
Primary=6.90 cfs 18,288 cf

Link DP2: Back Patio

Inflow=1.00 cfs 2,907 cf
Primary=1.00 cfs 2,907 cf

Total Runoff Area = 86,725 sf Runoff Volume = 21,195 cf Average Runoff Depth = 2.93"
51.29% Pervious = 44,485 sf 48.71% Impervious = 42,240 sf

Summary for Subcatchment EX-1: Front Entry

Runoff = 6.90 cfs @ 12.12 hrs, Volume= 18,288 cf, Depth= 3.62"

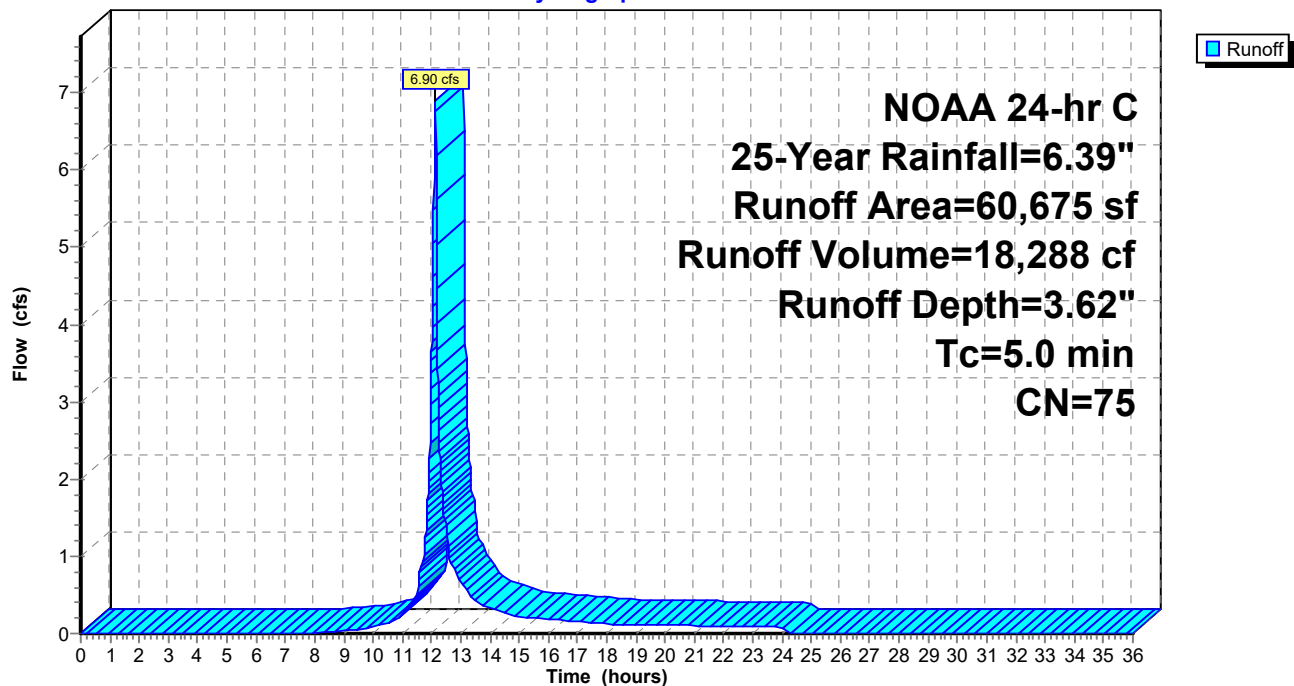
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 NOAA 24-hr C 25-Year Rainfall=6.39"

Area (sf)	CN	Description
37,220	98	Paved parking, HSG A
23,455	39	>75% Grass cover, Good, HSG A
60,675	75	Weighted Average
23,455		38.66% Pervious Area
37,220		61.34% Impervious Area

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

Subcatchment EX-1: Front Entry

Hydrograph



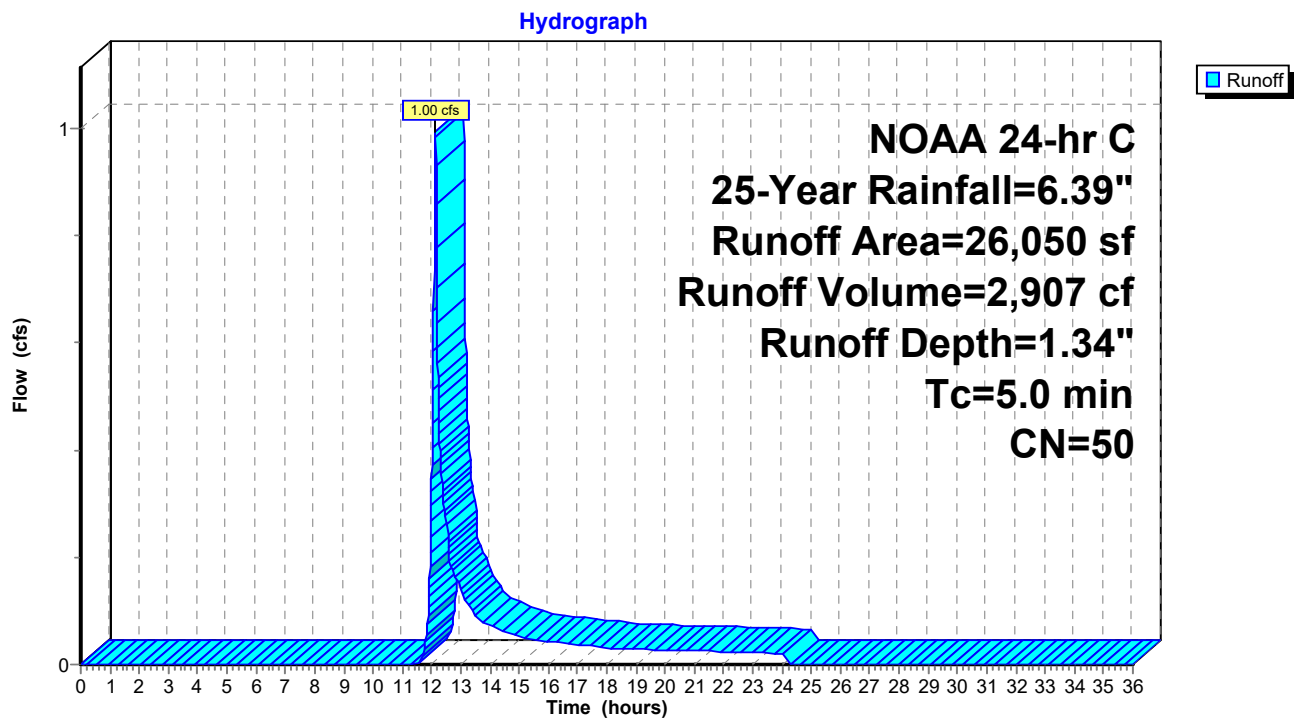
Summary for Subcatchment EX-2: Back Patio

Runoff = 1.00 cfs @ 12.13 hrs, Volume= 2,907 cf, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 NOAA 24-hr C 25-Year Rainfall=6.39"

Area (sf)	CN	Description
5,020	98	Paved parking, HSG A
21,030	39	>75% Grass cover, Good, HSG A
26,050	50	Weighted Average
21,030		80.73% Pervious Area
5,020		19.27% Impervious Area

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

Subcatchment EX-2: Back Patio

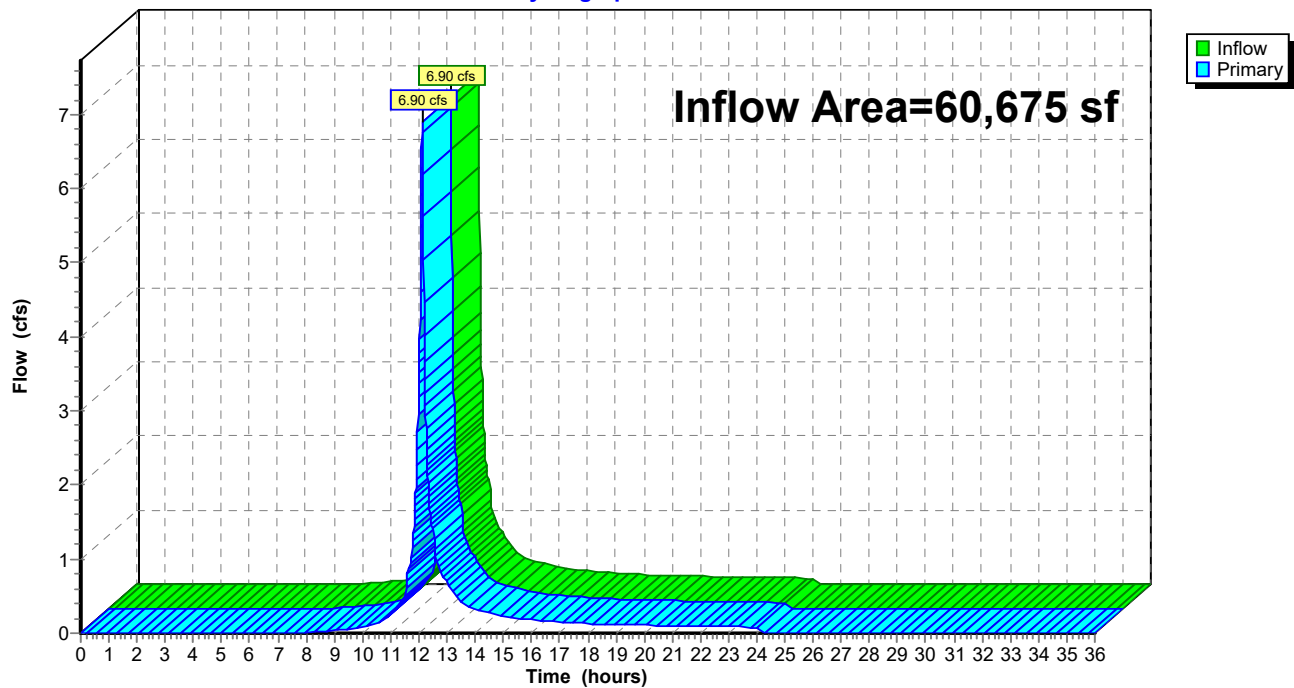
Summary for Link DP1: Front Entry

Inflow Area = 60,675 sf, 61.34% Impervious, Inflow Depth = 3.62" for 25-Year event
Inflow = 6.90 cfs @ 12.12 hrs, Volume= 18,288 cf
Primary = 6.90 cfs @ 12.12 hrs, Volume= 18,288 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link DP1: Front Entry

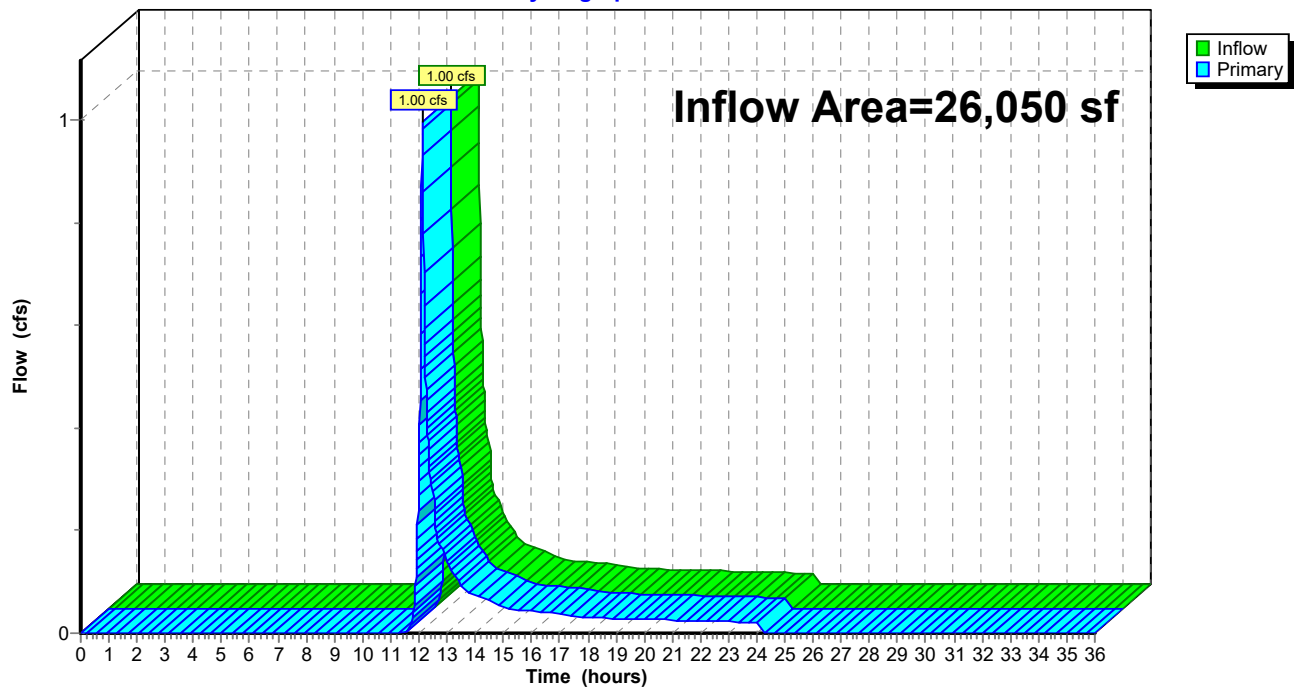
Hydrograph



Summary for Link DP2: Back Patio

Inflow Area = 26,050 sf, 19.27% Impervious, Inflow Depth = 1.34" for 25-Year event
Inflow = 1.00 cfs @ 12.13 hrs, Volume= 2,907 cf
Primary = 1.00 cfs @ 12.13 hrs, Volume= 2,907 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link DP2: Back Patio**Hydrograph**

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

SubcatchmentEX-1: Front Entry

Runoff Area=60,675 sf 61.34% Impervious Runoff Depth=5.23"
Tc=5.0 min CN=75 Runoff=9.85 cfs 26,452 cf

SubcatchmentEX-2: Back Patio

Runoff Area=26,050 sf 19.27% Impervious Runoff Depth=2.38"
Tc=5.0 min CN=50 Runoff=1.90 cfs 5,164 cf

Link DP1: Front Entry

Inflow=9.85 cfs 26,452 cf
Primary=9.85 cfs 26,452 cf

Link DP2: Back Patio

Inflow=1.90 cfs 5,164 cf
Primary=1.90 cfs 5,164 cf

Total Runoff Area = 86,725 sf Runoff Volume = 31,617 cf Average Runoff Depth = 4.37"
51.29% Pervious = 44,485 sf 48.71% Impervious = 42,240 sf

Summary for Subcatchment EX-1: Front Entry

Runoff = 9.85 cfs @ 12.12 hrs, Volume= 26,452 cf, Depth= 5.23"

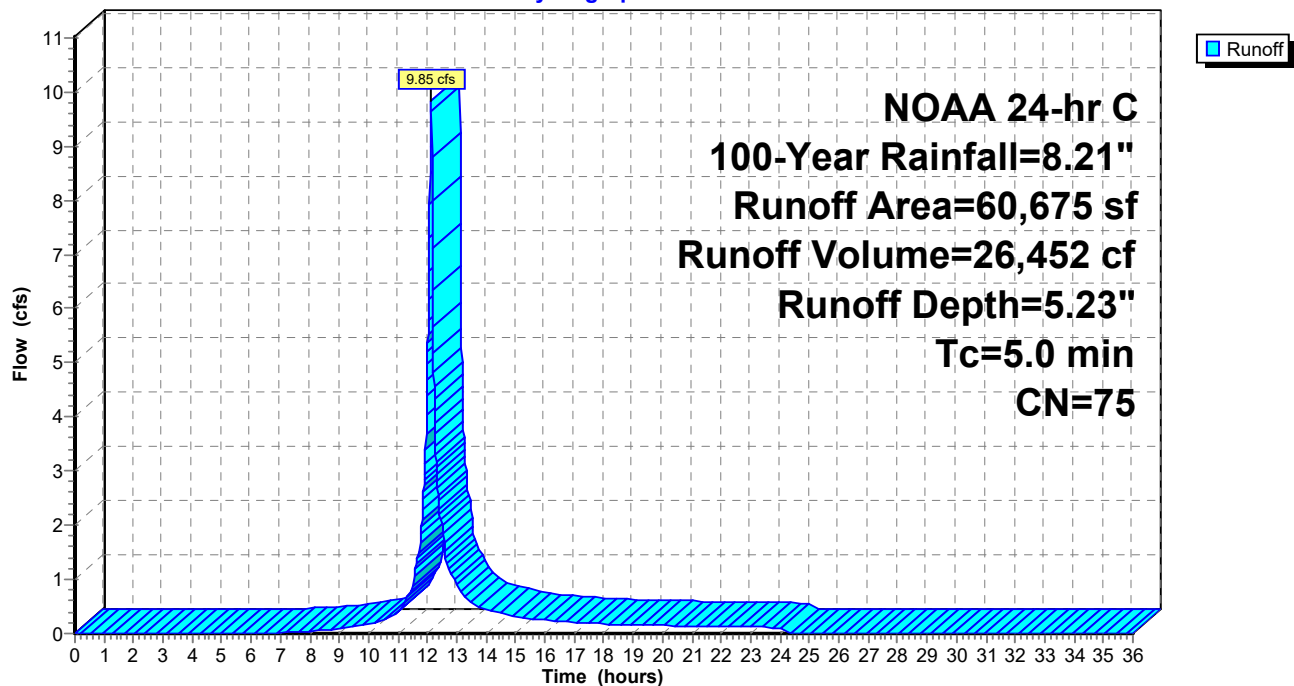
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 NOAA 24-hr C 100-Year Rainfall=8.21"

Area (sf)	CN	Description
37,220	98	Paved parking, HSG A
23,455	39	>75% Grass cover, Good, HSG A
60,675	75	Weighted Average
23,455		38.66% Pervious Area
37,220		61.34% Impervious Area

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

Subcatchment EX-1: Front Entry

Hydrograph



Summary for Subcatchment EX-2: Back Patio

Runoff = 1.90 cfs @ 12.13 hrs, Volume= 5,164 cf, Depth= 2.38"

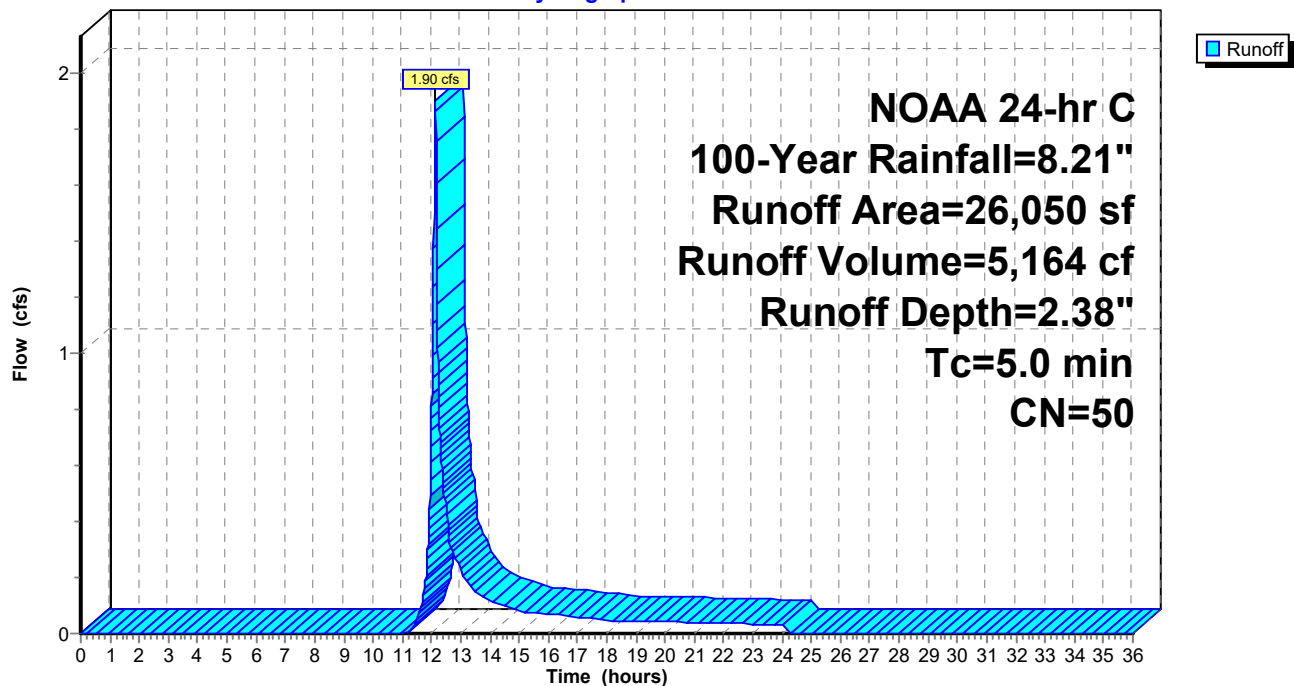
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 NOAA 24-hr C 100-Year Rainfall=8.21"

Area (sf)	CN	Description
5,020	98	Paved parking, HSG A
21,030	39	>75% Grass cover, Good, HSG A
26,050	50	Weighted Average
21,030		80.73% Pervious Area
5,020		19.27% Impervious Area

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

Subcatchment EX-2: Back Patio

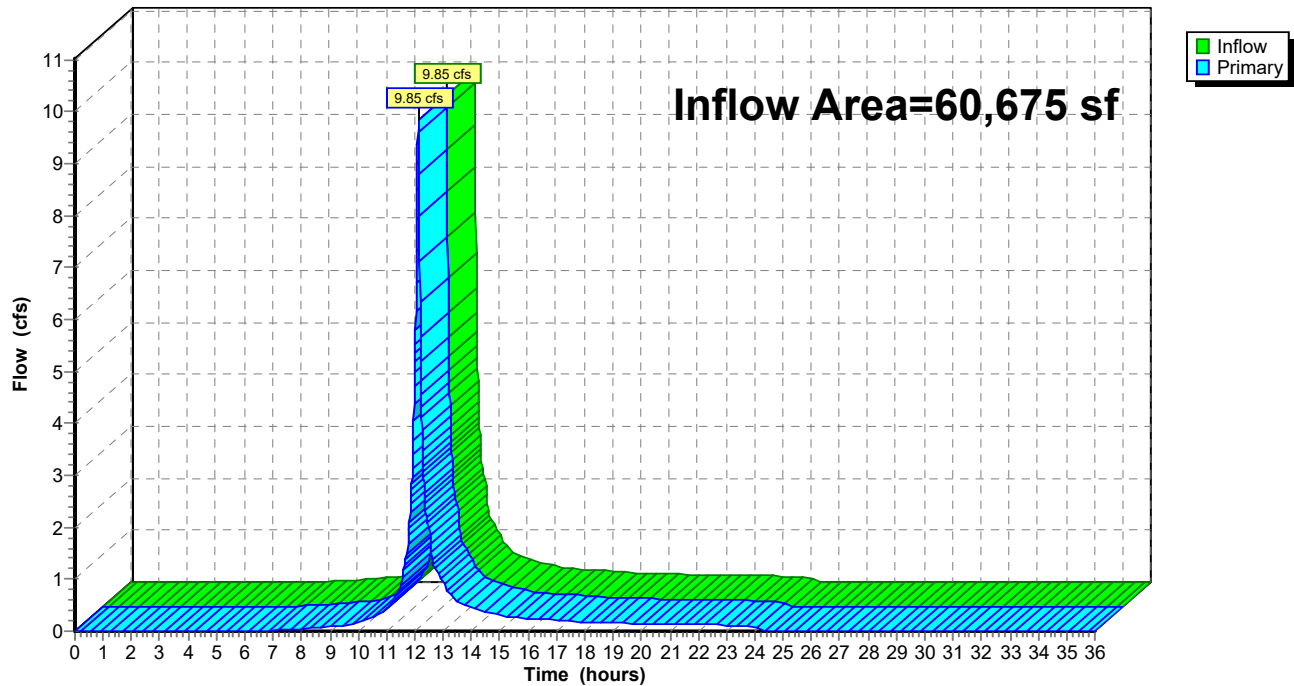
Hydrograph



Summary for Link DP1: Front Entry

Inflow Area = 60,675 sf, 61.34% Impervious, Inflow Depth = 5.23" for 100-Year event
Inflow = 9.85 cfs @ 12.12 hrs, Volume= 26,452 cf
Primary = 9.85 cfs @ 12.12 hrs, Volume= 26,452 cf, Atten= 0%, Lag= 0.0 min

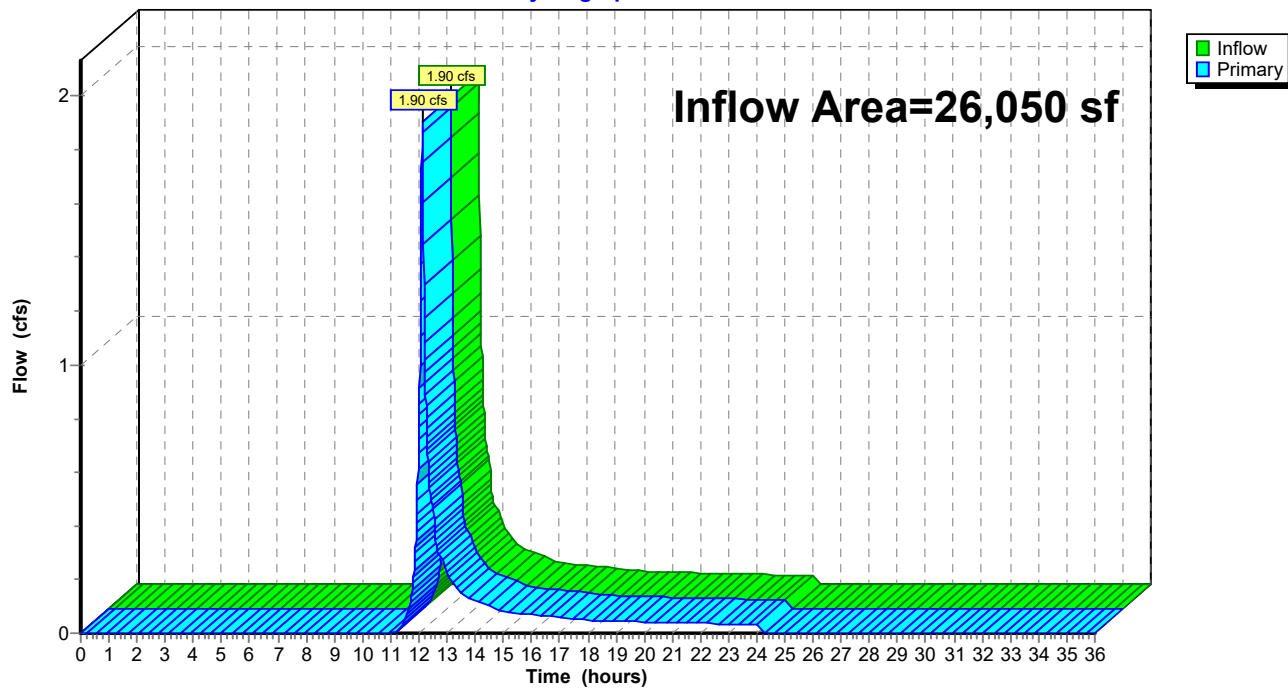
Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

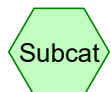
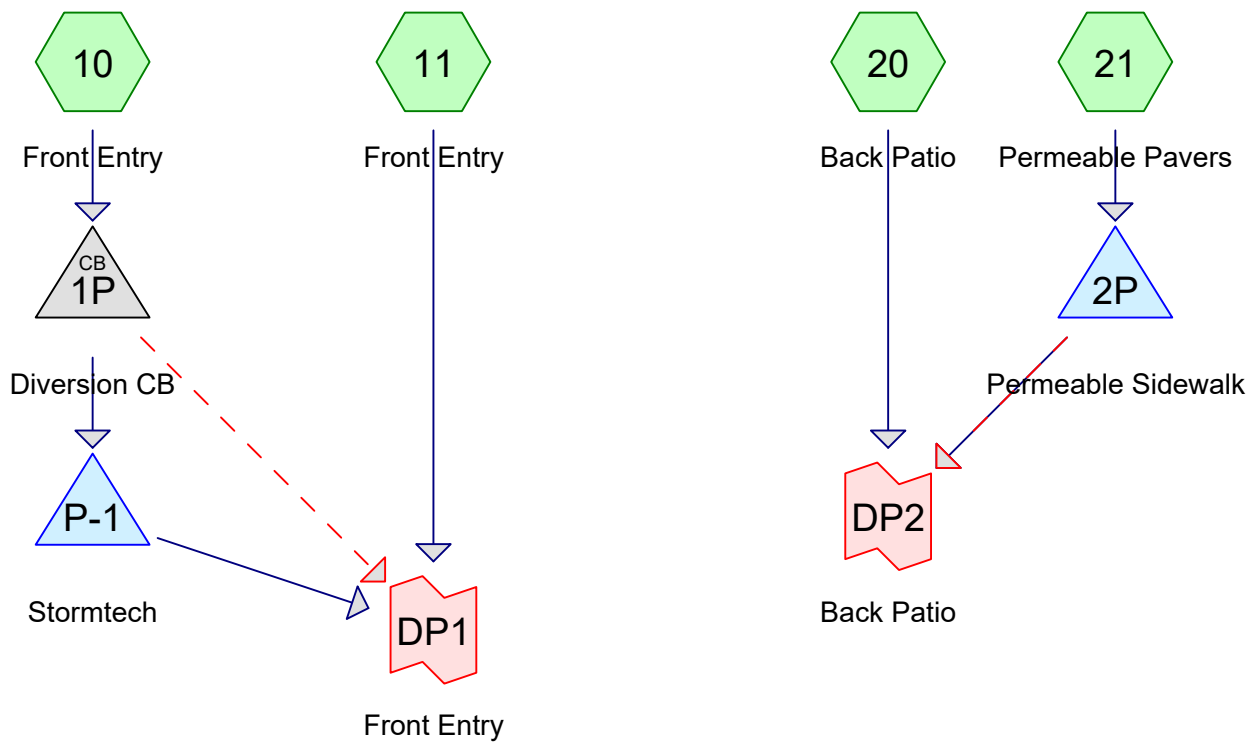
Link DP1: Front Entry**Hydrograph**

Summary for Link DP2: Back Patio

Inflow Area = 26,050 sf, 19.27% Impervious, Inflow Depth = 2.38" for 100-Year event
Inflow = 1.90 cfs @ 12.13 hrs, Volume= 5,164 cf
Primary = 1.90 cfs @ 12.13 hrs, Volume= 5,164 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

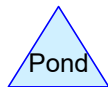
Link DP2: Back Patio**Hydrograph**



Subcat



Reach



Pond



Link

Routing Diagram for 1462800_PR

Prepared by VHB, Printed 9/17/2020

HydroCAD® 10.00-25 s/n 01038 © 2019 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
40,332	39	>75% Grass cover, Good, HSG A (10, 11, 20)
42,893	98	Paved parking, HSG A (10, 11, 20)
3,500	98	Permeable (21)
86,725	71	TOTAL AREA

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 Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment10: Front Entry Runoff Area=34,320 sf 72.93% Impervious Runoff Depth=1.64"
 Tc=5.0 min CN=82 Runoff=1.79 cfs 4,700 cf

Subcatchment11: Front Entry Runoff Area=26,355 sf 52.38% Impervious Runoff Depth=0.90"
 Tc=5.0 min CN=70 Runoff=0.73 cfs 1,987 cf

Subcatchment20: Back Patio Runoff Area=22,550 sf 18.00% Impervious Runoff Depth=0.16"
 Tc=5.0 min CN=50 Runoff=0.02 cfs 293 cf

Subcatchment21: Permeable Pavers Runoff Area=3,500 sf 100.00% Impervious Runoff Depth=3.10"
 Tc=5.0 min CN=98 Runoff=0.29 cfs 903 cf

Pond 1P: Diversion CB Peak Elev=93.98' Inflow=1.79 cfs 4,700 cf
 Primary=1.79 cfs 4,700 cf Secondary=0.00 cfs 0 cf Outflow=1.79 cfs 4,700 cf

Pond 2P: Permeable Sidewalk Peak Elev=98.60' Storage=135 cf Inflow=0.29 cfs 903 cf
 Discarded=0.08 cfs 904 cf Primary=0.00 cfs 0 cf Secondary=0.00 cfs 0 cf Outflow=0.08 cfs 904 cf

Pond P-1: Stormtech Peak Elev=93.98' Storage=2,771 cf Inflow=1.79 cfs 4,700 cf
 Discarded=0.05 cfs 4,511 cf Primary=0.00 cfs 0 cf Outflow=0.05 cfs 4,511 cf

Link DP1: Front Entry Inflow=0.73 cfs 1,987 cf
 Primary=0.73 cfs 1,987 cf

Link DP2: Back Patio Inflow=0.02 cfs 293 cf
 Primary=0.02 cfs 293 cf

Total Runoff Area = 86,725 sf Runoff Volume = 7,884 cf Average Runoff Depth = 1.09"
46.51% Pervious = 40,332 sf 53.49% Impervious = 46,393 sf

Summary for Subcatchment 10: Front Entry

Runoff = 1.79 cfs @ 12.13 hrs, Volume= 4,700 cf, Depth= 1.64"

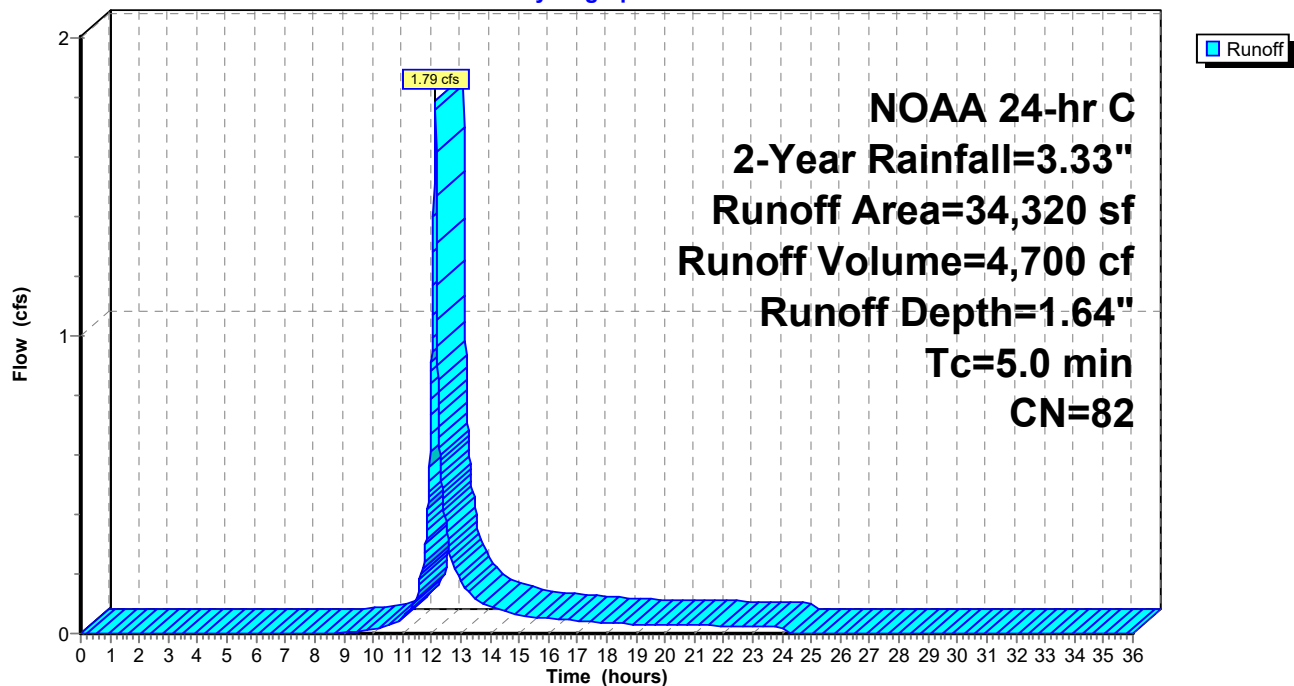
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 NOAA 24-hr C 2-Year Rainfall=3.33"

Area (sf)	CN	Description
25,030	98	Paved parking, HSG A
9,290	39	>75% Grass cover, Good, HSG A
34,320	82	Weighted Average
9,290		27.07% Pervious Area
25,030		72.93% Impervious Area

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

Subcatchment 10: Front Entry

Hydrograph



Summary for Subcatchment 11: Front Entry

Runoff = 0.73 cfs @ 12.13 hrs, Volume= 1,987 cf, Depth= 0.90"

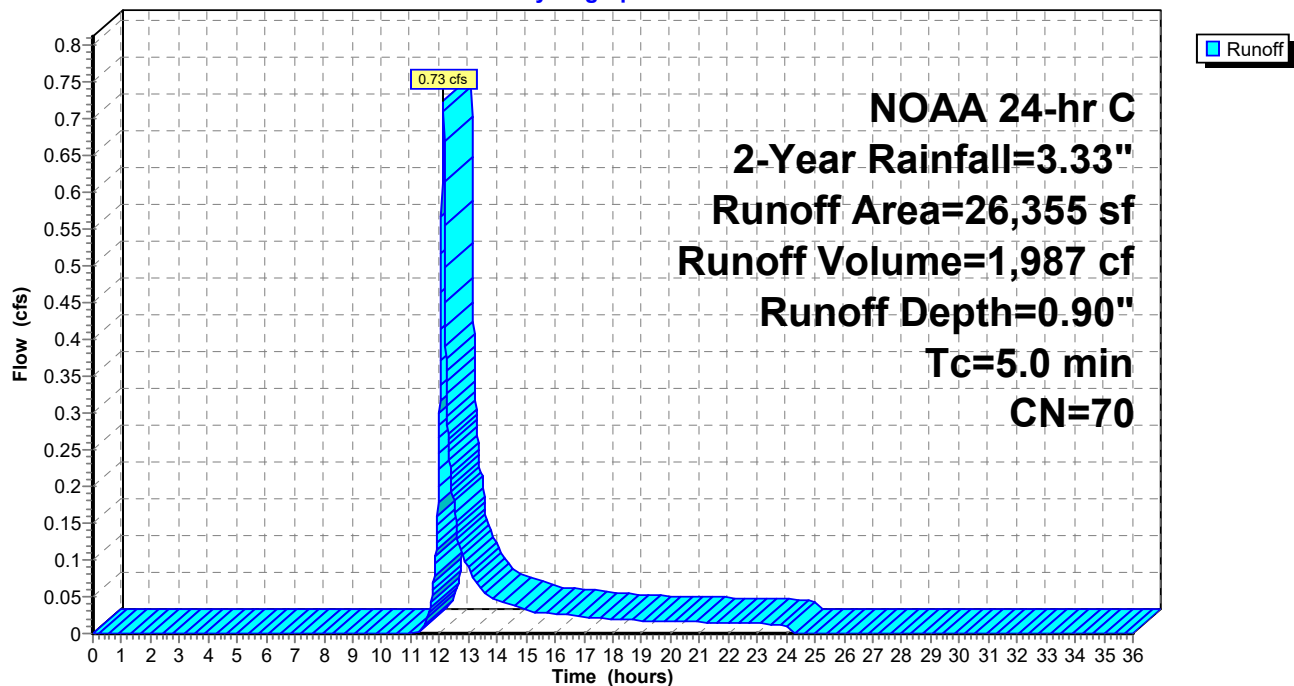
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 NOAA 24-hr C 2-Year Rainfall=3.33"

Area (sf)	CN	Description
13,805	98	Paved parking, HSG A
12,550	39	>75% Grass cover, Good, HSG A
26,355	70	Weighted Average
12,550		47.62% Pervious Area
13,805		52.38% Impervious Area

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

Subcatchment 11: Front Entry

Hydrograph



Summary for Subcatchment 20: Back Patio

Runoff = 0.02 cfs @ 12.53 hrs, Volume= 293 cf, Depth= 0.16"

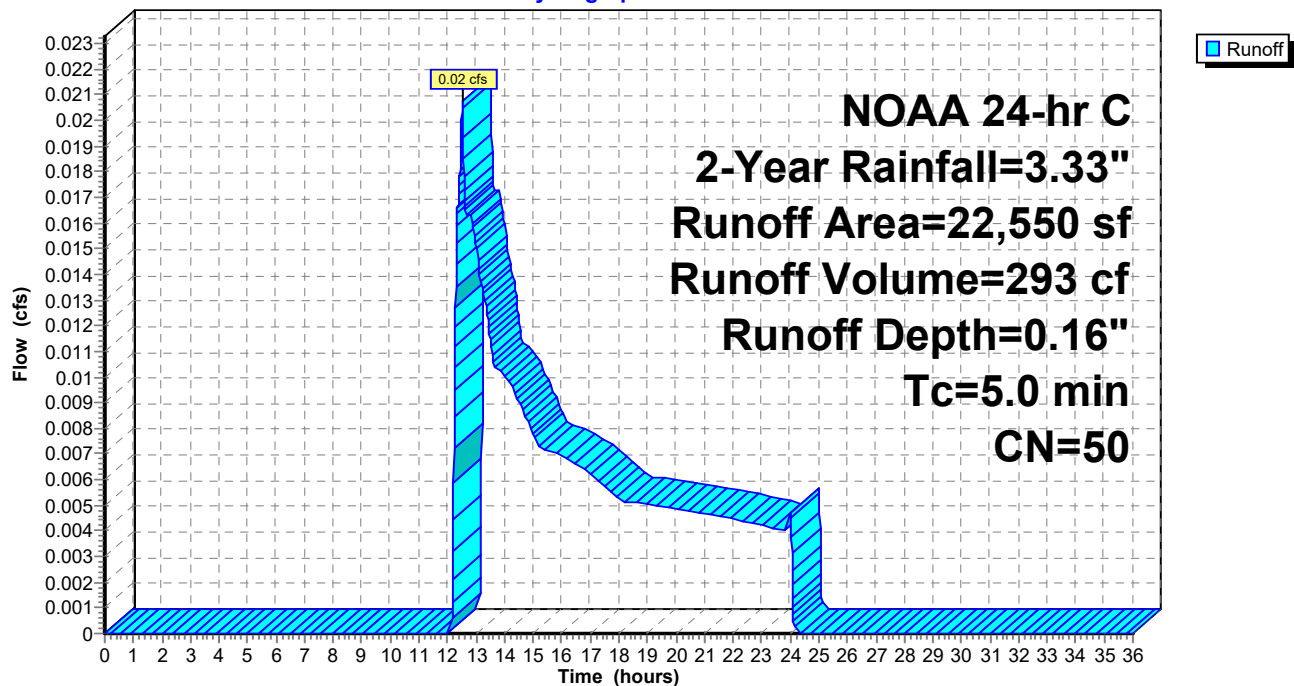
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NOAA 24-hr C 2-Year Rainfall=3.33"

Area (sf)	CN	Description
4,058	98	Paved parking, HSG A
18,492	39	>75% Grass cover, Good, HSG A
22,550	50	Weighted Average
18,492		82.00% Pervious Area
4,058		18.00% Impervious Area

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

Subcatchment 20: Back Patio

Hydrograph



Summary for Subcatchment 21: Permeable Pavers

Runoff = 0.29 cfs @ 12.12 hrs, Volume= 903 cf, Depth= 3.10"

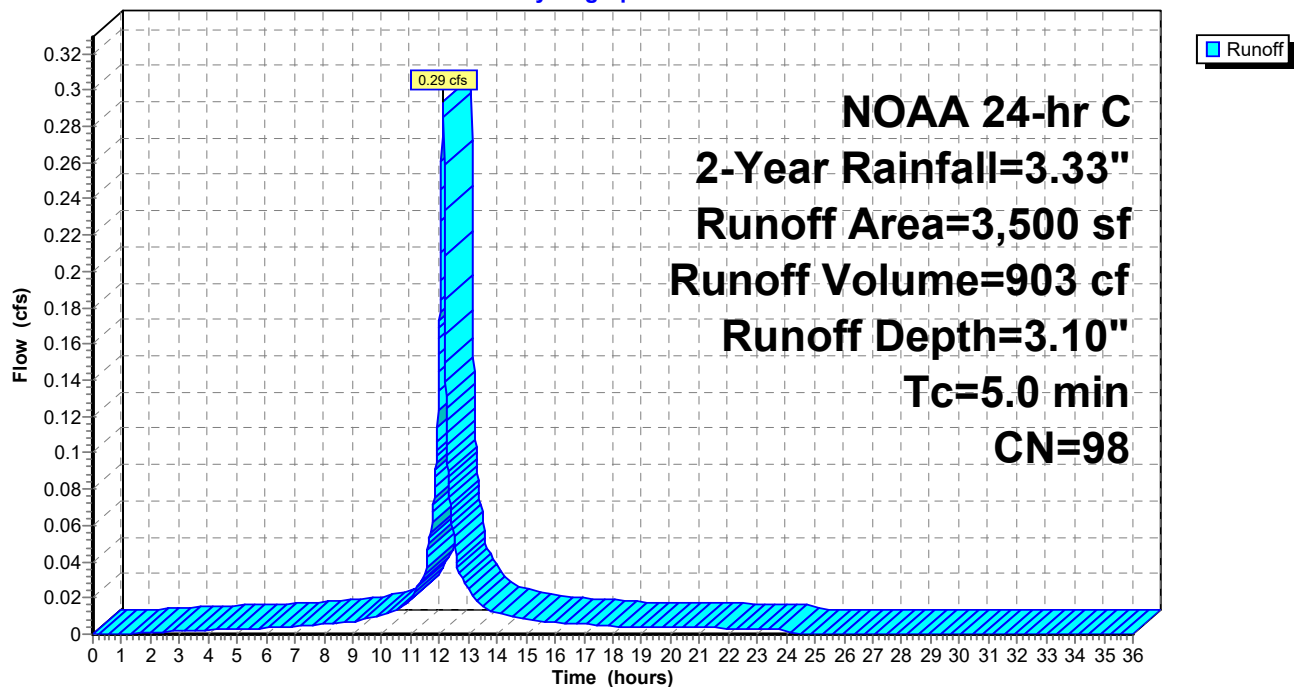
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 NOAA 24-hr C 2-Year Rainfall=3.33"

	Area (sf)	CN	Description
*	3,500	98	Permeable
	3,500		100.00% Impervious Area

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

Subcatchment 21: Permeable Pavers

Hydrograph



Summary for Pond 1P: Diversion CB

Inflow Area = 34,320 sf, 72.93% Impervious, Inflow Depth = 1.64" for 2-Year event
 Inflow = 1.79 cfs @ 12.13 hrs, Volume= 4,700 cf
 Outflow = 1.79 cfs @ 12.13 hrs, Volume= 4,700 cf, Atten= 0%, Lag= 0.0 min
 Primary = 1.79 cfs @ 12.13 hrs, Volume= 4,700 cf
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

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

Peak Elev= 93.98' @ 16.27 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	92.60'	24.0" Round Culvert L= 10.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 92.60' / 92.50' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Secondary	94.40'	10.0" Round Culvert L= 5.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 94.40' / 94.30' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 0.55 sf

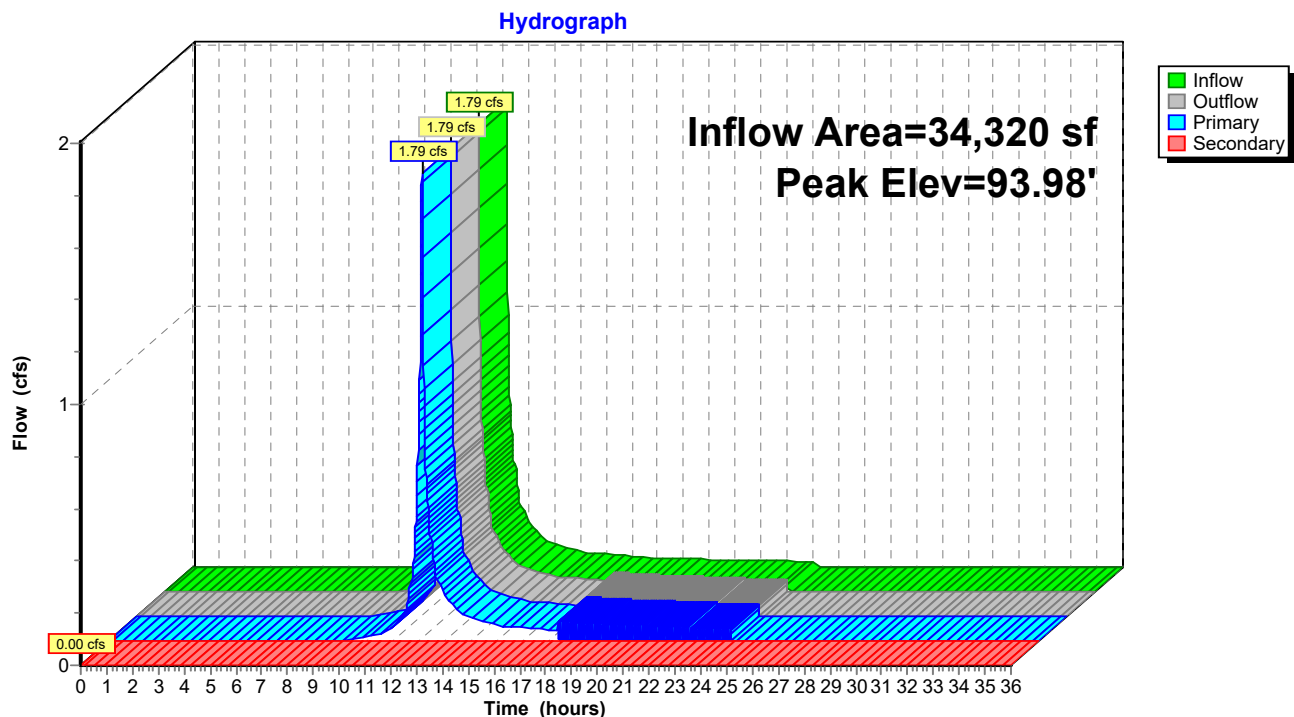
Primary OutFlow Max=1.78 cfs @ 12.13 hrs HW=93.24' TW=92.93' (Dynamic Tailwater)

↑**1=Culvert** (Barrel Controls 1.78 cfs @ 3.11 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=92.60' TW=0.00' (Dynamic Tailwater)

↑**2=Culvert** (Controls 0.00 cfs)

Pond 1P: Diversion CB



Summary for Pond 2P: Permeable Sidewalk

Inflow Area = 3,500 sf, 100.00% Impervious, Inflow Depth = 3.10" for 2-Year event
 Inflow = 0.29 cfs @ 12.12 hrs, Volume= 903 cf
 Outflow = 0.08 cfs @ 12.01 hrs, Volume= 904 cf, Atten= 72%, Lag= 0.0 min
 Discarded = 0.08 cfs @ 12.01 hrs, Volume= 904 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 98.60' @ 12.32 hrs Surf.Area= 3,500 sf Storage= 135 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 6.7 min (762.5 - 755.8)

Volume	Invert	Avail.Storage	Storage Description
#1	98.50'	1,750 cf	Permeable (Prismatic) Listed below (Recalc) 4,375 cf Overall x 40.0% Voids
#2	99.75'	875 cf	Surface (Prismatic) Listed below (Recalc) -Impervious
		2,625 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
98.50	3,500	0	0
99.75	3,500	4,375	4,375

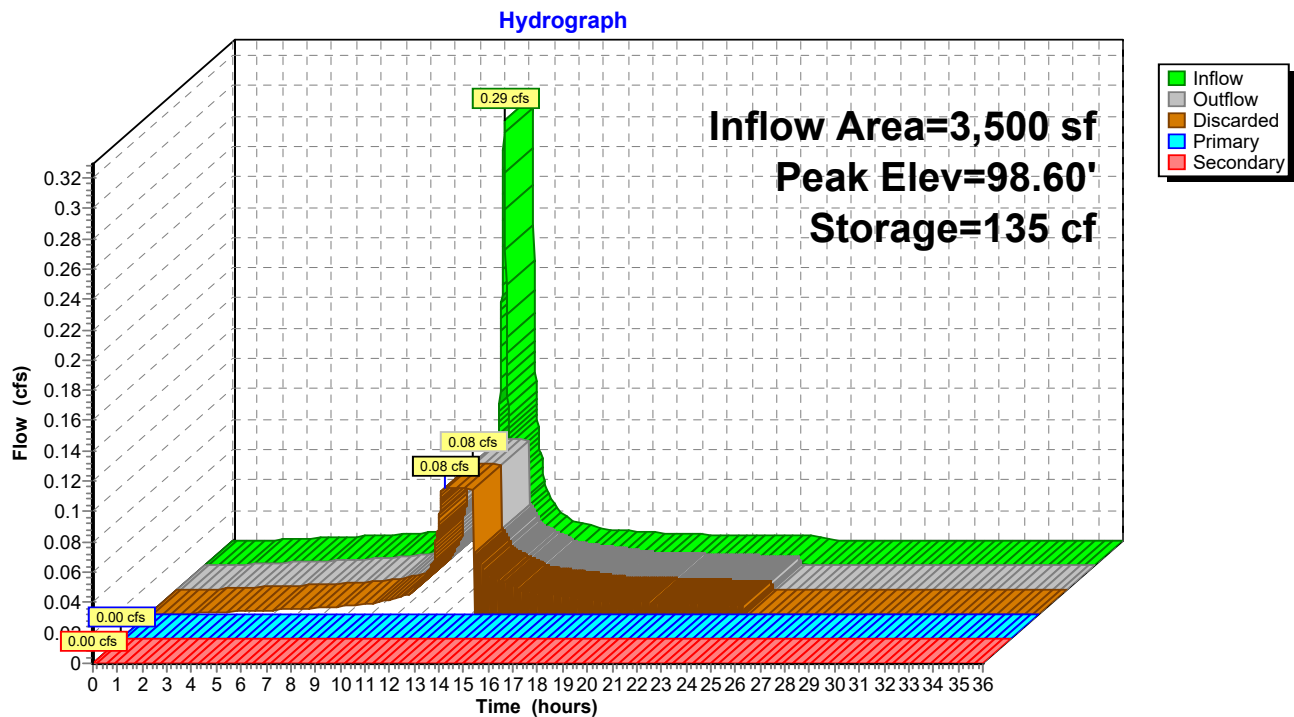
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
99.75	3,500	0	0
100.00	3,500	875	875

Device	Routing	Invert	Outlet Devices
#1	Discarded	98.50'	1.020 in/hr Exfiltration over Surface area
#2	Primary	98.75'	6.0" Round Culvert L= 10.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 98.75' / 98.40' S= 0.0350 ' / Cc= 0.900 n= 0.012, Flow Area= 0.20 sf
#3	Secondary	99.95'	20.0' long x 4.0' 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) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Discarded OutFlow Max=0.08 cfs @ 12.01 hrs HW=98.52' (Free Discharge)
 ↑ **1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=98.50' TW=0.00' (Dynamic Tailwater)
 ↑ **2=Culvert** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=98.50' TW=0.00' (Dynamic Tailwater)
 ↑ **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: Permeable Sidewalk

Summary for Pond P-1: Stormtech

Inflow Area = 34,320 sf, 72.93% Impervious, Inflow Depth = 1.64" for 2-Year event
 Inflow = 1.79 cfs @ 12.13 hrs, Volume= 4,700 cf
 Outflow = 0.05 cfs @ 11.95 hrs, Volume= 4,511 cf, Atten= 97%, Lag= 0.0 min
 Discarded = 0.05 cfs @ 11.95 hrs, Volume= 4,511 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 93.98' @ 16.26 hrs Surf.Area= 2,062 sf Storage= 2,771 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 550.6 min (1,387.4 - 836.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	92.00'	1,878 cf	44.25'W x 46.34'L x 3.50'H Field A 7,176 cf Overall - 2,481 cf Embedded = 4,696 cf x 40.0% Voids
#2A	92.50'	2,481 cf	ADS_StormTech SC-740 +Cap x 54 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 54 Chambers in 9 Rows
#3	92.50'	861 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
		5,220 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
92.50	12	0	0
96.90	12	53	53
97.00	110	6	59
97.50	3,100	803	861

Device	Routing	Invert	Outlet Devices
#1	Primary	96.90'	2.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	92.00'	1.020 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.05 cfs @ 11.95 hrs HW=92.51' (Free Discharge)
 ↑ **2=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=92.00' TW=0.00' (Dynamic Tailwater)
 ↑ **1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond P-1: Stormtech - Chamber Wizard Field A**Chamber Model = ADS_StormTechSC-740 +Cap (ADS StormTech®SC-740 with cap length)**

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

6 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 44.34' Row Length +12.0" End Stone x 2 = 46.34' Base Length

9 Rows x 51.0" Wide + 6.0" Spacing x 8 + 12.0" Side Stone x 2 = 44.25' Base Width

6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

54 Chambers x 45.9 cf = 2,480.8 cf Chamber Storage

7,176.4 cf Field - 2,480.8 cf Chambers = 4,695.6 cf Stone x 40.0% Voids = 1,878.3 cf Stone Storage

Chamber Storage + Stone Storage = 4,359.0 cf = 0.100 af

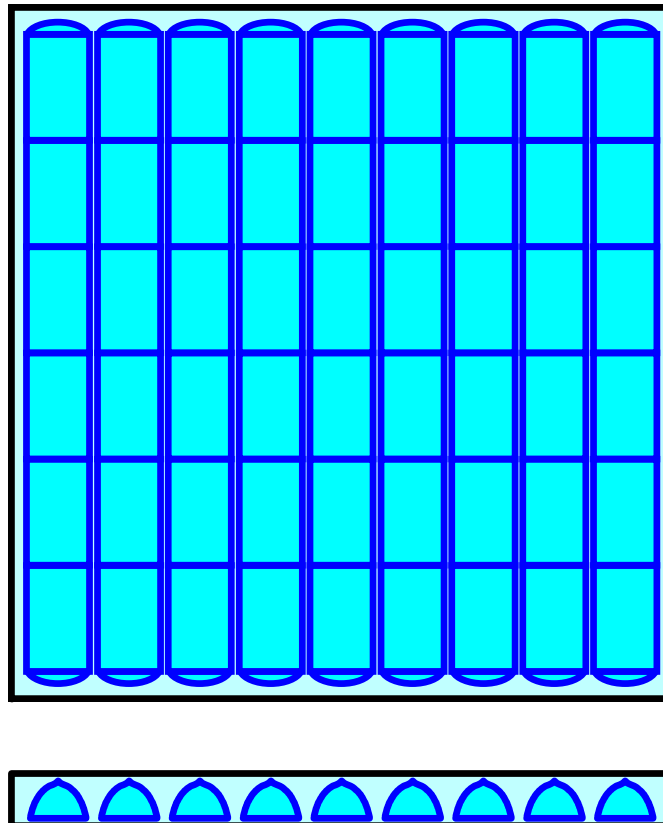
Overall Storage Efficiency = 60.7%

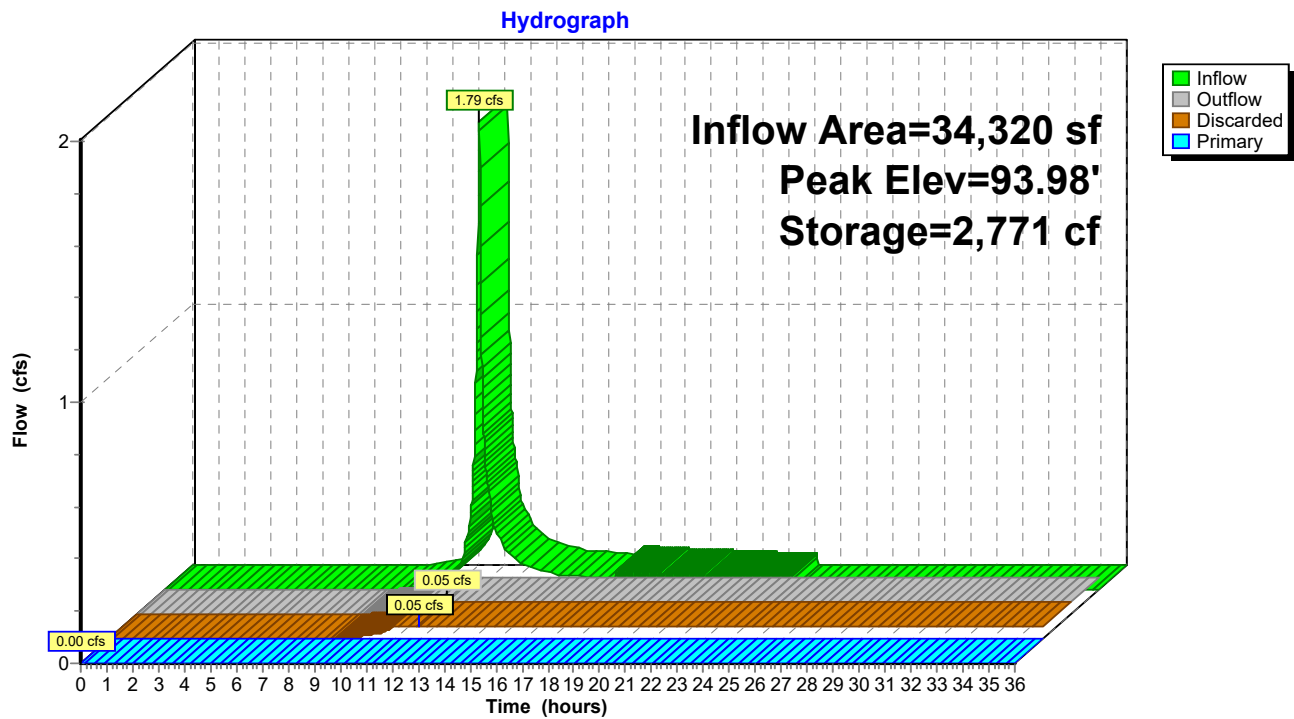
Overall System Size = 46.34' x 44.25' x 3.50'

54 Chambers

265.8 cy Field

173.9 cy Stone

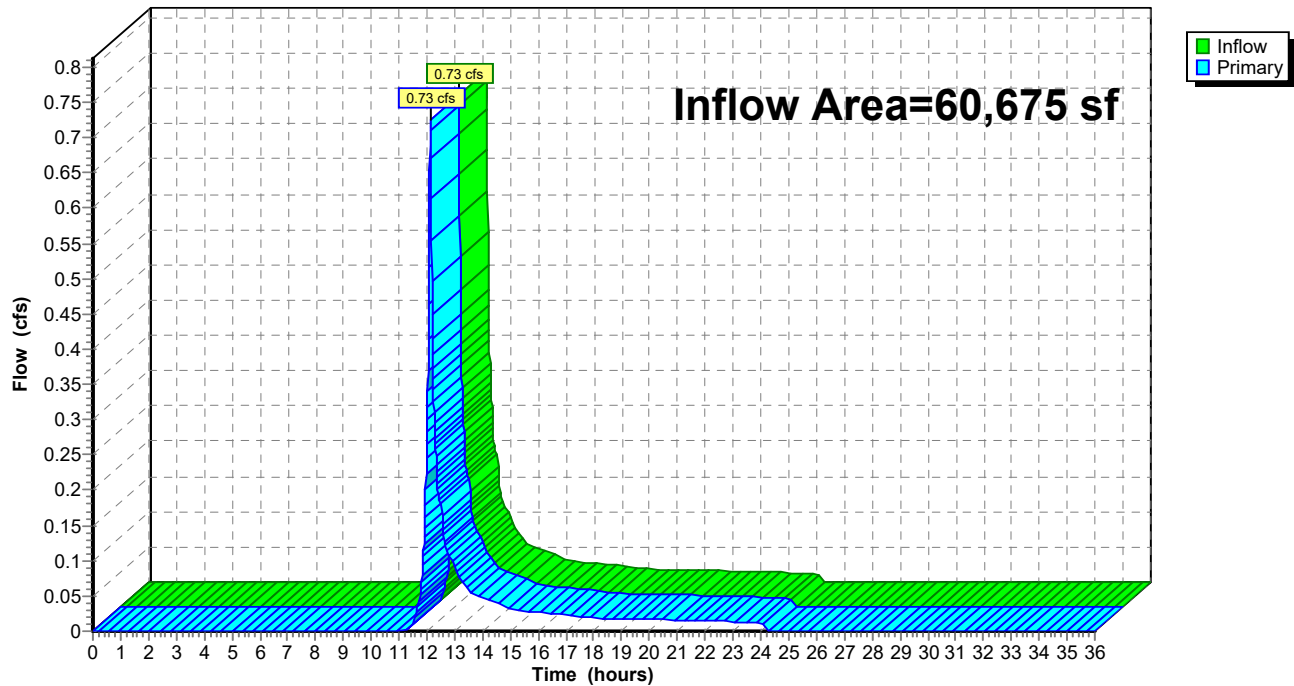


Pond P-1: Stormtech

Summary for Link DP1: Front Entry

Inflow Area = 60,675 sf, 64.00% Impervious, Inflow Depth = 0.39" for 2-Year event
Inflow = 0.73 cfs @ 12.13 hrs, Volume= 1,987 cf
Primary = 0.73 cfs @ 12.13 hrs, Volume= 1,987 cf, Atten= 0%, Lag= 0.0 min

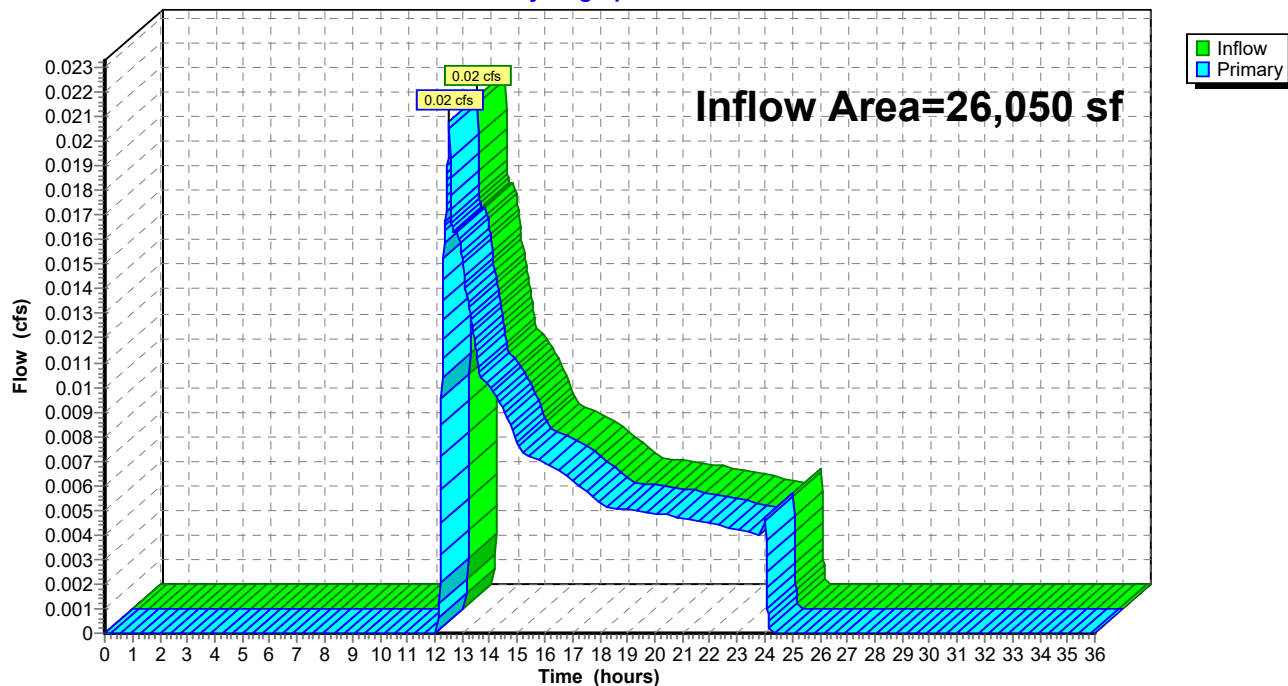
Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link DP1: Front Entry**Hydrograph**

Summary for Link DP2: Back Patio

Inflow Area = 26,050 sf, 29.01% Impervious, Inflow Depth = 0.14" for 2-Year event
Inflow = 0.02 cfs @ 12.53 hrs, Volume= 293 cf
Primary = 0.02 cfs @ 12.53 hrs, Volume= 293 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link DP2: Back Patio**Hydrograph**

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 Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment10: Front Entry Runoff Area=34,320 sf 72.93% Impervious Runoff Depth=3.28"
 Tc=5.0 min CN=82 Runoff=3.50 cfs 9,371 cf

Subcatchment11: Front Entry Runoff Area=26,355 sf 52.38% Impervious Runoff Depth=2.20"
 Tc=5.0 min CN=70 Runoff=1.84 cfs 4,834 cf

Subcatchment20: Back Patio Runoff Area=22,550 sf 18.00% Impervious Runoff Depth=0.78"
 Tc=5.0 min CN=50 Runoff=0.44 cfs 1,474 cf

Subcatchment21: Permeable Pavers Runoff Area=3,500 sf 100.00% Impervious Runoff Depth=4.98"
 Tc=5.0 min CN=98 Runoff=0.46 cfs 1,453 cf

Pond 1P: Diversion CB Peak Elev=94.94' Inflow=3.50 cfs 9,371 cf
 Primary=3.50 cfs 6,045 cf Secondary=0.87 cfs 3,325 cf Outflow=3.50 cfs 9,370 cf

Pond 2P: Permeable Sidewalk Peak Elev=98.73' Storage=320 cf Inflow=0.46 cfs 1,453 cf
 Discarded=0.08 cfs 1,454 cf Primary=0.00 cfs 0 cf Secondary=0.00 cfs 0 cf Outflow=0.08 cfs 1,454 cf

Pond P-1: Stormtech Peak Elev=94.94' Storage=3,928 cf Inflow=3.50 cfs 6,045 cf
 Discarded=0.05 cfs 4,813 cf Primary=0.00 cfs 0 cf Outflow=0.05 cfs 4,813 cf

Link DP1: Front Entry Inflow=1.84 cfs 8,158 cf
 Primary=1.84 cfs 8,158 cf

Link DP2: Back Patio Inflow=0.44 cfs 1,474 cf
 Primary=0.44 cfs 1,474 cf

Total Runoff Area = 86,725 sf Runoff Volume = 17,132 cf Average Runoff Depth = 2.37"
46.51% Pervious = 40,332 sf 53.49% Impervious = 46,393 sf

Summary for Subcatchment 10: Front Entry

Runoff = 3.50 cfs @ 12.12 hrs, Volume= 9,371 cf, Depth= 3.28"

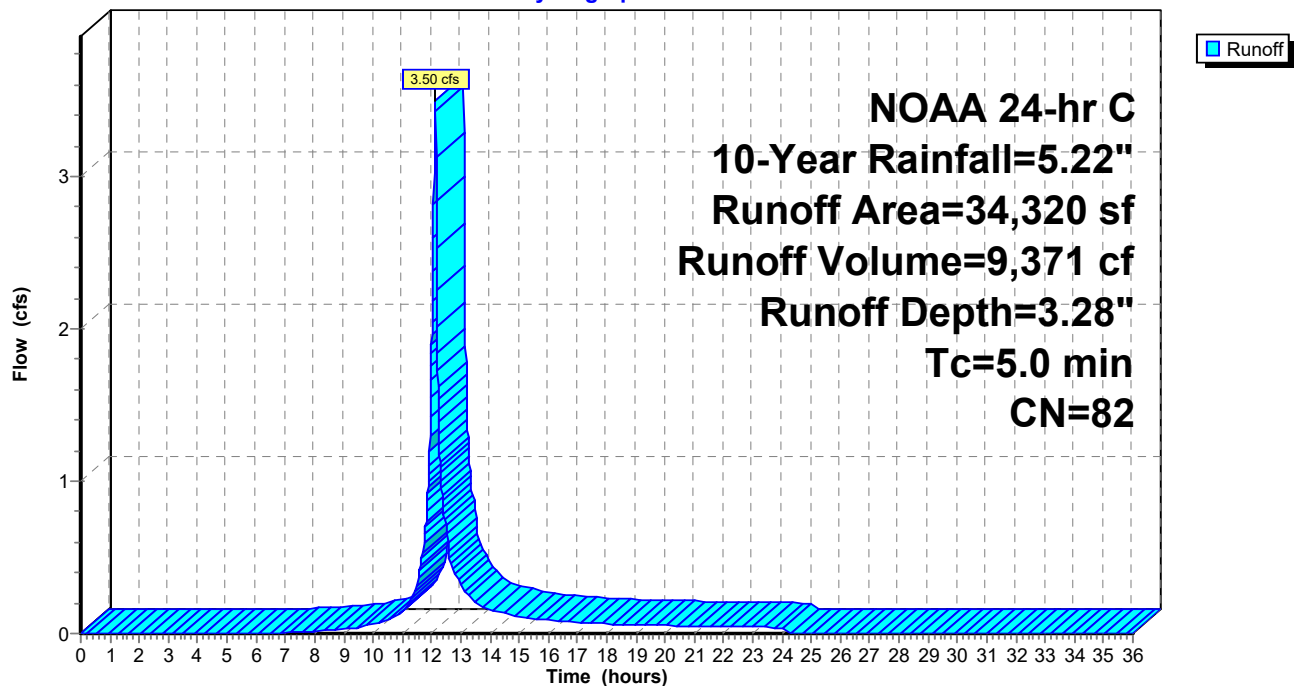
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 NOAA 24-hr C 10-Year Rainfall=5.22"

Area (sf)	CN	Description
25,030	98	Paved parking, HSG A
9,290	39	>75% Grass cover, Good, HSG A
34,320	82	Weighted Average
9,290		27.07% Pervious Area
25,030		72.93% Impervious Area

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

Subcatchment 10: Front Entry

Hydrograph



Summary for Subcatchment 11: Front Entry

Runoff = 1.84 cfs @ 12.13 hrs, Volume= 4,834 cf, Depth= 2.20"

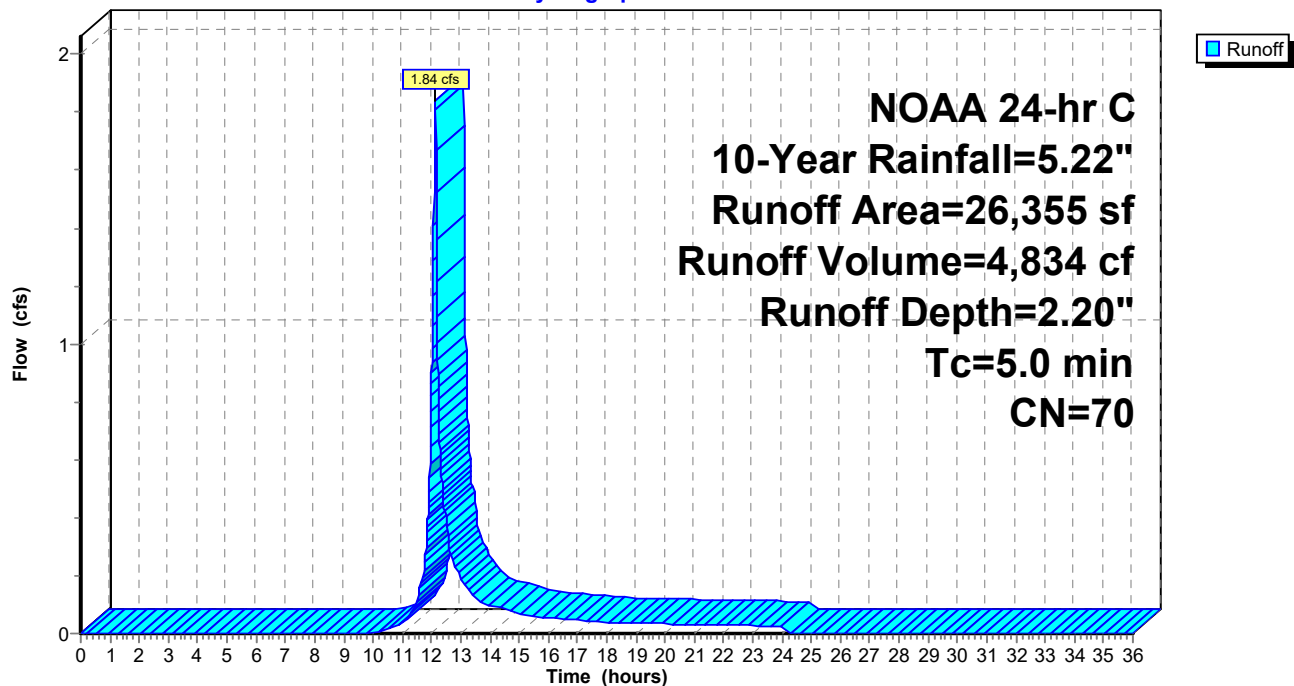
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 NOAA 24-hr C 10-Year Rainfall=5.22"

Area (sf)	CN	Description
13,805	98	Paved parking, HSG A
12,550	39	>75% Grass cover, Good, HSG A
26,355	70	Weighted Average
12,550		47.62% Pervious Area
13,805		52.38% Impervious Area

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

Subcatchment 11: Front Entry

Hydrograph



Summary for Subcatchment 20: Back Patio

Runoff = 0.44 cfs @ 12.14 hrs, Volume= 1,474 cf, Depth= 0.78"

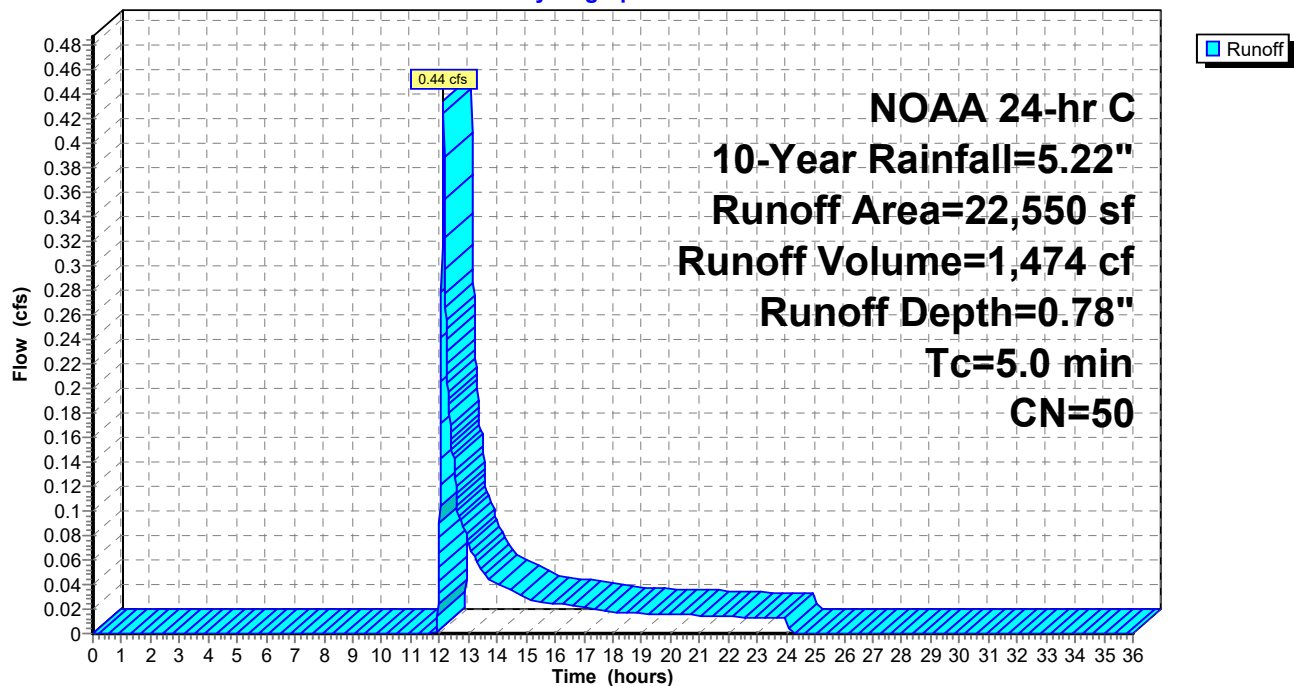
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 NOAA 24-hr C 10-Year Rainfall=5.22"

Area (sf)	CN	Description
4,058	98	Paved parking, HSG A
18,492	39	>75% Grass cover, Good, HSG A
22,550	50	Weighted Average
18,492		82.00% Pervious Area
4,058		18.00% Impervious Area

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

Subcatchment 20: Back Patio

Hydrograph



Summary for Subcatchment 21: Permeable Pavers

Runoff = 0.46 cfs @ 12.12 hrs, Volume= 1,453 cf, Depth= 4.98"

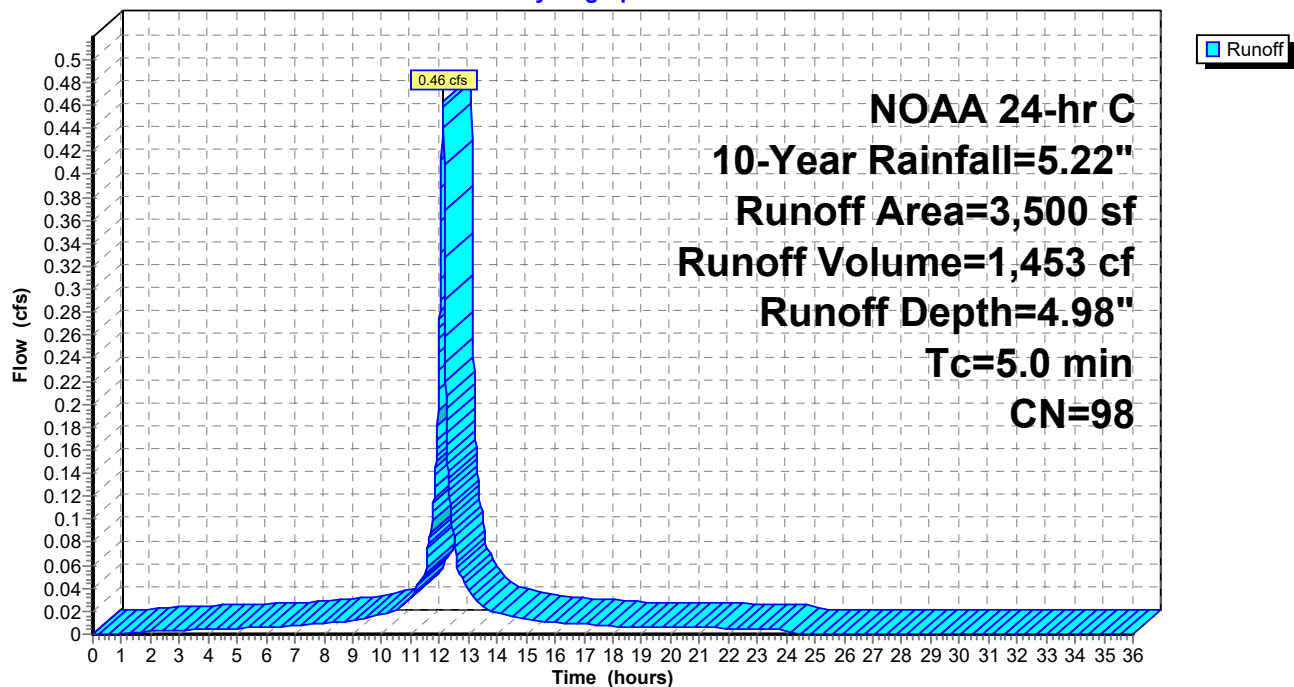
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 NOAA 24-hr C 10-Year Rainfall=5.22"

	Area (sf)	CN	Description
*	3,500	98	Permeable
	3,500		100.00% Impervious Area

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

Subcatchment 21: Permeable Pavers

Hydrograph



Summary for Pond 1P: Diversion CB

Inflow Area = 34,320 sf, 72.93% Impervious, Inflow Depth = 3.28" for 10-Year event
 Inflow = 3.50 cfs @ 12.12 hrs, Volume= 9,371 cf
 Outflow = 3.50 cfs @ 12.12 hrs, Volume= 9,370 cf, Atten= 0%, Lag= 0.0 min
 Primary = 3.50 cfs @ 12.12 hrs, Volume= 6,045 cf
 Secondary = 0.87 cfs @ 12.36 hrs, Volume= 3,325 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 94.94' @ 12.36 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	92.60'	24.0" Round Culvert L= 10.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 92.60' / 92.50' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Secondary	94.40'	10.0" Round Culvert L= 5.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 94.40' / 94.30' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 0.55 sf

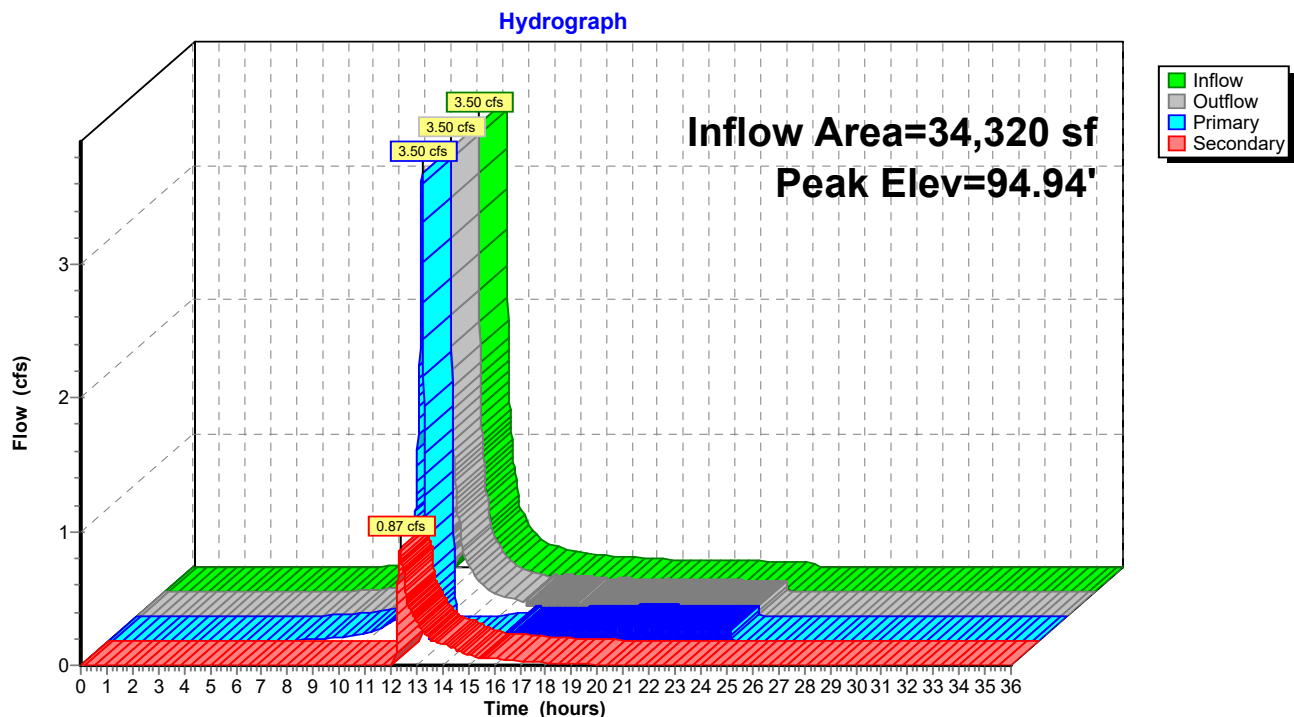
Primary OutFlow Max=1.41 cfs @ 12.12 hrs HW=94.03' TW=94.02' (Dynamic Tailwater)

↑**1=Culvert** (Outlet Controls 1.41 cfs @ 0.82 fps)

Secondary OutFlow Max=0.87 cfs @ 12.36 hrs HW=94.94' TW=0.00' (Dynamic Tailwater)

↑**2=Culvert** (Barrel Controls 0.87 cfs @ 3.32 fps)

Pond 1P: Diversion CB



Summary for Pond 2P: Permeable Sidewalk

Inflow Area = 3,500 sf, 100.00% Impervious, Inflow Depth = 4.98" for 10-Year event
 Inflow = 0.46 cfs @ 12.12 hrs, Volume= 1,453 cf
 Outflow = 0.08 cfs @ 11.89 hrs, Volume= 1,454 cf, Atten= 82%, Lag= 0.0 min
 Discarded = 0.08 cfs @ 11.89 hrs, Volume= 1,454 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 98.73' @ 12.54 hrs Surf.Area= 3,500 sf Storage= 320 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 19.2 min (766.4 - 747.2)

Volume	Invert	Avail.Storage	Storage Description
#1	98.50'	1,750 cf	Permeable (Prismatic) Listed below (Recalc) 4,375 cf Overall x 40.0% Voids
#2	99.75'	875 cf	Surface (Prismatic) Listed below (Recalc) -Impervious
		2,625 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
98.50	3,500	0	0
99.75	3,500	4,375	4,375

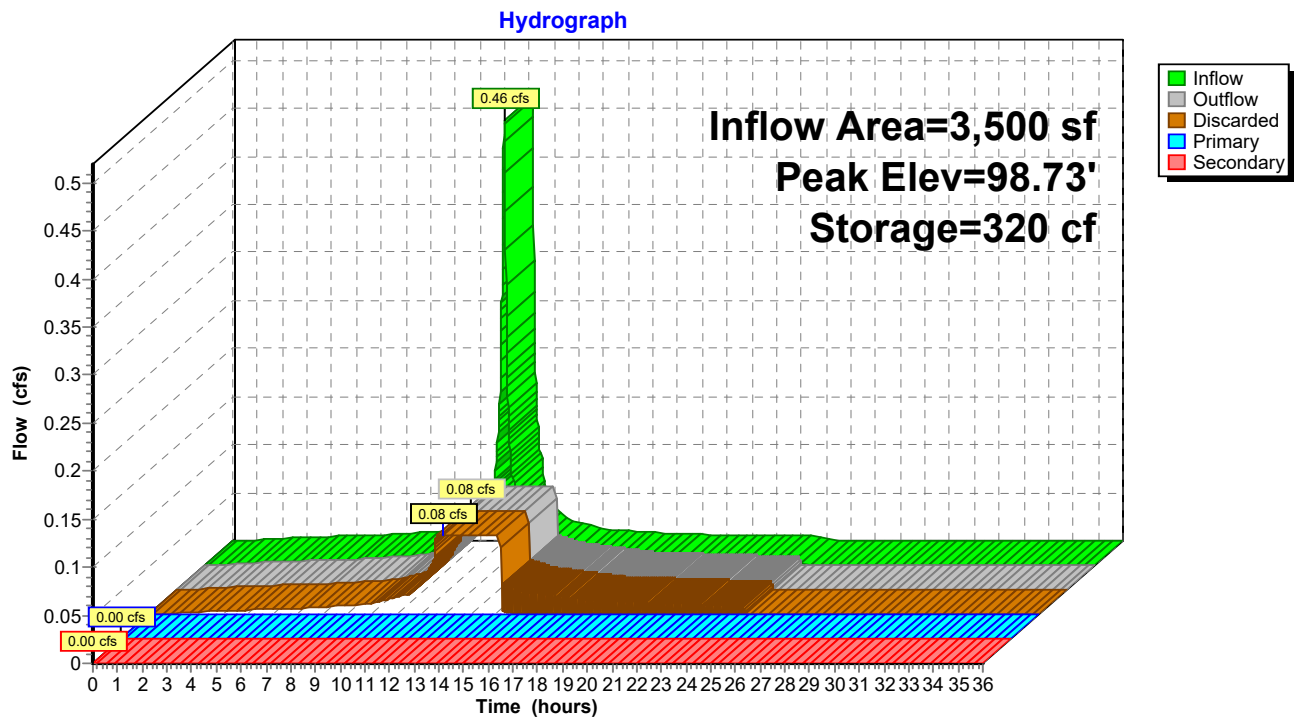
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
99.75	3,500	0	0
100.00	3,500	875	875

Device	Routing	Invert	Outlet Devices
#1	Discarded	98.50'	1.020 in/hr Exfiltration over Surface area
#2	Primary	98.75'	6.0" Round Culvert L= 10.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 98.75' / 98.40' S= 0.0350 ' / Cc= 0.900 n= 0.012, Flow Area= 0.20 sf
#3	Secondary	99.95'	20.0' long x 4.0' 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) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Discarded OutFlow Max=0.08 cfs @ 11.89 hrs HW=98.52' (Free Discharge)
 ↑ **1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=98.50' TW=0.00' (Dynamic Tailwater)
 ↑ **2=Culvert** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=98.50' TW=0.00' (Dynamic Tailwater)
 ↑ **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: Permeable Sidewalk

Summary for Pond P-1: Stormtech

Inflow Area = 34,320 sf, 72.93% Impervious, Inflow Depth = 2.11" for 10-Year event
 Inflow = 3.50 cfs @ 12.12 hrs, Volume= 6,045 cf
 Outflow = 0.05 cfs @ 11.45 hrs, Volume= 4,813 cf, Atten= 99%, Lag= 0.0 min
 Discarded = 0.05 cfs @ 11.45 hrs, Volume= 4,813 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 94.94' @ 12.36 hrs Surf.Area= 2,062 sf Storage= 3,928 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 523.5 min (1,335.6 - 812.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	92.00'	1,878 cf	44.25'W x 46.34'L x 3.50'H Field A 7,176 cf Overall - 2,481 cf Embedded = 4,696 cf x 40.0% Voids
#2A	92.50'	2,481 cf	ADS_StormTech SC-740 +Cap x 54 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 54 Chambers in 9 Rows
#3	92.50'	861 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
		5,220 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
92.50	12	0	0
96.90	12	53	53
97.00	110	6	59
97.50	3,100	803	861

Device	Routing	Invert	Outlet Devices
#1	Primary	96.90'	2.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	92.00'	1.020 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.05 cfs @ 11.45 hrs HW=92.50' (Free Discharge)

↑ **2=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=92.00' TW=0.00' (Dynamic Tailwater)

↑ **1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond P-1: Stormtech - Chamber Wizard Field A**Chamber Model = ADS_StormTechSC-740 +Cap (ADS StormTech®SC-740 with cap length)**

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

6 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 44.34' Row Length +12.0" End Stone x 2 = 46.34' Base Length

9 Rows x 51.0" Wide + 6.0" Spacing x 8 + 12.0" Side Stone x 2 = 44.25' Base Width

6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

54 Chambers x 45.9 cf = 2,480.8 cf Chamber Storage

7,176.4 cf Field - 2,480.8 cf Chambers = 4,695.6 cf Stone x 40.0% Voids = 1,878.3 cf Stone Storage

Chamber Storage + Stone Storage = 4,359.0 cf = 0.100 af

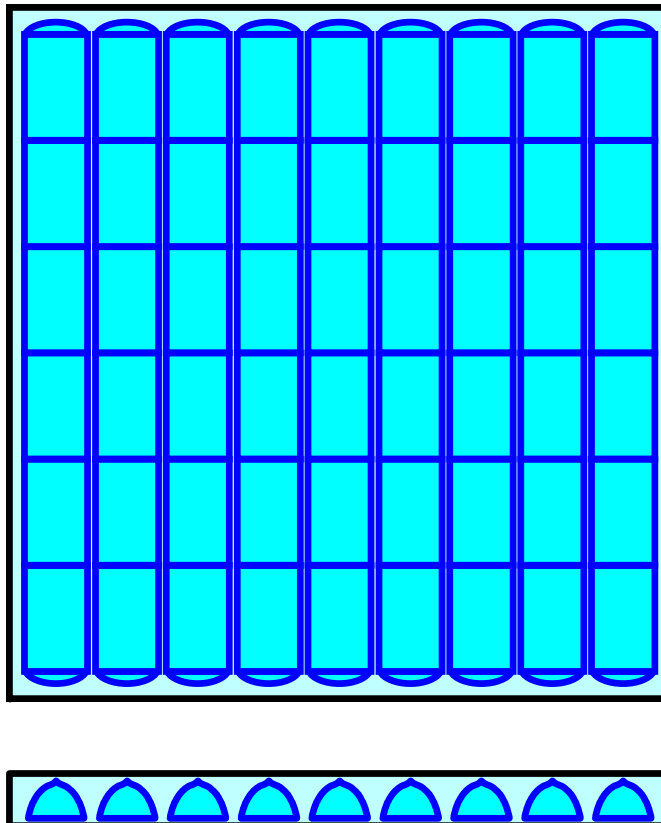
Overall Storage Efficiency = 60.7%

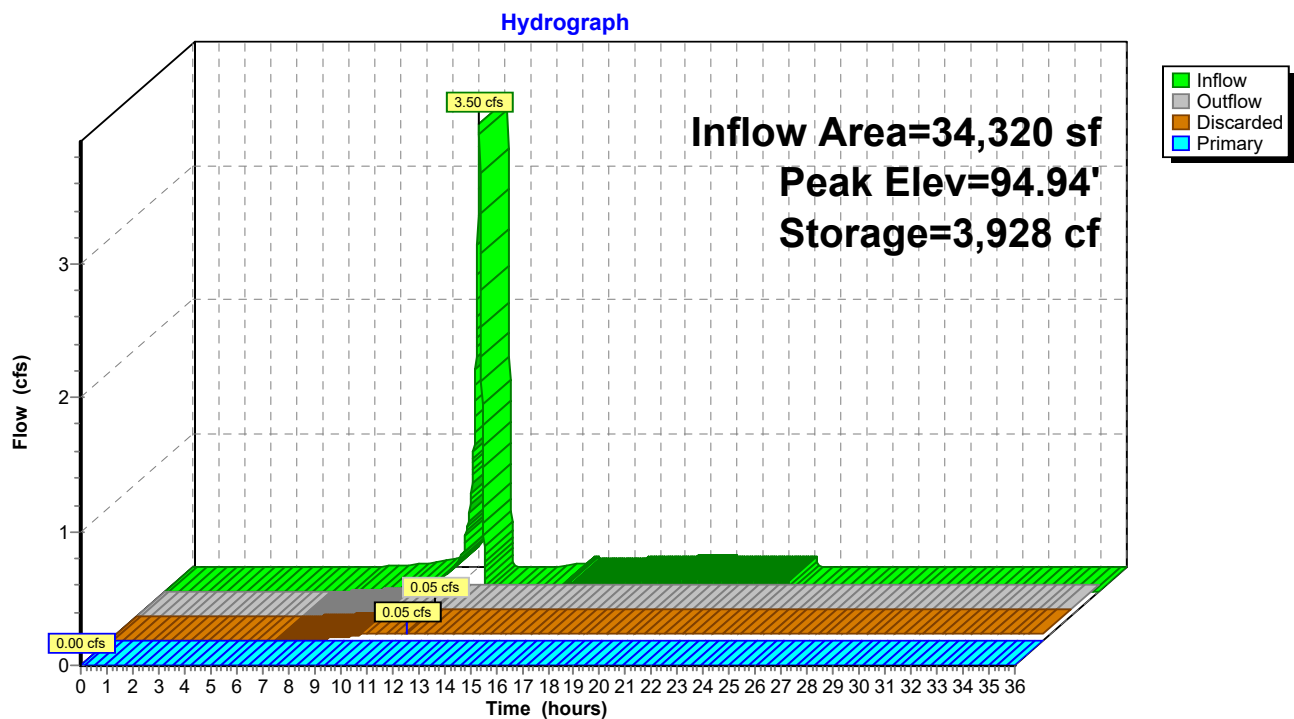
Overall System Size = 46.34' x 44.25' x 3.50'

54 Chambers

265.8 cy Field

173.9 cy Stone

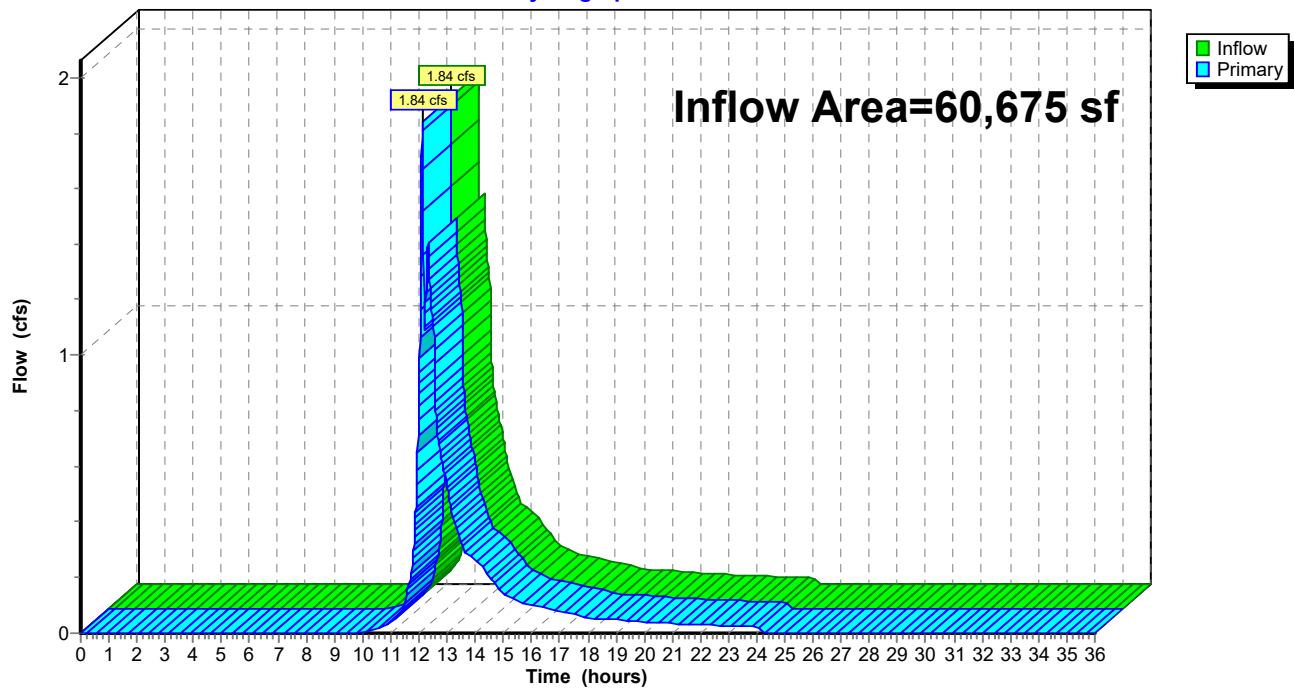


Pond P-1: Stormtech

Summary for Link DP1: Front Entry

Inflow Area = 60,675 sf, 64.00% Impervious, Inflow Depth = 1.61" for 10-Year event
Inflow = 1.84 cfs @ 12.13 hrs, Volume= 8,158 cf
Primary = 1.84 cfs @ 12.13 hrs, Volume= 8,158 cf, Atten= 0%, Lag= 0.0 min

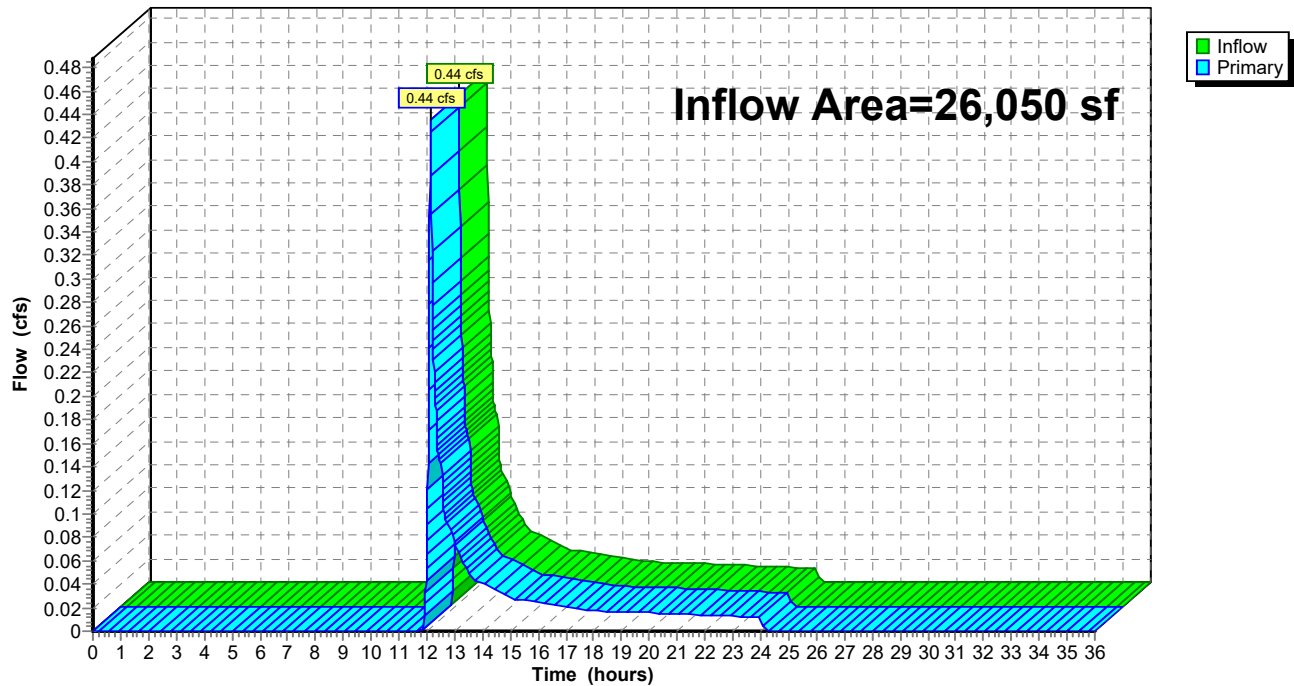
Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link DP1: Front Entry**Hydrograph**

Summary for Link DP2: Back Patio

Inflow Area = 26,050 sf, 29.01% Impervious, Inflow Depth = 0.68" for 10-Year event
Inflow = 0.44 cfs @ 12.14 hrs, Volume= 1,474 cf
Primary = 0.44 cfs @ 12.14 hrs, Volume= 1,474 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link DP2: Back Patio**Hydrograph**

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 Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment10: Front Entry Runoff Area=34,320 sf 72.93% Impervious Runoff Depth=4.35"
 Tc=5.0 min CN=82 Runoff=4.58 cfs 12,433 cf

Subcatchment11: Front Entry Runoff Area=26,355 sf 52.38% Impervious Runoff Depth=3.12"
 Tc=5.0 min CN=70 Runoff=2.61 cfs 6,848 cf

Subcatchment20: Back Patio Runoff Area=22,550 sf 18.00% Impervious Runoff Depth=1.34"
 Tc=5.0 min CN=50 Runoff=0.86 cfs 2,517 cf

Subcatchment21: Permeable Pavers Runoff Area=3,500 sf 100.00% Impervious Runoff Depth=6.15"
 Tc=5.0 min CN=98 Runoff=0.57 cfs 1,794 cf

Pond 1P: Diversion CB Peak Elev=95.75' Inflow=4.58 cfs 12,433 cf
 Primary=4.16 cfs 6,296 cf Secondary=2.94 cfs 6,137 cf Outflow=4.58 cfs 12,433 cf

Pond 2P: Permeable Sidewalk Peak Elev=98.82' Storage=445 cf Inflow=0.57 cfs 1,794 cf
 Discarded=0.08 cfs 1,766 cf Primary=0.01 cfs 28 cf Secondary=0.00 cfs 0 cf Outflow=0.10 cfs 1,794 cf

Pond P-1: Stormtech Peak Elev=97.03' Storage=4,425 cf Inflow=4.16 cfs 6,296 cf
 Discarded=0.06 cfs 4,979 cf Primary=0.25 cfs 17 cf Outflow=0.31 cfs 4,995 cf

Link DP1: Front Entry Inflow=4.88 cfs 13,001 cf
 Primary=4.88 cfs 13,001 cf

Link DP2: Back Patio Inflow=0.86 cfs 2,545 cf
 Primary=0.86 cfs 2,545 cf

Total Runoff Area = 86,725 sf Runoff Volume = 23,592 cf Average Runoff Depth = 3.26"
46.51% Pervious = 40,332 sf 53.49% Impervious = 46,393 sf

Summary for Subcatchment 10: Front Entry

Runoff = 4.58 cfs @ 12.12 hrs, Volume= 12,433 cf, Depth= 4.35"

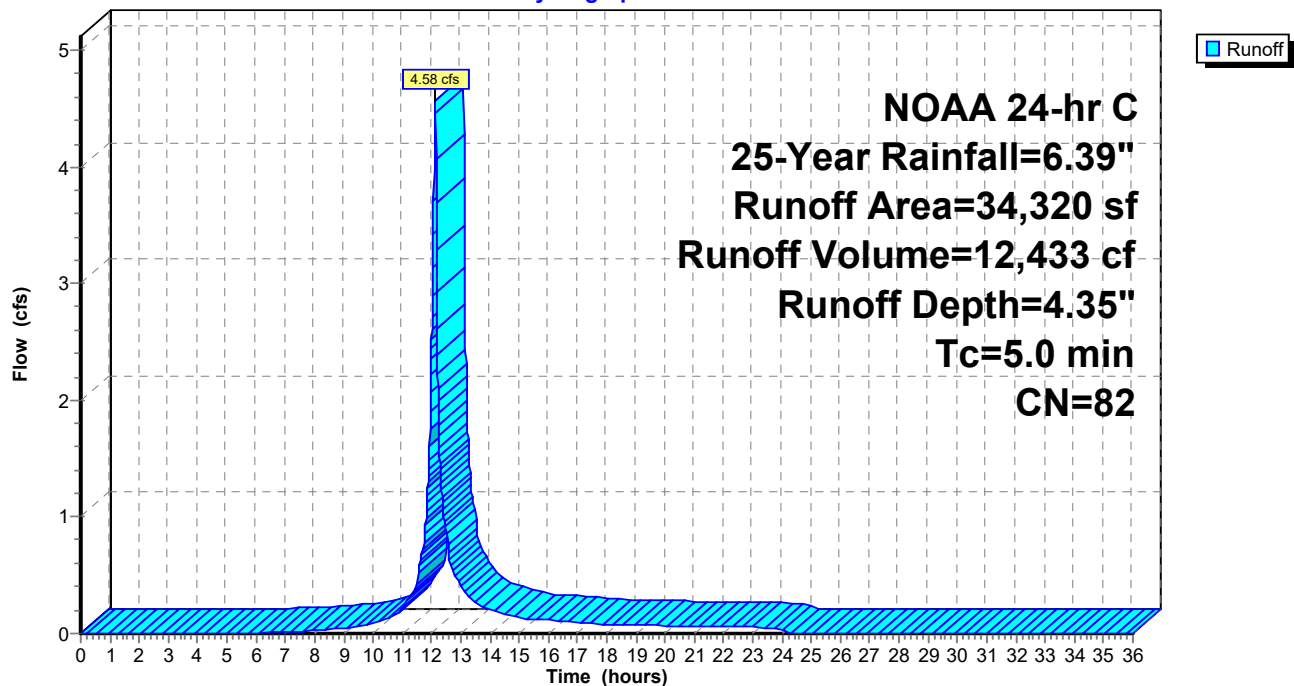
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 NOAA 24-hr C 25-Year Rainfall=6.39"

Area (sf)	CN	Description
25,030	98	Paved parking, HSG A
9,290	39	>75% Grass cover, Good, HSG A
34,320	82	Weighted Average
9,290		27.07% Pervious Area
25,030		72.93% Impervious Area

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

Subcatchment 10: Front Entry

Hydrograph



Summary for Subcatchment 11: Front Entry

Runoff = 2.61 cfs @ 12.13 hrs, Volume= 6,848 cf, Depth= 3.12"

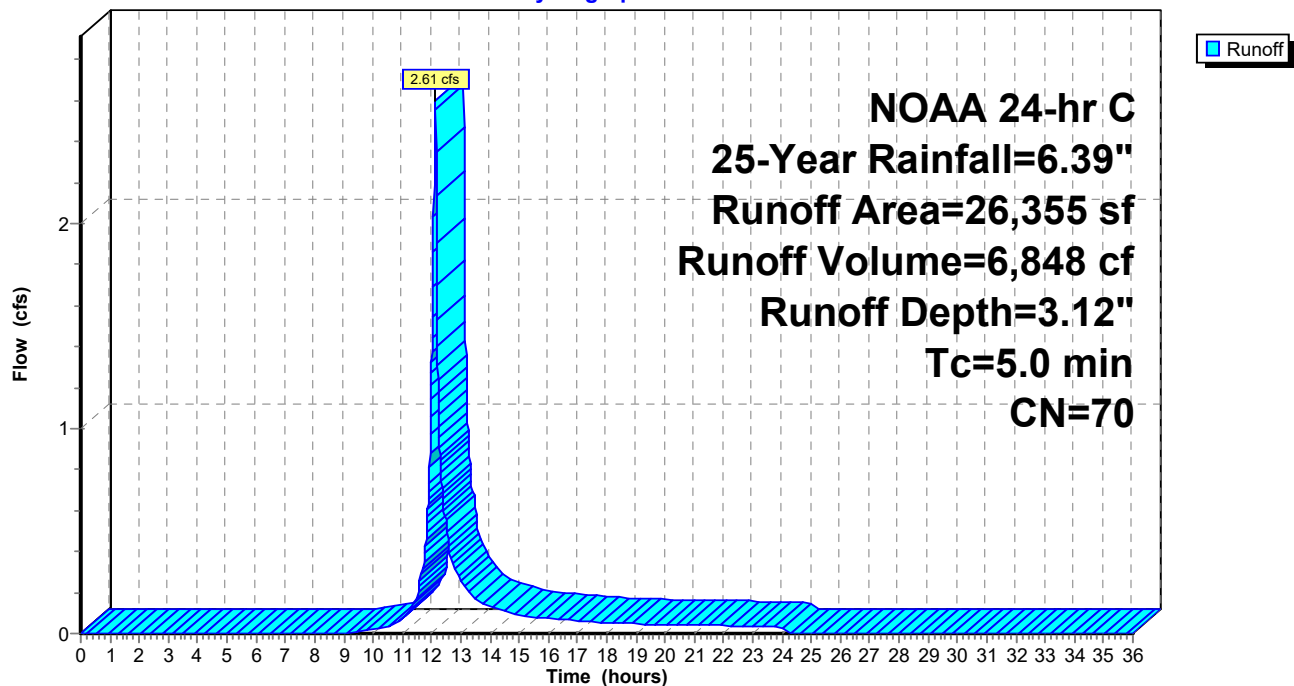
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 NOAA 24-hr C 25-Year Rainfall=6.39"

Area (sf)	CN	Description
13,805	98	Paved parking, HSG A
12,550	39	>75% Grass cover, Good, HSG A
26,355	70	Weighted Average
12,550		47.62% Pervious Area
13,805		52.38% Impervious Area

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

Subcatchment 11: Front Entry

Hydrograph



Summary for Subcatchment 20: Back Patio

Runoff = 0.86 cfs @ 12.13 hrs, Volume= 2,517 cf, Depth= 1.34"

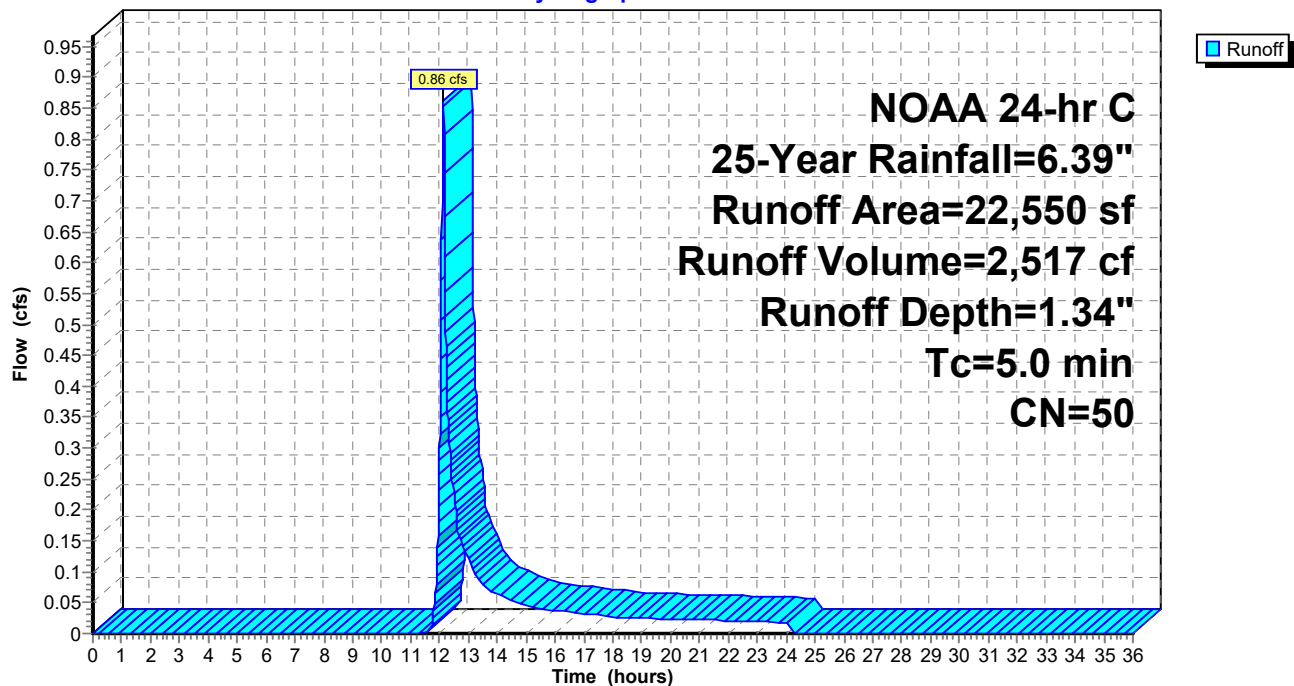
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 NOAA 24-hr C 25-Year Rainfall=6.39"

Area (sf)	CN	Description
4,058	98	Paved parking, HSG A
18,492	39	>75% Grass cover, Good, HSG A
22,550	50	Weighted Average
18,492		82.00% Pervious Area
4,058		18.00% Impervious Area

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

Subcatchment 20: Back Patio

Hydrograph



Summary for Subcatchment 21: Permeable Pavers

Runoff = 0.57 cfs @ 12.12 hrs, Volume= 1,794 cf, Depth= 6.15"

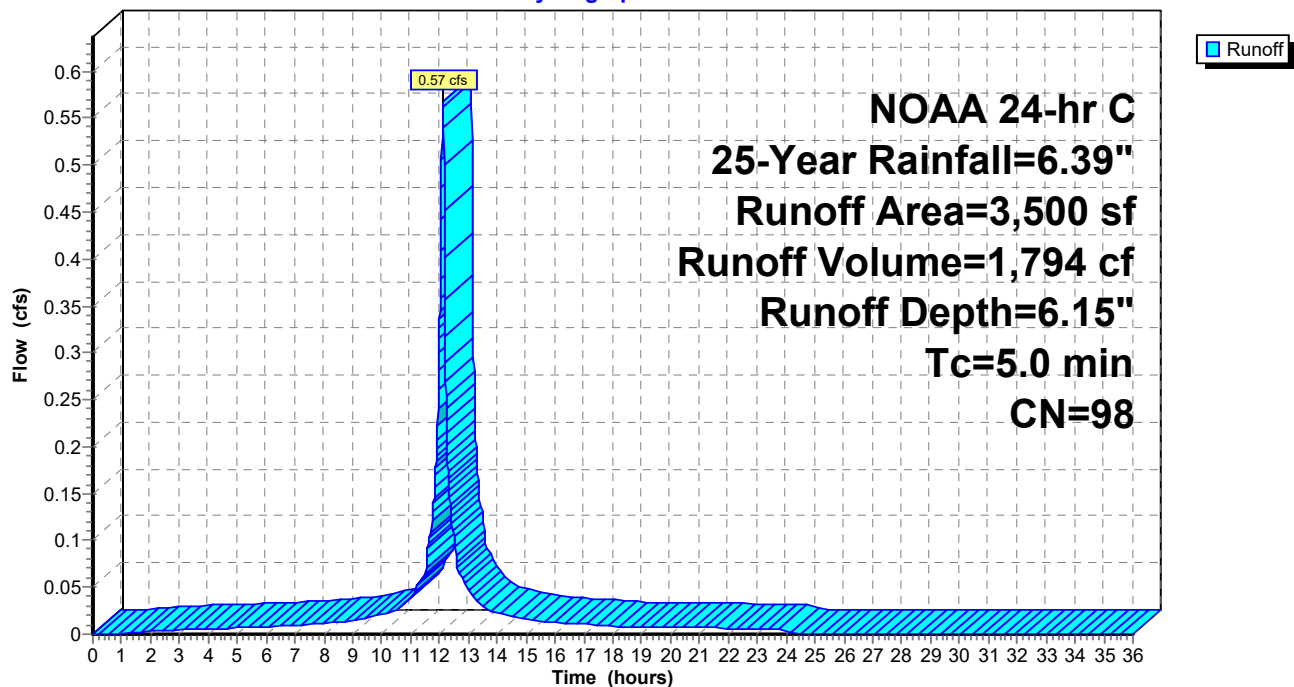
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 NOAA 24-hr C 25-Year Rainfall=6.39"

	Area (sf)	CN	Description
*	3,500	98	Permeable
	3,500		100.00% Impervious Area

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

Subcatchment 21: Permeable Pavers

Hydrograph



Summary for Pond 1P: Diversion CB

Inflow Area = 34,320 sf, 72.93% Impervious, Inflow Depth = 4.35" for 25-Year event
 Inflow = 4.58 cfs @ 12.12 hrs, Volume= 12,433 cf
 Outflow = 4.58 cfs @ 12.12 hrs, Volume= 12,433 cf, Atten= 0%, Lag= 0.0 min
 Primary = 4.16 cfs @ 12.10 hrs, Volume= 6,296 cf
 Secondary = 2.94 cfs @ 12.18 hrs, Volume= 6,137 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 95.75' @ 12.18 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	92.60'	24.0" Round Culvert L= 10.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 92.60' / 92.50' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Secondary	94.40'	10.0" Round Culvert L= 5.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 94.40' / 94.30' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 0.55 sf

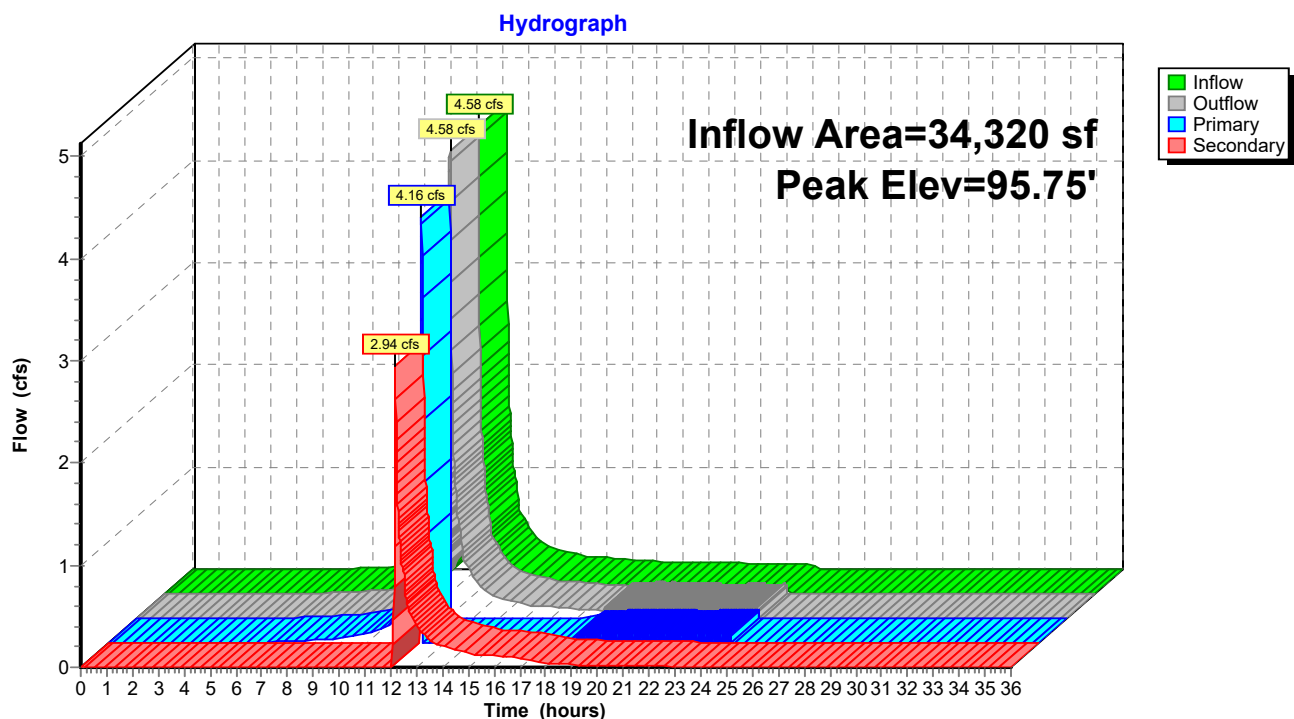
Primary OutFlow Max=0.00 cfs @ 12.10 hrs HW=94.60' TW=94.65' (Dynamic Tailwater)

↑1=Culvert (Controls 0.00 cfs)

Secondary OutFlow Max=2.87 cfs @ 12.18 hrs HW=95.72' TW=0.00' (Dynamic Tailwater)

↑2=Culvert (Barrel Controls 2.87 cfs @ 5.27 fps)

Pond 1P: Diversion CB



Summary for Pond 2P: Permeable Sidewalk

Inflow Area = 3,500 sf, 100.00% Impervious, Inflow Depth = 6.15" for 25-Year event
 Inflow = 0.57 cfs @ 12.12 hrs, Volume= 1,794 cf
 Outflow = 0.10 cfs @ 12.55 hrs, Volume= 1,794 cf, Atten= 83%, Lag= 25.7 min
 Discarded = 0.08 cfs @ 11.80 hrs, Volume= 1,766 cf
 Primary = 0.01 cfs @ 12.55 hrs, Volume= 28 cf
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 98.82' @ 12.55 hrs Surf.Area= 3,500 sf Storage= 445 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 27.2 min (771.2 - 744.0)

Volume	Invert	Avail.Storage	Storage Description
#1	98.50'	1,750 cf	Permeable (Prismatic) Listed below (Recalc) 4,375 cf Overall x 40.0% Voids
#2	99.75'	875 cf	Surface (Prismatic) Listed below (Recalc) -Impervious
		2,625 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
98.50	3,500	0	0
99.75	3,500	4,375	4,375

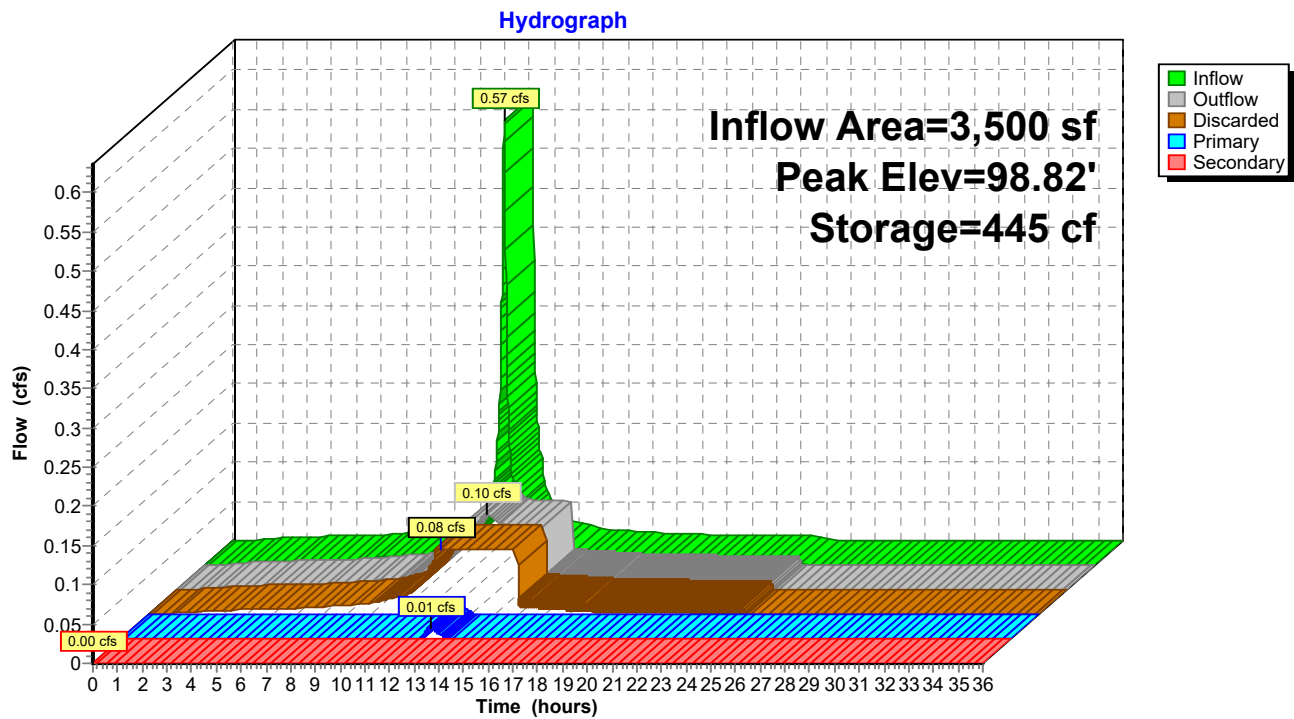
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
99.75	3,500	0	0
100.00	3,500	875	875

Device	Routing	Invert	Outlet Devices
#1	Discarded	98.50'	1.020 in/hr Exfiltration over Surface area
#2	Primary	98.75'	6.0" Round Culvert L= 10.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 98.75' / 98.40' S= 0.0350 ' / Cc= 0.900 n= 0.012, Flow Area= 0.20 sf
#3	Secondary	99.95'	20.0' long x 4.0' 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) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Discarded OutFlow Max=0.08 cfs @ 11.80 hrs HW=98.52' (Free Discharge)
 ↑ **1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=0.01 cfs @ 12.55 hrs HW=98.82' TW=0.00' (Dynamic Tailwater)
 ↑ **2=Culvert** (Inlet Controls 0.01 cfs @ 0.89 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=98.50' TW=0.00' (Dynamic Tailwater)
 ↑ **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: Permeable Sidewalk

Summary for Pond P-1: Stormtech

Inflow Area = 34,320 sf, 72.93% Impervious, Inflow Depth = 2.20" for 25-Year event
 Inflow = 4.16 cfs @ 12.10 hrs, Volume= 6,296 cf
 Outflow = 0.31 cfs @ 12.18 hrs, Volume= 4,995 cf, Atten= 93%, Lag= 5.1 min
 Discarded = 0.06 cfs @ 12.18 hrs, Volume= 4,979 cf
 Primary = 0.25 cfs @ 12.18 hrs, Volume= 17 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 97.03' @ 12.18 hrs Surf.Area= 2,367 sf Storage= 4,425 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 522.9 min (1,305.2 - 782.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	92.00'	1,878 cf	44.25'W x 46.34'L x 3.50'H Field A 7,176 cf Overall - 2,481 cf Embedded = 4,696 cf x 40.0% Voids
#2A	92.50'	2,481 cf	ADS_StormTech SC-740 +Cap x 54 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 54 Chambers in 9 Rows
#3	92.50'	861 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
		5,220 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
92.50	12	0	0
96.90	12	53	53
97.00	110	6	59
97.50	3,100	803	861

Device	Routing	Invert	Outlet Devices
#1	Primary	96.90'	2.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	92.00'	1.020 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.06 cfs @ 12.18 hrs HW=97.03' (Free Discharge)

↑ **2=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.24 cfs @ 12.18 hrs HW=97.03' TW=0.00' (Dynamic Tailwater)

↑ **1=Broad-Crested Rectangular Weir** (Weir Controls 0.24 cfs @ 0.92 fps)

Pond P-1: Stormtech - Chamber Wizard Field A**Chamber Model = ADS_StormTechSC-740 +Cap (ADS StormTech®SC-740 with cap length)**

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

6 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 44.34' Row Length +12.0" End Stone x 2 = 46.34' Base Length

9 Rows x 51.0" Wide + 6.0" Spacing x 8 + 12.0" Side Stone x 2 = 44.25' Base Width

6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

54 Chambers x 45.9 cf = 2,480.8 cf Chamber Storage

7,176.4 cf Field - 2,480.8 cf Chambers = 4,695.6 cf Stone x 40.0% Voids = 1,878.3 cf Stone Storage

Chamber Storage + Stone Storage = 4,359.0 cf = 0.100 af

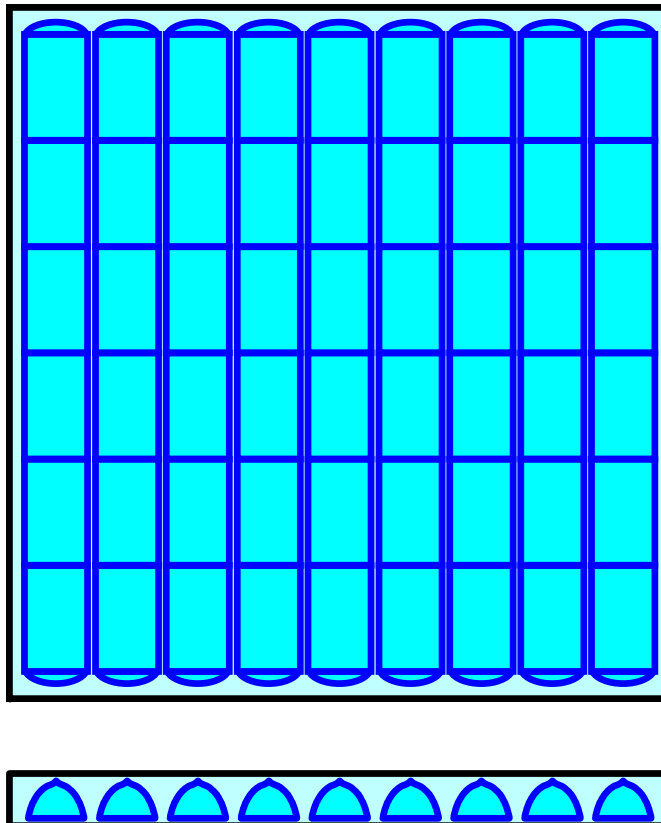
Overall Storage Efficiency = 60.7%

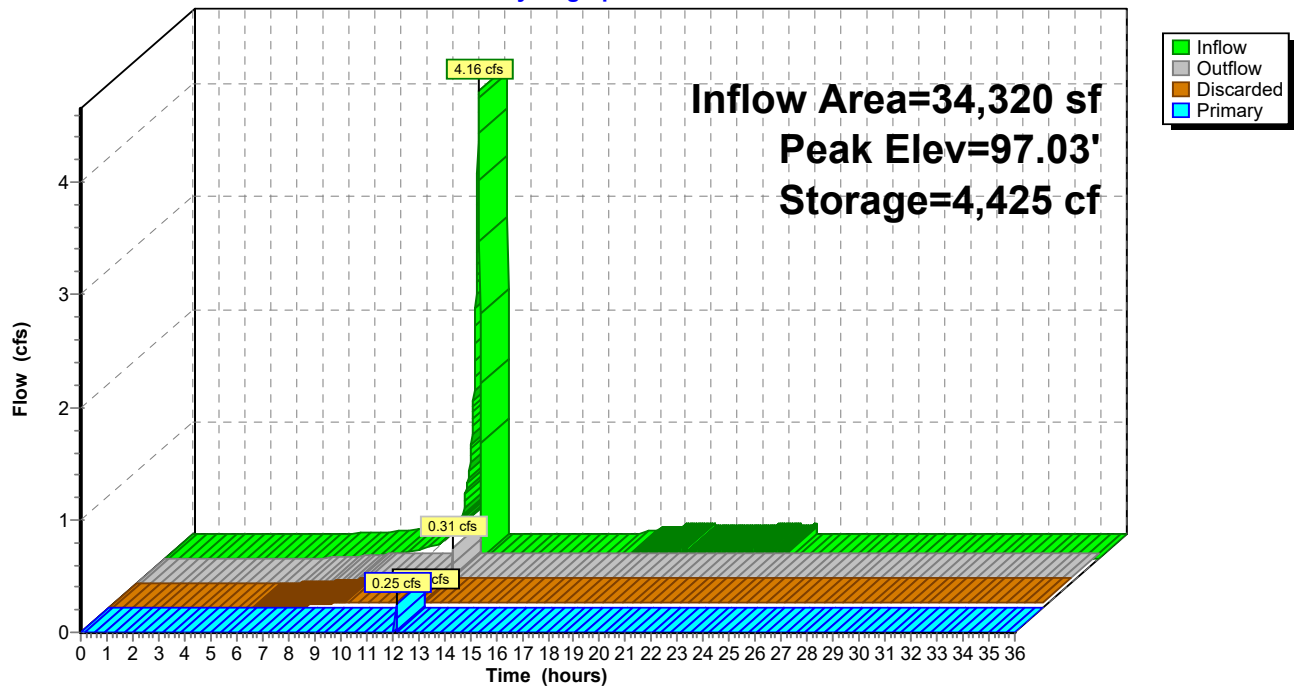
Overall System Size = 46.34' x 44.25' x 3.50'

54 Chambers

265.8 cy Field

173.9 cy Stone

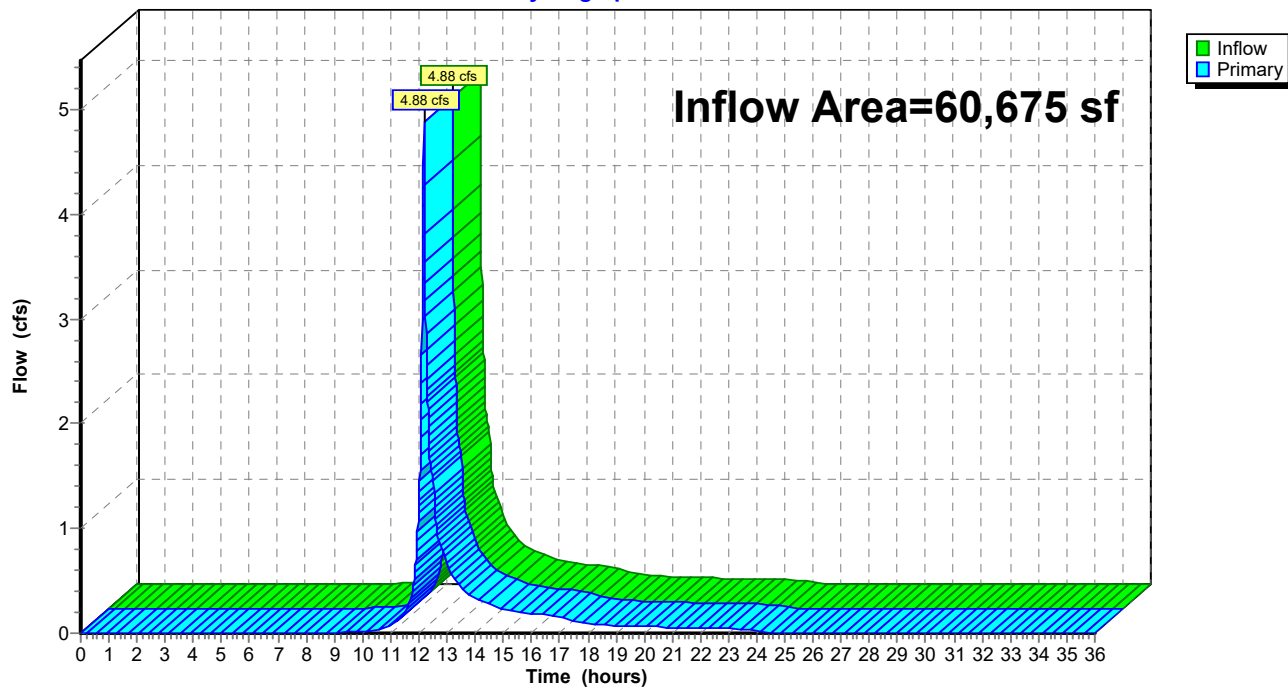


Pond P-1: Stormtech**Hydrograph**

Summary for Link DP1: Front Entry

Inflow Area = 60,675 sf, 64.00% Impervious, Inflow Depth = 2.57" for 25-Year event
Inflow = 4.88 cfs @ 12.18 hrs, Volume= 13,001 cf
Primary = 4.88 cfs @ 12.18 hrs, Volume= 13,001 cf, Atten= 0%, Lag= 0.0 min

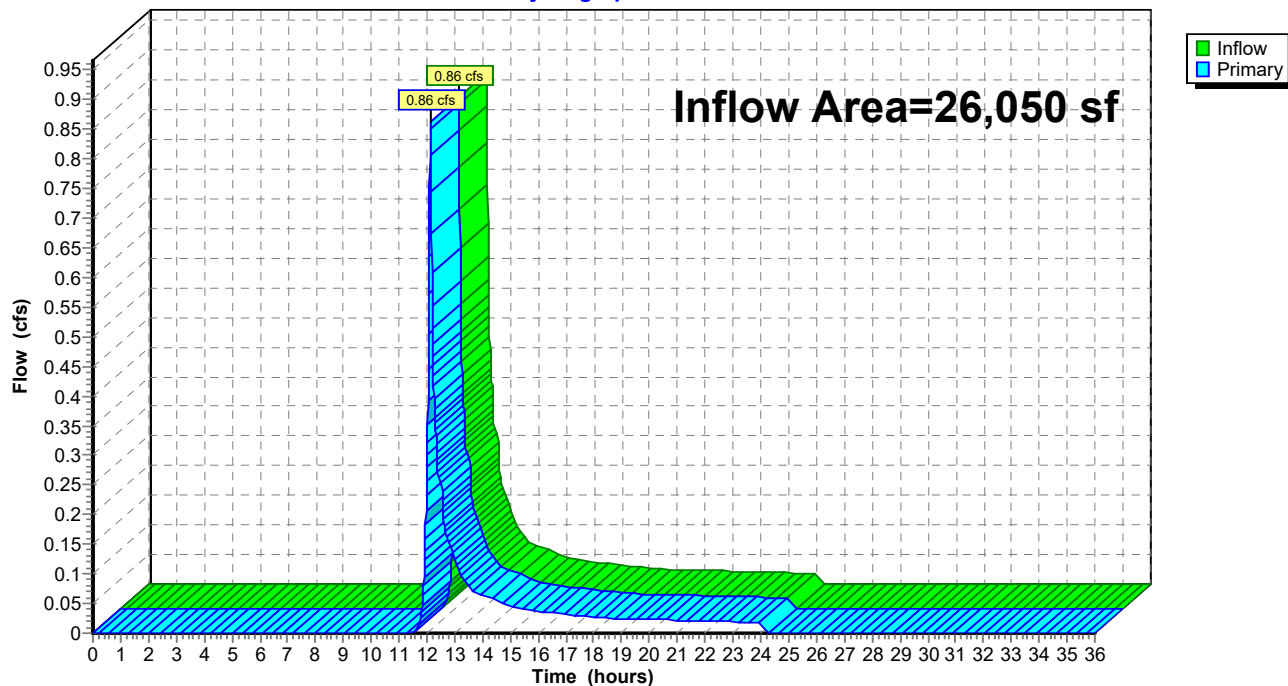
Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link DP1: Front Entry**Hydrograph**

Summary for Link DP2: Back Patio

Inflow Area = 26,050 sf, 29.01% Impervious, Inflow Depth = 1.17" for 25-Year event
Inflow = 0.86 cfs @ 12.13 hrs, Volume= 2,545 cf
Primary = 0.86 cfs @ 12.13 hrs, Volume= 2,545 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link DP2: Back Patio**Hydrograph**

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 Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment10: Front Entry Runoff Area=34,320 sf 72.93% Impervious Runoff Depth=6.06"
 Tc=5.0 min CN=82 Runoff=6.26 cfs 17,330 cf

Subcatchment11: Front Entry Runoff Area=26,355 sf 52.38% Impervious Runoff Depth=4.65"
 Tc=5.0 min CN=70 Runoff=3.85 cfs 10,202 cf

Subcatchment20: Back Patio Runoff Area=22,550 sf 18.00% Impervious Runoff Depth=2.38"
 Tc=5.0 min CN=50 Runoff=1.65 cfs 4,471 cf

Subcatchment21: Permeable Pavers Runoff Area=3,500 sf 100.00% Impervious Runoff Depth=7.97"
 Tc=5.0 min CN=98 Runoff=0.73 cfs 2,325 cf

Pond 1P: Diversion CB Peak Elev=97.19' Inflow=6.26 cfs 17,330 cf
 Primary=2.68 cfs 6,882 cf Secondary=5.05 cfs 10,449 cf Outflow=6.26 cfs 17,331 cf

Pond 2P: Permeable Sidewalk Peak Elev=98.92' Storage=585 cf Inflow=0.73 cfs 2,325 cf
 Discarded=0.08 cfs 2,116 cf Primary=0.08 cfs 210 cf Secondary=0.00 cfs 0 cf Outflow=0.16 cfs 2,326 cf

Pond P-1: Stormtech Peak Elev=97.18' Storage=4,540 cf Inflow=2.68 cfs 6,882 cf
 Discarded=0.08 cfs 5,210 cf Primary=0.78 cfs 331 cf Outflow=0.86 cfs 5,540 cf

Link DP1: Front Entry Inflow=9.63 cfs 20,981 cf
 Primary=9.63 cfs 20,981 cf

Link DP2: Back Patio Inflow=1.66 cfs 4,681 cf
 Primary=1.66 cfs 4,681 cf

Total Runoff Area = 86,725 sf Runoff Volume = 34,327 cf Average Runoff Depth = 4.75"
46.51% Pervious = 40,332 sf 53.49% Impervious = 46,393 sf

Summary for Subcatchment 10: Front Entry

Runoff = 6.26 cfs @ 12.12 hrs, Volume= 17,330 cf, Depth= 6.06"

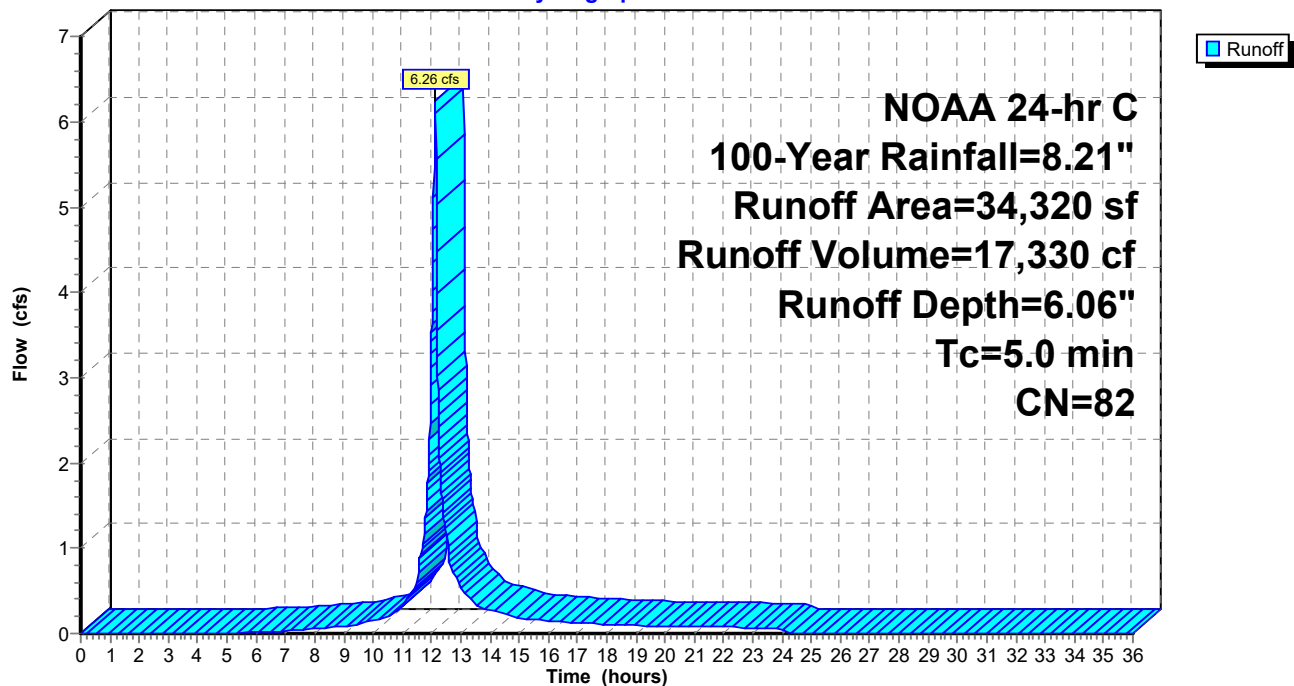
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 NOAA 24-hr C 100-Year Rainfall=8.21"

Area (sf)	CN	Description
25,030	98	Paved parking, HSG A
9,290	39	>75% Grass cover, Good, HSG A
34,320	82	Weighted Average
9,290		27.07% Pervious Area
25,030		72.93% Impervious Area

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

Subcatchment 10: Front Entry

Hydrograph



Summary for Subcatchment 11: Front Entry

Runoff = 3.85 cfs @ 12.12 hrs, Volume= 10,202 cf, Depth= 4.65"

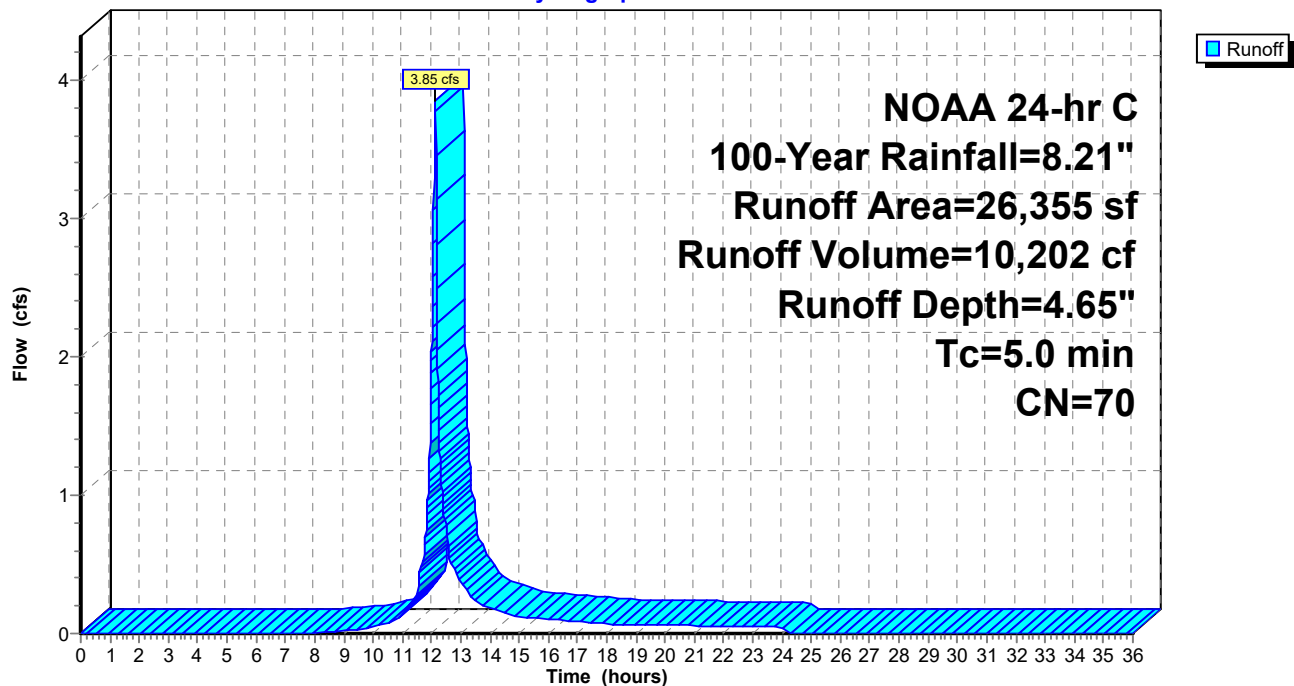
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 NOAA 24-hr C 100-Year Rainfall=8.21"

Area (sf)	CN	Description
13,805	98	Paved parking, HSG A
12,550	39	>75% Grass cover, Good, HSG A
26,355	70	Weighted Average
12,550		47.62% Pervious Area
13,805		52.38% Impervious Area

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

Subcatchment 11: Front Entry

Hydrograph



Summary for Subcatchment 20: Back Patio

Runoff = 1.65 cfs @ 12.13 hrs, Volume= 4,471 cf, Depth= 2.38"

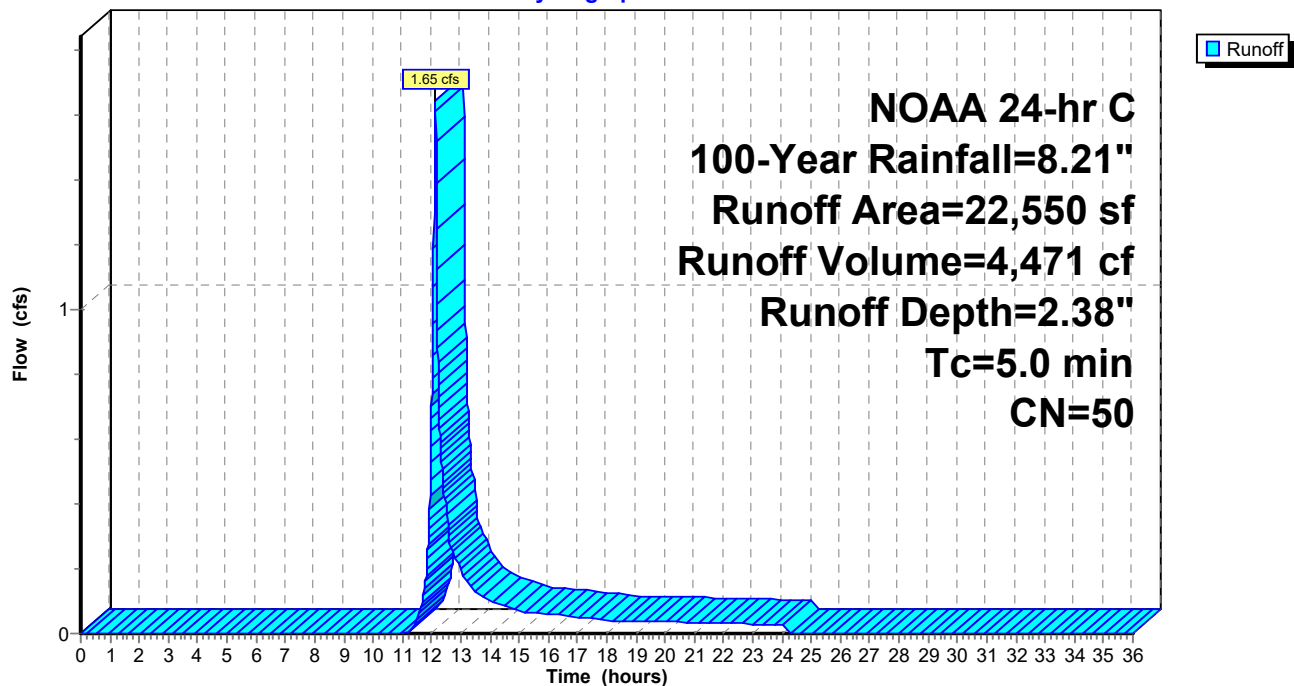
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 NOAA 24-hr C 100-Year Rainfall=8.21"

Area (sf)	CN	Description
4,058	98	Paved parking, HSG A
18,492	39	>75% Grass cover, Good, HSG A
22,550	50	Weighted Average
18,492		82.00% Pervious Area
4,058		18.00% Impervious Area

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

Subcatchment 20: Back Patio

Hydrograph



Summary for Subcatchment 21: Permeable Pavers

Runoff = 0.73 cfs @ 12.12 hrs, Volume= 2,325 cf, Depth= 7.97"

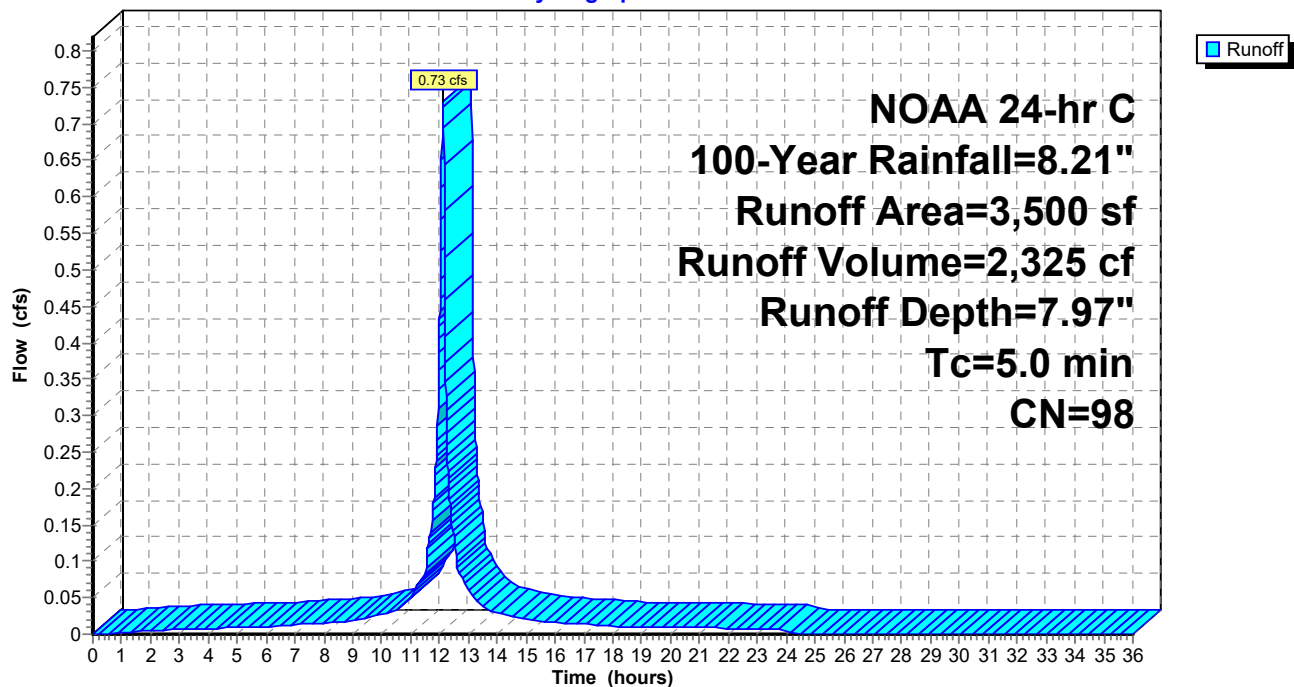
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 NOAA 24-hr C 100-Year Rainfall=8.21"

	Area (sf)	CN	Description
*	3,500	98	Permeable
	3,500		100.00% Impervious Area

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

Subcatchment 21: Permeable Pavers

Hydrograph



Summary for Pond 1P: Diversion CB

Inflow Area = 34,320 sf, 72.93% Impervious, Inflow Depth = 6.06" for 100-Year event
 Inflow = 6.26 cfs @ 12.12 hrs, Volume= 17,330 cf
 Outflow = 6.26 cfs @ 12.12 hrs, Volume= 17,331 cf, Atten= 0%, Lag= 0.0 min
 Primary = 2.68 cfs @ 11.98 hrs, Volume= 6,882 cf
 Secondary = 5.05 cfs @ 12.15 hrs, Volume= 10,449 cf

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

Peak Elev= 97.19' @ 12.15 hrs

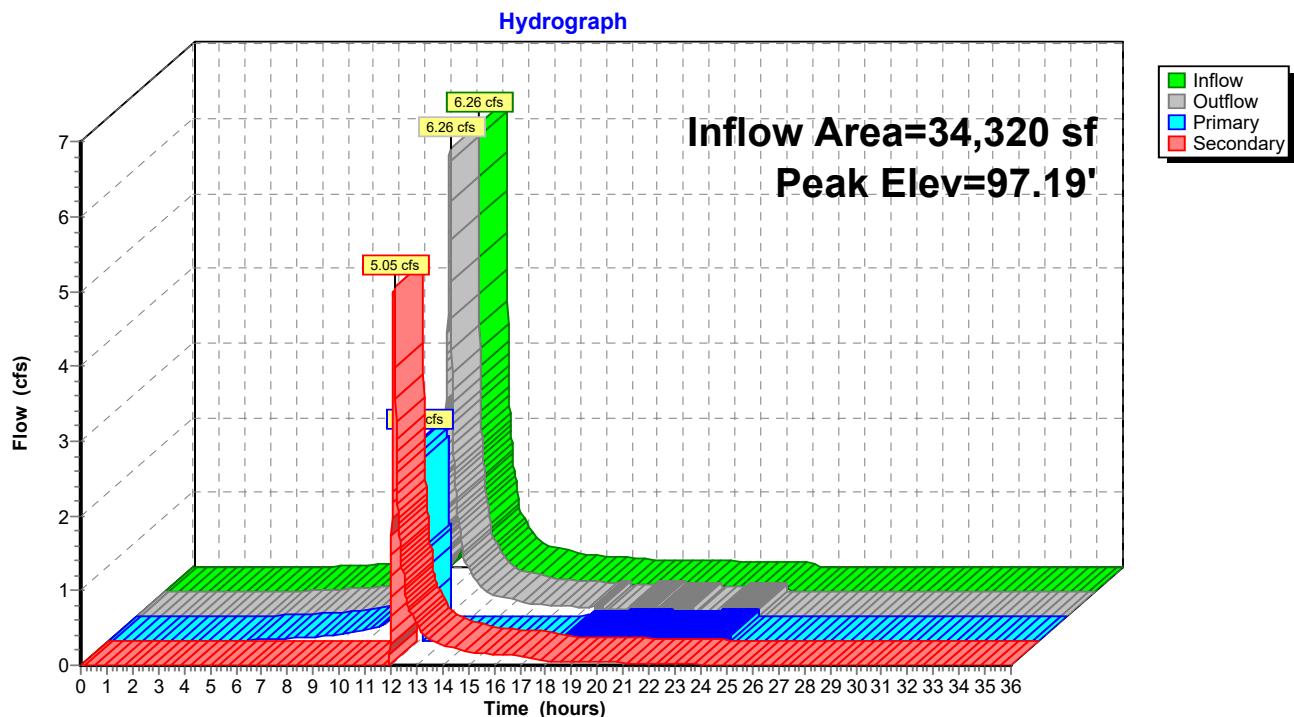
Device	Routing	Invert	Outlet Devices
#1	Primary	92.60'	24.0" Round Culvert L= 10.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 92.60' / 92.50' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Secondary	94.40'	10.0" Round Culvert L= 5.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 94.40' / 94.30' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 0.55 sf

Primary OutFlow Max=0.00 cfs @ 11.98 hrs HW=94.76' TW=94.82' (Dynamic Tailwater)

↑1=Culvert (Controls 0.00 cfs)

Secondary OutFlow Max=5.05 cfs @ 12.15 hrs HW=97.19' TW=0.00' (Dynamic Tailwater)

↑2=Culvert (Inlet Controls 5.05 cfs @ 9.26 fps)

Pond 1P: Diversion CB

Summary for Pond 2P: Permeable Sidewalk

Inflow Area = 3,500 sf, 100.00% Impervious, Inflow Depth = 7.97" for 100-Year event
 Inflow = 0.73 cfs @ 12.12 hrs, Volume= 2,325 cf
 Outflow = 0.16 cfs @ 12.38 hrs, Volume= 2,326 cf, Atten= 78%, Lag= 15.6 min
 Discarded = 0.08 cfs @ 11.69 hrs, Volume= 2,116 cf
 Primary = 0.08 cfs @ 12.38 hrs, Volume= 210 cf
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 98.92' @ 12.38 hrs Surf.Area= 3,500 sf Storage= 585 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 30.3 min (770.8 - 740.5)

Volume	Invert	Avail.Storage	Storage Description
#1	98.50'	1,750 cf	Permeable (Prismatic) Listed below (Recalc) 4,375 cf Overall x 40.0% Voids
#2	99.75'	875 cf	Surface (Prismatic) Listed below (Recalc) -Impervious
		2,625 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
98.50	3,500	0	0
99.75	3,500	4,375	4,375

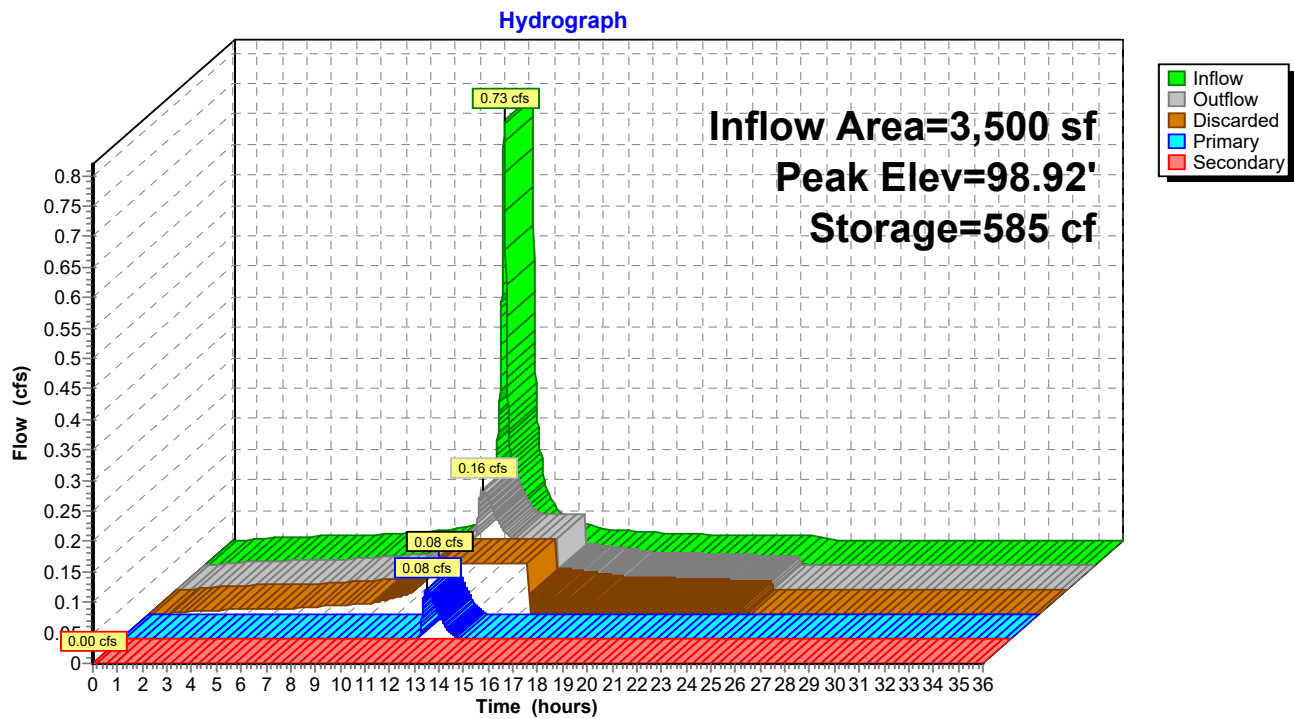
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
99.75	3,500	0	0
100.00	3,500	875	875

Device	Routing	Invert	Outlet Devices
#1	Discarded	98.50'	1.020 in/hr Exfiltration over Surface area
#2	Primary	98.75'	6.0" Round Culvert L= 10.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 98.75' / 98.40' S= 0.0350 ' / Cc= 0.900 n= 0.012, Flow Area= 0.20 sf
#3	Secondary	99.95'	20.0' long x 4.0' 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) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Discarded OutFlow Max=0.08 cfs @ 11.69 hrs HW=98.52' (Free Discharge)
 ↑ **1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=0.08 cfs @ 12.38 hrs HW=98.92' TW=0.00' (Dynamic Tailwater)
 ↑ **2=Culvert** (Inlet Controls 0.08 cfs @ 1.40 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=98.50' TW=0.00' (Dynamic Tailwater)
 ↑ **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: Permeable Sidewalk

Summary for Pond P-1: Stormtech

Inflow Area = 34,320 sf, 72.93% Impervious, Inflow Depth = 2.41" for 100-Year event
 Inflow = 2.68 cfs @ 11.98 hrs, Volume= 6,882 cf
 Outflow = 0.86 cfs @ 12.14 hrs, Volume= 5,540 cf, Atten= 68%, Lag= 9.7 min
 Discarded = 0.08 cfs @ 12.14 hrs, Volume= 5,210 cf
 Primary = 0.78 cfs @ 12.14 hrs, Volume= 331 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 97.18' @ 12.14 hrs Surf.Area= 3,265 sf Storage= 4,540 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 479.8 min (1,236.3 - 756.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	92.00'	1,878 cf	44.25'W x 46.34'L x 3.50'H Field A 7,176 cf Overall - 2,481 cf Embedded = 4,696 cf x 40.0% Voids
#2A	92.50'	2,481 cf	ADS_StormTech SC-740 +Cap x 54 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 54 Chambers in 9 Rows
#3	92.50'	861 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
		5,220 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
92.50	12	0	0
96.90	12	53	53
97.00	110	6	59
97.50	3,100	803	861

Device	Routing	Invert	Outlet Devices
#1	Primary	96.90'	2.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	92.00'	1.020 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.08 cfs @ 12.14 hrs HW=97.18' (Free Discharge)

↑ **2=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=0.78 cfs @ 12.14 hrs HW=97.18' TW=0.00' (Dynamic Tailwater)

↑ **1=Broad-Crested Rectangular Weir** (Weir Controls 0.78 cfs @ 1.37 fps)

Pond P-1: Stormtech - Chamber Wizard Field A**Chamber Model = ADS_StormTechSC-740 +Cap (ADS StormTech®SC-740 with cap length)**

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

6 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 44.34' Row Length +12.0" End Stone x 2 = 46.34' Base Length

9 Rows x 51.0" Wide + 6.0" Spacing x 8 + 12.0" Side Stone x 2 = 44.25' Base Width

6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

54 Chambers x 45.9 cf = 2,480.8 cf Chamber Storage

7,176.4 cf Field - 2,480.8 cf Chambers = 4,695.6 cf Stone x 40.0% Voids = 1,878.3 cf Stone Storage

Chamber Storage + Stone Storage = 4,359.0 cf = 0.100 af

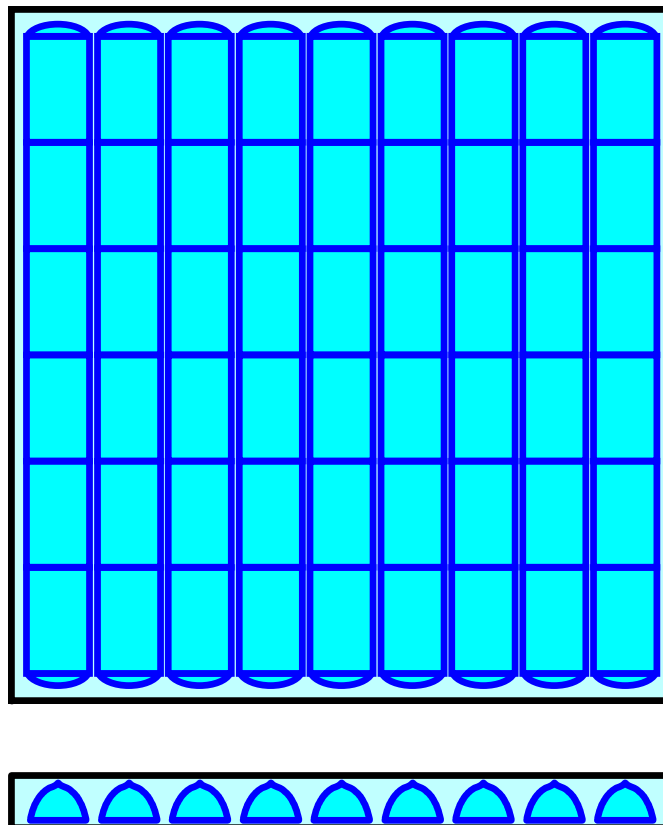
Overall Storage Efficiency = 60.7%

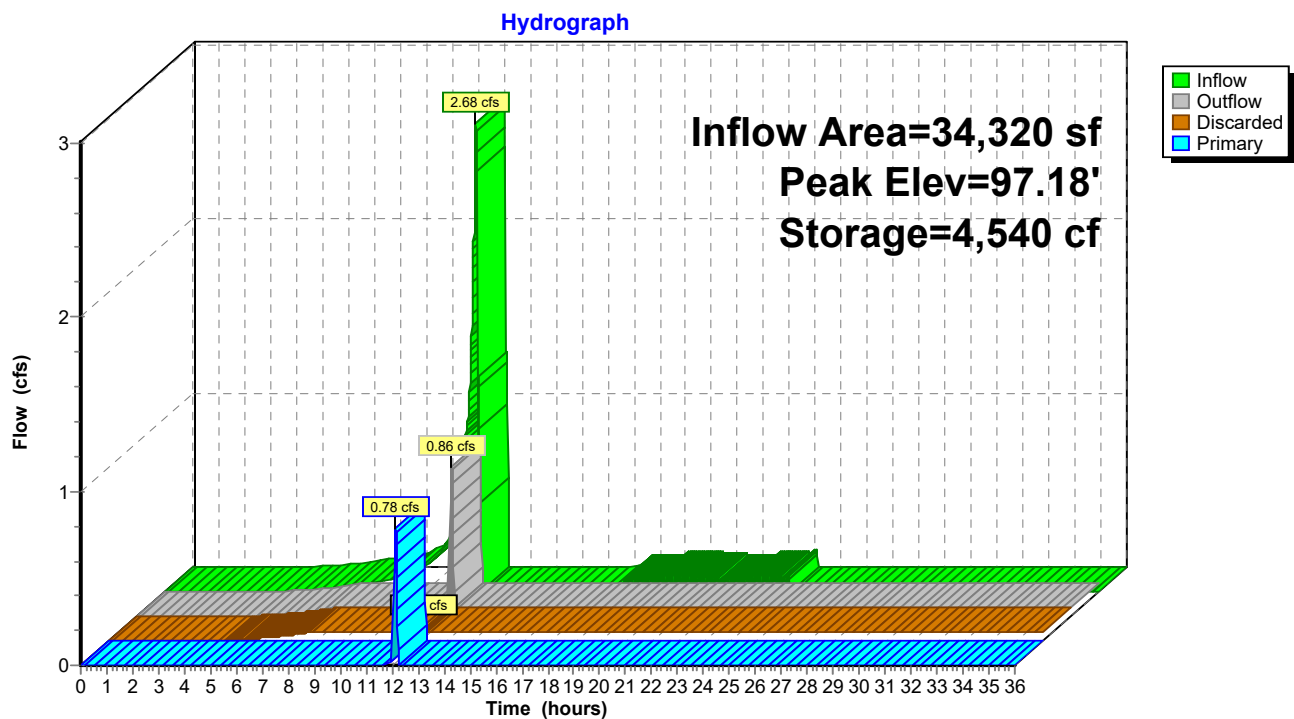
Overall System Size = 46.34' x 44.25' x 3.50'

54 Chambers

265.8 cy Field

173.9 cy Stone

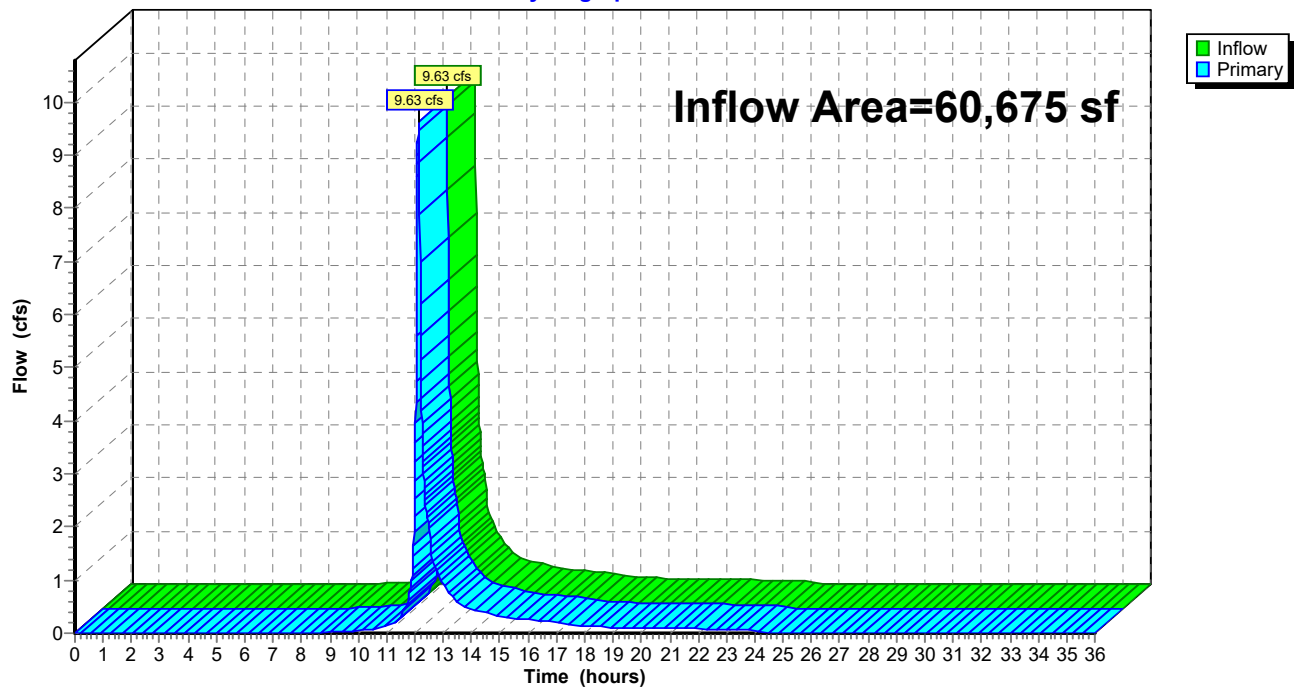


Pond P-1: Stormtech

Summary for Link DP1: Front Entry

Inflow Area = 60,675 sf, 64.00% Impervious, Inflow Depth = 4.15" for 100-Year event
Inflow = 9.63 cfs @ 12.13 hrs, Volume= 20,981 cf
Primary = 9.63 cfs @ 12.13 hrs, Volume= 20,981 cf, Atten= 0%, Lag= 0.0 min

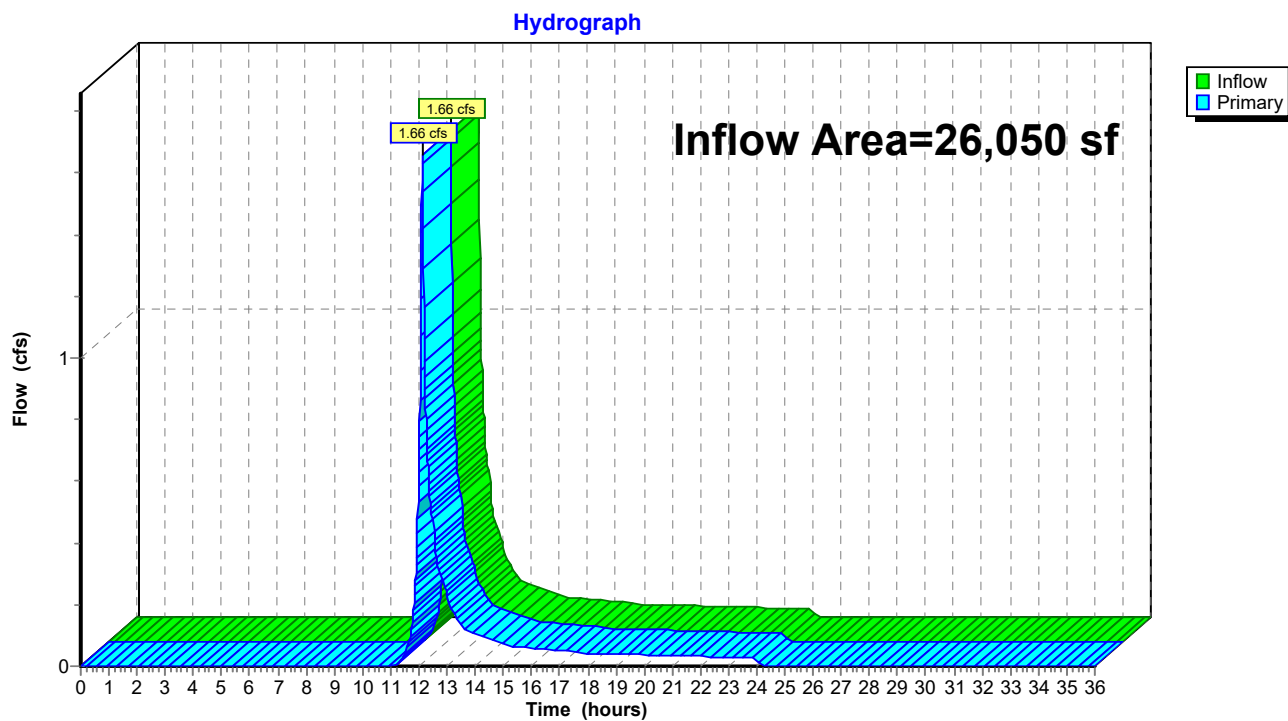
Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link DP1: Front Entry**Hydrograph**

Summary for Link DP2: Back Patio

Inflow Area = 26,050 sf, 29.01% Impervious, Inflow Depth = 2.16" for 100-Year event
Inflow = 1.66 cfs @ 12.13 hrs, Volume= 4,681 cf
Primary = 1.66 cfs @ 12.13 hrs, Volume= 4,681 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link DP2: Back Patio



Long-Term Pollution Prevention Plan

This Long-Term Pollution Prevention Plan has been developed to establish site management practices that improve the quality of stormwater discharges from the Project.

Description of Pollutant Sources

The project contains parking and drive areas that will experience high volume traffic that will potentially be a pollutant source.

Pollutant Control Approach

Maintenance of Pavement Systems

Standard Asphalt Pavement

Regular maintenance of pavement surfaces will prevent pollutants such as oil and grease, trash, and sediments from entering the stormwater management system. The following practices should be performed:

- Sweep or vacuum asphalt pavement areas [semi-annually, annually, monthly, etc] with a commercial cleaning unit and dispose of removed material.
- Check loading docks and dumpster areas frequently for spillage and/or pavement staining and clean as necessary
- Routinely pick up and remove litter from the parking areas, islands, and perimeter landscaping.

Permeable Pavers

The primary maintenance requirement for permeable pavers is to clean the surface drainage voids. Fine debris and dirt accumulate in the drainage openings and reduce the pavement's flow capacity. Even though some irreplaceable loss in permeability should be expected over the paver's lifetime, one can increase the longevity of the system by following the maintenance schedule for vacuum sweeping and high-



pressure washing, restricting the area's use by heavy vehicles, limiting the use of de-icing chemicals and sand, and implementing a stringent sediment control plan.

Preventing Clogging of Permeable Paver Surface Areas

- Patio areas and/or other areas with permeable pavers shall be cleaned annually with vacuums or washed with high pressure washers.
- Do not allow construction staging, soil/mulch storage, etc. on unprotected pavement surface.
- Maintain vegetated areas adjacent to areas with permeable pavers to prevent washout of soil onto surface.
- Do not apply any type of sealant to permeable pavers.

Inspecting the System

- Inspect areas paved with permeable pavers monthly for the first three months after construction to ensure proper functioning and correct any areas that have settled or experienced washouts.
- Inspect areas paved with permeable pavers annually after initial three month period. Annual inspections should take place after large storms, when puddles will make any clogging obvious.

Maintenance of Vegetated Areas

Proper maintenance of vegetated areas can prevent the pollution of stormwater runoff by controlling the source of pollutants such as suspended sediments, excess nutrients, and chemicals from landscape care products. Practices that should be followed under the regular maintenance of the vegetated landscape include:

- Inspect planted areas on a semi-annual basis and remove any litter.
- Maintain planted areas adjacent to pavement to prevent soil washout.
- Immediately clean any soil deposited on pavement.
- Re-seed bare areas; install appropriate erosion control measures when native soil is exposed or erosion channels are forming.
- Plant alternative mixture of grass species in the event of unsuccessful establishment.
- The grass vegetation should be cut to a height between three and four inches.
- Pesticide/Herbicide Usage – No pesticides are to be used unless a single spot treatment is required for a specific control application.
- Fertilizer usage should be avoided. If deemed necessary, slow release fertilizer should be used. Fertilizer may be used to begin the establishment of vegetation in bare or damaged areas, but should not be applied on a regular basis unless necessary.
- Pet waste provision if applicable.

Management of Snow and Ice

Storage and Disposal

Snow shall be stockpiled on standard pavement surfaces so sand and salt may be swept in the spring or removed as snow melts and drains through the stormwater management system. Recommended locations for snow storage are shown on the attached Snow Storage Plan. Key practices for the safe storage and disposal of snow include:

- Under no circumstances shall snow be disposed or stored in wetland resource areas.
- Under no circumstances shall snow be disposed or stored in stormwater basins, ponds, rain gardens, swales, channels, or trenches.
- Do not stockpile snow on permeable pavement surfaces. Sand and grit in snow will clog pavement.
- Plow parking areas paved with permeable asphalt pavement carefully. Plow blades should be set approximately 1" higher than usual to avoid scarring the pavement and loosening material that could potentially clog surface pores.
- Do not apply abrasives such as sand or grit on or adjacent to permeable asphalt pavement.
- Monitor application rates of deicing materials on permeable pavement areas and reduce application rate accordingly. Permeable pavements tend to require less deicer per unit area because the water is not required to remain liquid over the entire parking surface area before discharge.
- Do not apply abrasives such as sand or grit on or adjacent to permeable pavers.
- Avoid plowing of areas with permeable pavers.

Salt and Deicing Chemicals

The amount of salt and deicing chemicals to be used on the site shall be reduced to the minimum amount needed to provide safe pedestrian and vehicle travel. The following practices should be followed to control the amount of salt and deicing materials that come into contact with stormwater runoff:

- Devices used for spreading salt and deicing chemicals should be capable of varying the rate of application based on the site specific conditions.
- Specific environmentally sensitive areas [engineer to identify] should be designated as no and/or reduced salt areas.
- Alternate materials [list alternate materials] should be used in place of standard salt and deicing chemicals in specific environmentally sensitive areas [engineer to identify].
- Sand and salt should be stockpiled under covered storage facilities that prevent precipitation and adjacent runoff from coming in contact with the deicing materials



Spill Prevention and Response Plan

Spill prevention equipment and training will be provided by the property management company.

Initial Notification

In the event of a spill the facility and/or construction manager or supervisor will be notified immediately.

FACILITY MANAGER

Name: _____ Home Phone: _____
Phone: _____ E-mail: _____

CONSTRUCTION MANAGER

Name: _____ Home Phone: _____
Phone: _____ E-mail: _____

The supervisor will first contact the Fire Department and then notify the Police Department, the Public Health Commission and the Conservation Commission. The Fire Department is ultimately responsible for matters of public health and safety and should be notified immediately.

Further Notification

Based on the assessment from the Fire Chief, additional notification to a cleanup contractor may be made. The Massachusetts Department of Environmental Protection (DEP) and the EPA may be notified depending upon the nature and severity of the spill. The Fire Chief will be responsible for determining the level of cleanup and notification required. The attached list of emergency phone numbers shall be posted in the main construction/facility office and readily accessible to all employees. A hazardous waste spill report shall be completed as necessary using the attached form.



Emergency Notification Phone Numbers

1. FACILITY MANAGER

Name: _____ Home Phone: _____
Phone: _____ E-mail: _____

ALTERNATE

Name: _____ Home Phone: _____
Phone: _____ E-mail: _____

2. FIRE DEPARTMENT

Emergency: **911**
Business: (781) 270-1925

POLICE DEPARTMENT

Emergency: **911**
Business: _____

3. CLEANUP CONTRACTOR:

Address: _____
Phone: _____

4. MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION

Emergency: _____
Northeast Region – Woburn Office: _____

5. NATIONAL RESPONSE CENTER

Phone: (800) 424-8802

ALTERNATE: U.S. ENVIRONMENTAL PROTECTION AGENCY

Emergency: _____
Business: _____

6. CONSERVATION COMMISSION

Contact: _____
Phone: _____

BOARD OF HEALTH

Contact: _____
Phone: _____



Hazardous Waste / Oil Spill Report

Date _____ Time _____ AM / PM

Exact location (Transformer #) _____

Type of equipment _____ Make _____ Size _____

S / N _____ Weather Conditions _____

On or near Water ☐ Yes If Yes, name of body of Water _____

☐ No

Type of chemical/oil spilled _____

Amount of chemical/oil spilled _____

Cause of Spill _____

Measures taken to contain or clean up spill _____

Amount of chemical/oil recovered _____ Method _____

Material collected as a result of cleanup:

_____ Drums containing _____

_____ Drums containing _____

_____ Drums containing _____

Location and method of debris disposal

Name and address of any person, firm, or corporation suffering damages:

Procedures, method, and precautions instituted to prevent a similar occurrence from recurring:

Spill reported to General Office by _____ Time _____ AM / PM

Spill reported to DEP / National Response Center by _____

DEP Date _____ Time _____ AM / PM Inspector _____

NRC Date _____ Time _____ AM / PM Inspector _____

Additional comments: _____



Assessment - Initial Containment

The supervisor or manager will assess the incident and initiate containment control measures with the appropriate spill containment equipment included in the spill kit kept on-site. A list of recommended spill equipment to be kept on site is included on the following page.

Fire / Police Department	911
Municipality Health Department	
Municipality Conservation Commission:	



Emergency Response Equipment

The following equipment and materials shall be maintained at all times and stored in a secure area for long-term emergency response need.

<i>Supplies</i>		<i>Recommended Suppliers</i>
SORBENT PILLOWS/"PIGS"	2	http://www.newpig.com
SORBENT BOOM/SOCK	25 FEET	Item # KIT276 — mobile container with two pigs,
SORBENT PADS	50	26 feet of sock, 50 pads, and five pounds of
LITE-DRI® ABSORBENT	5	absorbent (or equivalent)
POUNDS		http://www.forestry-suppliers.com
SHOVEL	1	Item # 43210 — Manhole cover pick (or
PRY BAR	1	equivalent)
GOGGLES	1 PAIR	Item # 33934 — Shovel (or equivalent)
GLOVES – HEAVY	1 PAIR	Item # 90926 — Gloves (or equivalent)
		<i>Item # 23334 — Goggles (or equivalent)</i>



Stormwater Operation and Maintenance Plan

Project Information

Site

140 Kendrick Street
Needham MA

Owner

Boston Properties
101 Federal Street
Boston, MA 02110

Site Supervisor

Name: __TBD_____

Telephone: _____

Cell phone: _____

Email: _____



Description of Stormwater Maintenance Measures

The following Operation and Maintenance (O&M) program is proposed to ensure the continued effectiveness of the stormwater management system. Attached to this plan are a Stormwater Best Management Practices Checklist and Maintenance Figure for use during the long term operation and maintenance of the stormwater management system.

Catch Basins

- All catch basins shall be inspected and cleaned a minimum of at least once per year.
- Sediment (if more than six inches deep) and/or floatable pollutants shall be pumped from the basin and disposed of at an approved offsite facility in accordance with all applicable regulations.
- Any structural damage or other indication of malfunction will be reported to the site manager and repaired as necessary
- During colder periods, the catch basin grates must be kept free of snow and ice.
- During warmer periods, the catch basin grates must be kept free of leaves, litter, sand, and debris.

Subsurface Infiltration System

- The subsurface infiltration systems will be inspected at least once each year by removing the manhole/access port covers and determining the thickness of sediment that has accumulated in the sediment removal row.
- If sediment is more than six inches deep, it must be suspended via flushing with clean water and removed using a vacuor truck.
- Manufacturer's specifications and instructions for cleaning the sediment removal row is provided as an attachment to this section.
- Emergency overflow pipes will be examined at least once each year and verified that no blockage has occurred.
- System will be observed after rainfalls to see if it is properly draining.

Inspection & Maintenance

Step 1) Inspect Isolator Row for Sediment

A. Inspection ports (if present)

- A.1. Remove/open lid on Nyloplast inline drain
- A.2. Remove and clean Flexstorm filter (if installed)
- A.3. Using a flashlight and stadia rod, measure depth of sediment and record on maintenance log



- A.4. Lower a camera into Isolator Row for visual inspection of sediment levels (optional)
- A.5. If sediment is at, or above, 3" proceed to Step 2. If not, proceed to Step 3

Step 2) Clean out Isolator Row using the JetVac process

- A. A fixed culvert cleaning nozzle with rear facing spread of 45" (1.1m) or more is preferred.
- B. Apply multiple passes of JetVac until backflush water is clean
- C. Vacuum structure sump as required

Permeable Pavers

The primary maintenance requirement for permeable pavers is to clean the surface drainage voids. Fine debris and dirt accumulate in the drainage openings and reduce the pavement's flow capacity. Even though some irreplaceable loss in permeability should be expected over the paver's lifetime, one can increase the longevity of the system by following the maintenance schedule for vacuum sweeping and high-pressure washing, restricting the area's use by heavy vehicles, limiting the use of de-icing chemicals and sand, and implementing a stringent sediment control plan.

Preventing Clogging of Permeable Paver Surface Areas

- Patio areas and/or other areas with permeable pavers shall be cleaned annually with vacuums or washed with high pressure washers.
- Do not allow construction staging, soil/mulch storage, etc. on unprotected pavement surface.
- Maintain vegetated areas adjacent to areas with permeable pavers to prevent washout of soil onto surface.
- Do not apply any type of sealant to permeable pavers.

Inspecting the System

- Inspect areas paved with permeable pavers monthly for the first three months after construction to ensure proper functioning and correct any areas that have settled or experienced washouts.
- Inspect areas paved with permeable pavers annually after initial three month period. Annual inspections should take place after large storms, when puddles will make any clogging obvious.

Stormwater Outfalls

- Inspect outfall locations monthly for the first three months after construction to ensure proper functioning and correct any areas that have settled or experienced washouts.
- Inspect outfalls annually after initial three month period.



- Annual inspections should be supplemented after large storms, when washouts may occur.
- Maintain vegetation around outfalls to prevent blockages at the outfall.
- Maintain rip rap pad below each outfall and replace any washouts.
- Remove and dispose of any trash or debris at the outfall.

Roof Drain Leaders

- Perform routine roof inspections quarterly.
- Keep roofs clean and free of debris.
- Keep roof drainage systems clear.
- Keep roof access limited to authorized personnel.
- Clean inlets draining to the subsurface bed twice per year as necessary.

not necessary density at areas subject to flooding, particularly from local drainage. The map is not intended to be used for flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) Report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. Floodway data is provided for areas where floodway boundaries have been determined. Floodway boundaries are shown in the Flood Insurance Study Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal base flood elevations are not shown for areas where coastal base flood elevations have been determined. Coastal base flood elevations are shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with the floodway boundaries shown in the Flood Insurance Study Report for this jurisdiction. Floodway boundaries are shown in the Flood Insurance Study Report for this jurisdiction. Floodway boundaries are shown in the Flood Insurance Study Report for this jurisdiction. Floodway boundaries are shown in the Flood Insurance Study Report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study Report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Massachusetts State Plane Mainland Zone (FIPS zone 2001). The **horizontal datum** was NAD 83. GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov> or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, NINGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit its website at <http://www.ngs.noaa.gov>.

Base map information shown on this FIRM was derived from digital orthophotography. Base map files were provided in digital format by Massachusetts Geographic Information System (MAGIS). The imagery was produced at a scale of 1:5,000. Aerial photography is dated April 2008.

The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations** and **floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unimproved streams may differ from what is shown on previous maps.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels, community map repository addresses, and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM, visit the **Map Service Center** (MSC) website at <http://www.fema.gov/business/mfp>. Available products may include digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map**, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange (FMIX) at 1-877-FEMA-MAP (1-877-362-6271) or visit the FEMA website at <http://www.fema.gov/business/mfp>.

